
# Warm Homes Technical Report: Home Heating Methods and Fuels in New Zealand

# Authors

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# Contents

# Executive Summary

This report presents the results of a survey of domestic heating methods and fuels carried out in 29 urban areas of New Zealand. The purpose of the survey was to collect information to be used in the assessment of measures to reduce $PM_{10}$ (suspended particles) emissions from domestic home heating in these areas. Additional information was collected on house variables including insulation, cost of heating, number of bedrooms, age of dwelling, household tenure and income. The latter information will help in the development of strategies to achieve warmer houses in New Zealand.

In addition to the 29 urban areas, a separate survey was carried out across the whole of New Zealand to represent average data. Once again, the aim was to help in the development of strategies to achieve warmer houses in New Zealand.

The survey results showed significant variations in heating methods across different urban areas. The use of wood burners to heat the main living area ranged from 67% of households in Masterton to 14% in Hamilton. The use of multi-fuel burners ranged from 1% in Richmond and Christchurch to 68% in Reefton. Other areas where more than 10% of households used multi-fuel burners included Invercargill, Gore, Westport, Alexandra, Masterton, Timaru, Balclutha, Cromwell, Mosgiel, Milton, Oamaru and Arrowtown. The use of open fires to heat the main living area was most common in Arrowtown (15% of dwellings) and least common in Alexandra (2% of dwellings). Pellet-style burners were most common in Rangiora and Gore (3% of dwellings). Electricity use was highest in Dunedin, with 77% of respondents using electricity in the main living area. Around 21% of households using electricity in Dunedin had heat pumps, while 40% used portable oil column heaters. Nationwide, 13% of respondents using electricity in their main living areas used heat pumps.

# 1 Introduction

National environmental standards (NES) for ambient air quality in New Zealand were introduced by the Ministry for the Environment (Ministry for the Environment) in 2004[1] and are effective from September 2005. The main contaminant that currently exceeds these standards in urban areas of New Zealand is suspended particles ($PM_{10}$).[2]

The main source of $PM_{10}$ in most urban areas of New Zealand is solid fuel burning for domestic home heating. The amount of emissions from this source in each area varies depending on the number of households using solid fuel, the types and quantities of fuel being used, and the types of appliances the fuel is burnt in. To reduce emissions from this source over time, the Ministry for the Environment has introduced an NES for wood burners, which restricts new installations to those burners that meet an emission criterion of 1.5 grams of emissions per kilogram of fuel burnt.

The Ministry is evaluating ways of helping regional and local government to achieve the NES by encouraging households to replace open fires and older, more polluting burners with cleaner forms of heating. This evaluation forms a part of the Ministry for the Environment's Warm Homes Project, which has been set up to examine a broad range of objectives, including ways to encourage New Zealand households to:

- move to cleaner heating sources
- increase household energy efficiency
- encourage generally warmer and healthier homes.

The project is investigating and developing possible national programmes that work with regional and local government, energy suppliers, manufacturers and communities to achieve these objectives. As part of this project, a domestic home heating survey was carried out for 29 urban areas within New Zealand. A random survey was also carried out across the whole of New Zealand to provide an average across the country.

The surveys collected data on home heating methods and fuels in the main living area of the home, as well as energy efficiency indicators and other variables relating to warm homes. The latter information included indicators of house age, size, income, insulation and cost of heating. This report presents the results of the surveys. Although some discussion on results is provided, the main aim of this report is to provide data from the survey that may be of use to different groups working on the Warm Homes Project.

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[1] Ministry for the Environment, 2004, *National Environmental Standards for Air Quality*, Ministry for the Environment, Wellington.

[2] Particle matter of less than 10 microns in diameter.

# 2 Methodology

## 2.1 Selection of study areas

Twenty-nine study areas were identified by the Ministry for the Environment based on locations where $PM_{10}$ concentrations in excess of 50 µg $m^{-3}$ (24-hour average) had been measured between 1992 and 2001. Most of these areas are detailed in Ministry for the Environment (2003).[3] Te Kuiti, Reefton and Westport were then added because more recent monitoring had indicated breaches in these areas during winter.

In addition, a national survey was carried out to provide an overall picture of domestic heating methods and fuels, and other variables relating to warm homes in New Zealand.

The resulting 30 study areas are as follows:

- National
- Gore
- Invercargill
- Reefton
- Westport
- Upper Hutt
- Te Kuiti
- Cromwell
- Dunedin
- Balclutha
- Milton
- Mosgiel
- Arrowtown
- Christchurch
- Rangiora
- Kaiapoi
- Ashburton
- Timaru
- Nelson
- Richmond
- Blenheim
- Napier
- Masterton
- Wainuiomata
- Auckland
- Alexandra
- Hamilton
- Oamaru
- Gisborne
- Rotorua

## 2.2 Domestic heating survey

The primary purpose of the domestic heating survey was to determine the home heating methods and fuels used by households in the study areas during the winter months, given that $PM_{10}$ concentrations in excess of the national environmental standard typically occur during winter. An additional purpose was to collect information relating to warm homes in New Zealand. In particular, data were collected on home heating methods and home insulation, age of dwelling, size of dwelling, home ownership and household income.

The survey questionnaire was structured to collect information on heating methods and fuels for all methods used in the main living area of the home. No additional information was sought on heating methods used in other areas of the home. For each heating method, the survey included questions on:

[3] Emission inventories for $PM_{10}$ in New Zealand 2003, Air Quality Technical Report No. 38 available from www.mfe.govt.nz/publications/air/air-quality-tech-report-38-aug03/index.html (August 2005).

- average daily fuel use during winter (excluding electricity)
- average daily fuel use during summer (for those heating during summer months)
- average number of days per week the heating method was used for each month of the year
- average monthly (electricity, gas) or annual (wood, coal, oil) heating costs during the winter.

Additional information was collected specific to heating methods. This included:

- the proportion of wood that was self-collected versus bought (for wood options only)[4]
- for electricity, the type of electric heater(s) used in the main living area
- for gas, whether it was mains or bottled, and flued or unflued
- for wood burners and multi-fuel burners, the age of the burner in terms of the following categories: less than 5 years, 5–10 years and more than 10 years.

The following data were also sought in the survey:

- number of bedrooms
- age of the dwelling
- whether the home was owner occupied or rented
- household income.

Additional data were collected by the survey company to ensure the respondents included a cross-section of the population. This included the age of respondent, type of household, sex, employment status, ethnic group, and number of occupants in the dwelling. These data have not been analysed for the purposes of this report.

Data shown in Table X.3 on monthly variations in heating behaviour and fuel use exclude information on seasonal variations in electricity use for domestic heating. This is because this information was collected to evaluate emissions from domestic heating to determine options for reducing $PM_{10}$ emissions in urban areas of New Zealand. Electricity is treated as a zero emission source for this purpose. Data from the graphs in Figure X.2 are shown in Tables X.5, X.7, X.11 and X.12.

[4] This question was added to the survey after the first survey had been carried out. As a result, information on this variable is not available for the first group surveyed, which includes Gore, Invercargill, Te Kuiti and the national survey.

## 2.3 Fuel use estimates

The survey questions relating to daily wood and coal use are based on the number of pieces of wood and the number of buckets of coal. These data have been converted to estimates of kilograms of fuel use based on the following conversion factors:

- the average weight of a log of wood is 1.9 kg
- the average weight of a bucket of coal is 9 kg.

Both conversion rates were based on work carried out by Lamb (2003)[5] for Christchurch. No studies appear to have been carried out for other areas of New Zealand. While it is uncertain whether the size of pieces of wood varies significantly across New Zealand, it would seem unlikely in the case of log burners because wood size is likely to be limited by the size of the appliances.

[5] Lamb C, 2003, *Household Solid Fuel Heating: 2002 Christchurch home heating diary panel*, prepared for Environment Canterbury.

# 3 National Results

A telephone survey of domestic heating methods and fuels for New Zealand was carried out by Digipoll in October 2004. The purpose of the survey was to collect data on home heating and related variables across the whole of New Zealand for input into the Ministry for the Environment's Warm Homes Project. These data were also collected for specific urban areas where concentrations of suspended particles ($PM_{10}$) currently exceed the national environmental standard. Those results are presented in Sections 3 to 33.

The national survey targeted 201 households randomly selected across the whole of New Zealand (Table 3.1). The number of households was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[6] These projections suggest a population increase for New Zealand of 35% by 2021.[7]

**Table 3.1: Summary survey data, New Zealand**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| New Zealand | 1,440,336 | 201 | 6.9% |

Tables 3.2, 3.3 and 3.4 show domestic heating methods and fuels used for the main living areas in New Zealand and seasonal variations in heating behaviour. The main methods of heating were electricity (57% of households), wood burners (38%) and gas (34%).

Of the 201 households surveyed across New Zealand, none used pellet burners for domestic heating. Results of domestic heating surveys for urban towns in New Zealand indicate that pellet burner use ranges from 0 to 3%. The proportion of households using pellet-style burners across the whole of New Zealand is likely to be less than the 6.9% sample error.

[6] Obtained from Statistics New Zealand, www.stats.govt.nz/

[7] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 3.2: Domestic home heating methods and fuels used, New Zealand**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | tonnes/day | % |
| Electricity | 57% | 816,907 | – | – |
| Total gas | 34% | 487,278 | 375 | 2% |
| Flued gas | 9% | 134,939 | – | – |
| Unflued gas | 24% | 352,339 | – | – |
| Oil | 2% | 28,663 | 0 | 0.0% |
| Open fire | 6% | 85,990 | – | – |
| Open fire: wood | 6% | 85,990 | 2080 | 12% |
| Open fire: coal | 2% | 28,663 | 295 | 2% |
| Total wood burner | 38% | 544,605 | 11,412 | 66% |
| Pre-1994 wood burner | 16% | 235,724 | 5,915 | 34% |
| 1994–99 wood burner | 12% | 178,825 | 4077 | 24% |
| Post-1999 wood burner | 9% | 130,055 | 1420 | 8% |
| Multi-fuel burners | 8% | 114,654 | – | – |
| Multi-fuel burners: wood | 8% | 114,654 | 1998 | 12% |
| Multi-fuel burners: coal | 5% | 78,824 | 1149 | 7% |
| Pellet burners | 0% | 0 | 0 | 0% |
| Total wood | 52% | 745,249 | 15,490 | 89% |
| Total coal | 7% | 107,488 | 1443 | 8% |
| Total | | 1,440,336 | 17,308 | |

Note: Rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Of the households using wood burners, around 4% indicated year-round use of the burner, although fuel quantities diminished in the summer months (Table 3.4). The average number of days per weeks a wood burner was used also decreased – from six during the winter to two during the summer. Data relating to open fire use are less certain owing to the small number of respondents using open fires during the summer months.

**Table 3.3: Monthly variations in heating behaviour and fuel use, New Zealand**

| | Percentage of houses using this method each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 2% | 0% | 5% | 22% | 54% | 80% | 86% | 86% | 60% | 22% | 0% | 0% |
| Open fire | 8% | 8% | 17% | 25% | 42% | 92% | 100% | 75% | 42% | 17% | 8% | 8% |
| Wood burner | 4% | 4% | 8% | 29% | 59% | 83% | 92% | 92% | 63% | 30% | 5% | 3% |
| Multi-fuel | 0% | 0% | 0% | 20% | 47% | 100% | 93% | 87% | 53% | 27% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 4 | 5 | 5 | 6 | 6 | 6 | 5 | 4 | – | – |
| Open fire [8] | 7 | 7 | 7 | 6 | 6 | 4 | 4 | 4 | 5 | 5 | 7 | 7 |
| Wood burner | 2 | 2 | 5 | 5 | 6 | 6 | 6 | 6 | 5 | 5 | 3 | – |
| Multi-fuel | – | – | – | 5 | 6 | 5 | 6 | 6 | 6 | 5 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 14 | 85 | 212 | 351 | 375 | 349 | 134 | 43 | – | – |
| Open fire: wood | 0 | 0 | 0 | 350 | 1743 | 2012 | 2080 | 2005 | 939 | 263 | 0 | 0 |
| Open fire: coal | 129 | 129 | 129 | 129 | 172 | 270 | 295 | 221 | 203 | 129 | 129 | 129 |
| Wood burner | 0.0 | 0.0 | 0.0 | 2480 | 6165 | 9952 | 11,412 | 10,609 | 5745 | 2570 | 0 | – |
| Multi-fuel: wood | – | – | – | 726 | 899 | 1939 | 1998 | 1970 | 1183 | 1037 | – | – |
| Multi-fuel: coal | – | – | – | 0 | 800 | 1137 | 1149 | 1149 | 0 | 0 | – | – |
| | **Daily fuel use (kg)/ total number of households that heat with that method** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.2 | 0.4 | 0.7 | 0.8 | 0.7 | 0.3 | 0.1 | – | – |
| Open fire: wood | 0.0 | 0.0 | 0.0 | 4.1 | 20.3 | 23.4 | 24.2 | 23.3 | 10.9 | 3.1 | 0.0 | 0.0 |
| Open fire: coal | 4.5 | 4.5 | 4.5 | 4.5 | 6.0 | 9.4 | 10.3 | 7.7 | 7.1 | 4.5 | 4.5 | 4.5 |
| Wood burner | 0.0 | 0.0 | 0.0 | 4.6 | 11.3 | 18.3 | 21.0 | 19.5 | 10.5 | 4.7 | 0.0 | – |
| Multi-fuel: wood | – | – | – | 6.3 | 7.8 | 16.9 | 17.4 | 17.2 | 10.3 | 9.0 | – | – |
| Multi-fuel: coal | – | – | – | 0 | 10 | 14 | 15 | 15 | 0 | 0 | – | – |

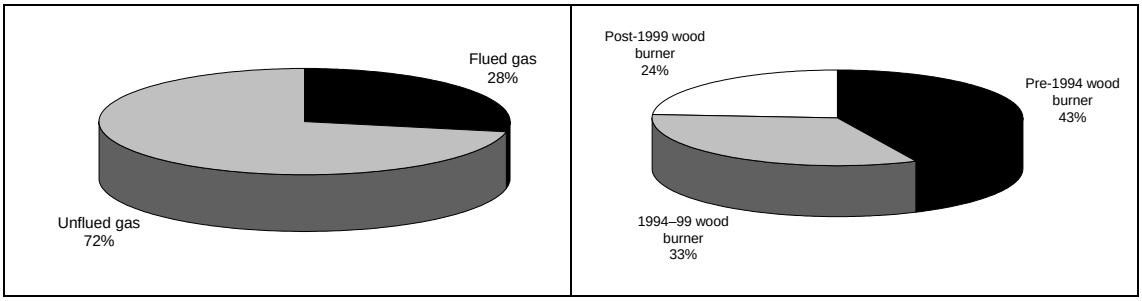
**Table 3.4: Estimated daily fuel use, by season, New Zealand**

| | Winter fuel use kg/day | Summer fuel use kg/day |
|---|---|---|
| Gas | 1 | – |
| Open fire: wood | 40 | 14 |
| Open fire: coal | 15 | 9 |
| Wood burner | 27 | 18 |
| Multi-fuel: wood | 20 | 11 |
| Multi-fuel: coal | 20 | 0 |

[8] Results for open fires use during the summer are biased by the small sample size for this heating method during summer months.

The majority (72%) of the households using gas in New Zealand did not have flued gas systems (Figure 3.1). The age distribution of wood burners used in houses in New Zealand suggests that around 40% of existing burners are more than 10 years old, with only a quarter being installed within the last five years.

**Figure 3.1: Distribution of flued versus unflued gas heating and age of wood burner, New Zealand**




Average winter month heating costs are shown in Table 3.5. These results indicate that more money is spent on electric heating than on other heating methods. Of those households using electric heating, around 33% use a fan heater and around 28% an oil column heater in their main living area (Table 3.6). Radiant heaters are also common (24%). The more efficient heat pumps are used by around 13% of households using electric heating in their main living area.

**Table 3.5: Average monthly heating costs (winter), New Zealand**

| | Winter month |
|---|---|
| Electric | $117 |
| Gas | $66 |
| Open fire | $61 |
| Wood burner | $60 |
| Multi-fuel | $73 |

**Table 3.6: Type of electric heating and average cost per household, New Zealand**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 42,995 | 193,478 | 222,141 | 64,493 | 265,137 | 107,488 | – | 64,493 |
| Percent | 5% | 24% | 28% | 8% | 33% | 13% | – | 8% |
| Cost* | $137 | $100 | $103 | – | $84 | $150 | – | $152 |

* Cost estimates were based on responses for households using one type of electric heating method only. No cost information was available within this data set for households using panel heaters.

Around 80% of the households surveyed owned their house, with the remaining 20% living in rented accommodation. Results show that open fires were more commonly used in owner occupied houses rather than in rental properties, and wood burners were much less common in rented houses (Table 3.7). Figure 3.2 shows that over 60% of the houses were more than 60 years old. Results suggest that over 20% of the open fires had been installed within the last 10 years.

**Figure 3.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, New Zealand**

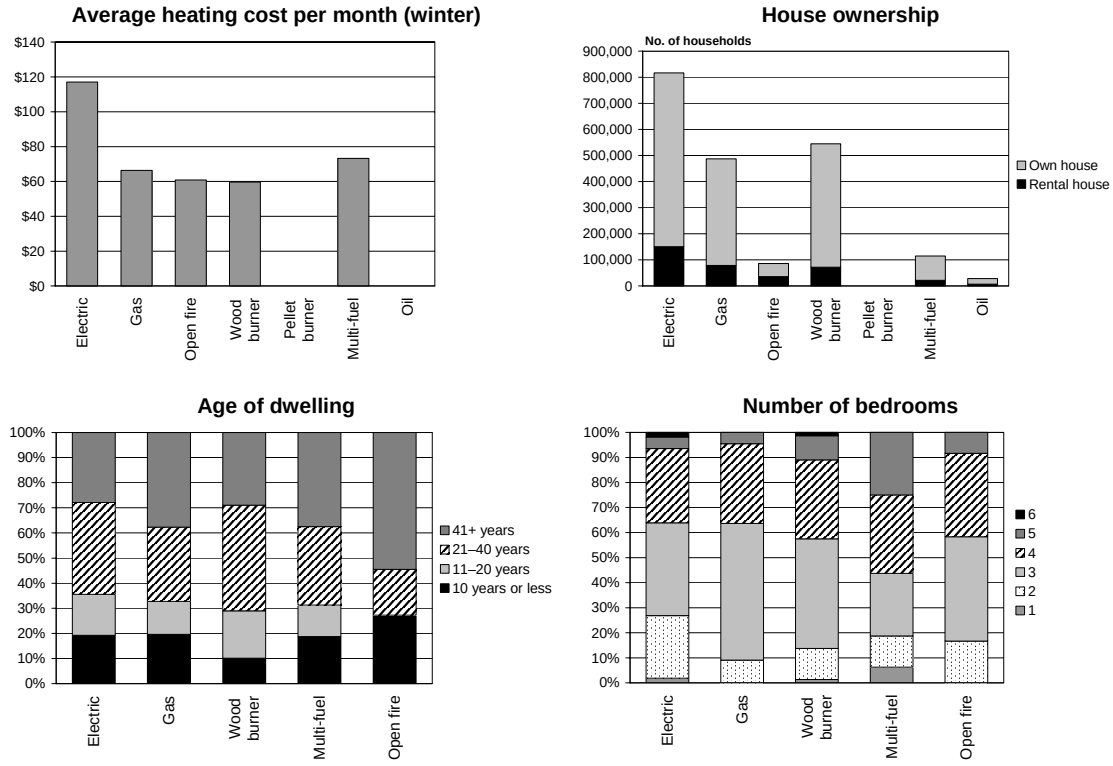



**Table 3.7: Home heating method, by house ownership, New Zealand**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 271,900 | 19% | 1,168,436 | 81% |
| Electric | 150,483 | 18% | 666,424 | 82% |
| Gas | 78,824 | 16% | 408,454 | 84% |
| Open fire | 35,829 | 42% | 50,161 | 58% |
| Wood burner | 71,659 | 13% | 472,946 | 87% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 21,498 | 19% | 93,156 | 81% |
| Oil | 7166 | 25% | 21,498 | 75% |

Survey results suggest that around 10% of houses in New Zealand may have no insulation or basic energy efficiency measures (Table 3.8). Around 71% have ceiling insulation and 50% have wall insulation. Floor insulation was less common at 22% of houses. About 10% of houses were double-glazed and 23% had hot water cylinder wraps fitted. Twenty-six percent of households have only one of these energy efficiency options and 1% have all five measures.

**Table 3.8: House insulation summary statistics, New Zealand**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1,017,551 | 71% | No insulation | 10% |
| Under floor | 315,297 | 22% | 1 type | 26% |
| Wall | 716,585 | 50% | 2 types | 27% |
| Cylinder wrap | 336,795 | 23% | 3 types | 16% |
| Double glazing | 150,483 | 10% | 4 types | 9% |
| None | 143,317 | 10% | 5 types | 1% |
| Don't know | 107,488 | 7% | Don't know | 7% |
| Other | 35,829 | 2% | | |

* One type means the household has just one of ceiling, under floor, wall insulation, a cylinder wrap or double-glazing; two types are any two of these, etc.

**Table 3.9: Degree of house insulation, by heating method, New Zealand**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 24% | 25% | 26% | 25% | 33% |
| 2 types | 30% | 29% | 28% | 19% | 17% |
| 3 types | 17% | 21% | 18% | 25% | 17% |
| 4 types | 11% | 6% | 14% | 13% | 0% |
| 5 types | 1% | 0% | 0% | 6% | 8% |
| None or don't know | 18% | 19% | 13% | 13% | 25% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

A comparison of home heating methods for households with different incomes is shown in Table 3.10. The non-response rate for this question was high, at around 17%. This limits the use of these data because there may be an income bias in the non-respondents. However, results do indicate that a reasonable proportion of houses with open fires have an income of more than $50,000.

**Table 3.10: Home heating method, by household income, New Zealand**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 17% | 9% | 21% | 25% | 33% |
| Less than $20,000 | 18% | 10% | 9% | 19% | 8% |
| $20,000 to $30,000 | 11% | 9% | 5% | 6% | 8% |
| $30,000 to $40,000 | 9% | 9% | 11% | 6% | 0% |
| $40,000 to $50,000 | 11% | 12% | 11% | 13% | 0% |
| $50,000 to $70,000 | 14% | 24% | 12% | 6% | 17% |
| $70,000 to $100,000 | 9% | 15% | 18% | 0% | 17% |
| More than $100,000 | 11% | 12% | 12% | 25% | 17% |

Tables 3.11 and 3.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 3.11: Home heating method, by age of dwelling, New Zealand**

| Age of dwelling | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 10 years or less | 18% | 18% | 9% | 19% | 25% |
| 11–20 years | 15% | 12% | 17% | 13% | 0% |
| 21–40 years | 33% | 26% | 38% | 31% | 17% |
| 41+ years | 25% | 34% | 26% | 38% | 50% |

**Table 3.12: Home heating method, by number of bedrooms, New Zealand**

| Number of bedrooms | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 1 | 2% | 0% | 1% | 6% | 0% |
| 2 | 24% | 9% | 12% | 13% | 17% |
| 3 | 35% | 53% | 42% | 25% | 42% |
| 4 | 28% | 31% | 30% | 31% | 33% |
| 5 | 4% | 4% | 9% | 25% | 8% |
| 6 | 2% | 0% | 1% | 0% | 0% |

# 4 Gore

A telephone survey of domestic heating methods and fuels for Gore was carried out by Digipoll in October 2004. This involved surveying 150 households within the 2001 census area unit (CAU) areas of North Gore, East Gore, Central Gore, West Gore and South Gore. Survey details are shown in Table 4.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[9] The latter suggest a population decrease for Gore of 19% by 2021.[10]

**Table 4.1: Summary survey data, Gore**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Gore | 3081 | 150 | 7.8% |

## 4.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Gore. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Gore, in particular the extent of change required to achieve the NES for $PM_{10}$. This section presents the results of the home heating survey for Gore largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 4.2 and 4.3 show domestic heating methods and fuels used for the main living areas in houses in Gore houses, and seasonal variations in heating behaviour. The main methods of heating were multi-fuel burners (48% of households) and electricity (50%). Many households used more than one method of heating in their main living area.

The big area of difference in home heating methods for Gore is the high use of multi-fuel burners (48% compared to a national average of around 8%). This is compensated to some degree by a lower use of wood burners (20% compared with a national average of around 38%) and is likely to relate to the accessibility of coal in the Southland region.

[9] New Zealand Statistics 2004, www.stats.govt.nz

[10] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 4.2: Domestic home heating methods and fuels, Gore**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | tonnes/day | % |
| Electricity | 50% | 1541 | – | – |
| Total gas | 16% | 493 | 1 | 1% |
| Flued gas | 5% | 157 | – | – |
| Unflued gas | 11% | 336 | – | – |
| Oil | 7% | 205 | 0.3 | 0.4% |
| Open fire | 5% | 144 | – | – |
| Open fire: wood | 4% | 123 | 2 | 2% |
| Open fire: coal | 3% | 103 | 2 | 2% |
| Total wood burner | 20% | 616 | 12 | 18% |
| Pre-1994 wood burner | 9% | 276 | 7 | 10% |
| 1994–99 wood burner | 5% | 149 | 3 | 4% |
| Post-1999 wood burner | 6% | 191 | 2 | 3% |
| Multi-fuel burners | 48% | 1479 | – | – |
| Multi-fuel burners: wood | 48% | 1479 | 24 | 34% |
| Multi-fuel burners: coal | 43% | 1335 | 29 | 41% |
| Pellet burners | 3% | 82 | 1 | 1% |
| Total wood | 72% | 2218 | 38 | 54% |
| Total coal | 47% | 1438 | 30 | 44% |
| Total | | 3081 | 70 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Of the households using wood burners, multi-fuel burners and gas over 10% burn all year round (Table 4.3). During January these households heat their homes an average of four days per week for households using gas, five days per week for households using wood and multi-fuel burners, and seven days per week for households using oil. However, the quantities of fuel used per day are typically much less during the summer months than during winter (Table 4.4).

**Table 4.3: Monthly variations in heating behaviour and fuel use, Gore**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 18% | 18% | 32% | 55% | 82% | 82% | 86% | 77% | 59% | 59% | 23% | 18% |
| Open fire | 0% | 0% | 17% | 50% | 67% | 83% | 100% | 100% | 100% | 50% | 0% | 0% |
| Wood burner | 10% | 10% | 33% | 57% | 83% | 100% | 100% | 97% | 90% | 70% | 30% | 17% |
| Multi-fuel | 10% | 16% | 33% | 70% | 87% | 99% | 99% | 94% | 90% | 71% | 27% | 13% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| Open fire | – | – | 3 | 4 | 5 | 6 | 6 | 6 | 5 | 5 | – | – |
| Wood burner | 5 | 5 | 6 | 7 | 6 | 6 | 7 | 7 | 6 | 5 | 5 | 7 |
| Multi-fuel | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 6 | 5 | 5 | 6 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.1 | 0.1 | 0.2 | 0.3 | 0.7 | 0.6 | 0.7 | 0.7 | 0.4 | 0.3 | 0.1 | 0.1 |
| Open fire: wood | – | – | 0.0 | 1.0 | 1.0 | 1.5 | 1.7 | 1.7 | 1.0 | 0.0 | – | – |
| Open fire: coal | – | – | 0.0 | 0.0 | 0.8 | 1.6 | 1.6 | 1.6 | 1.3 | 0.7 | – | – |
| Wood burner | 0.1 | 0.1 | 1.5 | 7.6 | 10.1 | 12.3 | 12.5 | 12.1 | 8.1 | 5.1 | 3.0 | 2.0 |
| Multi-fuel: wood | 0.3 | 0.3 | 4.3 | 7.5 | 18.5 | 23.3 | 23.6 | 21.5 | 10.4 | 7.1 | 1.7 | 0.9 |
| Multi-fuel: coal | 1.2 | 3.1 | 6.2 | 10.1 | 25.1 | 28.5 | 28.9 | 27.6 | 13.3 | 9.7 | 4.8 | 2.2 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.2 | 0.2 | 0.5 | 0.7 | 1.4 | 1.2 | 1.4 | 1.3 | 0.8 | 0.6 | 0.2 | 0.2 |
| Open fire: wood | 0.0 | 0.0 | 0.0 | 8.1 | 8.0 | 12.1 | 14.0 | 14.0 | 8.1 | 0.0 | 0.0 | 0.0 |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 0.0 | 7.7 | 15.1 | 15.1 | 15.1 | 12.4 | 6.4 | 0.0 | 0.0 |
| Wood burner | 0.2 | 0.2 | 2.5 | 12.4 | 16.4 | 19.9 | 20.2 | 19.7 | 13.1 | 8.3 | 4.8 | 3.3 |
| Multi-fuel: wood | 0.2 | 0.2 | 2.9 | 5.1 | 12.5 | 15.7 | 16.0 | 14.5 | 7.0 | 4.8 | 1.2 | 0.6 |
| Multi-fuel: coal | 0.9 | 2.3 | 4.7 | 7.6 | 18.8 | 21.4 | 21.7 | 20.7 | 10.0 | 7.2 | 3.6 | 1.7 |

**Table 4.4: Estimated daily fuel use, by season, Gore**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 2 | 1 |
| Open fire: wood | 18 | 19 |
| Open fire: coal | 20 | 15 |
| Wood burner | 24 | 16 |
| Multi-fuel: wood | 17 | 8 |
| Multi-fuel: coal | 24 | 12 |

## 4.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Gore are presented in this section.

Figure 4.1 shows that around 32% of households using gas heating in Gore have flued gas systems. This compares with around 28% on average across New Zealand.

The amount spent on heating for a winter month, by heating method, is shown in Table 4.5. In Gore, households using open fires and multi-fuel burners spend less per month on average ($40) than those using other heating methods. This is less than the national average for these methods ($60) and may relate to the availability of local coal and a greater proportion of households obtaining wood free of charge.

Figure 4.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Gore. Unlike the results for New Zealand as a whole, open fires are not common in new houses in Gore. One-bedroom houses are typically heated using electricity, and open fires are relatively uncommon when compared to other locations. Pellet burners were only used in owner-occupied dwellings, with around 3% of houses using this method.

**Figure 4.1: Distribution of flued versus unflued gas heating and age of wood burner, Gore**

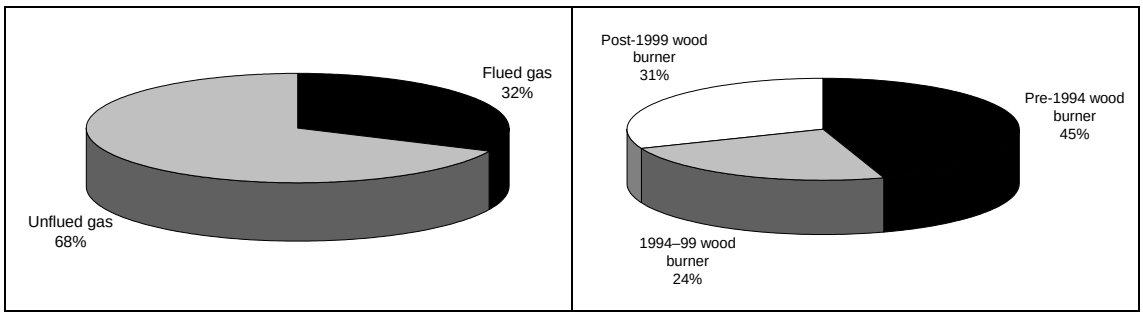



**Table 4.5: Average monthly heating costs (winter), Gore**

| | Winter month cost |
|---|---|
| Electric | $77 |
| Gas | $68 |
| Open fire | $40 |
| Wood burner | $60 |
| Pellet burner | $98 |
| Multi-fuel | $40 |
| Oil | $170 |

**Figure 4.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Gore**

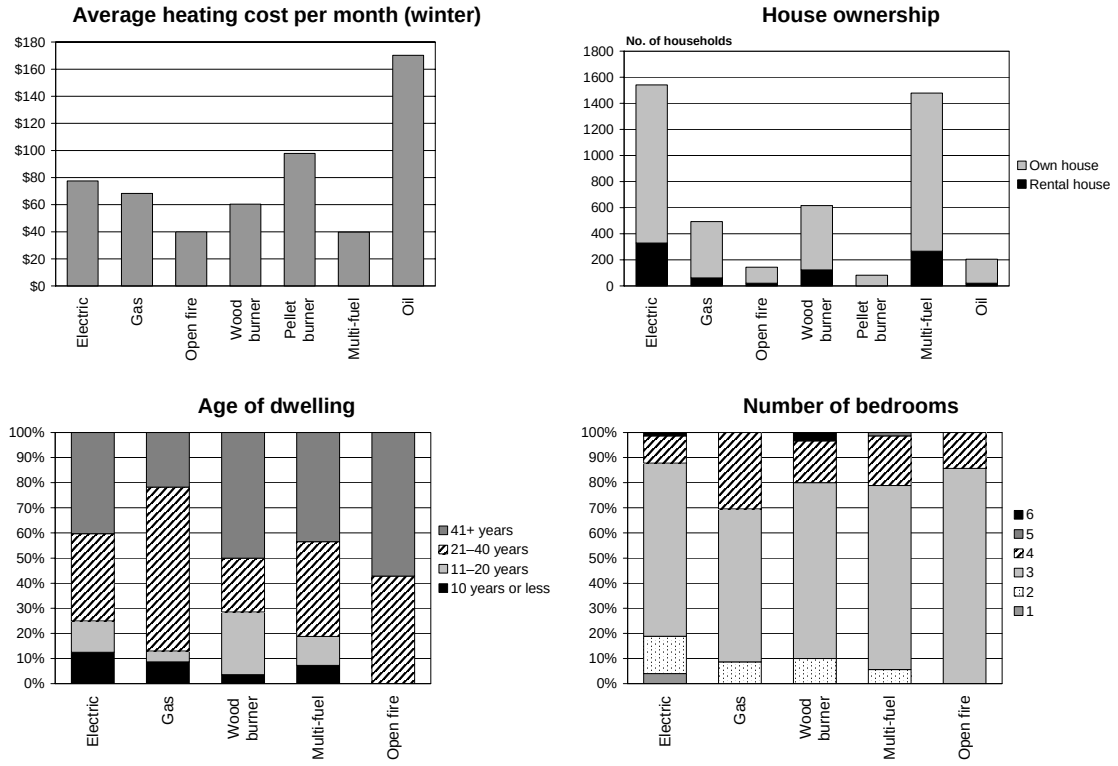



**Table 4.6: Type of electric heating, Gore**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 349 | 205 | 452 | 123 | 472 | 205 | – | 62 |
| Percent | 23% | 13% | 29% | 8% | 31% | 13% | – | 4% |

The types of electric heaters used in the main living areas of houses in Gore were similar to the average results for New Zealand. The main exception was the greater use of night-store and lesser use of radiant heaters in Gore (Table 4.6). The use of heat pumps was the same at around 13% of houses using electricity to heat their main living area.

Table 4.7 shows that around 19% of respondents were living in rental accommodation.

**Table 4.7: Home heating method, by house ownership, Gore**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 575 | 19% | 2485 | 81% |
| Electric | 329 | 21% | 1212 | 79% |
| Gas | 62 | 13% | 431 | 88% |
| Open fire | 21 | 14% | 123 | 86% |
| Wood burner | 123 | 20% | 493 | 80% |
| Pellet burner | 0 | 0% | 82 | 100% |
| Multi-fuel | 267 | 18% | 1212 | 82% |
| Oil | 21 | 10% | 185 | 90% |

The types of insulation used in houses relative to the household heating method is shown in Tables 4.8 and 4.9. Table 4.10 shows heating method by household income. Although the overall non-response rate was around 15%, all of the households with open fires provided income information. Results are consistent with the national results in that a reasonable proportion of households with open fires have an income of greater than $50,000 per year.

**Table 4.8: House insulation summary statistics, Gore**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 2465 | 80% | No insulation | 5% |
| Under floor | 616 | 20% | 1 type* | 32% |
| Wall | 1602 | 52% | 2 types | 26% |
| Cylinder wrap | 781 | 25% | 3 types | 13% |
| Double glazing | 514 | 17% | 4 types | 13% |
| None | 144 | 5% | 5 types | 4% |
| Don't know | 226 | 7% | Don't know | 7% |
| Other | 41 | 1% | | |

* One type means the household just has one of ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types is any two of these, etc.

**Table 4.9: Degree of house insulation, by heating method, Gore**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 31% | 38% | 33% | 33% | 43% |
| 2 types | 27% | 21% | 23% | 26% | 29% |
| 3 types | 15% | 8% | 13% | 13% | 0% |
| 4 types | 12% | 21% | 17% | 13% | 14% |
| 5 types | 1% | 4% | 7% | 3% | 0% |
| None or don't know | 15% | 8% | 7% | 13% | 14% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 4.10: Home heating method, by household income, Gore**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 12% | 25% | 10% | 17% | 0% |
| Less than $20,000 | 21% | 8% | 13% | 15% | 29% |
| $20,000 to $30,000 | 15% | 17% | 30% | 11% | 29% |
| $30,000 to $40,000 | 13% | 21% | 17% | 18% | 0% |
| $40,000 to $50,000 | 12% | 8% | 10% | 11% | 0% |
| $50,000 to $70,000 | 15% | 13% | 7% | 18% | 14% |
| $70,000 to $100,000 | 5% | 8% | 10% | 3% | 14% |
| More than $100,000 | 7% | 0% | 3% | 7% | 14% |

Tables 4.11 and 4.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 4.11: Home heating method, by age of dwelling, Gore**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 12% | 8% | 3% | 7% | 0% |
| 11–20 years | 12% | 4% | 23% | 11% | 0% |
| 21–40 years | 33% | 63% | 20% | 36% | 43% |
| 41+ years | 39% | 21% | 47% | 42% | 57% |

**Table 4.12: Home heating method, by number of bedrooms, Gore**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 4% | 0% | 0% | 0% | 0% |
| 2 | 15% | 8% | 10% | 6% | 0% |
| 3 | 68% | 58% | 70% | 72% | 86% |
| 4 | 11% | 29% | 17% | 19% | 14% |
| 5 | 0% | 0% | 0% | 1% | 0% |
| 6 | 1% | 0% | 3% | 0% | 0% |

# 5 Invercargill

A telephone survey of domestic heating methods and fuels for Invercargill was carried out by Digipoll in October 2004. This involved surveying 158 households within the 2001 census area unit (CAU) areas of:

- Grasmere
- Waikiwi
- Rosedale
- Gladstone–Avenal
- Windsor
- Waverley–Glengarry
- Crinan
- West Invercargill
- Georgetown
- Newfield–Rockdale
- Heidelberg
- Strathern
- Hawthorndale
- Richmond
- Otakaro Park
- Appleby–Kew
- Kingswell–Clifton
- Tisbury

Survey details are shown in Table 5.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[11] The latter suggest a population projection for Invercargill of -14% by 2021.[12]

**Table 5.1: Summary survey data, Invercargill**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Invercargill | 16,438 | 158 | 7.8% |

## 5.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Invercargill. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Invercargill, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Invercargill largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 5.2 and 5.3 show domestic heating methods and fuels used for the main living areas in Invercargill houses, and seasonal variations in heating behaviour. The main methods of heating were multi-fuel burners (34% of households) and electricity (63%). Many households used more than one method of heating in their main living area.

As with Gore, the use of multi-fuel burners in Invercargill is high (at 34%) relative to the national average (8% of households). This is compensated to some degree by a lower use of wood burners (17% compared with a national average of around 38%), and is likely to relate to the accessibility of coal in the Southland region.

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[11] New Zealand Statistics 2004, www.stats.govt.nz/

[12] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 5.2: Domestic home heating methods and fuels, Invercargill**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 63% | 10,300 | – | – |
| Total gas | 18% | 2913 | 3 | 1% |
| Flued gas | 5% | 755 | – | – |
| Unflued gas | 13% | 2158 | – | – |
| Oil | 3% | 416 | 0.1 | 0.0% |
| Open fire | 8% | 1248 | – | – |
| Open fire: wood | 7% | 1144 | 33 | 7% |
| Open fire: coal | 6% | 1040 | 12 | 3% |
| Total wood burner | 17% | 2809 | 58 | 13% |
| Pre-1994 wood burner | 4% | 733 | 25 | 5% |
| 1994–99 wood burner | 5% | 855 | 18 | 4% |
| Post-1999 wood burner | 7% | 1221 | 16 | 3% |
| Multi-fuel burners | 34% | 5514 | – | – |
| Multi-fuel burners: wood | 34% | 5514 | 184 | 40% |
| Multi-fuel burners: coal | 33% | 5410 | 160 | 35% |
| Pellet burners | 2% | 312 | 4 | 1% |
| Total wood | 58% | 9467 | 276 | 61% |
| Total coal | 39% | 6450 | 172 | 38% |
| Total | 63% | 10,300 | | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Of the households using wood burners, multi-fuel burners, open fires and gas, a small proportion burn all year round. During January these households heat their homes on an average of four days per week for households using gas, seven days per week for households using wood burners, and three days per week for households using multi-fuel burners. Results for open fires are subject to significant uncertainty owing to the smaller number of respondents with this heating method.

The quantities of fuel used per day are typically much less during the summer months than during the winter (Table 5.4). The exception is open fires, which indicate higher results during the summer months. This is likely to occur because the summer results are based on a very small number of households, which in this case burn more during the summer than the average of all households burning during the winter. It is likely that these households burn more than the winter average during the winter months as well.

**Table 5.3: Monthly variations in heating behaviour and fuel use, Invercargill**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 4% | 7% | 19% | 48% | 81% | 81% | 81% | 78% | 70% | 48% | 4% | 4% |
| Open fire | 9% | 18% | 18% | 18% | 82% | 100% | 91% | 91% | 73% | 27% | 18% | 9% |
| Wood burner | 4% | 4% | 26% | 44% | 78% | 93% | 93% | 96% | 85% | 52% | 11% | 7% |
| Multi-fuel | 4% | 2% | 18% | 43% | 86% | 98% | 98% | 96% | 67% | 51% | 6% | 6% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 4 | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 4 | 4 |
| Open fire | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 1 |
| Wood burner | 7 | 7 | 6 | 6 | 6 | 6 | 7 | 6 | 6 | 5 | 7 | 7 |
| Multi-fuel | 3 | 5 | 6 | 6 | 6 | 7 | 6 | 6 | 6 | 5 | 5 | 5 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.3 | 0.5 | 1.7 | 3.3 | 3.3 | 3.2 | 3.1 | 2.2 | 1.5 | 0.0 | 0.0 |
| Open fire: wood | 0.2 | 0.4 | 0.4 | 0.6 | 32.0 | 36.2 | 33.3 | 33.3 | 45.8 | 44.1 | 0.5 | 0.1 |
| Open fire: coal | 0.5 | 2.4 | 2.4 | 4.0 | 10.5 | 15.4 | 12.2 | 11.9 | 8.6 | 3.7 | 2.9 | 0.3 |
| Wood burner | 2.0 | 2.0 | 4.7 | 10.6 | 49.9 | 58.3 | 58.4 | 56.9 | 24.1 | 16.5 | 3.1 | 3.1 |
| Multi-fuel: wood | 1.5 | 1.5 | 17.1 | 40.1 | 169.6 | 184.8 | 184.0 | 180.4 | 37.6 | 24.7 | 4.4 | 3.9 |
| Multi-fuel: coal | 3.2 | 3.0 | 15.9 | 28.6 | 152.3 | 160.0 | 159.7 | 157.6 | 61.0 | 28.8 | 7.0 | 6.6 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.1 | 0.2 | 0.6 | 1.1 | 1.1 | 1.1 | 1.1 | 0.8 | 0.5 | 0.0 | 0.0 |
| Open fire: wood | 0.1 | 0.3 | 0.3 | 0.5 | 28.0 | 31.6 | 29.1 | 29.1 | 40.0 | 38.5 | 0.4 | 0.1 |
| Open fire: coal | 0.5 | 2.3 | 2.3 | 3.9 | 10.1 | 14.8 | 11.7 | 11.4 | 8.2 | 3.6 | 2.8 | 0.3 |
| Wood burner | 0.7 | 0.7 | 1.7 | 3.8 | 17.8 | 20.8 | 20.8 | 20.2 | 8.6 | 5.9 | 1.1 | 1.1 |
| Multi-fuel: wood | 0.3 | 0.3 | 3.1 | 7.3 | 30.8 | 33.5 | 33.4 | 32.7 | 6.8 | 4.5 | 0.8 | 0.7 |
| Multi-fuel: coal | 0.6 | 0.6 | 2.9 | 5.3 | 28.2 | 29.6 | 29.5 | 29.1 | 11.3 | 5.3 | 1.3 | 1.2 |

**Table 5.4: Estimated daily fuel use, by season, Invercargill**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 2 | 1 |
| Open fire: wood | 36 | 40 |
| Open fire: coal | 21 | 11 |
| Wood burner | 32 | 17 |
| Multi-fuel: wood | 37 | 11 |
| Multi-fuel: coal | 33 | 14 |

## 5.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Invercargill are presented in this section.

Figure 5.1 shows that the proportion of households using gas systems that are properly flued in Invercargill is similar to the national average (26% in Invercargill compared with 28% in the national survey). The proportion of older (pre-1994) wood burners (26% of wood burners) is less than the national average of 43%.

The amount spent on heating for a winter month, by heating method, is shown in Table 5.5. In Invercargill, households heating using open fires and wood burners spend less per month (around $60) than those using other heating methods, on average. This is similar to the national average for these methods ($60). Households using gas and multi-fuel burners spend more per month on heating than the national average for these methods.

Figure 5.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Invercargill. Unlike the results for New Zealand as a whole, open fires are not present in new houses in Invercargill (Figure 5.2). One-bedroom houses are typically heated using electricity and six-bedroom houses typically use wood burners or electricity in their main living area. Pellet burners were only used in owner-occupied dwellings, with around 2% of houses using this method.

**Figure 5.1: Distribution of flued versus unflued gas heating and age of wood burner, Invercargill**

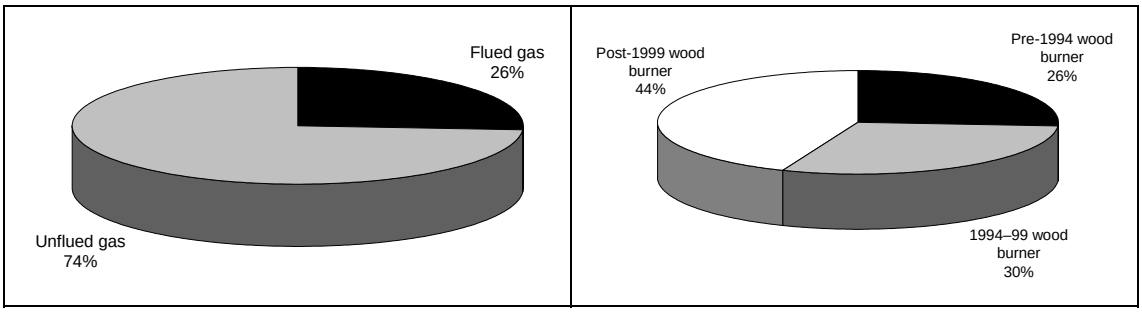


**Table 5.5: Average monthly heating costs (winter), Invercargill**

| | Winter month cost |
|---|---|
| Electric | $119 |
| Gas | $115 |
| Open fire | $55 |
| Wood burner | $60 |
| Pellet burner | $76 |
| Multi-fuel | $155 |
| Oil | $123 |

**Figure 5.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Invercargill**

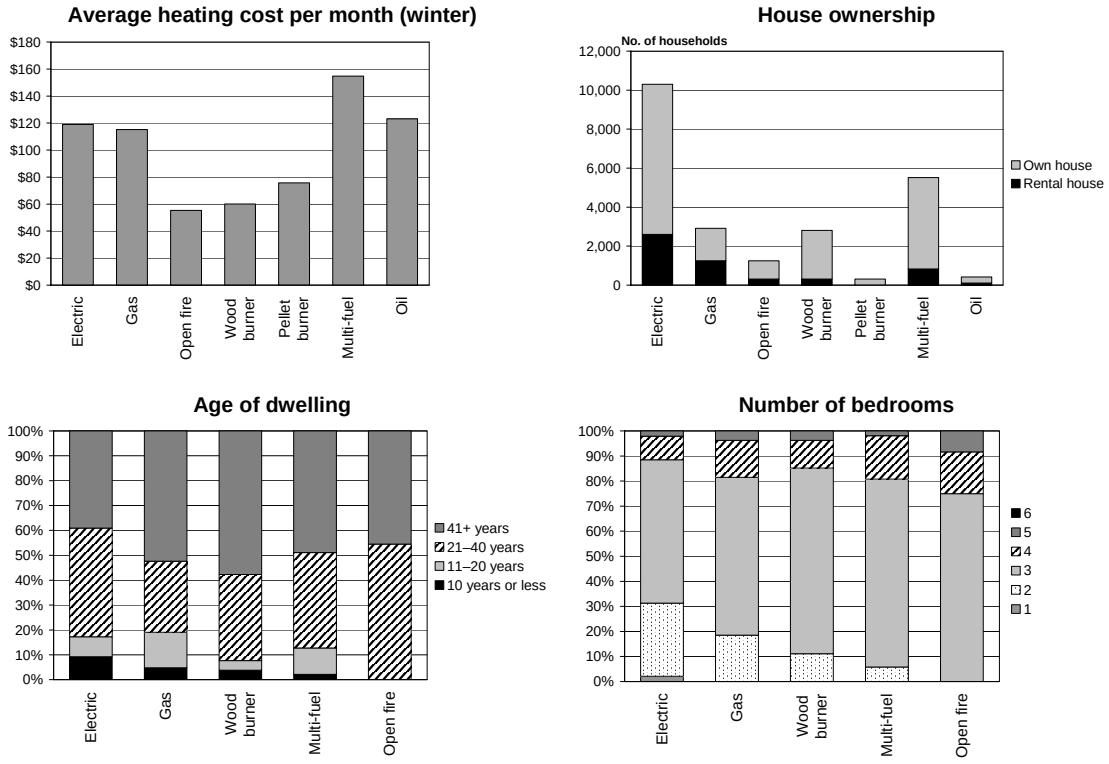


**Table 5.6: Type of electric heating, Invercargill**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 2185 | 1352 | 1769 | 624 | 2913 | 3121 | – | 624 |
| Percent | 21% | 13% | 17% | 6% | 28% | 30% | – | 6% |

The main difference in the types of electric heaters used in Invercargill was the prevalence of heat pumps, which were used by 30% of households compared to a national average of 13% (Table 5.6). Night store heaters were also more common, with 21% of households using electricity having this form of heater.

**Table 5.7: Home heating method, by house ownership, Invercargill**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 3745 | 23% | 12,693 | 77% |
| Electric | 2601 | 25% | 7699 | 75% |
| Gas | 1248 | 43% | 1665 | 57% |
| Open fire | 312 | 25% | 936 | 75% |
| Wood burner | 312 | 11% | 2497 | 89% |
| Pellet burner | 0 | 0% | 312 | 100% |
| Multi-fuel | 832 | 15% | 4682 | 85% |
| Oil | 104 | 25% | 312 | 75% |

Around 23% of respondents in Invercargill were living in rented accommodation (Table 5.7).

Household insulation types and heating methods are shown in Tables 5.8 and 5.9. Table 5.10 shows home heating method by household income. The overall non-response rate was around 26%. This limits the use of these data, because there may be an income bias in the non-respondents.

**Table 5.8: House insulation summary statistics, Invercargill**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 12,276 | 75% | No insulation | 11% |
| Under floor | 1977 | 12% | 1 type* | 31% |
| Wall | 6762 | 41% | 2 types | 34% |
| Cylinder wrap | 2809 | 17% | 3 types | 9% |
| Double glazing | 1561 | 9% | 4 types | 7% |
| None | 1769 | 11% | 5 types | 0% |
| Don't know | 1144 | 7% | Don't know | 7% |
| Other | 416 | 3% | | |

* One type means the household just has one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 5.9: Degree of house insulation, by heating method, Invercargill**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 34% | 36% | 30% | 36% | 17% |
| 2 types | 31% | 21% | 41% | 36% | 25% |
| 3 types | 8% | 0% | 15% | 6% | 17% |
| 4 types | 8% | 7% | 4% | 9% | 0% |
| 5 types | 0% | 0% | 0% | 0% | 0% |
| None or don't know | 18% | 36% | 11% | 13% | 42% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 5.10: Home heating method, by household income, Invercargill**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 27% | 21% | 15% | 28% | 42% |
| Less than $20,000 | 18% | 18% | 11% | 9% | 17% |
| $20,000 to $30,000 | 15% | 25% | 22% | 13% | 0% |
| $30,000 to $40,000 | 6% | 11% | 7% | 11% | 17% |
| $40,000 to $50,000 | 10% | 0% | 11% | 8% | 0% |
| $50,000 to $70,000 | 9% | 11% | 15% | 19% | 8% |
| $70,000 to $100,000 | 7% | 11% | 11% | 6% | 17% |
| More than $100,000 | 6% | 4% | 7% | 6% | 0% |

Tables 5.11 and 5.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 5.11: Home heating method, by age of dwelling, Invercargill**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 8% | 4% | 4% | 2% | 0% |
| 11–20 years | 7% | 11% | 4% | 9% | 0% |
| 21–40 years | 38% | 21% | 33% | 34% | 50% |
| 41+ years | 34% | 39% | 56% | 43% | 42% |

**Table 5.12: Home heating method, by number of bedrooms, Invercargill**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 2% | 0% | 0% | 0% | 0% |
| 2 | 28% | 18% | 11% | 6% | 0% |
| 3 | 56% | 61% | 74% | 74% | 75% |
| 4 | 9% | 14% | 11% | 17% | 17% |
| 5 | 2% | 4% | 4% | 2% | 8% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 6 Reefton

A telephone survey of domestic heating methods and fuels for Reefton was carried out by Digipoll in October 2004. This involved surveying 158 households within the 2001 census area unit (CAU) area of Reefton.

Survey details are shown in Table 6.1. The number of households for 2004 was estimated based on 2001 census data, extrapolated for 2004 based on Statistics New Zealand population projections.[13] The latter suggest a population decrease for the Buller Region of 14% by 2021.[14]

**Table 6.1: Summary survey data, Reefton**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Reefton | 417 | 157 | 6.2% |

## 6.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Reefton. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Reefton, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Reefton largely in tabular form, in the expectation that these results will be of value in other assessments (e.g. emission inventory studies).

Tables 6.2 and 6.3 show domestic heating methods and fuels used for main living areas in Reefton houses, and seasonal variations in heating behaviour. Multi-fuel burners were used by 68% of households in Reefton for heating the main living area. Overall, 67% of households in Reefton used coal for domestic heating. Many households used more than one method of heating in their main living area.

[13] New Zealand Statistics 2004, www.stats.govt.nz

[14] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 6.2: Domestic home heating methods and fuels, Reefton**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 24% | 98 | – | – |
| Total gas | 13% | 56 | 0 | 0% |
| Flued gas | 1% | 3 | – | – |
| Unflued gas | 13% | 52 | – | – |
| Oil | 1% | 5 | 0.0 | 0.0% |
| Open fire | 11% | 45 | – | – |
| Open fire: wood | 10% | 40 | 1 | 7% |
| Open fire: coal | 7% | 29 | 1 | 5% |
| Total wood burner | 19% | 80 | 2 | 14% |
| Pre-1994 wood burner | 10% | 40 | 1 | 7% |
| 1994–99 wood burner | 5% | 23 | 1 | 5% |
| Post-1999 wood burner | 4% | 17 | 0 | 2% |
| Multi-fuel burners | 68% | 282 | – | – |
| Multi-fuel burners: wood | 68% | 282 | 6 | 41% |
| Multi-fuel burners: coal | 60% | 250 | 5 | 33% |
| Pellet burners | 0% | 0 | 0 | 0% |
| Total wood | 96% | 401 | 10 | 62% |
| Total coal | 67% | 279 | 6 | 38% |
| Total | | 417 | 16 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 6.3 shows that households using multi-fuel burners heat their houses during both the summer and winter months, averaging seven days per week for most months of the year. The quantities of fuel used per day during the summer are approximately half the amount used during the winter for multi-fuel burners (Table 6.4).

**Table 6.3: Monthly variations in heating behaviour and fuel use, Reefton**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 11% | 17% | 28% | 39% | 56% | 72% | 56% | 56% | 44% | 33% | 22% | 11% |
| Open fire | 19% | 19% | 19% | 38% | 63% | 88% | 100% | 94% | 75% | 50% | 25% | 19% |
| Wood burner | 3% | 3% | 10% | 40% | 60% | 87% | 90% | 87% | 73% | 53% | 7% | 3% |
| Pellet burner | – | – | – | – | – | – | – | – | – | – | – | – |
| Multi-fuel | 17% | 16% | 23% | 46% | 79% | 94% | 99% | 94% | 81% | 58% | 25% | 18% |
| Oil | 0% | 0% | 0% | 0% | 0% | 50% | 100% | 50% | 50% | 50% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 4 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 3 | 4 |
| Open fire | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 |
| Wood burner | – | – | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Multi-fuel | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 7 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | 0.1 | 0.1 | 0.1 | 0.2 | 0.7 | 0.8 | 1.1 | 1.0 | 0.8 | 0.5 | 0.2 | 0.1 |
| Open fire: coal | 0.3 | 0.3 | 0.3 | 0.5 | 0.4 | 0.5 | 0.8 | 0.8 | 0.8 | 0.6 | 0.5 | 0.3 |
| Wood burner | – | – | 0.0 | 0.6 | 1.8 | 2.1 | 2.1 | 1.9 | 1.6 | 1.4 | 0.0 | 0.0 |
| Multi-fuel: wood | 0.5 | 0.4 | 0.7 | 1.2 | 5.7 | 6.2 | 6.3 | 6.2 | 3.1 | 1.8 | 0.7 | 0.5 |
| Multi-fuel: coal | 0.59 | 0.59 | 0.94 | 1.61 | 3.83 | 4.66 | 5.17 | 4.95 | 2.85 | 2.00 | 0.87 | 0.60 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.5 | 0.4 | 0.5 | 0.3 | 0.2 | 0.1 | 0.1 |
| Open fire: wood | 2.7 | 2.7 | 2.7 | 6.0 | 16.4 | 20.0 | 27.8 | 24.4 | 21.1 | 12.4 | 4.7 | 2.7 |
| Open fire: coal | 11.6 | 11.6 | 11.6 | 15.4 | 14.4 | 18.0 | 26.9 | 27.2 | 27.4 | 21.9 | 16.2 | 11.6 |
| Wood burner | – | – | 0.0 | 7.4 | 22.3 | 26.5 | 26.8 | 24.2 | 20.5 | 17.0 | 0.0 | 0.0 |
| Multi-fuel: wood | 1.6 | 1.3 | 2.4 | 4.1 | 20.3 | 21.9 | 22.5 | 22.0 | 10.9 | 6.4 | 2.6 | 1.6 |
| Multi-fuel: coal | 2.4 | 2.3 | 3.8 | 6.4 | 15.4 | 18.7 | 20.7 | 19.8 | 11.4 | 8.0 | 3.5 | 2.4 |

**Table 6.4: Estimated daily fuel use, by season, Reefton**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 33 | 30 |
| Open fire: coal | 35 | 30 |
| Wood burner | 32 | 26 |
| Multi-fuel: wood | 24 | 12 |
| Multi-fuel: coal | 22 | 12 |

## 6.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Reefton are presented in this section.

Figure 6.1 shows that around 6% of households using gas in Reefton during 2004 used gas systems that were properly flued. This is significantly less than the national average of 28%.

The amount spent on heating for a winter month, by heating method, is shown in Table 6.5. In Reefton, households heating using solid fuel burning methods spent less per month on average (around $60) than those using electricity, but more than those using gas ($35).

Figure 6.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Reefton.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 6.3 shows that around a quarter of the wood used on wood burners in Reefton is self-collected, compared with over half for open fires and multi-fuel burners.

**Figure 6.1: Distribution of flued versus unflued gas heating and age of wood burner, Reefton**

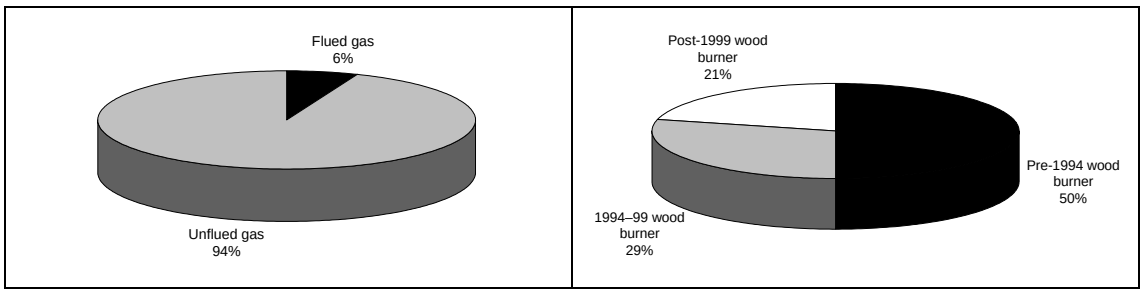


**Table 6.5: Average monthly heating costs (winter), Reefton**

| | Winter month cost |
|---|---|
| Electric | $137 |
| Gas | $35 |
| Open fire | $67 |
| Wood burner | $60 |
| Multi-fuel | $64 |

**Figure 6.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Reefton**

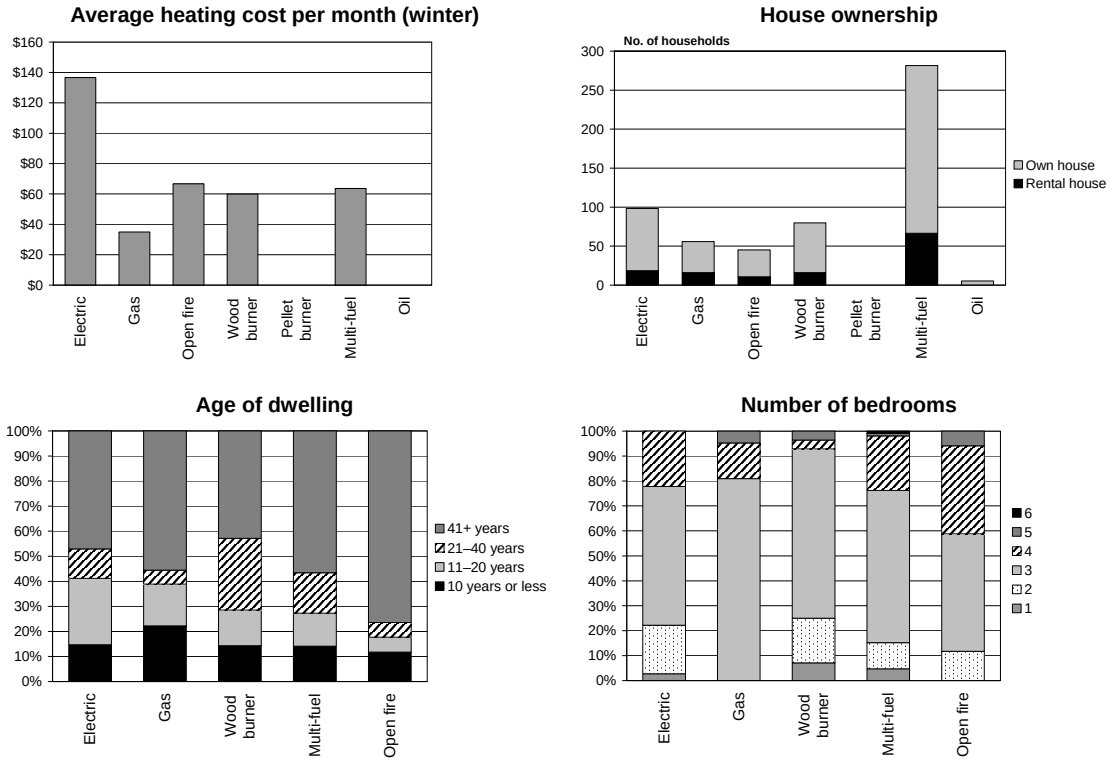


**Figure 6.3: Proportions of fuel obtained free of charge versus bought, Reefton**

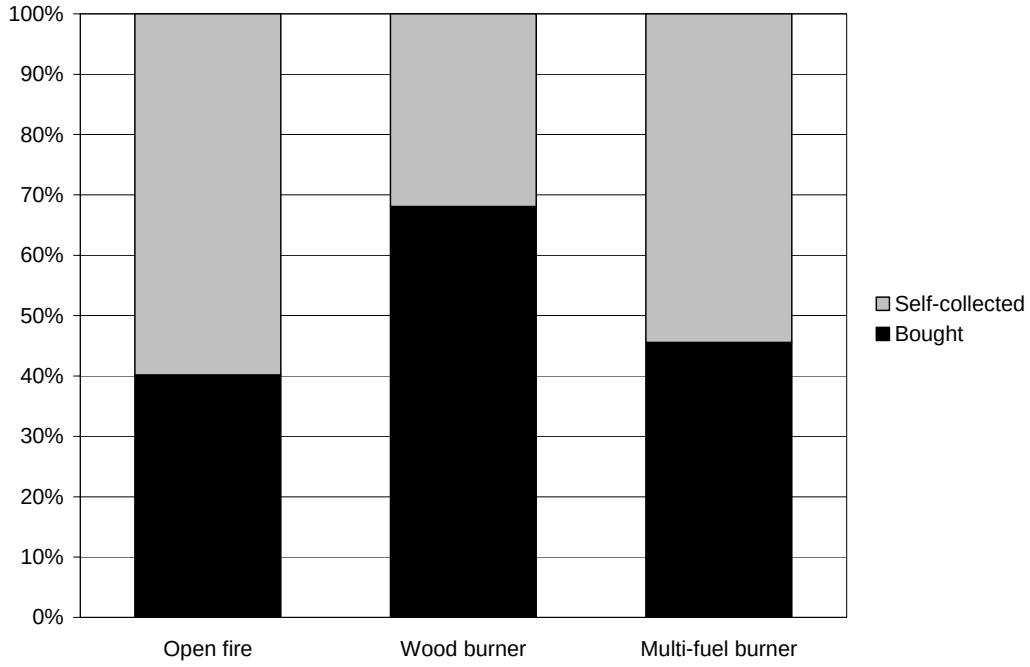

**Table 6.6: Type of electric heating, Reefton**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 13 | 16 | 32 | 3 | 19 | 16 | – | 5 |
| Percent | 14% | 16% | 32% | 3% | 19% | 16% | – | 5% |

The main type of electric heating used by households in their main living area in Reefton was portable oil column heaters and fan heaters, which were used by 32% and 19% of households, respectively (Table 6.6). Around 16% of households using electricity used heat pumps in their main living area.

Detailed data on home heating method, by house ownership, are shown in Table 6.7.

**Table 6.7: Home heating method, by house ownership, Reefton**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 95 | 23% | 322 | 77% |
| Electric | 19 | 19% | 80 | 81% |
| Gas | 16 | 29% | 40 | 71% |
| Open fire | 11 | 24% | 35 | 76% |
| Wood burner | 16 | 20% | 64 | 80% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 66 | 24% | 215 | 76% |
| Oil | 0 | 0% | 5 | 100% |

Household insulation types and heating methods are shown in Tables 6.8 and 6.9. Table 6.10 shows home heating method, by household income. The overall non-response rate was around 21%. This limits the use of these data, because there may be an income bias in the non-respondents.

**Table 6.8: House insulation summary statistics, Reefton**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 303 | 73% | No insulation | 17% |
| Under floor | 58 | 14% | 1 type* | 27% |
| Wall | 189 | 45% | 2 types | 30% |
| Cylinder wrap | 114 | 27% | 3 types | 15% |
| Double glazing | 19 | 4% | 4 types | 6% |
| None | 72 | 17% | 5 types | 2% |
| Don't know | 16 | 4% | Don't know | 4% |
| Other | 8 | 2% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 6.9: Degree of house insulation, by heating method, Reefton**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 14% | 14% | 30% | 29% | 41% |
| 2 types | 46% | 38% | 20% | 29% | 24% |
| 3 types | 16% | 14% | 23% | 13% | 12% |
| 4 types | 5% | 5% | 3% | 6% | 0% |
| 5 types | 0% | 5% | 3% | 2% | 0% |
| None or don't know | 19% | 24% | 20% | 21% | 24% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 6.10: Home heating method, by household income, Reefton**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 27% | 10% | 17% | 22% | 35% |
| Less than $20,000 | 19% | 24% | 27% | 24% | 29% |
| $20,000 to $30,000 | 14% | 10% | 23% | 15% | 0% |
| $30,000 to $40,000 | 8% | 14% | 7% | 10% | 18% |
| $40,000 to $50,000 | 11% | 19% | 10% | 12% | 6% |
| $50,000 to $70,000 | 16% | 24% | 17% | 12% | 12% |
| $70,000 to $100,000 | 0% | 0% | 0% | 3% | 0% |
| More than $100,000 | 5% | 0% | 0% | 2% | 0% |

Tables 6.11 and 6.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 6.11: Home heating method, by age of dwelling, Reefton**

| Age of dwelling | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 10 years or less | 14% | 19% | 13% | 13% | 12% |
| 11–20 years | 24% | 14% | 13% | 12% | 6% |
| 21–40 years | 11% | 5% | 27% | 15% | 6% |
| 41+ years | 43% | 48% | 40% | 53% | 76% |

**Table 6.12: Home heating method, by number of bedrooms, Reefton**

| Number of bedrooms | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 7% | 5% | 0% |
| 2 | 19% | 0% | 17% | 10% | 12% |
| 3 | 54% | 81% | 63% | 60% | 47% |
| 4 | 22% | 14% | 3% | 22% | 35% |
| 5 | 0% | 5% | 3% | 1% | 6% |
| 6 | 0% | 0% | 0% | 1% | 0% |

# 7 Westport

A telephone survey of domestic heating methods and fuels for Westport was carried out by Digipoll in October 2004. This involved surveying 153 households within the 2001 census area unit (CAU) area of urban Westport.

Survey details are shown in Table 7.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[15] The latter suggest a population decrease for the Buller Region of 14% by 2021.[16]

**Table 7.1: Summary survey data, Westport**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Westport | 1592 | 153 | 7.5% |

## 7.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Westport. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Westport, in particular the extent of change required to achieve the NES for $PM_{10}$. This section presents the results of the home heating survey for Westport largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 7.2 and 7.3 show domestic heating methods and fuels used for main living areas in Westport houses, and seasonal variations in heating behaviour. Multi-fuel burners and electric heating were the most common methods of heating the main living area and were used by 48% and 35% of households, respectively. Around 27% of the households used gas and 22% used wood burners. Many households used more than one method of heating in their main living area.

[15] New Zealand Statistics 2004, www.stats.govt.nz

[16] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 7.2: Domestic home heating methods and fuels, Westport**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 35% | 551 | – | – |
| Total gas | 27% | 427 | 0 | 1% |
| Flued gas | 5% | 88 | – | – |
| Unflued gas | 21% | 339 | – | – |
| Oil | 1% | 21 | 0.01 | 0.04% |
| Open fire | 9% | 146 | – | – |
| Open fire: wood | 9% | 146 | 3 | 9% |
| Open fire: coal | 6% | 94 | 2 | 6% |
| Total wood burner | 22% | 354 | 7 | 21% |
| Pre-1994 wood burner | 11% | 171 | 3 | 9% |
| 1994–99 wood burner | 8% | 122 | 2 | 7% |
| Post-1999 wood burner | 4% | 61 | 2 | 5% |
| Multi-fuel burners | 48% | 760 | – | – |
| Multi-fuel burners: wood | 48% | 760 | 11 | 33% |
| Multi-fuel burners: coal | 46% | 739 | 10 | 30% |
| Pellet burners | 0% | 0 | 0 | 0% |
| Total wood | 79% | 1259 | 21 | 63% |
| Total coal | 52% | 832 | 12 | 36% |
| Total | | 1592 | 33 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 7.3 shows households using multi-fuel burners heat their houses during both the summer and winter months, averaging seven days per week for most months of the year. Table 7.4 shows that the amount of wood burnt per day during the summer months on multi-fuel burners was about half that burnt during the winter, but the daily coal use per burner was similar for both seasons.

**Table 7.3: Monthly variations in heating behaviour and fuel use, Westport**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3% | 3% | 5% | 15% | 41% | 72% | 77% | 74% | 54% | 36% | 8% | 3% |
| Open fire | 0% | 0% | 0% | 8% | 62% | 85% | 100% | 85% | 62% | 23% | 0% | 0% |
| Wood burner | 9% | 9% | 15% | 32% | 59% | 91% | 91% | 88% | 65% | 29% | 12% | 9% |
| Multi-fuel | 8% | 9% | 15% | 32% | 68% | 94% | 98% | 102% | 80% | 57% | 14% | 8% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 7 | 7 | 7 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 7 |
| Open fire | – | – | – | 7 | 6 | 6 | 5 | 6 | 5 | 4 | – | – |
| Wood burner | 4 | 4 | 5 | 5 | 6 | 7 | 7 | 7 | 6 | 5 | 6 | 5 |
| Multi-fuel | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 7 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.1 | 2.7 | 2.8 | 2.9 | 2.8 | 1.3 | 0.1 | – | – |
| Open fire: coal | – | – | – | 1.3 | 1.8 | 1.7 | 1.9 | 1.9 | 2.5 | 1.3 | – | – |
| Wood burner | 0.5 | 0.5 | 1.1 | 1.7 | 5.0 | 8.3 | 6.9 | 6.5 | 5.0 | 2.8 | 0.8 | 0.6 |
| Multi-fuel: wood | 0.4 | 1.2 | 1.9 | 3.1 | 7.3 | 10.3 | 11.0 | 11.1 | 5.4 | 3.9 | 1.2 | 1.1 |
| Multi-fuel: coal | 0.6 | 0.7 | 1.0 | 2.2 | 6.7 | 8.9 | 9.9 | 10.1 | 11.2 | 9.3 | 0.9 | 0.7 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.6 | 0.6 | 0.7 | 0.5 | 0.4 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 1.0 | 18.8 | 19.2 | 19.7 | 19.5 | 8.6 | 1.0 | – | – |
| Open fire: coal | – | – | – | 13.5 | 19.1 | 18.6 | 20.4 | 20.4 | 26.7 | 13.5 | – | – |
| Wood burner | 1.5 | 1.5 | 3.0 | 4.8 | 14.0 | 23.5 | 19.5 | 18.3 | 14.1 | 7.9 | 2.2 | 1.7 |
| Multi-fuel: wood | 0.6 | 1.6 | 2.6 | 4.0 | 9.6 | 13.5 | 14.5 | 14.6 | 7.1 | 5.2 | 1.6 | 1.5 |
| Multi-fuel: coal | 0.8 | 1.0 | 1.4 | 2.9 | 9.1 | 12.0 | 13.4 | 13.7 | 15.1 | 12.6 | 1.2 | 1.0 |

**Table 7.4: Estimated daily fuel use, by season, Westport**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 26 | 12 |
| Open fire: coal | 31 | 29 |
| Wood burner | 27 | 19 |
| Multi-fuel: wood | 17 | 8 |
| Multi-fuel: coal | 16 | 17 |

## 7.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Westport are presented in this section.

Figure 7.1 shows that around 21% of households using gas in Westport used flued gas systems. This compares to a national average of 28%.

The amount spent on heating for a winter month, by heating method, is shown in Table 7.5. In Westport, households heating using wood burners and gas spent less on heating per month during the winter than households using other methods.

Figure 7.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Westport. One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 7.3 shows that around a quarter of the wood used on wood burners in Westport is self-collected, compared with around 60% for open fires and 45% for multi-fuel burners.

**Figure 7.1: Distribution of flued versus unflued gas heating and age of wood burner, Westport**

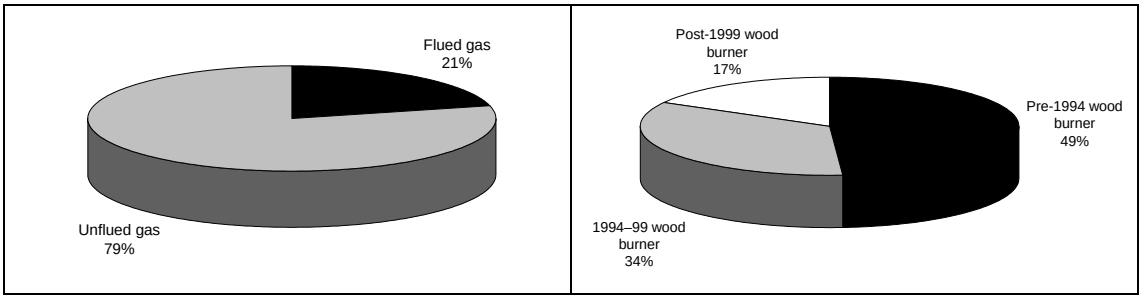


**Table 7.5: Average monthly heating costs (winter), Westport**

| | Winter month cost |
|---|---|
| Electric | $88 |
| Gas | $52 |
| Open fire | $68 |
| Wood burner | $48 |
| Multi-fuel | $78 |
| Oil | $220 |

**Figure 7.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Westport**

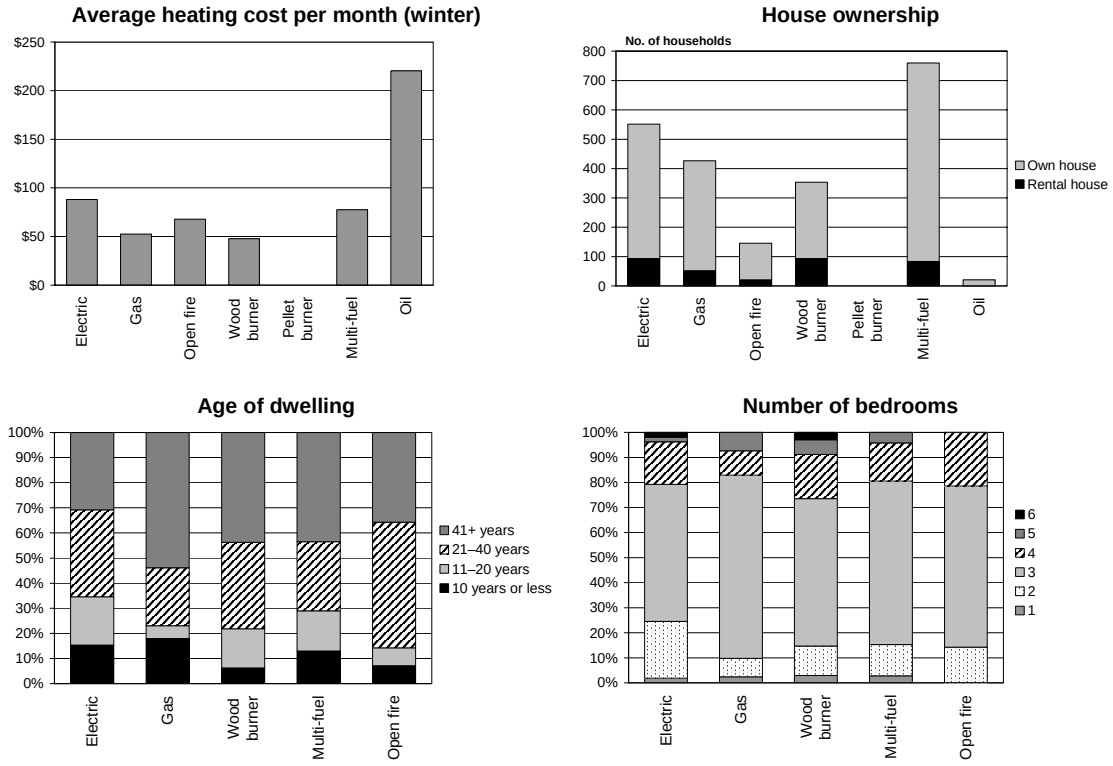


**Figure 7.3: Proportions of fuel obtained free of charge versus bought, Westport**

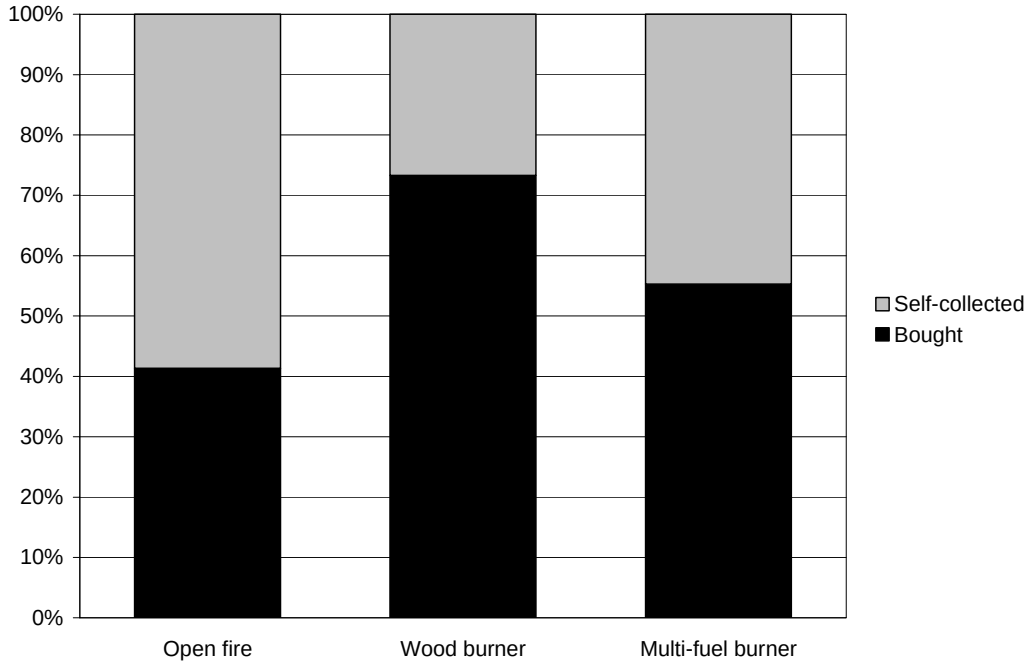

**Table 7.6: Type of electric heating, Westport**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 52 | 114 | 187 | – | 125 | 52 | – | 52 |
| Percent | 9% | 21% | 34% | 0% | 23% | 9% | – | 9% |

The main types of electric heating used by households in their main living area in Westport during 2004 were portable oil column heaters and fan heaters, which were used by 34% and 23% of households, respectively (Table 7.6). Around 9% of households using electricity used heat pumps in their main living area.

Detailed data on home heating method, by house ownership, are shown in Table 7.7.

**Table 7.7: Home heating method, by house ownership, Westport**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 232 | 15% | 1360 | 85% |
| Electric | 94 | 17% | 458 | 83% |
| Gas | 52 | 12% | 375 | 88% |
| Open fire | 21 | 14% | 125 | 86% |
| Wood burner | 94 | 26% | 260 | 74% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 83 | 11% | 676 | 89% |
| Oil | 0 | 0% | 21 | 100% |

Household insulation types and heating methods are shown in Tables 7.8 and 7.9. Table 7.10 shows home heating method by household income. The overall non-response rate was around 18%. This limits the use of these data, because there may be an income bias in the non-respondents. However, from the responses given, at least 35% of households using open fires to heat their main living area in Westport earn over $50,000 per year.

**Table 7.8: House insulation summary statistics, Westport**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1269 | 80% | No insulation | 12% |
| Under floor | 239 | 15% | 1 type | 29% |
| Wall | 853 | 54% | 2 types | 33% |
| Cylinder wrap | 364 | 23% | 3 types | 16% |
| Double glazing | 94 | 6% | 4 types | 7% |
| None | 198 | 12% | 5 types | 1% |
| Don't know | 21 | 1% | Don't know | 1% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 7.9: Degree of house insulation, by heating method, Westport**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 26% | 37% | 29% | 27% | 50% |
| 2 types | 34% | 27% | 35% | 41% | 21% |
| 3 types | 15% | 17% | 18% | 11% | 14% |
| 4 types | 11% | 2% | 3% | 8% | 7% |
| 5 types | 0% | 2% | 0% | 1% | 0% |
| None or don't know | 13% | 15% | 15% | 11% | 7% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Table 7.10: Home heating method, by household income, Westport**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 15% | 17% | 18% | 15% | 29% |
| Less than $20,000 | 30% | 22% | 18% | 25% | 21% |
| $20,000 to $30,000 | 11% | 24% | 21% | 10% | 7% |
| $30,000 to $40,000 | 8% | 7% | 12% | 16% | 7% |
| $40,000 to $50,000 | 8% | 12% | 12% | 7% | 0% |
| $50,000 to $70,000 | 13% | 10% | 3% | 16% | 7% |
| $70,000 to $100,000 | 8% | 7% | 12% | 8% | 21% |
| More than $100,000 | 8% | 0% | 6% | 3% | 7% |

* Note: columns may not sum exactly to 100 due to rounding error.

Tables 7.11 and 7.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 7.11: Home heating method, by age of dwelling, Westport**

| Age of dwelling | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 10 years or less | 15% | 17% | 6% | 12% | 7% |
| 11–20 years | 19% | 5% | 15% | 15% | 7% |
| 21–40 years | 34% | 22% | 32% | 26% | 50% |
| 41+ years | 30% | 51% | 41% | 41% | 36% |

**Table 7.12: Home heating method, by number of bedrooms, Westport**

| Number of bedrooms | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 1 | 2% | 2% | 3% | 3% | 0% |
| 2 | 23% | 7% | 12% | 12% | 14% |
| 3 | 55% | 73% | 59% | 64% | 64% |
| 4 | 17% | 10% | 18% | 15% | 21% |
| 5 | 2% | 7% | 6% | 4% | 0% |
| 6 | 2% | 0% | 3% | 0% | 0% |

# 8 Upper Hutt

A telephone survey of domestic heating methods and fuels for Upper Hutt was carried out by Digipoll in November 2004. This involved surveying 153 households within the 2001 census area unit (CAU) areas of:

- Heretaunga Park
- Trentham South
- Pinehaven
- Emerald Hill
- Maoribank
- Clouston Park
- Upper Hutt Central
- Maidstone
- Wallaceville
- Elderslea
- Moonshine
- Brentwood
- Totara Park
- Edentown
- Trentham North
- Heretaunga–Silverstream

Survey details are shown in Table 8.1. The number of households for 2004 was estimated based on 2001 census data, extrapolated for 2004 based on Statistics New Zealand population projections.[17] The latter suggest a population decrease for Upper Hutt City of 9% by 2021.[18]

**Table 8.1: Summary survey data, Upper Hutt**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Upper Hutt | 11,939 | 153 | 7.9% |

## 8.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Upper Hutt. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Upper Hutt, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Upper Hutt largely in tabular form, in the expectation that these results will be of value in other assessments (e.g. emission inventory studies).

Tables 8.2 and 8.3 show domestic heating methods and fuels used for main living areas in Upper Hutt houses, and seasonal variations in heating behaviour. Gas was the most common method of heating the main living areas of houses in Upper Hutt, with 52% of households using this method. Electricity and wood burners were also common at 34% and 28%, respectively. Many households used more than one method of heating in their main living area.

[17] New Zealand Statistics 2004, www.stats.govt.nz

[18] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 8.2: Domestic home heating methods and fuels, Upper Hutt**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 34% | 4058 | – | – |
| Total gas | 52% | 6165 | 3 | 2% |
| Flued gas | 36% | 4347 | – | – |
| Unflued gas | 15% | 1818 | – | – |
| Oil | 1% | 78 | – | – |
| Open fire | 7% | 780 | – | – |
| Open fire: wood | 6% | 702 | 21 | 16% |
| Open fire: coal | 1% | 78 | 2 | 2% |
| Total wood burner | 28% | 3355 | 98 | 74% |
| Pre-1994 wood burner | 9% | 1088 | 62 | 47% |
| 1994–99 wood burner | 6% | 725 | 18 | 13% |
| Post-1999 wood burner | 13% | 1542 | 18 | 14% |
| Multi-fuel burners | 3% | 390 | – | – |
| Multi-fuel burners: wood | 3% | 390 | 9 | 7% |
| Multi-fuel burners: coal | 0% | 0 | 0 | 0% |
| Pellet burners | 1% | 78 | – | – |
| Total wood | 37% | 4448 | 128 | 96% |
| Total coal | 1% | 78 | 2 | 2% |
| Total | | 11,939 | 133 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 8.3 shows that only a small proportion of households in Upper Hutt heat their homes during the summer months. The quantities of fuel used per household per day during the non-winter months are generally less than the amount used during winter (Table 8.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 8.3: Monthly variations in heating behaviour and fuel use, Upper Hutt**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 1% | 1% | 7% | 24% | 65% | 78% | 85% | 88% | 69% | 41% | 7% | 1% |
| Open fire | 0% | 0% | 0% | 11% | 56% | 100% | 100% | 89% | 67% | 22% | 0% | 11% |
| Wood burner | 2% | 2% | 5% | 26% | 70% | 93% | 98% | 88% | 72% | 35% | 5% | 2% |
| Multi-fuel | 0% | 0% | 0% | 0% | 60% | 100% | 100% | 100% | 80% | 60% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3 | 5 | 4 | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | – |
| Open fire | – | – | – | 3 | 5 | 6 | 7 | 6 | 4 | 3 | – | 3 |
| Wood burner | 7 | 7 | 7 | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 7 | 7 |
| Multi-fuel | – | – | – | – | 7 | 6 | 6 | 6 | 6 | 7 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 1.6 | 3.0 | 2.8 | 2.7 | 3.2 | 1.9 | 1.3 | 0.4 | 0.0 |
| Open fire: wood | 0.0 | 0.0 | 0.0 | 0.0 | 7.7 | 18.1 | 21.3 | 20.3 | 9.4 | 5.3 | 0.0 | 0.7 |
| Open fire: coal | – | – | – | – | 2.1 | 2.1 | 2.1 | 2.1 | – | – | – | – |
| Wood burner | 2.1 | 2.1 | 2.1 | 11.6 | 70.8 | 94.5 | 98.3 | 51.2 | 53.3 | 16.8 | 2.1 | 2.1 |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 8.7 | 8.7 | 8.7 | 8.9 | 4.8 | 0.0 | 0.0 |
| Multi-fuel: coal | – | – | – | – | – | – | – | – | – | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.3 | 0.5 | 0.5 | 0.4 | 0.5 | 0.3 | 0.2 | 0.1 | 0.0 |
| Open fire: wood | 0.0 | 0.0 | 0.0 | 0.0 | 10.9 | 25.7 | 30.3 | 29.0 | 13.4 | 7.5 | 0.0 | 1.0 |
| Open fire: coal | – | – | – | – | 27.0 | 27.0 | 27.0 | 27.0 | – | – | – | – |
| Wood burner | 0.6 | 0.6 | 0.6 | 3.5 | 21.1 | 28.2 | 29.3 | 15.2 | 15.9 | 5.0 | 0.6 | 0.6 |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 0.0 | 16.5 | 22.3 | 22.3 | 22.3 | 22.9 | 12.2 | 0.0 | 0.0 |
| Multi-fuel: coal | – | – | – | – | – | – | – | – | – | – | – | – |

**Table 8.4: Estimated daily fuel use, by season, Upper Hutt**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 32 | 20 |
| Open fire: coal | 27 | – |
| Wood burner | 37 | 29 |
| Multi-fuel: wood | 27 | 29 |

## 8.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Upper Hutt are presented in this section.

Figure 8.1 shows that, unlike most urban areas of New Zealand, the majority (71%) of households using gas for heating in Upper Hutt have flued gas systems.

No data were available for heating costs for open fires, oil and pellet burners and multi-fuel burners because of the small number of responses (Table 8.5).

Figure 8.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Upper Hutt.

One factor influencing the amount spent on different heating methods is the ability of households using wood burners to obtain wood free of charge. Figure 8.3 shows that around half of the wood used for home heating in Upper Hutt is self-collected.

**Figure 8.1: Distribution of flued versus unflued gas heating and age of wood burner, Upper Hutt**

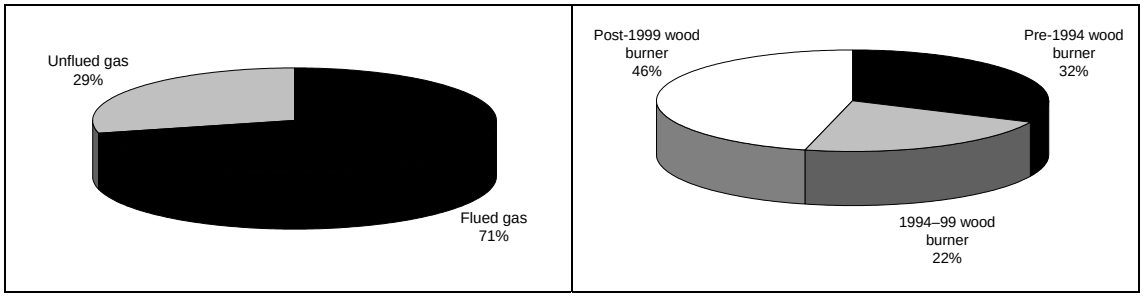


**Table 8.5: Average monthly heating costs (winter), Upper Hutt**

| | Winter month cost |
|---|---|
| Electric | $90 |
| Gas | $78 |
| Wood burner | $66 |

**Figure 8.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Upper Hutt**

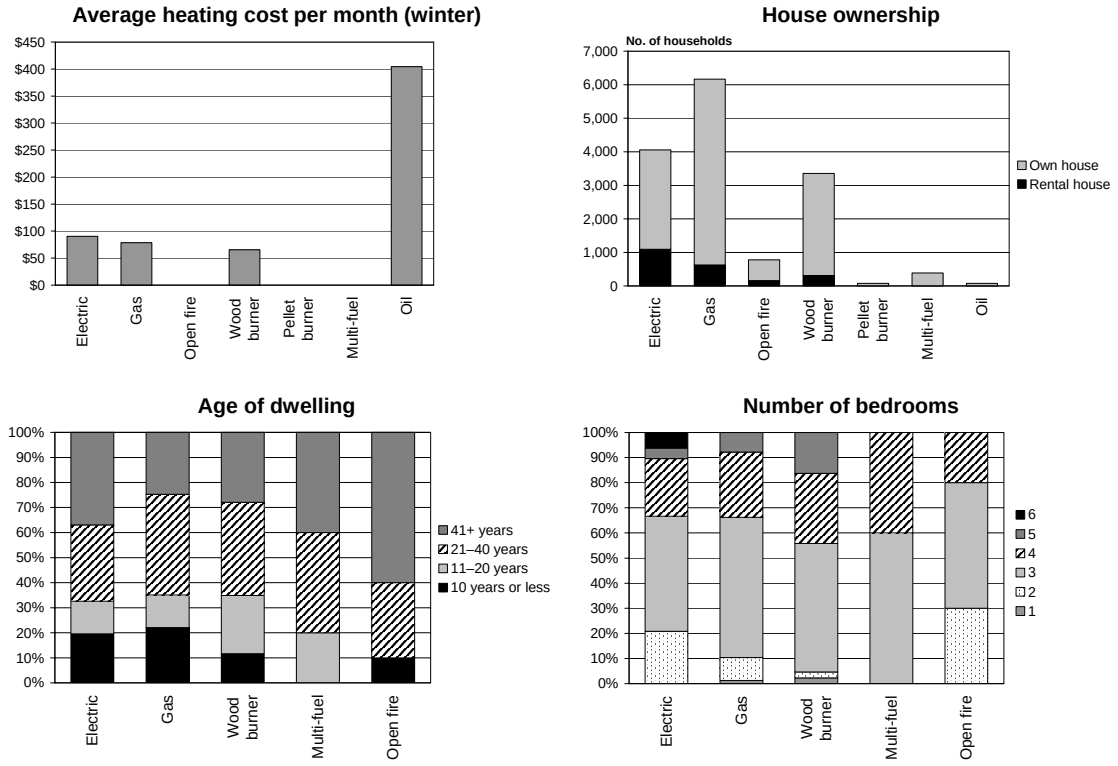


**Figure 8.3: Proportions of fuel obtained free of charge versus bought, Upper Hutt**

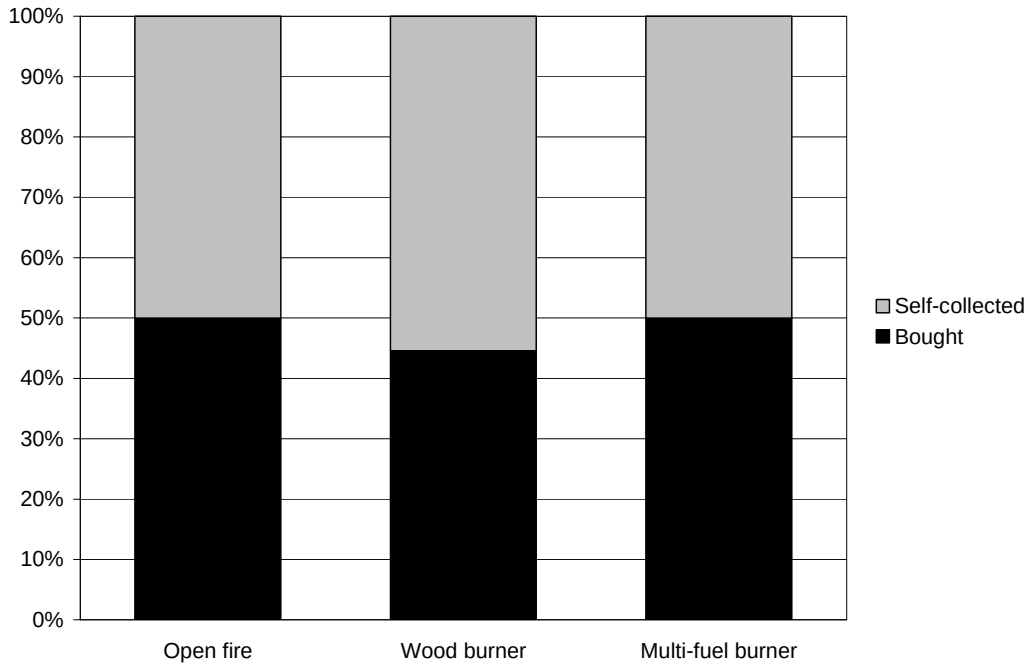

**Table 8.6: Type of electric heating, Upper Hutt**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 234 | 936 | 1,639 | 234 | 858 | 468 | – | 312 |
| Percent | 6% | 24% | 41% | 6% | 22% | 12% | – | 8% |

The main type of electric heating used by households in their main living area in Upper Hutt were portable oil column heaters, radiant heaters and fan heaters, used by 41%, 24% and 22% of households using electric heating, respectively (Table 8.6). Around 12% of households using electricity used heat pumps in their main living area.

Detailed data on home heating method, by house ownership, are shown in Table 8.7.

**Table 8.7: Home heating method, by house ownership, Upper Hutt**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 1977 | 17% | 9962 | 83% |
| Electric | 1092 | 27% | 2965 | 73% |
| Gas | 624 | 10% | 5540 | 90% |
| Open fire | 156 | 20% | 624 | 80% |
| Wood burner | 312 | 9% | 3043 | 91% |
| Pellet burner | 0 | 0% | 78 | 100% |
| Multi-fuel | 0 | 0% | 390 | 100% |
| Oil | 0 | 0% | 78 | 100% |

Household insulation types and heating methods are shown in Tables 8.8 and 8.9. Around 8% of households report having no insulation and 36% two types of insulation. Table 8.10 shows home heating method, by household income. The overall non-response rate was around 20%. This limits the use of these data, because there may be an income bias in the non-respondents.

**Table 8.8: House insulation summary statistics, Upper Hutt**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 9910 | 83% | No insulation | 8% |
| Under floor | 2419 | 20% | 1 type | 25% |
| Wall | 6945 | 58% | 2 types | 36% |
| Cylinder wrap | 2341 | 20% | 3 types | 19% |
| Double glazing | 858 | 7% | 4 types | 7% |
| None | 936 | 8% | 5 types | 1% |
| Don't know | 390 | 3% | Don't know | 3% |
| Other | 156 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 8.9: Degree of house insulation, by heating method, Upper Hutt**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 31% | 23% | 30% | 40% | 40% |
| 2 types | 21% | 44% | 35% | 20% | 20% |
| 3 types | 21% | 18% | 23% | 20% | 10% |
| 4 types | 6% | 6% | 9% | 20% | 10% |
| 5 types | 2% | 1% | 0% | 0% | 0% |
| None or don't know | 19% | 8% | 2% | 0% | 20% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 8.10: Home heating method, by household income, Upper Hutt**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 21% | 19% | 19% | 20% | 20% |
| Less than $20,000 | 17% | 9% | 7% | 0% | 40% |
| $20,000 to $30,000 | 8% | 4% | 7% | 0% | 10% |
| $30,000 to $40,000 | 12% | 6% | 12% | 20% | 20% |
| $40,000 to $50,000 | 8% | 15% | 16% | 0% | 0% |
| $50,000 to $70,000 | 12% | 22% | 16% | 40% | 0% |
| $70,000 to $100,000 | 10% | 15% | 9% | 0% | 0% |
| More than $100,000 | 13% | 10% | 14% | 20% | 10% |

Tables 8.11 and 8.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 8.11: Home heating method, by age of dwelling, Upper Hutt**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 17% | 22% | 12% | 0% | 10% |
| 11–20 years | 12% | 13% | 23% | 20% | 0% |
| 21–40 years | 27% | 39% | 37% | 40% | 30% |
| 41+ years | 33% | 24% | 28% | 40% | 60% |

**Table 8.12: Home heating method, by number of bedrooms, Upper Hutt**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 0% | 1% | 2% | 0% | 0% |
| 2 | 19% | 9% | 2% | 0% | 30% |
| 3 | 42% | 54% | 51% | 60% | 50% |
| 4 | 21% | 25% | 28% | 40% | 20% |
| 5 | 4% | 8% | 16% | 0% | 0% |
| 6 | 6% | 0% | 0% | 0% | 0% |

# 9 Te Kuiti

A telephone survey of domestic heating methods and fuels for Te Kuiti was carried out by Digipoll in November 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Te Kuiti.

Survey details are shown in Table 9.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[19] The latter suggest a population projection for Waitomo District of 10% by 2021.[20] It is assumed that the population decrease for the district as a whole apply to the urban area of Te Kuiti.

**Table 9.1: Summary survey data, Te Kuiti**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Te Kuiti | 1560 | 150 | 7.6% |

## 9.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Te Kuiti. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Te Kuiti, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Te Kuiti largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 9.2 and 9.3 show domestic heating methods and fuels used for the main living areas in Te Kuiti houses, and seasonal variations in heating behaviour. Wood burners were the most common method of heating the main living areas of houses in Te Kuiti, with 49% of households using this method. Electricity and gas were also common methods at 39% and 29%, respectively. Many households used more than one method of heating in their main living area. Overall, 67% of households in Te Kuiti used wood and 5% used coal for heating in their main living areas.

[19] New Zealand Statistics 2004, www.stats.govt.nz

[20] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 9.2: Domestic home heating methods and fuels, Te Kuiti**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 39% | 614 | | |
| Total gas | 29% | 447 | 0 | 1% |
| Flued gas | 8% | 125 | – | – |
| Unflued gas | 21% | 322 | – | – |
| Oil | 1% | 21 | 0.0 | 0.0% |
| Open fire | 9% | 135 | – | |
| Open fire: wood | 8% | 125 | 1 | 5% |
| Open fire: coal | 1% | 21 | 0 | 1% |
| Total wood burner | 49% | 770 | 23 | 77% |
| Pre-1994 wood burner | 26% | 412 | 13 | 45% |
| 1994–99 wood burner | 10% | 152 | 7 | 24% |
| Post-1999 wood burner | 13% | 206 | 3 | 9% |
| Multi-fuel burners | 10% | 156 | – | – |
| Multi-fuel burners: wood | 10% | 156 | 4 | 14% |
| Multi-fuel burners: coal | 4% | 62 | 1 | 2% |
| Pellet burners | 0% | 0 | 0 | 0% |
| Total wood | 67% | 1050 | 29 | 96% |
| Total coal | 5% | 83 | 1 | 3% |
| Total | | 1560 | 30 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 9.3 shows that very few households in Te Kuiti heat their homes during the summer months. Those that do typically use gas, and heat their house seven days a week. Daily fuel use per household is generally less during the non-winter months (Table 9.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations and fuel use for some heating types.

**Table 9.3: Monthly variations in heating behaviour and fuel use, Te Kuiti**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 2% | 2% | 2% | 20% | 46% | 76% | 85% | 88% | 71% | 24% | 7% | 2% |
| Open fire | 0% | 0% | 0% | 18% | 55% | 73% | 73% | 82% | 55% | 18% | 9% | 0% |
| Wood burner | 0% | 0% | 1% | 22% | 65% | 88% | 95% | 95% | 78% | 49% | 4% | 0% |
| Multi-fuel | 0% | 0% | 0% | 29% | 71% | 93% | 100% | 93% | 64% | 36% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 7 | 7 | 7 | 5 | 6 | 6 | 6 | 6 | 6 | 4 | 7 | 7 |
| Open fire | – | – | – | 5 | 5 | 6 | 6 | 5 | 6 | 4 | 2 | – |
| Wood burner | – | – | 7 | 7 | 6 | 7 | 7 | 6 | 6 | 5 | 6 | – |
| Multi-fuel | – | – | – | 6 | 7 | 7 | 7 | 7 | 7 | 5 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.4 | 0.4 | 0.5 | 0.3 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.3 | 1.3 | 1.1 | 1.5 | 1.8 | 2.8 | 0.9 | 0.2 | – |
| Open fire: coal | – | – | – | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.0 | – |
| Wood burner | – | – | 0.5 | 7.7 | 17.2 | 21.0 | 23.2 | 23.9 | 17.6 | 8.4 | 0.5 | – |
| Multi-fuel: wood | – | – | – | 0.1 | 2.9 | 3.9 | 4.1 | 3.4 | 2.3 | 1.0 | 0.0 | – |
| Multi-fuel: coal | – | – | – | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.3 | 0.7 | 0.9 | 0.9 | 1.2 | 0.6 | 0.2 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 2.7 | 10.5 | 8.8 | 11.7 | 14.3 | 22.1 | 6.9 | 1.8 | – |
| Open fire: coal | – | – | – | 0.0 | 6.4 | 8.4 | 8.4 | 8.4 | 4.5 | 0.0 | 0.0 | – |
| Wood burner | – | – | 0.7 | 10.1 | 22.3 | 27.2 | 30.1 | 31.0 | 22.9 | 10.9 | 0.7 | – |
| Multi-fuel: wood | – | – | 0.0 | 0.7 | 18.7 | 25.1 | 26.1 | 21.5 | 14.7 | 6.6 | 0.0 | – |
| Multi-fuel: coal | – | – | – | – | 4.5 | 6.8 | 9.6 | 9.0 | – | – | – | – |

**Table 9.4: Estimated daily fuel use, by season, Te Kuiti**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 0 |
| Open fire: wood | 30 | 23 |
| Open fire: coal | 9 | 5 |
| Wood burner | 39 | 29 |
| Multi-fuel: wood | 31 | 15 |
| Multi-fuel: coal | 11 | – |

## 9.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Te Kuiti are presented in this section.

Figure 9.1 shows that in Te Kuiti around 28% of households using gas have flued gas systems. This is consistent with the national average (also 28%).

The average amount spent on solid fuel methods in Te Kuiti ranges from $31 for wood burners to $47 dollars per month for open fires (Table 9.5). This compares to a national average of around $60 per month.

Figure 9.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Te Kuiti. Unlike other areas of New Zealand, installations of open fires into new dwellings (less than 10 years old) are not present in Te Kuiti.

**Figure 9.1: Distribution of flued versus unflued gas heating and age of wood burner, Te Kuiti**

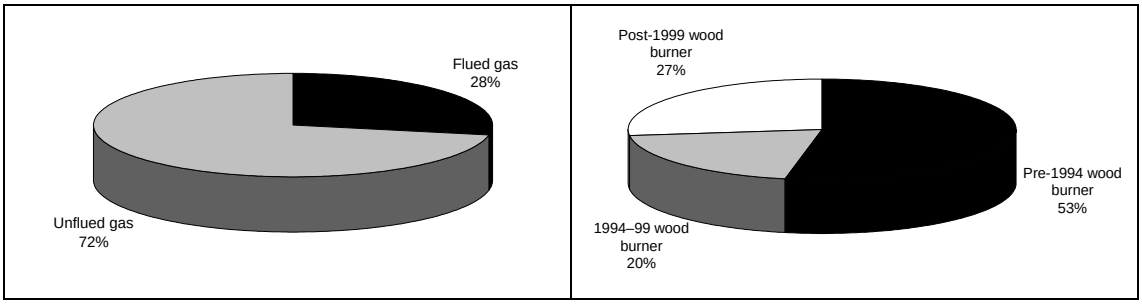


**Table 9.5: Average monthly heating costs (winter), Te Kuiti**

| | Winter month cost |
|---|---|
| Electric | $88 |
| Gas | $86 |
| Open fire | $47 |
| Wood burner | $31 |
| Multi-fuel | $41 |
| Oil | $15 |

**Figure 9.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Te Kuiti**

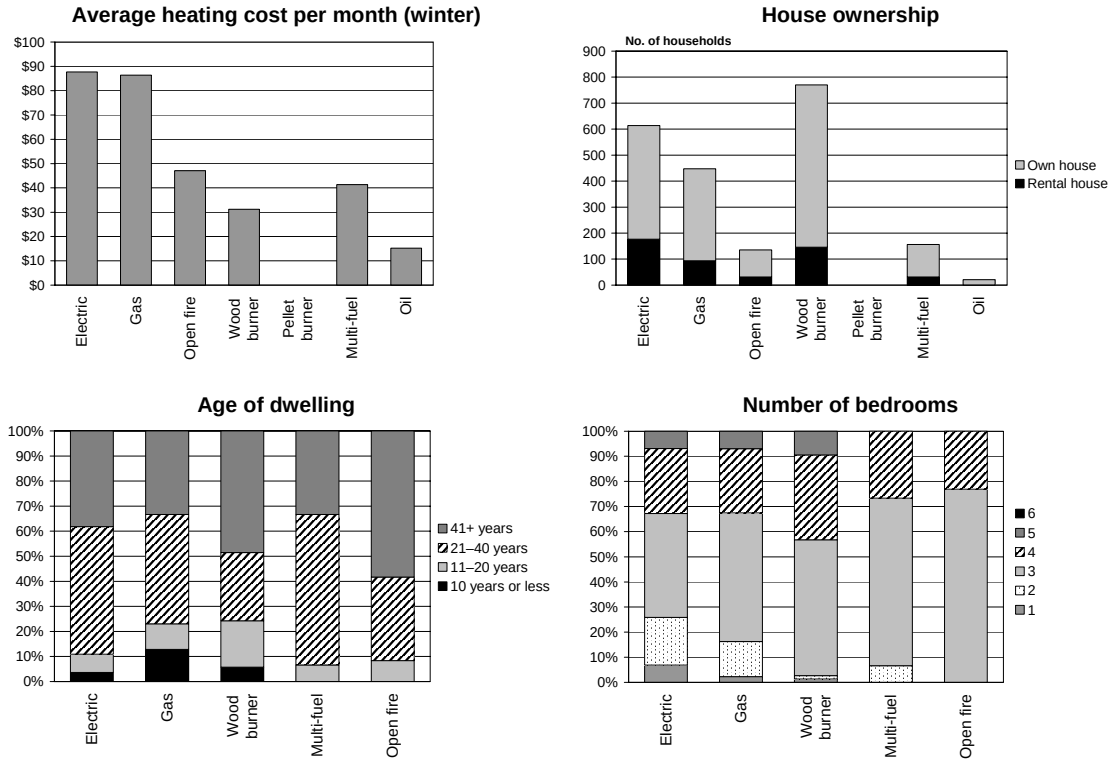


**Table 9.6: Type of electric heating, Te Kuiti**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 42 | 94 | 229 | 52 | 135 | 52 | – | 42 |
| Percent | 7% | 16% | 38% | 9% | 22% | 9% | – | 7% |

The main type of electric heater used by households in their main living area in Te Kuiti were portable oil column heaters and fan heaters, used by 38% and 22% of households using electric heating, respectively (Table 9.6). Around 9% of households using electricity used heat pumps in their main living area.

Detailed data on home heating methods, by house ownership, are shown in Table 9.7.

**Table 9.7: Home heating method, by house ownership, Te Kuiti**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 403 | 26% | 1157 | 74% |
| Electric | 177 | 29% | 437 | 71% |
| Gas | 94 | 21% | 354 | 79% |
| Open fire | 31 | 23% | 104 | 77% |
| Wood burner | 146 | 19% | 624 | 81% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 31 | 20% | 125 | 80% |
| Oil | 0 | 0% | 21 | 100% |

Household insulation types and heating methods are shown in Tables 9.8 and 9.9. Table 9.8 shows that around 18% of houses report having no insulation. This is higher than the national average of 10%.

Table 9.10 shows home heating method, by household income. The overall non-response rate was around 14%. This limits the use of these data because there may be an income bias in non-respondents. The non-response rate for households with open fires, however, was zero. Results indicate that about half of the households surveyed with open fires have an annual average income of less than $30,000 and around 24% have an annual income of more than $50,000. (Note that these data should be treated as indicative only because the total number of respondents with open fires in the survey was small).

**Table 9.8: House insulation summary statistics, Te Kuiti**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1092 | 70% | No insulation | 18% |
| Under floor | 270 | 17% | 1 type | 19% |
| Wall | 738 | 47% | 2 types | 39% |
| Cylinder wrap | 281 | 18% | 3 types | 11% |
| Double glazing | 52 | 3% | 4 types | 7% |
| None | 281 | 18% | 5 types | 0% |
| Don't know | 125 | 8% | Don't know | 8% |
| Other | 31 | 2% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 9.9: Degree of house insulation, by heating method, Te Kuiti**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 22% | 30% | 11% | 33% | 31% |
| 2 types | 37% | 35% | 47% | 27% | 23% |
| 3 types | 7% | 5% | 16% | 13% | 0% |
| 4 types | 7% | 5% | 7% | 0% | 8% |
| 5 types | 0% | 0% | 0% | 0% | 0% |
| None or don't know | 27% | 26% | 19% | 27% | 38% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 9.10: Home heating method, by household income, Te Kuiti**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 7% | 12% | 16% | 20% | 0% |
| Less than $20,000 | 34% | 23% | 9% | 27% | 23% |
| $20,000 to $30,000 | 8% | 14% | 14% | 13% | 31% |
| $30,000 to $40,000 | 17% | 12% | 18% | 0% | 8% |
| $40,000 to $50,000 | 5% | 7% | 8% | 20% | 15% |
| $50,000 to $70,000 | 10% | 14% | 14% | 13% | 8% |
| $70,000 to $100,000 | 10% | 5% | 11% | 7% | 8% |
| More than $100,000 | 8% | 14% | 11% | 0% | 8% |

Tables 9.11 and 9.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 9.11: Home heating method, by age of dwelling, Te Kuiti**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 3% | 12% | 5% | 0% | 0% |
| 11–20 years | 7% | 9% | 18% | 7% | 8% |
| 21–40 years | 47% | 40% | 26% | 60% | 31% |
| 41+ years | 36% | 30% | 46% | 33% | 54% |

**Table 9.12: Home heating method, by number of bedrooms, Te Kuiti**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 7% | 2% | 1% | 0% | 0% |
| 2 | 19% | 14% | 1% | 7% | 0% |
| 3 | 41% | 51% | 54% | 67% | 77% |
| 4 | 25% | 26% | 34% | 27% | 23% |
| 5 | 7% | 7% | 9% | 0% | 0% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 10 Alexandra

A telephone survey of domestic heating methods and fuels for Alexandra was carried out by Digipoll in November and December 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Alexandra.

Survey details are shown in Table 10.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[21] The latter suggest a population decrease for Central Otago of 18% by 2021.[22] It is assumed that this population decrease also applies to the urban area of Alexandra.

**Table 10.1: Summary survey data, Alexandra**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Alexandra | 1810 | 150 | 7.7% |

## 10.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Alexandra. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Alexandra, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Alexandra largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 10.2 and 10.3 show domestic heating methods and fuels used for the main living areas in Alexandra houses, and seasonal variations in heating behaviour. Electricity and wood burners were the commonest methods of heating the main living areas of houses in Alexandra, with 59% and 47% of households, respectively, using these methods. Many households used more than one method of heating. Overall, 67% of households in Alexandra used wood and 9% used coal for heating in their main living areas.

[21] New Zealand Statistics 2004, www.stats.govt.nz

[22] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 10.2: Domestic home heating methods and fuels, Alexandra**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 59% | 1074 | – | – |
| Total gas | 13% | 229 | 0.2 | 0% |
| Flued gas | 4% | 67 | – | – |
| Unflued gas | 9% | 162 | – | – |
| Oil | 5% | 84 | 0.0 | 0.1% |
| Open fire | 2% | 36 | – | – |
| Open fire: wood | 2% | 36 | 3 | 9% |
| Open fire: coal | 1% | 12 | 0 | 0% |
| Total wood burner | 47% | 845 | 20 | 60% |
| Pre-1994 wood burner | 23% | 416 | 12 | 36% |
| 1994–99 wood burner | 13% | 241 | 5 | 16% |
| Post-1999 wood burner | 10% | 188 | 2 | 7% |
| Multi-fuel burners | 18% | 326 | – | |
| Multi-fuel burners: wood | 18% | 326 | 8 | 24% |
| Multi-fuel burners: coal | 9% | 157 | 2 | 6% |
| Pellet burners | 1% | 12 | 0 | 1% |
| Total wood | 67% | 1207 | 31 | 93% |
| Total coal | 9% | 169 | 2 | 6% |
| Total | | 1810 | 33 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Only a small proportion of households in Alexandra heat their homes during the summer months (Table 10.3). Table 10.4 shows that daily fuel use per household is generally less during the non-winter months. No data on fuel use were provided for open fires because of the low response rate for this question.

Data shown in Table 10.3 exclude information relating to seasonal variations in electricity use for domestic heating. This is because this information was collected for the evaluation of emissions from domestic heating to determine options for reducing $PM_{10}$ emissions in urban areas of New Zealand. Electricity is treated as a zero emission source for this purpose.

**Table 10.3: Monthly variations in heating behaviour and fuel use, Alexandra**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 6% | 6% | 17% | 50% | 56% | 89% | 83% | 78% | 61% | 22% | 11% | 6% |
| Open fire | 0% | 0% | 0% | 0% | 50% | 50% | 100% | 100% | 0% | 0% | 0% | 0% |
| Wood burner | 0% | 0% | 6% | 43% | 79% | 89% | 94% | 86% | 60% | 27% | 6% | 0% |
| Multi-fuel | 0% | 0% | 8% | 31% | 69% | 96% | 96% | 92% | 77% | 23% | 4% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 5 | 5 | 5 | 6 | 6 | 5 | 5 | 5 | 1 | – |
| Open fire | – | – | – | – | 5 | 5 | 6 | 6 | – | – | – | – |
| Wood burner | – | – | 5 | 6 | 6 | 7 | 7 | 6 | 6 | 6 | 5 | – |
| Multi-fuel | – | – | 3 | 6 | 6 | 6 | 7 | 7 | 6 | 6 | 7 | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | – | – | – | – | – | – | – | – |
| Open fire: coal | – | – | – | – | 0.1 | 0.1 | 0.1 | 0.1 | – | – | – | – |
| Wood burner | – | – | 1.2 | 6.7 | 15.2 | 18.4 | 19.9 | 17.3 | 6.8 | 2.9 | 0.1 | – |
| Multi-fuel: wood | – | – | 0.0 | 2.8 | 5.4 | 7.6 | 7.8 | 7.3 | 4.0 | 0.2 | 0.0 | – |
| Multi-fuel: coal | – | – | 0.0 | 0.3 | 1.8 | 2.1 | 1.9 | 1.8 | 1.2 | 0.7 | 0.2 | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.1 | 0.3 | 0.4 | 0.7 | 0.7 | 0.7 | 0.4 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | – | – | – | – | – | – | – | – |
| Open fire: coal | – | – | – | – | 6.4 | 6.4 | 6.4 | 6.4 | – | – | – | – |
| Wood burner | – | – | 1.4 | 8.0 | 18.0 | 21.7 | 23.6 | 20.4 | 8.0 | 3.4 | 0.2 | – |
| Multi-fuel: wood | – | – | 0.1 | 8.6 | 16.7 | 23.4 | 24.1 | 22.3 | 12.4 | 0.7 | 0.0 | – |
| Multi-fuel: coal | – | – | 0.1 | 1.7 | 11.6 | 13.2 | 12.4 | 11.6 | 7.7 | 4.4 | 1.0 | – |

**Table 10.4: Estimated daily fuel use, by season, Alexandra**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 0.4 |
| Wood burner | 29 | 17 |
| Multi-fuel: wood | 26 | 15 |
| Multi-fuel: coal | 14 | 9 |

## 10.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Alexandra are presented in this section.

Figure 10.1 shows that in Alexandra around 29% of households using gas have flued gas systems. This is consistent with the national average (28%). The average amount spent on solid fuel methods in Alexandra ranges from $33 for open fires to $153 dollars per month for electric heating (Table 10.5).

Figure 10.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Alexandra. Wood burners and electricity were the main methods of heating the main living area in rented houses in Alexandra.

One factor influencing the amount spent on different heating methods is the ability for households using solid fuel burners to obtain wood free of charge. Figure 10.3 shows that less than half of the wood used for home heating in Alexandra is self-collected.

**Figure 10.1: Distribution of flued versus unflued gas heating and age of wood burner, Alexandra**

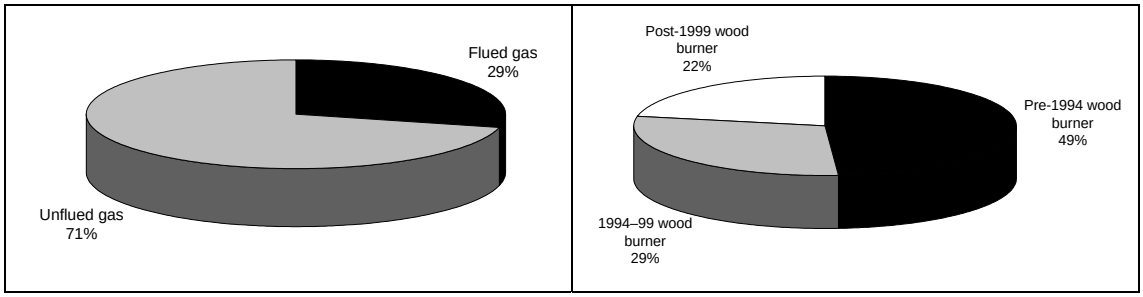


**Table 10.5: Average monthly heating costs (winter), Alexandra**

| | Winter month cost |
|---|---|
| Electric | $153 |
| Gas | $118 |
| Open fire | $33 |
| Wood burner | $84 |
| Pellet burner | $177 |
| Multi-fuel | $72 |
| Oil | $145 |

**Figure 10.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Alexandra**

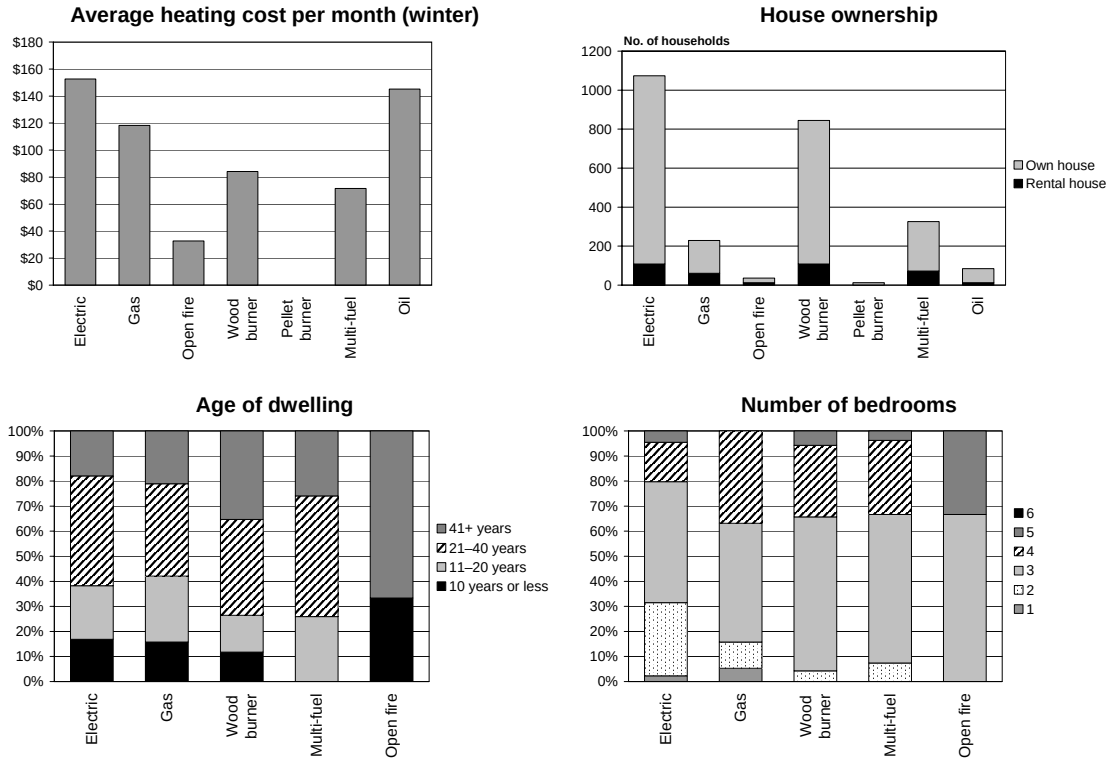


**Figure 10.3: Proportions of fuel obtained free of charge versus bought, Alexandra**

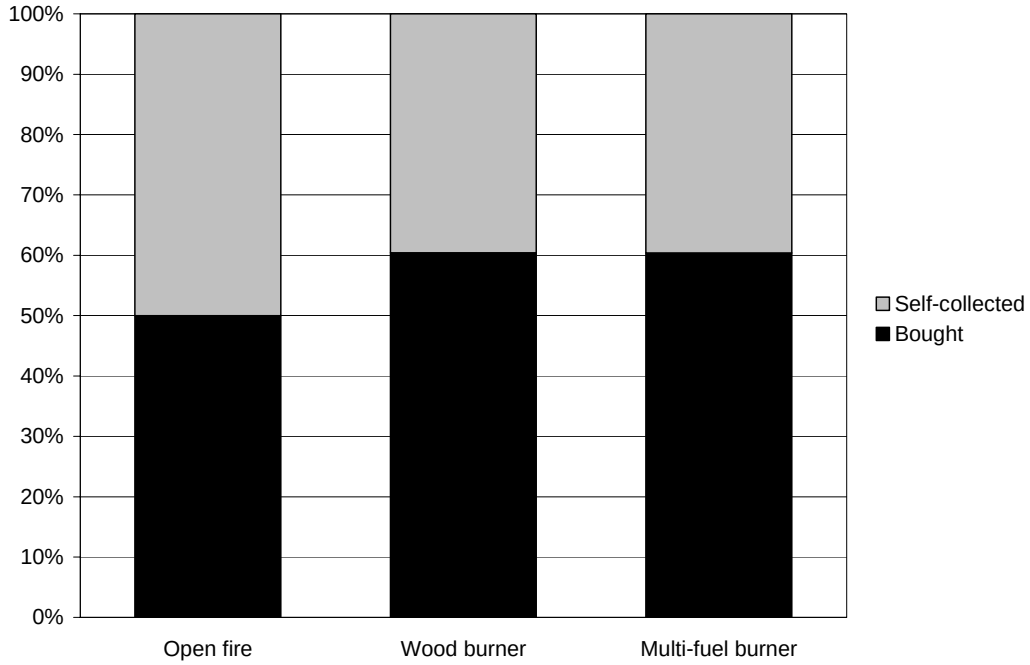

**Table 10.6: Type of electric heating, Alexandra**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 145 | 157 | 169 | 109 | 253 | 434 | – | 133 |
| Percent | 13% | 15% | 16% | 10% | 24% | 40% | – | 12% |

The main types of electric heating used by households in their main living area in Alexandra were heat pumps and fan heaters, used by 40% and 24% of households using electric heating, respectively (Table 10.6). The proportion of houses with heat pumps is much higher than the national average (13% of households using electric heating in their main living area).

Detailed data on home heating method, by house ownership, are shown in Table 10.7.

**Table 10.7: Home heating method, by house ownership, Alexandra**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 241 | 13% | 1569 | 87% |
| Electric | 109 | 10% | 965 | 90% |
| Gas | 60 | 26% | 169 | 74% |
| Open fire | 12 | 33% | 24 | 67% |
| Wood burner | 109 | 13% | 736 | 87% |
| Pellet burner | 0 | 0% | 12 | 100% |
| Multi-fuel | 72 | 22% | 253 | 78% |
| Oil | 12 | 14% | 72 | 86% |

Household insulation types and heating methods are shown in Tables 10.8 and 10.9. Around 5% of houses in Alexandra are reported as having no insulation, which is lower than the national average of 10%. Table 10.10 shows home heating method, by household income. The overall non-response rate was around 17%. This limits the use of these data because there may be an income bias in the non-respondents.

**Table 10.8: House insulation summary statistics, Alexandra**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1545 | 85% | No insulation | 5% |
| Under floor | 483 | 27% | 1 type | 21% |
| Wall | 1183 | 65% | 2 types | 32% |
| Cylinder wrap | 495 | 27% | 3 types | 27% |
| Double glazing | 253 | 14% | 4 types | 8% |
| None | 97 | 5% | 5 types | 5% |
| Don't know | 48 | 3% | Don't know | 3% |
| Other | 24 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 10.9: Degree of house insulation, by heating method, Alexandra**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 20% | 16% | 19% | 33% | 33% |
| 2 types | 34% | 21% | 37% | 19% | 0% |
| 3 types | 27% | 37% | 26% | 22% | 0% |
| 4 types | 10% | 21% | 6% | 15% | 0% |
| 5 types | 4% | 0% | 4% | 4% | 33% |
| None or don't know | 4% | 5% | 9% | 7% | 33% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 10.10: Home heating method, by household income, Alexandra**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 15% | 16% | 16% | 15% | 67% |
| Less than $20,000 | 26% | 11% | 10% | 11% | 0% |
| $20,000 to $30,000 | 22% | 26% | 19% | 15% | 0% |
| $30,000 to $40,000 | 7% | 21% | 14% | 11% | 0% |
| $40,000 to $50,000 | 12% | 5% | 13% | 22% | 33% |
| $50,000 to $70,000 | 8% | 5% | 16% | 19% | 0% |
| $70,000 to $100,000 | 6% | 0% | 9% | 4% | 0% |
| More than $100,000 | 4% | 16% | 4% | 4% | 0% |

Tables 10.11 and 10.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 10.11: Home heating method, by age of dwelling, Alexandra**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 17% | 16% | 11% | 0% | 33% |
| 11–20 years | 21% | 26% | 14% | 26% | 0% |
| 21–40 years | 44% | 37% | 37% | 48% | 0% |
| 41+ years | 18% | 21% | 34% | 26% | 67% |

**Table 10.12: Home heating method, by number of bedrooms, Alexandra**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 2% | 5% | 0% | 0% | 0% |
| 2 | 29% | 11% | 4% | 7% | 0% |
| 3 | 48% | 47% | 61% | 59% | 67% |
| 4 | 16% | 37% | 29% | 30% | 0% |
| 5 | 4% | 0% | 6% | 4% | 33% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 11 Oamaru

A telephone survey of domestic heating methods and fuels for Oamaru was carried out by Digipoll in November 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Oamaru North, Orana Park, Oamaru Central and Oamaru South.

Survey details are shown in Table 11.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[23] The latter suggest a population decrease for the Waitaki District of 17% by 2021.[24] It is assumed that this decrease applies to the urban area of Oamaru.

**Table 11.1: Summary survey data, Oamaru**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Oamaru | 4602 | 150 | 7.9% |

## 11.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Oamaru. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Oamaru, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Oamaru largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 11.2 and 11.3 show domestic heating methods and fuels used for main living areas in Oamaru houses, and seasonal variations in heating behaviour. Electricity and wood burners were the commonest methods of heating in Oamaru, with 47% and 57% of households using these methods, respectively. Many households used more than one method of heating in their main living area. Overall, 79% of households in Oamaru used wood and 13% used coal for heating in their main living areas.

[23] New Zealand Statistics 2004, www.stats.govt.nz

[24] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 11.2: Domestic home heating methods and fuels, Oamaru**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 47% | 2148 | – | – |
| Total gas | 18% | 828 | 1 | 1% |
| Flued gas | 6% | 265 | – | – |
| Unflued gas | 12% | 563 | – | – |
| Oil | 1% | 31 | 0.0 | 0.0% |
| Open fire | 6% | 276 | – | – |
| Open fire: wood | 6% | 276 | 5 | 5% |
| Open fire: coal | 4% | 184 | 3 | 4% |
| Total wood burner | 57% | 2608 | 58 | 65% |
| Pre-1994 wood burner | 25% | 1159 | 24 | 26% |
| 1994–99 wood burner | 19% | 869 | 21 | 23% |
| Post-1999 wood burner | 13% | 580 | 14 | 15% |
| Multi-fuel burners | 17% | 767 | – | – |
| Multi-fuel burners: wood | 17% | 767 | 15 | 16% |
| Multi-fuel burners: coal | 9% | 430 | 6 | 6% |
| Pellet burners | 1% | 31 | 2 | 3% |
| Total wood | 79% | 3651 | 77 | 86% |
| Total coal | 13% | 614 | 9 | 10% |
| Total | | 4602 | 89 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 11.3 shows that around 4% of households using wood burners for heating heat their homes during the summer months, burning on average three days per week during January and February. Data shown in Table 11.3 exclude information relating to seasonal variations in electricity use for domestic heating. This is because this information was collected for the evaluation of emissions from domestic heating to determine options for reducing $PM_{10}$ emissions in urban areas of New Zealand. Electricity is treated as a zero emission source for this purpose.

Table 11.4 shows that while daily fuel use per household is generally less during the non-winter months, the amount of coal used on an open fire is actually higher than during the winter months. This does not suggest that any given household uses more fuel during summer than during winter, as fewer households reported coal use on open fires during the non-winter months and these houses burnt more than the average amount of coal during the winter months. Data are not presented for all heating methods, because the number of respondents for methods such as oil and pellet burners was small.

**Table 11.3: Monthly variations in heating behaviour and fuel use, Oamaru**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 10% | 14% | 43% | 76% | 81% | 81% | 43% | 24% | 14% | 0% |
| Open fire | 0% | 0% | 11% | 22% | 56% | 89% | 100% | 89% | 44% | 22% | 0% | 0% |
| Wood burner | 4% | 4% | 18% | 35% | 71% | 87% | 91% | 87% | 67% | 41% | 21% | 7% |
| Multi-fuel | 0% | 0% | 20% | 40% | 70% | 95% | 95% | 90% | 50% | 40% | 10% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 6 | 5 | 5 | 6 | 6 | 4 | 4 | 2 | 3 | – |
| Open fire | – | – | 7 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | – | – |
| Wood burner | 3 | 3 | 6 | 6 | 6 | 7 | 7 | 7 | 6 | 6 | 5 | 6 |
| Multi-fuel | – | – | 5 | 6 | 6 | 7 | 7 | 7 | 6 | 6 | 4 | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.2 | 0.2 | 0.4 | 0.8 | 0.7 | 0.4 | 0.2 | 0.2 | 0.2 | – |
| Open fire: wood | – | – | 3.7 | 3.7 | 1.1 | 2.2 | 4.7 | 3.5 | 3.7 | 3.7 | – | – |
| Open fire: coal | – | – | 8.3 | 8.3 | 2.0 | 2.9 | 3.5 | 2.7 | 8.3 | 8.3 | – | – |
| Wood burner | 3.9 | 3.9 | 20.8 | 25.5 | 41.4 | 55.0 | 58.0 | 53.1 | 61.5 | 34.3 | 15.1 | 6.3 |
| Multi-fuel: wood | – | – | 2.0 | 4.1 | 11.1 | 15.8 | 14.6 | 12.6 | 7.1 | 4.2 | 1.2 | – |
| Multi-fuel: coal | – | – | 0.2 | 0.8 | 2.2 | 4.6 | 5.8 | 5.7 | 2.2 | 1.3 | 0.2 | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.3 | 0.3 | 0.5 | 0.9 | 0.8 | 0.5 | 0.3 | 0.2 | 0.2 | – |
| Open fire: wood | – | – | 13.3 | 13.3 | 4.0 | 8.1 | 16.9 | 12.8 | 13.3 | 13.3 | – | – |
| Open fire: coal | – | – | 45.0 | 45.0 | 10.7 | 15.9 | 18.9 | 14.6 | 45.0 | 45.0 | – | – |
| Wood burner | 1.5 | 1.5 | 8.0 | 9.8 | 15.9 | 21.1 | 22.2 | 20.4 | 23.6 | 13.1 | 5.8 | 2.4 |
| Multi-fuel: wood | – | – | 2.6 | 5.4 | 14.5 | 20.7 | 19.0 | 16.5 | 9.2 | 5.4 | 1.6 | – |
| Multi-fuel: coal | – | – | 0.5 | 1.8 | 5.0 | 10.7 | 13.4 | 13.3 | 5.1 | 3.1 | 0.5 | – |

**Table 11.4: Estimated daily fuel use, by season, Oamaru**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 3 |
| Open fire: wood | 18 | 13 |
| Open fire: coal | 26 | 45 |
| Wood burner | 29 | 28 |
| Multi-fuel: wood | 23 | 12 |
| Multi-fuel: coal | 15 | 5 |

# 11.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Oamaru are presented in this section.

Figure 11.1 shows that in Oamaru around 32% of households using gas have flued gas systems.

The average amount spent on fuel for solid fuel methods in Oamaru ranged from $43 for open fires to $135 dollars per month for multi-fuel burners (Table 11.5).

Figure 11.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Oamaru. This shows that larger houses in Oamaru typically use an open fire or gas for heating the main living area, and that electricity or wood burners are the most common forms of heating in rental properties.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 11.3 shows that over half of the wood used for home heating in Oamaru is self-collected.

**Figure 11.1: Distribution of flued versus unflued gas heating and age of wood burner, Oamaru**

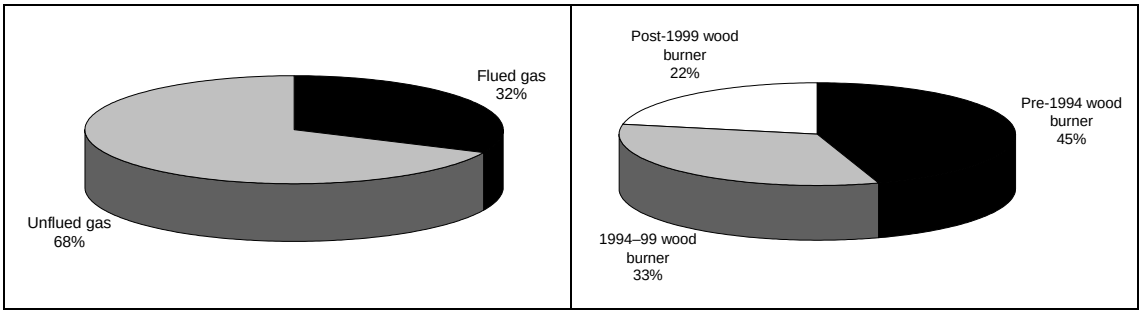


**Table 11.5: Average monthly heating costs (winter), Oamaru**

| | Winter month cost |
|---|---|
| Electric | $90 |
| Gas | $70 |
| Open fire | $43 |
| Wood burner | $79 |
| Multi-fuel | $135 |

**Figure 11.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Oamaru**

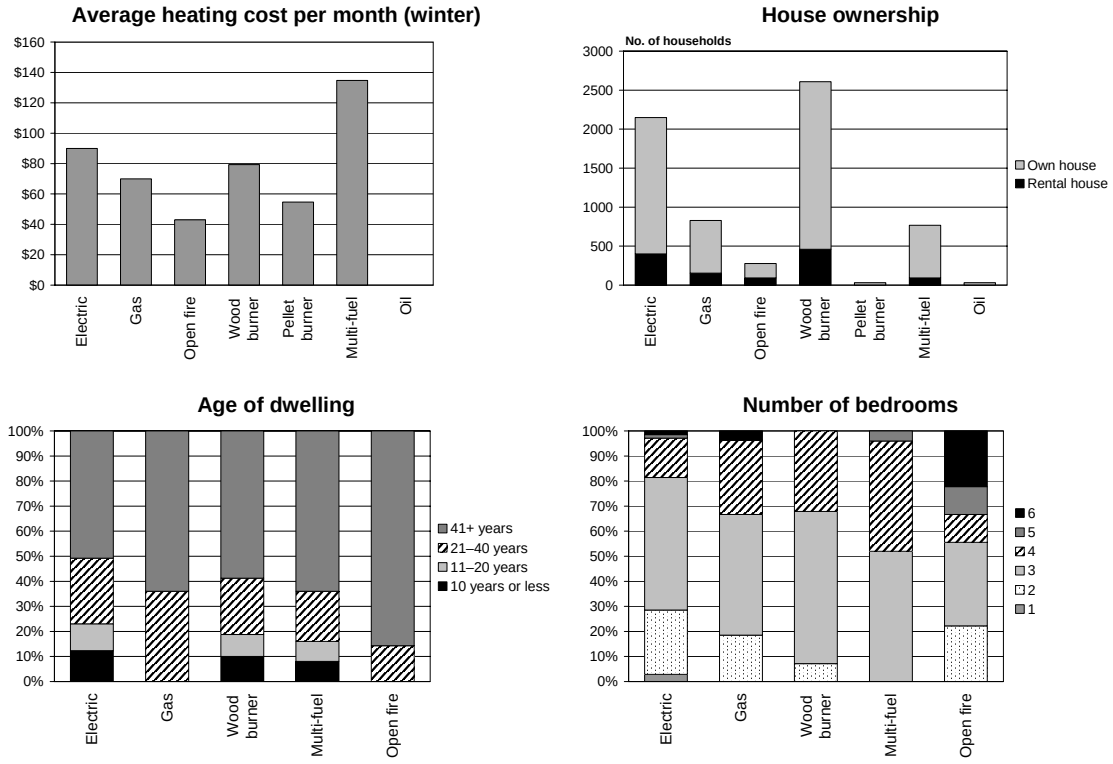


**Figure 11.3: Proportions of fuel obtained free of charge versus bought, Oamaru**

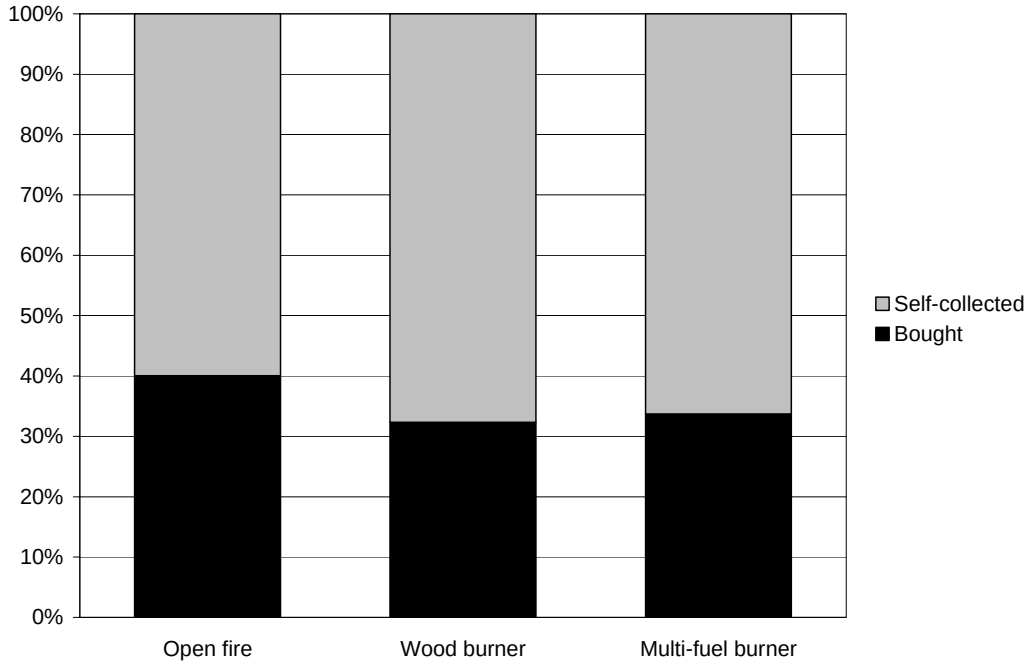

**Table 11.6: Type of electric heating, Oamaru**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 245 | 430 | 337 | 153 | 552 | 552 | – | 123 |
| Percent | 11% | 20% | 16% | 7% | 26% | 26% | – | 6% |

The main types of electric heaters used by households in their main living area in Oamaru were heat pumps and fan heaters, both used by 26% of households using electric heating (Table 11.6). At 26% the proportion of houses with heat pumps is much higher than the national average (13% of households using electric heating in their main living area).

Detailed data on home heating, by house ownership, are shown in Table 11.7.

**Table 11.7: Home heating method, by house ownership, Oamaru**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 736 | 16% | 3866 | 84% |
| Electric | 399 | 19% | 1749 | 81% |
| Gas | 153 | 19% | 675 | 81% |
| Open fire | 92 | 33% | 184 | 67% |
| Wood burner | 460 | 18% | 2148 | 82% |
| Pellet burner | 0 | 0% | 31 | 100% |
| Multi-fuel | 92 | 12% | 675 | 88% |
| Oil | 0 | 0% | 31 | 100% |

Household insulation types and heating methods are shown in Tables 11.8 and 11.9. Around 13% of houses in Oamaru report having no insulation. Table 11.10 shows home heating method, by household income. The overall non-response rate was around 21%. This limits the use of these data because there may be an income bias in the non-respondents.

**Table 11.8: House insulation summary statistics, Oamaru**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 3559 | 77% | No insulation | 13% |
| Under floor | 675 | 15% | 1 type | 32% |
| Wall | 2178 | 47% | 2 types | 27% |
| Cylinder wrap | 1074 | 23% | 3 types | 18% |
| Double glazing | 430 | 9% | 4 types | 5% |
| None | 614 | 13% | 5 types | 2% |
| Don't know | 92 | 2% | Don't know | 2% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 11.9: Degree of house insulation, by heating method, Oamaru**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 36% | 41% | 32% | 32% | 56% |
| 2 types | 26% | 26% | 25% | 28% | 11% |
| 3 types | 13% | 11% | 20% | 16% | 0% |
| 4 types | 6% | 4% | 5% | 4% | 0% |
| 5 types | 3% | 0% | 2% | 0% | 0% |
| None or don't know | 17% | 19% | 16% | 20% | 33% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 11.10: Home heating method, by household income, Oamaru**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 21% | 26% | 24% | 16% | 11% |
| Less than $20,000 | 27% | 26% | 12% | 4% | 44% |
| $20,000 to $30,000 | 10% | 26% | 20% | 20% | 11% |
| $30,000 to $40,000 | 7% | 4% | 12% | 4% | 0% |
| $40,000 to $50,000 | 10% | 0% | 8% | 8% | 0% |
| $50,000 to $70,000 | 11% | 7% | 11% | 12% | 11% |
| $70,000 to $100,000 | 6% | 7% | 11% | 24% | 11% |
| More than $100,000 | 7% | 4% | 4% | 12% | 11% |

Tables 11.11 and 11.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 11.11: Home heating method, by age of dwelling, Oamaru**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 11% | 0% | 9% | 8% | 0% |
| 11–20 years | 10% | 0% | 8% | 8% | 0% |
| 21–40 years | 24% | 33% | 21% | 20% | 11% |
| 41+ years | 47% | 59% | 55% | 64% | 67% |

**Table 11.12: Home heating method, by number of bedrooms, Oamaru**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 0% | 0% | 0% |
| 2 | 26% | 19% | 7% | 0% | 22% |
| 3 | 53% | 48% | 60% | 52% | 33% |
| 4 | 16% | 30% | 32% | 44% | 11% |
| 5 | 1% | 0% | 0% | 4% | 11% |
| 6 | 1% | 4% | 0% | 0% | 22% |

# 12 Mosgiel

A telephone survey of domestic heating methods and fuels for Mosgiel was carried out by Digipoll in November 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Mosgiel.

Survey details are shown in Table 12.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[25] The latter suggest a population increase of 4% by 2021.[26]

**Table 12.1: Summary survey data, Mosgiel**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Mosgiel | 2752 | 150 | 7.8% |

## 12.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Mosgiel. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Mosgiel, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Mosgiel largely in tabular form, in the expectation that the results will be of value in other assessments (eg, emission inventory studies).

Tables 12.2 and 12.3 show domestic heating methods and fuels used for the main living areas in Mosgiel houses, and seasonal variations in heating behaviour. Electricity was the most common method of heating the main living areas of houses in Mosgiel, with 59% of households using this method. Wood burners and multi-fuel burners were used by 32% and 23% of households, respectively. Many households used more than one method of heating in their main living area. Overall, 65% of households in Mosgiel used wood and 19% used coal for heating in their main living areas.

[25] New Zealand Statistics 2004, www.stats.govt.nz

[26] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 12.2: Domestic home heating methods and fuels, Mosgiel**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 59% | 1633 | – | – |
| Total gas | 16% | 440 | 0 | 1% |
| Flued gas | 6% | 160 | – | – |
| Unflued gas | 10% | 280 | – | – |
| Oil | 4% | 110 | 0.0 | 0.1% |
| Open fire | 10% | 275 | – | — |
| Open fire: wood | 10% | 275 | 5 | 11% |
| Open fire: coal | 7% | 202 | 1 | 3% |
| Total wood burner | 32% | 881 | 22 | 46% |
| Pre-1994 wood burner | 11% | 308 | 9 | 19% |
| 1994–99 wood burner | 6% | 176 | 5 | 10% |
| Post-1999 wood burner | 14% | 396 | 8 | 16% |
| Multi-fuel burners | 23% | 624 | – | – |
| Multi-fuel burners: wood | 23% | 624 | 11 | 22% |
| Multi-fuel burners: coal | 11% | 312 | 8 | 17% |
| Pellet burners | 1% | 37 | 0 | 0% |
| Total wood | 65% | 1780 | 38 | 80% |
| Total coal | 19% | 514 | 9 | 19% |
| Total | | 2752 | 48 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 12.3 shows that only a small proportion of households in Mosgiel heat their homes during the summer months. Those that do heat their homes during summer typically use gas and multi-fuel burners, and heat on around three days per week during the summer months. Data shown in Table 12.3 exclude information relating to seasonal variations in electricity use for domestic heating. This is because this information was collected for the evaluation of emissions from domestic heating to determine options for reducing $PM_{10}$ emissions in urban areas of New Zealand. Electricity is treated as a zero emission source for this purpose.

Table 12.4 shows that the average daily fuel use per household during the non-winter months is less than the amount used per day during the winter. Data are not presented for all heating methods because of the small number of respondents for some categories.

**Table 12.3: Monthly variations in heating behaviour and fuel use, Mosgiel**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 5% | 5% | 10% | 19% | 62% | 90% | 90% | 76% | 38% | 19% | 10% | 10% |
| Open fire | 0% | 0% | 0% | 27% | 67% | 93% | 93% | 87% | 47% | 27% | 0% | 0% |
| Wood burner | 0% | 0% | 8% | 38% | 60% | 79% | 90% | 85% | 63% | 17% | 8% | 0% |
| Multi-fuel | 3% | 3% | 13% | 27% | 63% | 80% | 90% | 87% | 67% | 30% | 13% | 7% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3 | 3 | 3 | 5 | 6 | 6 | 6 | 6 | 6 | 4 | 3 | 3 |
| Open fire | – | – | – | 7 | 6 | 5 | 6 | 6 | 6 | 6 | – | – |
| Wood burner | – | – | 4 | 6 | 6 | 7 | 7 | 7 | 6 | 5 | 2 | – |
| Multi-fuel | – | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 3 | 4 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.5 | 0.4 | 0.4 | 0.2 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 4.5 | 5.3 | 5.3 | 5.3 | 5.2 | 0.0 | – | – |
| Open fire: coal | – | – | – | 0.0 | 0.8 | 1.5 | 1.2 | 1.2 | 0.6 | 0.3 | – | – |
| Wood burner | – | – | 2.9 | 10.7 | 17.2 | 20.1 | 22.0 | 22.2 | 13.6 | 4.1 | 1.1 | – |
| Multi-fuel: wood | – | 0.3 | 4.1 | 4.9 | 8.4 | 9.6 | 10.7 | 10.2 | 10.4 | 5.8 | 1.4 | 0.2 |
| Multi-fuel: coal | – | 0.0 | 0.7 | 0.7 | 7.4 | 7.6 | 7.9 | 7.8 | 1.4 | 1.1 | 0.0 | 0.0 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.2 | 0.7 | 1.1 | 0.9 | 0.8 | 0.5 | 0.2 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 16.2 | 19.4 | 19.4 | 19.4 | 19.0 | 0.0 | – | – |
| Open fire: coal | – | – | – | 0.0 | 4.1 | 7.2 | 5.9 | 5.9 | 3.0 | 1.7 | – | – |
| Wood burner | – | – | 3.3 | 12.2 | 19.5 | 22.8 | 25.0 | 25.2 | 15.4 | 4.7 | 1.3 | – |
| Multi-fuel: wood | – | 0.4 | 6.6 | 7.8 | 13.5 | 15.3 | 17.2 | 16.3 | 16.7 | 9.2 | 2.2 | 0.3 |
| Multi-fuel: coal | – | 0.0 | 2.3 | 2.3 | 23.9 | 24.3 | 25.5 | 24.9 | 4.3 | 3.5 | 0.0 | 0.0 |

**Table 12.4: Estimated daily fuel use, by season, Mosgiel**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 28 | 19 |
| Open fire: coal | 11 | 3 |
| Wood burner | 33 | 20 |
| Multi-fuel: wood | 27 | 22 |
| Multi-fuel: coal | 29 | 6 |

## 12.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Mosgiel are presented in this section.

Figure 12.1 shows that in Mosgiel around 32% of households using gas have flued gas systems. This compares to a national average of around 28%.

The average amount spent on fuel for solid fuel methods in Mosgiel ranges from $31 for open fires to $405 per month for oil burners (Table 12.5).

The average heating costs, home ownership, age of dwelling and number of bedrooms for households in Mosgiel are shown in Figure 12.2.

One factor influencing the amount spent on different heating methods is the ability of households using wood burners to obtain wood free of charge. Figure 12.3 shows that generally over half of the wood used for home heating in Mosgiel is self-collected.

**Figure 12.1: Distribution of flued versus unflued gas heating and age of wood burner, Mosgiel**

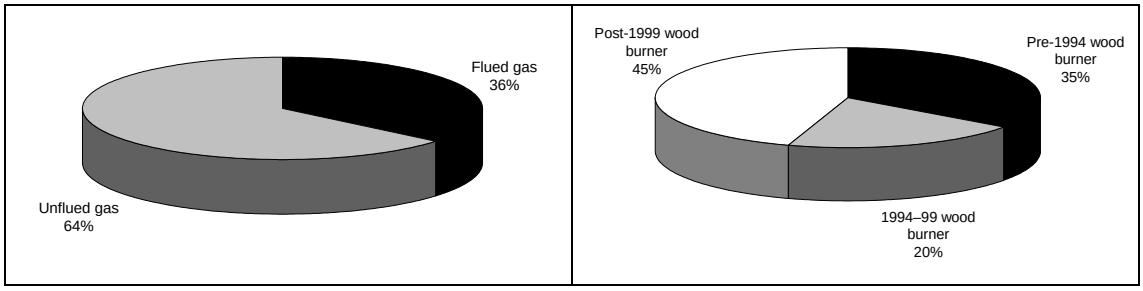


**Table 12.5: Average monthly heating costs (winter), Mosgiel**

| | Winter month cost |
|---|---|
| Electric | $113 |
| Gas | $81 |
| Open fire | $31 |
| Wood burner | $105 |
| Multi-fuel | $124 |
| Oil | $405 |

**Figure 12.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Mosgiel**

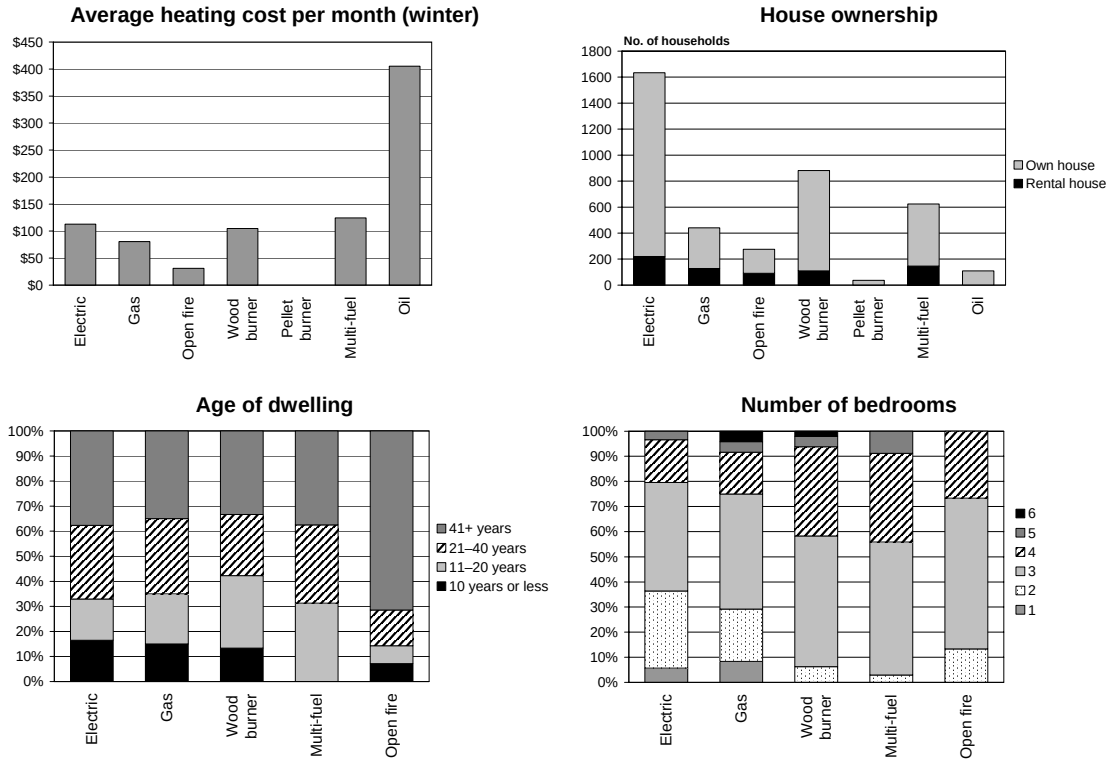


**Figure 12.3: Proportions of fuel obtained free of charge versus bought, Mosgiel**

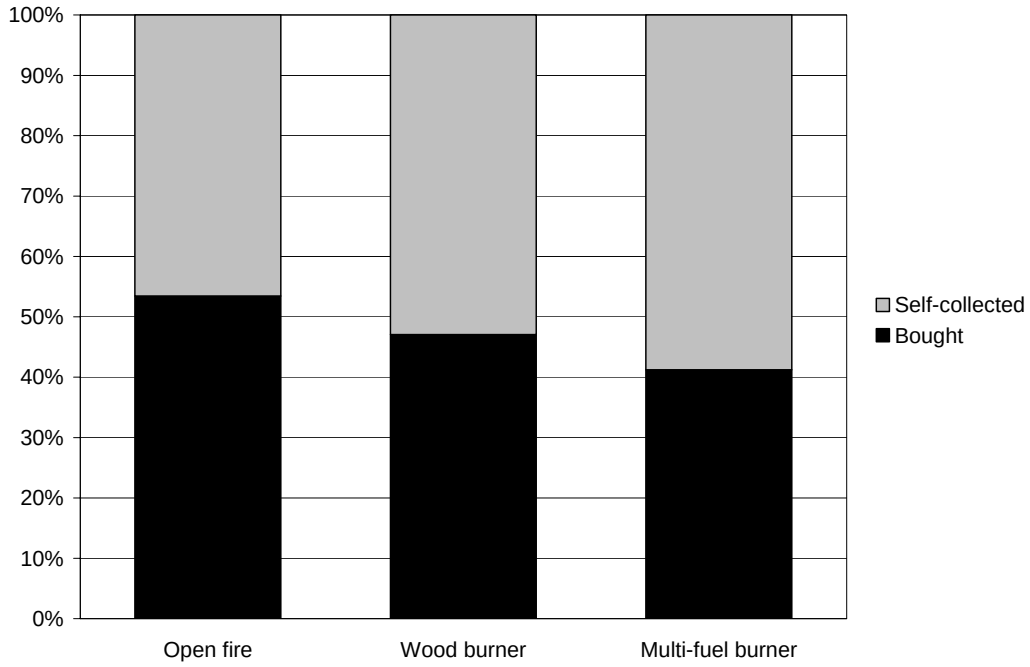

**Table 12.6: Type of electric heating, Mosgiel**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 128 | 330 | 349 | 147 | 367 | 385 | – | 165 |
| Percent | 8% | 20% | 21% | 9% | 22% | 24% | – | 10% |

The main types of electric heater used by households in their main living area in Mosgiel were heat pumps, portable oil column heaters, radiant heaters and fan heating, which were each used by around 20% of households using electric heating (Table 12.6). The proportion of houses with heat pumps (24%) is higher than the national average (13% of households using electric heating in their main living area).

Detailed data on home heating method, by house ownership, are shown in Table 12.7.

**Table 12.7: Home heating method, by house ownership, Mosgiel**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 495 | 18% | 2202 | 80% |
| Electric | 220 | 13% | 1413 | 87% |
| Gas | 128 | 29% | 312 | 71% |
| Open fire | 92 | 33% | 183 | 67% |
| Wood burner | 110 | 13% | 771 | 88% |
| Pellet burner | 0 | 0% | 37 | 100% |
| Multi-fuel | 147 | 24% | 477 | 76% |
| Oil | 0 | 0% | 110 | 100% |

Household insulation types and heating methods are shown in Tables 12.8 and 12.9. Around 9% of houses in Mosgiel report having no insulation. Table 12.10 shows household income, by heating method. Results suggest around 28% of respondents using open fires in Mosgiel had incomes greater than $50,000. Results for other heating methods are difficult to interpret because of the non-response rate (16% overall).

**Table 12.8: House insulation summary statistics, Mosgiel**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 2183 | 79% | No insulation | 9% |
| Under floor | 587 | 21% | 1 type | 31% |
| Wall | 1174 | 43% | 2 types | 25% |
| Cylinder wrap | 660 | 24% | 3 types | 20% |
| Double glazing | 349 | 13% | 4 types | 9% |
| None | 239 | 9% | 5 types | 1% |
| Don't know | 147 | 5% | Don't know | 5% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 12.9: Degree of house insulation, by heating method, Mosgiel**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 30% | 42% | 27% | 32% | 53% |
| 2 types | 26% | 25% | 25% | 15% | 13% |
| 3 types | 22% | 8% | 27% | 26% | 7% |
| 4 types | 7% | 8% | 8% | 12% | 7% |
| 5 types | 1% | 0% | 2% | 0% | 0% |
| None or don't know | 13% | 17% | 10% | 15% | 20% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 12.10: Home heating method, by household income, Mosgiel**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 20% | 13% | 17% | 18% | 0% |
| Less than $20,000 | 27% | 33% | 13% | 21% | 33% |
| $20,000 to $30,000 | 18% | 17% | 8% | 24% | 13% |
| $30,000 to $40,000 | 9% | 8% | 13% | 12% | 20% |
| $40,000 to $50,000 | 8% | 13% | 13% | 6% | 7% |
| $50,000 to $70,000 | 7% | 8% | 17% | 6% | 13% |
| $70,000 to $100,000 | 8% | 8% | 8% | 6% | 7% |
| More than $100,000 | 3% | 0% | 13% | 9% | 7% |

Tables 12.11 and 12.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 12.11: Home heating method, by age of dwelling, Mosgiel**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 16% | 13% | 13% | 0% | 7% |
| 11–20 years | 16% | 17% | 27% | 29% | 7% |
| 21–40 years | 28% | 25% | 23% | 29% | 13% |
| 41+ years | 36% | 29% | 31% | 35% | 67% |

**Table 12.12: Home heating method, by number of bedrooms, Mosgiel**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 6% | 8% | 0% | 0% | 0% |
| 2 | 30% | 21% | 6% | 3% | 13% |
| 3 | 43% | 46% | 52% | 53% | 60% |
| 4 | 17% | 17% | 35% | 35% | 27% |
| 5 | 3% | 4% | 4% | 9% | 0% |
| 6 | 0% | 4% | 2% | 0% | 0% |

# 13 Cromwell

A telephone survey of domestic heating methods and fuels for Cromwell was carried out by Digipoll in November 2004. This involved surveying 151 households within the 2001 census area unit (CAU) area of Cromwell.

Survey details are shown in Table 13.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[27] The latter suggest a population decrease for the Central Otago District of 18% by 2021.[28] It is assumed that this decrease applies to the urban area of Cromwell.

**Table 13.1: Summary survey data, Cromwell**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Cromwell | 1083 | 151 | 7.4% |

## 13.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Cromwell. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Cromwell, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Cromwell largely in tabular form, in the expectation that these results will be of value in other assessments (eg,emission inventory studies).

Tables 13.2 and 13.3 show domestic heating methods and fuels used for main living areas in Cromwell houses, and seasonal variations in heating behaviour. Electricity and wood burners were the commonest methods of heating the main living areas of houses in Cromwell, with 47% and 56% of households (respectively) using this method. Multi-fuel burner use was also quite high at 25%. Many households used more than one method of heating in their main living area. Overall, 84% of households in Cromwell used wood and 19% used coal for heating in their main living areas.

[27] New Zealand Statistics 2004, www.stats.govt.nz

[28] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 13.2: Domestic home heating methods and fuels, Cromwell**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 47% | 509 | – | – |
| Total gas | 13% | 143 | 0 | 1% |
| Flued gas | 3% | 36 | – | – |
| Unflued gas | 10% | 108 | – | – |
| Oil | 3% | 29 | 0.0 | 0.0% |
| Open fire | 4% | 43 | – | – |
| Open fire: wood | 4% | 43 | 1 | 4% |
| Open fire: coal | 1% | 14 | 0 | 1% |
| Total wood burner | 56% | 602 | 10 | 55% |
| Pre-1994 wood burner | 19% | 206 | 4 | 25% |
| 1994–99 wood burner | 15% | 159 | 2 | 12% |
| Post-1999 wood burner | 22% | 238 | 3 | 18% |
| Multi-fuel burners | 25% | 265 | – | – |
| Multi-fuel burners: wood | 25% | 265 | 5 | 28% |
| Multi-fuel burners: coal | 18% | 194 | 2 | 11% |
| Pellet burners | 1% | 7 | – | – |
| Total wood | 84% | 911 | 15 | 87% |
| Total coal | 19% | 208 | 2 | 12% |
| Total | | 1083 | 18 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 13.3 shows that only a small proportion of households heat their homes during the summer in Cromwell. Data shown in Table 13.3 exclude information relating to seasonal variations in electricity use for domestic heating. This is because this information was collected for the evaluation of emissions from domestic heating to determine options for reducing $PM_{10}$ emissions in urban areas of New Zealand. Electricity is treated as a zero emission source for this purpose.

The average daily fuel use per household during the non-winter months is generally less than the amount used per day during the winter (Table 13.4). Data are not presented for all heating methods, because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 13.3: Monthly variations in heating behaviour and fuel use, Cromwell**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 6% | 33% | 50% | 67% | 72% | 72% | 56% | 22% | 17% | 6% |
| Open fire | 0% | 0% | 0% | 33% | 67% | 100% | 83% | 100% | 67% | 17% | 0% | 0% |
| Wood burner | 1% | 1% | 6% | 33% | 74% | 87% | 94% | 90% | 64% | 27% | 6% | 1% |
| Multi-fuel | 0% | 0% | 3% | 25% | 56% | 78% | 94% | 72% | 50% | 17% | 11% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 1 | 4 | 7 | 6 | 6 | 6 | 6 | 4 | 2 | 3 |
| Open fire | – | – | – | – | 4 | 5 | 5 | 5 | 4 | 7 | – | – |
| Wood burner | 7 | 7 | 6 | 6 | 6 | 7 | 7 | 6 | 6 | 5 | 6 | 7 |
| Multi-fuel | – | – | 1 | 6 | 7 | 7 | 7 | 7 | 7 | 5 | 3 | |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | 0.4 | 1.1 | 0.7 | 1.1 | 0.9 | 0.5 | – | – |
| Open fire: coal | – | – | – | – | 0.1 | 0.1 | 0.1 | 0.1 | – | – | – | – |
| Wood burner | 0.0 | 0.0 | 0.6 | 2.6 | 7.5 | 9.2 | 9.8 | 9.1 | 6.6 | 4.1 | 1.4 | 0.0 |
| Multi-fuel: wood | – | – | 0.1 | 1.1 | 3.2 | 4.9 | 4.9 | 3.8 | 2.9 | 0.5 | 0.1 | – |
| Multi-fuel: coal | | – | 0.0 | 0.3 | 1.1 | 1.7 | 2.0 | 1.6 | 1.2 | 0.3 | 0.1 | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.4 | 0.9 | 1.3 | 1.3 | 1.1 | 0.6 | 0.1 | 0.1 | 0.1 |
| Open fire: wood | – | – | – | – | 8.1 | 24.9 | 15.4 | 24.9 | 20.8 | 12.7 | – | – |
| Open fire: coal | – | – | – | – | 9.0 | 9.0 | 9.0 | 9.0 | – | – | – | – |
| Wood burner | 0.0 | 0.0 | 1.0 | 4.3 | 12.4 | 15.3 | 16.2 | 15.1 | 11.0 | 6.7 | 2.3 | 0.0 |
| Multi-fuel: wood | – | – | 0.4 | 4.2 | 11.9 | 18.3 | 18.6 | 14.2 | 11.0 | 1.7 | 0.4 | – |
| Multi-fuel: coal | – | – | 0.0 | 1.4 | 5.5 | 8.7 | 10.1 | 8.1 | 6.2 | 1.4 | 0.3 | – |

**Table 13.4: Estimated daily fuel use, by season, Cromwell**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 2 | 1 |
| Open fire: wood | 41 | 41 |
| Open fire: coal | 9 | – |
| Wood burner | 29 | 17 |
| Multi-fuel: wood | 21 | 12 |
| Multi-fuel: coal | 13 | 7 |

## 13.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Cromwell are presented in this section.

Figure 13.1 shows that in Cromwell around 25% of households using gas have flued gas systems.

The average amount spent on fuel for solid fuel methods in Cromwell ranges from $91 for wood burners to $176 per month for multi-fuel burners. These values are generally higher than the national average values, which range from $60 to $70 for gas and solid fuel heating methods and $117 per month for electricity.

The average heating costs, home ownership, age of dwelling and number of bedrooms for households in Cromwell are shown in Figure 13.2.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 13.3 shows that around half of the wood used for home heating in Cromwell is self-collected.

**Figure 13.1: Distribution of flued versus unflued gas heating and age of wood burner, Cromwell**

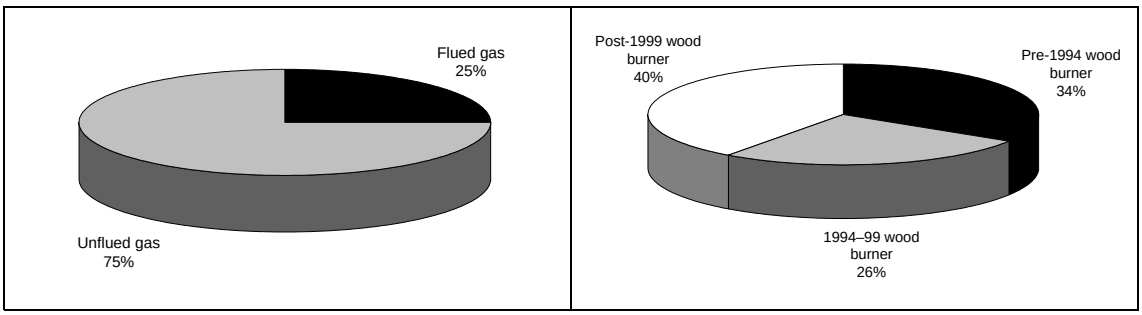


**Table 13.5: Average monthly heating costs (winter), Cromwell**

| | Winter month cost |
|---|---|
| Electric | $137 |
| Gas | $112 |
| Open fire | $118 |
| Wood burner | $91 |
| Multi-fuel | $176 |

**Figure 13.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Cromwell**

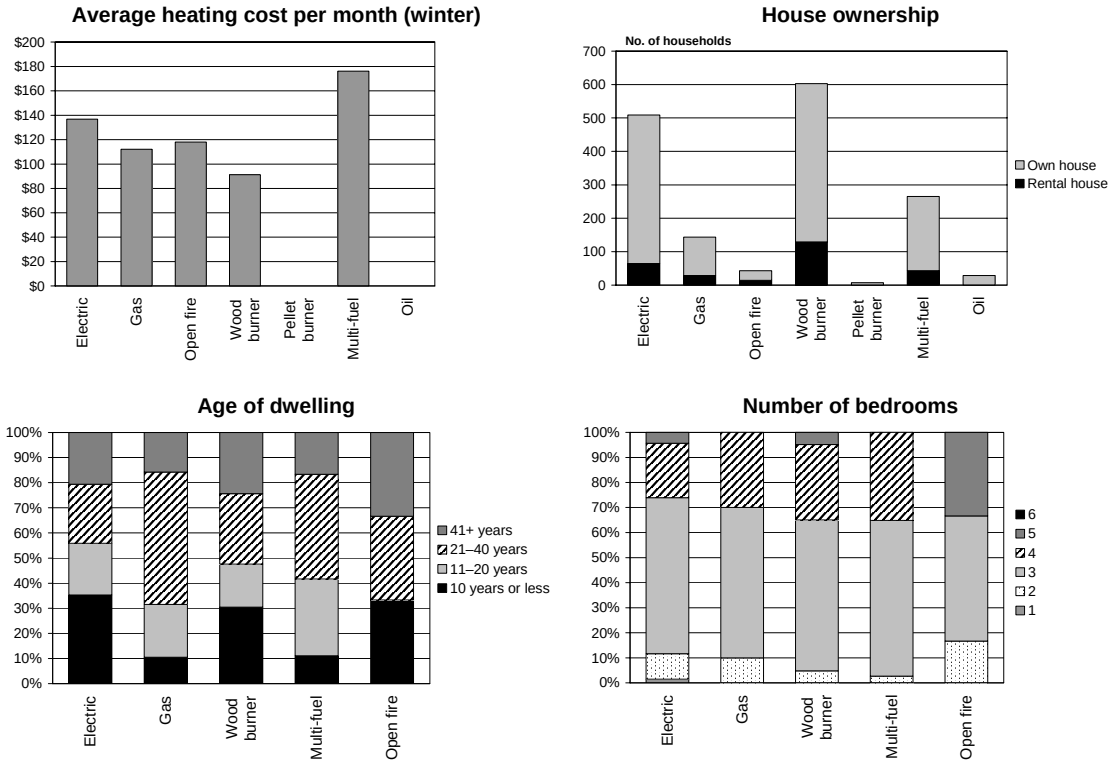


**Figure 13.3: Proportions of fuel obtained free of charge versus bought, Cromwell**

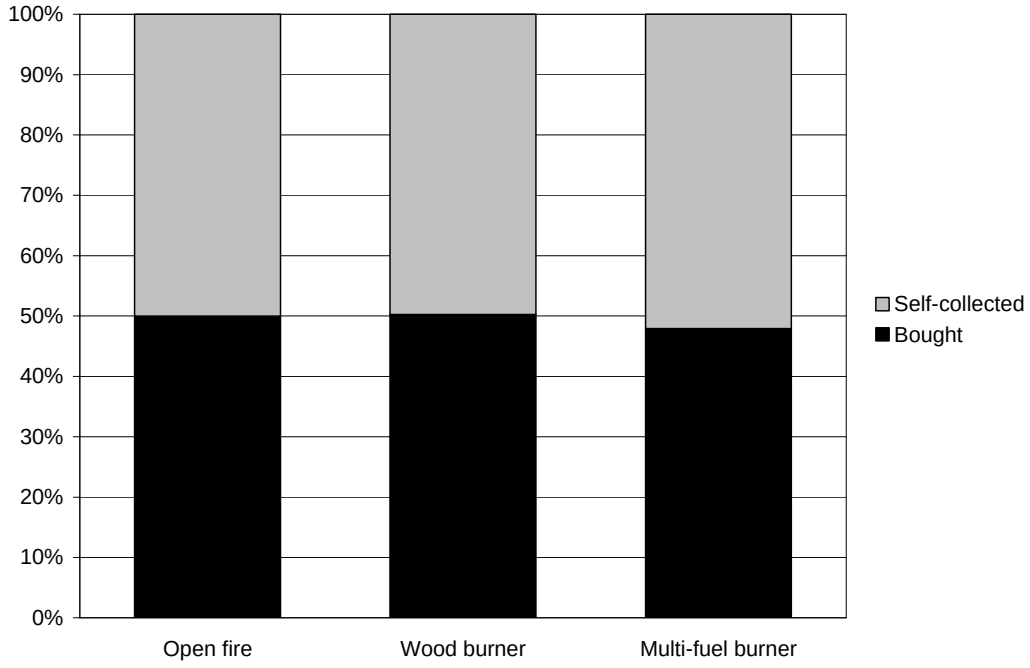

**Table 13.6: Type of electric heating, Cromwell**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 72 | 36 | 36 | 36 | 136 | 208 | – | 36 |
| Percent | 14% | 7% | 7% | 7% | 27% | 41% | – | 7% |

The main types of electric heating used by households in their main living area in Cromwell were heat pumps and fan heaters, which were used by 41% and 27% of households using electric heating, respectively. The proportion of houses with heat pumps is much higher than the national average (13% of households using electric heating in their main living area).

Detailed data for home heating method, by house ownership, are shown in Table 13.7.

**Table 13.7: Home heating method, by house ownership, Cromwell**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 158 | 15% | 904 | 83% |
| Electric | 65 | 13% | 445 | 87% |
| Gas | 29 | 20% | 115 | 80% |
| Open fire | 14 | 33% | 29 | 67% |
| Wood burner | 129 | 21% | 473 | 79% |
| Pellet burner | 0 | 0% | 7 | 100% |
| Multi-fuel | 43 | 16% | 222 | 84% |
| Oil | 0 | 0% | 29 | 100% |

Household insulation types and heating methods are shown in Tables 13.8 and 13.9. Around 6% of houses in Cromwell report no insulation. Table 13.10 shows home heating method, by household income. Results suggest a large proportion of households using open fires in Cromwell had incomes greater than $50,000. Results for other heating methods are difficult to interpret because of the non-response rate (19% overall).

**Table 13.8: House insulation summary statistics, Cromwell**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 918 | 85% | No insulation | 6% |
| Under floor | 308 | 28% | 1 type | 17% |
| Wall | 760 | 70% | 2 types | 22% |
| Cylinder wrap | 402 | 37% | 3 types | 24% |
| Double glazing | 265 | 25% | 4 types | 15% |
| None | 65 | 6% | 5 types | 11% |
| Don't know | 72 | 7% | Don't know | 7% |
| Other | 14 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 13.9: Degree of house insulation, by heating method, Cromwell**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 15% | 5% | 17% | 16% | 17% |
| 2 types | 21% | 25% | 27% | 24% | 0% |
| 3 types | 24% | 25% | 24% | 24% | 50% |
| 4 types | 17% | 30% | 13% | 16% | 0% |
| 5 types | 14% | 0% | 10% | 14% | 17% |
| None or don't know | 8% | 15% | 10% | 5% | 17% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 13.10: Home heating method, by household income, Cromwell**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 10% | 25% | 19% | 24% | 0% |
| Less than $20,000 | 15% | 10% | 6% | 8% | 17% |
| $20,000 to $30,000 | 15% | 25% | 17% | 19% | 0% |
| $30,000 to $40,000 | 14% | 15% | 14% | 14% | 0% |
| $40,000 to $50,000 | 13% | 5% | 13% | 14% | 0% |
| $50,000 to $70,000 | 18% | 0% | 19% | 14% | 17% |
| $70,000 to $100,000 | 11% | 20% | 11% | 8% | 33% |
| More than $100,000 | 3% | 0% | 1% | 0% | 33% |

Tables 13.11 and 13.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 13.11: Home heating method, by age of dwelling, Cromwell**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 34% | 10% | 30% | 11% | 33% |
| 11–20 years | 20% | 20% | 17% | 30% | 0% |
| 21–40 years | 23% | 50% | 27% | 41% | 33% |
| 41+ years | 20% | 15% | 24% | 16% | 33% |

**Table 13.12: Home heating method, by number of bedrooms, Cromwell**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 1% | 0% | 0% | 0% | 0% |
| 2 | 10% | 10% | 5% | 3% | 17% |
| 3 | 61% | 60% | 60% | 62% | 50% |
| 4 | 21% | 30% | 30% | 35% | 0% |
| 5 | 4% | 0% | 5% | 0% | 33% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 14 Dunedin

A telephone survey of domestic heating methods and fuels for Dunedin was carried out by Digipoll in October 2004. This involved surveying 151 households within the 2001 census area unit (CAU) areas of:

- Fryatt
- Maori Hill
- Musselburgh
- Belleknowes
- High Street–The Oval
- Balmacewen
- Andersons Bay
- Kenmure
- High Street–Stuart Street
- Glenleith
- Vauxhall
- Caversham
- Stuart Street–Frederick Street
- North-East Valley
- Halfway Bush
- St Kilda Central
- Caledonian
- Pine Hill
- Brockville
- St Kilda East
- South Dunedin
- Woodhaugh
- Roslyn North
- Green Island Central
- Forbury
- North Dunedin
- Helensburgh
- Ravensbourne
- Corstorphine West
- Opoho
- Wakari
- St Kilda West
- Corstorphine East
- Roslyn South
- Abbotsford
- St Clair
- Otago University
- Mornington
- Concord

Survey details are shown in Table 14.1. Although the total number of respondents used in the analysis was 151, initial results were inconsistent with data for Dunedin on the proportion of rented versus owner-occupied dwellings (the original survey showed 20% of households were rented compared with a value of around 32% from census and other data). It is unclear whether the difference occurred as a result of sampling error or bias in non-respondents. Because of the significant difference, additional sampling was made for 44 respondents in rented accommodation. These data were used in place of the first 44 respondents for occupied dwellings.

The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[29] The latter suggest a population increase for Dunedin of 4% by 2021.[30]

**Table 14.1: Summary survey data, Dunedin**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Dunedin | 31,502 | 151 | 8.0% |

[29] New Zealand Statistics 2004, www.stats.govt.nz

[30] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

## 14.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Dunedin. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Dunedin, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Dunedin largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 14.2 and 14.3 show domestic heating methods and fuels used for main living areas in Dunedin houses, and seasonal variations in heating behaviour. The commonest method of heating the main living area in Dunedin homes was electricity, which was used by 77% of households. Many households used more than one method of heating in their main living area.

The main difference in home heating methods for Dunedin was the low use of solid fuel burning for domestic home heating. In particular, the use of wood burners was low at 14% of households compared to a national average of around 38%. Overall, 30% of households in Dunedin used wood and 12% used coal. This compares with national averages of 52% and 7%, respectively. One reason for the lower proportion of wood use is likely to be the higher proportion of dwellings in Dunedin that are rented as opposed to owner-occupied; as subsequent data show, wood burners are less common in rental accommodation in Dunedin. Although this may account for some of the difference, wood use among owner-occupied dwellings was also lower in Dunedin. The reasons for this are unclear.

**Table 14.2: Domestic home heating methods and fuels, Dunedin**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 77% | 24,409 | – | – |
| Total gas | 20% | 6259 | 8 | 4% |
| Flued gas | 7% | 2318 | – | – |
| Unflued gas | 13% | 3941 | – | – |
| Oil | 2% | 626 | 0.0 | 0.0% |
| Open fire | 11% | 3547 | – | – |
| Open fire: wood | 11% | 3338 | 32 | 18% |
| Open fire: coal | 9% | 2712 | 36 | 20% |
| Total wood burner | 14% | 4381 | 82 | 47% |
| Pre-1994 wood burner | 4% | 1383 | 24 | 14% |
| 1994–99 wood burner | 4% | 1153 | 34 | 19% |
| Post-1999 wood burner | 6% | 1845 | 24 | 14% |
| Multi-fuel burners | 6% | 1878 | – | – |
| Multi-fuel burners: wood | 6% | 1878 | 9 | 5% |
| Multi-fuel burners: coal | 3% | 1043 | 8 | 5% |
| Pellet burners | 0% | 0 | 0 | 0% |
| Total wood | 30% | 9597 | 123 | 70% |
| Total coal | 12% | 3755 | 44 | 25% |
| Total | | 31,502 | 175 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

About 13% of the households using multi-fuel burners operated them during the summer months, generally burning seven days a week. Gas was also used for heating during the summer months by a small proportion of households using that method. However, the quantities of fuel used per day on multi-fuel burners was typically much less during the non-winter months than during winter (Table 14.4). Results for wood burners suggest high fuel use on average during non-winter months. This does not imply that households that heat their homes all year round burn more wood in the non-winter months. It is likely to occur because of the smaller sample size during the non-winter months. Data are not presented for all heating methods, because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 14.3: Monthly variations in heating behaviour and fuel use, Dunedin**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 7% | 4% | 14% | 36% | 43% | 86% | 93% | 86% | 57% | 25% | 14% | 11% |
| Open fire | 0% | 0% | 6% | 19% | 56% | 88% | 94% | 94% | 50% | 31% | 13% | 6% |
| Wood burner | 0% | 0% | 10% | 33% | 62% | 90% | 100% | 90% | 52% | 38% | 10% | 5% |
| Multi-fuel | 13% | 13% | 25% | 63% | 75% | 88% | 100% | 100% | 75% | 38% | 25% | 13% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 5 | 5 | 4 | 6 | 5 |
| Open fire | – | – | 1 | 4 | 4 | 5 | 4 | 5 | 6 | 5 | 5 | 5 |
| Wood burner | – | – | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 2 | 2 |
| Multi-fuel | 7 | 7 | 7 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 7 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.2 | 0.2 | 1.3 | 1.7 | 3.9 | 7.4 | 7.8 | 7.7 | 3.8 | 1.5 | 1.3 | 0.2 |
| Open fire: wood | – | – | 0.0 | 0.0 | 12.7 | 30.3 | 31.8 | 49.8 | 25.4 | 18.1 | 0.0 | 0.0 |
| Open fire: coal | – | – | 0.0 | 0.0 | 24.4 | 34.9 | 35.6 | 35.6 | 39.1 | 31.4 | 0.0 | 0.0 |
| Wood burner | – | – | – | – | 41.6 | 75.7 | 81.9 | 79.8 | – | – | – | – |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 0.0 | 7.9 | 7.9 | 9.2 | 9.2 | 2.0 | 2.0 | 2.0 | 0.0 |
| Multi-fuel: coal | 4.7 | 4.7 | 4.7 | 8.0 | 8.4 | 8.4 | 8.4 | 8.4 | 9.4 | 4.7 | 4.7 | 4.7 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.2 | 0.3 | 0.6 | 1.2 | 1.2 | 1.2 | 0.6 | 0.2 | 0.2 | 0.0 |
| Open fire: wood | – | – | 0.0 | 0.0 | 3.8 | 9.1 | 9.5 | 14.9 | 7.6 | 5.4 | 0.0 | 0.0 |
| Open fire: coal | – | – | 0.0 | 0.0 | 9.0 | 12.9 | 13.1 | 13.1 | 14.4 | 11.6 | 0.0 | 0.0 |
| Wood burner | – | – | – | – | 9.5 | 17.3 | 18.7 | 18.2 | – | – | – | – |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 4.2 | 4.9 | 4.9 | 1.1 | 1.1 | 1.1 | 0.0 |
| Multi-fuel: coal | 4.5 | 4.5 | 4.5 | 7.7 | 8.0 | 8.0 | 8.0 | 8.0 | 9.0 | 4.5 | 4.5 | 4.5 |

**Table 14.4: Estimated daily fuel use, by season, Dunedin**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 2 | 2 |
| Open fire: wood | 18 | 8 |
| Open fire: coal | 15 | 14 |
| Wood burner | 28 | 38 |
| Multi-fuel: wood | 12 | 2 |

## 14.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Dunedin are presented in this section.

Figure 14.1 shows that the proportion of households using gas systems that are properly flued in Dunedin is around 37%. This compares to a national average of around 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 14.5. In Dunedin, households heating using open fires and multi-fuel burners spend on average less per month (around $38 and $51, respectively) than those using other heating methods.

Figure 14.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Dunedin. Results indicate that some of the open fires were installed in new dwellings in Dunedin within the last 10 years. Open fires and wood burners were more common heating methods in owner-occupied houses than in rented accommodation.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 14.3 shows that over 60% of the wood used on solid fuel burners and open fires in Dunedin is self-collected compared with around 40% for multi-fuel burners.

**Figure 14.1: Distribution of flued versus unflued gas heating and age of wood burner, Dunedin**

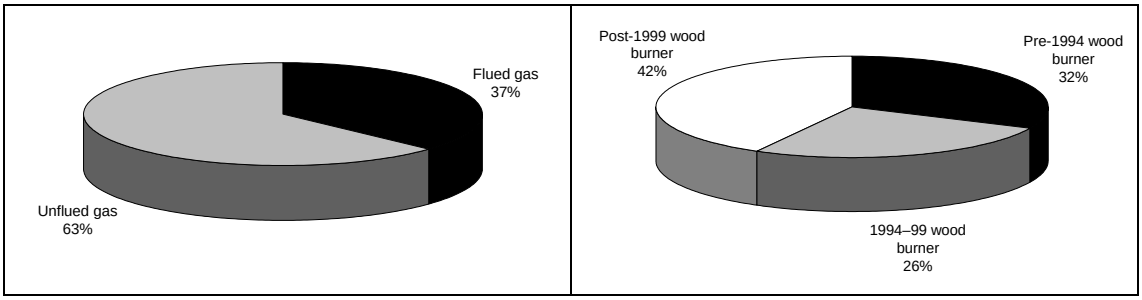


**Table 14.5: Average monthly heating costs (winter), Dunedin**

| | Winter month cost |
|---|---|
| Electric | $142 |
| Gas | $87 |
| Open fire | $38 |
| Wood burner | $81 |
| Multi-fuel | $51 |

**Figure 14.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Dunedin**

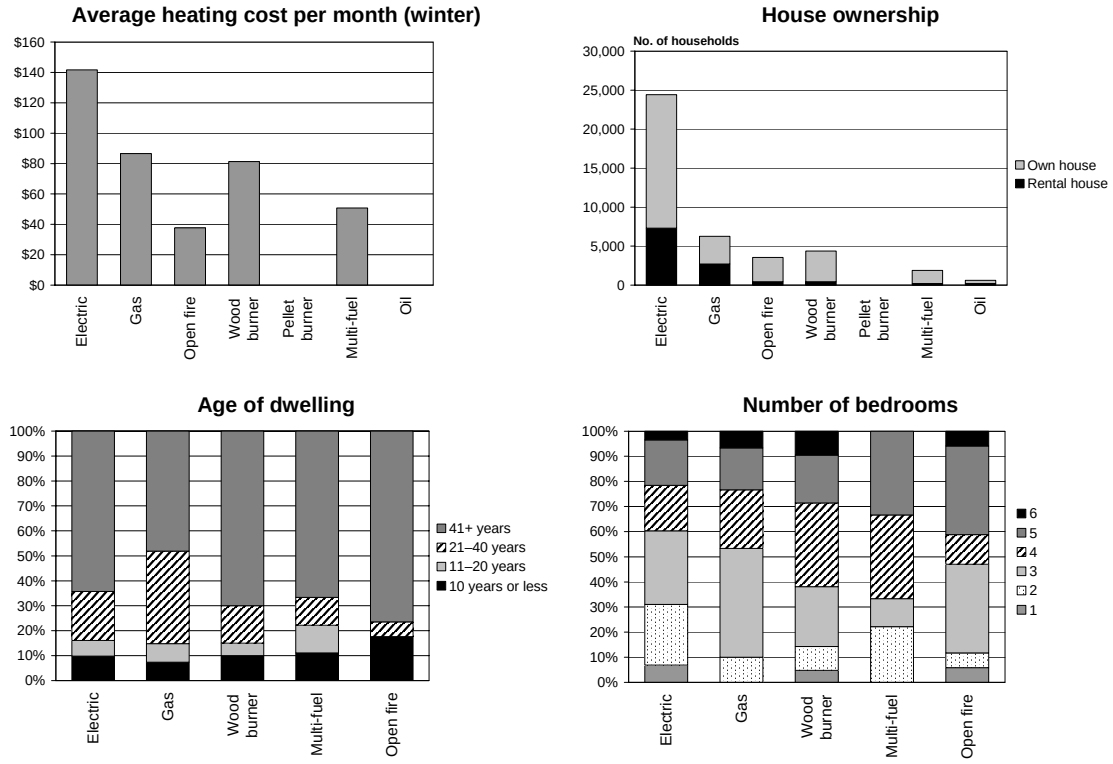


**Figure 14.3: Proportions of fuel obtained free of charge versus bought, Dunedin**

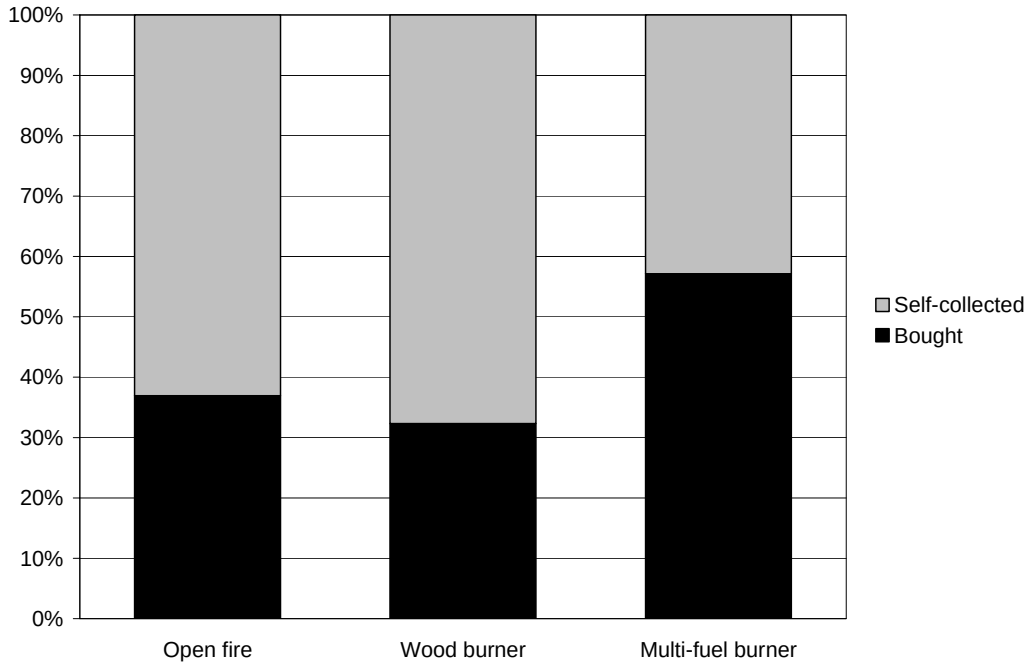

**Table 14.6: Type of electric heating, Dunedin**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 1460 | 5841 | 9805 | 834 | 3964 | 5216 | – | 1460 |
| Percent | 6% | 24% | 40% | 3% | 16% | 21% | – | 6% |

The most common types of electric heating used in the main living area in Dunedin houses were oil column heaters (Table 14.6). Radiant and fan heaters were also common. The proportion of houses using the more efficient heat pumps was 21%, which is higher than the national average (13%).

Data on home heating methods, by house ownership, are shown in Table 14.7.

**Table 14.7: Home heating method, by house ownership, Dunedin**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 10,014 | 32% | 21,488 | 68% |
| Electric | 7302 | 30% | 17,107 | 70% |
| Gas | 2712 | 43% | 3547 | 57% |
| Open fire | 417 | 12% | 3129 | 88% |
| Wood burner | 417 | 10% | 3964 | 90% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 209 | 11% | 1669 | 89% |
| Oil | 209 | 33% | 417 | 67% |

Household insulation types and heating methods are shown in Tables 14.8 and 14.9. Around 19% of households in Dunedin indicated that the house had no insulation. This compares with a national average of 10%. Table 14.10 shows household income, by heating method. The overall non-response rate was around 22%. This limits the interpretation of these data, because there may be an income bias in the non-respondents.

**Table 14.8: House insulation summary statistics, Dunedin**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 20,028 | 64% | No insulation | 19% |
| Under floor | 6676 | 21% | 1 type* | 28% |
| Wall | 9388 | 30% | 2 types | 24% |
| Cylinder wrap | 5007 | 16% | 3 types | 17% |
| Double glazing | 2921 | 9% | 4 types | 3% |
| None | 6050 | 19% | 5 types | 0% |
| Don't know | 2712 | 9% | Don't know | 9% |
| Other | 209 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 14.9: Degree of house insulation, by heating method, Dunedin**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 29% | 30% | 19% | 44% | 59% |
| 2 types | 22% | 27% | 38% | 11% | 12% |
| 3 types | 19% | 13% | 19% | 22% | 6% |
| 4 types | 3% | 0% | 5% | 11% | 6% |
| 5 types | 0% | 0% | 0% | 0% | 0% |
| None or don't know | 27% | 30% | 19% | 11% | 18% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 14.10: Home heating method, by household income, Dunedin**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 21% | 23% | 19% | 22% | 35% |
| Less than $20,000 | 21% | 33% | 5% | 11% | 18% |
| $20,000 to $30,000 | 12% | 13% | 10% | 11% | 0% |
| $30,000 to $40,000 | 13% | 0% | 5% | 11% | 18% |
| $40,000 to $50,000 | 6% | 3% | 5% | 11% | 0% |
| $50,000 to $70,000 | 11% | 7% | 29% | 22% | 6% |
| $70,000 to $100,000 | 7% | 13% | 10% | 11% | 12% |
| More than $100,000 | 9% | 7% | 19% | 0% | 12% |

Tables 14.11 and 14.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 14.11: Home heating method, by age of dwelling, Dunedin**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 9% | 7% | 10% | 11% | 18% |
| 11–20 years | 6% | 7% | 5% | 11% | 0% |
| 21–40 years | 19% | 33% | 14% | 11% | 6% |
| 41+ years | 62% | 43% | 67% | 67% | 76% |

**Table 14.12: Home heating method, by number of bedrooms, Dunedin**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 7% | 0% | 5% | 0% | 6% |
| 2 | 24% | 10% | 10% | 22% | 6% |
| 3 | 29% | 43% | 24% | 11% | 35% |
| 4 | 18% | 23% | 33% | 33% | 12% |
| 5 | 18% | 17% | 19% | 33% | 35% |
| 6 | 3% | 7% | 10% | 0% | 6% |

# 15 Balclutha

A telephone survey of domestic heating methods and fuels for Balclutha was carried out by Digipoll in October 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Balclutha.

Survey details are shown in Table 15.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[31] The latter suggest a population decrease for Clutha District of 13% by 2021.[32] It is assumed that this decrease applies to the urban area of Balclutha.

**Table 15.1: Summary survey data, Balclutha**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Balclutha | 1638 | 150 | 7.6% |

## 15.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Balclutha. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Balclutha, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Balclutha largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 15.2 and 15.3 show domestic heating methods and fuels used for main living areas in Balclutha houses, and seasonal variations in heating behaviour. The commonest method of heating the main living area in Balclutha houses was electricity, which was used by 53% of households. Many households used more than one method of heating in their main living area.

The main difference in home heating methods for Balclutha was the large proportion of houses (42%) using multi-fuel burners for domestic home heating. Overall, 74% of households in Balclutha used wood and 47% used coal, although this includes 40% of households with multi-fuel burners that also burn wood. In fact a greater quantity of coal is burnt in Balclutha than wood (24 tonnes versus 17 tonnes per day, on average).

[31] New Zealand Statistics 2004, www.stats.govt.nz

[32] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 15.2: Domestic home heating methods and fuels, Balclutha**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 53% | 874 | – | – |
| Total gas | 15% | 240 | 0 | 1% |
| Flued gas | 3% | 55 | – | – |
| Unflued gas | 11% | 186 | – | – |
| Oil | 1% | 22 | 0.0 | 0.0% |
| Open fire | 7% | 120 | – | – |
| Open fire: wood | 7% | 109 | 2 | 5% |
| Open fire: coal | 7% | 120 | 2 | 5% |
| Total wood burner | 25% | 415 | 7 | 17% |
| Pre-1994 wood burner | 12% | 196 | 5 | 12% |
| 1994–99 wood burner | 6% | 92 | 1 | 3% |
| Post-1999 wood burner | 8% | 127 | 1 | 3% |
| Multi-fuel burners | 42% | 688 | – | – |
| Multi-fuel burners: wood | 42% | 688 | 8 | 19% |
| Multi-fuel burners: coal | 40% | 655 | 22 | 53% |
| Pellet burners | 1% | 11 | 0 | 0% |
| Total wood | 74% | 1212 | 17 | 42% |
| Total coal | 47% | 775 | 24 | 58% |
| Total | | 1638 | 42 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Another point of difference for Balclutha is the high proportion of households using heating during the summer months (Table 15.3). In particular, over 10% of the households using solid fuel burning heat their houses during summer. On average these households burn on five days per week during the summer months. Data are not presented for all heating methods, because there was a high non-response rate for questions relating to seasonal variations for some heating types.

Table 15.4 shows the quantity of fuel used per household per day to be typically less during the non-winter months.

**Table 15.3: Monthly variations in heating behaviour and fuel use, Balclutha**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 15% | 15% | 15% | 40% | 55% | 55% | 70% | 65% | 55% | 45% | 25% | 25% |
| Open fire | 0% | 0% | 10% | 40% | 50% | 90% | 100% | 90% | 70% | 40% | 10% | 10% |
| Wood burner | 11% | 11% | 26% | 53% | 76% | 92% | 92% | 89% | 71% | 61% | 26% | 21% |
| Multi-fuel | 22% | 24% | 33% | 54% | 81% | 92% | 95% | 95% | 70% | 51% | 32% | 33% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 2 | 2 | 2 | 4 | 6 | 6 | 6 | 6 | 5 | 4 | 2 | 3 |
| Open fire | – | – | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 1 | 1 |
| Wood burner | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| Multi-fuel | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 6 | 6 | 6 | 5 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | 0.4 | 0.8 | 0.5 | 2.2 | 2.2 | 2.2 | 1.1 | 0.8 | 0.1 | 0.1 |
| Open fire: coal | – | – | 0.4 | 1.3 | 1.2 | 2.0 | 2.0 | 2.0 | 2.3 | 0.9 | 0.0 | 0.0 |
| Wood burner | 1.3 | 0.9 | 1.6 | 4.0 | 4.7 | 7.2 | 7.2 | 7.0 | 5.2 | 3.2 | 1.9 | 1.9 |
| Multi-fuel: wood | 1.0 | 0.8 | 1.3 | 3.2 | 6.3 | 6.8 | 8.0 | 7.8 | 4.1 | 2.2 | 1.2 | 1.5 |
| Multi-fuel: coal | 2.2 | 1.9 | 2.7 | 4.7 | 10.7 | 21.7 | 22.1 | 22.4 | 9.1 | 6.4 | 2.9 | 2.9 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Open fire: wood | – | – | 4 | 7 | 5 | 20 | 20 | 20 | 10 | 8 | 1 | 1 |
| Open fire: coal | – | – | 4 | 11 | 10 | 17 | 17 | 17 | 19 | 7 | 0 | 0 |
| Wood burner | 3 | 2 | 4 | 10 | 11 | 17 | 17 | 17 | 13 | 8 | 5 | 5 |
| Multi-fuel: wood | 2 | 1 | 2 | 5 | 9 | 10 | 12 | 11 | 6 | 3 | 2 | 2 |
| Multi-fuel: coal | 3 | 3 | 4 | 7 | 16 | 33 | 34 | 34 | 14 | 10 | 4 | 4 |

**Table 15.4: Estimated daily fuel use, by season, Balclutha**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 2 | 0 |
| Open fire: wood | 21 | 11 |
| Open fire: coal | 19 | 20 |
| Wood burner | 25 | 16 |
| Multi-fuel: wood | 14 | 9 |
| Multi-fuel: coal | 37 | 18 |

## 15.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Balclutha are presented in this section.

Figure 15.1 shows that the proportion of households using gas systems that are properly flued in Balclutha is similar to the national average (23% in Balclutha compared with 28% in the national survey).

The amount spent on heating for a winter month by heating method is shown in Table 15.5. In Balclutha, households heating using open fires spent less per month on average (around $40) than households using electricity (around $115) on average.

Figure 15.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Balclutha. Around 17% of the respondents in Balclutha were living in rented accommodation, and the majority (72%) of these households used electricity to heat the main living area.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 15.3 shows that the vast majority of wood burnt on open fires is self-collected, whereas around two-thirds of the wood burnt on wood and multi-fuel burners is bought.

**Figure 15.1: Distribution of flued versus unflued gas heating and age of wood burner, Balclutha**

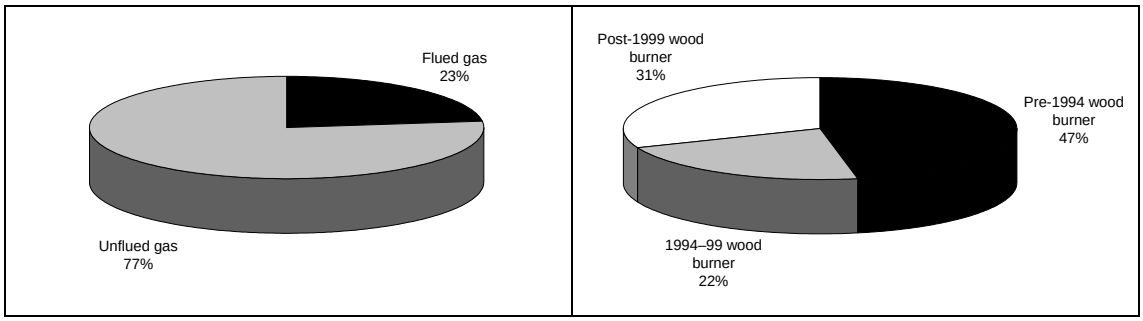


**Table 15.5: Average monthly heating costs (winter), Balclutha**

| | Winter month cost |
|---|---|
| Electric | $114 |
| Gas | $57 |
| Open fire | $39 |
| Wood burner | $53 |
| Multi-fuel | $77 |

**Figure 15.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Balclutha**

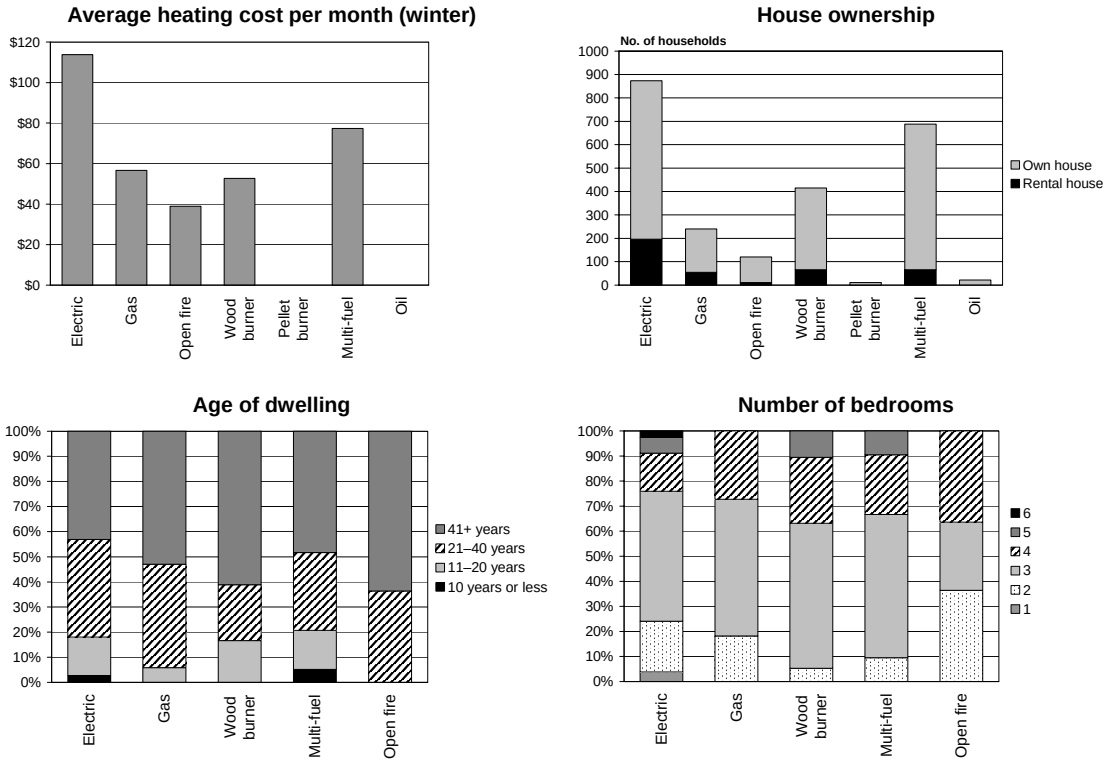


**Figure 15.3: Proportions of fuel obtained free of charge versus bought, Balclutha**

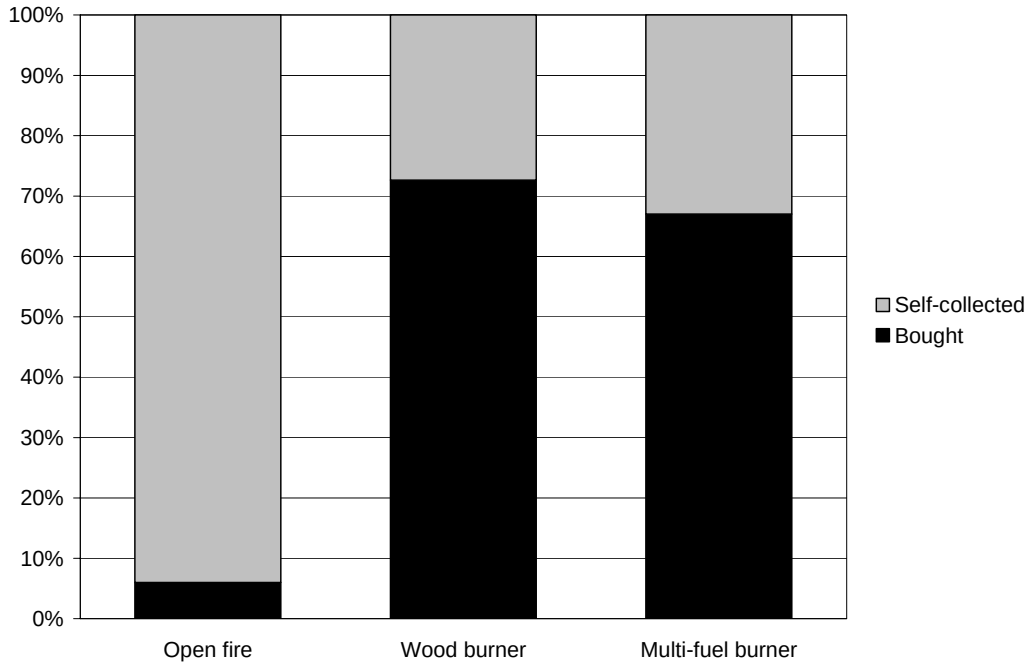

**Table 15.6: Type of electric heating, Balclutha**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 98 | 131 | 142 | 98 | 229 | 218 | – | 66 |
| Percent | 11% | 15% | 16% | 11% | 26% | 25% | – | 8% |

The commonest types of electric heating used in the main living area in Balclutha houses were fan heaters and heat pumps (Table 15.6). The latter usage is greater than the national average (13%).

Data on home heating methods, by house ownership, are shown in Table 15.7.

**Table 15.7: Home heating method, by house ownership, Balclutha**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 273 | 17% | 1354 | 83% |
| Electric | 197 | 23% | 677 | 78% |
| Gas | 55 | 23% | 186 | 77% |
| Open fire | 11 | 9% | 109 | 91% |
| Wood burner | 66 | 16% | 349 | 84% |
| Pellet burner | 0 | 0% | 11 | 100% |
| Multi-fuel | 66 | 10% | 622 | 90% |
| Oil | 0 | 0% | 22 | 100% |

Household insulation types and heating methods are shown in Tables 15.8 and 15.9. Around 8% of households in Balclutha indicated that the house had no insulation. This compares with a national average of 10%. The majority of households indicated that the dwelling had ceiling insulation and 47% had wall insulation.

Table 15.10 shows home heating method, by household income. The overall non-response rate was around 18%. This limits the interpretation of these data because there may be an income bias in the non-respondents. The response rate within the open fire category, however, was 100%. Results for this category indicate that the majority of households using open fires had an annual income of less than $40,000, with 45% earning less than $20,000.

**Table 15.8: House insulation summary statistics, Balclutha**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1278 | 78% | No insulation | 8% |
| Under floor | 317 | 19% | 1 type* | 31% |
| Wall | 775 | 47% | 2 types | 31% |
| Cylinder wrap | 459 | 28% | 3 types | 19% |
| Double glazing | 120 | 7% | 4 types | 5% |
| None | 131 | 8% | 5 types | 2% |
| Don't know | 76 | 5% | Don't know | 5% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 15.9: Degree of house insulation, by heating method, Balclutha**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 30% | 41% | 21% | 32% | 18% |
| 2 types | 26% | 32% | 39% | 37% | 36% |
| 3 types | 23% | 18% | 24% | 17% | 9% |
| 4 types | 5% | 0% | 5% | 5% | 9% |
| 5 types | 3% | 0% | 3% | 0% | 0% |
| None or don't know | 14% | 9% | 8% | 10% | 27% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 15.10: Home heating method, by household income, Balclutha**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 25% | 36% | 13% | 17% | 0% |
| Less than $20,000 | 18% | 9% | 5% | 8% | 45% |
| $20,000 to $30,000 | 9% | 0% | 16% | 19% | 9% |
| $30,000 to $40,000 | 19% | 18% | 11% | 10% | 27% |
| $40,000 to $50,000 | 8% | 18% | 13% | 16% | 0% |
| $50,000 to $70,000 | 8% | 9% | 21% | 10% | 9% |
| $70,000 to $100,000 | 13% | 5% | 16% | 16% | 0% |
| More than $100,000 | 3% | 5% | 5% | 5% | 9% |

Tables 15.11 and 15.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 15.11: Home heating method, by age of dwelling, Balclutha**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 3% | 0% | 0% | 5% | 0% |
| 11–20 years | 14% | 5% | 16% | 14% | 0% |
| 21–40 years | 35% | 32% | 21% | 29% | 36% |
| 41+ years | 39% | 41% | 58% | 44% | 64% |

**Table 15.12: Home heating method, by number of bedrooms, Balclutha**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 4% | 0% | 0% | 0% | 0% |
| 2 | 20% | 18% | 5% | 10% | 36% |
| 3 | 51% | 55% | 58% | 57% | 27% |
| 4 | 15% | 27% | 26% | 24% | 36% |
| 5 | 6% | 0% | 11% | 10% | 0% |
| 6 | 3% | 0% | 0% | 0% | 0% |

# 16 Milton

A telephone survey of domestic heating methods and fuels for Milton was carried out by Digipoll in December 2004. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Milton.

Survey details are shown in Table 15.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[33] The latter suggest a population decrease for Clutha District of 13% by 2021.[34] This decrease was assumed to apply to the urban area of Milton.

**Table 16.1: Summary survey data, Milton**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Milton | 756 | 150 | 7.2% |

## 16.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Milton. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Milton, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Milton largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 16.2 and 16.3 show domestic heating methods and fuels used for main living areas in Milton houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Milton were electricity (43%), multi-fuel burners (39%) and wood burners (35%). Many households used more than one method of heating in their main living area.

Like Balclutha, the use of multi-fuel burners in Milton was higher than average at 39%, compared with a national average of 8%. In contrast to Balclutha, however, the main solid fuel source in Milton is wood (77%).

[33] New Zealand Statistics 2004, www.stats.govt.nz

[34] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 16.2: Domestic home heating methods and fuels, Milton**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 43% | 328 | – | – |
| Total gas | 23% | 176 | 0.2 | 1% |
| Flued gas | 5% | 40 | – | – |
| Unflued gas | 18% | 136 | – | – |
| Oil | 2% | 15 | – | – |
| Open fire | 4% | 30 | – | – |
| Open fire: wood | 4% | 30 | 0.3 | 2% |
| Open fire: coal | 2% | 15 | 0.1 | 1% |
| Total wood burner | 35% | 262 | 8 | 40% |
| Pre-1994 wood burner | 18% | 139 | 5 | 22% |
| 1994–99 wood burner | 11% | 86 | 3 | 15% |
| Post-1999 wood burner | 5% | 37 | 1 | 3% |
| Multi-fuel burners | 39% | 292 | – | – |
| Multi-fuel burners: wood | 39% | 292 | 7 | 36% |
| Multi-fuel burners: coal | 33% | 252 | 4 | 21% |
| Pellet burners | 1% | 5 | – | – |
| Total wood | 77% | 585 | 16 | 77% |
| Total coal | 35% | 267 | 5 | 22% |
| Total | | 756 | 21 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

At least 10% of the households using solid fuel burning for domestic home heating operated them during the non-winter months, generally burning on around five days a week. Gas was also used for heating during the summer months by around 9% of the households using that method. The quantities of fuel used per day during the non-winter months were less than during the winter (Table 16.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 16.3: Monthly variations in heating behaviour and fuel use, Milton**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 9% | 9% | 18% | 45% | 64% | 85% | 85% | 76% | 39% | 30% | 21% | 15% |
| Open fire | 17% | 17% | 0% | 0% | 50% | 67% | 67% | 67% | 33% | 33% | 17% | 17% |
| Wood burner | 10% | 10% | 17% | 44% | 60% | 85% | 88% | 87% | 62% | 44% | 27% | 17% |
| Multi-fuel | 11% | 13% | 23% | 36% | 71% | 93% | 98% | 98% | 61% | 36% | 25% | 16% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Open fire | 1 | 1 | 0 | 0 | 7 | 7 | 7 | 6 | 6 | 6 | 1 | 1 |
| Wood burner | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 6 | 7 | 6 | 5 | 5 |
| Multi-fuel | 6 | 5 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 |
| Open fire: coal | – | – | – | – | 0.1 | 0.1 | 0.1 | 0.1 | – | – | – | – |
| Wood burner | 0.5 | 0.5 | 2.8 | 4.7 | 7.0 | 8.3 | 8.3 | 8.2 | 6.3 | 4.9 | 3.7 | 1.4 |
| Multi-fuel: wood | 0.4 | 0.4 | 2.2 | 2.8 | 6.3 | 7.4 | 7.4 | 7.3 | 4.0 | 3.6 | 2.4 | 0.4 |
| Multi-fuel: coal | 0.7 | 0.8 | 1.4 | 2.5 | 3.3 | 4.5 | 4.5 | 4.3 | 3.5 | 2.2 | 1.7 | 1.3 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.2 | 0.7 | 1.3 | 1.4 | 1.2 | 1.1 | 0.4 | 0.3 | 0.2 | 0.1 |
| Open fire: wood | 2.7 | 2.7 | 0.0 | 0.0 | 0.0 | 11.4 | 11.4 | 11.4 | 4.3 | 4.3 | 2.7 | 2.7 |
| Open fire: coal | – | – | – | – | 8.6 | 8.6 | 8.6 | 9.9 | – | – | – | – |
| Wood burner | 2.1 | 2.1 | 10.5 | 18.0 | 26.6 | 31.8 | 31.8 | 31.2 | 24.2 | 18.6 | 14.0 | 5.4 |
| Multi-fuel: wood | 1.2 | 1.2 | 7.6 | 9.5 | 21.6 | 25.3 | 25.5 | 25.1 | 13.5 | 12.3 | 8.1 | 1.2 |
| Multi-fuel: coal | 2.9 | 3.0 | 5.4 | 9.7 | 13.1 | 17.8 | 17.8 | 17.1 | 13.8 | 8.7 | 6.6 | 5.0 |

**Table 16.4: Estimated daily fuel use, by season, Milton**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 2 | 1 |
| Open fire: wood | 30 | 27 |
| Open fire: coal | 12 | – |
| Wood burner | 38 | 28 |
| Multi-fuel: wood | 26 | 14 |
| Multi-fuel: coal | 19 | 17 |

# 16.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Milton are presented in this section.

Figure 16.1 shows that the proportion of households using gas systems that are properly flued in Milton is similar to the national average (23% in Milton compared with 28% in the national survey). The proportion of wood burners that were thought to be more than 10 years old was slightly greater than average at 53% compared with 43% nationally.

The amount spent on heating for a winter month, by heating method, is shown in Table 16.5. With the exception of households using electricity and open fires, which spend almost twice as much as some other methods, the monthly fuel costs do not vary significantly with heating method in Milton.

Figure 16.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Milton. One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 16.3 shows that around half of the wood used on wood burners and open fires in Milton is self-collected, compared with around 70% for multi-fuel burners.

**Figure 16.1: Distribution of flued versus unflued gas heating and age of wood burner, Milton**

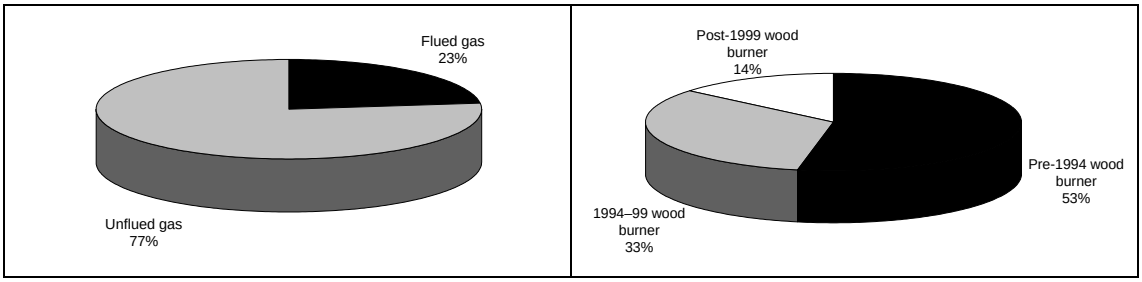


**Table 16.5: Average monthly heating costs (winter), Milton**

| | Winter month cost |
|---|---|
| Electric | $122 |
| Gas | $59 |
| Open fire | $122 |
| Wood burner | $65 |
| Multi-fuel | $62 |

**Figure 16.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Milton**

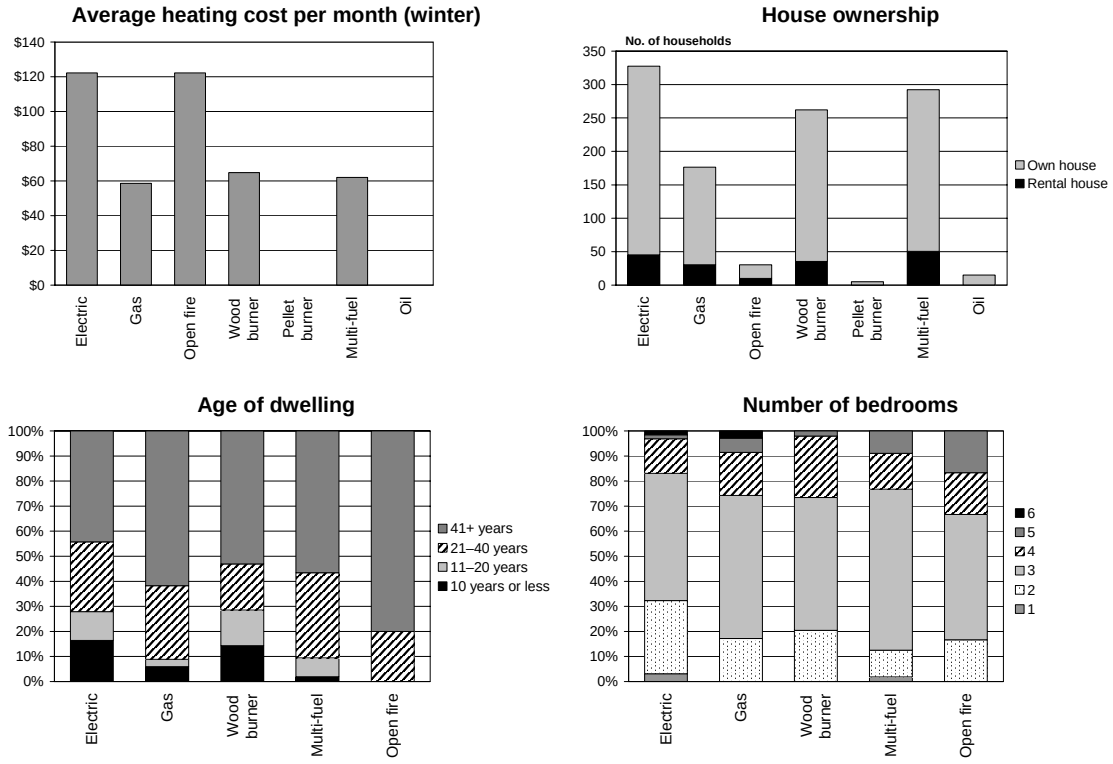


**Figure 16.3: Proportions of fuel obtained free of charge versus bought, Milton**

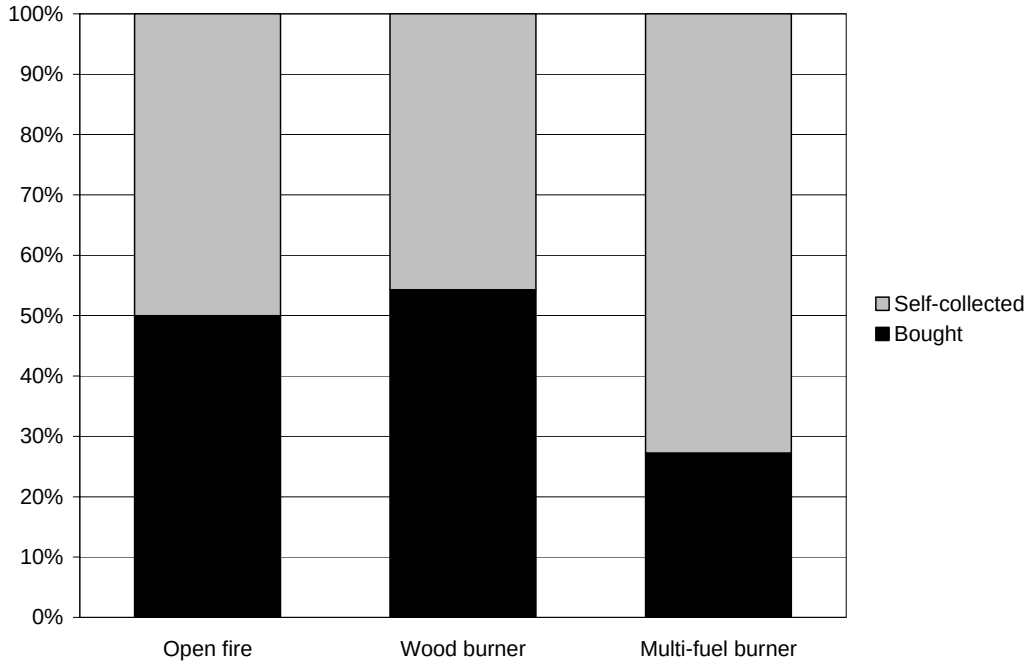

**Table 16.6: Type of electric heating, Milton**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 40 | 50 | 66 | 30 | 45 | 101 | – | 55 |
| Percent | 12% | 15% | 20% | 9% | 14% | 31% | – | 17% |

Heat pumps were the most common method of electric heating for houses in Milton, with around 31% of households using electricity in the main living area having a heat pump (Table 16.6). This is much higher than the national average (13%). Portable oil column heaters were also common (20%).

Data on home heating methods, by house ownership, are shown in Table 16.7.

**Table 16.7: Home heating method, by house ownership, Milton**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 109 | 14% | 647 | 86% |
| Electric | 45 | 14% | 282 | 86% |
| Gas | 30 | 17% | 146 | 83% |
| Open fire | 10 | 33% | 20 | 67% |
| Wood burner | 35 | 13% | 227 | 87% |
| Pellet burner | 0 | 0% | 5 | 100% |
| Multi-fuel | 50 | 17% | 242 | 83% |
| Oil | 0 | 0% | 15 | 100% |

Household insulation types and heating methods are shown in Tables 16.8 and 16.9. The proportion of households that were thought to have no insulation (13%) was similar to the national average (10%).

Table 16.10 shows home heating method, by household income. The overall non-response rate was around 29%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 16.8: House insulation summary statistics, Milton**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 559 | 74% | No insulation | 13% |
| Under floor | 171 | 23% | 1 type* | 29% |
| Wall | 363 | 48% | 2 types | 27% |
| Cylinder wrap | 181 | 24% | 3 types | 17% |
| Double glazing | 55 | 7% | 4 types | 7% |
| None | 101 | 13% | 5 types | 3% |
| Don't know | 30 | 4% | Don't know | 4% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 16.9: Degree of house insulation, by heating method, Milton**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 34% | 29% | 23% | 28% | 0% |
| 2 types | 20% | 23% | 17% | 31% | 33% |
| 3 types | 18% | 14% | 25% | 12% | 17% |
| 4 types | 11% | 11% | 8% | 7% | 0% |
| 5 types | 2% | 0% | 2% | 3% | 0% |
| None or don't know | 15% | 23% | 25% | 19% | 50% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 16.10: Home heating method, by household income, Milton**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 31% | 37% | 23% | 26% | 50% |
| Less than $20,000 | 29% | 14% | 25% | 19% | 0% |
| $20,000 to $30,000 | 11% | 17% | 8% | 12% | 17% |
| $30,000 to $40,000 | 9% | 6% | 13% | 16% | 0% |
| $40,000 to $50,000 | 8% | 9% | 12% | 9% | 17% |
| $50,000 to $70,000 | 12% | 6% | 15% | 14% | 0% |
| $70,000 to $100,000 | 0% | 9% | 4% | 2% | 0% |
| More than $100,000 | 0% | 3% | 0% | 3% | 17% |

Tables 16.11 and 16.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 16.11: Home heating method, by age of dwelling, Milton**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 15% | 6% | 13% | 2% | 0% |
| 11–20 years | 11% | 3% | 13% | 7% | 0% |
| 21–40 years | 26% | 29% | 17% | 31% | 17% |
| 41+ years | 42% | 60% | 50% | 52% | 67% |

**Table 16.12: Home heating method, by number of bedrooms, Milton**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 0% | 2% | 0% |
| 2 | 29% | 17% | 19% | 10% | 17% |
| 3 | 51% | 57% | 50% | 62% | 50% |
| 4 | 14% | 17% | 23% | 14% | 17% |
| 5 | 2% | 6% | 2% | 9% | 17% |
| 6 | 2% | 3% | 0% | 0% | 0% |

# 17 Arrowtown

A telephone survey of domestic heating methods and fuels for Arrowtown was carried out by Digipoll in December 2004. This involved surveying 150 households within the 2001 census area unit (CAU) area of Arrowtown.

Survey details are shown in Table 17.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[35] The latter suggest a population increase for the Queenstown–Lakes District of 30% by 2021.[36] It was assumed that the increase applies to the urban area of Arrowtown.

**Table 17.1: Summary survey data, Arrowtown**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Arrowtown | 721 | 150 | 7.1% |

## 17.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Arrowtown. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Arrowtown, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Arrowtown largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 17.2 and 17.3 show domestic heating methods and fuels used for main living areas in Arrowtown houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in houses in Arrowtown were electricity (51%) and wood burners (46%). Many households used more than one method of heating in their main living area.

[35] New Zealand Statistics 2004, www.stats.govt.nz

[36] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 17.2: Domestic home heating methods and fuels, Arrowtown**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 51% | 365 | – | – |
| Total gas | 27% | 192 | 0.4 | 3% |
| Flued gas | 14% | 99 | – | – |
| Unflued gas | 13% | 94 | – | – |
| Oil | 3% | 24 | 0.0 | 0.0% |
| Open fire | 15% | 111 | – | – |
| Open fire: wood | 15% | 106 | 2 | 14% |
| Open fire: coal | 5% | 38 | 1 | 4% |
| Total wood burner | 46% | 332 | 7 | 47% |
| Pre-1994 wood burner | 16% | 116 | 3 | 21% |
| 1994–99 wood burner | 15% | 106 | 2 | 16% |
| Post-1999 wood burner | 15% | 111 | 2 | 11% |
| Multi-fuel burners | 23% | 163 | – | – |
| Multi-fuel burners: wood | 23% | 163 | 3 | 23% |
| Multi-fuel burners: coal | 16% | 115 | 1 | 9% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 83% | 601 | 13 | 85% |
| Total coal | 21% | 154 | 2 | 12% |
| Total | | 721 | 15 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Between 3% and 10% of the households using gas or solid fuel burners in Arrowtown indicated that they operate them during the summer months. On average these households use their heating methods around one day per week during January and February. Table 17.4 shows that the quantities of fuel used during the non-winter months is less than during the winter months. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 17.3: Monthly variations in heating behaviour and fuel use, Arrowtown**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 5% | 5% | 13% | 33% | 67% | 90% | 90% | 92% | 62% | 31% | 18% | 10% |
| Open fire | 5% | 5% | 10% | 29% | 52% | 95% | 100% | 95% | 67% | 33% | 14% | 10% |
| Wood burner | 3% | 3% | 7% | 30% | 77% | 96% | 100% | 94% | 68% | 41% | 16% | 9% |
| Multi-fuel | 3% | 0% | 9% | 41% | 65% | 91% | 100% | 91% | 71% | 38% | 12% | 12% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 1 | – | 2 | 4 | 6 | 6 | 6 | 6 | 5 | 6 | 4 | – |
| Open fire | 1 | 1 | 2 | 5 | 5 | 6 | 6 | 6 | 5 | 5 | 4 | 4 |
| Wood burner | 1 | 1 | 3 | 5 | 6 | 6 | 7 | 6 | 6 | 5 | 4 | 5 |
| Multi-fuel | 2 | – | 5 | 6 | 6 | 6 | 7 | 6 | 5 | 5 | 6 | 6 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | – | 0.0 | 0.1 | 0.3 | 0.4 | 0.4 | 0.4 | 0.2 | 0.1 | 0.0 | – |
| Open fire: wood | 0.0 | 0.0 | 0.1 | 1.2 | 0.8 | 2.0 | 2.1 | 2.0 | 1.8 | 1.1 | 0.5 | 0.5 |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 | 0.6 | 0.6 | 0.5 | 0.0 | 0.0 | 0.0 |
| Wood burner | 0.0 | 0.0 | 0.2 | 1.8 | 5.2 | 6.5 | 7.0 | 6.7 | 3.9 | 1.5 | 0.3 | 0.2 |
| Multi-fuel: wood | 0.0 | – | 0.1 | 0.7 | 1.8 | 3.1 | 3.4 | 3.1 | 1.1 | 0.6 | 0.1 | 0.1 |
| Multi-fuel: coal | 0.0 | – | 0.1 | 0.2 | 0.6 | 1.1 | 1.3 | 0.9 | 0.2 | 0.1 | 0.0 | 0.0 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | – | 0.1 | 0.3 | 1.7 | 2.3 | 2.3 | 2.2 | 1.0 | 0.7 | 0.1 | – |
| Open fire: wood | 0.2 | 0.2 | 0.6 | 11.8 | 7.6 | 19.3 | 20.0 | 19.3 | 17.4 | 10.3 | 5.0 | 4.5 |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 11.8 | 14.3 | 14.3 | 13.5 | 0.0 | 0.0 | 0.0 |
| Wood burner | 0.1 | 0.1 | 0.5 | 5.5 | 15.5 | 19.7 | 21.0 | 20.4 | 11.8 | 4.6 | 1.0 | 0.5 |
| Multi-fuel: wood | 0.2 | – | 0.7 | 4.0 | 11.0 | 19.0 | 21.1 | 19.0 | 6.9 | 4.0 | 0.8 | 0.8 |
| Multi-fuel: coal | 0.0 | – | 0.5 | 1.9 | 4.9 | 9.8 | 10.9 | 7.5 | 2.1 | 1.0 | 0.0 | 0.0 |

**Table 17.4: Estimated daily fuel use, by season, Arrowtown**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 3 | 1 |
| Open fire: wood | 27 | 19 |
| Open fire: coal | 21 | 14 |
| Wood burner | 26 | 17 |
| Multi-fuel: wood | 23 | 10 |
| Multi-fuel: coal | 14 | 3 |

## 17.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Arrowtown are presented in this section.

The proportion of households using gas systems that are properly flued in Arrowtown (51%) is much higher than the national average of 28% (Figure 17.1). The area also showed a greater proportion of newer wood burners (33%) than the average (24%).

The amount spent on heating for a winter month, by heating method, is shown in Table 17.5. The average heating expenditure in Arrowtown is higher than for most areas, with average monthly heating costs in excess of $80 per month for all heating types.

Figure 17.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Arrowtown. Wood burners and electric heating were the most common heating methods in houses that were rented. In Arrowtown approximately 26% of the households were rented in 2004.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 17.3 shows that over 50% of the wood used on solid fuel burners in Arrowtown was self-collected.

**Figure 17.1: Distribution of flued versus unflued gas heating and age of wood burner, Arrowtown**

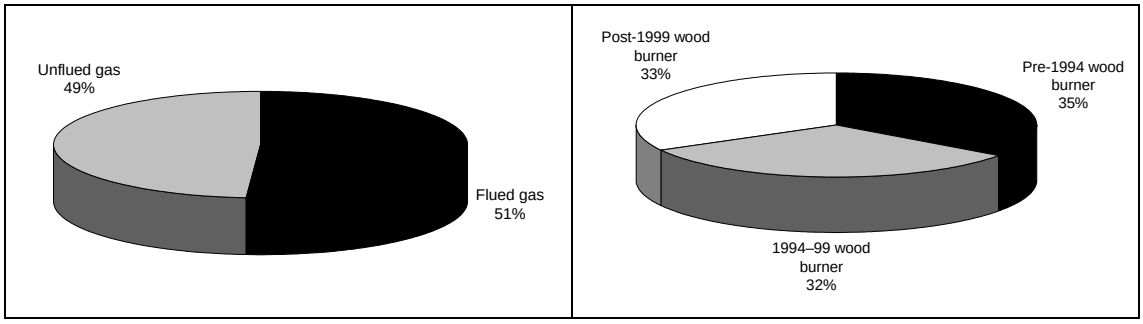


**Table 17.5: Average monthly heating costs (winter), Arrowtown**

| | Winter month cost |
|---|---|
| Electric | $158 |
| Gas | $133 |
| Open fire | $84 |
| Pellet burner | – |
| Multi-fuel | $143 |

**Figure 17.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Arrowtown**

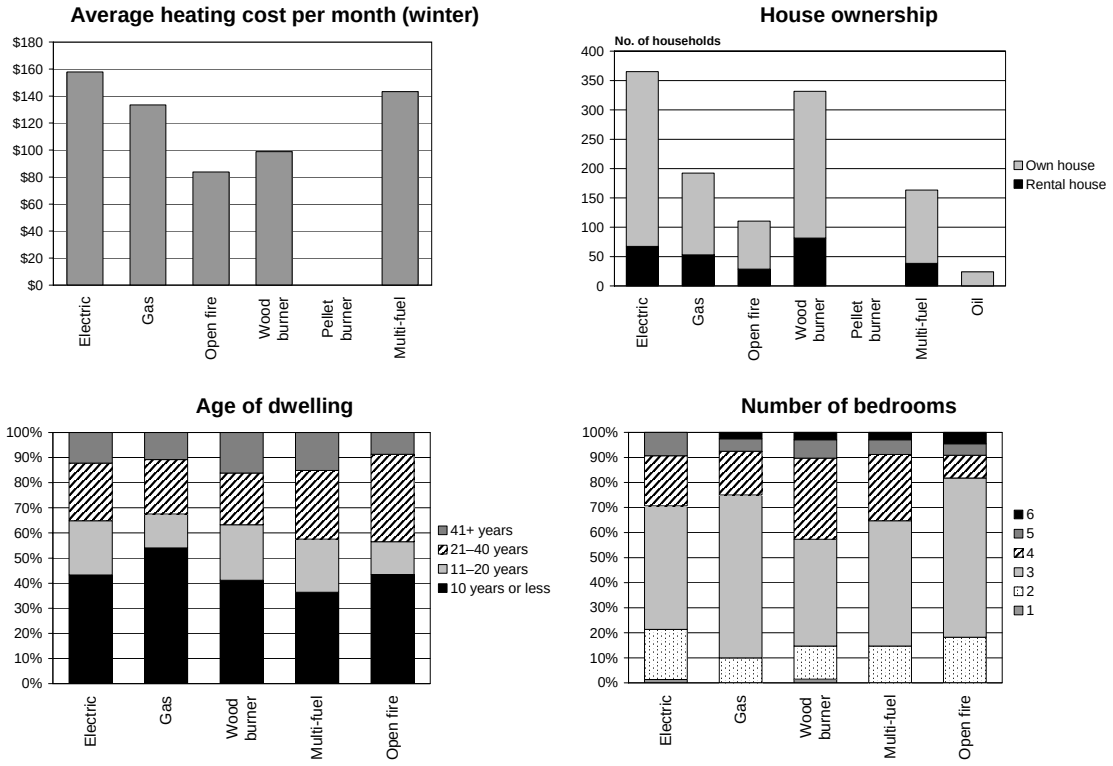


**Figure 17.3: Proportions of fuel obtained free of charge versus bought, Arrowtown**

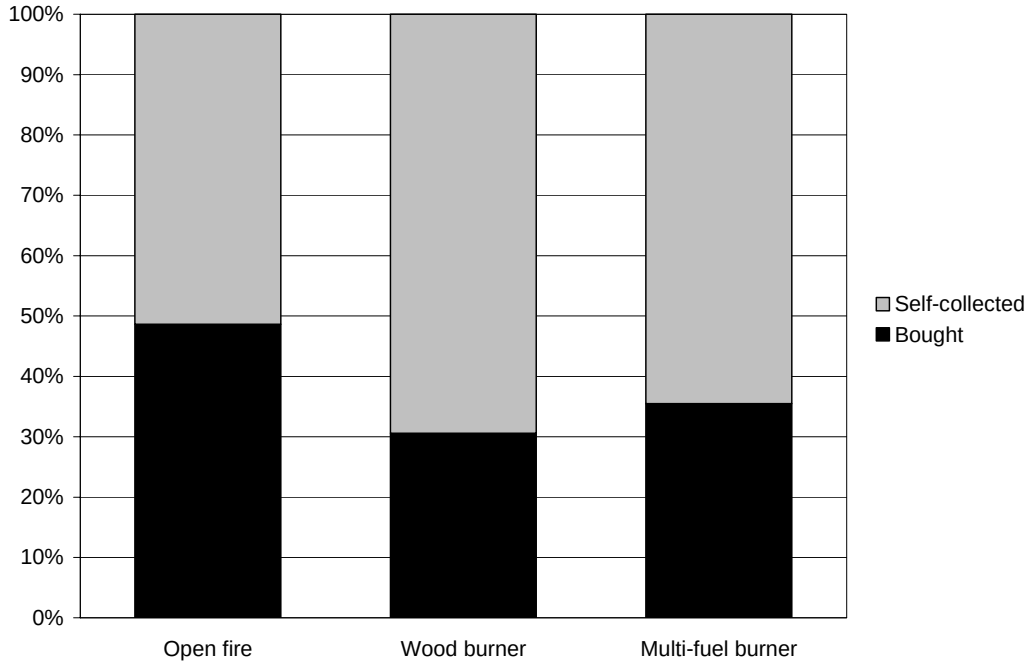

**Table 17.6: Type of electric heating, Arrowtown**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 87 | 48 | 96 | 19 | 101 | 53 | – | 58 |
| Percent | 24% | 13% | 26% | 5% | 28% | 14% | – | 16% |

The commonest types of electric heaters used in the main living area in Arrowtown houses were fan heaters, oil column heaters and night store heaters (Table 17.6). Radiant heaters were also fairly common. The proportion of houses using the more efficient heat pumps was 14%, which is similar to the national average (13%).

Data on home heating methods, by house ownership, are shown in Table 17.7.

**Table 17.7: Home heating method, by house ownership, Arrowtown**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 187 | 26% | 524 | 73% |
| Electric | 67 | 18% | 298 | 82% |
| Gas | 53 | 28% | 139 | 73% |
| Open fire | 29 | 26% | 82 | 74% |
| Wood burner | 82 | 25% | 250 | 75% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 38 | 24% | 125 | 76% |
| Oil | 0 | 0% | 24 | 100% |

Household insulation types and heating methods are shown in Tables 17.8 and 17.9. The proportion of households thought not be insulated in Arrowtown (8%) is similar to the national average of 10%.

Table 17.10 shows home heating method, by household income. The overall non-response rate was around 27%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 17.8: House insulation summary statistics, Arrowtown**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 610 | 85% | No insulation | 8% |
| Under floor | 288 | 40% | 1 type* | 11% |
| Wall | 529 | 73% | 2 types | 23% |
| Cylinder wrap | 255 | 35% | 3 types | 29% |
| Double glazing | 240 | 33% | 4 types | 16% |
| None | 58 | 8% | 5 types | 11% |
| Don't know | 10 | 1% | Don't know | 1% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 17.9: Degree of house insulation, by heating method, Arrowtown**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 14% | 13% | 7% | 9% | 13% |
| 2 types | 18% | 30% | 28% | 24% | 9% |
| 3 types | 25% | 28% | 32% | 35% | 26% |
| 4 types | 18% | 5% | 13% | 21% | 13% |
| 5 types | 14% | 15% | 14% | 6% | 22% |
| None or don't know | 9% | 10% | 6% | 6% | 17% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 17.10: Home heating method, by household income, Arrowtown**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 21% | 23% | 30% | 12% | 26% |
| Less than $20,000 | 7% | 8% | 1% | 3% | 4% |
| $20,000 to $30,000 | 7% | 0% | 3% | 6% | 9% |
| $30,000 to $40,000 | 12% | 18% | 10% | 24% | 17% |
| $40,000 to $50,000 | 13% | 13% | 16% | 6% | 9% |
| $50,000 to $70,000 | 12% | 5% | 12% | 15% | 13% |
| $70,000 to $100,000 | 13% | 18% | 13% | 21% | 4% |
| More than $100,000 | 16% | 18% | 14% | 15% | 17% |

Tables 17.11 and 17.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 17.11: Home heating method, by age of dwelling, Arrowtown**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 42% | 50% | 41% | 35% | 43% |
| 11–20 years | 21% | 13% | 22% | 21% | 13% |
| 21–40 years | 22% | 20% | 20% | 26% | 35% |
| 41+ years | 12% | 10% | 16% | 15% | 9% |

**Table 17.12: Home heating method, by number of bedrooms, Arrowtown**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 1% | 0% | 1% | 0% | 0% |
| 2 | 20% | 10% | 13% | 15% | 17% |
| 3 | 49% | 65% | 42% | 50% | 61% |
| 4 | 20% | 18% | 32% | 26% | 9% |
| 5 | 9% | 5% | 7% | 6% | 4% |
| 6 | 0% | 3% | 3% | 3% | 4% |

# 18 Rangiora

A telephone survey of domestic heating methods and fuels for Rangiora was carried out by Digipoll in December 2004. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Rangiora North, Rangiora West, Rangiora East and Southbrook.

Survey details are shown in Table 18.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[37] The latter suggest a population increase for the Waimakariri District of 36% by 2021.[38] It is assumed that this increase applies to the urban area of Rangiora.

**Table 18.1: Summary survey data, Rangiora**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Rangiora | 4389 | 150 | 7.9% |

## 18.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Rangiora. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Rangiora, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Rangiora largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 18.2 and 18.3 show domestic heating methods and fuels used for main living areas in Rangiora houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Rangiora were electricity (51%) and wood burners (53%). Many households used more than one method of heating in their main living area.

[37] New Zealand Statistics 2004, www.stats.govt.nz

[38] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 18.2: Domestic home heating methods and fuels, Rangiora**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 51% | 2253 | – | – |
| Total gas | 20% | 878 | 1 | 2% |
| Flued gas | 8% | 351 | – | – |
| Unflued gas | 12% | 527 | – | – |
| Oil | 1% | 29 | – | – |
| Open fire | 9% | 380 | – | – |
| Open fire: wood | 9% | 380 | 5 | 12% |
| Open fire: coal | 2% | 88 | 0 | 1% |
| Total wood burner | 53% | 2341 | 37 | 80% |
| Pre-1994 wood burner | 27% | 1170 | 19 | 42% |
| 1994–99 wood burner | 10% | 455 | 9 | 21% |
| Post-1999 wood burner | 16% | 715 | 8 | 18% |
| Multi-fuel burners | 3% | 117 | – | – |
| Multi-fuel burners: wood | 3% | 117 | 1 | 3% |
| Multi-fuel burners: coal | 1% | 59 | 1 | 1% |
| Pellet burners | 3% | 146 | 1 | 1% |
| Total wood | 65% | 2838 | 44 | 95% |
| Total coal | 3% | 146 | 1 | 2% |
| Total | | 4389 | 46 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 16% and 10% of households that use wood burners heat their homes during November and December respectively. Only a small proportion of those using wood burners (around 1%) do so during January and February (Table 18.3). The quantities of fuel used per day during non-winter months was typically less than during winter (Table 18.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 18.3: Monthly variations in heating behaviour and fuel use, Rangiora**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 7% | 7% | 11% | 41% | 56% | 85% | 81% | 70% | 52% | 37% | 22% | 11% |
| Open fire | 8% | 0% | 0% | 31% | 62% | 92% | 100% | 85% | 46% | 31% | 15% | 15% |
| Wood burner | 1% | 1% | 8% | 34% | 71% | 91% | 95% | 91% | 63% | 39% | 16% | 10% |
| Multi-fuel | 0% | 0% | 0% | 50% | 75% | 100% | 100% | 100% | 75% | 25% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 1 | 1 | 3 | 5 | 5 | 6 | 6 | 6 | 5 | 4 | 4 | 4 |
| Open fire | 2 | – | – | 3 | 4 | 5 | 4 | 5 | 4 | 3 | 1 | 1 |
| Wood burner | 3 | 3 | 5 | 5 | 6 | 6 | 7 | 7 | 6 | 5 | 4 | 4 |
| Multi-fuel | – | – | – | 7 | 7 | 7 | 7 | 7 | 7 | 6 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.2 | 0.7 | 0.9 | 0.8 | 0.7 | 0.3 | 0.2 | 0.1 | 0.0 |
| Open fire: wood | 0.4 | – | – | 1.5 | 2.1 | 5.3 | 5.4 | 4.7 | 2.7 | 1.1 | 0.2 | 0.2 |
| Open fire: coal | 0.0 | – | – | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wood burner | 0.3 | 0.3 | 0.4 | 10.2 | 27.2 | 34.5 | 36.7 | 35.7 | 25.8 | 17.5 | 5.0 | 1.6 |
| Multi-fuel: wood | – | – | – | 0.9 | 1.5 | 1.5 | 1.5 | 1.5 | 1.7 | 0.8 | – | – |
| Multi-fuel: coal | – | – | – | – | 0.0 | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.2 | 0.8 | 1.0 | 1.0 | 0.8 | 0.4 | 0.2 | 0.1 | 0.0 |
| Open fire: wood | 1.1 | – | – | 3.9 | 5.5 | 13.8 | 14.3 | 12.5 | 7.2 | 2.8 | 0.5 | 0.5 |
| Open fire: coal | 0.0 | – | – | 1.3 | 3.9 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wood burner | 0.1 | 0.1 | 0.2 | 4.3 | 11.6 | 14.7 | 15.7 | 15.3 | 11.0 | 7.5 | 2.2 | 0.7 |
| Multi-fuel: wood | – | – | – | 7.6 | 12.6 | 12.6 | 12.6 | 12.6 | 14.1 | 6.5 | – | – |
| Multi-fuel: coal | – | – | – | – | 0.0 | 9.0 | 9.0 | 9.0 | 0.0 | 0.0 | – | – |

**Table 18.4: Estimated daily fuel use, by season, Rangiora**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 19 | 13 |
| Open fire: coal | 9 | 14 |
| Wood burner | 20 | 15 |
| Multi-fuel: wood | 4 | 9 |
| Multi-fuel: coal | 13 | 15 |

## 18.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Rangiora are presented in this section.

Figure 18.1 shows that the proportion of households using gas systems that are properly flued in Rangiora is around 40%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 18.5. In Rangiora, households heating using open fires spent on average less per month (around $50) than those using other heating methods.

Figure 18.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Rangiora. Only a small proportion (11%) of the respondents in Rangiora were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 18.3 shows that around 50% of the wood used on solid fuel burners in Rangiora is self-collected.

**Figure 18.1: Distribution of flued versus unflued gas heating and age of wood burner, Rangiora**

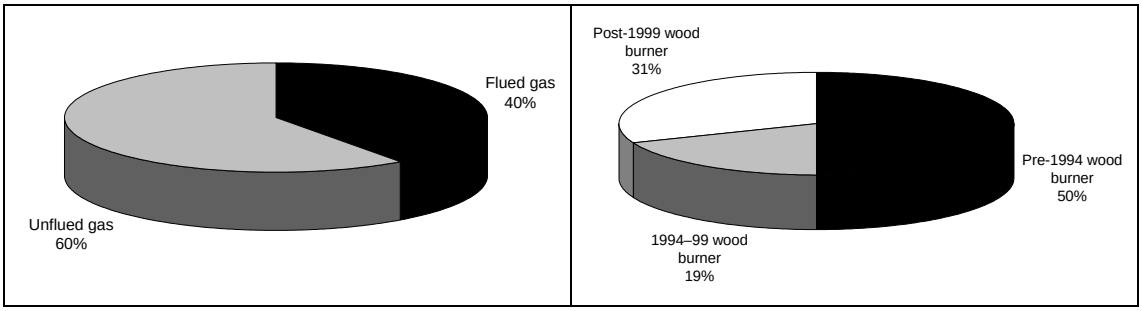


**Table 18.5: Average monthly heating costs (winter), Rangiora**

| | Winter month cost |
|---|---|
| Electric | $100 |
| Gas | $85 |
| Open fire | $50 |
| Wood burner | $86 |
| Multi-fuel | $68 |

**Figure 18.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Rangiora**

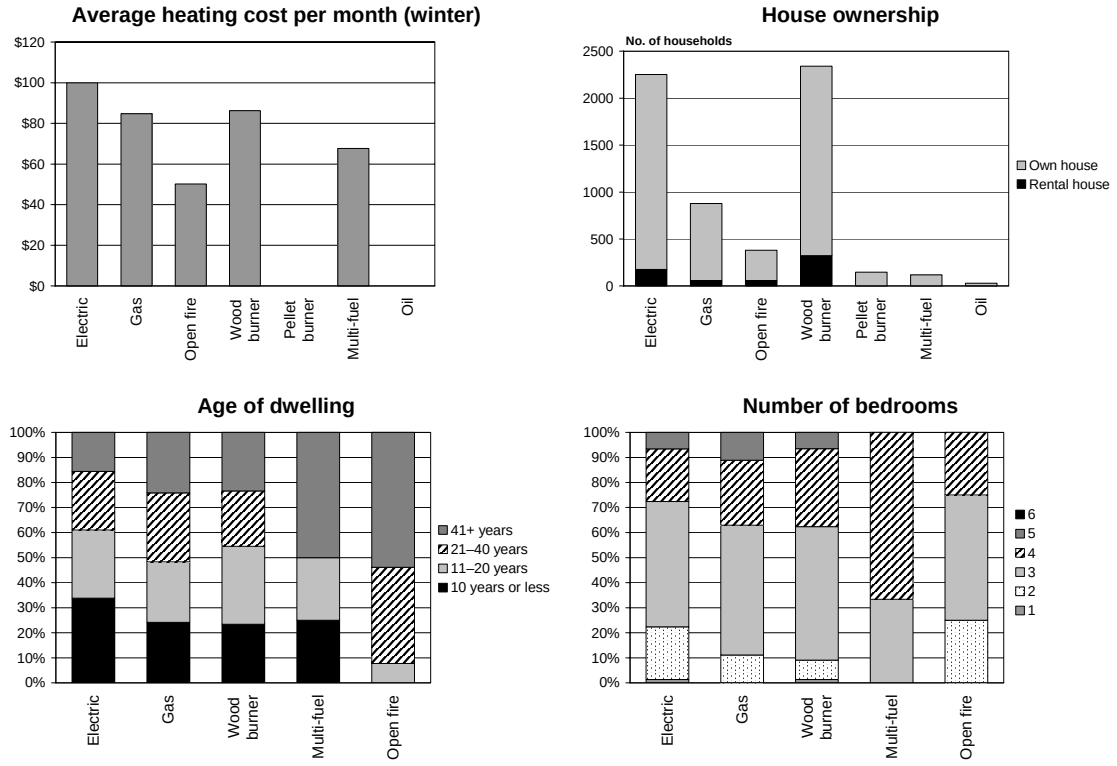


**Figure 18.3: Proportions of fuel obtained free of charge versus bought, Rangiora**

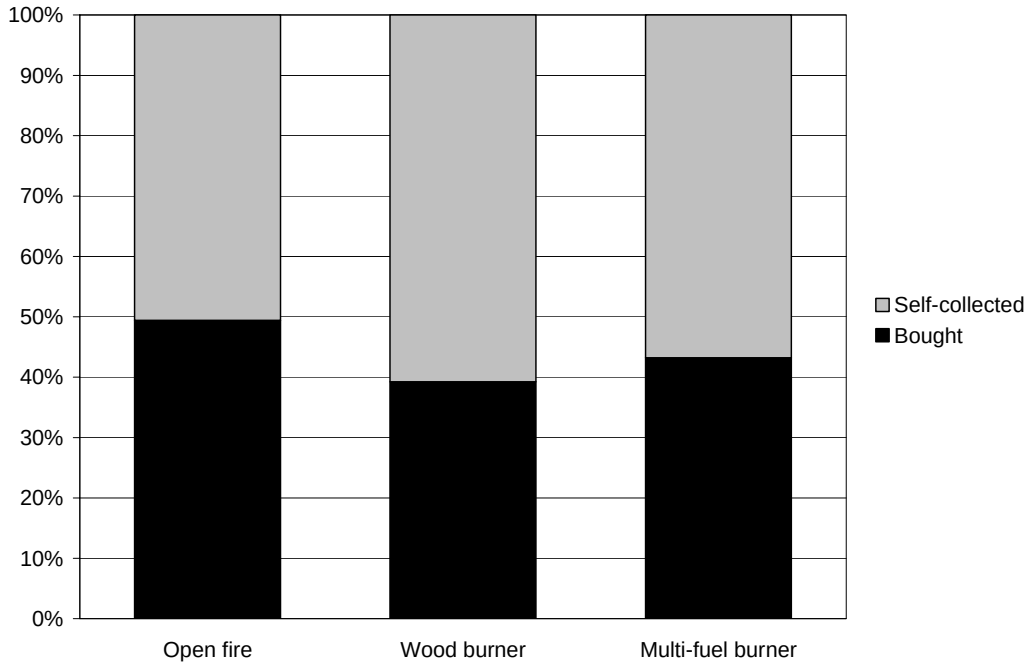

**Table 18.6: Type of electric heating, Rangiora**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 380 | 234 | 614 | 205 | 585 | 614 | – | 176 |
| Percent | 17% | 10% | 27% | 9% | 26% | 27% | – | 8% |

The commonest types of electric heating used in the main living area in Rangiora houses were oil column heaters, heat pumps and fan heaters (Table 18.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 18.7.

**Table 18.7: Home heating method, by house ownership, Rangiora**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 468 | 11% | 3862 | 88% |
| Electric | 176 | 8% | 2077 | 92% |
| Gas | 59 | 7% | 819 | 93% |
| Open fire | 59 | 15% | 322 | 85% |
| Wood burner | 322 | 14% | 2019 | 86% |
| Pellet burner | 0 | 0% | 146 | 100% |
| Multi-fuel | 0 | 0% | 117 | 100% |
| Oil | 0 | 0% | 29 | 100% |

Household insulation types and heating methods are shown in Tables 18.8 and 18.9. Most houses had ceiling insulation and around 62% had wall insulation. About 35% of houses had at least three types of insulation. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

Table 18.10 shows home heating method, by household income. The overall non-response rate was around 25%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 18.8: House insulation summary statistics, Rangiora**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 3716 | 85% | No insulation | 7% |
| Under floor | 761 | 17% | 1 type* | 22% |
| Wall | 2721 | 62% | 2 types | 33% |
| Cylinder wrap | 1141 | 26% | 3 types | 25% |
| Double glazing | 644 | 15% | 4 types | 8% |
| None | 293 | 7% | 5 types | 2% |
| Don't know | 176 | 4% | Don't know | 4% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 18.9: Degree of house insulation, by heating method, Rangiora**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 27% | 20% | 19% | 0% | 23% |
| 2 types | 36% | 40% | 34% | 25% | 15% |
| 3 types | 21% | 23% | 25% | 50% | 31% |
| 4 types | 6% | 10% | 9% | 25% | 8% |
| 5 types | 4% | 3% | 0% | 0% | 0% |
| None or don't know | 5% | 3% | 14% | 0% | 23% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 18.10: Home heating method, by household income, Rangiora**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 22% | 23% | 26% | 25% | 31% |
| Less than $20,000 | 14% | 17% | 11% | 0% | 8% |
| $20,000 to $30,000 | 9% | 3% | 10% | 0% | 0% |
| $30,000 to $40,000 | 12% | 7% | 10% | 0% | 0% |
| $40,000 to $50,000 | 4% | 13% | 10% | 0% | 8% |
| $50,000 to $70,000 | 29% | 13% | 18% | 50% | 38% |
| $70,000 to $100,000 | 3% | 17% | 11% | 25% | 15% |
| More than $100,000 | 8% | 7% | 4% | 0% | 0% |

Tables 18.11 and 18.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 18.11: Home heating method, by age of dwelling, Rangiora**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 34% | 23% | 23% | 25% | 0% |
| 11–20 years | 27% | 23% | 30% | 25% | 8% |
| 21–40 years | 23% | 27% | 21% | 0% | 38% |
| 41+ years | 16% | 23% | 23% | 50% | 54% |

**Table 18.12: Home heating method, by number of bedrooms, Rangiora**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 1% | 0% | 1% | 0% | 0% |
| 2 | 21% | 10% | 8% | 0% | 23% |
| 3 | 49% | 47% | 51% | 25% | 46% |
| 4 | 21% | 23% | 30% | 50% | 23% |
| 5 | 6% | 10% | 6% | 0% | 0% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 19 Christchurch

A telephone survey of domestic heating methods and fuels for Christchurch was carried out by Digipoll in December 2004. This involved surveying 150 households within the 2001 census area Unit (CAU) areas comprising the territorial local authority area of Christchurch. This included the following CAUs:

- Sumner
- Jellie Park
- Bryndwr
- Holmwood
- Fendalton
- Deans Bush
- Hawthornden
- Merrin
- Westburn
- Masham
- Avonhead
- Ilam
- Upper Riccarton
- Wharenui
- Middleton
- Belfast
- Marshland
- Styx
- Parklands
- Riccarton West
- Riccarton
- Riccarton South
- Cashmere West
- Cashmere East
- Rapaki Track
- Heathcote Valley
- Cathedral Square
- Avon Loop
- Northcote
- Papanui
- Aorangi
- Strowan
- Merivale
- Rutland
- St Albans West
- St Albans East
- Mairehau
- Edgeware
- Shirley West
- Shirley East
- Burwood
- Dallington
- Travis
- Avondale
- Chisnall
- Aranui
- North Richmond
- South Richmond
- Avonside
- Linwood
- Phillipstown
- North Linwood
- East Linwood
- Bexley
- Oaklands
- Halswell South
- Hornby North
- Hornby South
- Sockburn
- Wigram
- Yaldhurst
- Broomfield
- Templeton
- Islington
- Halswell West
- Halswell East
- Westmorland
- McLeans Island
- Kennedys Bush
- Redwood North
- Redwood South
- Styx Mill
- Casebrook
- Sawyers Arms
- Kaimahi
- Harewood
- Bishopdale
- Russley
- Burnside
- Woolston West
- Ferrymead
- Hagley Park
- Barrington South
- Spreydon
- Hoon Hay
- Hoon Hay South
- Hillmorton
- Avon–Heathcote Estuary
- Moncks Bay
- Bromley
- Somerfield
- Beckenham
- North Beach
- Rawhiti
- New Brighton
- South Brighton
- Mt Pleasant
- Woolston South
- Ensors
- Opawa
- St Martins
- Waltham
- Sydenham
- Addington
- Barrington North

Survey details are shown in Table 19.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[39] The latter suggests a population increase for Christchurch of 10% by 2021.[40]

**Table 19.1: Summary survey data, Christchurch**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Christchurch | 125,125 | 150 | 8.0% |

# 19.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Christchurch. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Christchurch, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Christchurch largely in tabular form, in the expectation that these results will be of value in other assessments (eg emission inventory studies).

Tables 19.2 and 19.3 show domestic heating methods and fuels used for the main living areas in Christchurch houses, and seasonal variations in heating behaviour. The commonest method of heating the main living area in Christchurch was electricity, which was used by 72% of households. Many households used more than one method of heating in their main living area.

The primary area of difference in home heating methods for Christchurch was the low use of solid fuel burning for domestic home heating. In particular, the use of wood burners is low at 19% of households compared to a national average of around 38%. Previous surveys for Christchurch (Lamb, 1999 and 2003)[41] have shown higher proportions of households using wood burners (34% and 30%, respectively). Although some reduction in wood burner numbers is expected as a result of the city's Clean Heat Programme, the impact of this is estimated to be a reduction in solid fuel burners of around 1920 (2400, less 20% using solid fuel replacement methods). By contrast, this survey suggests a decrease in solid fuel burners of over 15,000 wood burners since 2002. While possible, this would seem unlikely and the possibility of heating method bias in households refusing to answer the survey questionnaire should be considered. That is, a greater proportion of households with wood burners may have refused to answer the survey questionnaire relative to households with other heating methods. This is highly feasible as awareness of the impact of heating methods on air quality in Christchurch is likely to be greater than for most areas, and households may be concerned about regulations relating to heating methods proposed in the Regional Air Plan.

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[39] New Zealand Statistics 2004, www.stats.govt.nz

[40] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

[41] Lamb C. 1999. Christchurch Home Heating Survey: A survey of domestic home heating methods and fuels in the Christchurch metropolitan area. Prepared for Environment Canterbury. Report U00/34; Lamb C. 2003. *2002 Christchurch Home Heating Survey* prepared for Environment Canterbury.

**Table 19.2: Domestic home heating methods and fuels, Christchurch**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 72% | 90,090 | – | – |
| Total gas | 25% | 30,864 | 31 | 5% |
| Flued gas | 8% | 10,010 | – | – |
| Unflued gas | 17% | 20,854 | – | – |
| Oil | 1% | 834 | – | – |
| Open fire | 6% | 7508 | – | – |
| Open fire: wood | 6% | 7508 | 82 | 12% |
| Open fire: coal | 1% | 1668 | 15 | 2% |
| Total wood burner | 19% | 23,357 | 511 | 77% |
| Pre-1994 wood burner | 8% | 10,010 | 245 | 37% |
| 1994–99 wood burner | 9% | 11,122 | 200 | 30% |
| Post-1999 wood burner | 2% | 2224 | 67 | 10% |
| Multi-fuel burners | 1% | 834 | – | – |
| Multi-fuel burners: wood | 1% | 834 | – | – |
| Multi-fuel burners: coal | 1% | 834 | 15 | 2% |
| Pellet burners | 1% | 1668 | 7 | 1% |
| Total wood | 25% | 31,698 | 593 | 90% |
| Total coal | 2% | 2503 | 30 | 5% |
| Total | | 125,125 | 661 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 4% of households using wood burners and 14% of households using open fires indicated that they operated them during the summer months, burning three to four times a week. Gas was also used for heating during the summer months by around 9% of the households using that method (Table 19.3). Table 19.4 shows that the average quantities of fuel burnt per day per household are typically less during the non-winter months than during the winter. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 19.3: Monthly variations in heating behaviour and fuel use, Christchurch**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 9% | 9% | 15% | 30% | 76% | 91% | 97% | 88% | 70% | 45% | 18% | 9% |
| Open fire | 14% | 14% | 14% | 29% | 29% | 86% | 86% | 57% | 43% | 14% | 14% | 14% |
| Wood burner | 4% | 4% | 7% | 21% | 57% | 86% | 86% | 82% | 43% | 14% | 7% | 4% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3 | 7 | 7 | 6 | 5 | 6 | 6 | 6 | 5 | 5 | 5 | 7 |
| Open fire | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 6 | 6 | 3 | 3 | 3 |
| Wood burner | 4 | 4 | 3 | 5 | 6 | 6 | 6 | 6 | 5 | 4 | 4 | 1 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3.3 | 3.3 | 3.3 | 6.8 | 18.1 | 28.4 | 31.0 | 29.0 | 13.0 | 7.1 | 3.4 | 3.3 |
| Open fire: wood | 8.2 | 8.2 | 8.2 | 22.4 | 17.8 | 81.5 | 81.5 | 36.2 | 57.7 | 8.2 | 8.2 | 8.2 |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 0.0 | 0.0 | 0.0 |
| Wood burner | – | – | – | – | 320.9 | 499.4 | 511.4 | 430.8 | – | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.1 | 0.1 | 0.1 | 0.2 | 0.6 | 0.9 | 1.0 | 0.9 | 0.4 | 0.2 | 0.1 | 0.1 |
| Open fire: wood | 1.1 | 1.1 | 1.1 | 3.0 | 2.4 | 10.9 | 10.9 | 4.8 | 7.7 | 1.1 | 1.1 | 1.1 |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 0.0 | 0.0 |
| Wood burner | – | – | – | – | 13.7 | 21.4 | 21.9 | 18.4 | – | – | – | – |

**Table 19.4: Estimated daily fuel use, by season, Christchurch**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 29 | 12 |
| Open fire: coal | 9 | 9 |
| Wood burner | 25 | 23 |

# 19.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Christchurch are presented in this section.

Figure 19.1 shows that the proportion of households using gas systems that are properly flued in Christchurch is similar to the national average (32% in Christchurch compared with 28% in the national survey).

The amount spent on heating for a winter month, by heating method, is shown in Table 19.5. In Christchurch, households heating using open fires spent on average less per month (around $40) than those using other heating methods.

Figure 19.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Christchurch. Around 43% of respondents were living in rented accommodation. The most common method of heating rental accommodation was electric. One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 19.3 shows that a large proportion of the wood used on solid fuel burners in Christchurch is self-collected.

**Figure 19.1: Distribution of flued versus unflued gas heating and age of wood burner, Christchurch**

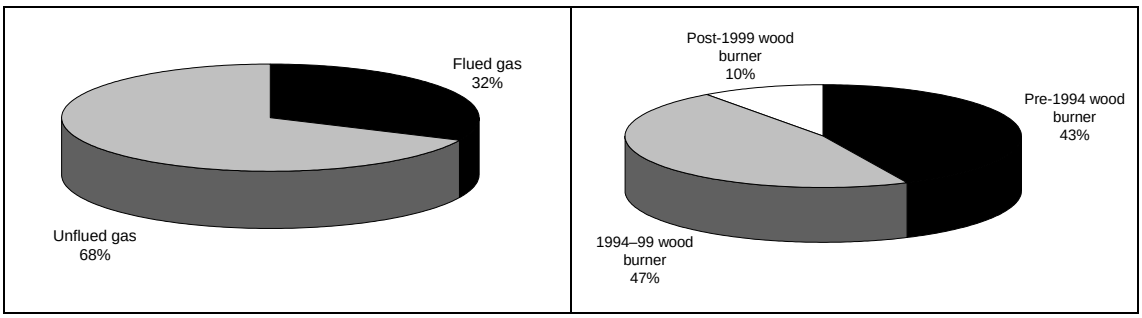


**Table 19.5: Average monthly heating costs (winter), Christchurch**

| | Winter month cost |
|---|---|
| Electric | $76 |
| Gas | $91 |
| Open fire | $42 |
| Wood burner | $80 |

**Figure 19.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Christchurch**

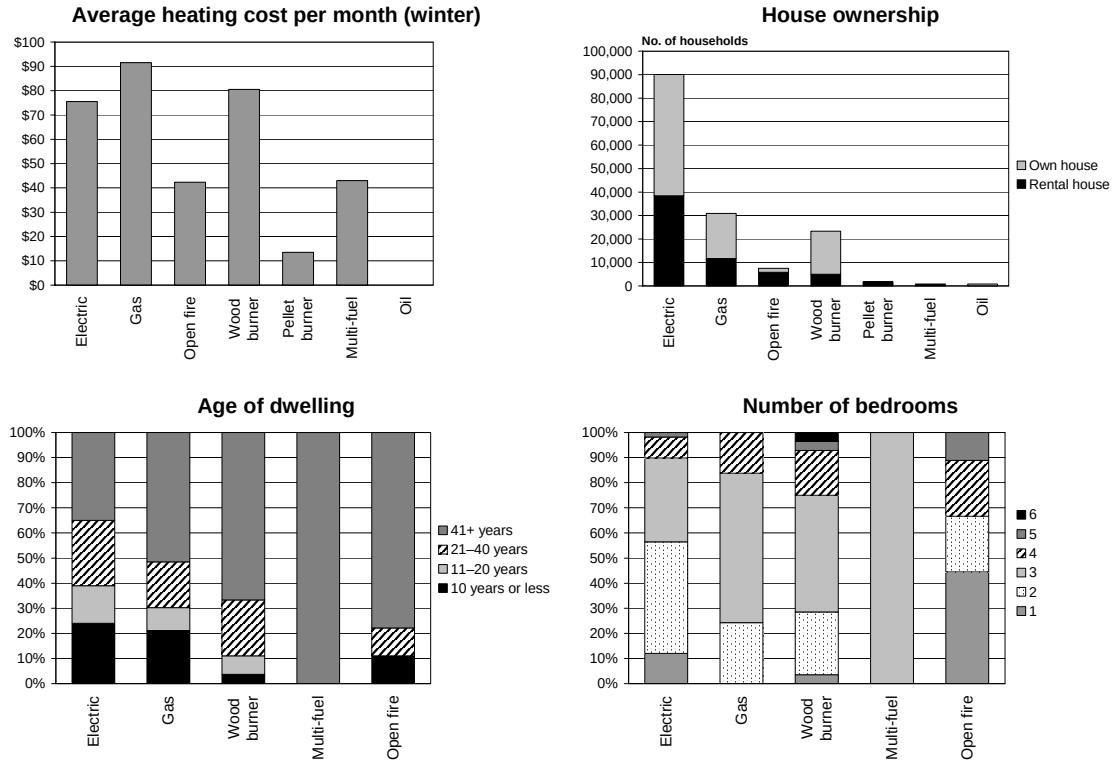


**Figure 19.3: Proportions of fuel obtained free of charge versus bought, Christchurch**

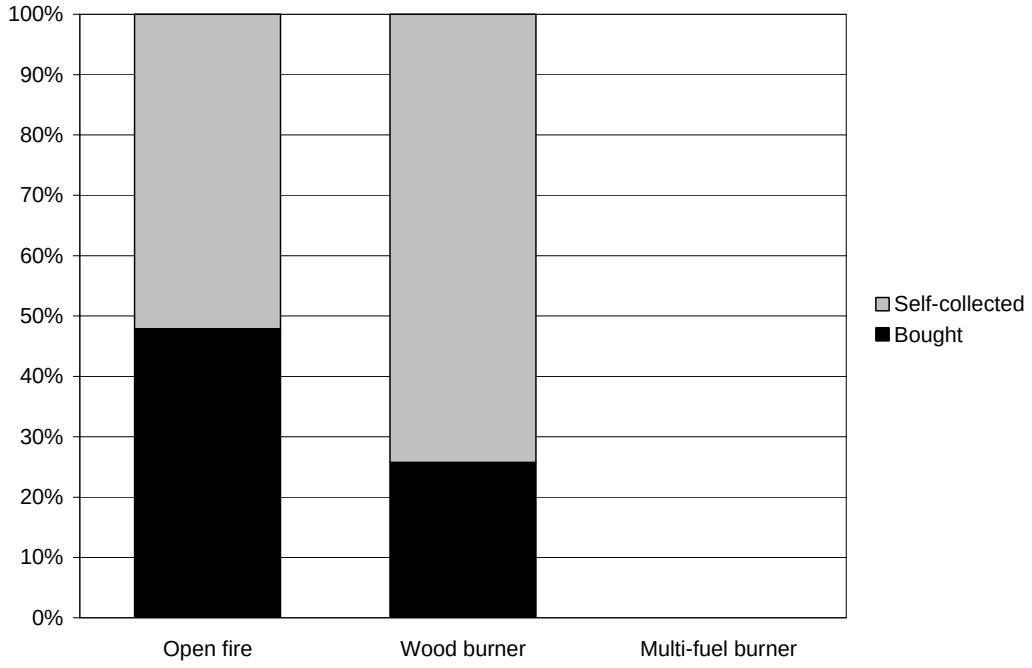

**Table 19.6: Type of electric heating, Christchurch**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 11,678 | 12,513 | 31,698 | 7508 | 19,186 | 10,844 | – | 6673 |
| Percent | 13% | 14% | 37% | 9% | 22% | 13% | – | 8% |

The commonest types of electric heating used in the main living area in Christchurch houses were oil column heaters and fan heaters (Table 19.6). The proportion of houses using the more efficient heat pumps was 13%, which is the same as the national average.

Data on home heating methods, by house ownership, are shown in Table 19.7.

**Table 19.7: Home heating method, by house ownership, Christchurch**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 53,387 | 43% | 71,738 | 57% |
| Electric | 38,372 | 43% | 51,718 | 57% |
| Gas | 11,678 | 38% | 19,186 | 62% |
| Open fire | 5839 | 78% | 1668 | 22% |
| Wood burner | 5005 | 21% | 18,352 | 79% |
| Pellet burner | 1668 | 0% | 0 | 0% |
| Multi-fuel | 834 | 100% | 0 | 0% |
| Oil | 0 | 0% | 834 | 100% |

Household insulation types and heating methods are shown in Tables 19.8 and 19.9. Around 18% of households in Christchurch indicated that the house had no insulation. This compares with a national average of 10%. Table 19.10 shows home heating method, by household income. The overall non-response rate was around 28%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 19.8: House insulation summary statistics, Christchurch**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 77,578 | 62% | No insulation | 18% |
| Under floor | 23,357 | 19% | 1 type | 28% |
| Wall | 42,543 | 34% | 2 types | 21% |
| Cylinder wrap | 29,196 | 23% | 3 types | 13% |
| Double glazing | 17,518 | 14% | 4 types | 9% |
| None | 22,523 | 18% | 5 types | 2% |
| Don't know | 13,347 | 11% | Don't know | 11% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 19.9: Degree of house insulation, by heating method, Christchurch**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 28% | 35% | 29% | 100% | 11% |
| 2 types | 22% | 19% | 25% | 0% | 11% |
| 3 types | 13% | 16% | 18% | 0% | 0% |
| 4 types | 6% | 8% | 14% | 0% | 11% |
| 5 types | 3% | 0% | 0% | 0% | 0% |
| None or don't know | 29% | 22% | 14% | 0% | 67% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 19.10: Home heating method, by household income, Christchurch**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 31% | 38% | 21% | 0% | 11% |
| Less than $20,000 | 19% | 3% | 0% | 100% | 22% |
| $20,000 to $30,000 | 13% | 14% | 11% | 0% | 0% |
| $30,000 to $40,000 | 15% | 22% | 25% | 0% | 44% |
| $40,000 to $50,000 | 5% | 11% | 14% | 0% | 11% |
| $50,000 to $70,000 | 6% | 8% | 11% | 0% | 11% |
| $70,000 to $100,000 | 9% | 3% | 11% | 0% | 0% |
| More than $100,000 | 3% | 3% | 7% | 0% | 0% |

Tables 19.11 and 19.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 19.11: Home heating method, by age of dwelling, Christchurch**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 22% | 19% | 4% | 0% | 11% |
| 11–20 years | 14% | 8% | 7% | 0% | 0% |
| 21–40 years | 24% | 16% | 21% | 0% | 11% |
| 41+ years | 32% | 46% | 64% | 100% | 78% |

**Table 19.12: Home heating method, by number of bedrooms, Christchurch**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 12% | 0% | 4% | 0% | 44% |
| 2 | 44% | 24% | 25% | 0% | 22% |
| 3 | 33% | 59% | 46% | 100% | 0% |
| 4 | 8% | 16% | 18% | 0% | 22% |
| 5 | 2% | 0% | 4% | 0% | 11% |
| 6 | 0% | 0% | 4% | 0% | 0% |

# 20 Ashburton

A telephone survey of domestic heating methods and fuels for Ashburton was carried out by Digipoll in January 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Allenton, Central Ashburton West, Netherby, Central Ashburton East, Hampstead and Tinwald.

Survey details are shown in Table 20.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[42] The latter suggests a population decrease for Ashburton of 2% by 2021.[43]

**Table 20.1: Summary survey data, Ashburton**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Ashburton | 5985 | 150 | 7.9% |

## 20.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Ashburton. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Ashburton, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Ashburton largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 20.2 and 20.3 show domestic heating methods and fuels used for main living areas in Ashburton houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Ashburton were electricity (61%) and wood burners (47%). Many households used more than one method of heating in their main living area.

[42] New Zealand Statistics 2004, www.stats.govt.nz

[43] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 20.2: Domestic home heating methods and fuels, Ashburton**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 61% | 3631 | – | – |
| Total gas | 21% | 1237 | 1 | 2% |
| Flued gas | 9% | 536 | – | – |
| Unflued gas | 12% | 701 | – | – |
| Oil | 4% | 239 | 0.1 | 0.2% |
| Open fire | 7% | 399 | – | – |
| Open fire: wood | 7% | 399 | 8 | 11% |
| Open fire: coal | 3% | 199 | 4 | 6% |
| Total wood burner | 47% | 2793 | 45 | 62% |
| Pre-1994 wood burner | 22% | 1325 | 24 | 34% |
| 1994–99 wood burner | 12% | 710 | 16 | 22% |
| Post-1999 wood burner | 13% | 757 | 5 | 7% |
| Multi-fuel burners | 10% | 598 | – | – |
| Multi-fuel burners: wood | 10% | 598 | 12 | 17% |
| Multi-fuel burners: coal | 5% | 279 | 2 | 3% |
| Pellet burners | 1% | 40 | – | – |
| Total wood | 63% | 3790 | 64 | 89% |
| Total coal | 8% | 479 | 6 | 9% |
| Total | | 5985 | 72 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Table 20.3 shows that around 3% of households using gas and 1% of households using wood burners heat their homes during January and February in Ashburton. A larger proportion (10% and 7% of these households) heat their houses during November. The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 20.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 20.3: Monthly variations in heating behaviour and fuel use, Ashburton**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3% | 3% | 7% | 30% | 67% | 87% | 93% | 83% | 47% | 13% | 10% | 10% |
| Open fire | 0% | 0% | 0% | 10% | 60% | 90% | 100% | 90% | 40% | 20% | 10% | 10% |
| Wood burner | 1% | 1% | 4% | 26% | 63% | 84% | 89% | 81% | 51% | 27% | 7% | 1% |
| Multi-fuel | 0% | 0% | 7% | 29% | 50% | 79% | 100% | 64% | 36% | 14% | 7% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 1 | – | 3 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 2 | 1 |
| Open fire | – | – | – | 4 | 6 | 6 | 6 | 6 | 7 | 5 | 7 | 7 |
| Wood burner | 7 | 7 | 4 | 6 | 6 | 7 | 7 | 7 | 6 | 5 | 4 | 7 |
| Multi-fuel | – | – | 7 | 6 | 6 | 7 | 7 | 7 | 6 | 5 | 7 | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | – | 0.0 | 0.1 | 0.9 | 1.1 | 1.1 | 0.9 | 0.3 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 5.3 | 7.1 | 7.6 | 7.2 | 4.5 | 1.1 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | 0.0 | 3.2 | 3.6 | 4.3 | 3.6 | 1.8 | 0.8 | 0.0 | 0.0 |
| Wood burner | 1.3 | 1.3 | 2.2 | 12.3 | 29.4 | 44.1 | 44.7 | 42.7 | 37.6 | 11.8 | 2.4 | 1.3 |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 1.6 | 9.0 | 9.7 | 12.0 | 8.6 | 4.2 | 0.3 | 0.0 | 0.0 |
| Multi-fuel: coal | – | – | 0.0 | 0.0 | 0.7 | 1.9 | 2.0 | 1.4 | 1.8 | 0.0 | 0.0 | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 0.8 | 0.9 | 0.9 | 0.7 | 0.3 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 13.3 | 17.9 | 19.0 | 18.1 | 11.4 | 2.7 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | 0.0 | 16.2 | 18.0 | 21.6 | 18.0 | 9.0 | 3.9 | 0.0 | 0.0 |
| Wood burner | 0.5 | 0.5 | 0.8 | 4.4 | 10.5 | 15.8 | 16.0 | 15.3 | 13.5 | 4.2 | 0.9 | 0.5 |
| Multi-fuel: wood | 0.0 | 0.0 | 0.0 | 2.6 | 15.0 | 16.3 | 20.1 | 14.4 | 6.9 | 0.5 | 0.0 | 0.0 |
| Multi-fuel: coal | – | – | 0.0 | 0.0 | 2.6 | 6.7 | 7.2 | 4.9 | 6.4 | 0.0 | 0.0 | – |

**Table 20.4: Estimated daily fuel use, by season, Ashburton**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | <1 |
| Open fire: wood | 21 | 13 |
| Open fire: coal | 31 | 9 |
| Wood burner | 21 | 18 |
| Multi-fuel: wood | 22 | 9 |
| Multi-fuel: coal | 9 | 9 |

## 20.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Ashburton are presented in this section.

Figure 20.1 shows that the proportion of households using gas systems that are properly flued in Ashburton is around 43%. This compares to a national average of around 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 20.5. In Ashburton, household heating expenditure ranges from $70 to $110 per month, on average, for different heating methods.

Figure 20.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Ashburton. Only a small proportion (14%) of the respondents in Ashburton were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 20.3 shows that over 50% of the wood used on solid fuel burners in Ashburton is self-collected.

**Figure 20.1: Distribution of flued versus unflued gas heating and age of wood burner, Ashburton**

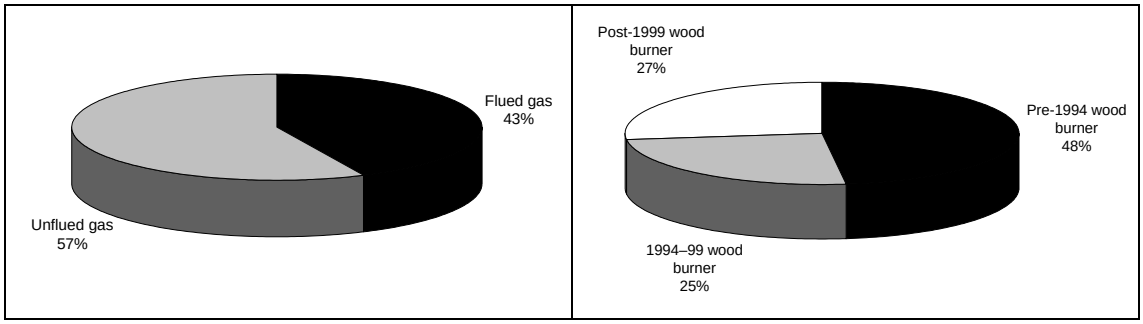


**Table 20.5: Average monthly heating costs (winter), Ashburton**

| | Winter month cost |
|---|---|
| Electric | $103 |
| Gas | $89 |
| Open fire | $74 |
| Wood burner | $85 |
| Pellet burner | – |
| Multi-fuel | $67 |
| Oil | $111 |

**Figure 20.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Ashburton**

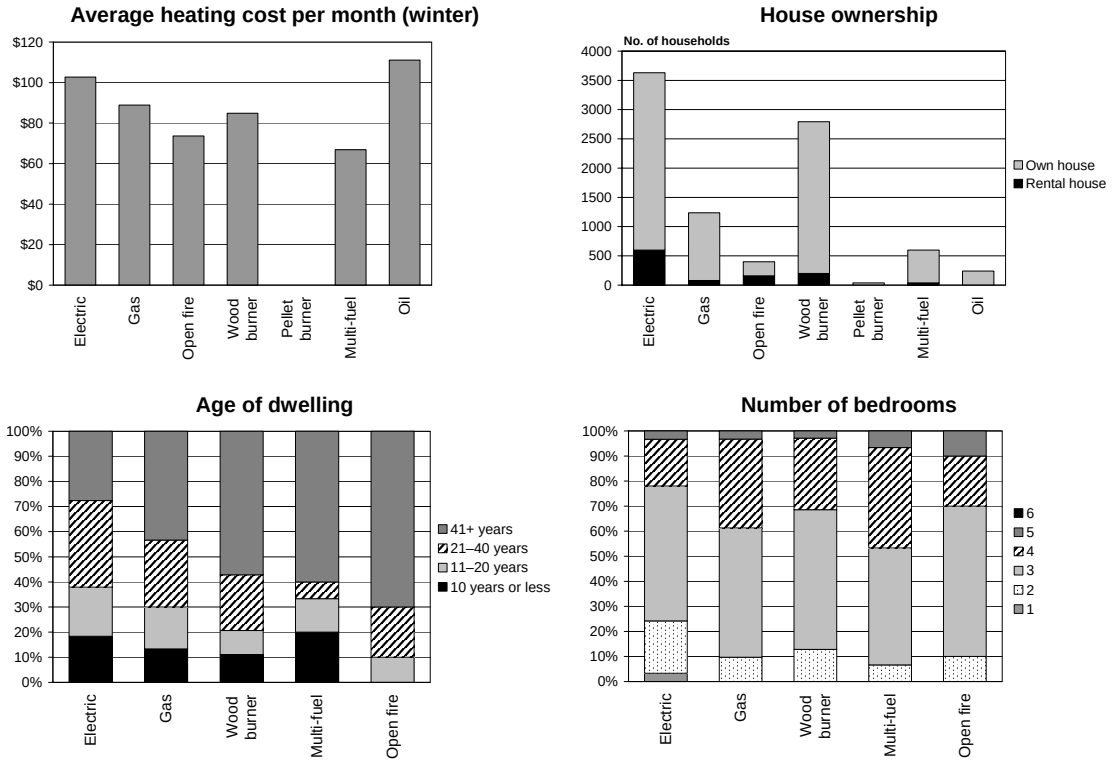


**Figure 20.3: Proportions of fuel obtained free of charge versus bought, Ashburton**

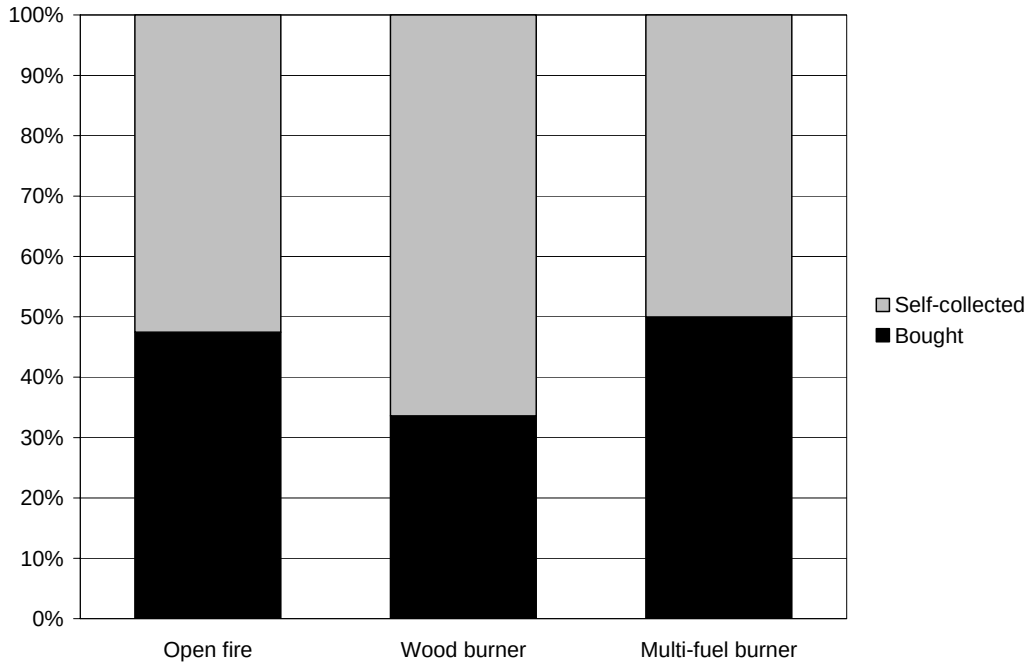

**Table 20.6: Type of electric heating, Ashburton**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 638 | 279 | 678 | 160 | 638 | 1516 | – | 439 |
| Percent | 18% | 8% | 19% | 4% | 18% | 42% | – | 12% |

The commonest types of electric heater used in the main living area in Ashburton houses were heat pumps, which were used by 42% of households using electric heating (Table 20.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 20.7.

**Table 20.7: Home heating method, by house ownership, Ashburton**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 838 | 14% | 5147 | 86% |
| Electric | 598 | 16% | 3032 | 84% |
| Gas | 80 | 6% | 1157 | 94% |
| Open fire | 160 | 40% | 239 | 60% |
| Wood burner | 199 | 7% | 2593 | 93% |
| Pellet burner | 0 | 0% | 40 | 100% |
| Multi-fuel | 40 | 7% | 559 | 93% |
| Oil | 0 | 0% | 239 | 100% |

Household insulation types and heating methods are shown in Tables 20.8 and 20.9. Most houses had ceiling insulation and around 50% had wall insulation. Around 21% of houses had at least three types of insulation.

Table 20.10 shows home heating method, by household income. The overall non-response rate was around 32%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 20.8: House insulation summary statistics, Ashburton**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 4948 | 83% | No insulation | 8% |
| Under floor | 758 | 13% | 1 type* | 32% |
| Wall | 2992 | 50% | 2 types | 35% |
| Cylinder wrap | 1157 | 19% | 3 types | 12% |
| Double glazing | 479 | 8% | 4 types | 7% |
| None | 479 | 8% | 5 types | 2% |
| Don't know | 319 | 5% | Don't know | 5% |
| Other | 80 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 20.9: Degree of house insulation, by heating method, Ashburton**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 27% | 29% | 33% | 7% | 40% |
| 2 types | 37% | 26% | 37% | 53% | 30% |
| 3 types | 14% | 23% | 11% | 7% | 10% |
| 4 types | 7% | 10% | 6% | 20% | 0% |
| 5 types | 3% | 0% | 1% | 0% | 0% |
| None or don't know | 11% | 13% | 11% | 13% | 20% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 20.10: Home heating method, by household income, Ashburton**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 32% | 35% | 33% | 33% | 0% |
| Less than $20,000 | 12% | 3% | 9% | 7% | 10% |
| $20,000 to $30,000 | 13% | 10% | 14% | 20% | 10% |
| $30,000 to $40,000 | 7% | 6% | 10% | 0% | 20% |
| $40,000 to $50,000 | 12% | 10% | 9% | 0% | 20% |
| $50,000 to $70,000 | 16% | 19% | 16% | 27% | 20% |
| $70,000 to $100,000 | 7% | 6% | 7% | 13% | 0% |
| More than $100,000 | 1% | 10% | 3% | 0% | 20% |

Tables 20.11 and 20.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 20.11: Home heating method, by age of dwelling, Ashburton**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 18% | 13% | 10% | 20% | 0% |
| 11–20 years | 19% | 16% | 9% | 13% | 10% |
| 21–40 years | 33% | 26% | 20% | 7% | 20% |
| 41+ years | 26% | 42% | 51% | 60% | 70% |

**Table 20.12: Home heating, method by number of bedrooms, Ashburton**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 0% | 0% | 0% |
| 2 | 21% | 10% | 13% | 7% | 10% |
| 3 | 54% | 52% | 56% | 47% | 60% |
| 4 | 19% | 35% | 29% | 40% | 20% |
| 5 | 3% | 3% | 3% | 7% | 10% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 21 Timaru

A telephone survey of domestic heating methods and fuels for Timaru was carried out by Digipoll in January 2005. This involved surveying 151 households within the 2001 census area unit (CAU) areas of Waimataitai, Marchwiel, Maori Park, Highfield, Glenwood, Gleniti, Fraser Park, Seaview, Watlington, Parkside, Timaru Gardens, Redruth and Inlet–Port Timaru.

Survey details are shown in Table 21.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[44] The latter suggest a population decrease for Timaru of 7% by 2021.[45]

**Table 21.1: Summary survey data, Timaru**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Timaru | 10,221 | 151 | 7.9% |

## 21.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Timaru. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Timaru, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Timaru largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 21.2 and 21.3 show domestic heating methods and fuels used for the main living areas in Timaru houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Timaru were electricity (59%) and wood burners (44%). Many households used more than one method of heating in their main living area.

[44] New Zealand Statistics 2004, www.stats.govt.nz

[45] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 21.2: Domestic home heating methods and fuels, Timaru**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 59% | 6024 | – | – |
| Total gas | 25% | 2504 | 3 | 3% |
| Flued gas | 10% | 1002 | – | – |
| Unflued gas | 15% | 1503 | – | |
| Oil | 2% | 203 | 0.1 | 0.1% |
| Open fire | 7% | 745 | – | – |
| Open fire: wood | 7% | 677 | 8 | 8% |
| Open fire: coal | 3% | 338 | 1 | 1% |
| Total wood burner | 44% | 4467 | 82 | 74% |
| Pre-1994 wood burner | 14% | 1415 | 27 | 24% |
| 1994–99 wood burner | 17% | 1712 | 44 | 40% |
| Post-1999 wood burner | 13% | 1340 | 11 | 10% |
| Multi-fuel burners | 11% | 1083 | – | – |
| Multi-fuel burners: wood | 11% | 1083 | 11 | 10% |
| Multi-fuel burners: coal | 7% | 745 | 6 | 5% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 61% | 6227 | 101 | 91% |
| Total coal | 11% | 1083 | 7 | 6% |
| Total | | 10,221 | 111 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Only a small proportion of households using solid fuel burning use their burners to heat their homes during the summer months (Table 21.3). Those that do burn during the summer months typically use less fuel per day than the average during winter (Table 21.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 21.3: Monthly variations in heating behaviour and fuel use, Timaru**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3% | 3% | 7% | 17% | 59% | 86% | 97% | 86% | 52% | 21% | 7% | 7% |
| Open fire | 0% | 0% | 11% | 11% | 56% | 100% | 100% | 89% | 33% | 11% | 0% | 0% |
| Wood burner | 2% | 0% | 2% | 32% | 68% | 85% | 94% | 88% | 55% | 17% | 3% | 2% |
| Multi-fuel | 9% | 9% | 27% | 55% | 91% | 109% | 109% | 109% | 73% | 27% | 18% | 9% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 1 | 1 | 2 | 3 | 5 | 6 | 6 | 6 | 5 | 4 | 2 | 2 |
| Open fire | – | – | – | – | 6 | 4 | 4 | 5 | 7 | – | – | – |
| Wood burner | 3 | – | – | 6 | 6 | 7 | 7 | 7 | 6 | 5 | 2 | 1 |
| Multi-fuel | 2 | 2 | 4 | 6 | 6 | 7 | 7 | 7 | 6 | 4 | 5 | 2 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.1 | 1.3 | 2.7 | 3.0 | 2.8 | 1.3 | 1.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | 4.0 | 7.3 | 8.4 | 8.1 | 12.2 | – | – | – |
| Open fire: coal | – | – | – | – | 0.0 | 1.1 | 1.1 | 1.0 | 3.0 | – | – | – |
| Wood burner | 0.7 | – | – | 21.7 | 52.0 | 71.2 | 82.0 | 69.7 | 40.9 | 9.8 | 0.3 | 0.2 |
| Multi-fuel: wood | 0.5 | 0.5 | 4.8 | 9.1 | 8.8 | 10.7 | 10.7 | 10.7 | 11.5 | 3.3 | 3.3 | 0.5 |
| Multi-fuel: coal | 0.0 | 0.0 | 2.6 | 2.9 | 4.7 | 5.7 | 5.7 | 5.7 | 5.0 | 1.4 | 1.4 | 0.0 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 1.1 | 1.2 | 1.1 | 0.5 | 0.4 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | 6.0 | 10.7 | 12.4 | 11.9 | 18.1 | – | – | – |
| Open fire: coal | – | – | – | – | 0.0 | 3.3 | 3.3 | 3.1 | 9.0 | – | – | – |
| Wood burner | 0.2 | – | – | 4.9 | 11.6 | 15.9 | 18.3 | 15.6 | 9.2 | 2.2 | 0.1 | 0.1 |
| Multi-fuel: wood | 0.5 | 0.5 | 4.4 | 8.4 | 8.1 | 9.9 | 9.9 | 9.9 | 10.6 | 3.1 | 3.1 | 0.5 |
| Multi-fuel: coal | 0.0 | 0.0 | 3.5 | 3.9 | 6.3 | 7.7 | 7.7 | 7.7 | 6.8 | 1.9 | 1.9 | 0.0 |

**Table 21.4: Estimated daily fuel use, by season, Timaru**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 0 |
| Open fire: wood | 19 | 18 |
| Open fire: coal | 11 | 9 |
| Wood burner | 22 | 16 |
| Multi-fuel: coal | 13 | 11 |

## 21.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Timaru are presented in this section.

Figure 21.1 shows that the proportion of households using gas systems that are properly flued in Timaru is around 40%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 21.5. In Timaru, households heating using open fires spent on average more per month (around $130) than those using other heating methods.

Figure 21.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Timaru. Only a small proportion (16%) of the respondents in Timaru were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 21.3 shows that over 70% of the wood used on solid fuel burners in Timaru is self-collected.

**Figure 21.1: Distribution of flued versus unflued gas heating and age of wood burner, Timaru**

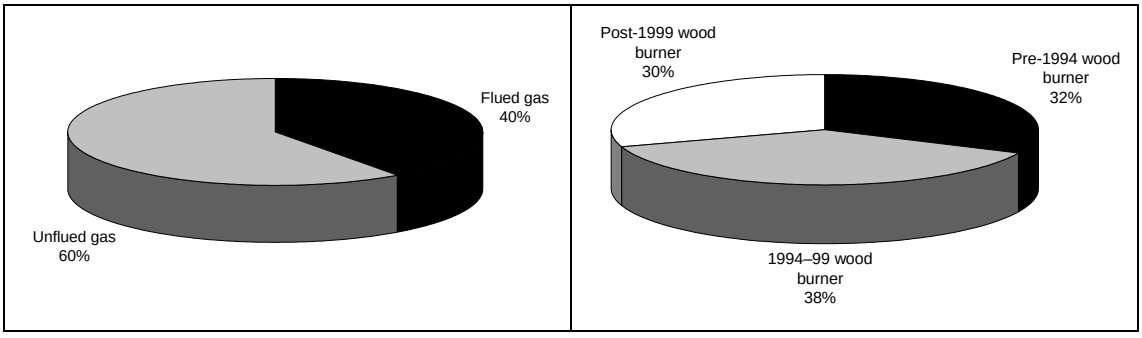


**Table 21.5: Average monthly heating costs (winter), Timaru**

| | Winter month cost |
|---|---|
| Electric | $77 |
| Gas | $69 |
| Open fire | $130 |
| Wood burner | $102 |
| Multi-fuel | $64 |
| Oil | $86 |

**Figure 21.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Timaru**

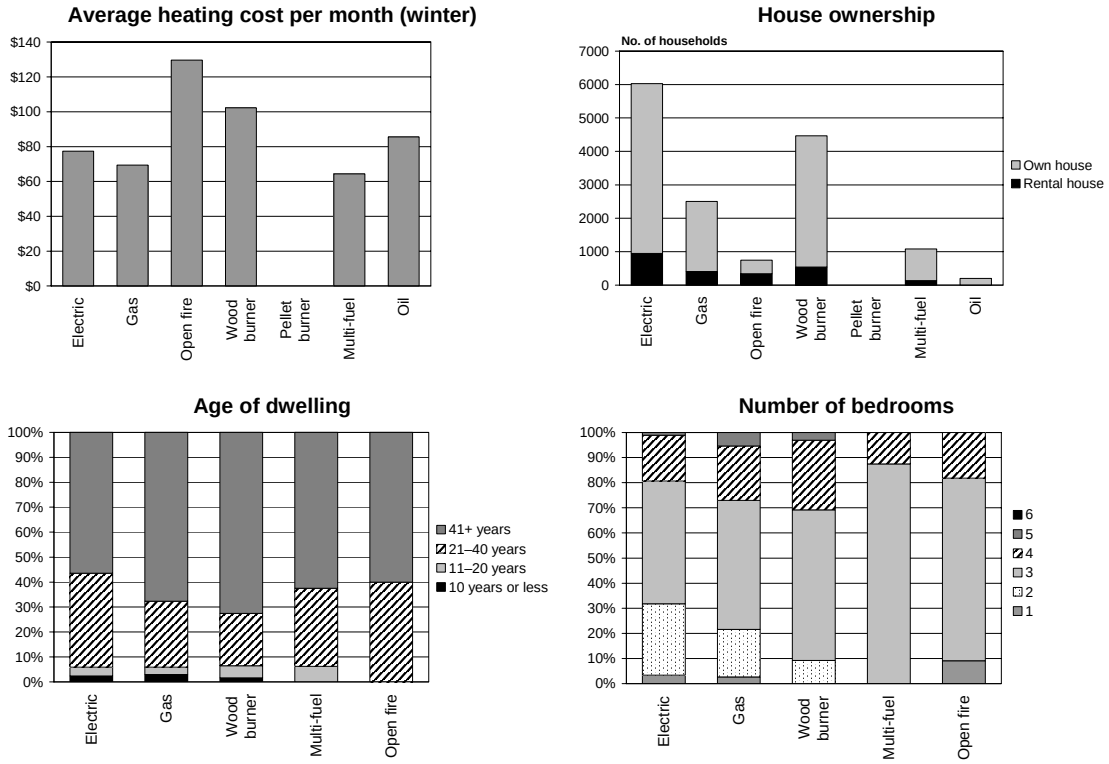


**Figure 21.3: Proportions of fuel obtained free of charge versus bought, Timaru**

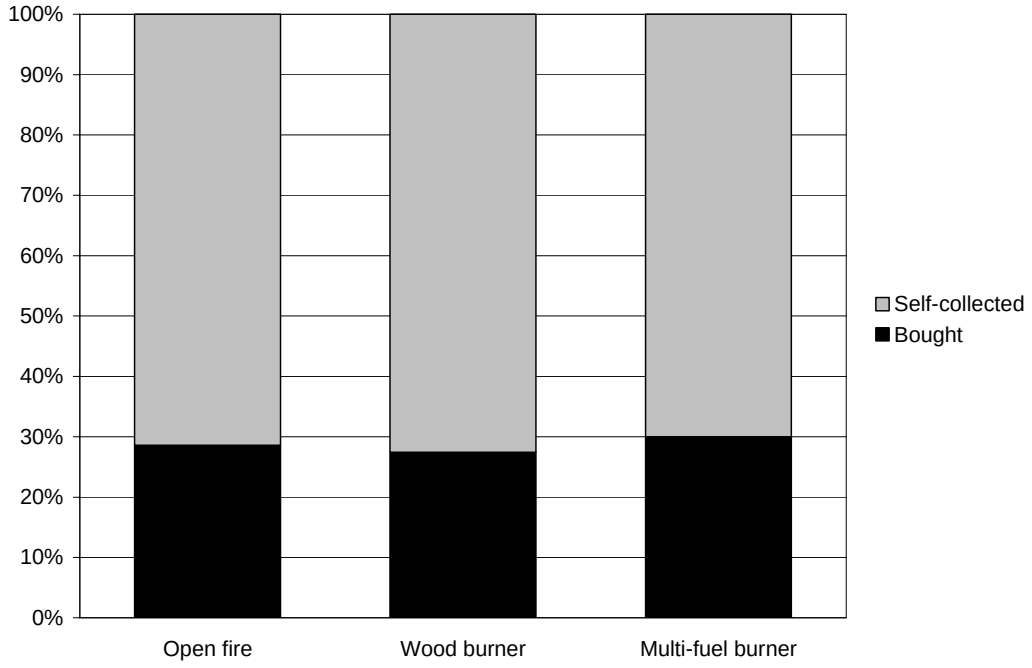

**Table 21.6: Type of electric heating, Timaru**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 609 | 1015 | 1218 | 474 | 1489 | 1624 | – | 203 |
| Percent | 10% | 17% | 20% | 8% | 25% | 27% | – | 3% |

The commonest types of electric heating used in the main living area in Timaru houses were heat pumps and fan heaters (Table 21.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 21.7.

**Table 21.7: Home heating method, by house ownership, Timaru**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 1624 | 16% | 8461 | 83% |
| Electric | 948 | 16% | 5076 | 84% |
| Gas | 406 | 16% | 2098 | 84% |
| Open fire | 338 | 45% | 406 | 55% |
| Wood burner | 541 | 12% | 3926 | 88% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 135 | 13% | 948 | 88% |
| Oil | 0 | 0% | 203 | 100% |

Household insulation types and heating methods are shown in Tables 21.8 and 21.9. Just under 80% of households had ceiling insulation and 44% had wall insulation. Only 25% of houses had at least three types of insulation.

Table 21.10 shows home heating, method by household income. The overall non-response rate was around 27%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 21.8: House insulation summary statistics, Timaru**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 7987 | 78% | No insulation | 11% |
| Under floor | 1760 | 17% | 1 type* | 35% |
| Wall | 4467 | 44% | 2 types | 26% |
| Cylinder wrap | 2031 | 20% | 3 types | 18% |
| Double glazing | 812 | 8% | 4 types | 6% |
| None | 1083 | 11% | 5 types | 1% |
| Don't know | 609 | 6% | Don't know | 6% |
| Other | 68 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 21.9: Degree of house insulation, by heating method, Timaru**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 36% | 38% | 41% | 31% | 45% |
| 2 types | 21% | 24% | 32% | 19% | 0% |
| 3 types | 18% | 22% | 15% | 25% | 18% |
| 4 types | 9% | 5% | 3% | 13% | 0% |
| 5 types | 0% | 0% | 2% | 0% | 0% |
| None or don't know | 16% | 11% | 8% | 13% | 36% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Table 21.10: Home heating method, by household income, Timaru**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 31% | 27% | 21% | 13% | 9% |
| Less than $20,000 | 16% | 16% | 12% | 0% | 9% |
| $20,000 to $30,000 | 13% | 24% | 14% | 13% | 27% |
| $30,000 to $40,000 | 15% | 8% | 14% | 19% | 18% |
| $40,000 to $50,000 | 7% | 5% | 9% | 13% | 0% |
| $50,000 to $70,000 | 10% | 11% | 17% | 31% | 18% |
| $70,000 to $100,000 | 6% | 5% | 9% | 13% | 18% |
| More than $100,000 | 2% | 3% | 5% | 0% | 0% |

* Note: columns may not sum exactly to 100 due to rounding error.

Tables 21.11 and 21.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 21.11: Home heating method, by age of dwelling, Timaru**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 2% | 3% | 2% | 0% | 0% |
| 11–20 years | 3% | 3% | 5% | 6% | 0% |
| 21–40 years | 36% | 24% | 20% | 31% | 36% |
| 41+ years | 54% | 62% | 68% | 63% | 55% |

**Table 21.12: Home heating method, by number of bedrooms, Timaru**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 3% | 0% | 0% | 9% |
| 2 | 28% | 19% | 9% | 0% | 0% |
| 3 | 48% | 51% | 59% | 88% | 73% |
| 4 | 18% | 22% | 27% | 13% | 18% |
| 5 | 1% | 5% | 3% | 0% | 0% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 22 Kaiapoi

A telephone survey of domestic heating methods and fuels for Kaiapoi was carried out by Digipoll in January 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Kaiapoi North, Kaiapoi South and Kaiapoi West.

Survey details are shown in Table 22.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[46] The latter suggest a population increase for the Waimakarari District of 36% by 2021.[47] This population increase is assumed to apply to the town of Kaiapoi.

**Table 22.1: Summary survey data, Kaiapoi**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Kaiapoi | 3620 | 150 | 7.8% |

## 22.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Kaiapoi. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Kaiapoi, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Kaiapoi largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 22.2 and 22.3 show domestic heating methods and fuels used for the main living areas in Kaiapoi houses, and seasonal variations in heating behaviour. The main methods of heating the main living area in Kaiapoi were electricity (48%) and wood burners (49%). Many households used more than one method of heating in their main living area.

[46] New Zealand Statistics 2004, www.stats.govt.nz

[47] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 22.2: Domestic home heating methods and fuels, Kaiapoi**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 48% | 1738 | – | – |
| Total gas | 23% | 845 | 1 | 3% |
| Flued gas | 7% | 266 | – | – |
| Unflued gas | 16% | 579 | – | – |
| Oil | 1% | 24 | 0.0 | 0.0% |
| Open fire | 5% | 193 | – | – |
| Open fire: wood | 5% | 193 | 5 | 12% |
| Open fire: coal | 1% | 48 | 0 | 1% |
| Total wood burner | 49% | 1786 | 32 | 72% |
| Pre-1994 wood burner | 22% | 800 | 17 | 39% |
| 1994–99 wood burner | 18% | 640 | 11 | 24% |
| Post-1999 wood burner | 10% | 347 | 4 | 9% |
| Multi-fuel burners | 4% | 145 | – | – |
| Multi-fuel burners: wood | 4% | 145 | 2 | 4% |
| Multi-fuel burners: coal | 3% | 97 | 3 | 7% |
| Pellet burners | 1% | 48 | 1 | 2% |
| Total wood | 59% | 2124 | 39 | 88% |
| Total coal | 4% | 145 | 4 | 8% |
| Total | | 3620 | 44 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 3% of households using gas heat their homes during the summer months (Table 22.3). The proportion is higher in November and December, when a small proportion of households using wood burners also heat their homes. Table 22.4 shows that while the amount of fuel used on a wood burner is less on average during the non-winter months, households using open fires and multi-fuels during non-winter months burn more fuel per day than in winter months. It is likely that these households also use more fuel than average during the winter months. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 22.3: Monthly variations in heating behaviour and fuel use, Kaiapoi**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 3% | 3% | 9% | 33% | 70% | 85% | 94% | 85% | 42% | 33% | 12% | 6% |
| Open fire | 0% | 0% | 17% | 33% | 67% | 100% | 100% | 83% | 33% | 33% | 0% | 0% |
| Wood burner | 0% | 0% | 7% | 30% | 58% | 84% | 97% | 92% | 55% | 20% | 7% | 1% |
| Multi-fuel | 0% | 0% | 0% | 25% | 75% | 100% | 100% | 50% | 25% | 25% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| Open fire | – | – | 6 | 7 | 7 | 6 | 6 | 7 | 7 | 5 | – | – |
| Wood burner | – | – | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| Multi-fuel | – | – | – | 5 | 6 | 7 | 7 | 7 | 5 | 4 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.2 | 0.7 | 0.7 | 1.1 | 0.7 | 0.4 | 0.2 | 0.1 | 0.0 |
| Open fire: wood | – | – | 3.1 | 6.8 | 4.5 | 5.3 | 5.3 | 5.4 | 6.8 | 4.7 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | – | 0.4 | 0.4 | 0.4 | 0.4 | – | – | – | – |
| Wood burner | – | – | 4.3 | 8.8 | 17.0 | 27.3 | 31.7 | 31.1 | 20.3 | 10.2 | 0.9 | 0.0 |
| Multi-fuel: wood | – | – | – | 2.0 | 1.3 | 1.7 | 1.8 | 1.7 | 0.0 | 0.0 | – | – |
| Multi-fuel: coal | – | – | – | 0.3 | 2.3 | 2.7 | 3.1 | 0.2 | 0.0 | 0.0 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.3 | 0.8 | 0.8 | 1.3 | 0.8 | 0.4 | 0.3 | 0.2 | 0.0 |
| Open fire: wood | – | – | 16.3 | 35.3 | 23.3 | 27.4 | 27.4 | 28.1 | 35.3 | 24.4 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | – | 9.0 | 9.0 | 9.0 | 9.0 | – | – | – | – |
| Wood burner | – | – | 2.4 | 4.9 | 9.5 | 15.3 | 17.7 | 17.4 | 11.4 | 5.7 | 0.5 | 0.0 |
| Multi-fuel: wood | – | – | – | 13.6 | 8.7 | 12.1 | 12.2 | 11.4 | 0.0 | 0.0 | – | – |
| Multi-fuel: coal | – | – | – | 3.2 | 24.1 | 28.3 | 32.1 | 2.3 | 0.0 | 0.0 | – | – |

**Table 22.4: Estimated daily fuel use, by season, Kaiapoi**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 2 | 2 |
| Open fire: wood | 29 | 38 |
| Open fire: coal | 9 | – |
| Wood burner | 24 | 16 |
| Multi-fuel: wood | 15 | – |
| Multi-fuel: coal | 16 | 19 |

## 22.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Kaiapoi are presented in this section.

Figure 22.1 shows that the proportion of households using gas systems that are properly flued in Kaiapoi is around 31%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 22.5. In Kaiapoi less was spent per month on multi-fuel burners ($37) than on other heating methods, on average.

Figure 22.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Kaiapoi. Only a small proportion (10%) of the respondents in Kaiapoi were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 22.3 shows that over 60% of the wood used on solid fuel burners in Kaiapoi is self-collected.

**Figure 22.1: Distribution of flued versus unflued gas heating and age of wood burner, Kaiapoi**

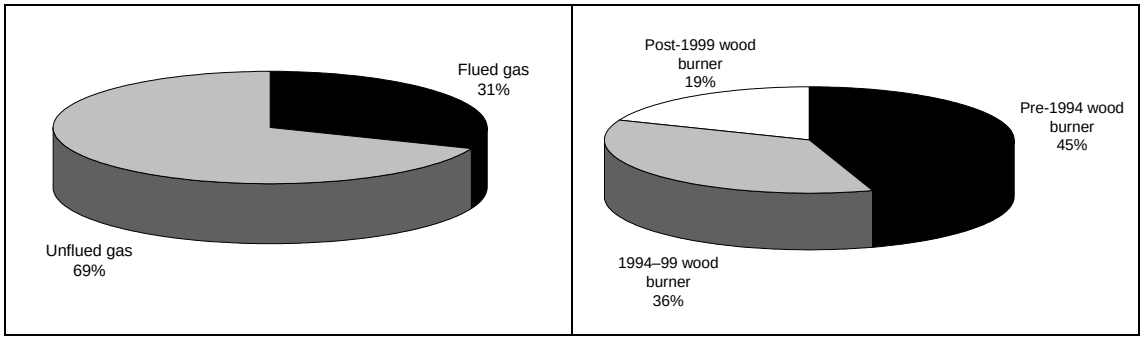


**Table 22.5: Average monthly heating costs (winter), Kaiapoi**

| | Winter month cost |
|---|---|
| Electric | $83 |
| Gas | $74 |
| Wood burner | $113 |
| Pellet burner | $133 |
| Multi-fuel | $37 |
| Oil | $115 |

**Figure 22.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Kaiapoi**

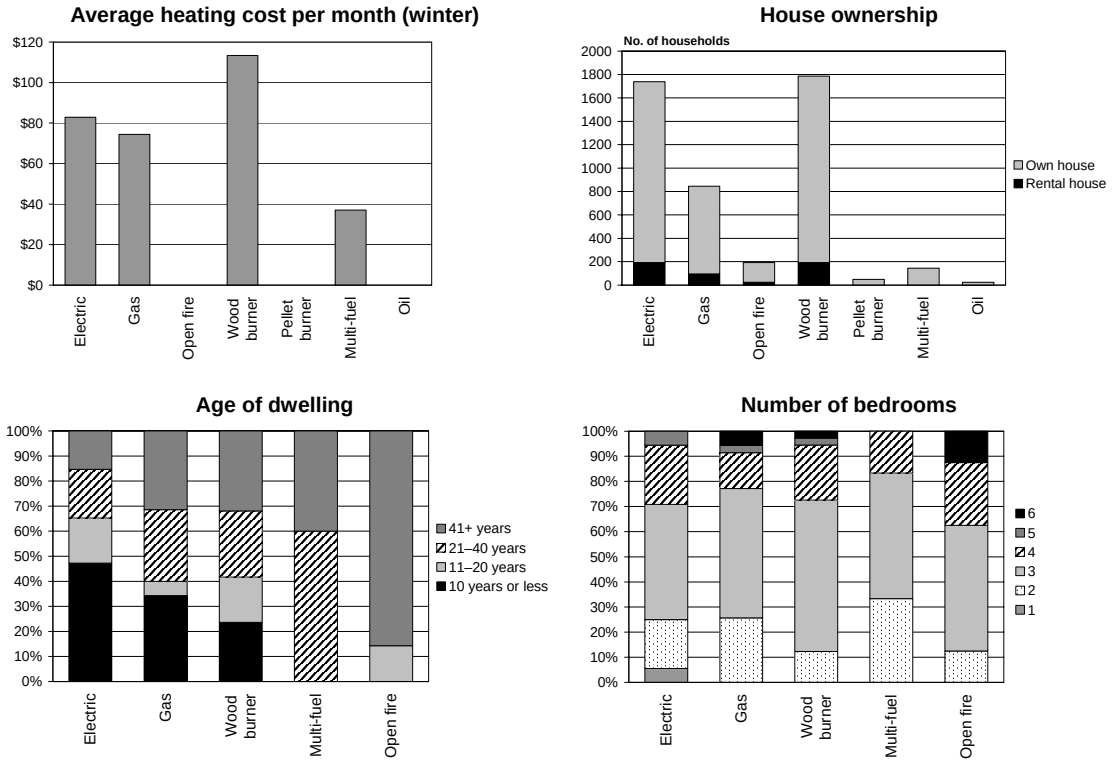


**Figure 22.3: Proportions of fuel obtained free of charge versus bought, Kaiapoi**

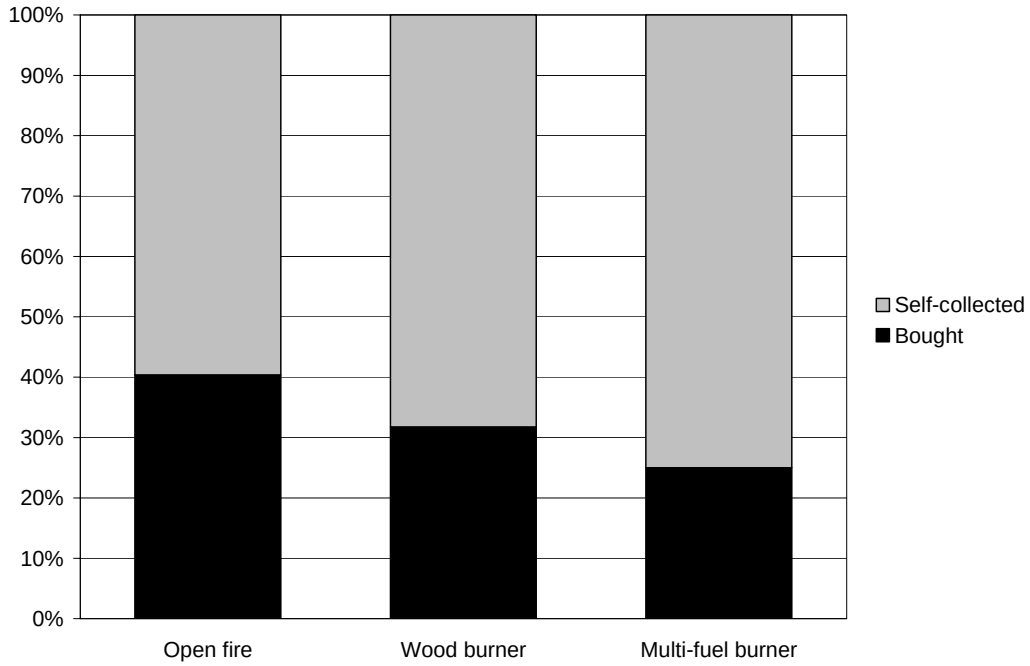

**Table 22.6: Type of electric heating, Kaiapoi**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 241 | 266 | 241 | 24 | 338 | 724 | – | 121 |
| Percent | 14% | 15% | 14% | 1% | 19% | 42% | – | 7% |

The commonest types of electric heater used in the main living area in Kaiapoi houses were heat pumps (Table 22.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 22.7.

**Table 22.7: Home heating method, by house ownership, Kaiapoi**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 362 | 10% | 3234 | 89% |
| Electric | 193 | 11% | 1545 | 89% |
| Gas | 97 | 11% | 748 | 89% |
| Open fire | 24 | 13% | 169 | 88% |
| Wood burner | 193 | 11% | 1593 | 89% |
| Pellet burner | 0 | 0% | 48 | 100% |
| Multi-fuel | 0 | 0% | 145 | 100% |
| Oil | 0 | 0% | 24 | 100% |

Household insulation types and heating methods are shown in Tables 22.8 and 22.9. Most houses (88%) had ceiling insulation and around 74% had wall insulation. Around 37% of houses had at least three types of insulation.

Table 22.10 shows home heating method, by household income. The overall non-response rate was around 29%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 22.8: House insulation summary statistics, Kaiapoi**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 3186 | 88% | No insulation | 5% |
| Under floor | 724 | 20% | 1 type* | 18% |
| Wall | 2679 | 74% | 2 types | 38% |
| Cylinder wrap | 821 | 23% | 3 types | 21% |
| Double glazing | 772 | 21% | 4 types | 13% |
| None | 193 | 5% | 5 types | 3% |
| Don't know | 72 | 2% | Don't know | 2% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 22.9: Degree of house insulation, by heating method, Kaiapoi**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 15% | 17% | 16% | 50% | 75% |
| 2 types | 35% | 43% | 45% | 33% | 25% |
| 3 types | 25% | 23% | 20% | 0% | 0% |
| 4 types | 19% | 3% | 9% | 0% | 0% |
| 5 types | 1% | 6% | 3% | 0% | 0% |
| None or don't know | 4% | 9% | 7% | 17% | 0% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Table 22.10: Home heating method, by household income, Kaiapoi**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 31% | 17% | 28% | 17% | 25% |
| Less than $20,000 | 18% | 11% | 8% | 17% | 13% |
| $20,000 to $30,000 | 13% | 26% | 9% | 17% | 13% |
| $30,000 to $40,000 | 10% | 11% | 11% | 17% | 25% |
| $40,000 to $50,000 | 3% | 9% | 8% | 17% | 0% |
| $50,000 to $70,000 | 10% | 17% | 19% | 0% | 0% |
| $70,000 to $100,000 | 13% | 3% | 9% | 17% | 13% |
| More than $100,000 | 4% | 6% | 7% | 0% | 13% |

* Note: columns may not sum exactly to 100 due to rounding error.

Tables 22.11 and 22.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 22.11: Home heating method, by age of dwelling, Kaiapoi**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 47% | 34% | 23% | 0% | 0% |
| 11–20 years | 18% | 6% | 18% | 0% | 13% |
| 21–40 years | 19% | 29% | 26% | 50% | 0% |
| 41+ years | 15% | 31% | 31% | 33% | 75% |

**Table 22.12: Home heating method, by number of bedrooms, Kaiapoi**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 6% | 0% | 0% | 0% | 0% |
| 2 | 19% | 26% | 12% | 33% | 13% |
| 3 | 46% | 51% | 59% | 50% | 50% |
| 4 | 24% | 14% | 22% | 17% | 25% |
| 5 | 6% | 3% | 3% | 0% | 0% |
| 6 | 0% | 6% | 3% | 0% | 13% |

# 23 Richmond

A telephone survey of domestic heating methods and fuels for Richmond was carried out by Digipoll in January 2005. This involved surveying 151 households within the 2001 census area unit (CAU) areas of Richmond North and Richmond South.

Survey details are shown in Table 23.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[48] The latter suggest a population increase for the Tasman District of 19% by 2021.[49] This population increase is assumed to apply to Richmond.

**Table 23.1: Summary survey data, Richmond**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Richmond | 4104 | 151 | 7.8% |

## 23.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Richmond. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Richmond, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Richmond largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 23.2 and 23.3 show domestic heating methods and fuels used for the main living areas in Richmond houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Richmond were electricity (48%) and wood burners (56%). Many households used more than one method of heating in their main living area.

[48] New Zealand Statistics 2004, www.stats.govt.nz

[49] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 23.2: Domestic home heating methods and fuels, Richmond**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 48% | 2117 | – | – |
| Total gas | 22% | 957 | 0.7 | 1% |
| Flued gas | 4% | 174 | – | – |
| Unflued gas | 18% | 783 | – | – |
| Oil | 0.7% | 29 | – | – |
| Open fire | 3% | 145 | – | – |
| Open fire: wood | 3% | 145 | 2.0 | 4% |
| Open fire: coal | 0% | 0 | – | – |
| Total wood burner | 56% | 2465 | 48.6 | 92% |
| Pre-1994 wood burner | 25% | 1109 | 24.1 | 46% |
| 1994–99 wood burner | 13% | 585 | 12.7 | 24% |
| Post-1999 wood burner | 18% | 770 | 11.9 | 23% |
| Multi-fuel burners | 1.3% | 58 | – | – |
| Multi-fuel burners: wood | 1.3% | 58 | 0.6 | 1% |
| Multi-fuel burners: coal | 1.3% | 58 | 0.7 | 1% |
| Pellet burners | 0.7% | 29 | – | – |
| Total wood | 61% | 2668 | 51.2 | 97% |
| Total coal | 1% | 58 | 0.7 | 1% |
| Total | | 4379 | 52.6 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Unlike in other urban areas, households in Richmond did not heat their homes during the summer months (Table 23.3). Non-winter heating of houses was confined to the months of March to May and September to November. The quantity of fuel used per day during non-winter months was less for wood burners but slightly higher than the average for open fires and multi-fuel burners using coal. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 23.3: Monthly variations in heating behaviour and fuel use, Richmond**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 0% | 13% | 56% | 94% | 94% | 75% | 31% | 13% | 0% | 0% |
| Open fire | 0% | 0% | 0% | 20% | 40% | 100% | 100% | 80% | 20% | 0% | 0% | 0% |
| Wood burner | 0% | 0% | 1% | 9% | 59% | 88% | 94% | 91% | 44% | 21% | 4% | 0% |
| Multi-fuel | 0% | 0% | 0% | 50% | 50% | 100% | 100% | 100% | 50% | 0% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 5 | 6 | 6 | 6 | 6 | 6 | 4 | – | – |
| Open fire | – | – | – | 1 | 2 | 3 | 4 | 4 | 3 | – | – | – |
| Wood burner | – | – | 5 | 7 | 6 | 7 | 7 | 6 | 6 | 5 | 2 | – |
| Multi-fuel | – | – | – | 7 | 7 | 6 | 6 | 6 | 7 | – | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 0.1 | 0.3 | 0.8 | 0.7 | 0.6 | 0.3 | 0.1 | – | – |
| Open fire: wood | – | – | – | 0.0 | 0.6 | 1.1 | 2.0 | 2.0 | 1.1 | – | – | – |
| Wood burner | – | – | 0.0 | 5.3 | 24.9 | 45.5 | 48.6 | 44.3 | 26.8 | 18.5 | 2.2 | – |
| Multi-fuel: wood | – | – | – | – | 0.0 | 0.6 | 0.6 | 0.6 | – | – | – | – |
| Multi-fuel: coal | – | – | – | 1.0 | 0.5 | 0.7 | 0.7 | 0.7 | 1.0 | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 0.1 | 0.3 | 0.8 | 0.8 | 0.6 | 0.3 | 0.2 | – | – |
| Open fire: wood | – | – | – | 0.0 | 4.5 | 7.9 | 13.8 | 13.8 | 7.3 | 0.0 | – | – |
| Wood burner | – | – | 0.0 | 2.1 | 10.1 | 18.5 | 19.7 | 18.0 | 10.9 | 7.5 | 0.9 | – |
| Multi-fuel: wood | – | – | – | – | 0.0 | 10.9 | 10.9 | 10.9 | – | – | – | – |
| Multi-fuel: coal | – | – | – | 18.0 | 9.0 | 11.6 | 11.6 | 11.6 | 18.0 | – | – | – |

**Table 23.4: Estimated daily fuel use, by season, Richmond**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | – |
| Open fire: wood | 15 | 17 |
| Wood burner | 25 | 19 |
| Multi-fuel: wood | 19 | – |
| Multi-fuel: coal | 14 | 18 |

# 23.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Richmond are presented in this section.

Figure 23.1 shows that the proportion of households using gas systems that are properly flued in Richmond is around 18%. This compares to a national average of 24%.

Table 23.5 compares the amount spent per month on heating using gas, electricity and wood burners. No data were available for other heating types because of the small number of respondents in these categories.

Figure 23.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Richmond. Only a small proportion (10%) of the respondents in Richmond were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 23.3 shows that around 35% of the wood used on wood burners and 50% of the wood used on open fires in Richmond is self-collected. No data were available for multi-fuel burners because of the small number of respondents.

**Figure 23.1: Distribution of flued versus unflued gas heating and age of wood burner, Richmond**

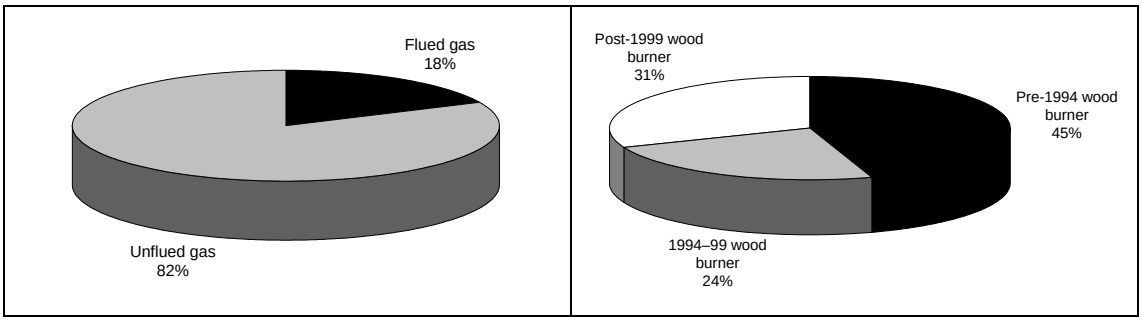


**Table 23.5: Average monthly heating costs (winter), Richmond**

| | Winter month cost |
|---|---|
| Electric | $67 |
| Gas | $72 |
| Wood burner | $66 |

**Figure 23.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Richmond**

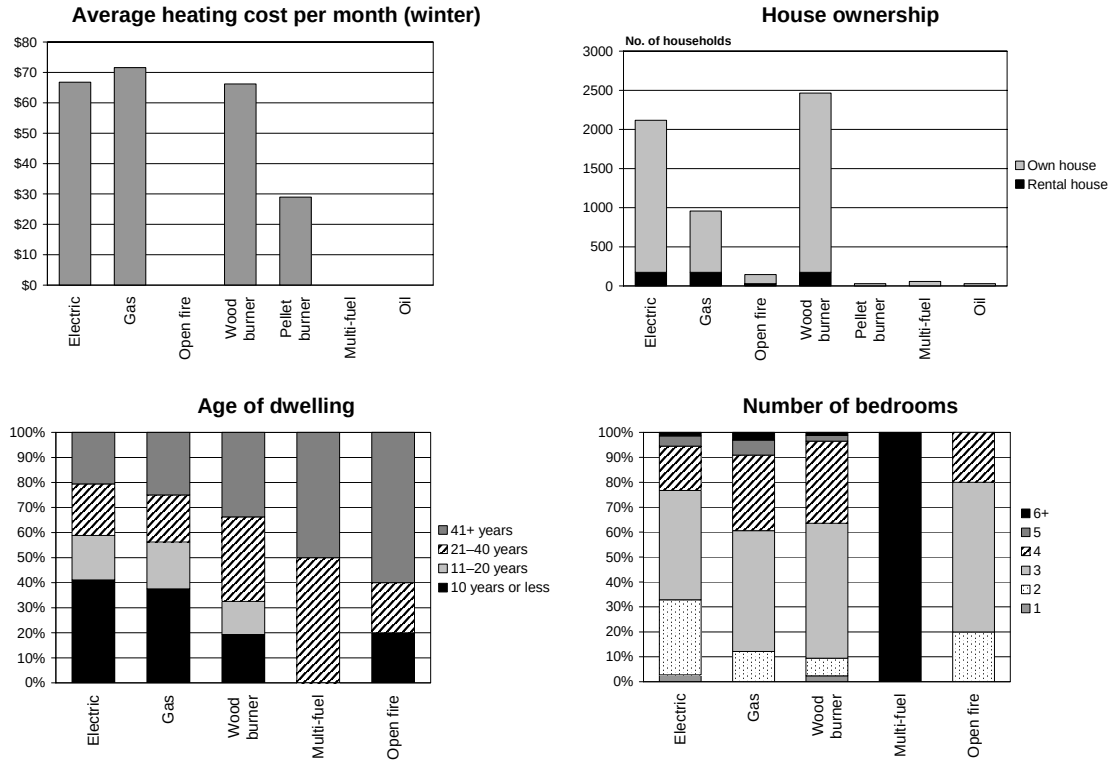


**Figure 23.3: Proportions of fuel obtained free of charge versus bought, Richmond**

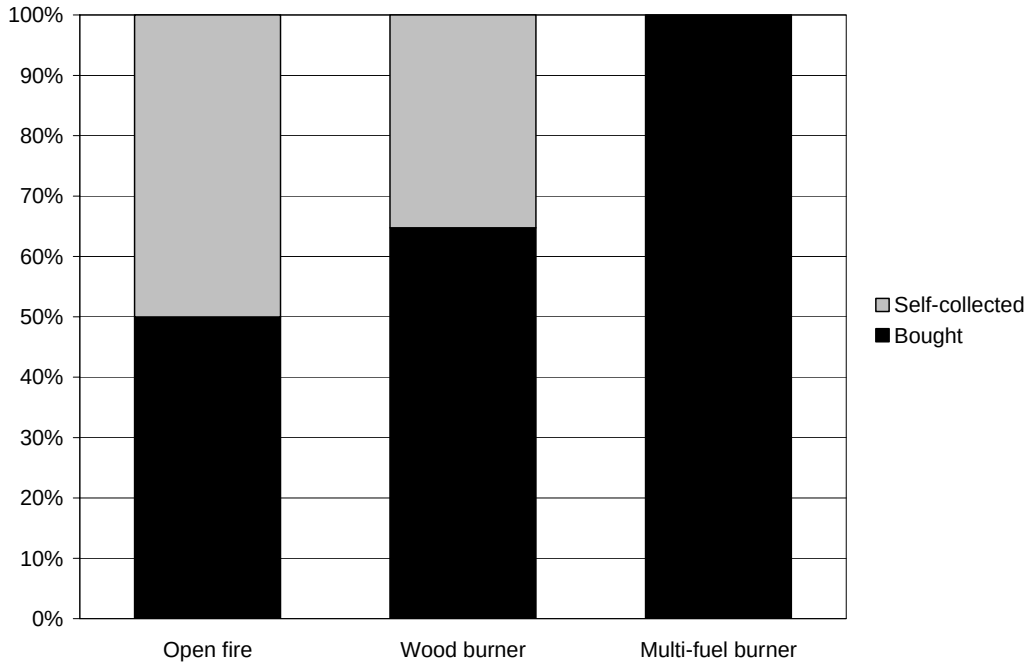

**Table 23.6: Type of electric heating, Richmond**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 190 | 163 | 761 | 109 | 326 | 679 | – | 27 |
| Percent | 10% | 8% | 38% | 5% | 16% | 34% | – | 1% |

The commonest types of electric heating used in the main living area in Richmond houses were oil column heaters and heat pumps (Table 23.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 23.7.

**Table 23.7: Home heating method, by house ownership, Richmond**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 441 | 10% | 3938 | 90% |
| Electric | 174 | 8% | 1943 | 92% |
| Gas | 174 | 18% | 783 | 82% |
| Open fire | 29 | 20% | 116 | 80% |
| Wood burner | 174 | 7% | 2291 | 93% |
| Pellet burner | 0 | 0% | 29 | 100% |
| Multi-fuel | 0 | 0% | 58 | 100% |
| Oil | 0 | 0% | 29 | 100% |

Household insulation types and heating methods are shown in Tables 23.8 and 23.9. Most houses (85%) had ceiling insulation and around 63% had wall insulation. Around 33% of houses had at least three types of insulation.

Table 23.10 shows home heating method, by household income. The overall non-response rate was around 23%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 23.8: House insulation summary statistics, Richmond**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 3479 | 85% | No insulation | 7% |
| Under floor | 1141 | 28% | 1 type* | 25% |
| Wall | 2582 | 63% | 2 types | 34% |
| Cylinder wrap | 707 | 17% | 3 types | 25% |
| Double glazing | 353 | 9% | 4 types | 7% |
| None | 272 | 7% | 5 types | 1% |
| Don't know | 136 | 3% | Don't know | 3% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 23.9: Degree of house insulation, by heating method, Richmond**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 19% | 30% | 27% | 100% | 0% |
| 2 types | 34% | 33% | 31% | 0% | 80% |
| 3 types | 26% | 12% | 26% | 0% | 0% |
| 4 types | 8% | 12% | 5% | 0% | 0% |
| 5 types | 3% | 3% | 0% | 0% | 0% |
| None or don't know | 10% | 9% | 12% | 0% | 20% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Table 23.10: Home heating method, by household income, Richmond**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 27% | 24% | 14% | 50% | 40% |
| Less than $20,000 | 12% | 12% | 7% | 0% | 0% |
| $20,000 to $30,000 | 16% | 12% | 16% | 0% | 0% |
| $30,000 to $40,000 | 10% | 6% | 6% | 0% | 0% |
| $40,000 to $50,000 | 3% | 6% | 9% | 0% | 0% |
| $50,000 to $70,000 | 12% | 18% | 28% | 0% | 20% |
| $70,000 to $100,000 | 10% | 12% | 12% | 0% | 20% |
| More than $100,000 | 10% | 9% | 7% | 50% | 20% |

* Note: columns may not sum exactly to 100 due to rounding error.

Tables 23.11 and 23.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 23.11: Home heating method, by age of dwelling, Richmond**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 41% | 36% | 19% | 0% | 20% |
| 11–20 years | 18% | 18% | 13% | 0% | 0% |
| 21–40 years | 21% | 18% | 33% | 50% | 20% |
| 41+ years | 21% | 24% | 33% | 50% | 60% |

**Table 23.12: Home heating method, by number of bedrooms, Richmond**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 2% | 0% | 0% |
| 2 | 30% | 12% | 7% | 0% | 20% |
| 3 | 44% | 48% | 54% | 0% | 60% |
| 4 | 18% | 30% | 33% | 0% | 20% |
| 5 | 4% | 6% | 2% | 0% | 0% |
| 6 | 1% | 3% | 1% | 50% | 0% |

# 24 Nelson

A telephone survey of domestic heating methods and fuels for Nelson was carried out by Digipoll in January 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Britannia Heights, Kirks, Bronte, Tahunanui, Toi Toi, Broads, Grampians and Nelson Airport. The survey focused on households within the two areas of Nelson where air quality is of greatest concern and the results were extrapolated to the rest of Nelson.

Survey details are shown in Table 24.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings for the above areas, extrapolated for 2004 based on Statistics New Zealand population projections.[50] The latter suggest a population increase for Nelson of 17% by 2021.[51]

**Table 24.1: Summary survey data, Nelson**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Nelson | 14,706 | 150 | 7.9% |

## 24.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Nelson. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Nelson, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Nelson largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 24.2 and 24.3 show domestic heating methods and fuels used for the main living areas in Nelson houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Nelson were electricity (44%) and wood burners (43%). Many households used more than one method of heating in their main living area.

[50] New Zealand Statistics 2004, www.stats.govt.nz

[51] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 24.2: Domestic home heating methods and fuels, Nelson**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 44% | 6,471 | – | – |
| Total gas | 33% | 4,804 | 7 | 5% |
| Flued gas | 8% | 1,124 | – | – |
| Unflued gas | 25% | 3,680 | – | – |
| Oil | 2% | 294 | 0.0 | 0.0% |
| Open fire | 11% | 1,667 | – | – |
| Open fire: wood | 11% | 1,569 | 17 | 12% |
| Open fire: coal | 2% | 294 | 2 | 1% |
| Total wood burner | 43% | 6,275 | 97 | 69% |
| Pre-1994 wood burner | 24% | 3,585 | 78 | 55% |
| 1994–99 wood burner | 5% | 784 | 4 | 3% |
| Post-1999 wood burner | 13% | 1,905 | 15 | 11% |
| Multi-fuel burners | 6% | 882 | – | – |
| Multi-fuel burners: wood | 6% | 882 | 18 | 13% |
| Multi-fuel burners: coal | 2% | 294 | 1 | 1% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 59% | 8,726 | 132 | 93% |
| Total coal | 4% | 588 | 3 | 2% |
| Total | | 14,706 | 141 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 6% of households using open fires and 3% of households using wood burners heat their homes during the summer months (Table 24.3). The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 24.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 24.3: Monthly variations in heating behaviour and fuel use, Nelson**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 0% | 18% | 59% | 68% | 84% | 77% | 66% | 23% | 2% | 0% |
| Open fire | 6% | 6% | 6% | 18% | 35% | 65% | 88% | 82% | 29% | 12% | 6% | 6% |
| Wood burner | 3% | 3% | 3% | 22% | 52% | 84% | 88% | 84% | 50% | 8% | 3% | 3% |
| Multi-fuel | 0% | 0% | 0% | 33% | 67% | 100% | 83% | 83% | 50% | 0% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 5 | 6 | 6 | 6 | 6 | 6 | 4 | 3 | – |
| Open fire | 3 | 3 | 3 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 3 |
| Wood burner | 5 | 7 | 7 | 5 | 6 | 6 | 6 | 6 | 5 | 6 | 7 | 7 |
| Multi-fuel | – | – | – | 3 | 5 | 7 | 7 | 7 | 5 | – | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 1.3 | 3.3 | 5.7 | 6.5 | 6.7 | 2.6 | 1.4 | 0.0 | 0.0 |
| Open fire: wood | 2.9 | 2.9 | 2.9 | 5.4 | 6.1 | 10.2 | 16.7 | 15.1 | 7.1 | 2.9 | 2.9 | 2.9 |
| Open fire: coal | – | – | – | – | 0.6 | 1.7 | 1.9 | 1.5 | – | – | – | – |
| Wood burner | – | – | – | – | 50.5 | 85.0 | 97.0 | 93.9 | – | – | – | – |
| Multi-fuel: wood | – | – | – | 0.0 | 12.9 | 17.8 | 17.8 | 16.6 | 0.0 | – | – | – |
| Multi-fuel: coal | – | – | – | 0.0 | 1.8 | 1.8 | 0.9 | 0.8 | 0.0 | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 0.3 | 0.7 | 1.2 | 1.4 | 1.4 | 0.5 | 0.3 | 0.0 | – |
| Open fire: wood | 1.8 | 1.8 | 1.8 | 3.5 | 3.9 | 6.5 | 10.7 | 9.7 | 4.5 | 1.8 | 1.8 | 1.8 |
| Open fire: coal | – | – | – | – | 1.9 | 5.8 | 6.4 | 5.1 | – | – | – | – |
| Wood burner | – | – | – | – | 8.0 | 13.5 | 15.5 | 15.0 | – | – | – | – |
| Multi-fuel: wood | – | – | – | 0.0 | 14.7 | 20.2 | 20.2 | 18.9 | 0.0 | – | – | – |
| Multi-fuel: coal | – | – | – | 0.0 | 6.0 | 6.0 | 3.0 | 2.6 | 0.0 | – | – | – |

**Table 24.4: Estimated daily fuel use, by season, Nelson**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 2 | 0.5 |
| Open fire: wood | 18 | 15 |
| Open fire: coal | 9 | – |
| Wood burner | 23 | 17 |
| Multi-fuel: wood | 26 | – |
| Multi-fuel: coal | 9 | 9 |

## 24.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Nelson are presented in this section.

Figure 24.1 shows that the proportion of households using gas systems that are properly flued in Nelson is around 23%. This is similar to the national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 24.5.

Figure 24.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Nelson. Around 22% of the respondents in Nelson were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 24.3 shows that around 50% of the wood used on solid fuel burners in Nelson is self-collected.

**Figure 24.1: Distribution of flued versus unflued gas heating and age of wood burner, Nelson**

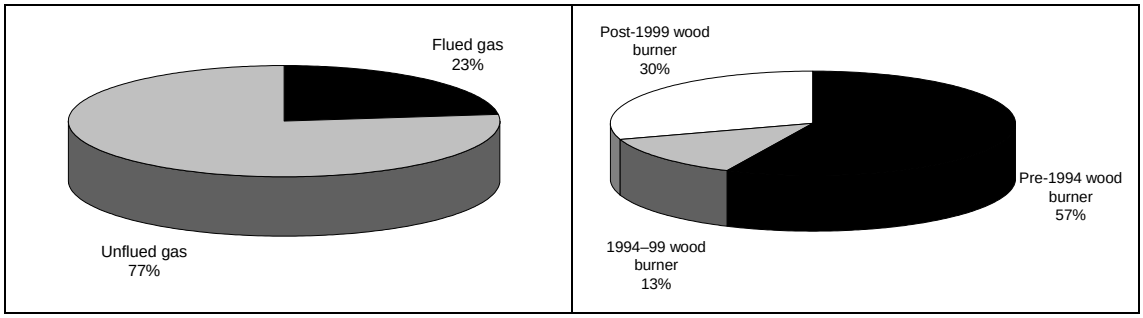


**Table 24.5: Average monthly heating costs (winter), Nelson**

| | Winter month cost |
|---|---|
| Electric | $86 |
| Gas | $92 |
| Open fire | $77 |
| Wood burner | $60 |

**Figure 24.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Nelson**

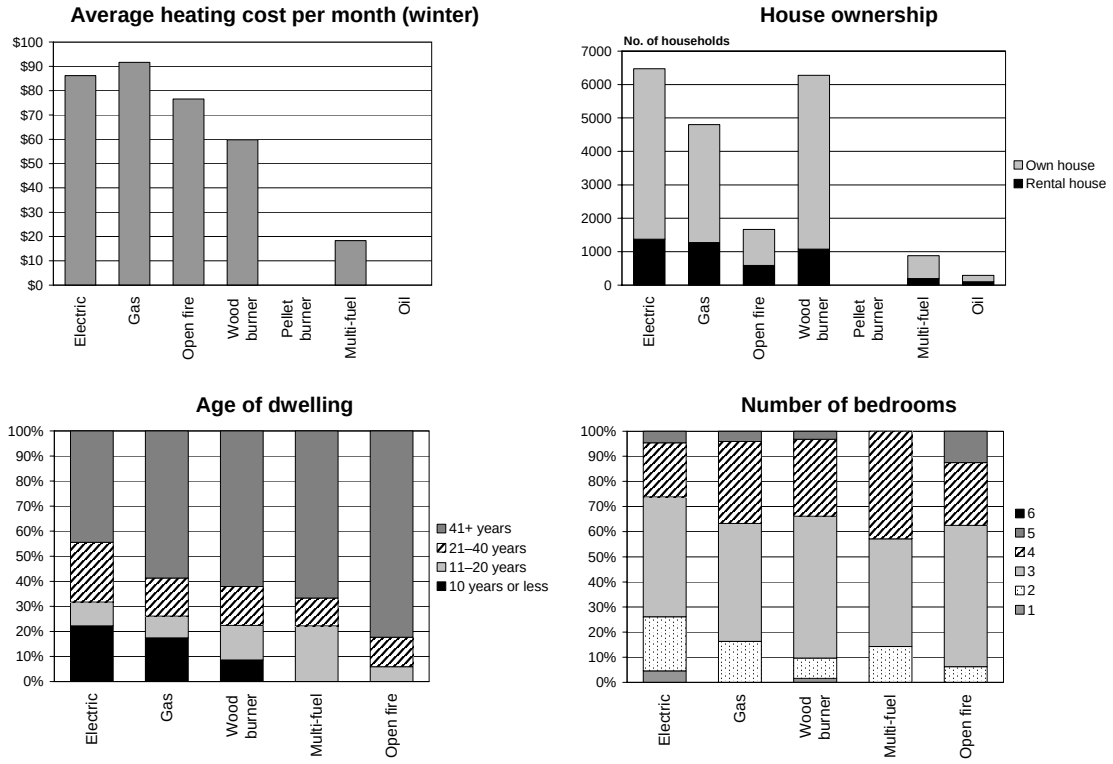


**Figure 24.3: Proportions of fuel obtained free of charge versus bought, Nelson**

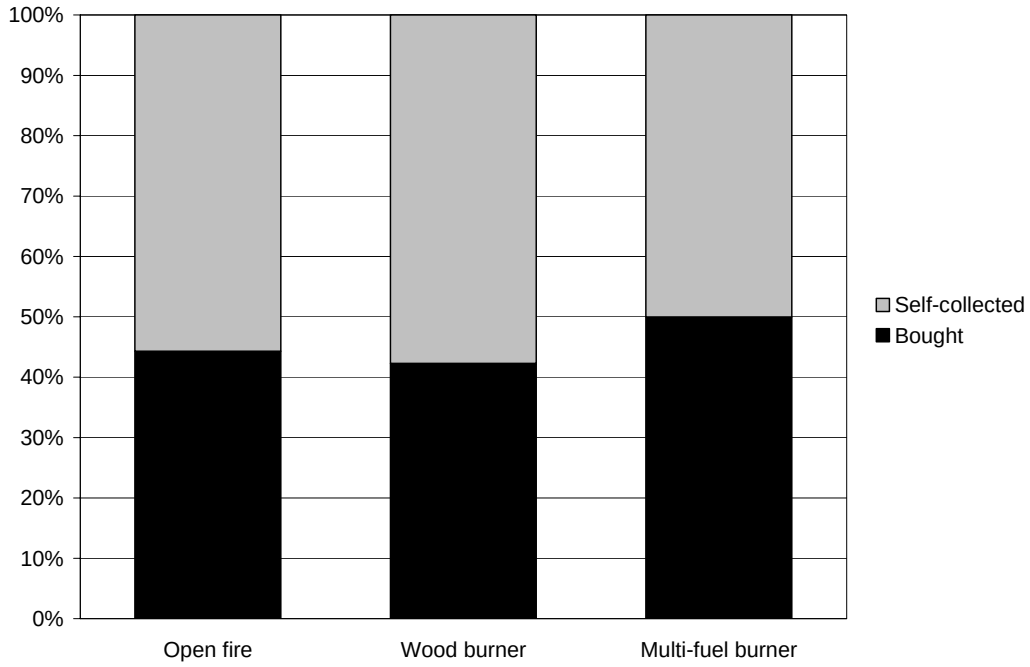

**Table 24.6: Type of electric heating, Nelson**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 558 | 319 | 558 | 199 | 558 | 558 | – | 199 |
| Percent | 22% | 12% | 22% | 8% | 22% | 22% | – | 8% |

The commonest types of electric heating used in the main living area in Nelson houses were oil column heaters, night-store heaters, heat pumps and fan heaters (Table 24.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 24.7.

**Table 24.7: Home heating method, by house ownership, Nelson**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 3257 | 22% | 11,449 | 78% |
| Electric | 1373 | 21% | 5098 | 79% |
| Gas | 1275 | 27% | 3529 | 73% |
| Open fire | 588 | 35% | 1078 | 65% |
| Wood burner | 1078 | 17% | 5196 | 83% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 196 | 22% | 686 | 78% |
| Oil | 98 | 33% | 196 | 67% |

Household insulation types and heating methods are shown in Tables 24.8 and 24.9. Around 73% of houses had ceiling insulation and around 55% had wall insulation. Only 29% of houses had at least three types of insulation.

Table 24.10 shows home heating method, by household income. The overall non-response rate was around 25%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 24.8: House insulation summary statistics, Nelson**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 10,784 | 73% | No insulation | 11% |
| Under floor | 3726 | 25% | 1 type* | 23% |
| Wall | 8137 | 55% | 2 types | 28% |
| Cylinder wrap | 3333 | 23% | 3 types | 19% |
| Double glazing | 1275 | 9% | 4 types | 7% |
| None | 1569 | 11% | 5 types | 3% |
| Don't know | 1176 | 8% | Don't know | 8% |
| Other | 196 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 24.9: Degree of house insulation, by heating method, Nelson**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 15% | 39% | 23% | 44% | 29% |
| 2 types | 35% | 20% | 28% | 0% | 12% |
| 3 types | 21% | 14% | 20% | 11% | 18% |
| 4 types | 6% | 2% | 11% | 22% | 0% |
| 5 types | 2% | 4% | 3% | 0% | 0% |
| None or don't know | 21% | 20% | 14% | 22% | 41% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 24.10: Home heating method, by household income, Nelson**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 26% | 14% | 25% | 33% | 6% |
| Less than $20,000 | 15% | 10% | 11% | 22% | 18% |
| $20,000 to $30,000 | 8% | 10% | 5% | 11% | 6% |
| $30,000 to $40,000 | 11% | 10% | 11% | 0% | 12% |
| $40,000 to $50,000 | 12% | 6% | 11% | 11% | 0% |
| $50,000 to $70,000 | 3% | 16% | 14% | 0% | 18% |
| $70,000 to $100,000 | 11% | 14% | 16% | 11% | 12% |
| More than $100,000 | 15% | 18% | 8% | 11% | 29% |

Tables 24.11 and 24.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 24.11: Home heating method, by age of dwelling, Nelson**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 21% | 16% | 8% | 0% | 0% |
| 11–20 years | 9% | 8% | 13% | 22% | 6% |
| 21–40 years | 23% | 14% | 14% | 11% | 12% |
| 41+ years | 42% | 55% | 56% | 67% | 82% |

**Table 24.12: Home heating method, by number of bedrooms, Nelson**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 5% | 0% | 2% | 0% | 0% |
| 2 | 21% | 16% | 8% | 11% | 6% |
| 3 | 47% | 47% | 55% | 33% | 53% |
| 4 | 21% | 33% | 30% | 33% | 24% |
| 5 | 5% | 4% | 3% | 0% | 12% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 25 Masterton

A telephone survey of domestic heating methods and fuels for Masterton was carried out by Digipoll in February 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Masterton Central, Masterton West, Masterton East, Solway North, Solway South, Ngaumutawa, Masterton Railway and Lansdowne.

Survey details are shown in Table 25.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[52] The latter suggest a population decrease for Masterton District of 7% by 2021.[53]

**Table 25.1: Summary survey data, Masterton**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Masterton | 6928 | 149 | 7.9% |

## 25.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Masterton. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Masterton, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Masterton largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 25.2 and 25.3 show domestic heating methods and fuels used for the main living areas in Masterton houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living areas were wood burners (67%), gas (32%) and electricity (20%). Many households used more than one method of heating in their main living area.

[52] New Zealand Statistics 2004, www.stats.govt.nz

[53] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 25.2: Domestic home heating methods and fuels, Masterton**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 20% | 1395 | – | – |
| Total gas | 32% | 2185 | 2 | 2% |
| Flued gas | 6% | 397 | – | – |
| Unflued gas | 26% | 1788 | – | – |
| Oil | 0% | 0 | – | – |
| Open fire | 7% | 511 | – | – |
| Open fire: wood | 7% | 511 | 11 | 10% |
| Open fire: coal | 1% | 93 | 1 | 1% |
| Total wood burner | 67% | 4650 | 84 | 72% |
| Pre-1994 wood burner | 13% | 918 | 19 | 16% |
| 1994–99 wood burner | 22% | 1550 | 36 | 31% |
| Post-1999 wood burner | 31% | 2181 | 29 | 25% |
| Multi-fuel burners | 11% | 790 | – | – |
| Multi-fuel burners: wood | 11% | 790 | 16 | 14% |
| Multi-fuel burners: coal | 3% | 232 | 2 | 2% |
| Pellet burners | 1% | 46 | – | – |
| Total wood | 86% | 5952 | 112 | 96% |
| Total coal | 5% | 325 | 3 | 2% |
| Total | | 6928 | 116 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Only a small proportion of households using wood burners heat their homes during January and February (Table 25.3). Household heating is more common in November and December, however, with an increased number of wood-burning households and a small proportion of gas and multi-fuel burner households heating during these months.

The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 25.4), the exception being households using open fires. It is likely that the small proportion of households heating with open fires during the non-winter months also use more fuel than average during the winter months as well. Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 25.3: Monthly variations in heating behaviour and fuel use, Masterton**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 7% | 27% | 63% | 78% | 88% | 80% | 51% | 22% | 5% | 5% |
| Open fire | 0% | 0% | 0% | 11% | 44% | 89% | 100% | 89% | 44% | 11% | 0% | 0% |
| Wood burner | 1% | 1% | 4% | 20% | 57% | 81% | 84% | 82% | 59% | 28% | 10% | 3% |
| Multi-fuel | 0% | 0% | 0% | 23% | 62% | 85% | 92% | 85% | 69% | 15% | 8% | 8% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 3 | 4 | 5 | 5 | 5 | 6 | 4 | 5 | 3 | 3 |
| Open fire | – | – | – | 5 | 5 | 5 | 5 | 5 | 7 | 7 | – | – |
| Wood burner | 1 | 1 | 4 | 5 | 6 | 6 | 7 | 7 | 6 | 5 | 4 | 3 |
| Multi-fuel | – | – | – | 5 | 6 | 6 | 7 | 7 | 6 | 5 | 4 | 4 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.2 | 0.4 | 1.4 | 1.6 | 1.8 | 1.6 | 0.4 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 5.3 | 10.4 | 11.2 | 10.5 | 19.8 | 1.9 | – | – |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | – | – |
| Wood burner | 0.6 | 0.6 | 4.4 | 7.9 | 45.5 | 72.7 | 84.1 | 76.0 | 71.4 | 24.1 | 8.1 | 4.1 |
| Multi-fuel: wood | – | – | – | 1.9 | 14.9 | 16.4 | 16.4 | 15.8 | 10.1 | 1.1 | 0.1 | 0.1 |
| Multi-fuel: coal | – | – | – | 0.0 | 1.0 | 1.3 | 1.8 | 1.0 | 0.4 | 0.0 | 0.0 | 0.0 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.1 | 0.2 | 0.7 | 0.7 | 0.8 | 0.7 | 0.2 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 10.3 | 20.2 | 22.0 | 20.6 | 38.6 | 3.8 | – | – |
| Open fire: coal | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 9.0 | 9.0 | 9.0 | 0.0 | 0.0 | – | – |
| Wood burner | 0.1 | 0.1 | 0.9 | 1.7 | 9.8 | 15.6 | 18.1 | 16.3 | 15.4 | 5.2 | 1.7 | 0.9 |
| Multi-fuel: wood | – | – | – | 2.4 | 18.8 | 20.8 | 20.8 | 20.0 | 12.8 | 1.4 | 0.2 | 0.2 |
| Multi-fuel: coal | – | – | – | 0.0 | 4.5 | 5.5 | 7.7 | 4.5 | 1.9 | 0.0 | 0.0 | 0.0 |

**Table 25.4: Estimated daily fuel use, by season, Masterton**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 29 | 39 |
| Open fire: coal | 9 | – |
| Wood burner | 26 | 22 |
| Multi-fuel: wood | 22 | 15 |
| Multi-fuel: coal | 9 | 5 |

## 25.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Masterton are presented in this section.

Figure 25.1 shows that the proportion of households using gas systems that are properly flued in Masterton is around 18%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 25.5. In Masterton, households heating using open fires on average spent less per month (around $34) than those using other heating methods.

Figure 25.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Masterton. Around 26% of the respondents in Masterton were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 25.3 shows that over 50% of the wood used on solid fuel burners in Masterton is self-collected.

**Figure 25.1: Distribution of flued versus unflued gas heating and age of wood burner, Masterton**

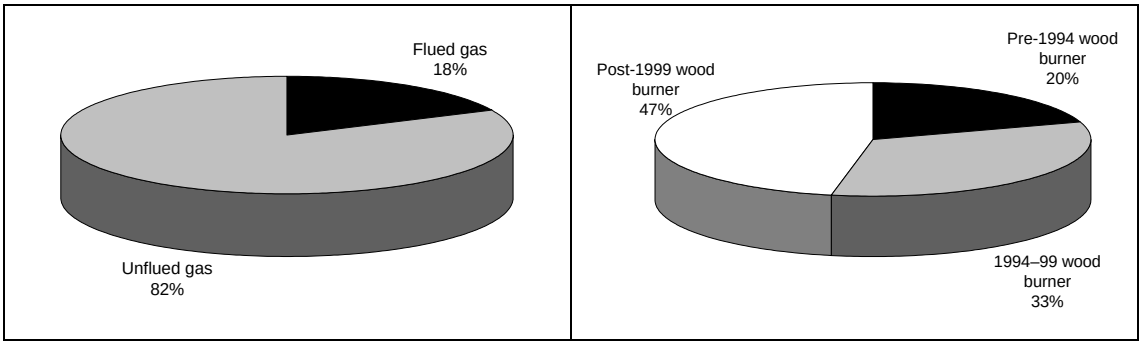


**Table 25.5: Average monthly heating costs (winter), Masterton**

| | Winter month cost |
|---|---|
| Electric | $104 |
| Gas | $81 |
| Open fire | $34 |
| Wood burner | $69 |
| Multi-fuel | $82 |

**Figure 25.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Masterton**

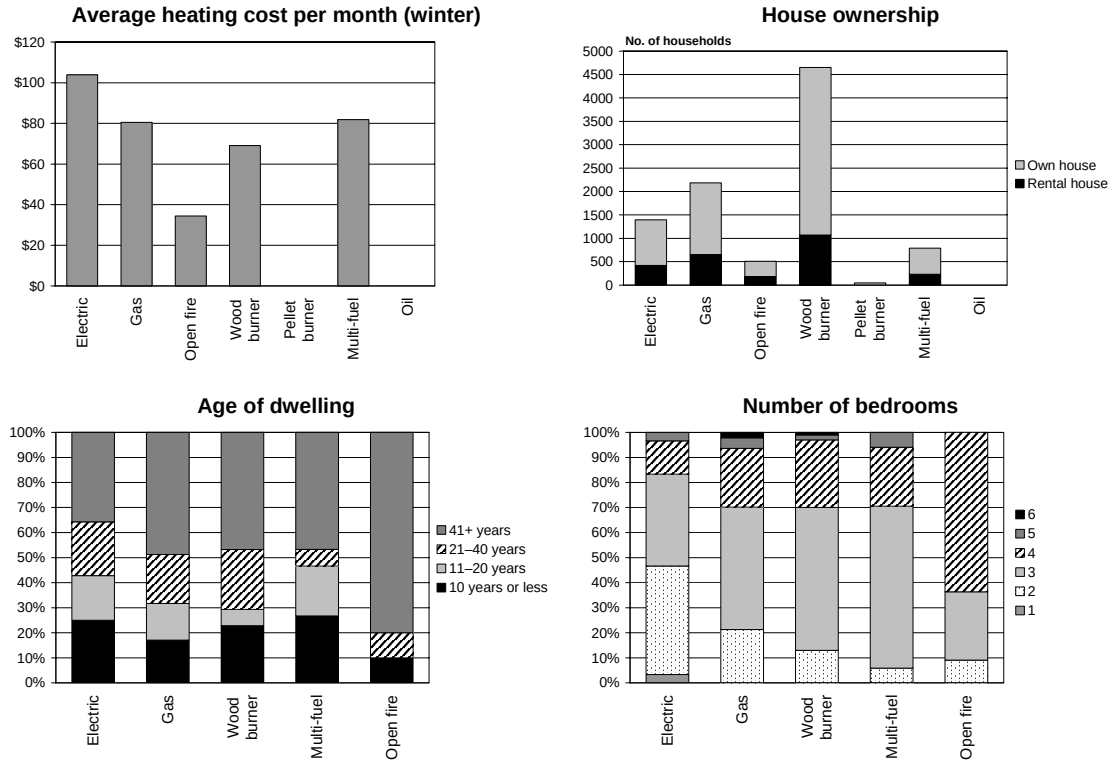


**Figure 25.3: Proportions of fuel obtained free of charge versus bought, Masterton**

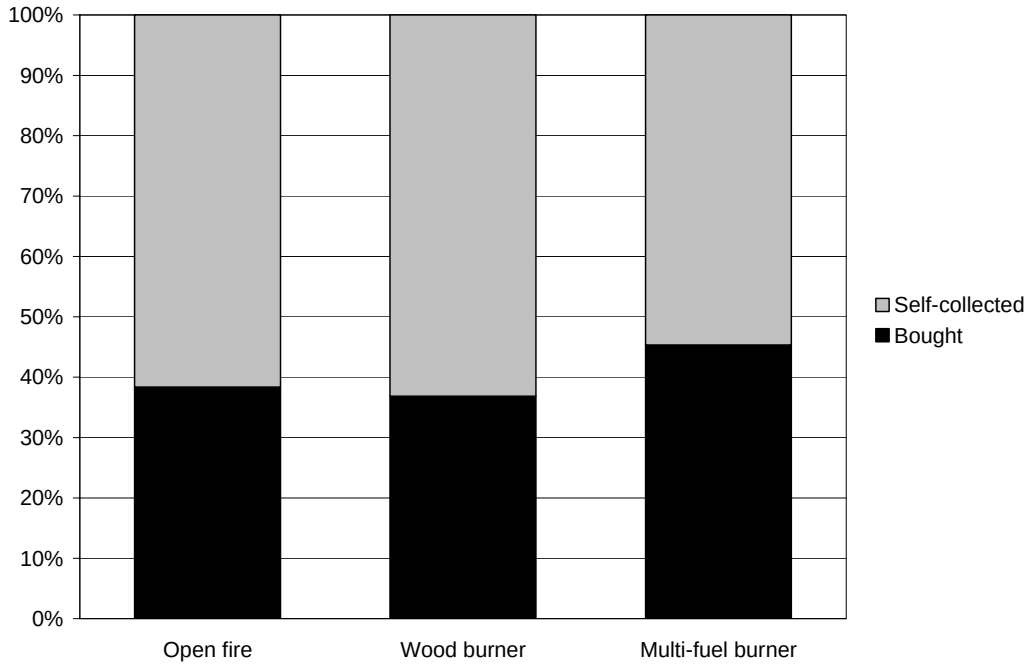

**Table 25.6: Type of electric heating, Masterton**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 186 | 139 | 418 | 93 | 325 | 46 | – | 232 |
| Percent | 14% | 10% | 31% | 7% | 24% | 3% | – | 17% |

The commonest types of electric heating used in the main living area in Masterton houses were oil column heaters and fan heaters (Table 25.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 25.7.

**Table 25.7: Home heating method, by house ownership, Masterton**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 1767 | 26% | 5161 | 74% |
| Electric | 418 | 30% | 976 | 70% |
| Gas | 651 | 30% | 1534 | 70% |
| Open fire | 186 | 36% | 325 | 64% |
| Wood burner | 1069 | 23% | 3580 | 77% |
| Pellet burner | 0 | 0% | 46 | 100% |
| Multi-fuel | 232 | 29% | 558 | 71% |
| Oil | – | – | – | – |

Household insulation types and heating methods are shown in Tables 25.8 and 25.9. Around 73% of houses had ceiling insulation and around 53% had wall insulation. Only 25% of houses had at least three types of insulation.

Table 25.10 shows home heating method, by household income. The overall non-response rate was around 28%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 25.8: House insulation summary statistics, Masterton**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 5068 | 73% | No insulation | 16% |
| Under floor | 1348 | 19% | 1 type* | 18% |
| Wall | 3673 | 53% | 2 types | 34% |
| Cylinder wrap | 1255 | 18% | 3 types | 18% |
| Double glazing | 279 | 4% | 4 types | 7% |
| None | 1116 | 16% | 5 types | 0% |
| Don't know | 604 | 9% | Don't know | 9% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 25.9: Degree of house insulation, by heating method, Masterton**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 13% | 21% | 21% | 24% | 9% |
| 2 types | 33% | 34% | 34% | 47% | 9% |
| 3 types | 13% | 13% | 18% | 0% | 36% |
| 4 types | 10% | 4% | 6% | 6% | 9% |
| 5 types | 0% | 0% | 0% | 0% | 0% |
| None or don't know | 30% | 28% | 21% | 24% | 36% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 25.10: Home heating, method by household income, Masterton**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 30% | 23% | 30% | 24% | 45% |
| Less than $20,000 | 33% | 15% | 9% | 0% | 9% |
| $20,000 to $30,000 | 20% | 23% | 13% | 35% | 9% |
| $30,000 to $40,000 | 13% | 11% | 8% | 12% | 18% |
| $40,000 to $50,000 | 0% | 4% | 12% | 6% | 9% |
| $50,000 to $70,000 | 3% | 9% | 16% | 18% | 9% |
| $70,000 to $100,000 | 0% | 6% | 8% | 6% | 0% |
| More than $100,000 | 0% | 9% | 4% | 0% | 0% |

Tables 25.11 and 25.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 25.11: Home heating method, by age of dwelling, Masterton**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 23% | 15% | 21% | 24% | 9% |
| 11–20 years | 17% | 13% | 6% | 18% | 0% |
| 21–40 years | 20% | 17% | 22% | 6% | 9% |
| 41+ years | 33% | 43% | 43% | 41% | 73% |

**Table 25.12: Home heating method, by number of bedrooms, Masterton**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 0% | 0% | 0% | 0% |
| 2 | 43% | 21% | 13% | 6% | 9% |
| 3 | 37% | 49% | 57% | 65% | 27% |
| 4 | 13% | 23% | 27% | 24% | 64% |
| 5 | 3% | 4% | 2% | 6% | 0% |
| 6 | 0% | 2% | 1% | 0% | 0% |

# 26 Blenheim

A telephone survey of domestic heating methods and fuels for Blenheim was carried out by Digipoll in February 2005. This involved surveying 152 households within the 2001 census area unit (CAU) areas of Springlands, Mayfield, Blenheim Central, Whitney, Redwoodtown and Witherlea.

Survey details are shown in Table 26.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[54] The latter suggest a population increase for Marlborough District of 12% by 2021.[55]

**Table 26.1: Summary survey data, Blenheim**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Blenheim | 8603 | 152 | 7.9% |

## 26.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Blenheim. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Blenheim, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Blenheim largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 26.2 and 26.3 show domestic heating methods and fuels used for the main living areas in Blenheim houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Blenheim were electricity (61%) and wood burners (52%). Many households used more than one method of heating in their main living area.

[54] New Zealand Statistics 2004, www.stats.govt.nz

[55] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 26.2: Domestic home heating methods and fuels, Blenheim**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 61% | 5207 | – | – |
| Total gas | 14% | 1245 | 0 | 0% |
| Flued gas | 0% | 0 | – | – |
| Unflued gas | 14% | 1245 | – | – |
| Oil | 0% | 0 | – | – |
| Open fire | 5% | 453 | – | – |
| Open fire: wood | 4% | 340 | 10 | 10% |
| Open fire: coal | 1% | 57 | 1 | 1% |
| Total wood burner | 52% | 4471 | 78 | 78% |
| Pre-1994 wood burner | 29% | 2462 | 44 | 44% |
| 1994–99 wood burner | 12% | 1037 | 27 | 27% |
| Post-1999 wood burner | 11% | 972 | 7 | 7% |
| Multi-fuel burners | 7% | 566 | – | – |
| Multi-fuel burners: wood | 7% | 566 | 9 | 9% |
| Multi-fuel burners: coal | 3% | 283 | 2 | 2% |
| Pellet burners | 1% | 57 | – | -1 |
| Total wood | 63% | 5377 | 97 | 97% |
| Total coal | 4% | 340 | 2 | 2% |
| Total | | 8603 | 100 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Most houses in Blenheim do not heat their homes during the summer months (Table 26.3). The quantities of fuel used per day during non-winter months were typically less than during the winter (Table 26.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 26.3: Monthly variations in heating behaviour and fuel use, Blenheim**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 5% | 14% | 48% | 86% | 86% | 67% | 24% | 5% | 5% | 5% |
| Open fire | 0% | 0% | 0% | 13% | 50% | 88% | 100% | 88% | 50% | 0% | 0% | 0% |
| Wood burner | 0% | 0% | 1% | 16% | 53% | 78% | 90% | 82% | 43% | 15% | 4% | 0% |
| Multi-fuel | 0% | 0% | 0% | 0% | 67% | 89% | 100% | 89% | 22% | 11% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 4 | 4 | 5 | 6 | 6 | 5 | 5 | 4 | 4 | 4 |
| Open fire | – | – | – | 2 | 7 | 6 | 6 | 6 | 5 | – | – | – |
| Wood burner | – | – | 7 | 6 | 6 | 7 | 7 | 6 | 6 | 4 | 2 | – |
| Multi-fuel | – | – | – | – | 7 | 6 | 6 | 6 | 4 | 4 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.0 | 0.2 | 0.5 | 0.4 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 0.0 | 2.8 | 3.2 | 9.7 | 9.2 | 1.2 | 0.0 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | – | 0.0 | 0.5 | 0.5 | 0.5 | – | – | – | – |
| Wood burner | – | – | 0.0 | 24.4 | 37.3 | 62.2 | 77.6 | 71.0 | 100.6 | 12.2 | 0.0 | – |
| Multi-fuel: wood | – | – | – | – | 6.6 | 6.6 | 9.4 | 9.4 | 9.2 | 7.4 | – | – |
| Multi-fuel: coal | – | – | – | – | 1.5 | 1.5 | 2.0 | 2.0 | 0.0 | 0.0 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | 0.0 | 0.0 | 0.0 | 0.0 | 8.1 | 9.5 | 28.5 | 27.1 | 3.4 | 0.0 | 0.0 | 0.0 |
| Open fire: coal | – | – | – | – | 0.0 | 9.0 | 9.0 | 9.0 | – | – | – | – |
| Wood burner | – | – | 0.0 | 5.5 | 8.4 | 13.9 | 17.4 | 15.9 | 22.5 | 2.7 | 0.0 | – |
| Multi-fuel: wood | – | – | – | – | 11.7 | 11.7 | 16.6 | 16.6 | 16.3 | 13.0 | – | – |
| Multi-fuel: coal | – | – | – | – | 5.4 | 5.4 | 6.9 | 6.9 | 0.0 | 0.0 | – | – |

**Table 26.4: Estimated daily fuel, use by season, Blenheim**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 1 |
| Open fire: wood | 29 | 5 |
| Open fire: coal | 9 | – |
| Wood burner | 23 | 26 |
| Multi-fuel: wood | 21 | 23 |
| Multi-fuel: coal | 11 | – |

## 26.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Blenheim are presented in this section.

Figure 26.1 shows that none of the respondents in the Blenheim survey had flued gas heating systems. (While some households in Blenheim may have flued gas heating systems, the results suggest that it would only be a small proportion.)

The amount spent on heating for a winter month, by heating method, is shown in Table 26.5. In Blenheim, households heating using multi-fuel burners and gas spent less per month on average ($19 and $49, respectively) than those using other heating methods, on average.

Figure 26.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Blenheim. Only a small proportion (15%) of the respondents in Blenheim were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 26.3 shows that around half of the wood used on solid fuel burners in Blenheim is self-collected.

**Figure 26.1: Distribution of flued versus unflued gas heating and age of wood burner, Blenheim**

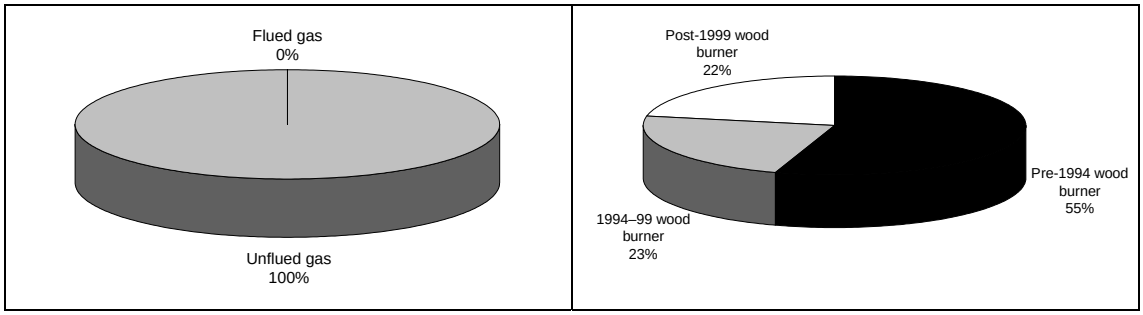


**Table 26.5: Average monthly heating costs (winter), Blenheim**

| | Winter month cost |
|---|---|
| Electric | $100 |
| Gas | $49 |
| Wood burner | $85 |
| Pellet burner | $71 |
| Multi-fuel | $19 |

**Figure 26.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Blenheim**

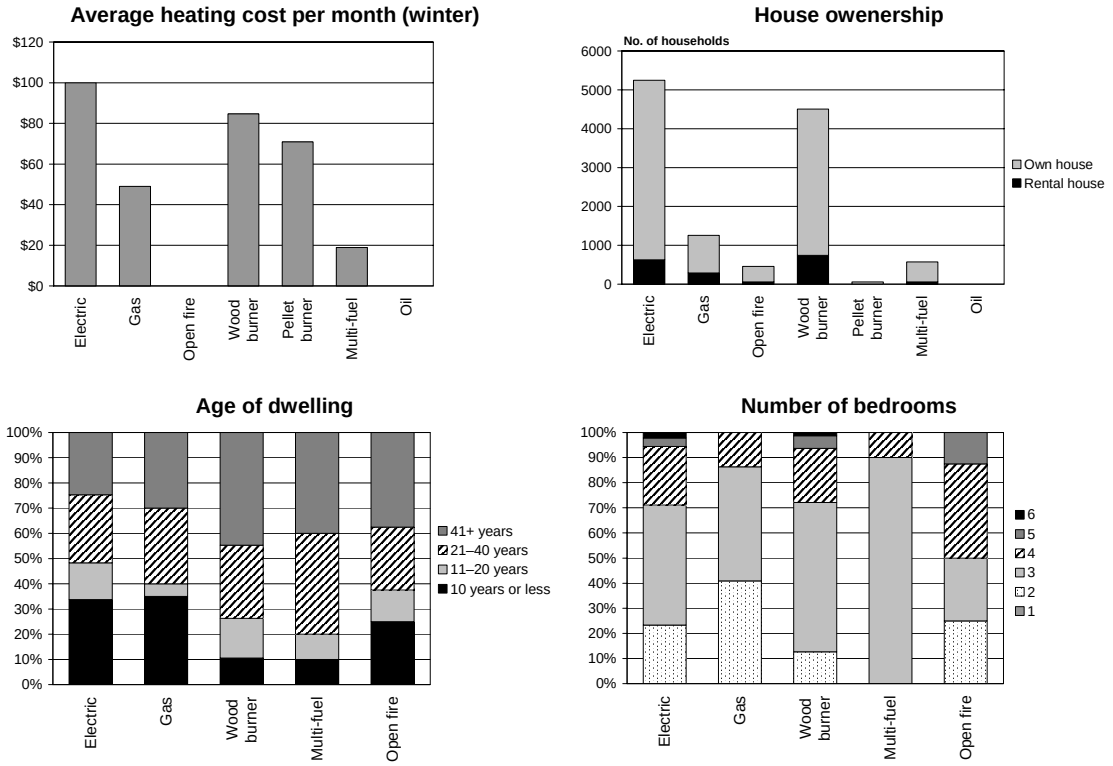


**Figure 26.3: Proportions of fuel obtained free of charge versus bought, Blenheim**

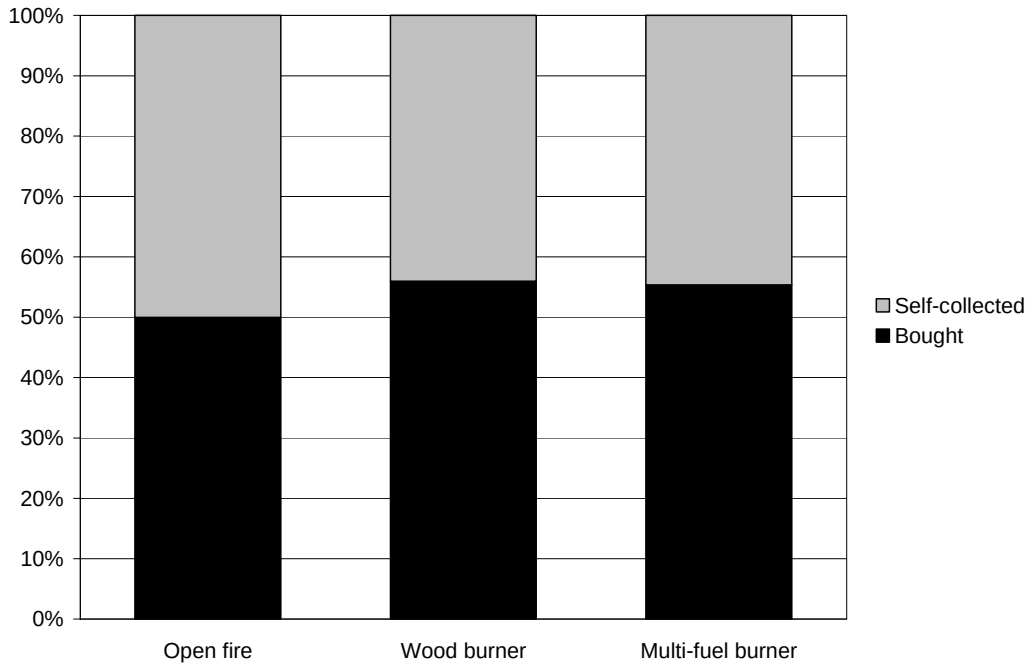

**Table 26.6: Type of electric heating, Blenheim**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 453 | 453 | 1415 | 340 | 849 | 2094 | – | 396 |
| Percent | 9% | 9% | 27% | 7% | 16% | 40% | – | 8% |

The commonest types of electric heating used in the main living areas in Blenheim houses were oil column heaters and heat pumps (Table 26.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 26.7.

**Table 26.7: Home heating method, by house ownership, Blenheim**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 1302 | 15% | 7245 | 84% |
| Electric | 623 | 12% | 4585 | 88% |
| Gas | 283 | 23% | 962 | 77% |
| Open fire | 57 | 13% | 396 | 88% |
| Wood burner | 736 | 16% | 3736 | 84% |
| Pellet burner | 0 | 0% | 57 | 100% |
| Multi-fuel | 57 | 10% | 509 | 90% |
| Oil | 0 | 0% | 0 | 0% |

Household insulation types and heating methods are shown in Tables 26.8 and 26.9. Most houses had ceiling insulation (82%) and around 60% had wall insulation. Around 31% of houses had at least three types of insulation.

Table 26.10 shows home heating method, by household income. The overall non-response rate was around 19%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 26.8: House insulation summary statistics, Blenheim**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 7075 | 82% | No insulation | 6% |
| Under floor | 1755 | 20% | 1 type* | 23% |
| Wall | 5151 | 60% | 2 types | 34% |
| Cylinder wrap | 1924 | 22% | 3 types | 19% |
| Double glazing | 1189 | 14% | 4 types | 9% |
| None | 509 | 6% | 5 types | 3% |
| Don't know | 509 | 6% | Don't know | 6% |
| Other | 0 | 0% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 26.9: Degree of house insulation, by heating method, Blenheim**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 18% | 23% | 34% | 20% | 0% |
| 2 types | 36% | 32% | 27% | 50% | 25% |
| 3 types | 20% | 14% | 19% | 10% | 38% |
| 4 types | 11% | 9% | 8% | 0% | 25% |
| 5 types | 3% | 0% | 1% | 10% | 0% |
| None or don't know | 12% | 23% | 11% | 10% | 13% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 26.10: Home heating method, by household income, Blenheim**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 18% | 14% | 16% | 30% | 38% |
| Less than $20,000 | 17% | 27% | 10% | 10% | 25% |
| $20,000 to $30,000 | 12% | 18% | 10% | 20% | 0% |
| $30,000 to $40,000 | 18% | 18% | 19% | 40% | 13% |
| $40,000 to $50,000 | 11% | 9% | 10% | 0% | 0% |
| $50,000 to $70,000 | 13% | 14% | 18% | 0% | 13% |
| $70,000 to $100,000 | 8% | 0% | 10% | 0% | 0% |
| More than $100,000 | 2% | 0% | 6% | 0% | 13% |

Tables 26.11 and 26.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 26.11: Home heating method, by age of dwelling, Blenheim**

| Age of dwelling | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 10 years or less | 33% | 32% | 10% | 10% | 25% |
| 11–20 years | 14% | 5% | 15% | 10% | 13% |
| 21–40 years | 26% | 27% | 28% | 40% | 25% |
| 41+ years | 24% | 27% | 43% | 40% | 38% |

**Table 26.12: Home heating method, by number of bedrooms, Blenheim**

| Number of bedrooms | Electric % | Gas % | Wood burner % | Multi-fuel % | Open fire % |
|---|---|---|---|---|---|
| 1 | 0% | 0% | 0% | 0% | 0% |
| 2 | 23% | 41% | 13% | 0% | 25% |
| 3 | 47% | 45% | 59% | 90% | 25% |
| 4 | 23% | 14% | 22% | 10% | 38% |
| 5 | 3% | 0% | 5% | 0% | 13% |
| 6 | 2% | 0% | 1% | 0% | 0% |

# 27 Auckland

A telephone survey of domestic heating methods and fuels for Auckland was carried out by Digipoll in December 2004. This involved surveying 151 households within the Auckland Region as defined by the 2001 census.

Survey details are shown in Table 27.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[56] The latter suggest a population increase for Auckland of 37% by 2021.[57]

**Table 27.1: Summary survey data, Auckland**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Auckland | 409,473 | 151 | 8.0% |

## 27.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Auckland. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Auckland, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Auckland largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 27.2 and 27.3 show domestic heating methods and fuels used for main living areas in Auckland houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Auckland were electricity (48%) and gas (35%). Many households used more than one method of heating in their main living area.

[56] New Zealand Statistics 2004, www.stats.govt.nz

[57] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 27.2: Domestic home heating methods and fuels, Auckland**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 48% | 197,957 | – | – |
| Total gas | 35% | 143,722 | 99 | 7% |
| Flued gas | 12% | 49,750 | – | – |
| Unflued gas | 23% | 93,972 | – | – |
| Oil | 2% | 8135 | 0.1 | 0.0% |
| Open fire | 7% | 29,829 | – | – |
| Open fire: wood | 7% | 27,117 | 167 | 12% |
| Open fire: coal | 3% | 10,847 | 214 | 16% |
| Total wood burner | 19% | 75,929 | 780 | 58% |
| Pre-1994 wood burner | 8% | 31,062 | 304 | 22% |
| 1994–99 wood burner | 5% | 20,708 | 233 | 17% |
| Post-1999 wood burner | 6% | 24,159 | 243 | 18% |
| Multi-fuel burners | 3% | 13,559 | – | – |
| Multi-fuel burners: wood | 3% | 13,559 | 63 | 5% |
| Multi-fuel burners: coal | 3% | 10,847 | 35 | 3% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 28% | 116,605 | 1009 | 74% |
| Total coal | 5% | 21,694 | 249 | 18% |
| Total | | 409,473 | 1357 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 9% of households using open fires for home heating carried out heating during the summer months (Table 27.3). The quantities of fuel used per day during non-winter months were typically less than during the winter (Table 27.4). The main exception in this case was multi-fuel burners using wood. These results do not suggest that individual households heating with multi-fuel burners use more fuel during the non-winter months. The higher average is more likely to reflect differences in the sample population, with fewer households burning during the non-winter months. Data are not presented for all heating methods, because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 27.3: Monthly variations in heating behaviour and fuel use, Auckland**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 2% | 2% | 2% | 8% | 27% | 76% | 90% | 84% | 37% | 12% | 4% | 2% |
| Open fire | 9% | 9% | 9% | 9% | 36% | 64% | 100% | 82% | 45% | 9% | 9% | 9% |
| Wood burner | 0% | 0% | 0% | 4% | 50% | 75% | 93% | 79% | 36% | 14% | 4% | 0% |
| Multi-fuel | 0% | 0% | 0% | 25% | 75% | 125% | 100% | 75% | 50% | 25% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 4 | 3 | 3 | 4 | 5 | 6 | 6 | 5 | 5 | 4 | 3 | 2 |
| Open fire | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| Wood burner | – | – | – | 5 | 6 | 6 | 6 | 5 | 5 | 6 | 7 | – |
| Multi-fuel | – | – | – | – | 4 | 5 | 6 | 6 | 5 | 4 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.9 | 17.7 | 73.8 | 98.7 | 74.3 | 21.3 | 1.9 | 0.0 | 0.0 |
| Open fire: wood | 49.1 | 49.1 | 49.1 | 49.1 | 11.0 | 137.1 | 166.5 | 237.4 | 51.5 | 49.1 | 49.1 | 49.1 |
| Open fire: coal | – | – | – | – | 4.6 | 4.6 | 213.8 | 213.8 | – | – | – | – |
| Wood burner | – | – | – | – | 524.5 | 556.2 | 780.1 | 384.0 | – | – | – | – |
| Multi-fuel: wood | – | – | – | – | 54.3 | 45.1 | 62.6 | 46.0 | 184.0 | 147.2 | – | – |
| Multi-fuel: coal | – | – | – | – | 76.7 | 69.7 | 34.9 | 34.9 | – | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 | 0.7 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 |
| Open fire: wood | 1.8 | 1.8 | 1.8 | 1.8 | 0.4 | 5.1 | 6.1 | 8.8 | 1.9 | 1.8 | 1.8 | 1.8 |
| Open fire: coal | – | – | – | – | 0.4 | 0.4 | 19.7 | 19.7 | – | – | – | – |
| Wood burner | – | – | – | – | 6.9 | 7.3 | 10.3 | 5.1 | – | – | – | – |
| Multi-fuel: wood | – | – | – | – | 4.0 | 3.3 | 4.6 | 3.4 | 13.6 | 10.9 | – | – |
| Multi-fuel: coal | – | – | – | – | 7.1 | 6.4 | 3.2 | 3.2 | – | – | – | – |

**Table 27.4: Estimated daily fuel use, by season, Auckland**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 0 |
| Open fire: wood | 25 | 13 |
| Wood burner | 17 | 7 |
| Multi-fuel: wood | 17 | 19 |
| Multi-fuel: coal | 14 | – |

# 27.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Auckland are presented in this section.

Figure 27.1 shows that the proportion of households using gas systems that are properly flued in Auckland is around 35%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 27.5. In Auckland, households heating using open fires and gas spent less per month on average ($30 and $43, respectively) than those using other heating methods.

Figure 27.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Auckland. Around 26% of the respondents in Auckland were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 27.3 shows that around 60% of the wood used on open fires and wood burners in Auckland is self-collected.

**Figure 27.1: Distribution of flued versus unflued gas heating and age of wood burner, Auckland**

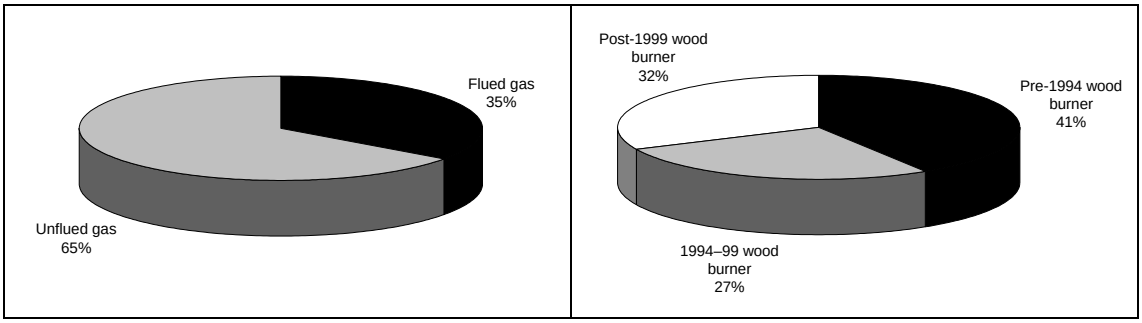


**Table 27.5: Average monthly heating costs (winter), Auckland**

| | Winter month cost |
|---|---|
| Electric | $69 |
| Gas | $43 |
| Open fire | $30 |
| Wood burner | $57 |
| Oil | $115 |

**Figure 27.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Auckland**

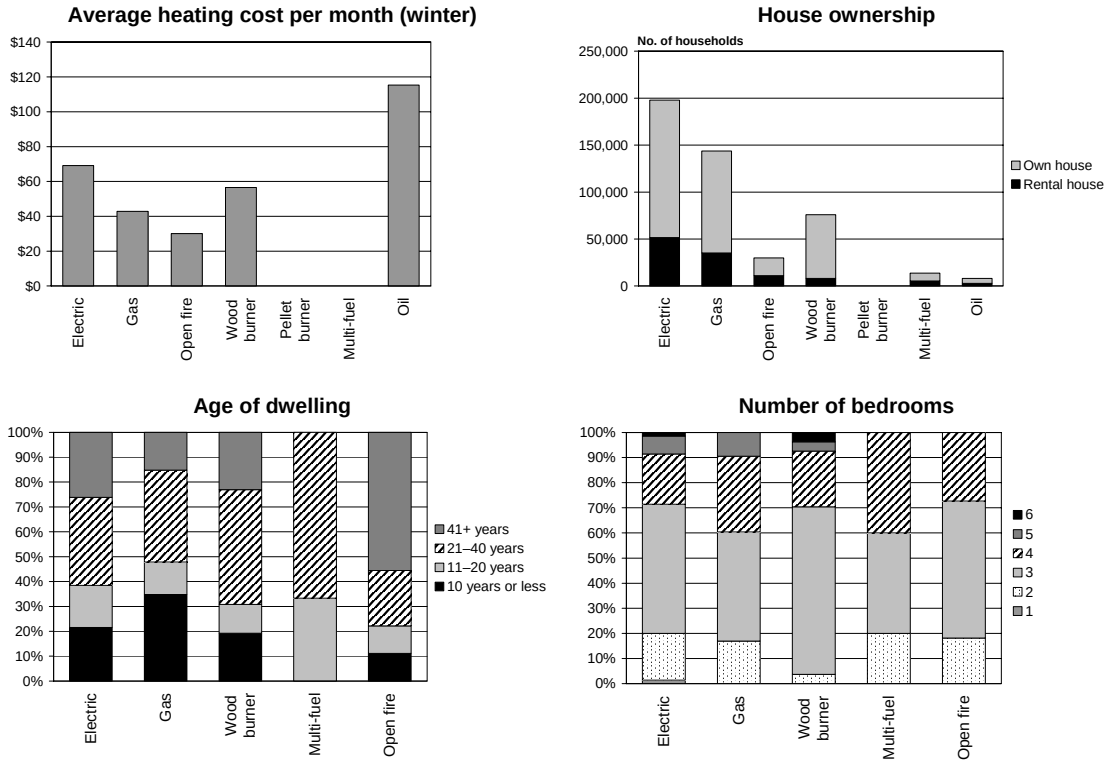


**Figure 27.3: Proportions of fuel obtained free of charge versus bought, Auckland**

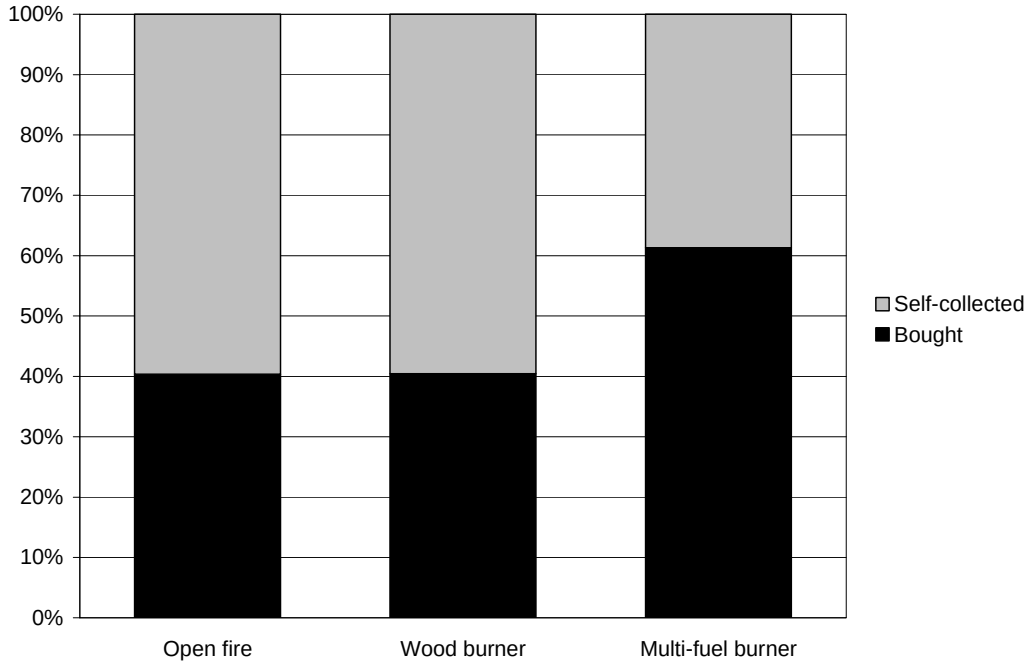

**Table 27.6: Type of electric heating, Auckland**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | – | 35,253 | 143,722 | 8135 | 32,541 | 2712 | – | 5423 |
| Percent | 0% | 18% | 73% | 4% | 16% | 1% | – | 3% |

Oil column heaters were the commonest type of electric heating used in the main living area of houses in Auckland (Table 27.6). The survey suggests that, unlike other areas of New Zealand, heat pumps are not a popular electrical heating choice in Auckland. A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 27.7.

**Table 27.7: Home heating method, by house ownership, Auckland**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 108,470 | 26% | 292,868 | 72% |
| Electric | 51,523 | 26% | 146,434 | 74% |
| Gas | 35,253 | 25% | 108,470 | 75% |
| Open fire | 10,847 | 36% | 18,982 | 64% |
| Wood burner | 8135 | 11% | 67,794 | 89% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 5423 | 40% | 8135 | 60% |
| Oil | 2712 | 33% | 5423 | 67% |

Household insulation types and heating methods are shown in Tables 27.8 and 27.9. In Auckland only 57% of houses had ceiling insulation and around 44% had wall insulation. Around 23% of households were thought to have no forms of insulation.

Table 27.10 shows home heating method, by household income. The overall non-response rate was around 23%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 27.8: House insulation summary statistics, Auckland**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 233,210 | 57% | No insulation | 23% |
| Under floor | 67,794 | 17% | 1 type* | 21% |
| Wall | 181,687 | 44% | 2 types | 29% |
| Cylinder wrap | 78,640 | 19% | 3 types | 15% |
| Double glazing | 29,829 | 7% | 4 types | 3% |
| None | 92,199 | 23% | 5 types | 3% |
| Don't know | 32,541 | 8% | Don't know | 8% |
| Other | 8135 | 2% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 27.9: Degree of house insulation, by heating method, Auckland**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 26% | 23% | 21% | 20% | 36% |
| 2 types | 29% | 36% | 29% | 20% | 0% |
| 3 types | 16% | 8% | 18% | 0% | 27% |
| 4 types | 1% | 4% | 0% | 40% | 9% |
| 5 types | 4% | 2% | 0% | 0% | 0% |
| None or don't know | 23% | 28% | 32% | 20% | 27% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 27.10: Home heating method, by household income, Auckland**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 22% | 26% | 14% | 20% | 9% |
| Less than $20,000 | 5% | 6% | 7% | 0% | 0% |
| $20,000 to $30,000 | 11% | 9% | 14% | 40% | 18% |
| $30,000 to $40,000 | 15% | 8% | 4% | 0% | 18% |
| $40,000 to $50,000 | 8% | 8% | 4% | 20% | 0% |
| $50,000 to $70,000 | 11% | 9% | 29% | 20% | 36% |
| $70,000 to $100,000 | 14% | 13% | 18% | 0% | 9% |
| More than $100,000 | 14% | 21% | 11% | 0% | 9% |

Tables 27.11 and 27.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 27.11: Home heating method, by age of dwelling, Auckland**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 19% | 30% | 18% | 0% | 9% |
| 11–20 years | 15% | 11% | 11% | 20% | 9% |
| 21–40 years | 32% | 32% | 43% | 40% | 18% |
| 41+ years | 23% | 13% | 21% | 0% | 45% |

**Table 27.12: Home heating method, by number of bedrooms, Auckland**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 1% | 0% | 0% | 0% | 0% |
| 2 | 18% | 17% | 4% | 20% | 18% |
| 3 | 49% | 43% | 64% | 40% | 55% |
| 4 | 19% | 30% | 21% | 40% | 27% |
| 5 | 7% | 9% | 4% | 0% | 0% |
| 6 | 1% | 0% | 4% | 0% | 0% |

# 28 Hamilton

A telephone survey of domestic heating methods and fuels for Hamilton was carried out by Digipoll in December 2004. This involved surveying 150 households within the 2001 census area unit (CAU) areas of:

- Bader
- Beerescourt
- Bryant
- Brymer
- Chartwell
- Chedworth
- Clarkin
- Claudelands
- Dinsdale North
- Dinsdale South
- Enderley
- Fairview Downs
- Flagstaff
- Frankton Junction
- Glenview
- Hamilton Central
- Hamilton East
- Hamilton Lake
- Horsham Downes
- Hillcrest West
- Huntington
- Insoll
- Maeroa
- Melville
- Nawton
- Naylor
- Peachgrove
- Porritt
- Pukete
- Pukete West
- Queenwood
- Riverlea
- Rototuna
- Rotokauri
- Silverdale
- Swarbrick
- Te Rapa
- University

Survey details are shown in Table 28.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[58] The latter suggest a population increase for Hamilton City of 26% by 2021.[59]

**Table 28.1: Summary survey data, Hamilton**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Hamilton | 42,285 | 152 | 7.9% |

## 28.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Hamilton. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Hamilton, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Hamilton largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 28.2 and 28.3 show domestic heating methods and fuels used for the main living areas in Hamilton houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Hamilton were gas (64%) and electricity (26%). Many households used more than one method of heating in their main living area.

[58] New Zealand Statistics 2004, www.stats.govt.nz

[59] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 28.2: Domestic home heating methods and fuels, Hamilton**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 26% | 11,128 | – | – |
| Total gas | 64% | 26,985 | 25 | 20% |
| Flued gas | 36% | 15,252 | – | – |
| Unflued gas | 28% | 11,732 | – | – |
| Oil | 0% | 0 | – | – |
| Open fire | 3% | 1113 | – | – |
| Open fire: wood | 3% | 1113 | 5 | 4% |
| Open fire: coal | 1% | 278 | 3 | 2% |
| Total wood burner | 14% | 5842 | 92 | 73% |
| Pre-1994 wood burner | 9% | 3690 | 67 | 54% |
| 1994–99 wood burner | 3% | 1230 | 10 | 8% |
| Post-1999 wood burner | 2% | 922 | 14 | 11% |
| Multi-fuel burners | 3% | 1391 | – | – |
| Multi-fuel burners: wood | 3% | 1391 | 0 | 0% |
| Multi-fuel burners: coal | 2% | 835 | 1 | 1% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 20% | 8346 | 97 | 77% |
| Total coal | 3% | 1113 | 4 | 3% |
| Total | | 42,285 | 125 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Around 5% of households that use wood burners heat their houses during the months of January and February (Table 28.3). The quantities of fuel used per day during non-winter months were typically less than during the winter (Table 28.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 28.3: Monthly variations in heating behaviour and fuel use, Hamilton**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 1% | 6% | 47% | 82% | 92% | 90% | 48% | 18% | 6% | 0% |
| Open fire | 0% | 0% | 0% | 0% | 50% | 100% | 100% | 75% | 25% | 25% | 0% | 0% |
| Wood burner | 5% | 5% | 0% | 10% | 48% | 62% | 76% | 62% | 38% | 14% | 10% | 0% |
| Multi-fuel | 0% | 0% | 0% | 0% | 67% | 67% | 67% | 67% | 33% | 0% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 7 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | – |
| Open fire | – | – | – | – | 5 | 5 | 5 | 6 | 7 | 7 | – | – |
| Wood burner | 3 | 3 | – | 3 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | – |
| Multi-fuel | – | – | – | – | 6 | 5 | 5 | 4 | 4 | – | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 15.3 | 24.2 | 24.9 | 28.9 | 13.2 | 6.8 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | 3.6 | 4.8 | 4.8 | 0.0 | – | – | – | – |
| Open fire: coal | – | – | – | – | 2.5 | 2.5 | 2.5 | 2.5 | – | – | – | – |
| Wood burner | – | – | – | – | 58.5 | 64.7 | 91.7 | 119.6 | – | – | – | – |
| Multi-fuel: wood | – | – | – | – | 6.6 | – | – | – | – | – | – | – |
| Multi-fuel: coal | – | – | – | – | 3.9 | 1.4 | 1.4 | 1.4 | 4.3 | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.9 | 0.9 | 1.1 | 0.5 | 0.3 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | – | 3.3 | 4.3 | 4.3 | 0.0 | – | – | – | – |
| Open fire: coal | – | – | – | – | 9.0 | 9.0 | 9.0 | 9.0 | – | – | – | – |
| Wood burner | – | – | – | – | 10.0 | 11.1 | 15.7 | 20.5 | – | – | – | – |
| Multi-fuel: wood | – | – | – | – | 4.8 | – | – | – | – | – | – | – |
| Multi-fuel: coal | – | – | – | – | 4.7 | 1.7 | 1.7 | 1.7 | 5.1 | – | – | – |

**Table 28.4: Estimated daily fuel use, by season, Hamilton**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 0 |
| Open fire: wood | 12 | – |
| Open fire: coal | 9 | – |
| Wood burner | 38 | 27 |
| Multi-fuel: coal | 12 | – |

## 28.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Hamilton are presented in this section.

Figure 28.1 shows that the proportion of households using gas systems that are properly flued in Hamilton is around 43%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 28.5. In Hamilton, households heating using wood burners spent less per month on average (around $55) than those using other heating methods.

Figure 28.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Hamilton. Around 28% of the respondents in Hamilton were living in rental accommodation. This compares with a national average of around 20%.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 28.3 shows that around 60% of the wood used on wood burners and multi-fuel burners in Hamilton is purchased.

**Figure 28.1: Distribution of flued versus unflued gas heating and age of wood burner, Hamilton**

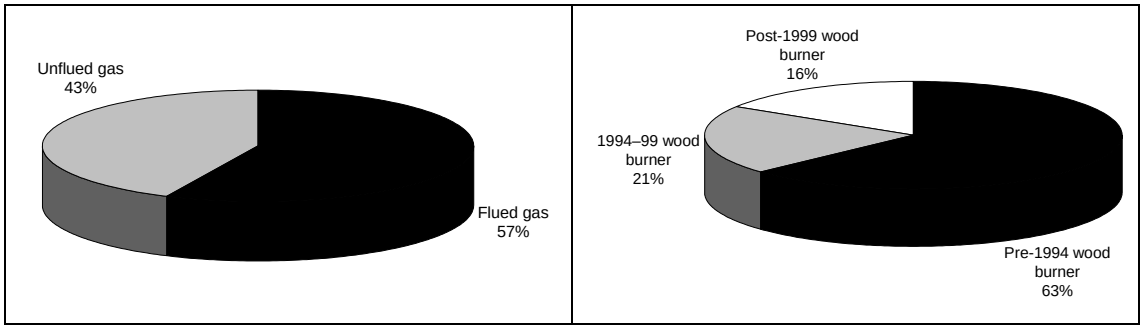


**Table 28.5: Average monthly heating costs (winter), Hamilton**

| | Winter month cost |
|---|---|
| Electric | $72 |
| Gas | $88 |
| Wood burner | $55 |
| Multi-fuel | $71 |

**Figure 28.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Hamilton**

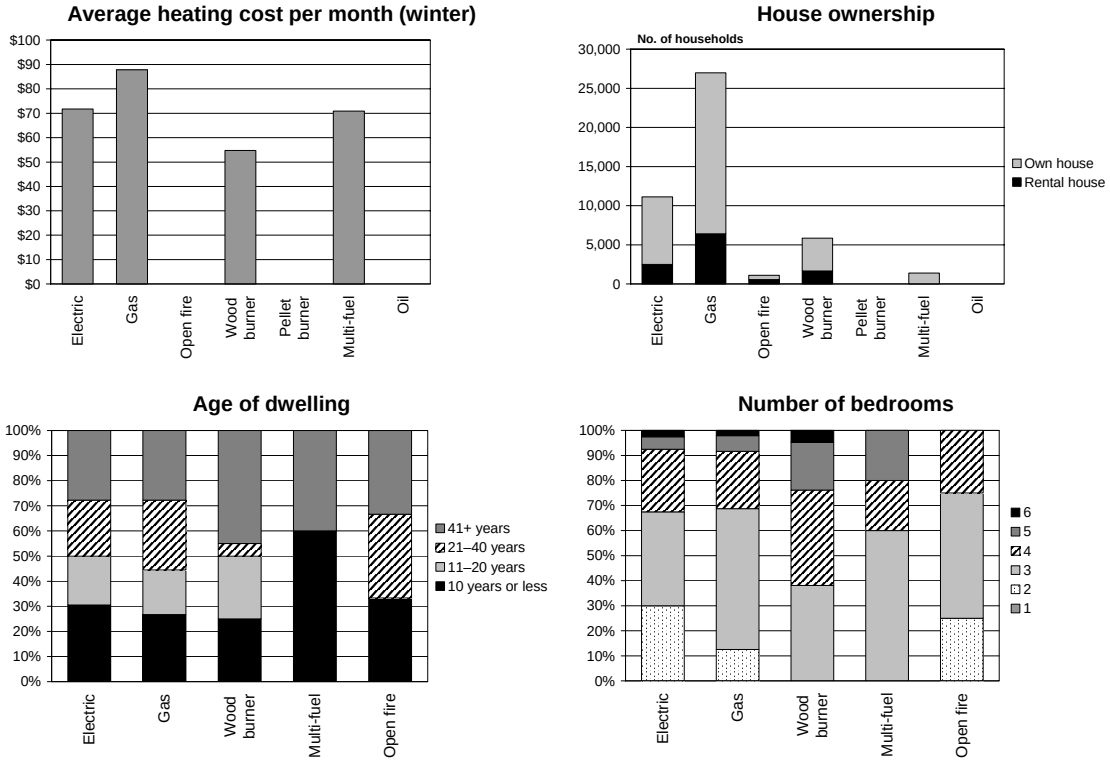


**Figure 28.3: Proportions of fuel obtained free of charge versus bought, Hamilton**

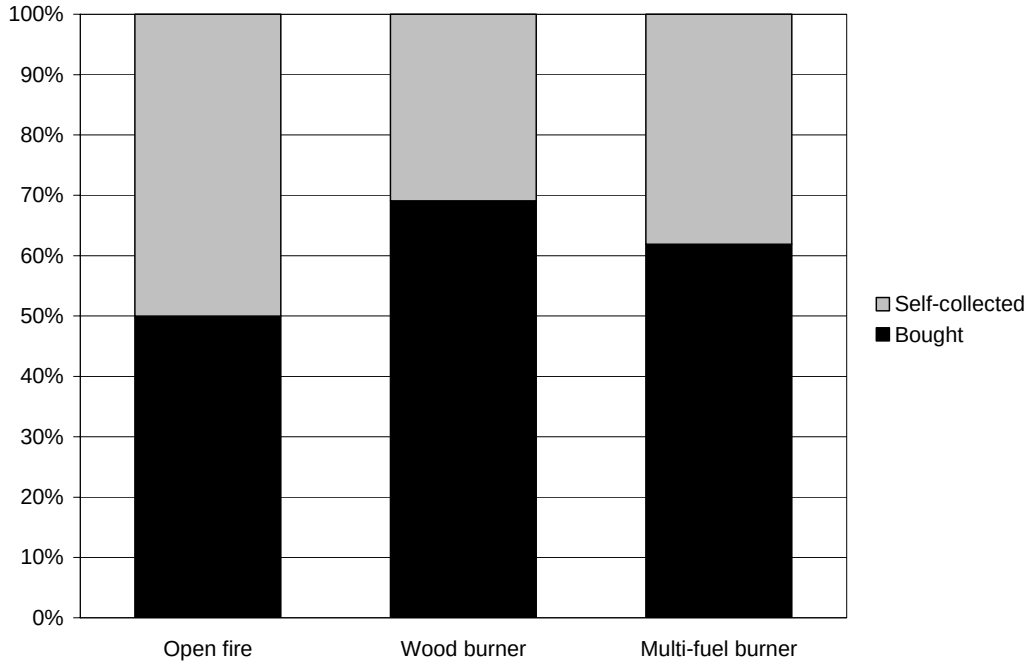

**Table 28.6: Type of electric heating, Hamilton**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 278 | 2226 | 3616 | 835 | 3616 | 1113 | – | 278 |
| Percent | 3% | 22% | 36% | 8% | 36% | 11% | – | 3% |

The commonest types of electric heating used in the main living area in Hamilton houses were oil column heaters, fan heaters and radiant heaters (Table 28.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 28.7.

**Table 28.7: Home heating method, by house ownership, Hamilton**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 11,684 | 28% | 29,767 | 70% |
| Electric | 2504 | 23% | 8624 | 78% |
| Gas | 6398 | 24% | 20,586 | 76% |
| Open fire | 556 | 50% | 556 | 50% |
| Wood burner | 1669 | 29% | 4173 | 71% |
| Pellet burner | – | – | – | – |
| Multi-fuel | 0 | 0% | 1391 | 100% |
| Oil | – | – | – | – |

Household insulation types and heating methods are shown in Tables 28.8 and 28.9. Around 75% of houses had ceiling insulation and around 55% had wall insulation. Around 8% of houses had at least four types of insulation.

Table 28.10 shows home heating method, by household income. The overall non-response rate was around 26%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 28.8: House insulation summary statistics, Hamilton**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 31,714 | 75% | No insulation | 12% |
| Under floor | 8624 | 20% | 1 type* | 24% |
| Wall | 23,090 | 55% | 2 types | 27% |
| Cylinder wrap | 7233 | 17% | 3 types | 20% |
| Double glazing | 3616 | 9% | 4 types | 5% |
| None | 5007 | 12% | 5 types | 3% |
| Don't know | 3616 | 9% | Don't know | 9% |
| Other | 278 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 28.9: Degree of house insulation, by heating method, Hamilton**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 23% | 28% | 19% | 40% | 0% |
| 2 types | 23% | 29% | 14% | 40% | 75% |
| 3 types | 28% | 16% | 29% | 20% | 0% |
| 4 types | 5% | 5% | 10% | 0% | 25% |
| 5 types | 3% | 3% | 10% | 0% | 0% |
| None or don't know | 20% | 19% | 19% | 0% | 0% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 28.10: Home heating method, by household income, Hamilton**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 18% | 32% | 19% | 40% | 0% |
| Less than $20,000 | 23% | 7% | 0% | 0% | 25% |
| $20,000 to $30,000 | 15% | 12% | 14% | 0% | 50% |
| $30,000 to $40,000 | 8% | 7% | 0% | 0% | 0% |
| $40,000 to $50,000 | 20% | 7% | 24% | 20% | 0% |
| $50,000 to $70,000 | 8% | 15% | 14% | 0% | 0% |
| $70,000 to $100,000 | 5% | 10% | 14% | 0% | 0% |
| More than $100,000 | 5% | 8% | 14% | 40% | 25% |

Tables 28.11 and 28.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 28.11: Home heating method, by age of dwelling, Hamilton**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 28% | 25% | 24% | 60% | 25% |
| 11–20 years | 18% | 16% | 24% | 0% | 0% |
| 21–40 years | 20% | 26% | 5% | 0% | 25% |
| 41+ years | 25% | 26% | 43% | 40% | 25% |

**Table 28.12: Home heating method, by number of bedrooms, Hamilton**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 0% | 0% | 0% | 0% | 0% |
| 2 | 30% | 12% | 0% | 0% | 25% |
| 3 | 38% | 56% | 38% | 60% | 50% |
| 4 | 25% | 23% | 38% | 20% | 25% |
| 5 | 5% | 6% | 19% | 20% | 0% |
| 6 | 3% | 2% | 5% | 0% | 0% |

# 29 Wainuiomata

A telephone survey of domestic heating methods and fuels for Wainuiomata was carried out by Digipoll in March 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Glendale, Parkway, Fernlea, Arakura, Homedale West and Homedale East.

Survey details are shown in Table 29.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[60] The latter suggest a population decrease for Wainuiomata of 1% by 2021.[61]

**Table 29.1: Summary survey data, Wainuiomata**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Wainuiomata | 5464 | 150 | 7.9% |

## 29.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Wainuiomata. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Wainuiomata, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Wainuiomata largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 29.2 and 29.3 show domestic heating methods and fuels used for main living areas in Wainuiomata houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Wainuiomata were electricity (41%) and gas (59%). Many households used more than one method of heating in their main living area.

[60] New Zealand Statistics 2004, www.stats.govt.nz

[61] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 29.2: Domestic home heating methods and fuels, Wainuiomata**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 41% | 2222 | – | – |
| Total gas | 59% | 3242 | 2 | 4% |
| Flued gas | 35% | 1937 | – | – |
| Unflued gas | 24% | 1305 | – | – |
| Oil | 0% | 0 | – | – |
| Open fire | 2% | 109 | – | – |
| Open fire: wood | 2% | 109 | 3 | 7% |
| Open fire: coal | 1% | 36 | 0 | 1% |
| Total wood burner | 33% | 1821 | 37 | 77% |
| Pre-1994 wood burner | 15% | 809 | 21 | 44% |
| 1994–99 wood burner | 7% | 405 | 7 | 15% |
| Post-1999 wood burner | 11% | 607 | 8 | 17% |
| Multi-fuel burners | 5% | 291 | – | – |
| Multi-fuel burners: wood | 5% | 291 | 6 | 11% |
| Multi-fuel burners: coal | 1% | 73 | 0 | 1% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 41% | 2222 | 46 | 95% |
| Total coal | 2% | 109 | 1 | 1% |
| Total | | 5464 | 49 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Only a third of households used wood burners to heat their main living area. A small proportion of these used their wood burners year round (Table 29.3). The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 29.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 29.3: Monthly variations in heating behaviour and fuel use, Wainuiomata**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 1% | 33% | 75% | 88% | 96% | 86% | 67% | 33% | 16% | 7% |
| Open fire | 0% | 0% | 0% | 67% | 67% | 67% | 100% | 67% | 33% | 33% | 0% | 0% |
| Wood burner | 2% | 2% | 4% | 28% | 64% | 76% | 90% | 80% | 52% | 22% | 8% | 8% |
| Multi-fuel | 0% | 0% | 0% | 0% | 75% | 75% | 100% | 75% | 63% | 13% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 5 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 4 |
| Open fire | – | – | – | 2 | 3 | 4 | 6 | 7 | 7 | 4 | – | – |
| Wood burner | 2 | 2 | 2 | 4 | 5 | 6 | 6 | 6 | 5 | 5 | 6 | 4 |
| Multi-fuel | – | – | – | – | 4 | 5 | 5 | 4 | 3 | 7 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 0.5 | 1.5 | 1.6 | 1.8 | 1.9 | 0.8 | 0.3 | 0.1 | 0.0 |
| Open fire: wood | – | – | – | 0.6 | 1.0 | 1.4 | 3.3 | 2.5 | 0.0 | 0.0 | – | – |
| Open fire: coal | – | – | – | 0.0 | 0.1 | 0.1 | 0.3 | 0.3 | 0.0 | 0.0 | – | – |
| Wood burner | 0.2 | 0.2 | 0.5 | 8.9 | 24.2 | 32.5 | 37.3 | 35.7 | 20.4 | 9.4 | 1.7 | 2.4 |
| Multi-fuel: wood | – | – | – | – | 3.5 | 4.6 | 5.5 | 3.0 | 4.5 | 2.8 | – | – |
| Multi-fuel: coal | – | – | – | – | 0.2 | 0.4 | 0.4 | 0.2 | 0.1 | 0.0 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | – | 0.2 | 0.5 | 0.5 | 0.6 | 0.6 | 0.2 | 0.1 | 0.0 | 0.0 |
| Open fire: wood | – | – | – | 5.4 | 9.5 | 13.1 | 29.9 | 23.1 | 0.0 | 0.0 | – | – |
| Open fire: coal | – | – | – | 0.0 | 2.6 | 3.9 | 9.0 | 9.0 | 0.0 | 0.0 | – | – |
| Wood burner | 0.1 | 0.1 | 0.3 | 4.9 | 13.3 | 17.9 | 20.5 | 19.6 | 11.2 | 5.2 | 0.9 | 1.3 |
| Multi-fuel: wood | – | – | – | – | 12.1 | 15.7 | 18.9 | 10.4 | 15.5 | 9.5 | – | – |
| Multi-fuel: coal | – | – | – | – | 2.6 | 5.1 | 5.1 | 2.6 | 1.3 | 0.0 | – | – |

**Table 29.4: Estimated daily fuel use, by season, Wainuiomata**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | – |
| Open fire: wood | 38 | 19 |
| Open fire: coal | 9 | – |
| Wood burner | 31 | 20 |
| Multi-fuel: wood | 23 | 24 |
| Multi-fuel: coal | 18 | 5 |

# 29.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Wainuiomata are presented in this section.

Figure 29.1 shows that the proportion of households using gas systems that are properly flued in Wainuiomata is around 60%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 29.5. Data were not available for open fire or multi-fuel burners because of the small number of respondents in these categories.

Figure 29.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Wainuiomata. Around 25% of the respondents in Wainuiomata were living in rental accommodation.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 29.3 shows that just over 50% of the wood used on solid fuel burners in Wainuiomata is self-collected.

**Figure 29.1: Distribution of flued versus unflued gas heating and age of wood burner, Wainuiomata**

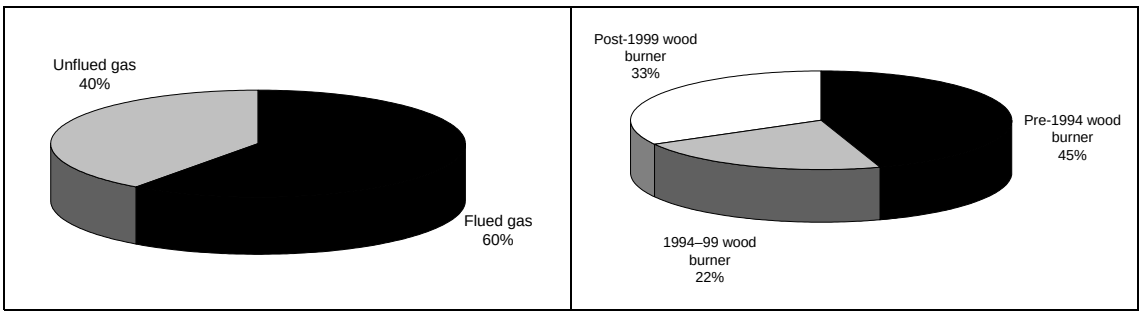


**Table 29.5: Average monthly heating costs (winter), Wainuiomata**

| | Winter month cost |
|---|---|
| Electric | $107 |
| Gas | $84 |
| Wood burner | $80 |

**Figure 29.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Wainuiomata**

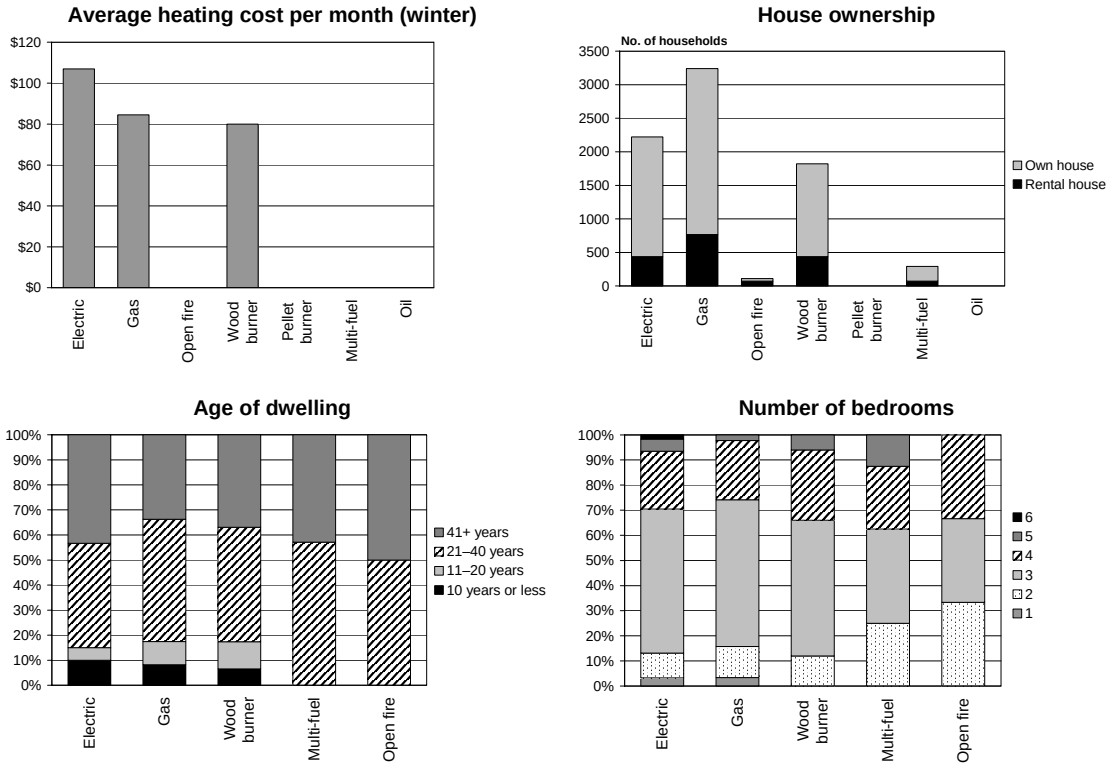


**Figure 29.3: Proportions of fuel obtained free of charge versus bought, Wainuiomata**

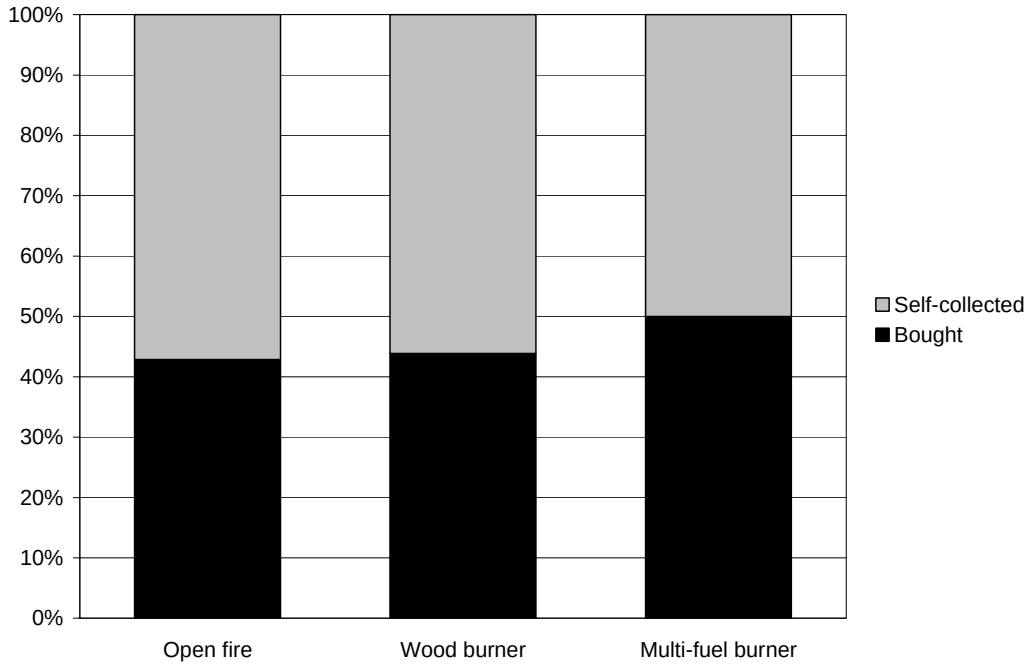

**Table 29.6: Type of electric heating, Wainuiomata**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 73 | 364 | 911 | 219 | 801 | 109 | – | 255 |
| Percent | 3% | 17% | 42% | 10% | 37% | 5% | – | 12% |

The commonest types of electric heater used in the main living area in Wainuiomata houses were oil column heaters and fan heaters (Table 29.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 29.7.

**Table 29.7: Home heating method, by house ownership, Wainuiomata**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 1348 | 25% | 4080 | 75% |
| Electric | 437 | 20% | 1785 | 80% |
| Gas | 765 | 24% | 2477 | 76% |
| Open fire | 73 | 67% | 36 | 33% |
| Wood burner | 437 | 24% | 1384 | 76% |
| Multi-fuel | 73 | 25% | 219 | 75% |

Household insulation types and heating methods are shown in Tables 29.8 and 29.9. Around 79% of houses had ceiling insulation but only 44% had wall insulation. Around 23% of houses had at least three types of insulation.

Table 29.10 shows home heating method, by household income. The overall non-response rate was around 23%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 29.8: House insulation summary statistics, Wainuiomata**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 4298 | 79% | No insulation | 11% |
| Under floor | 1093 | 20% | 1 type* | 31% |
| Wall | 2404 | 44% | 2 types | 31% |
| Cylinder wrap | 1056 | 19% | 3 types | 19% |
| Double glazing | 255 | 5% | 4 types | 2% |
| None | 619 | 11% | 5 types | 2% |
| Don't know | 219 | 4% | Don't know | 4% |
| Other | 36 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 29.9: Degree of house insulation, by heating method, Wainuiomata**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 30% | 30% | 26% | 38% | 0% |
| 2 types | 31% | 31% | 36% | 25% | 0% |
| 3 types | 18% | 18% | 18% | 0% | 0% |
| 4 types | 3% | 2% | 2% | 0% | 0% |
| 5 types | 2% | 1% | 4% | 0% | 0% |
| None or don't know | 16% | 17% | 14% | 38% | 100% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 29.10: Home heating method, by household income, Wainuiomata**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 20% | 22% | 22% | 13% | 33% |
| Less than $20,000 | 16% | 18% | 6% | 13% | 33% |
| $20,000 to $30,000 | 7% | 7% | 8% | 0% | 0% |
| $30,000 to $40,000 | 16% | 15% | 16% | 38% | 0% |
| $40,000 to $50,000 | 7% | 9% | 10% | 25% | 33% |
| $50,000 to $70,000 | 21% | 18% | 16% | 0% | 0% |
| $70,000 to $100,000 | 2% | 10% | 14% | 0% | 0% |
| More than $100,000 | 11% | 1% | 8% | 13% | 0% |

Tables 29.11 and 29.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 29.11: Home heating method, by age of dwelling, Wainuiomata**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 10% | 8% | 6% | 0% | 0% |
| 11–20 years | 5% | 9% | 10% | 0% | 0% |
| 21–40 years | 41% | 47% | 42% | 50% | 33% |
| 41+ years | 43% | 33% | 34% | 38% | 33% |

**Table 29.12: Home heating method, by number of bedrooms, Wainuiomata**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 3% | 3% | 0% | 0% | 0% |
| 2 | 10% | 12% | 12% | 25% | 33% |
| 3 | 57% | 58% | 54% | 38% | 33% |
| 4 | 23% | 24% | 28% | 25% | 33% |
| 5 | 5% | 2% | 6% | 13% | 0% |
| 6 | 2% | 0% | 0% | 0% | 0% |

# 30 Rotorua

A telephone survey of domestic heating methods and fuels for Rotorua was carried out by Digipoll in March 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Ngongotaha South, Poets Corner, Ngapuna, Owhata South, Lynmore, Owhata West, Selwyn Heights, Western Heights, Fairy Springs, Pukehangi North, Pukehangi South, Mangakakahi, Sunnybrook, Fordlands, Utuhina, Pomare, Hillcrest, Springfield, Kawaha Point, Koutu, Ohinemutu, Kuirau, Victoria, Glenholme East, Glenholme West, Fenton, and Whaka.

Survey details are shown in Table 30.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[62] The latter suggest a population increase for Rotorua of 8% by 2021.[63]

**Table 30.1: Summary survey data, Rotorua**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Rotorua | 17,196 | 151 | 7.9% |

## 30.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Rotorua. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Rotorua, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Rotorua largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 30.2 and 30.3 show domestic heating methods and fuels used for the main living areas in Rotorua houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Rotorua were gas (44%), electricity (35%) and wood burners (34%). Many households used more than one method of heating in their main living area.

[62] New Zealand Statistics 2004, www.stats.govt.nz

[63] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 30.2: Domestic home heating methods and fuels, Rotorua**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 35% | 6036 | – | – |
| Total gas | 44% | 7630 | 5 | 3% |
| Flued gas | 24% | 4184 | – | – |
| Unflued gas | 20% | 3446 | – | – |
| Oil | 1% | 228 | – | – |
| Open fire | 5% | 797 | – | – |
| Open fire: wood | 5% | 797 | 4 | 3% |
| Open fire: coal | 1% | 114 | – | – |
| Total wood burner | 34% | 5808 | 95 | 60% |
| Pre-1994 wood burner | 15% | 2640 | 47 | 30% |
| 1994–99 wood burner | 12% | 1980 | 34 | 21% |
| Post-1999 wood burner | 7% | 1188 | 14 | 9% |
| Multi-fuel burners | 7% | 1253 | – | – |
| Multi-fuel burners: wood | 7% | 1253 | 54 | 34% |
| Multi-fuel burners: coal | 1% | 114 | 0 | 0% |
| Pellet burners | 1% | 228 | 1 | 0% |
| Total wood | 46% | 7858 | 154 | 97% |
| Total coal | 1% | 228 | 0 | 0% |
| Total | | 17,196 | 159 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

A small proportion of households in Rotorua indicated that they used wood burners for home heating during November and December (Table 30.3). The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 30.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 30.3: Monthly variations in heating behaviour and fuel use, Rotorua**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 2% | 3% | 33% | 67% | 86% | 94% | 87% | 60% | 21% | 5% | 2% |
| Open fire | 0% | 0% | 0% | 0% | 50% | 67% | 100% | 100% | 33% | 17% | 0% | 0% |
| Wood burner | 0% | 0% | 2% | 20% | 57% | 80% | 84% | 78% | 61% | 27% | 8% | 4% |
| Multi-fuel | 0% | 0% | 11% | 22% | 44% | 89% | 78% | 67% | 33% | 11% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | 7 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 4 | 4 | 3 |
| Open fire | – | – | – | – | 2 | 3 | 3 | 3 | 2 | 1 | – | – |
| Wood burner | – | – | 7 | 6 | 6 | 7 | 6 | 6 | 6 | 6 | 6 | 7 |
| Multi-fuel | – | – | 3 | 5 | 6 | 6 | 6 | 6 | 6 | – | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | 0.0 | 0.0 | 1.2 | 3.3 | 4.1 | 4.7 | 4.2 | 2.4 | 0.8 | 0.4 | 0.0 |
| Open fire: wood | – | – | – | – | 4.0 | 4.0 | 4.4 | 4.4 | 3.9 | 1.3 | – | – |
| Wood burner | – | – | 0.0 | 7.7 | 46.0 | 83.5 | 94.7 | 76.0 | 67.9 | 47.1 | 15.5 | 8.4 |
| Multi-fuel: wood | – | – | 0.0 | 0.0 | 41.7 | 54.4 | 54.4 | 54.4 | 0.0 | – | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | 0.0 | 0.0 | 0.2 | 0.4 | 0.5 | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 | 0.0 |
| Open fire: wood | – | – | – | – | 5.1 | 5.1 | 5.5 | 5.5 | 4.9 | 1.6 | – | – |
| Wood burner | – | – | 0.0 | 1.3 | 7.9 | 14.4 | 16.3 | 13.1 | 11.7 | 8.1 | 2.7 | 1.4 |
| Multi-fuel: wood | – | – | 0.0 | 0.0 | 33.3 | 43.4 | 43.4 | 43.4 | 0.0 | – | – | – |

**Table 30.4: Estimated daily fuel use, by season, Rotorua**

| | **Winter fuel use kg/day** | **Non-winter fuel use kg/day** |
|---|---|---|
| Gas | 1 | 2 |
| Open fire: wood | 23 | 11 |
| Wood burner | 30 | 23 |
| Multi-fuel: wood | 57 | – |

## 30.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Rotorua are presented in this section.

Figure 30.1 shows that the proportion of households using gas systems that are properly flued in Rotorua is around 45%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 30.5. No results were available for open fires, multi-fuel burners or pellet burners because of the small number of respondents for these categories.

Figure 30.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Rotorua. Around 23% of the respondents in Rotorua were living in rental accommodation.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 30.3 shows that around 50% of the wood used on solid fuel burners in Rotorua is self-collected.

**Figure 30.1: Distribution of flued versus unflued gas heating and age of wood burner, Rotorua**

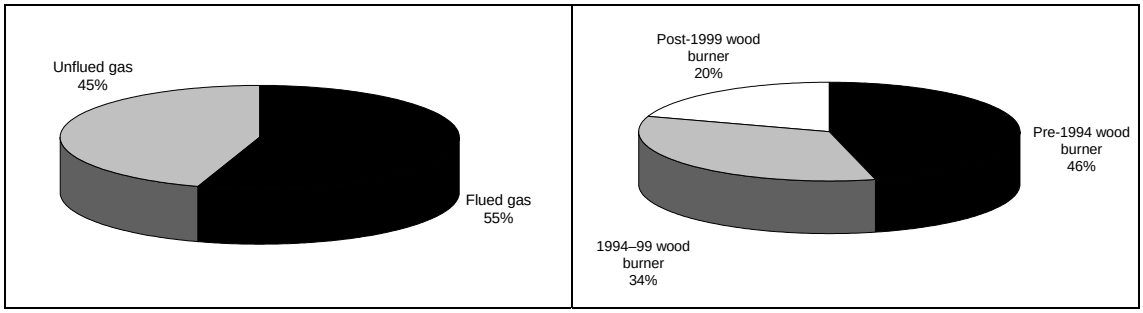


**Table 30.5: Average monthly heating costs (winter), Rotorua**

| | Winter month cost |
|---|---|
| Electric | $90 |
| Gas | $75 |
| Wood burner | $96 |

**Figure 30.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Rotorua**

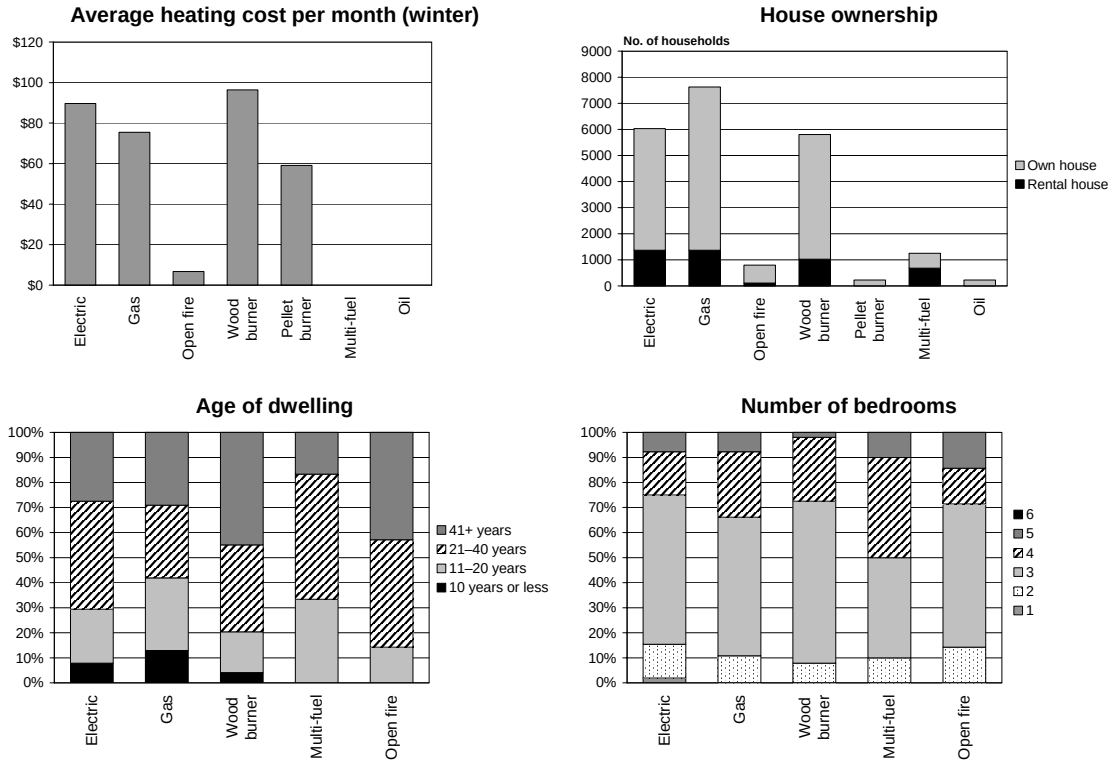


**Figure 30.3: Proportions of fuel obtained free of charge versus bought, Rotorua**

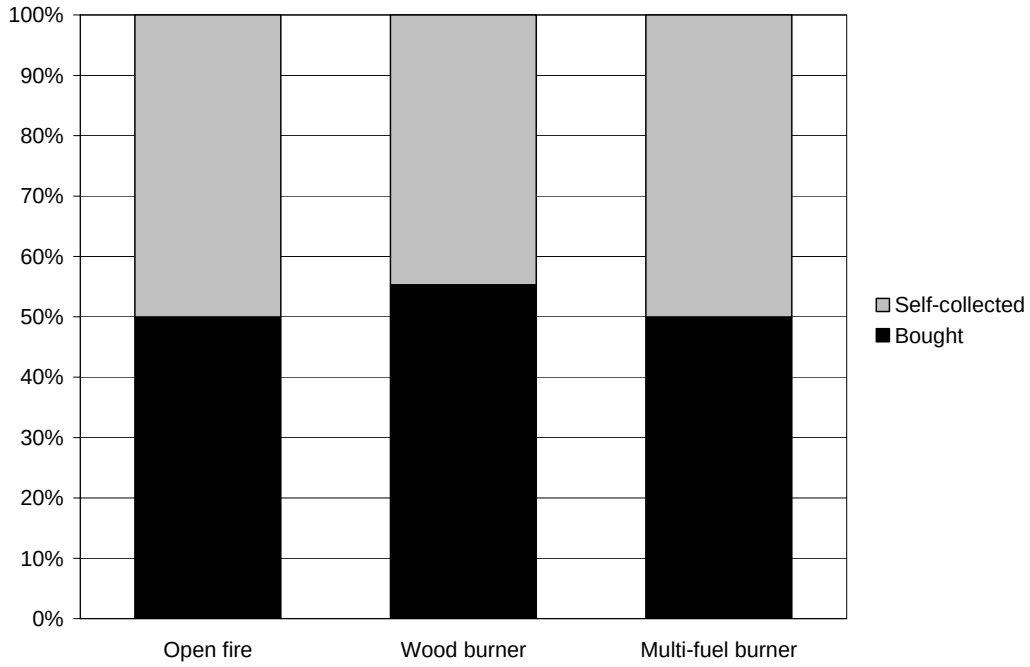

**Table 30.6: Type of electric heating, Rotorua**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 569 | 797 | 1822 | 228 | 1480 | 797 | – | 456 |
| Percent | 10% | 14% | 31% | 4% | 25% | 14% | – | 8% |

The commonest types of electric heating used in the main living area in Rotorua houses were oil column heaters and fan heaters (Table 30.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 30.7.

**Table 30.7: Home heating method, by house ownership, Rotorua**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 3872 | 23% | 12,755 | 74% |
| Electric | 1367 | 23% | 4669 | 77% |
| Gas | 1367 | 18% | 6263 | 82% |
| Open fire | 114 | 14% | 683 | 86% |
| Wood burner | 1025 | 18% | 4783 | 82% |
| Pellet burner | 0 | 0% | 228 | 100% |
| Multi-fuel | 683 | 55% | 569 | 45% |
| Oil | 0 | 0% | 228 | 100% |

Household insulation types and heating methods are shown in Tables 30.8 and 30.9. Around 73% of households had ceiling insulation but only 47% had wall insulation. Only 23% of houses had at least three types of insulation.

Table 30.10 shows home heating method, by household income. The overall non-response rate was around 25%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 30.8: House insulation summary statistics, Rotorua**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 12,527 | 73% | No insulation | 11% |
| Under floor | 3303 | 19% | 1 type* | 29% |
| Wall | 8085 | 47% | 2 types | 30% |
| Cylinder wrap | 3303 | 19% | 3 types | 14% |
| Double glazing | 1936 | 11% | 4 types | 7% |
| None | 1822 | 11% | 5 types | 2% |
| Don't know | 1253 | 7% | Don't know | 7% |
| Other | 228 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double-glazing; two types are any two of these, etc.

**Table 30.9: Degree of house insulation, by heating method, Rotorua**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 34% | 27% | 29% | 27% | 43% |
| 2 types | 30% | 30% | 31% | 36% | 29% |
| 3 types | 15% | 13% | 14% | 9% | 0% |
| 4 types | 4% | 6% | 10% | 9% | 14% |
| 5 types | 2% | 3% | 0% | 0% | 0% |
| None or don't know | 15% | 21% | 16% | 18% | 14% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 30.10: Home heating method, by household income, Rotorua**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 21% | 22% | 18% | 18% | 57% |
| Less than $20,000 | 21% | 18% | 10% | 9% | 14% |
| $20,000 to $30,000 | 8% | 9% | 12% | 9% | 0% |
| $30,000 to $40,000 | 9% | 7% | 16% | 27% | 0% |
| $40,000 to $50,000 | 9% | 6% | 16% | 0% | 0% |
| $50,000 to $70,000 | 13% | 9% | 10% | 9% | 0% |
| $70,000 to $100,000 | 11% | 19% | 16% | 27% | 0% |
| More than $100,000 | 8% | 9% | 4% | 0% | 29% |

Tables 30.11 and 30.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 30.11: Home heating method, by age of dwelling, Rotorua**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 8% | 12% | 4% | 0% | 0% |
| 11–20 years | 21% | 27% | 16% | 18% | 14% |
| 21–40 years | 42% | 27% | 33% | 27% | 43% |
| 41+ years | 26% | 27% | 43% | 9% | 43% |

**Table 30.12: Home heating method, by number of bedrooms, Rotorua**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 2% | 0% | 0% | 0% | 0% |
| 2 | 13% | 10% | 8% | 9% | 14% |
| 3 | 58% | 54% | 65% | 36% | 57% |
| 4 | 17% | 25% | 25% | 36% | 14% |
| 5 | 8% | 7% | 2% | 9% | 14% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 31 Napier

A telephone survey of domestic heating methods and fuels for Napier was carried out by Digipoll in March 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Westshore, Ahuriri, Onekawa Central, Onekawa West, Onekawa South, Marewa, Maraenui, Hospital Hill, Bluff Hill, Nelson Park, Mclean Park, Tamatea North, Tamatea South, Greenmeadows, Taradale North, Taradale South and Pirimai.

Survey details are shown in Table 31.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[64] The latter suggest no change in the population of Napier between 2001 and 2021.[65]

**Table 31.1: Summary survey data, Napier**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Napier | 19,521 | 150 | 8.0% |

## 31.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Napier. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Napier, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Napier largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 31.2 and 31.3 show domestic heating methods and fuels used for the main living areas in Napier houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Napier houses were gas (53%), electricity (42%) and wood burners (36%). Many households used more than one method of heating in their main living area. Coal use in Napier is minimal comprising, less than 1% of total fuel use by weight.

[64] New Zealand Statistics 2004, www.stats.govt.nz

[65] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 31.2: Domestic home heating methods and fuels, Napier**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 42% | 8,199 | – | – |
| Total gas | 53% | 10,281 | 8 | 5% |
| Flued gas | 20% | 3,855 | – | – |
| Unflued gas | 33% | 6,426 | – | – |
| Oil | 0% | 0 | – | – |
| Open fire | 11% | 2,082 | – | – |
| Open fire: wood | 9% | 1,822 | 19 | 11% |
| Open fire: coal | 0% | 0 | – | – |
| Total wood burner | 36% | 7,028 | 127 | 73% |
| Pre-1994 wood burner | 19% | 3,720 | 56 | 32% |
| 1994–99 wood burner | 11% | 2,067 | 55 | 32% |
| Post-1999 wood burner | 6% | 1,240 | 15 | 9% |
| Multi-fuel burners | 6% | 1,171 | – | – |
| Multi-fuel burners: wood | 6% | 1,171 | 18 | 11% |
| Multi-fuel burners: coal | 1% | 130 | 1 | 1% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 51% | 10,021 | 164 | 95% |
| Total coal | 1% | 130 | 1 | 1% |
| Total | | 19,521 | 173 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

Fuel use during the summer months is not common in Napier, with only a small proportion of households using multi-fuel burners to heat their homes during the summer months (Table 31.3). The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 31.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

**Table 31.3: Monthly variations in heating behaviour and fuel use, Napier**

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 6% | 23% | 59% | 90% | 97% | 94% | 54% | 19% | 7% | 0% |
| Open fire | 0% | 0% | 0% | 0% | 31% | 85% | 92% | 77% | 38% | 0% | 0% | 8% |
| Wood burner | 0% | 0% | 0% | 15% | 46% | 81% | 91% | 85% | 43% | 13% | 2% | 0% |
| Multi-fuel | 13% | 13% | 13% | 13% | 63% | 75% | 113% | 88% | 75% | 25% | 13% | 13% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 3 | 4 | 5 | 6 | 6 | 6 | 6 | 5 | 4 | – |
| Open fire | – | – | – | – | 4 | 4 | 4 | 4 | 3 | – | – | 1 |
| Wood burner | – | – | – | 4 | 6 | 6 | 6 | 6 | 5 | 5 | 2 | – |
| Multi-fuel | 3 | 2 | 3 | 2 | 6 | 6 | 6 | 6 | 5 | 4 | 3 | 2 |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.2 | 2.1 | 4.6 | 6.5 | 8.2 | 7.4 | 2.4 | 1.4 | 1.0 | – |
| Open fire: wood | – | – | – | 0.0 | 5.2 | 11.7 | 18.7 | 16.4 | 12.9 | 0.0 | 0.0 | 1.0 |
| Wood burner | – | – | – | 34.0 | 85.9 | 119.0 | 126.6 | 118.0 | 93.2 | 42.8 | 0.0 | – |
| Multi-fuel: wood | 2.4 | 1.6 | 2.4 | 1.6 | 6.0 | 17.0 | 18.4 | 17.0 | 13.9 | 7.6 | 2.4 | 1.6 |
| Multi-fuel: coal | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.0 | 0.0 | 0.0 |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.2 | 0.4 | 0.6 | 0.8 | 0.7 | 0.2 | 0.1 | 0.1 | – |
| Open fire: wood | – | – | – | 0.0 | 2.9 | 6.4 | 10.3 | 9.0 | 7.1 | 0.0 | 0.0 | 0.5 |
| Wood burner | – | – | – | 4.8 | 12.2 | 16.9 | 18.0 | 16.8 | 13.3 | 6.1 | 0.0 | – |
| Multi-fuel: wood | 2.0 | 1.4 | 2.0 | 1.4 | 5.2 | 14.5 | 15.7 | 14.5 | 11.9 | 6.4 | 2.0 | 1.4 |
| Multi-fuel: coal | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 0.0 | 0.0 |

**Table 31.4: Estimated daily fuel use, by season, Napier**

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | 2 |
| Open fire: wood | 20 | 16 |
| Wood burner | 27 | 25 |
| Multi-fuel: wood | 21 | 17 |
| Multi-fuel: coal | 9 | 9 |

# 31.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Napier are presented in this section.

Figure 31.1 shows that the proportion of households using gas systems that are properly flued in Napier is around 38%. This compares to a national average of 24%.

The amount spent on heating for a winter month, by heating method, is shown in Table 31.5. In Napier, households typically spent on average $60–$90 per month.

Figure 31.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Napier. Around 25% of the respondents in Napier were living in rental accommodation.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 31.3 shows that around 50% of the wood used on solid fuel burners in Napier is self-collected.

**Figure 31.1: Distribution of flued versus unflued gas heating and age of wood burner, Napier**

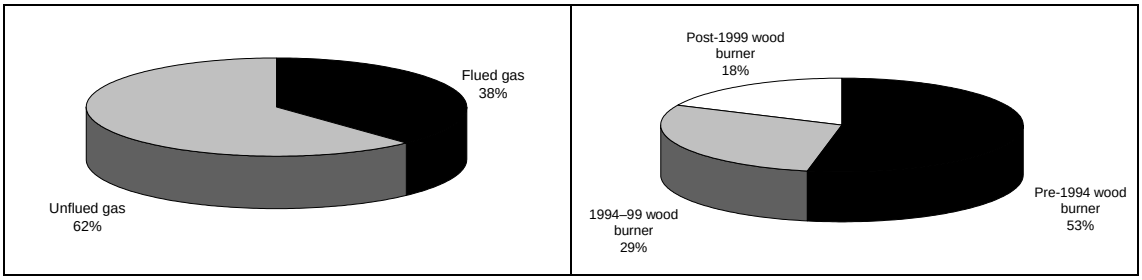


**Table 31.5: Average monthly heating costs (winter), Napier**

| | Winter month cost |
|---|---|
| Electric | $89 |
| Gas | $68 |
| Wood burner | $58 |
| Multi-fuel | $61 |

**Figure 31.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Napier**

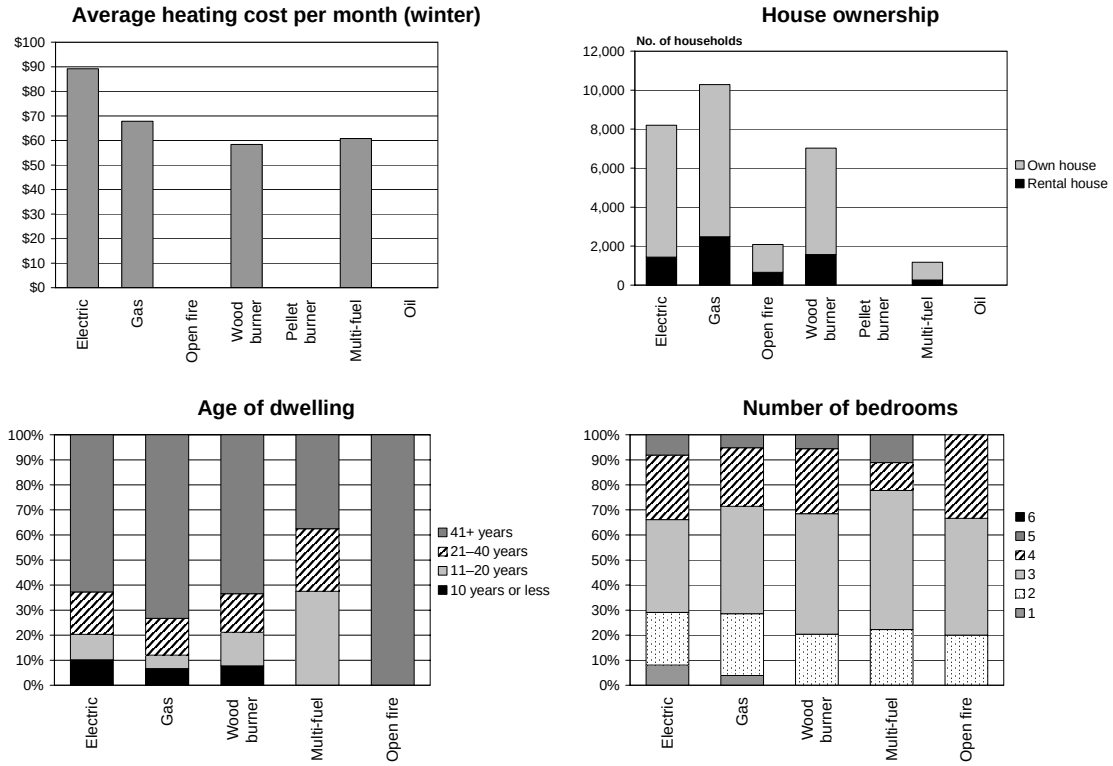


**Figure 31.3: Proportions of fuel obtained free of charge versus bought, Napier**

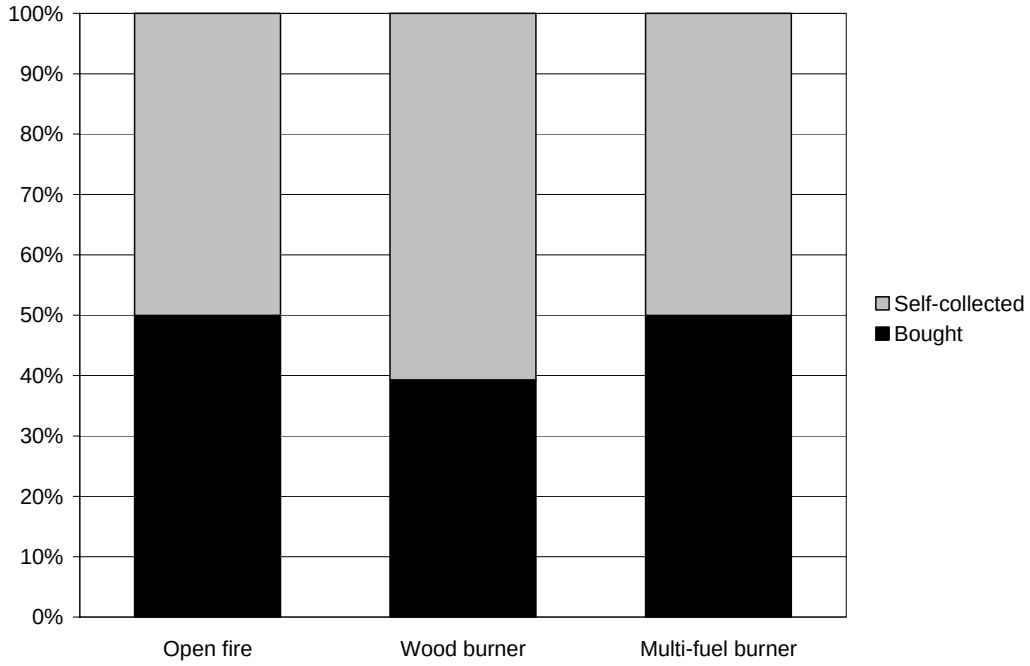

**Table 31.6: Type of electric heating, Napier**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | 390 | 521 | 2993 | 651 | 2343 | 1041 | – | 1171 |
| Percent | 5% | 7% | 38% | 8% | 30% | 13% | – | 15% |

The commonest types of electric heating used in the main living area in Napier houses were oil column heaters and fan heaters (Table 31.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 31.7.

**Table 31.7: Home heating method, by house ownership, Napier**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 4815 | 25% | 14,315 | 73% |
| Electric | 1432 | 17% | 6767 | 83% |
| Gas | 2473 | 24% | 7808 | 76% |
| Open fire | 651 | 31% | 1432 | 69% |
| Wood burner | 1562 | 22% | 5466 | 78% |
| Multi-fuel | 260 | 22% | 911 | 78% |

Household insulation types and heating methods are shown in Tables 31.8 and 31.9. Around two-thirds of houses had ceiling insulation but only 43% had wall insulation. Only 20% of houses had at least three types of insulation.

Table 31.10 shows home heating method, by household income. The overall non-response rate was around 21%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 31.8: House insulation summary statistics, Napier**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 12,884 | 66% | No insulation | 15% |
| Under floor | 3904 | 20% | 1 type* | 31% |
| Wall | 8329 | 43% | 2 types | 25% |
| Cylinder wrap | 3904 | 20% | 3 types | 12% |
| Double glazing | 521 | 3% | 4 types | 7% |
| None | 2993 | 15% | 5 types | 1% |
| Don't know | 1562 | 8% | Don't know | 8% |
| Other | 390 | 2% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 31.9: Degree of house insulation, by heating method, Napier**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 29% | 29% | 39% | 44% | 31% |
| 2 types | 25% | 27% | 22% | 33% | 13% |
| 3 types | 13% | 11% | 13% | 11% | 6% |
| 4 types | 10% | 4% | 7% | 0% | 0% |
| 5 types | 0% | 1% | 2% | 11% | 0% |
| None or don't know | 24% | 28% | 17% | 0% | 50% |
| Total | 100% | 100% | 100% | 100% | 100% |

* Note: columns may not sum exactly to 100 due to rounding error.

**Table 31.10: Home heating method, by household income, Napier**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 22% | 16% | 19% | 11% | 6% |
| Less than $20,000 | 16% | 16% | 7% | 11% | 13% |
| $20,000 to $30,000 | 10% | 16% | 9% | 22% | 6% |
| $30,000 to $40,000 | 10% | 13% | 9% | 0% | 25% |
| $40,000 to $50,000 | 5% | 8% | 13% | 11% | 13% |
| $50,000 to $70,000 | 10% | 10% | 13% | 0% | 6% |
| $70,000 to $100,000 | 14% | 11% | 20% | 22% | 19% |
| More than $100,000 | 14% | 9% | 9% | 22% | 13% |

Tables 31.11 and 31.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 31.11: Home heating method, by age of dwelling, Napier**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 10% | 6% | 7% | 0% | 0% |
| 11–20 years | 10% | 5% | 13% | 33% | 0% |
| 21–40 years | 16% | 14% | 15% | 22% | 0% |
| 41+ years | 59% | 70% | 61% | 33% | 94% |

**Table 31.12: Home heating method, by number of bedrooms, Napier**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 8% | 4% | 0% | 0% | 0% |
| 2 | 21% | 24% | 20% | 22% | 19% |
| 3 | 37% | 42% | 48% | 56% | 44% |
| 4 | 25% | 23% | 26% | 11% | 31% |
| 5 | 8% | 5% | 6% | 11% | 0% |
| 6 | 0% | 0% | 0% | 0% | 0% |

# 32 Gisborne

A telephone survey of domestic heating methods and fuels for Gisborne was carried out by Digipoll in March 2005. This involved surveying 150 households within the 2001 census area unit (CAU) areas of Mangapapa, Te Hapara, Gisborne Airport, Whataupoko, Gisborne Central, Kaiti North, Outer Kaiti, Kaiti South, Tamarau and Riverdale.

Survey details are shown in Table 32.1. The number of households for 2004 was estimated based on 2001 census data for occupied dwellings, extrapolated for 2004 based on Statistics New Zealand population projections.[66] The latter suggest a population decrease for Gisborne of 6% by 2021.[67]

**Table 32.1: Summary survey data, Gisborne**

| Location | Households – 2004 | Sample size | Sample error |
|---|---|---|---|
| Gisborne | 10,260 | 150 | 7.9% |

## 32.1 Home heating methods and fuels

The Digipoll survey was used to collect information on home heating methods and fuels for Gisborne. These data were collected for the purpose of evaluating the impact of variations in heating methods on air quality in Gisborne, in particular the extent of change required to achieve the national environmental standard for $PM_{10}$. This section presents the results of the home heating survey for Gisborne largely in tabular form, in the expectation that these results will be of value in other assessments (eg, emission inventory studies).

Tables 32.2 and 32.3 show domestic heating methods and fuels used for the main living areas in Gisborne houses, and seasonal variations in heating behaviour. The commonest methods of heating the main living area in Gisborne were wood burners (47%) and gas (44%). Many households used more than one method of heating in their main living area.

[66] New Zealand Statistics 2004, www.stats.govt.nz

[67] High, medium and low population projections were estimated by Statistics New Zealand. The value used is the medium population projection.

**Table 32.2: Domestic home heating methods and fuels, Gisborne**

| | Households | | Winter fuel use (July) | |
|---|---|---|---|---|
| | % | Number | Tonnes/day | % |
| Electricity | 35% | 3,557 | 3 | 3% |
| Total gas | 44% | 4,514 | – | – |
| Flued gas | 17% | 1,712 | – | – |
| Unflued gas | 27% | 2,802 | – | – |
| Oil | 1% | 68 | | – |
| Open fire | 2% | 246 | | |
| Open fire: wood | 2% | 226 | 6 | 6% |
| Open fire: coal | 1% | 62 | 1 | 1% |
| Total wood burner | 47% | 4,788 | 89 | 88% |
| Pre-1994 wood burner | 25% | 2,597 | 56 | 55% |
| 1994–99 wood burner | 8% | 812 | 19 | 19% |
| Post-1999 wood burner | 13% | 1,380 | 14 | 14% |
| Multi-fuel burners | 2% | 185 | – | – |
| Multi-fuel burners: wood | 2% | 185 | 2 | 2% |
| Multi-fuel burners: coal | 1% | 62 | 1 | 1% |
| Pellet burners | 0% | 0 | – | – |
| Total wood | 51% | 5,199 | 97 | 96% |
| Total coal | 1% | 123 | 1 | 1% |
| Total | | 10,260 | 101 | |

* Note: rounding errors may occur in the proportion of burners in different age categories and in types of gas heating.

A small proportion of households used wood burners during the months of November and December, but none of the respondents heated their homes during January or February (Table 32.3). The quantities of fuel used per day during non-winter months was typically less than during the winter (Table 32.4). Data are not presented for all heating methods because there was a high non-response rate for questions relating to seasonal variations for some heating types.

### Table 32.3: Monthly variations in heating behaviour and fuel use, Gisborne

| | Percentage of houses using this method that use it each month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | 0% | 0% | 2% | 40% | 70% | 86% | 88% | 79% | 49% | 21% | 2% | 0% |
| Open fire | 0% | 0% | 9% | 36% | 82% | 91% | 91% | 100% | 73% | 27% | 0% | 0% |
| Wood burner | 0% | 0% | 0% | 26% | 66% | 90% | 93% | 83% | 46% | 14% | 3% | 3% |
| Multi-fuel | 0% | 0% | 0% | 29% | 29% | 71% | 86% | 86% | 14% | 14% | 0% | 0% |
| | **Average number of days per week house is heated (only for those heating during that month)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 2 | 5 | 5 | 6 | 6 | 6 | 5 | 4 | 6 | – |
| Open fire | – | – | 7 | 4 | 5 | 7 | 7 | 6 | 5 | 4 | – | – |
| Wood burner | – | – | – | 5 | 6 | 6 | 6 | 6 | 5 | 5 | 4 | 1 |
| Multi-fuel | – | – | – | 5 | 6 | 6 | 6 | 6 | 7 | 3 | – | – |
| | **Daily fuel use (tonnes)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.5 | 1.1 | 2.4 | 2.6 | 2.3 | 1.1 | 0.3 | 0.0 | – |
| Open fire: wood | – | – | 0.0 | 0.7 | 4.9 | 5.9 | 5.9 | 6.0 | 1.9 | 1.4 | – | – |
| Open fire: coal | – | – | 0.3 | 0.3 | 0.5 | 0.6 | 0.6 | 0.6 | 0.3 | 0.0 | – | – |
| Wood burner | – | – | – | 53.3 | 66.2 | 91.2 | 89.4 | 80.1 | 53.5 | 5.8 | 0.0 | 0.0 |
| Multi-fuel: wood | – | – | – | 0.6 | 0.4 | 2.1 | 2.1 | 2.1 | 0.0 | 0.6 | – | – |
| Multi-fuel: coal | – | – | – | 0.2 | 0.0 | 0.4 | 0.5 | 0.5 | 0.0 | 0.2 | – | – |
| | **Daily fuel use (kg) per household (for households using that method)** | | | | | | | | | | | |
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| Gas | – | – | 0.0 | 0.1 | 0.2 | 0.5 | 0.6 | 0.5 | 0.2 | 0.1 | 0.0 | – |
| Open fire: wood | – | – | 0.0 | 3.3 | 21.5 | 26.1 | 26.1 | 26.5 | 8.4 | 6.2 | – | – |
| Open fire: coal | – | – | 4.5 | 4.5 | 7.7 | 9.0 | 9.0 | 9.0 | 4.5 | 0.0 | – | – |
| Wood burner | – | – | – | 11.1 | 13.8 | 19.1 | 18.7 | 16.7 | 11.2 | 1.2 | 0.0 | 0.0 |
| Multi-fuel: wood | – | – | – | 3.3 | 2.2 | 11.1 | 11.6 | 11.6 | 0.0 | 3.3 | – | – |
| Multi-fuel: coal | – | – | – | 3.9 | 0.0 | 6.0 | 8.6 | 8.6 | 0.0 | 3.9 | – | – |

### Table 32.4: Estimated daily fuel use, by season, Gisborne

| | Winter fuel use kg/day | Non-winter fuel use kg/day |
|---|---|---|
| Gas | 1 | – |
| Open fire: wood | 29 | 8 |
| Open fire: coal | 9 | 5 |
| Wood burner | 28 | 28 |
| Multi-fuel: wood | 16 | 8 |
| Multi-fuel: coal | 18 | 9 |

## 32.2 Insulation, cost of heating, income, and house age and size

In addition to collecting data for the purpose of evaluating the impact of variations in heating methods on air quality, information was collected on a number of variables relevant to the Ministry for the Environment's Warm Homes Project. Relevant data for Gisborne are presented in this section.

Figure 32.1 shows that the proportion of households using gas systems that are properly flued in Gisborne is around 38%.

The amount spent on heating for a winter month, by heating method, is shown in Table 32.5. In Gisborne, household heating costs range on average from $54 per month for wood burners to $112 per month for electric heating.

Figure 32.2 shows the average heating costs, home ownership, age of dwelling and number of bedrooms for households in Gisborne. Around 26% of the respondents in Gisborne were living in rental accommodation.

One factor influencing the amount spent on different heating methods is the ability of households using solid fuel burners to obtain wood free of charge. Figure 32.3 shows that over 80% of the wood used on wood burners in Gisborne is self-collected.

**Figure 32.1: Distribution of flued versus unflued gas heating and age of wood burner, Gisborne**

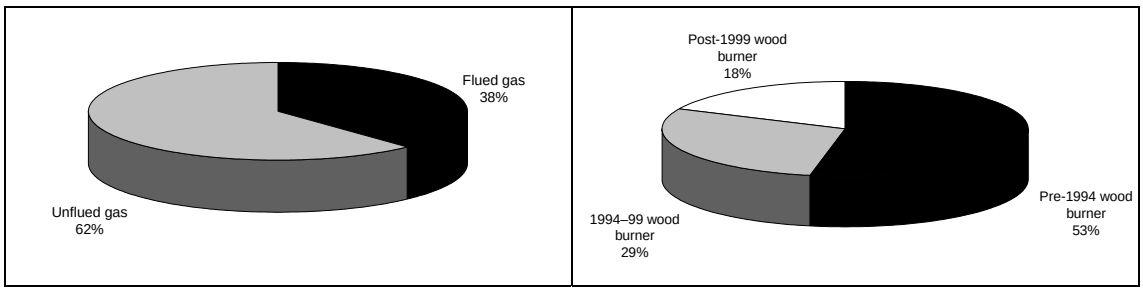


**Table 32.5: Average monthly heating costs (winter), Gisborne**

| | Winter month cost |
|---|---|
| Electric | $112 |
| Gas | $67 |
| Wood burner | $54 |

**Figure 32.2: Domestic heating method, by average monthly heating expenditure, house ownership, house age and number of bedrooms, Gisborne**

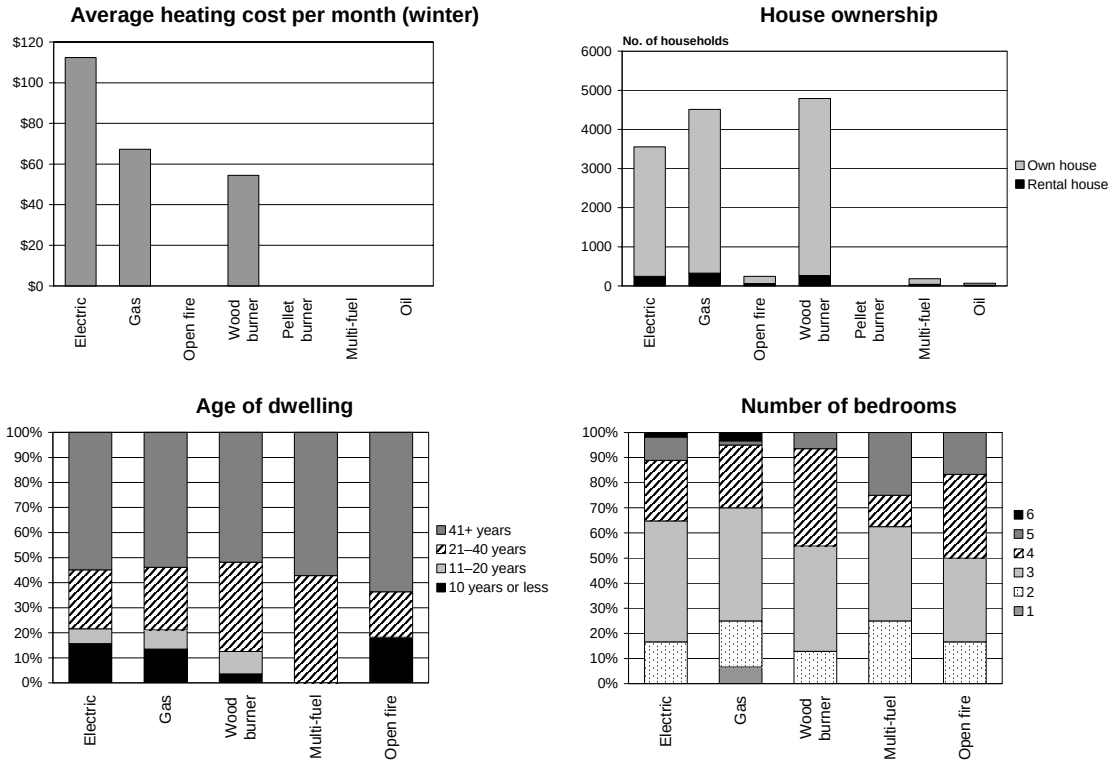


**Figure 32.3: Proportions of fuel obtained free of charge versus bought, Gisborne**

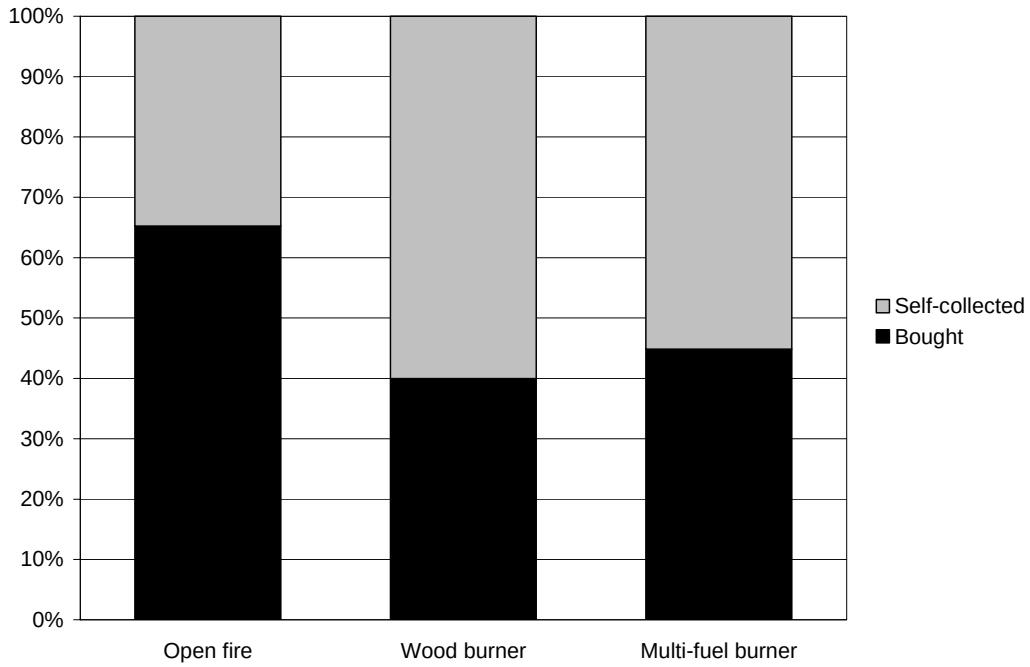

**Table 32.6: Type of electric heating, Gisborne**

| | Night store | Radiant | Portable oil column | Panel | Fan | Heat pump | Don't know/ refused | Other |
|---|---|---|---|---|---|---|---|---|
| Households | – | 889 | 958 | 410 | 821 | 479 | – | 274 |
| Percent | 0% | 28% | 30% | 13% | 26% | 15% | – | 9% |

The commonest types of electric heating used in the main living area in Gisborne houses were oil column heaters, radiant heaters and fan heaters (Table 32.6). A number of houses used more than one type of electric heater in their main living area.

Data on home heating methods, by house ownership, are shown in Table 32.7.

**Table 32.7: Home heating method, by house ownership, Gisborne**

| | Households living in rental | Percent living in rental | Households living in own house | Percent living in own house |
|---|---|---|---|---|
| Total | 2668 | 26% | 7455 | 73% |
| Electric | 246 | 7% | 3310 | 93% |
| Gas | 329 | 7% | 4186 | 93% |
| Open fire | 62 | 25% | 185 | 75% |
| Wood burner | 267 | 6% | 4521 | 94% |
| Multi-fuel | 41 | 22% | 144 | 78% |
| Oil | 21 | 30% | 48 | 70% |

Household insulation types and heating methods are shown in Tables 32.8 and 32.9. Sixty-four percent of houses had ceiling insulation and only 40% had wall insulation. Only 20% of houses had at least three types of insulation.

Table 32.10 shows home heating method, by household income. The overall non-response rate was around 23%. This limits the interpretation of these data because there may be an income bias in the non-respondents.

**Table 32.8: House insulation summary statistics, Gisborne**

| | Insulation type | | Degree of insulation | |
|---|---|---|---|---|
| | Households | % | | |
| Ceiling | 1972 | 64% | No insulation | 13% |
| Under floor | 390 | 13% | 1 type* | 35% |
| Wall | 1232 | 40% | 2 types | 20% |
| Cylinder wrap | 575 | 19% | 3 types | 15% |
| Double glazing | 144 | 5% | 4 types | 4% |
| None | 390 | 13% | 5 types | 1% |
| Don't know | 390 | 13% | Don't know | 13% |
| Other | 21 | 1% | | |

* One type means the household has just one of: ceiling, under floor or wall insulation, a cylinder wrap or double glazing; two types are any two of these, etc.

**Table 32.9: Degree of house insulation, by heating method, Gisborne**

| Degree of insulation | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 type | 13% | 7% | 12% | 56% | 33% |
| 2 types | 5% | 7% | 5% | 22% | 17% |
| 3 types | 5% | 5% | 5% | 0% | 17% |
| 4 types | 1% | 1% | 1% | 0% | 0% |
| 5 types | 0% | 0% | 0% | 0% | 8% |
| None or don't know | 76% | 80% | 76% | 22% | 25% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Table 32.10: Home heating method, by household income, Gisborne**

| | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| Non-response | 5% | 7% | 5% | 22% | 33% |
| Less than $20,000 | 6% | 4% | 2% | 22% | 8% |
| $20,000 to $30,000 | 6% | 5% | 6% | 11% | 8% |
| $30,000 to $40,000 | 5% | 2% | 3% | 11% | 0% |
| $40,000 to $50,000 | 2% | 2% | 3% | 11% | 25% |
| $50,000 to $70,000 | 4% | 2% | 6% | 11% | 8% |
| $70,000 to $100,000 | 1% | 2% | 3% | 11% | 8% |
| More than $100,000 | 3% | 2% | 0% | 0% | 8% |

* Note: columns may not sum exactly to 100 due to rounding error.

Tables 32.11 and 32.12 show the relationship between heating methods and the age of the dwelling and number of bedrooms, respectively.

**Table 32.11: Home heating method, by age of dwelling, Gisborne**

| Age of dwelling | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 10 years or less | 5% | 3% | 1% | 0% | 17% |
| 11–20 years | 2% | 2% | 2% | 0% | 0% |
| 21–40 years | 7% | 6% | 9% | 33% | 17% |
| 41+ years | 16% | 13% | 12% | 44% | 58% |

**Table 32.12: Home heating method, by number of bedrooms, Gisborne**

| Number of bedrooms | Electric | Gas | Wood burner | Multi-fuel | Open fire |
|---|---|---|---|---|---|
| 1 | 0% | 2% | 0% | 0% | 0% |
| 2 | 5% | 5% | 3% | 22% | 17% |
| 3 | 15% | 12% | 11% | 33% | 33% |
| 4 | 8% | 7% | 10% | 11% | 33% |
| 5 | 3% | 0% | 2% | 22% | 17% |
| 6 | 1% | 1% | 0% | 0% | 0% |

# 33 Additional Data

Data on fuel use and cost of heating methods for pellet-style burners and oil burners were not presented for most of the urban areas because of the small numbers of respondents in these categories. It is not possible to collate the results from all of the urban areas to give an average result for the whole of New Zealand because the survey was limited to 29 urban areas and it would be inappropriate to assume no geographical variations in the quantities of fuel used or the amount spent per month on heating. However, results can be collated to give an indication of the average fuel use and cost of heating for households using these methods across the 29 urban areas. Table 33.1 shows the cost of heating and average fuel use for oil burners and pellet-style burners across the 29 study areas.

**Table 33.1: Cost of heating and average fuel use for oil burners and pellet-style burners across the 29 study areas**

| | Monthly fuel expenditure ($) | Average fuel use (winter) kg/day |
|---|---|---|
| Oil | $180 | 1 |
| Pellet burner | $65 | 6.5 |

# Appendix A: Domestic Heating Survey

1. Good morning/afternoon/evening – Is this a home or business number? (Terminate if business)

   Hi, I'm _____ from Digipoll and I am calling on behalf of the Ministry for the Environment.

   May I please speak to an adult in your household who knows about your home heating systems? We are currently undertaking a survey in your area on methods of home heating. We wish to know what you use to heat your main living area during a typical year. The survey will take about five minutes. Is it a good time to talk to you now?

2. (a) Do you use any type of electrical heating in your MAIN living area during a typical year? What type of electrical heating do you use? Would it be ...

   - ☐ Night store
   - ☐ Radiant
   - ☐ Portable oil column
   - ☐ Panel
   - ☐ Fan
   - ☐ Heat pump
   - ☐ Don't know/refused
   - ☐ Other *(specify)* .....

2. (b) Do you use any other heating system in your main living area in a typical year? *(If Yes then question 3 otherwise Q8)*

3. (a) Do you use any type of gas heating in your MAIN living area during a typical year? *(If No then question 4)*

   (b) Is it flued or unflued gas heating? If necessary: (a flued gas heating appliance will have an external vent or chimney).

   (c) Which months of the year do you use your gas burner?

   | | | | |
   |---|---|---|---|
   | ☐ January | ☐ February | ☐ March | ☐ April |
   | ☐ May | ☐ June | ☐ July | ☐ August |
   | ☐ September | ☐ October | ☐ November | ☐ December |

   (d) How many days per week would you use your gas burner during?

   | | | | |
   |---|---|---|---|
   | ☐ January | ☐ February | ☐ March | ☐ April |
   | ☐ May | ☐ June | ☐ July | ☐ August |
   | ☐ September | ☐ October | ☐ November | ☐ December |

   (e) Do you use mains or bottled gas for home heating?

   (f) What size gas bottle do you use?

   (f.2) How many times in a winter would you refill your x kg gas bottle? Interviewer: Winter is defined as May to August inclusive.

4. (a) Do you use a log burner in your MAIN living area during a typical year? (This is a fully enclosed burner but does not include multi-fuel burner, ie, those that burn coal.) *(If No then question 5)*

(b) Which months of the year do you use your log burner?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(c) How many days per week would you use your log burner during?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(d) How old is your log burner?

(e) In a typical year, how many pieces of wood do you use on an average winter's day? Interviewer's note : winter is defined as May to August inclusive.

(f) Ask only if they used their log burner during non-winter months: How many pieces of wood do you use per day during the other months? Interviewer's note: winter is defined as May to August inclusive.

(g) In a typical year, how much wood would you use per year on your log burner? (Record wood use in cubic metres – note 1 cord equals 3.6 cubic metres of loosely piled blocks, one trailer equals about 1.65 cubic metres without cage, or 2.2 with cage.)

5. (a) Do you use an enclosed burner which burns coal as well as wood, ie, a multi-fuel burner in your MAIN living area during a typical year? (This includes incinerators, pot belly stoves, McKay space heaters, etc. but does not include open fires.) *(If No then question 6)*

(b) Which months of the year do you use your multi-fuel burner?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(c) How many days per week would you use your multi-fuel burner during?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(d) How old is your multi-fuel burner?

(e) What type of multi-fuel burner is it?

(f) In a typical year, how much wood do you use on your multi-fuel burner per day during the winter? (Ask them how many pieces of wood [logs] they use on an average winter's day.) Interviewer: Winter is defined as May to August inclusive.

(g) Ask only if they used their multi-fuel burner during non-winter months: How much wood do you use per day during the other months?

(h) In a typical year, how much wood would you use per year on your multi-fuel burner?_____ (record wood use in cubic metres – note 1 cord equals 3.6 cubic metres of loosely piled blocks one trailer equals about 1.65 cubic metres without cage, or 2.2 with.

(i) Do you use coal on your multi-fuel burner?

(j) How many buckets of coal do you use per day during the winter? (How many buckets of coal used on an average winter's day?) Interviewer: Winter is defined as May to August inclusive.

(k) Ask only if they used their log burner during non-winter months: How much coal do you use per day during the other months?

6. (a) Do you use an open fire (includes a visor fireplace which is one enclosed on three sides but open to the front) in your MAIN living area during a typical year? *(If No then question 7)*

(b) Which months of the year do you use your open fire?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(c) How many days per week would you use your open fire during?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(d) Do you use wood on your open fire?

(e) On a typical year, how much wood do you use per day during the winter? (Ask them how many pieces of wood [logs] they use on an average winter's day.) Interviewer: Winter is defined as may to August inclusive.

(f) Ask only if they used their log burner during non winter months: How much wood do you use per day during the other months?

(g) In a typical year, how much wood would you use per year on your open fire? (Record wood use in cubic metres – note 1 cord equals 3.6 cubic metres of loosely piled blocks one trailer equals about 1.65 cubic metres without cage, or 2.2 with cage).

(h) Do you use coal on your open fire?

(i) How many buckets of coal do you use per day during the winter? (How many buckets of coal used on an average winter's day)____ Interviewer: Winter is defined as may to August inclusive.

(j) Ask only if they used their log burner during non-winter months: How much coal do you use per day during the other months?

7. (a) Do you use a pellet burner in your MAIN living area during a typical year? *(If No then question 8)*

(b) Which months of the year do you use your pellet burner?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(c) How many days per week would you use your pellet burner during?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(d) How old is your pellet burner?

(e) What make and model is your pellet burner? First, can you tell me the make? and what model is your pellet burner?

(f) In a typical year, how many kilograms of pellets do you use on an average winter's day? Interviewer's note: winter is defined as May to August inclusive.

(g) Ask only if they used their pellet burner during non-winter months: How many kgs of pellets do you use per day during the other months? Interviewer's note: winter is defined as May to August inclusive.

(h) In a typical year, how many kilograms of pellets would you use per year on your pellet burner?

8. (a) Do you use any other heating system in your MAIN living area during a typical year? *(If No then Q 9)*

(b) What type of heating system do you use? (If they respond with diesel or oil burner go to question c; otherwise go to Q9.)

(c) Which months of the year do you use your diesel/oil burner?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(d) How many days per week would you use your diesel/oil burner during?

| | | | |
|---|---|---|---|
| ☐ January | ☐ February | ☐ March | ☐ April |
| ☐ May | ☐ June | ☐ July | ☐ August |
| ☐ September | ☐ October | ☐ November | ☐ December |

(e) How much oil do you use per year?

9. Does your home have insulation?

- ☐ Ceiling
- ☐ Under floor
- ☐ Wall
- ☐ Cylinder wrap
- ☐ Double glazing
- ☐ None
- ☐ Don't know
- ☐ Other *(specify)* .....

**Demographics**

We would like to ask some questions about you now, just to make sure we have a cross-section of people for the survey. We keep this information strictly confidential.

D1. Would you mind telling me in what year you were born?

D2. Which of the following describes you and your household situation?

- ☐ Single person below 40 living alone
- ☐ Single person 40 or older living alone
- ☐ Young couple without children
- ☐ Family with oldest child who is school age or younger
- ☐ Family with an adult child still at home
- ☐ Couple without children at home
- ☐ Flatting together
- ☐ Boarder

D3. With which ethnic group do you most closely relate?

Interviewer: tick gender.

How many people live at your address?

Do you own your home or rent it?

How old is the dwelling you live in?

How many bedrooms in the dwelling you live in?

D4. Would you estimate your total combined household income before tax to be:

- ☐ Less than $20,000
- ☐ $20,000 to $30,000
- ☐ $30,000 to $40,000
- ☐ $40,000 to $50,000
- ☐ $50,000 to $70,000
- ☐ $70,000 to $100,000
- ☐ More than $100,000
- ☐ Don't know/refused

D5. What is your employment status:

Thank you for your time today. Your answers will be very helpful. In case you missed it, my name is _____ from Digipoll in Hamilton. Have a nice day/evening.