E3
Equipment Energy Efficiency

Product Profile: Gas Space & Decorative (Fuel Effect) Heaters

For the Australian and New Zealand Markets

Prepared by EnergyConsult

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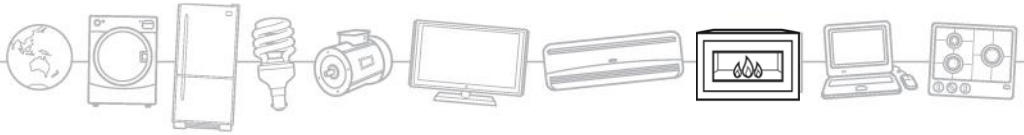

A joint initiative of Australian, State and Territory and New Zealand Governments.

This Report is available at

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Introduction

Energy consumed in the operation of equipment and appliances is a major source of energy demand and greenhouse gas emissions within the Australian and New Zealand residential, commercial and industrial sectors. The Australian and New Zealand governments have both recognised the substantial reductions in energy use which can be made by improving the efficiency of domestic products. Improved efficiency will reduce the demand for energy and have flow-on effects for security of energy supplies, less reliance on fossil fuels to meet peak demands and a reduced cost to the end user.

The purpose of this report is to provide an analysis of the policy options for improving the efficiency of non-ducted gas space heating and decorative (fuel effect) gas appliances. The primary purpose of this analysis is to investigate these product types for suitability in an expanded energy efficiency labelling and/or Minimum Energy Performance Standards (MEPS) regime under the joint Australia-New Zealand Equipment Energy Efficiency programme.

Trends

In Australia, the overall stock of gas space heaters and decorative appliances is projected to decline from 1.9M units in 2008 to 1.3M units in 2020. The stock of certain categories, such as decorative appliances, balanced flue convection and flued radiant/convection heaters is projected to increase over this period. Liquefied Petroleum Gas (LPG) appliances represent 12% of the total stock of gas space heaters and decorative appliances. While in New Zealand, the overall stock of gas space heaters and decorative appliances is projected to increase from 365,000 units in 2008 to 505,000 units in 2020. LPG appliances represent 62% of the total stock of New Zealand gas space heaters and decorative appliances.

Annual energy consumption of gas space heaters and decorative appliances is estimated to decline from 18 PJ p.a. in 2008 to 14 PJ in 2020 in Australia. The estimated greenhouse gas emissions are estimated to be 1.4 Mt CO2-e p.a. in 2008.

In New Zealand, Environet estimated gas space and decorative heating to consume 1.1 PJ p.a. of natural gas in 2007 and 1.2 PJ of LPG in 2008. This represents greenhouse gas emissions of approximately 240 kt CO2-e p.a. from gas space heaters and decorative appliances.

Minimum Energy Performance Standards (MEPS) and Mandatory Energy Performance Labelling (MEPL) are potential policy options that could improve the efficiency of gas space heaters and decorative appliances. The suitability of including these appliances in the E3 MEPS programme is explored in this product profile, along with other policy options.

Efficiency of space heaters and decorative appliances

Aligning the efficiency requirements for gas appliances between Australia and New Zealand is desirable as the gas appliances are common to both markets. Aligning regulatory requirements reduces trade barriers and is in keeping with the Trans-Tasman Mutual Recognition Arrangements (TTMRA).

In Australia, space heaters are subject to efficiency and safety regulations under the Australian Standard AS 4553. Initially the energy labelling scheme for gas space heaters was started as an industry program, run by the Australia Gas Association (AGA), but has become part of the certification requirements of gas regulators. All State and Territories require that gas space heaters are registered and compliant with the one of three approved certification schemes, run by three certification bodies. The regulators prohibit the sale of uncertified products. This means the space heaters must be tested for safety and efficiency according to the AS 4553 and display a gas energy rating label.

New Zealand does not have an equivalent efficiency Standard, although they accept products certified to the AS 4553 as Deemed to Comply for safety purposes. Some products therefore enter the New Zealand market carrying efficiency labels.

The suitability of adopting these appliances into the E3 MEPS and labelling programme, refining the Australian Standard for use as the efficiency test for both countries, and extending mandatory labelling to New Zealand is explored further in this report.

There are two measures of efficiency used in the AS 4553 for gas space heaters – thermal efficiency and net efficiency. The thermal efficiency is used to rate the appliances suitability for sale, whereas the net efficiency is used to determine the star rating and annual energy consumption for the Energy Rating Label.

The potential for increasing the energy efficiency of gas space heaters was addressed in the Mark Ellis & Associates 2002 (MEA) study, which recommended that net efficiency be used to rate the appliances instead of thermal efficiency.

Flued radiant/convection heaters and wall furnaces could be examined for increased energy efficiency under the MEPS programme. For simplicity, the MEPS could apply to all gas space heater product categories.

The greatest potential improvement in business as usual (BAU) energy consumption would be by actions targeted to decorative appliances[1], where the average net efficiency is approximately 15%. One approach is to impose a maximum gas consumption rate standard on all decorative appliances, in addition to enhanced warnings to consumers that these appliances are for decorative purposes only. This would still allow for the design flexibility currently available in this product but would decrease the current trend for some of these products to be presented or used as heaters. Alternatively the decorative appliances could be moved under the space heater AS 4553 standard requirements, or under any future space heating and mandatory energy labelling requirements. Again, further analysis of options should be explored.

Energy labelling

In Australia, comparative energy labelling applies to gas space heaters, but not to decorative appliances. The current Australian gas labelling program has evolved from a program first introduced in Victoria and then developed into a national program under the control of the AGA in the mid-1980s. The AGA gas codes, which are principally appliance safety requirements, were shifted in the mid-2000s to Standards Australia. The requirement for certification to these standards, which includes energy labelling, is now a mandatory requirement of the State Government Gas Technical Regulators, as part of the gas appliance certification scheme in Australia.

The Australian gas energy rating label has not been redesigned since it was introduced for gas space heaters in the 1990's. The spread of star ratings for the various flued heater categories appears to be sufficient to allow consumers choice of more efficient models. However the star ratings for almost all flueless heaters are between 5.7 and 5.9, with the vast majority at 5.9 stars. Therefore the star rating for these types of heaters does not provide useful information to help consumers choose between flueless models. Also, there is no recognition in the rating of flueless heaters that it is necessary, and often mandatory, to ventilate the spaces where they are used. This ventilation significantly decreases the net efficiency of these heaters.

For decorative appliances, there is no published comparative information on the gas input. For consumers, a direct comparison should be possible between decorative appliances, and between decorative appliances and the competing space heaters - typically flued radiant/convection heaters. The energy savings possible from introducing energy labelling for decorative appliances could be substantial if this has the typical dual effect of creating market pull (consumers choosing more efficient appliances) and market push (suppliers improving the efficiency of the products).

The main issue surrounding the star rating for decorative appliances is that many models will not achieve a 1 star rating (or 60% net efficiency) under the current space heater AS 4553 standard but the appliances would be labelled as 1 star if they are rated using this standard due to the design of the label. For heaters with less than 1 star, the label could be changed as follows:

- to indicate 'zero' stars; and/or
- a statement included that warns the consumer that this model does not meet the minimum requirements for the space heating label; and/or
- the net efficiency is displayed on the label of all heaters. However this is unlikely to be meaningful to most consumers.

[1] Note: Decorative appliances in this report refers to 'Decorative gas log and other fuel effect appliances' as defined in AS 4558, both Type 1 and 2 appliances. These should not be confused with genuine gas heaters registered under AS4553, which also promote themselves as flame effect, gas log effect or decorative heaters.

The provision of easily accessible comparable information on gas space heaters would increase the effectiveness of a gas labelling program. It may also be possible to encourage a voluntary approach for the provision of performance information, similar to the Energy Rating website for electric appliances. The AGA and other certification bodies have been responsible for recording the gas space heaters certified in Australia. Further investigation would be needed into the merits of developing a similar public database for space heaters and decorative appliances, and extending its capacity to include products sold on the New Zealand market.

Endorsement Labelling and Financial Incentives

Voluntary endorsement labels were examined and it was found that these would be consistent with the ENERGY STAR program used in New Zealand. However, endorsement labelling will always convey less information to consumers than comparative energy labelling, as only the most efficient products are labelled. Endorsement labelling needs considerable support for marketing and promotion, and compliance checking, if consumers are to use and have confidence in the scheme, plus there needs to be an efficiency rating scheme in place on which to base the endorsement process. Endorsement labelling will also not address the split incentive issue. Finally, endorsement labelling is not currently used on gas appliances in Australia and may confuse consumers used to comparative labels.

Financial incentives have been used to encourage consumer's purchases of appliances to more efficient appliances, including gas space heaters. Such a scheme can be expensive to operate, say a minimum of $200 per incentive, and results in the tax payer bearing the cost of the incentives, while the consumer gains the energy savings.

Neither endorsement labelling nor financial incentives will be as cost effective as comparative labelling and MEPS, nor likely to produce the same energy and greenhouse emission savings.

Conclusions

The conclusions of this product profile are:

- Further investigation into gas space heaters and decorative appliances being added to the E3 MEPS programme is warranted because of theoretical energy savings and greenhouse gas reductions. This research should consider the energy savings from different test methods, efficiency levels, and extending labelling provisions to New Zealand and for decorative products. Industry feedback on this Product Profile is encouraged, and will be valuable.
- There may be potential for a small reduction in the energy consumption of the flued category of space heaters by improving product efficiency.
- Flueless space heaters are responsible for 46% of energy consumption of gas space heaters and decorative appliances in Australia, and there is limited capability to further improve their energy efficiency as the average net efficiency is 89%. However, the measurement of their efficiency ignores the necessary, and in some States mandatory, requirement for ventilation of the space in which flueless heaters operate, which will significantly reduce their real 'net' efficiency. This needs to be recognised in the standards when testing and rating these units.
- Aligning the provisions for efficiency between New Zealand and Australia would be beneficial to ensure effective trade in these appliances between both countries.

Where to from here

Consultation on this product profile

Readers are asked to comment on a number of aspects in this document, particularly market data and modelling assumptions, to assist with the formulation of a preferred policy option in future. While we welcome comments on all aspects of the Product Profile, comment of the questions in the breakout box below would be of particular assistance.

Written comments should be sent via e-mail, and should be received by Friday 1 June 2012. Comments should be clearly titled and sent to:

Australia

energyrating@climatechange.gov.au

New Zealand

regs@eeca.govt.nz

After consultation on the product profile

The evidence in this Product Profile will be reviewed and supplemented in light of any written submissions made by stakeholders and/or issues raised at stakeholder meetings.

Decisions will be made on whether to proceed with a proposal for gas space heaters and decorative appliances (to improve their energy efficiency) and what the preferred options should be.

If the preferred options involve regulation (e.g. MEPS and/or labelling) a Regulatory Impact Statement (RIS) will be prepared to analyse the costs, benefits, and other impacts of the proposal. Consultation will be undertaken with stakeholders prior to any final decisions being made.

Final decisions on policy will be made by the Ministerial Council on Energy in Australia and by the New Zealand Cabinet.

Gas Space Heater and Decorative Appliances Product Profile – Key Questions

- Do you agree with the market data presented for Australia and New Zealand? In particular, do you agree with the estimates of current and projected stock and sales of gas heaters and decorative appliances? Are there any products that are only sold in New Zealand?
- Do you agree with the breakdown of sales between the various product types? Are there any major trends that are not specified in the product profile for Australia and New Zealand?
- Do you agree with the projected trends? Are the average efficiency, size and operating hours accurately estimated for Australian and New Zealand?
- Do you agree with the breakdown between heaters fuelled by natural gas and LPG in the Australian and New Zealand markets?
- Is there a source of sales weighted average efficiency of appliances in New Zealand that can be used for further analysis?
- What do you think would be the best way for governments to facilitate an increase in the average energy efficiency of gas heaters and decorative appliances sold?
- Do you think that there is a case for MEPS for gas heaters and decorative appliances and implementing a government regulated trans-Tasman MEPS?
- Do you think that there is a case for mandatory energy labelling of gas heaters and decorative appliances as part of a trans-Tasman government program?
- What impact do you think implementing more stringent trans-Tasman MEPS and energy labelling for gas heaters and decorative appliances would have on the gas appliance industry?
- Do you think that the current Australian standards AS 4553 and AS 4558 could be used as the basis of a government regulated MEPS and/or labelling program? Do you think these standards needs to be made more robust before it can support government regulated MEPS and labelling?
- What additional costs do you think this would place on industry compared to the current situation? What impact do you think it would have on competition and consumer choice?

- Are there any additional measures which the E3 Program could consider to increase the energy efficiency of gas heaters and decorative appliances?

1. Introduction

Background to project

Energy consumed in the operation of equipment and appliances is a major source of energy demand and greenhouse gas emissions within the Australian and New Zealand residential, commercial and industrial sectors. The Australian and New Zealand governments have recognised the substantial contribution that improving energy efficiency can make to climate change abatement. Improved efficiency will reduce the demand for energy and have flow-on effects for security of energy supply, less reliance on fossil fuels to meet peak demands and reduced cost to the end user.

The purpose of this report is to provide analysis of the types and performance of gas heaters available on the Australian and New Zealand markets.

History of Government & Industry Efficiency Activities for Gas Heaters

In Australia, minimum efficiency levels have been applied to gas space heaters since 1982 and comparative energy labelling has been used since the 1990s through State and Territory Safety Regulations . The performance levels and basis for efficiency and labelling, however, have not been updated, despite the changes in product energy efficiency and types. These minimum efficiency level and labelling requirements are not part of a separate efficiency standard, but are implemented through the AS 4553 standard that also covers gas appliance safety. These requirements do not form part of the E3 MEPS and labelling program which has been applied to electrical products.

Efficiency levels are not required for gas "heaters" sold in New Zealand, although New Zealand recognises Australian safety requirements as equivalent, and accept models displaying the Australian energy rating label as deemed to comply with requirements.

Since 1998, the Commonwealth and state and territory governments, through the Equipment Energy Efficiency Committee (E3) have coordinated the development of a nationally consistent appliance and equipment efficiency program to improve efficiency of gas appliances and equipment. New Zealand joined the Committee in 2006. There is no mandatory requirement for efficiency, or energy rating labelling for gas space heaters in New Zealand.

In 2002, Sustainable Energy Authority Victoria, the Australian Greenhouse Office and the Victorian Office of Gas Safety commenced working together to review the gas appliance labelling and efficiency levels arrangements, and to explore options for driving energy efficiency improvements. The first step in this process was to commission a consultant study to review the gas appliance scheme (MEA 2002). This study made recommendations to review the energy labelling categories and the efficiency levels for space heaters, as heaters were 'bunching up' towards the top of the labelling categories and, for some heater types, exceeding efficiency levels within AS 4553.

The paper was followed by a Discussion Document (Sustainable Energy Authority Victoria (SEAV) 2003), which reviewed the findings of the MEA paper, identified key priorities and proposed a timetable for reviewing test methods, standards, efficiency and labelling for gas heaters. The timetable proposed introducing new efficiency levels in 2008.

The discussion paper was followed by an Australian strategic paper in 2004, 'Switched on Gas' (MCE 2004) which spelled out a ten year strategy for improving gas appliance and equipment efficiency.

In 2006 the strategy was revised and a new draft discussion paper prepared 'Switched on Gas - Revised Work Plan for 2007 to 2007/08' (MCE 2006). This strategy document highlighted the variation between different types of space heaters and their categorisation, the complexities of flueless heaters and pointed out that 'decorative appliances' have no efficiency criteria under the Australian Standard: AS 4558. As Canada mandates comparative energy labelling for decorative appliances, the 'Switched on Gas' Strategy recommended that the Canadian scheme and test method for efficiency should be considered as part of the test method review.

Scope

This Product Profile considers the development and revision of efficiency levels and product labelling for gas space heaters, including, fuel effect (decorative) appliances used in the residential sector. It is an investigation into the market in New Zealand and Australia, and the potential for improving the efficiency of these appliances and extending the current labelling and minimum efficiency requirements in a joint manner, to New Zealand. The project draws on the work of the 'Energy Labelling & Minimum Energy Performance Standards for Domestic Gas Appliances' study by MEA 2002. Gas ducted space heaters are outside the scope of this project and covered in separate product profile (EnergyConsult 2011).

This Product Profile takes into account the following

- Product description – including types of products and their main uses.
- Market profile – historical background, principal manufacturers, importers and suppliers, countries of origin, sales data, projected trends.
- Estimated energy consumption of different product types currently available in the Australian and New Zealand markets, and whether certain product types are gaining (or losing) market share and so likely to represent higher (or lower) gas consumption in future.
- Whether there are distinct technology types or designs with regard to energy efficiency.
- Scope for technological improvements to product energy efficiency.
- The appropriate efficiency levels, if any, in the relevant standards, the coverage by the energy labelling program, and the justification for coverage or non-coverage (e.g. AS 4558 appliances are considered as 'decorative only' rather than space heaters, so energy labelling requirements do not apply).
- Current trans-Tasman, national, state, territory or other regulations bearing on the energy efficiency of these products.
- Testing standards – Australian and international standards for energy consumption/efficiency.
- International standards applied to these products (if any).

A single product profile covering Australia and New Zealand was developed through the integration of product profiles developed covering the Australian and New Zealand markets. Environet Limited was also commissioned to prepare a product profile on gas space heaters and decorative appliances in the New Zealand residential sector. The New Zealand related information and analysis contained in this combined Australia and New Zealand product profile report was based entirely on the New Zealand report (Environet 2009).

Methodology and Workplan

The development of the product profile involved:

- Sales Data – collecting and obtaining sales of gas heaters for Australia and New Zealand, plus using estimations when 'actual' figures were not possible.
- Energy Performance Data – obtaining and using AGA information on certified Gas Products, including the Annual Energy Consumption and star rating (for Australia), and supplementing this with data collected directly from suppliers concerning 'decorative only' heaters, and New Zealand data where possible.
- Market Trends – the share of stock and new sales (and forecasts) of gas room heaters and decorative units.
- Energy Performance Trends – integrating market and energy performance data to determine the overall market gas consumption trends and trends in heater types.

The project tasks included:

- Initiation meeting and identifying data sources and gaps;
- Researching Australian data requirements;
- Modelling Australian energy consumption and greenhouse gas emissions;
- Research Australian and international testing and MEPS standards;
- Develop Draft and Final Australian Product Profile; and
- Develop Draft and Final Australian and New Zealand Product Profile.

2. Product Description

This report is concerned with a range of gas space heating products and decorative appliances. Each of these product types are separately defined and described below.

Gas Space Heaters

A definition for gas space heaters can be obtained from Australian Standards, and this definition is commonly accepted in New Zealand. The Australian Standard AS 4553-2008 Gas Space Heating Appliances defines space heating appliances as:

> *'gas space heating appliances (convectors, radiant convectors, wall furnaces) with natural draught or fan assisted combustion systems intended for use with natural gas, town gas, liquefied petroleum gas (LPG) and tempered liquefied petroleum gas (TLP) with gas consumptions not exceeding 150 MJ/h'.* (Australian Standard AS 4553-2008, page 5)

The standard for gas space heaters specifically excludes decorative appliances and ducted ('central') heaters.

Gas space heaters can be either radiant or convection, permanent or portable, flued or flueless heaters. The Standard defines a number of space heater types, including:

- Convection heater - an appliance with an effective output of heated air and no visible source of radiation.
- Radiant convection heater - an appliance with an effective output of both radiation and heated air.
- Radiant heater - an appliance with an effective output mainly in the form of radiation.
- Wall heater or wall furnace - a flued convection heater designed for installation external to a wall, or partly or wholly inside the room wall.

Space heaters are typically used as the primary form of heating for a room or part of a house, such as the main living areas and to a lesser extent may be used for heating smaller areas, such as bedrooms.

Gas space heaters are composed of the gas burner(s), an ignition system, thermostat, flame safety guard device, and some units will also include a heat exchanger, fan(s), flue(s), air ducting and dampers to control air flow. They vary greatly in design and appearance.

Gas Decorative Appliances

Again the Australian Standards provide a useful definition of decorative appliances. The Australian Standard AS 4558-2000 *Decorative gas log and other fuel effect appliances* focuses on appliances designed with the prime purpose to have a decorative appearance, and 'apply to decorative gas log, coal or other fuel effect fires with gas consumptions not exceeding 72 MJ/h'. Two types of appliances are defined:

- Type 1: 'An appliance which consists of an assembly or kit that comprises a burner, simulated fuel effect logs or coals, grate and decorative surround and which is designed to be installed in a fireplace of indeterminate specifications and in which the chimney is intended to convey flue products to outside air' (Australian Standard AS 4558-2000, pg 19), or
- Type 2: 'An appliance which consists of a complete assembly which includes a fire box/surround and a conventional fabricated flue system. The flue shall be either supplied with the appliance or clearly specified by the manufacturer in the installation instructions' (Australian Standard AS 4558-2000, pg 19).

The type 2 'complete assembly' includes the assembly or kit as defined for the type 1 appliance. In other words, the type 2 appliance consists of the type 1 appliance located in a specifically constructed fire box or housing, complete with a flue system.

The standard also covers products that are not 'appliances', such as a gas flame kit that can be added to a wood burner. Indoor flueless decorative appliances are not included in the standard, nor are appliances primarily designed for space heating. Flueless appliances are covered under AS 4553.

Although gas heaters can be termed decorative log effect, log effect or decorative effect space heater, many of these are not certified under AS 4558. The model description of many of these heaters may include these words, however on closer inspection they are certified under AS 4553 as flued convection or radiant/convection heaters or balanced flue convection heaters. Almost 80% of the models listed in the category of flued radiant/convection heaters (AS 4553) use the term 'decorative' or 'log effect' in their model description.

Apart from confusion among product suppliers, there may also be confusion among buyers, who may well expect that any form of gas heater, even one with a log or coal effect, would be usable for space heating. It is not known whether products which properly comply with AS 4558 (as distinct from the AS 4553-compliant models designated as 'decorative') are clearly labelled 'primarily a decorative appliance not certified as a space heater'.

Gas decorative appliances, like space heaters, are composed principally of an ignition system, thermostat flame safety guard device, and gas burner(s), plus fans, flues etc as required. The design focuses on displaying the flames and flame effects, usually by having part of the fire box or surround made of glass. They can vary greatly in design and appearance and relative heat output.

The decorative appliances are segmented in the market according to whether they are 'type 1' heaters, which are the appliances that are installed in existing fireplaces, and 'type 2' which are complete units that can be free-standing or installed into the wall space.

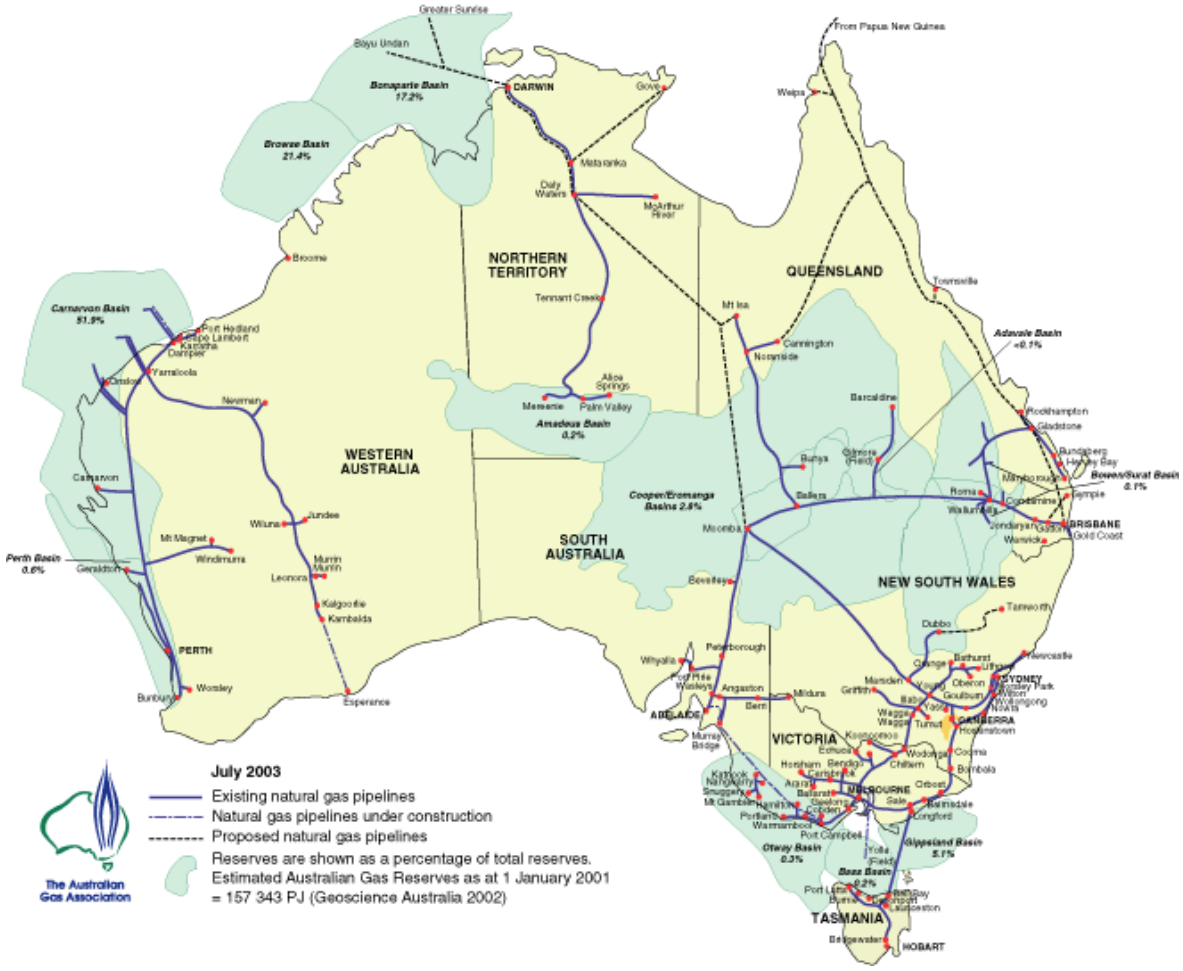
3. Market Characteristics

Australian Historical Background

'Town gas' (manufactured gas) was first used in Australia for lighting prior to the discovery of natural gas. The Australian Gas Light Company provided gas for the first public lighting in Sydney in 1841. In Melbourne, gas was first used for shop lighting in 1849, and for public use on New Year's Day 1856. Most major cities introduced town gas lighting throughout the mid to late 1800s.

In the 1960s the first offshore discoveries of gas reserves and the subsequent building of major infrastructure to develop, produce and process the gas led to natural gas gradually replacing town gas in Australian towns and cities. In 1969, natural gas was introduced in Adelaide, Brisbane and Melbourne and arrived in Sydney at the end of 1976. Now natural gas is piped to major cities, regional towns, and a variety of commercial and industrial sites around Australia. Figure 1 shows a map of the gas pipeline distribution throughout Australia.

Figure 1 - Australian natural gas network



Source: www.ena.asn.au

Most of the natural gas used in Australia is consumed in industry and electricity generation, but gas is also used in homes for space heating, cooking and water heating. Gas (natural and LPG/bottled gas) is the second most common source of energy after electricity. Gas was used by 61% of households in Australia in 2008. In Victoria and Western Australia gas was used by 90% and 87% of households respectively (ABS 2008). The following table details the use of natural gas and LPG as a source of energy in households.

Table 1 - Natural Gas & LPG as a source of Energy in Households

	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust
No ('000)									
Natural Gas	1,016.1	1,667.2	202.5	361.8	563.3	5.6	4.6	87.8	3,909.1
LPG	353.6	178.0	292.2	85.1	157.4	27.0	20.8	1.1	1,115.3
Proportion (%)									
Natural gas	37.5	81.1	12.5	55.9	68.1	2.8	7.6	68.4	47.4
LPG	13.1	8.7	18.1	13.2	19.0	13.4	34.1	0.9	13.5

Source: ABS 2008

In all states of Australia, the gas regulator (e.g. Energy Safe Victoria) must 'accept' that a gas appliance is of safe design before it can be legally installed in that state. For example in Victoria this is enforced under the *Gas Safety Act 1997 (VIC)* s70. Appliances for residential and light commercial use are generally accepted through approved certification schemes. The Australian Gas Association (AGA), SAI Global, IAPMO R&T Oceana and Global-Mark operate certification schemes accepted by most jurisdictions. The AGA scheme undertake the vast majority of certifications of appliances and are estimated to certify over 90% of space heaters. The application is generally made directly to one of those certifying bodies. Every gas appliance is required to have a 'data plate' affixed to it, showing essential details (type of gas, energy consumption, etc). That data plate will also show the Certificate Number.

The product certification is based upon an independent technical assessment of a sample product against relevant safety standards (i.e., type-testing) and compliance with any other regulatory requirements. The AGA publish a biennial *Directory of Certified Appliances and Components*, as do other certification bodies, which lists the registration number, supplier, brand, model and relevant performance characteristics of each certified appliance. Characteristics include annual energy consumption figures (MJ/year) and the associated star ratings/shadings, if the relevant standard calls for these. SAI Global operates the Gas Safety Certification Scheme (GSCS), which also requires the collection of similar information. Certificates are published on their website, which can be found at www.standardsmark.saiglobal.com.

New Zealand Historical Background

In 1959, commercially viable natural gas[2] was found at the Kapuni gas field in Taranaki, New Zealand. By 1969 a piped gas network that included Auckland and Wellington in the North Island, was completed and bulk transmissions began in 1970. The major Maui offshore field was discovered in 1970 and a second pipeline was constructed. By 1979 Maui gas was also on-stream, with an intended primary use of electricity generation in thermal power stations.

Reticulated natural gas is available to a large proportion of households in parts of the North Island of New Zealand and is used in many homes for space heating, water heating and cooking. New Zealand has more than 3,400 kilometres of high pressure gas transmission pipelines and around 2,800 kilometres of intermediate, medium and low pressure gas distribution pipeline networks connected to the high pressure system, all on the North Island. The natural gas network extends from Kauri, north of Whangarei, to Wellington and encompasses areas such as Hastings, Gisborne and New Plymouth.

The two main transmission entities are Vector transmission and the Maui pipeline, which is owned by Maui Development Limited. Smaller transmission pipelines are also owned by Todd Petroleum and Shell, Todd Taranaki, Origin and Westech Energy.

In 2007, there were around 231,000 households using natural gas in New Zealand. These households consumed 3.4% of the total natural gas used in New Zealand for 2007. Average natural gas consumption by the residential sector for 2007 was 24 gigajoules (GJ) per connection and represents a decrease from previous years (MED, 2008).

[2] Natural gas consists largely of methane, is produced from underground hydrocarbon deposits, often in association with petroleum.

Liquefied Petroleum Gas (LPG) is also very common in New Zealand for space heating, heating water and cooking. The main liquid gas used in New Zealand is LPG which consists of propane (60%) and butane (40%). LPG can be supplied in bottled form to households or may be piped from a local storage area.

Historically, LPG was sourced from the Maui gas field in the North Island of New Zealand. Since 2003 New Zealand has been a net importer of LPG. Reticulated LPG is a system providing LPG from a central source to residential dwellings and commercial activities. It is most common in new subdivisions in the South Island and areas of the North Island without access to reticulated natural gas.

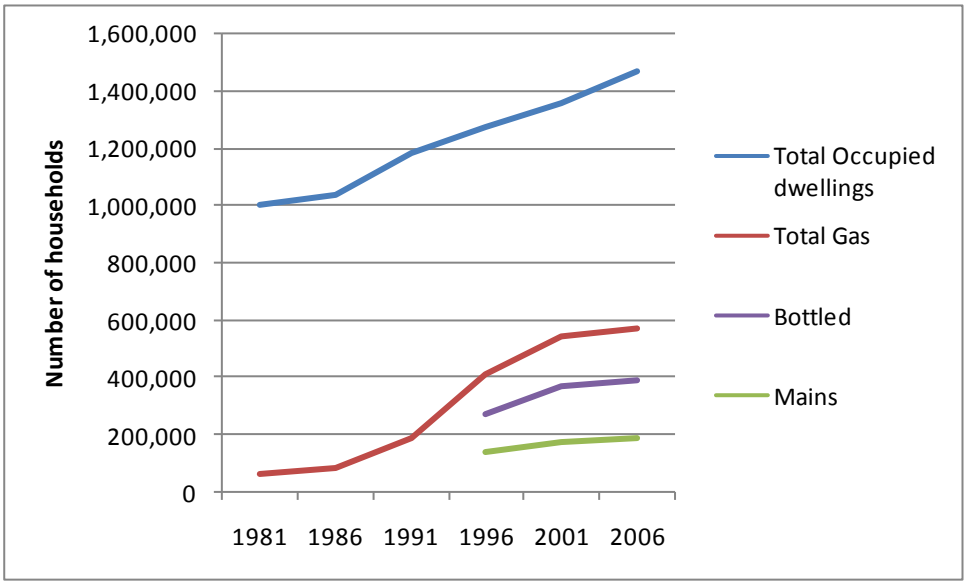
In 2008 around 5,000 households in the South Island were connected to reticulated LPG, with the majority of these in Christchurch. Piped LPG in the North Island is not common with less than 50 households having access to this fuel source.

Bottled LPG is the most common form of gas used for home heating in New Zealand. Around 389,000 households (26% of all households) reporting to be using this for space heating in 2006 (Statistics New Zealand, 2008) and 227,000 households (15%) using this method in 2008 (Home Heating survey, section 4.3). In New Zealand bottled LPG is available either through cylinder refill service centres; 'swap a bottle' services or home deliveries. There are approximately 300 Rockgas service centres throughout New Zealand where cylinders can be filled (http://www.rockgas.co.nz/4-merchants). OnGas supplies LPG to BP petrol stations throughout New Zealand. With the refill option, householders purchase a certified gas bottle which is refilled at a service centre when empty. Depending on the age of the gas bottle, this service is either free or has a one off charge of up to $25. The most common gas bottle size is nine kilograms, which was used by around 70% of households using bottled gas in the 2008 home heating survey. These small cylinders are designed to be fitted directly into the space heater.

The New Zealand Census is carried out every five years and includes a question on the type of fuel used to heat an occupied dwelling. Census data on gas use was collated for 1981, 1986, 1991, 1996, 2001 and 2006. Since 1996 gas use on the census has been segregated into mains gas and bottled gas. In the census data, mains gas includes reticulated natural gas and piped LPG.

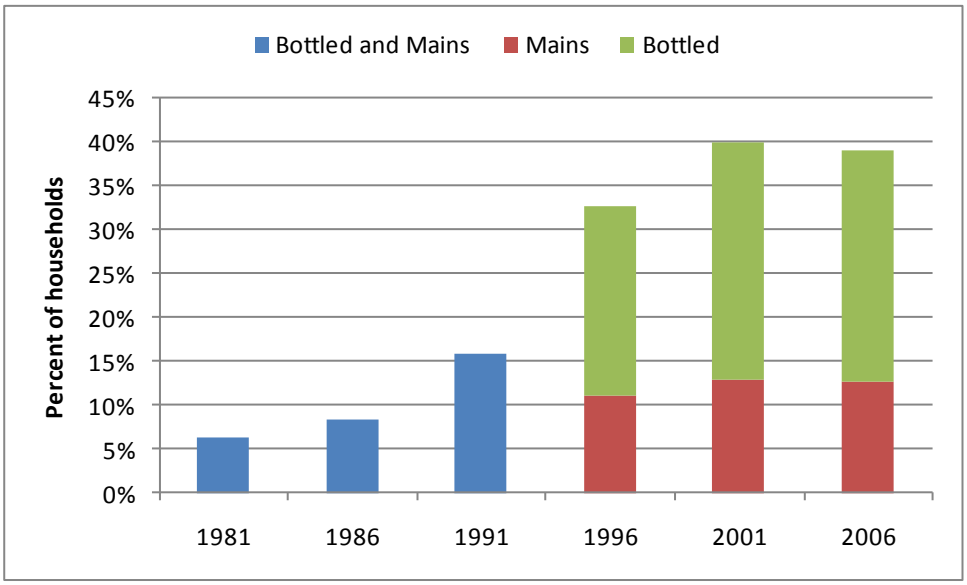
Figure 2 shows the number of occupied dwellings using gas for home heating has increased from 64,000 in 1981 to 574,000 in 2006. In 2006, around 389,000 households (68% of gas-heating households) reported using bottled gas for home heating compared with 186,000 (32%) households using mains gas (includes around 4,000 households with piped LPG). The proportion of occupied dwellings using gas heating has increased from 6% in 1981 to 40% in 2001 and a slight decrease to 39% in 2006 (Figure 3). Environet Ltd conducted a survey in 2008 of home heating methods (Environet 2009). Results of this 2008 survey suggest a significant decrease in the number of households using mains and bottled gas for home heating since the census data of 2006. Gas consumption data form MED was available for 2000 to 2007 and also showed that gas consumption reduced over this time.

Figure 2 - Trends in Households Using Gas for Residential Heating in New Zealand



Source: Statistics New Zealand (1981 to 2006)

Figure 3 - Proportion of Households in New Zealand Using Gas for Residential Heating

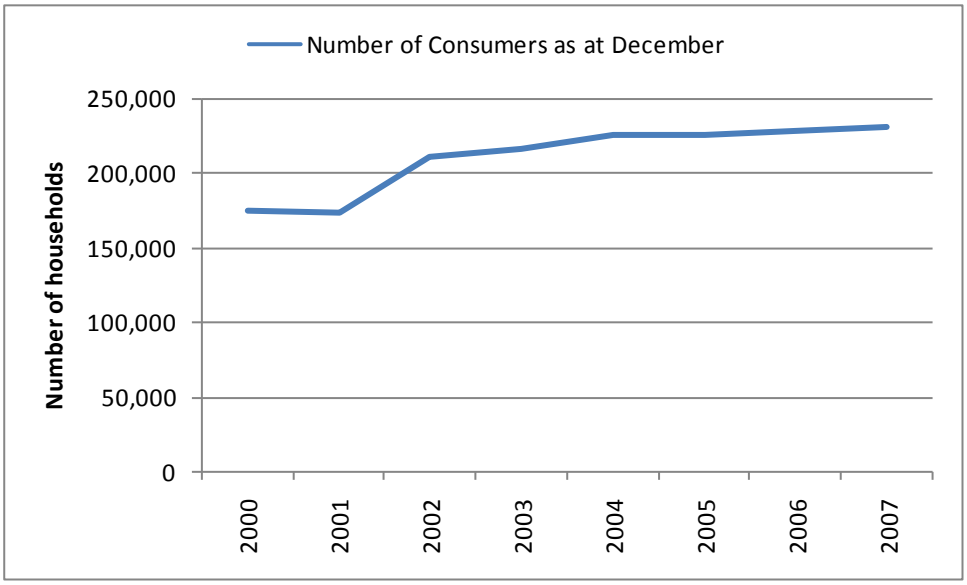


Source: Statistics New Zealand (1981 to 2006)

Natural Gas Connections and Consumption

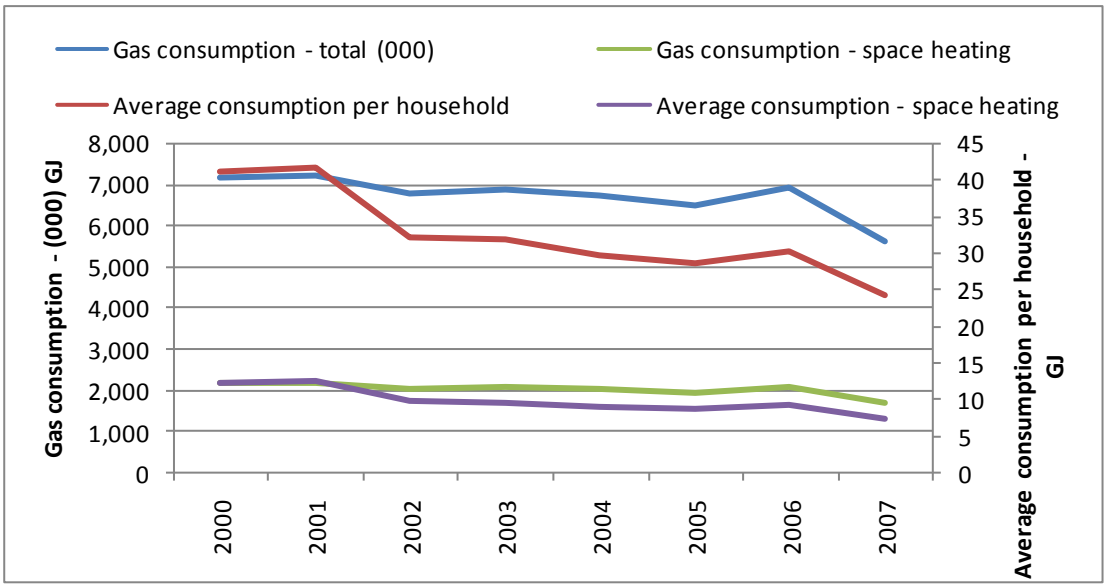
Figure 4 and Figure 5 show the number of residential consumers connected to the reticulated natural gas network in New Zealand and the gas consumed by these households. Both graphs include households using natural gas for purposes other than home heating. A comparison of the 2006 connections information and the 2006 census data suggests that around 20% of households for 2006 with domestic gas connections do not use the gas for heating their home. The reduction in household gas consumption for 2007 is most likely an indicator of a reduction in households using gas for heating, particularly when considered in conjunction with results of the 2008 home heating survey (Environet 2009), which showed a general reduction in gas heating.

Figure 4 - Number of Residential Households Connected to the Reticulated Natural Gas Network



The number of households connected to the reticulated natural gas network increased from 174,643 in 2000 to 230,901 in 2007 (Figure 4). Over the same period, total natural gas consumption has decreased from 7,172,000 to 5,611,000 GJ per year; a 22% decrease (Figure 5), with the majority of the decrease occurring between 2006 and 2007. The average annual gas consumption per connection has decreased 41% from 41 GJ per household in 2000 to 24 GJ per household in 2007.

Figure 5 - Trends in Total Residential Gas Consumption (2000 to 2007) and Average Consumption per Household



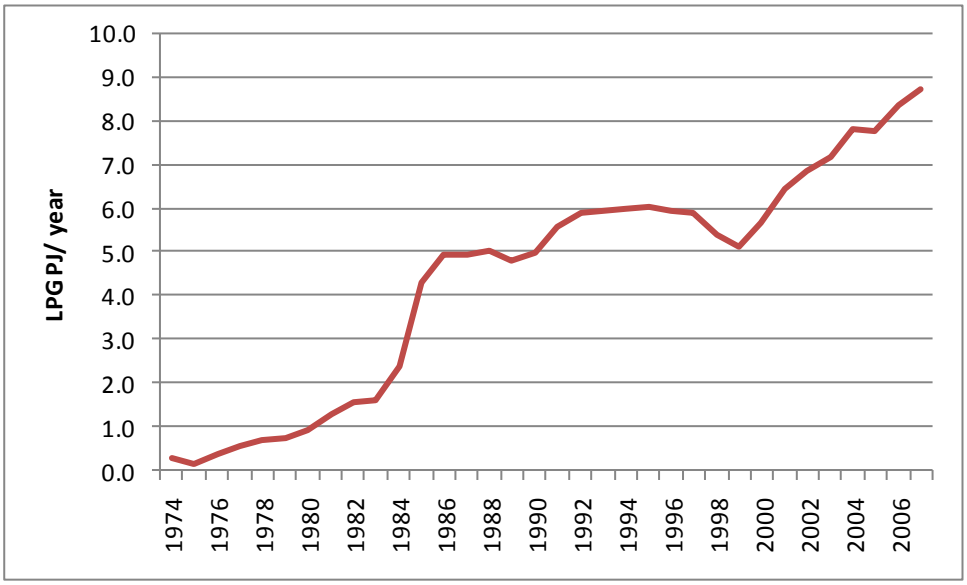
Source: Environet 2009

Liquefied Petroleum Gas (LPG) Consumption

Unlike natural gas, national energy data on LPG consumption is not available by sector. However, Figure 6 (LPG consumption from 1974 to 2007) is consistent with trends in households using gas for heating (Figure 52). Around 2.7 PJ (32% of total) of 2006 LPG consumption was estimated to be used for residential heating.

In New Zealand, LPG consumption has increased, in contrast to natural gas use, with major increases in the mid 1980s and again in the early 2000s. A decrease in LPG consumption around the year 1999 is likely to be associated with concerns about ongoing supply occurring as a result of falling reserves in the Maui field and uncertainty around future supply.

Figure 6 - Trends in total LPG/ LNG consumption (PJ/year - gross) in New Zealand (1974 to 2007)



Source: MED, energy data files

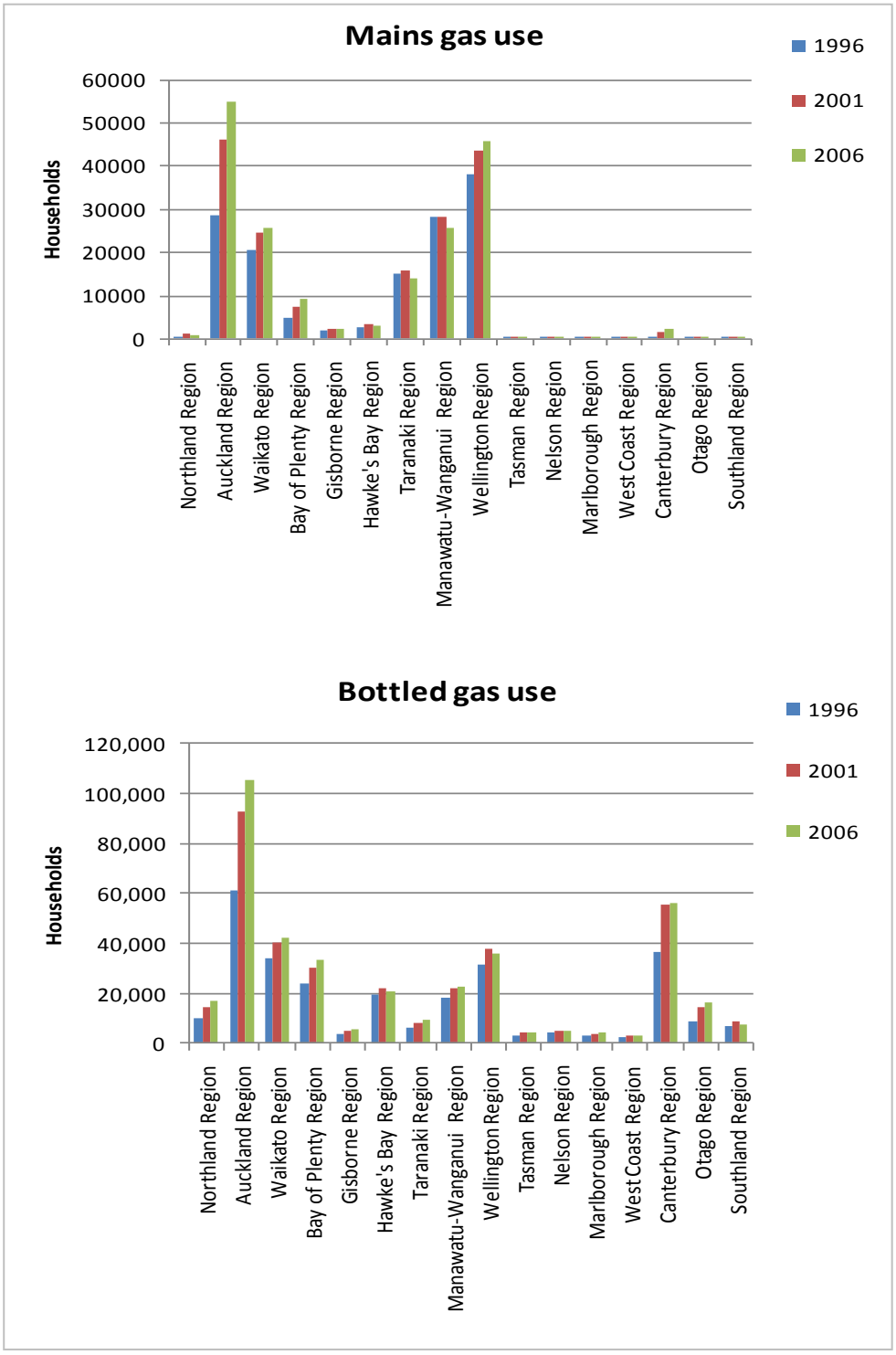
Geographical Location

In New Zealand, mains gas use is largely limited to the natural gas pipelines of the North Island. Piped LPG is available in the north and south islands, although it is used by fewer households. Figure 7 indicates an increase in mains gas use in Auckland, Wellington and the Waikato from 1996 to 2006. Mains gas is the predominant fuel used in Wellington, Hamilton, Palmerston North, Whangarei and New Plymouth. Both mains and bottled gas are

common in Auckland. In Auckland increases in mains gas use are most notable in Central Auckland, Manakau and on the North Shore.

In the South Island, mains gas use is negligible because there is no access to piped natural gas. Trends in the South Island are therefore dominated by bottled gas use which increased in most regions from 1996 to 2001 but did not change noticeably between 2001 and 2006. In Christchurch, the number of houses with piped LPG has increased from around 500 in 1996 to around 1,800 in 2006.

Figure 7 - Number of Households Using Mains and Bottled Gas in New Zealand by Region



Australian Space Heater and Decorative Appliance Market

Decorative Appliance Market

The Australian decorative appliance market is largely supplied by the same suppliers as the space heater market, though some smaller suppliers are specialising in the decorative appliance market. There are 16 suppliers of decorative appliances, of which 10 are Australian based. Jet Master and Real Flame are two of the main suppliers. Decorative appliances are predominantly sold in Victoria (35%) and South Australia (30%), with the remaining third of heaters being sold throughout the other states.

Decorative appliances are purchased for their appearance and the 'atmosphere' of warmth they create. They are also purchased for their heating function in some of the warmer states. According to industry sources, decorative appliances are generally a secondary heating appliance, with the householder also having central or ducted heating. Consequently industry sources believe the majority of these appliances are typically not operated for long periods, and almost certainly less often than the household's main source of heating.

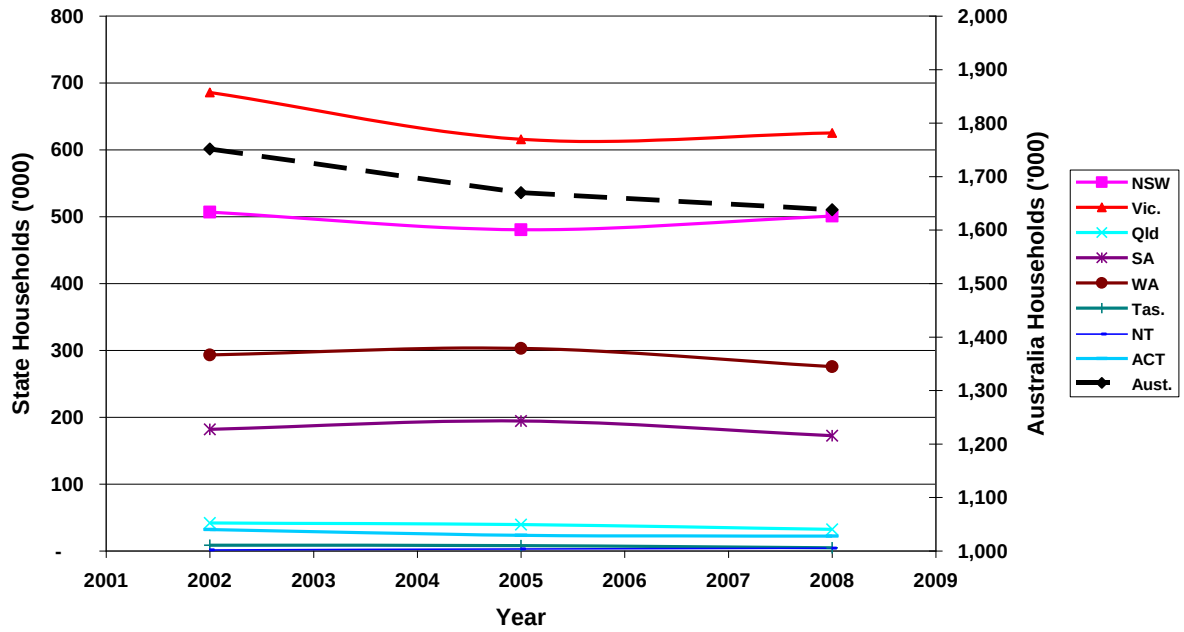
There are a variety of decorative appliance models, with around 50 models in the market at present. Models range from those marketed as purely decorative appliances, through to models which are marketed as capable of supplying some space heating function. The gas consumption of the appliances also varies, from around 20 – 60 MJ/h. This is a significant level of gas consumption, given that flueless space heaters, which account for the great majority of gas heater sales, have gas consumption rates in the range of 8 – 25 MJ/h.

The exact size of the market is not reported by known sources of market data, however interviews with suppliers have revealed that approximately 10,000 units are sold per annum and the market is relatively steady. Decorative appliances were first sold in volume in the late 1980's.

Stock and Sales

The number of households who use non-ducted gas space heaters as their main form of heating has decreased during the period from 2002 to 2008. As shown in Figure 8, the data from the ABS 4602 time series reports shows that the number of households using non-ducted gas heating has declined by 6.5% from 2002 to 2008. This is a decline of approximately 1% per annum.

Figure 8 - Number of Households Main Heating: Non-Ducted Gas Heating 2002 - 2008



Source: ABS 4602 from 2002, 2005, 2008

The declining use of non-ducted space heating is most obvious in Victoria where the proportion of households with non-ducted gas space heating has declined from 40.1% in 1999 to 31.2% in 2008. The same data also shows that the proportion of those households in Victoria with ducted gas heating increased from 31.5% in 1999 to 40% in

2008. This data suggests that households are installing ducted gas heating in place of non-ducted gas heating in Victoria.

The ACT and WA have also seen a decrease in the proportion and number of households using non-ducted gas space heating. Householder concerns over the adverse health impacts flueless heaters may be contributing to this trend. The trend in NSW indicates that numbers are stable or slightly in decline, as shown in Table 2.

Table 2 - Number & Proportion of Households Main Heating: Non-Ducted Gas Heating 2002 - 2008

Year	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
Proportion (%)									
1999	23.0	40.1	5.8	32.4	42.8	5.1	32.3	22.9	**29.0**
2002	25.1	37.7	6.4	32.1	45.8	4.6	31.2	26.0	**29.1**
2005	24.0	33.0	6.0	33.0	46.2	4.1	49.1	19.3	**27.4**
2008	24.3	31.2	4.5	29.2	40.7	2.4	49.7	17.7	**25.6**
Number ('000)									
2002	507	686	42	182	293	9	1	32	**1,751**
2005	481	616	40	194	303	8	3	24	**1,670**
2008	501	625	32	172	276	5	4	22	**1,638**

These latest statistics and the sales data in the following section were used to develop the figures for estimated stock and sales. The estimated stock and sales of non-ducted gas space heaters by category are shown in Figure 11 and Figure 12.

The sales by category of gas space heater from 2006 to 2008 are presented in summary form in Table 3.

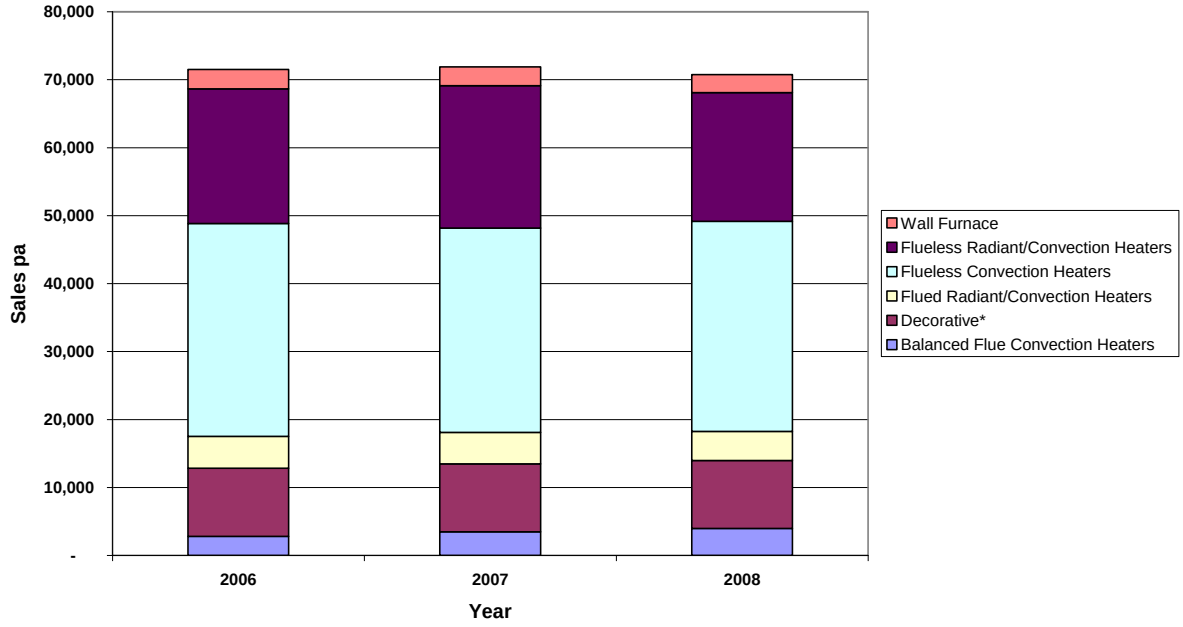
Table 3 - Sales of Gas Space Heaters, Australia (2006 - 2008)

Category	2006	2007	2008
Balanced Flue Convection Heaters	2,811	3,466	3,955
Decorative*	10,000	10,000	10,000
Flued Radiant/Convection Heaters	4,699	4,631	4,268
Flueless Convection Heaters	31,303	30,058	30,935
Flueless Radiant/Convection Heaters	19,817	20,948	18,934
Wall Furnace	2,851	2,764	2,638
Total	71,481	71,867	70,730

*Source GfK 2008, * Decorative is based on industry estimate*

As shown in Figure 9, flueless convection and combined radiant/convection heaters represent the majority of sales of non-ducted gas space heaters in Australia. Annual sales of wall furnace type gas heaters are declining rapidly while annual sales of balanced flue convention heaters are increasing.

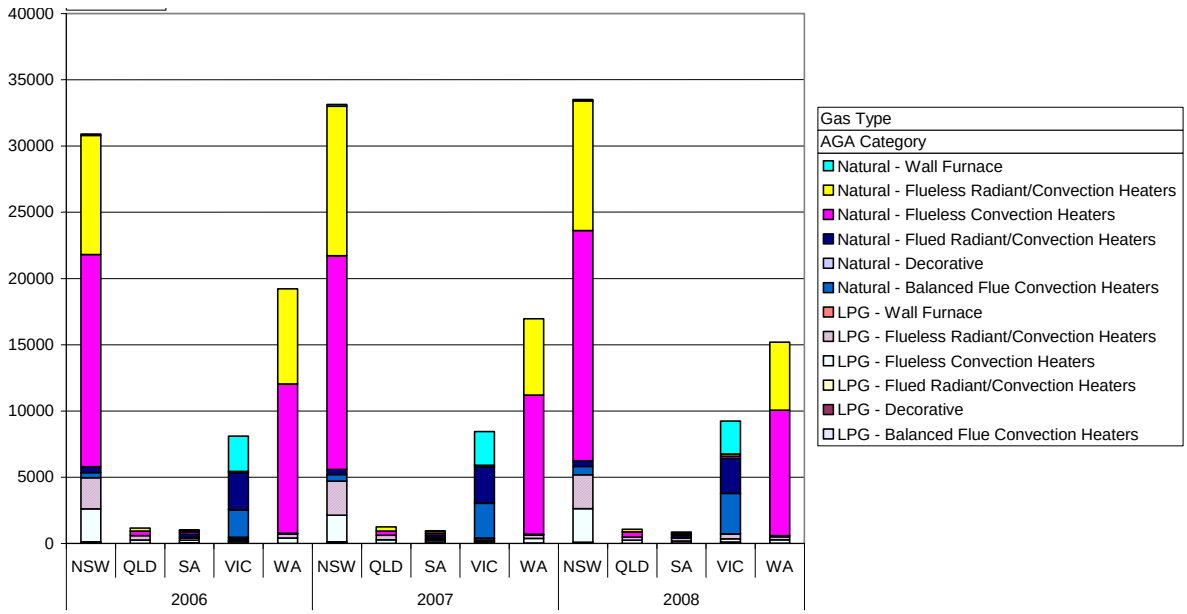
Figure 9 - Total Annual Sales of Gas Space Heaters in Australia (LPG and Natural Gas)



*Source: GfK 2008, *Decorative appliance sales are based on industry estimates*

The disaggregated data by state shows that certain categories of heaters are more popular in particular states of Australia. Figure 10 shows that flueless convection heaters and combined radiant/convection heaters are primarily sold in NSW and WA while flued heaters are more popular in Victoria. This would be partially attributable to the Victorian regulations that prevent the use of natural gas flueless heaters in that state. The GfK data includes sales via retailers and excludes sales direct to builders and trade. The GfK coverage of gas space heaters is very high as most sales of gas space heaters are made by retailers.

Figure 10 - Total Annual Sales of Gas Space Heaters in Australia by State and Gas Source



Source: GfK 2008, note that only a small proportion of Decorative appliances sales are included in this data.

Suppliers

There are 31 suppliers of gas space heaters and decorative appliances listed in the AGA Certified Product Directory (Aug 2008)[3], with over 40 brands and more than 190 models[4]. Flued radiant/convection heaters have 88 models listed followed by decorative appliances with 38 models.

Approximately half of the suppliers manufacture these units in Australia, which represents 40% of total number of models in the AGA Certified Product Directory. The major countries of origin of the imported models are Japan, USA and New Zealand.

Analysis of the GfK sales data from 2006 to 2008 shows that the vast majority of gas space heater sales are dominated by Rinnai, Everdure, Paloma and Vulcan. An estimated 70% of the units sold in the market are imported.

For decorative appliances, Australia and the USA represent the major source of models on the market. Table 4 shows the suppliers of gas space heaters and decorative appliances, the number of principal models and brands, and country of origin.

Table 4 - Suppliers of Gas Space Heaters and Decorative Appliances, Number of Models, Brands and Country of Origin

Supplier	Brands	Country of origin	Balanced Flue Conv' Heaters	Flued Radiant/ Conv' Heaters	Flueless Conv' Heaters	Flueless Radiant/ Conv' Heaters	Wall Furnace	Dec-orative
			Number of Principal Models listed in AGA Directory					
AF Gason P/L	Eureka, Jindara	Australia		2				
Aurora Climate Systems P/L			1					
Bowin mfg P/L	Bowin	Australia			5			
Bromic P/L						2		
CFM Europe Ltd		UK						1
Climate Technologies P/L	Pyrox, Vulcan	Australia		2			6	
CVO Fires P/L	CVO Fires	UK						1
Dragon Wholesaling Pty Lt	Lopi	USA		1				
Escea Ltd	Escea	New Zealand		2				
Firefox Industries P/L	Firefox	Australia						1
Fireplace Products Australia P/L	Regency	USA	5	7				1
Gas Log Fires P/L								1
Glen Dimplex Australasia	Masport	New Zealand		8		1		
Hearth & Home Technologies Inc	Jetmaster, Heat-N-Glo	USA	3	11				6
Illusion Open Gas Log Fires P/L	Illusion	Australia		5				2

3 Though other certifying bodies also list suppliers and products, the number they list is relatively small, e.g. in early 2009 the SAI Global's Gas Safety Certification Scheme contained three suppliers with approximately 10 products certified to AS 4553 and one to AS 4558. Consequently the AGA Directory was used as the prime data source.

4 These represent the principal models with many variations in colour, natural gas or LPG, and other features.

Supplier	Brands	Country of origin	Balanced Flue Conv' Heaters	Flued Radiant/ Conv' Heaters	Flueless Conv' Heaters	Flueless Radiant/ Conv' Heaters	Wall Furnace	Dec-orative
Jarrahdale Solid Fuel Heating	Jarrahdale	Australia		1				
Jetmaster Fireplaces Australia P/L	Jetmaster, Kemlan, Agnews, Heat-N-Glo	Australia						9
Multiglow Fires	Multiglow	UK						1
Paloma Industries - Agent: Paloma Australia	Paloma	Japan				4		
Pecan Engineering	Pecan, Maxiheat	Australia		6				4
Real Fires New Zealand Ltd	Real Fires	NZ						1
Real Flame P/L	Real flame, Jindara, Eureka	Australia		4				5
Rheem Australia P/L (Vic)	Rheem, Raypak Vermont, Paloma	Aust/USA/ Japan		4	2	1		
Rinnai Australia P/L	Rinnai	Japan/NZ	6	18	14	7		2
Sampford IXL P/L	Cannon	Australia	1	2				
Seeley International P/L	Braemar	Australia					2	
Shamic Sheetmetal (Aust) P/L	Coonara, Heatcharm, Arrow	Australia		4				
Shriro Australia P/L	Everdure	Australia				4		
Stove Builder Intl Inc – Agent: Melton Craft P/L	Osburn	Canada		2				
Ultimate Australia P/L	Millenium, Esprit, Ultimate	Australia		9				
TOTAL			**16**	**88**	**21**	**19**	**8**	**38**

Projected Trends

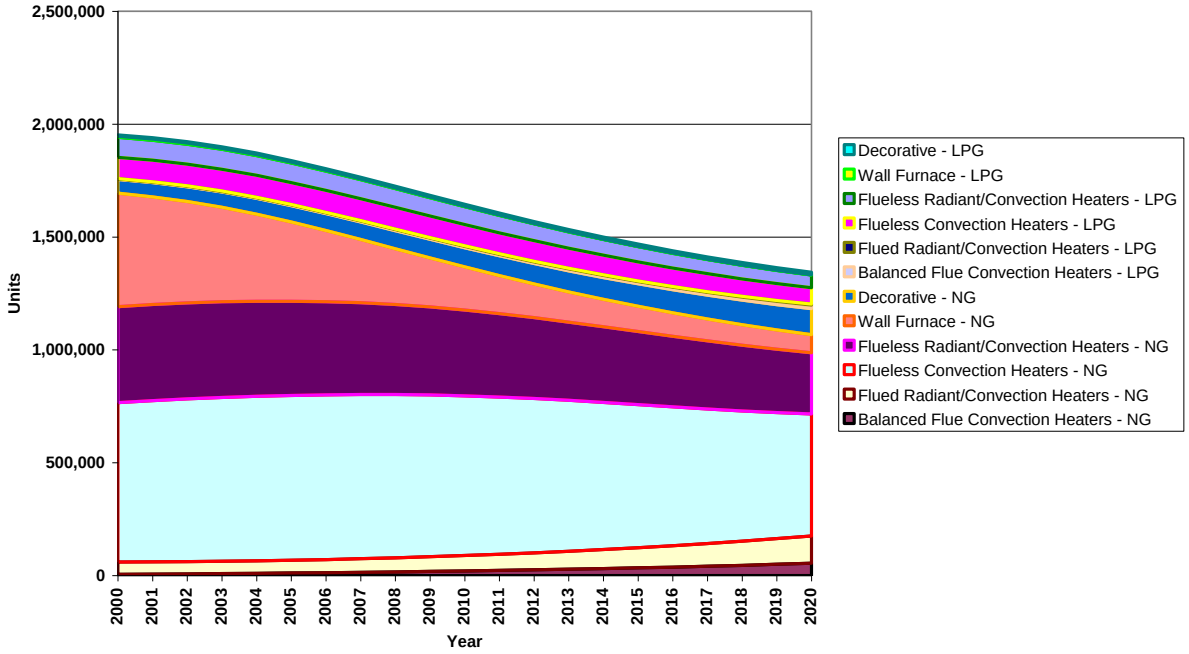
Based on the detailed sales and historical trends from ABS and GfK data, a model was developed of the historical and projected stock and sales of gas space heaters in Australia. This detailed model segments the categories of gas space heaters by state, category (AGA/Australian Standard classifications) and gas source (Natural Gas or LPG). The model accounts for the retirement of stock based on a logistic function, representing the estimated useful life of gas space heaters. Some of the key assumptions include:

- The total stock of gas space heaters are declining after peaking in the earlier part of this decade (based on ABS data).
- Sales of flueless convection and radiant/convection heaters are declining in sales by approximately 1 – 3% p.a. (based on GfK data).
- Sales of balanced flue convection heaters, flued radiant/convection heaters are increasing by 1 – 5% p.a. (based on GfK data).
- Sales of decorative appliances were increasing until the middle of this decade and are now relatively stable. It has been assumed that decorative appliances will grow at 1% p.a. as industry stakeholders gave mixed views on the growth of this market segment.

- The average life of gas space heaters is between 15 to 25 years, with industry sources suggesting that about 50% of the heaters are replaced after 20 years.
- State stock and sales shares are based on ABS data and GfK sales by state.

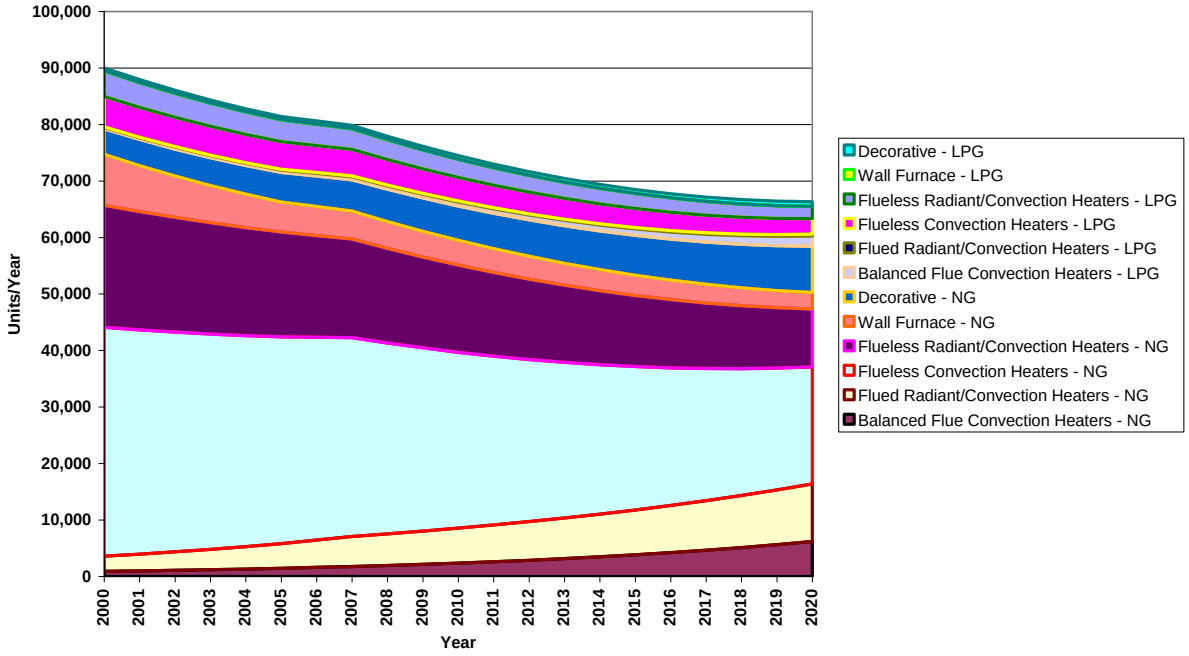
The estimated historical and projected stock of gas space heaters and decorative appliances are shown in Figure 11. The overall stock is projected to decline from 1.9M units in 2008 to 1.3M units in 2020. The stock of certain categories, such as decorative appliances, balanced flue convection and flued radiant/convection heaters is projected to increase over this period. LPG space heaters represent 12% of the total stock of gas space heaters and decorative appliances.

Figure 11 - Estimated Stock of Gas Space Heaters by Category 2000 - 2020



The historical and forecast sales of gas space heaters and decorative appliances are shown in Figure 12. Estimated total sales are based on GfK data from the period 2006-2008, which shows some decline in the sales for flueless heaters and a slight increase in sales of flued heaters.

Figure 12 - Estimated Sales of Gas Space Heaters by Category 2000 - 2020



The data presented by MEA et al 2002 study, estimated that sales of room gas space heaters were approximately 190,000 in 1999/2000, and stated that no information was available to verify this figure. This study however, based the estimated sales on an estimated retirement life of 13.4 years and assumed that all retirements were replaced. The trend observed by industry is that many units are replaced by ducted or non-gas space heaters. Also many units last longer than 13.4 years and will effectively increase the stock that must be replaced by new sales (also assuming that they are replaced by space heaters). The combined effect of these assumptions was for the MEA study to overestimate the sales of gas space heaters. The GfK data also shows that total sales are not as high as estimated by the MEA study.

New Zealand Space Heater and Decorative Appliance Market

Sales Data

A number of agencies including the Ministry for Economic Development and representatives from the Gas Association and the LPG Association were contacted by Environet Ltd to obtain sales data for gas heating appliances. It was not possible to obtain sales data as no single agency holds such data. Manufacturers and suppliers were unwilling to provide sales figures as they considered this information to be commercially sensitive. The exception was portable gas heaters supplied to the New Zealand market for which information was obtained from the LPG Association. The total number of portable cabinet gas heater supplied for 2004 to 2008 are shown in Table 5.

Table 5 - Number of portable gas heaters supplied to the New Zealand market, 2004 to 2008.

Year	Total
2004	35,575
2005	47,522
2006	48,131
2007	60,546
2008	36,775

Source: LPG Association (NZ)

An alternative approach of seeking import data from the New Zealand Customs Service was used by Environet Ltd to provide an indication of the number of units imported. Imports of gas heaters are covered by a wide ranging tariff code that included gas space heaters and other duel fuel gas heating appliances. A detailed breakdown of the products within this tariff code was requested from the New Zealand Customs Service, but this was not available.

However, the total imports in this tariff code are likely to be dominated by gas heaters but will include some imports of dual fuel heaters where these have been imported with gas heaters. Table 6 shows import data by country of origin for 2007 and January to October 2008. Figure 13 shows the trends in total import data for gas heaters and other fuels from 2003 to 2007.

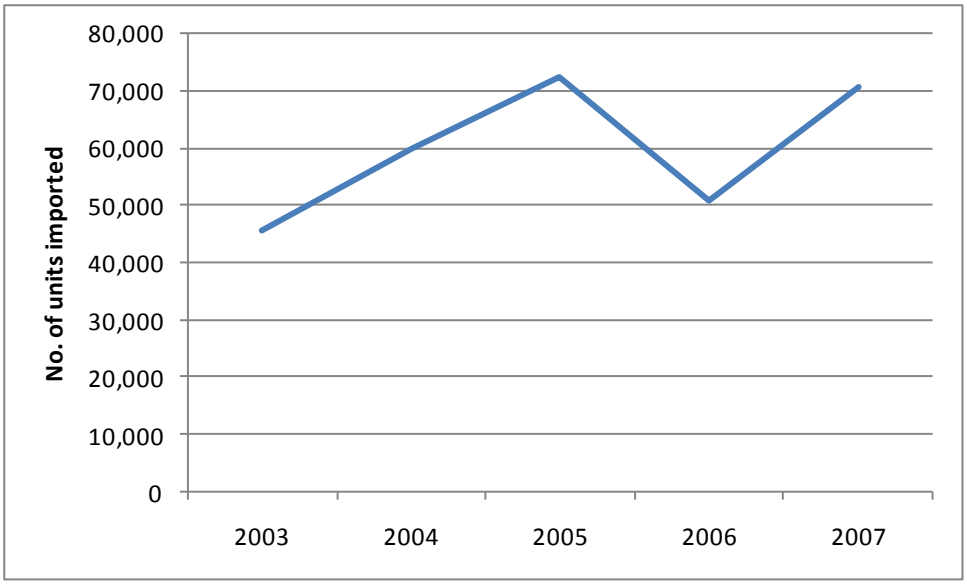
While the import data shows the number of gas heating appliances that are imported into New Zealand, the number of gas appliances manufactured in New Zealand is unknown. The manufacturers of these appliances are Dallas Metals, Escea, Harris Home Fires, Living Flame, Glen Dimplex Australasia Limited, Real Fires, Rinnai Gas Appliances, Warmington Industries Limited, Yunca Heating and Havelock Metal Craft.

Table 6 - Import of gas and dual fuel heaters by country of origin, for 2007 and January to October 2008

Country of Origin	Quantity	Quantity	Value for duty ($NZ)	Value for duty ($NZ)
	2007	2008	2007	2008
Argentina	300		$ 46,034	
Australia	24	190	$ 37,380	$ 280,452
Belgium	7		$ 24,975	
Canada	351	8	$ 514,980	$ 13,535
China, People's Republic of	52,474	35,889	$ 4,314,502	$ 2,383,077
Germany	161	110	$ 100,150	$ 66,190
Italy	10,594	9,545	$ 1,158,881	$ 1,069,792
Japan	3,821	2,686	$ 1,680,870	$ 1,103,790
Korea, Republic of	1	102	$ 453	$ 3,643
Netherlands	2	176	$ 3,490	$ 260,023
New Zealand	582		$ 322,437	
South Africa	1,193	551	$ 476,983	$ 224,024
United Kingdom	255	94	$ 230,277	$ 111,628
United States of America	655	251	$ 635,650	$ 313,687
Total	70,420	49,602	$ 9,547,062	$ 5,829,841

Source: New Zealand Customs Service

Figure 13 - Total number of imports from 2003 to 2007



Source: New Zealand Customs Service

Manufacturers, importers and suppliers

There are 27 companies that manufacture gas heating appliances for the New Zealand market. These companies are from New Zealand, Australia, China, Argentina, Canada, the United Kingdom, the United States of America, Norway, Canada, Japan and South Africa. There are 18 suppliers and/or importers of these products (Table 7).

Table 7 - Manufacturers, country of origin and the suppliers and/or importers of gas heating appliances in New Zealand

Manufacturer	Country of Origin for gas heating appliances	Supplier and/or Importer to the New Zealand market
Aurora Climate Systems Australia		BBQ Factory
Chant Limited	China	BBQ Factory
Climate Australia	Australia	AberGas Limited
Dallas Metals	New Zealand	AberGas Limited
De'Longhi International	Australia and China	De'Longhi New Zealand Limited
Emerge Argentina	Argentina	AberGas Limited
Escea	New Zealand	Escea
Esse	United Kingdom	Masport Heating
Fireplace Products International	Canada	Regent Distributors
Gaz Co	United States of America	The Fire Place
Glen Dimplex Australasia Limited	New Zealand	Masport Heating
Harris Home Fires	New Zealand	Harris Home Fires
Havelock Metal Craft	New Zealand	The Warehouse
Heat and Glo	United Kingdom	The Fire Place
Jet Master	South Africa	The Fire Place
Jotual	Norway	Retail Links Nelson
Kyung Dong Navien	South Korea	Rheem NZ Limited
Living Flame	New Zealand	Living Flame
Mitre 10 New Zealand Limited	China	Mitre 10 Mega and Mitre 10 and AMH Group
Paloma Limited	Japan	AberGas Limited
Rasmussen	United States of America	AberGas Limited
Real Fires	New Zealand	Real Fires
Rinnai Gas Appliances	New Zealand	Rinnai Gas Appliances
Sampford IXL Australia	Australia	AberGas Limited
Valley Comfort Systems	Canada	Masport Heating
Warmington Industries Limited	New Zealand	Warmington Industries Limited
Yantai Alpha Fire Place Co	China	Retail Links Nelson
Yunca Heating	New Zealand	Yunca Heating

Source: Environet 2009

Stock

Our survey results for 2008 indicate around 21% of households in New Zealand use gas space heaters or decorative appliances in their main living area. Around 2% use gas fired central heating systems. Around 37% of households using gas in their main living area reported using mains gas with 79% of these using reticulated natural gas and 21% using piped LPG. These results are compared with a home heating survey undertaken for the Ministry for the Environment in 2005 (Table 8). In 2008, 55% of households using gas for heating in their main living area used unflued gas.

Of the households using gas, 38% were using mains gas and 62% were using bottled gas. 35% of households using mains gas used unflued gas heaters. 66% of households on bottled gas used unflued gas heaters.

For the households using gas heaters in their main living area, 64% were able to advise the make of their gas burner. Table 8 shows the proportion of different burners used by these respondents. Note that these data are indicative only of common makes used in New Zealand and should not be used as indicative of market share because of the potential for bias in non-respondents.

In areas other than the main living area, 7% of households used gas for heating. The distribution of these amongst other rooms were 4% in a secondary living area, 2% used gas heating in bedrooms and 1% in other areas such as hallways, kitchens and bathrooms.

Outdoor piped gas heaters were used by 2.7% of the population with the majority of these (91%) using bottled LPG.

Table 8 - Reported home heating methods, main living area, 2008 and 2005

	2008 Heating Methods				2005 Heating Methods			
	%	Total	Mains	Bottled	%	Total	Mains	Bottled
Electricity	57%	854,427			57%	816,907		
Total Gas	21%	308,543	118,242	190,301	36%	487,278	142,435	344,843
Total Flued gas	8%	123,121	75,999	63,181	9%	134,939	82,462	52,476
Flame effect – Flued	2%	31,151	25,076	12,395				
Ducted Central Heater - Flued	2%	31,151	21,976	16,482				
Other Space Heater - Flued	4%	91,970	28,947	34,304				
Unflued gas	13%	185,423	42,244	127,120	24%	352,339	59,973	292,367
Oil	1%	19,284			2%	28,663		
Open fire	6%	93,453			6%	85,990		
Wood burner	25%	373,812			38%	544,605		
Multi fuel burners	8%	124,604			8%	114,654		
Pellet burners	1%	17,801			<1%			
Reported methods/home	1.2%	1,791,923			1.5%			
No heating reported	13%				2%			

Table 8, above, shows that there are significant differences between the 2005 and 2008 usage rates of gas heating and wood use in the main living area. A likely explanation for the decrease in gas use is the higher cost of LPG which peaked in 2008 at around 6 c/MJ. This coincided with greater pressure on household budgets associated with high interest rates and increases in the cost of fuel and groceries. The consumer price index (CPI) showed increases of between 0.5% and 1.6% for all quarters from December 2006 until September 2008. Economic activity in New Zealand decreased during 2008 with the March, June and September quarters each showing a drop of less than 0.5% in gross domestic product (GDP).

Additional analysis was undertaken by Environet Ltd to further explain the differences. This indicated the following:

- Results of the 2005 home heating survey were similar to the 2006 for households using gas heating (39% for census for all heating compared with 34% in the survey for main living areas only).
- The proportion of households using no heating in their main living area increased from 2% in 2005 to 13% in 2008. The 2005 survey data was validated using 2006 census data which indicated 2.3% of households, including 1% of South Island households, did not heat their homes.
- The proportion of households using both electricity and another form of heating decreased from 37% of households in 2005 to 27% of households in 2008. While it is likely that the economic downturn played a large role, with households heating their homes to a lesser extent, the uptake of Energy Efficiency and Conservation Authority (EECA) and Regional Council initiatives to increase household insulation and clean heating options (e.g., heat pumps), may also have contributed.
- A comparison of the gas consumption per household from MED data for 2006 and 2007 indicated a 20% decrease in the gas consumption per household.

In summary, the 2008 survey indicated that gas heating has decreased since 2006. The largest reduction was that 50% of households using unflued gas heaters had stopped using this heating method, compared to 3% of

households who stopped using flued gas appliances. The majority of the reduction is within the portable unflued gas systems, particularly in households using these as a secondary heating method in their main living area. The number of households using these fell by 57% from 2005 and 2008. The use of unflued gas in mains systems has also fallen by 30% between 2005 and 2008.

Data on installations of all gas outlets and appliances in residential and commercial premises was provided by the New Zealand Plumbers, Gasfitters and Drainlayers Board for the years 2004 and 2008. This data was evaluated to determine the proportion of gas heater installations for these years that met the criteria for decorative appliances. This information was required because the survey question related to flame effect heaters, some of which meet the criteria for space heaters as opposed to solely decorative appliances.

The installation dataset included around 30,000 entries for each year. Only a third of these were gas fires. A subset of around 2,000 gas installations was chosen from April 2004 and 2008 to separate out gas fires from other appliances. Over 97% of these installation records had sufficient detail to identify the burners as true heaters (certified to AS 4553) or decorative types (certified to AS 4558). Table 9 shows the number of fires identified and the proportion of installations that is categorised as space heaters or decorative appliances.

Table 9 - Installation of space and decorative burners 2004 and 2008

Appliance Type	2004		2008	
Space Heaters (total)	783	85%	464	82%
Decorative	134	15%	93	17%
Total space and decorative	917		557	

Source: New Zealand Plumbers, Gasfitters and Drainlayers Board

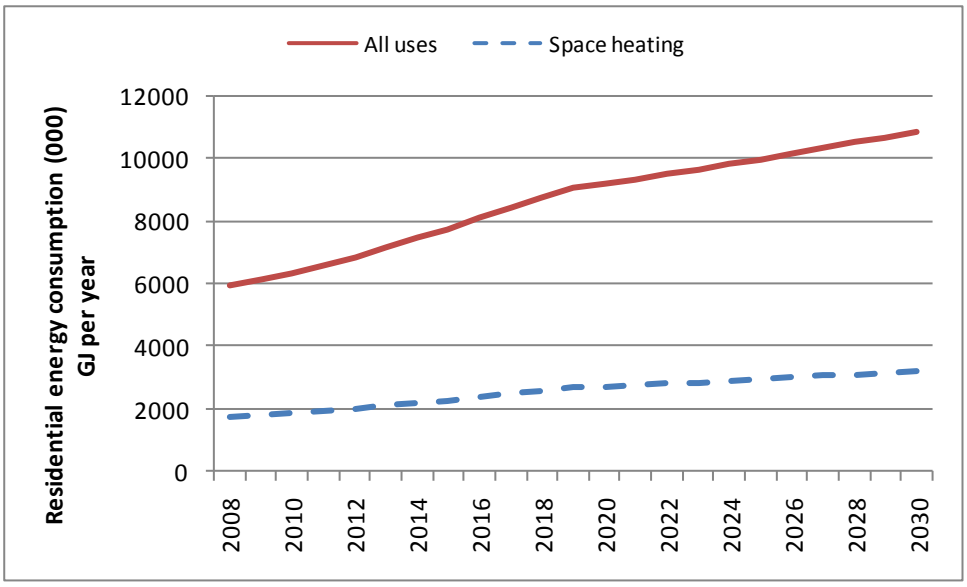
Subsequent sections of this report require energy consumption data for decorative and space heaters and therefore estimates of 'flame effect' types had to be apportioned to either space or decorative quantities. A total of 78% of the appliances originally classified as 'flame effect' were space heaters certified to AS 4553. The energy consumption data were therefore adjusted to account for this discrepancy.

Projected Trends

Future growth in the residential market for natural gas is predicted by the Ministry of Economic Development (MED). One deterrent to new connections is the set up cost, which is around $10, 000 to connect a house to piped natural gas, even if it is located across the road from the piped network. As a result, electricity can be a more attractive option for retailers to promote as it can take 10 - 15 years to recover the investment on the installation of piped natural gas under these circumstances. The 2007 average residential electricity cost was 6.1 c/MJ compared with 3 – 3.6 c/MJ for natural gas.

The MED predicts an average annual increase in natural gas use by the residential sector of 4.1% from 2008 to 2019 reducing to 1.8% per year from 2020 to 2030. Figure 14 shows the projected total residential energy consumption from natural gas based on MED projections and an estimated 30% space heating contribution.

Figure 14 - Projected residential natural gas consumption, 2008 to 2030



Source: MED, 2008

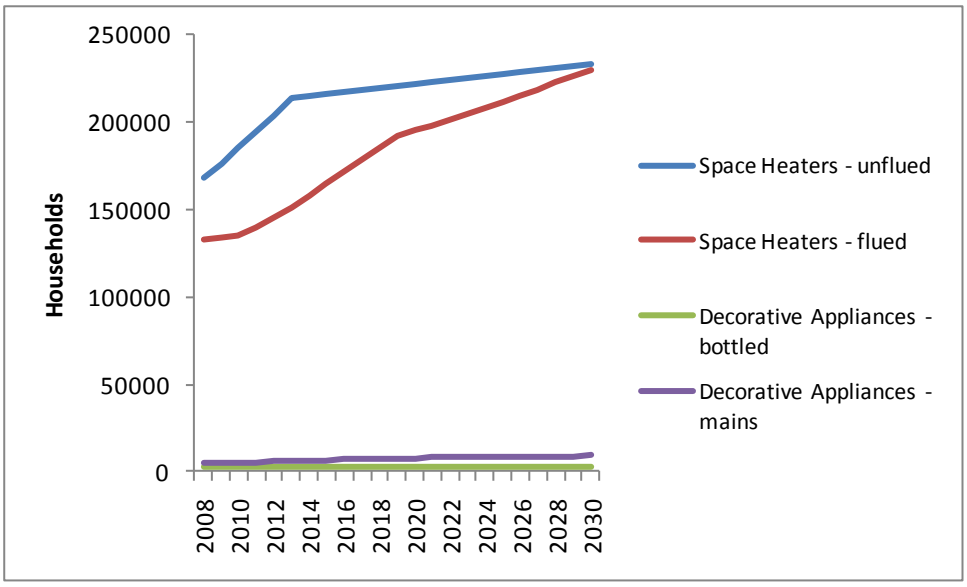
Comparable projections of LPG consumption are not available for New Zealand, although the LPG Association have provided some comment on likely drivers. Compared with natural gas, the price of LPG is currently high (3 – 3.6 c/MJ for natural gas compared with 5 – 6 c/MJ for LPG). This gap, however, is likely to narrow slightly as LPG prices decrease in 2009. Despite this, LPG appears to be a reasonably popular method for home heating in areas without access to natural gas with evidence of decreases in market share only evident in 2008. From 1996 to 2001 there was a 34% increase in households using LPG for heating, although this decreased by 5% from 2001 to 2006.

Information from suppliers and the LPG Association suggests that the portable gas heater market is not increasing in market share and that current demand for portable gas heaters is from households replacing existing ones.

Figure 15 shows projections in gas heater use in New Zealand. For natural gas the projections made by MED were used in conjunction with the 2008 appliance numbers. The MED projections did not predict the changes observed in 2008 data and it is therefore likely that they overestimate increases in natural gas use for the current economic climate. Consequently the percentage increase for the first two years has been reduced to one quarter of the MED predictions. Economic factors were also considered when determining LPG projections as were potential future reductions in LPG prices. Factors that should be noted when considering Figure 15 are:

- Decorative appliances – bottled LPG: the popularity of decorative appliances is linked with general wealth. High current LPG prices are likely to limit future installations to high end new builds or renovations. Increases are therefore likely to be minimal in the short term. In the absence of specific projections for LPG, estimates have been made based on one quarter of the MED natural gas projected increases per year.
- Decorative appliances – reticulated gas: one quarter of MED projections for years 2009 to 2010, then 100% of the MED projections.
- Space heaters – flued: increases based on one quarter of the MED natural gas projections for two years and then 100% of the MED natural gas projections.
- Space heaters – unflued: economic pressures and other drivers had the greatest impact on this group of gas heaters from 2006 to 2008 and significant decreases were observed in this group. It is assumed that the decreases observed will be recovered as the economic situation improves and that subsequent increases will be minimal at one quarter of the MED natural gas projections.

Figure 15 - Projected changes in gas heating methods in New Zealand



Source: Environet 2009

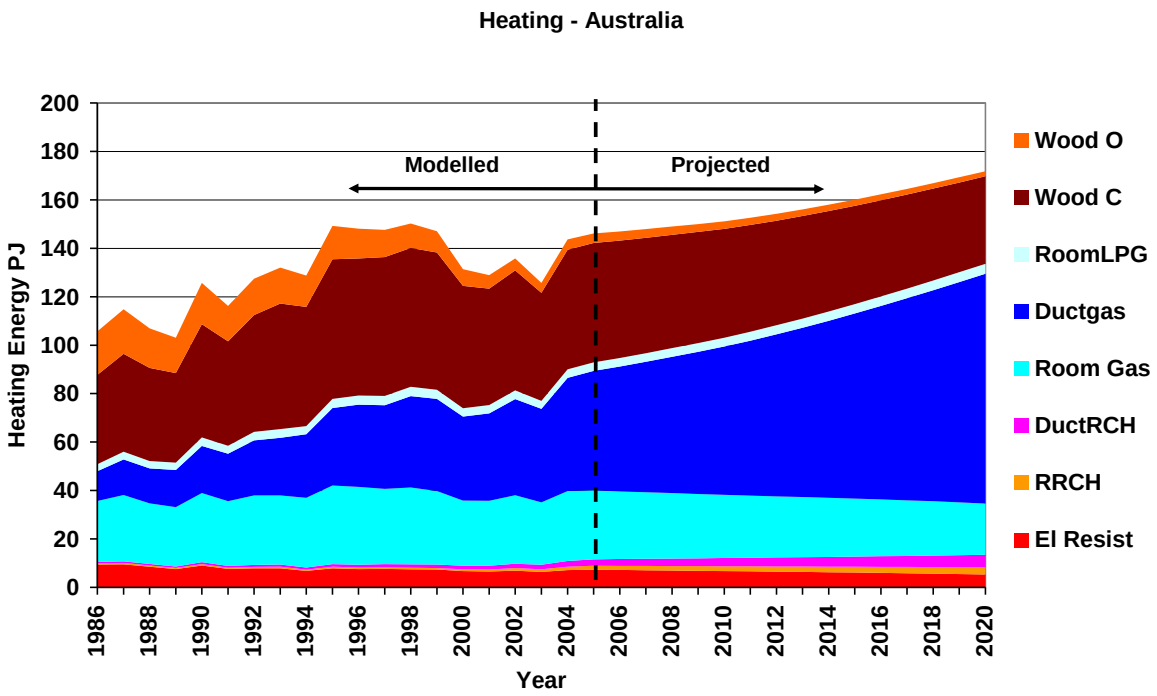
4. Energy Consumption and Greenhouse Gas Emissions

Australia

Energy Consumption

The estimated energy consumption by gas space heaters has been reported by EES (2008) in the *Energy use in the Australian Residential Sector, 1986-2020*, as ranging from 25 PJ p.a. to 32 PJ p.a. over the period 1986 to 1998, with the overall energy consumption reducing to 25 PJ p.a. in 2003. As shown in Figure 16, energy consumption attributed to gas heaters is projected to decline and energy consumption from the use of ducted gas heaters is projected to increase substantially.

Figure 16 - Residential Heating Energy Consumption in Australia 1986 – 2020 (EES 2008)

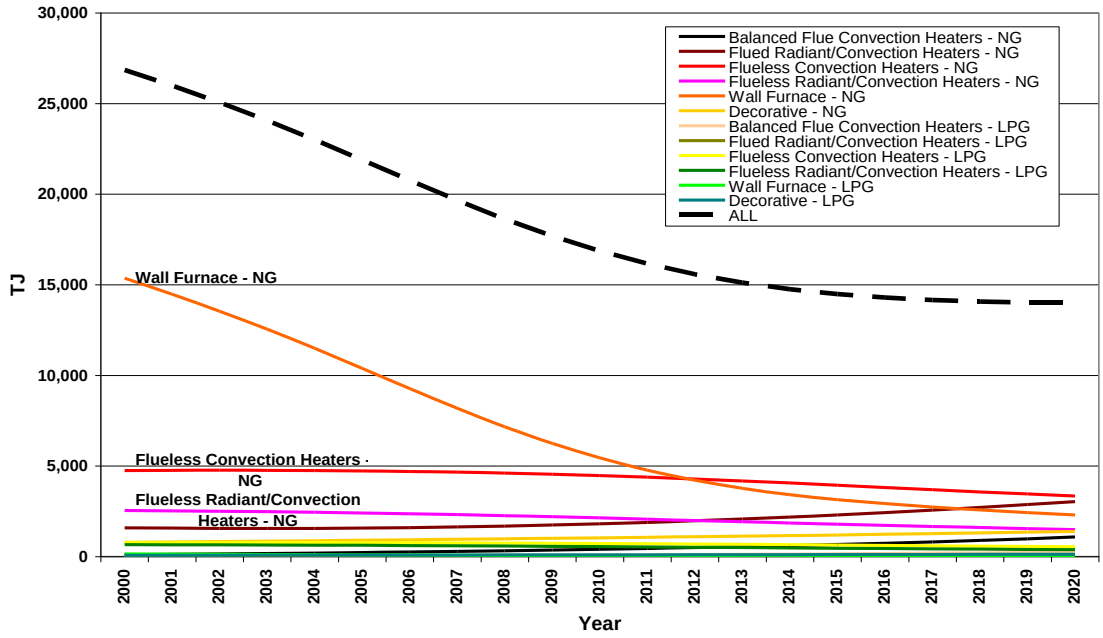


Key: Wood O = wood – open combustion; Wood C = wood – closed combustion; RoomLPG = LPG gas non-ducted (room heater); Ductgas = mains gas ducted; Room Gas = mains gas non-ducted (room heater); DuctRCH = AC reverse-cycle ducted; RRCH = AC reverse-cycle non-ducted; El Resist – electric resistive.

In comparison, the historical and projected energy consumption by gas space heaters for the present study has been estimated using a stock/sales model that is combined with various appliance and usage attributes. The results of the present study have been compared to the output of the EES 2008 study and found to be reasonably close, both in terms of state based energy consumption and by year. The main difference identified was the lower level of efficiency assigned to the space heaters by EES, with EES assuming an average efficiency of around 65% and declining, while the average efficiency used for the present study has been determined as 76% based on the sales weighted average efficiency of all the identified models sold from 2006 to 2008, according to GfK (see the section *Sales Weighted Average Efficiency*, page 47 for details). This difference explains the lower values of total energy consumption estimated by the present study compared to the EES 2008 report, as shown in later figures and tables.

The total annual energy consumption by space heater category is shown in Figure 17 with estimated energy consumption declining from 27 PJ p.a. in 2000 to 14 PJ p.a. in 2020. The decline in energy consumption is largely due to the declining sales and stock of gas space heaters.

Figure 17 - Annual Energy Consumption by Category 2000 - 2020



Flueless convection, wall furnace and flueless radiant/convection heaters represent the vast majority of energy consumption.

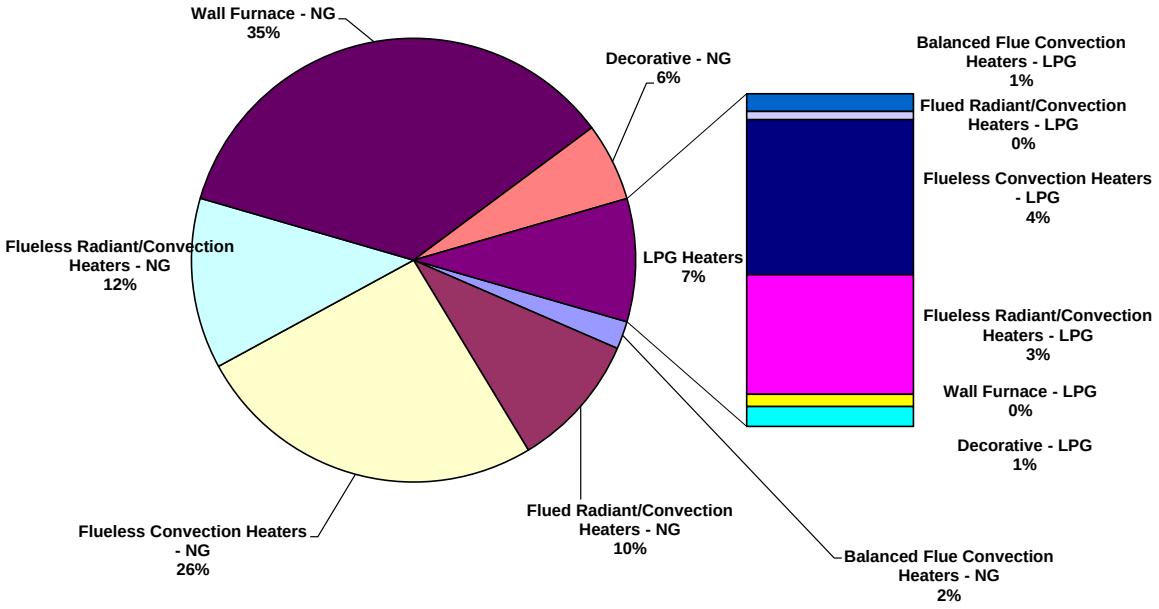
Table 10 below shows that Victoria represents the vast majority of energy consumption attributed to gas space heaters, followed by New South Wales/ACT, Western Australia and South Australia. Tasmania and Queensland represent only a small proportion of the total annual energy consumption of gas space heaters. Tasmania's natural gas network was introduced in the middle of this decade and now covers several major cities and regional areas; hence the forecast shows an increase in natural gas energy consumption by space heaters from 2007.

Table 10 - Annual Energy Consumption by State 2000 – 2020 (TJ pa) Natural and LPG Space Heaters

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST
2000	5,585	0	328	1,286	110	17,766	1,776	**26,851**
2001	5,573	0	327	1,278	110	16,920	1,776	**25,985**
2002	5,551	0	326	1,269	110	16,028	1,772	**25,056**
2003	5,518	0	324	1,257	109	15,089	1,766	**24,063**
2004	5,475	0	321	1,243	109	14,102	1,755	**23,005**
2005	5,421	0	318	1,227	108	13,070	1,742	**21,885**
2006	5,358	0	314	1,208	111	12,042	1,725	**20,757**
2007	5,285	0	310	1,188	114	11,059	1,705	**19,661**
2008	5,201	0	305	1,167	118	10,154	1,680	**18,625**
2009	5,106	0	299	1,143	122	9,361	1,652	**17,682**
2010	5,000	0	292	1,119	127	8,702	1,619	**16,859**
2011	4,887	0	286	1,094	133	8,177	1,583	**16,159**
2012	4,768	0	279	1,068	139	7,782	1,544	**15,579**
2013	4,645	0	271	1,042	146	7,507	1,503	**15,114**
2014	4,519	0	264	1,017	153	7,341	1,461	**14,754**
2015	4,392	0	256	992	161	7,269	1,418	**14,488**
2016	4,267	0	249	968	170	7,266	1,375	**14,294**
2017	4,146	0	241	945	180	7,314	1,333	**14,158**
2018	4,030	0	234	923	191	7,401	1,292	**14,072**
2019	3,923	0	228	903	203	7,521	1,254	**14,032**
2020	3,818	0	221	885	216	7,676	1,217	**14,033**

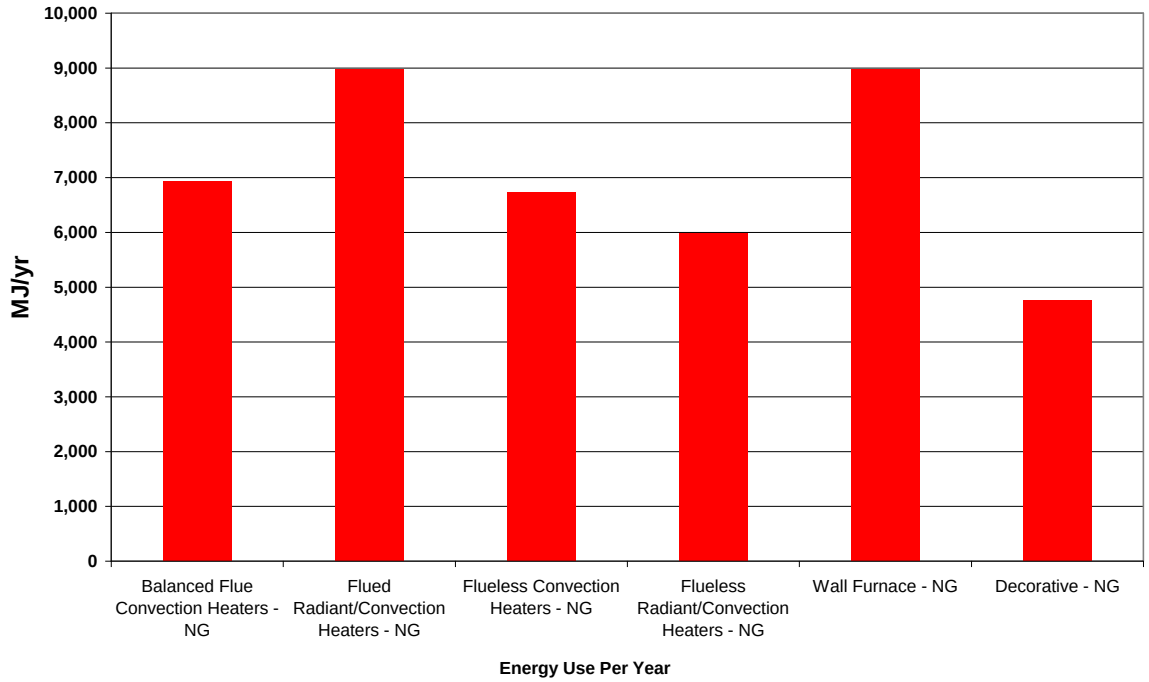
Figure 18 below presents the share of the total annual energy consumption by category in 2009. The share of decorative appliances is estimated to be 7% of the total annual energy consumption in 2009.

Figure 18 - Proportion of Annual Energy Consumption by Category – Australia 2009



The estimated annual per unit energy consumption by category is shown in Figure 19 for NSW and shows the average annual consumption if a household has this appliance.

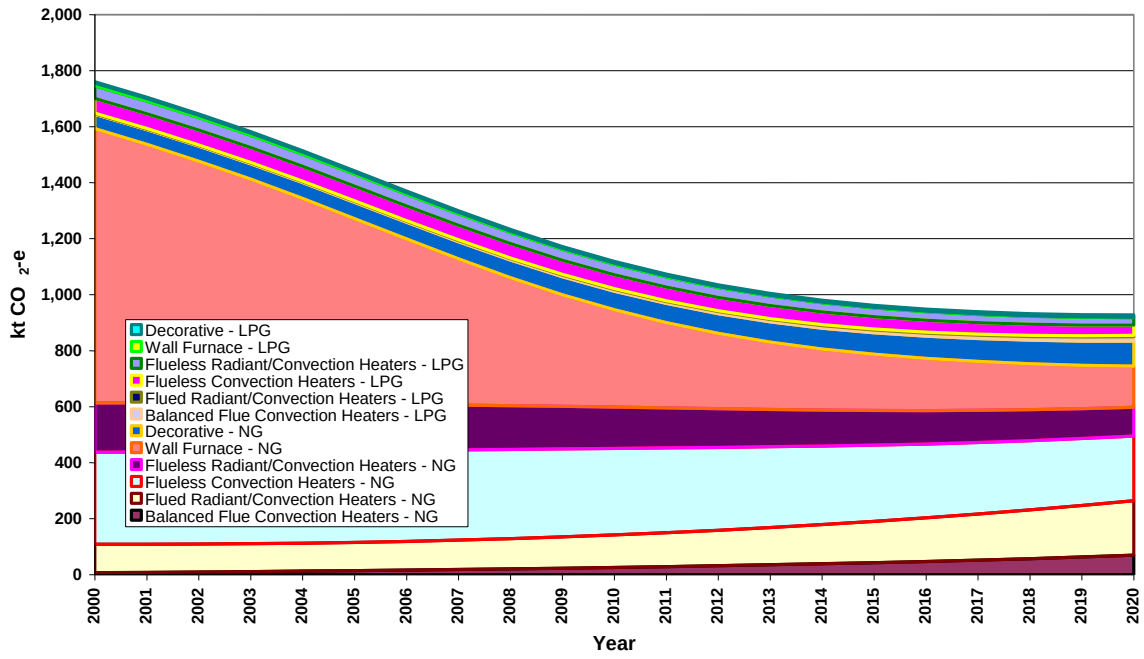
Figure 19 - Annual per Unit Energy Consumption by Category, NSW 2009



Greenhouse Gas Emissions

The estimated greenhouse gas emissions by category from 2000 to 2020 are shown in Figure 20.

Figure 20 - Annual Greenhouse Gas Emissions by Category, Australia 2000 – 2020 (kt CO2-e)



Australian Model Features and Assumptions

To estimate energy consumption and greenhouse emission by state, heater category and fuel, a detailed model was developed utilising the stock and sales of gas space heaters/decorative appliances, along with the energy efficiency, usage and heater output characteristics. The energy used by gas appliances is a function of average gas input, number of operating units and average number of hours of operation. In turn the greenhouse gas emissions are a function of energy consumption and emission factors for gas combustion.

The number of operating units is a function of existing stock, replacements and new sales. Estimates of stock and sales were made for all Australian states/territories with summary results shown in the earlier sections. The stock and new sales were subjected to a "survival function" that reflected the life span of gas space heaters.

The average number of hours of operation for gas space heaters was sourced from the input attributes of the EES 2008 study and is shown in Table 11. It was assumed that gas decorative appliances were used for about 30% of the time of gas space heaters. This probably over states the use of the majority of decorative appliances which are not used as a primary heater, but as a decorative appliance according to the interviews with suppliers. However, some decorative appliances are used for heating in the warmer states, so a higher average usage rate has been estimated. Surveys of the end users of decorative appliances would be helpful in refining the estimated time that these appliances are used.

Table 11 - Average Annual Operating Hours by Appliance and State

Gas Appliance	NSW	NT	QLD	SA	TAS	VIC	WA
Gas Space Heaters	300	50	100	380	1,200	1,000	250
Decorative Appliances	90	15	30	114	360	300	75

The average heat output and gas input of gas space heaters was determined from the sales weighted average heater output from 2006 – 2008 by heater category. For decorative appliances, the average appliance output and gas input was determined from appliance literature. Table 12 shows the values determined by category.

Table 12 - Maximum Appliance Heat Output by Category (kW)

Product Category	Maximum Output (kW)	Maximum Input (MJ/h)
Balanced Flue Convection Heaters	5.2	23.1
Flued Radiant/Convection Heaters	6.0	30.2
Flueless Convection Heaters	5.6	22.4
Flueless Radiant/Convection Heaters	5.0	19.9
Wall Furnace	5.9	29.6
Decorative	2.2	52

Gas space heaters and decorative appliances were assumed to have a useful half life of 20 years, i.e., this is the point where 50% of the appliances would be discarded and only 25% of the appliances would remain after 25 years. A logistic survival function was utilised to retire the stock of appliances based on the age installed.

The greenhouse gas emission factors for natural gas space heaters and decorative appliances are shown in

Table 13, and are the same emission factors used for the calculation of emissions undertaken by the National Equipment Energy Efficiency (E3) Program for Regulatory Impact Statements (RIS). The E3 RISs utilise state based average fuel cycle emission factors. To simplify the model, the same emission factors were used for LPG, as less than 7% of the energy consumption of gas space heaters and decorative appliances was attributed to LPG. The emission factor used by the E3 Program for LPG is 59.9 kg CO_2-e/GJ, which is very close to the average emission factors for natural gas. Hence the greenhouse gas emissions from LPG fuelled appliances are slightly overestimated in the model results.

Table 13 – Greenhouse Gas Emission Factors by State Natural Gas (kg CO2-e/GJ)

State	Emission Factor (kg CO2-e/GJ)
New South Wales & ACT	71.3
Northern Territory	53.6
Queensland	68.8
South Australia	73.8
Tasmania	60.0
Victoria	63.6
Western Australia	60.7

Source: Equipment Energy Efficiency Program: RIS Household and Greenhouse Emission Factors, July 2008

The average net efficiency of gas space heaters and decorative appliances used for the calculation of gas input was determined from the sales weighted average efficiency of heaters in 2006 – 2008. The values used for sales of new heaters and appliances in 2007 are shown in Table 14 and are based on the data analysis shown in Figure 21. The average net efficiency of decorative appliances was determined from product literature providing the gas input and estimated heat output/area heated. The average net efficiency of the decorative appliances is of considerable concern, given their extremely low levels of efficiency.

Table 14 - Average Net Efficiency by Category 2007

Product Category	Average net Efficiency (%)
Balanced Flue Convection Heaters	81.1
Flued Radiant/Convection Heaters	71.5
Flueless Convection Heaters	89.9
Flueless Radiant/Convection Heaters	90.4
Wall Furnace	71.7
Decorative	15.0

Based on the analysis of the GfK data, the net efficiency of flued radiant/convection heaters was assumed to be increasing by 0.5% p.a. and for wall furnaces it was assumed to be decreasing by 0.5% pa. The net efficiency of new product for the other product categories was assumed not to change over the period 2000 – 2020, based on the analysis of GfK data.

New Zealand

Energy Consumption

Natural Gas

Residential heating was estimated by Environet Ltd to consume 1.4 PJ of natural gas during 2007. This includes households using ducted gas systems (gas central heating), which are specifically excluded from this product profile and likely to consume around 0.3 PJ per year. The 2008 home heating survey indicates that these comprise around 15% of households using reticulated gas in New Zealand. Table 15 shows the estimated gas consumption for home heating in New Zealand by heater type based on the assumption of similar consumption rates across different gas heating appliances, on average. All natural gas energy consumption data are based on net calorific value.

Table 15 - Natural gas home heating energy use

Type of burner	Energy consumption PJ/ year, 2007
Space Heaters (excluding central heaters and decorative appliances)	1.03
Central Heaters	0.25
Decorative Appliances	0.11

Source: Environet 2009

Liquefied Petroleum Gas (LPG)

Fuel consumption from bottled LPG was estimated by Environet Ltd based on the number of households using bottled gas for 2006 (Statistics NZ), the 2008 home heating survey as well as the average annual fuel use from the 2008 home heating survey. Table 16 shows the estimated number of households, annual fuel consumption and an estimate of the energy consumption for 2006 and 2008.

Fuel consumption from piped LPG was estimated based on census information for dwellings in the South Island, gas supplier information on dwellings for the North Island and average LPG consumption per household for home heating. Environet (2009) estimated space and decorative heaters used 1.2 PJ p.a. in 2008, as illustrated in the table below.

Table 16 - Bottled and piped LPG home heating fuel consumption and energy use

	2006			2008		
Burner Type	Households using	Annual fuel consumption t/year	Total PJ/ year	Households No.	Annual fuel consumption t/year	Total PJ/ year
Space Heaters	325,683	45,684	2.3	163,894	22,890	1.1
Central Heaters	53,753	7,745	0.4	53,753	7,745	0.4
Decorative Appliances	9,310	1,341	0.1	9,310	1,341	0.1
Total	388,746	57,436	2.8	226,957	34,641	1.7

Source: Environet 2009, note that data for Central Heaters in 2006 and were assumed to be the same in 2008

Greenhouse Gas Emissions

Greenhouse gas emission estimates from natural gas and LPG residential heaters and decorative appliances are shown in Table 17.

Table 17 - Summary of Greenhouse Gas Emissions by Fuel: Residential Gas Space Heaters and Decorative Appliances (kt CO2-e /yr)

Fuel Source	Total	Space Heaters	Decorative Appliances	Radiant Outdoor Heaters
Natural Gas (2008)	74	54	6	1
LPG (2007)	166	137	4	8
Total	240	191	10	9

Source: Environet 2009

New Zealand Model Features and Assumptions

Environet Ltd calculated the energy consumption and greenhouse gas emissions associated with space heaters and decorative appliances in New Zealand. The approach shown in their report (Environet 2009) is summarised in this section.

Gas consumption data were obtained from MED for total residential natural gas use for 2000 to 2007. The proportion of natural gas connected households who were also using natural gas for residential space heating was estimated at 80% for 2006. This is based on the number of households reportedly using mains gas for space heating (less those using piped LPG) from 2006 census divided by the total number of connections (as reported by MED).

For the 80% of natural gas connected households using gas for space heating, 35% of the annual gas consumption was assumed to be used for space heating. This was based on Table 18 and requires the assumption that all households using gas for home heating also use gas for water heating and cooking. Around 30% of the residential natural gas consumption was estimated to be associated with space heating.

Table 18 - Average Annual Residential Gas Consumption

Residential Gas Use	Annual Consumption
Water Heating	21.6 – 25.2 GJ/ pa
Space Heating	14.4- 18 GJ/ pa
Cooking	5.4 –7.2 GJ/ pa

Source: Gas Association of New Zealand www.ganz.org.nz

Annual LPG consumption was estimated based on the number of households using LPG and the average annual consumption per household (kg/year) from the 2008 home heating survey. The survey included estimates of consumption in the main living area, as well as secondary living areas, bedrooms and other rooms.

Greenhouse gas emissions were estimated for 2007 (natural gas) and 2008 (LPG) based on the estimated energy consumption and the emission factors shown in Table 19.

The emission factors for greenhouse gas emissions from residential natural gas and LPG use in New Zealand were sourced from MED (2007) and are shown in Table 19. These were based on a Tier 1 approach of using country-specific emission factors for CO_2 emissions and mainly Intergovernmental Panel on Climate Change (IPCC) default factors for non-CO_2 emissions (IPCC 2006).

In MED (2007) emission factors for non-CO_2 emissions are presented for gross and net calorific value. The gross calorific value (GCV) emissions factors were derived by MED (2007) from the IPCC default factors which are provided on a net calorific basis. MED (2007) assumed that the net calorific values (NCV) for oil and coal are 5% less than GCVs, and NCVs for gas are 10% less than GCVs. Estimates of greenhouse gas emissions were made for CO_2, CH_4 and N_2O separately and combined as CO_2 equivalents. The latter was based on the following CO_2 equivalent conversions: CO_2 – 1, CH_4 – 23, N_2O – 296.

Table 19 - Greenhouse gas emission factors CO2-e for residential gas use (kt CO2-e/ PJ)

Gross CV		Net CV	
Natural gas – residential	**LPG – residential**	**Natural gas – residential**	**LPG – residential**
53.3	60.0	58.65	65.7

Source: Adapted based on MED, 2007

5. Relevant Standards and Regulations

Testing and Efficiency Standards/Labelling

Australia

There are two standards in Australia covering safety of non-ducted gas space heaters and gas decorative appliances. However, only the gas space heaters standard includes the gas energy rating label and efficiency requirements.

Space Heaters

The non-ducted space heater standard is as follows:

> AS 4553-2008 which applies to 'gas space heating appliances (convectors, radiant convectors, wall furnaces) with natural draught or fan assisted combustion systems intended for use with natural gas, town gas, liquefied petroleum gas (LPG) and tempered liquefied petroleum gas (TLP) with gas consumptions not exceeding 150 MJ/h.' The standard does not cover decorative gas log fires.

The efficiency requirements for gas space heaters are described in the table below.

Table 20 - Efficiency Requirements - Non-ducted Gas Space Heaters

Type of Space Heater	Heating Method	Minimum Gross Thermal Efficiency
Radiant		30% radiant efficiency
Convection and Radiant	Natural	60% total efficiency
	Forced Convection	70% total efficiency
Room Sealed		70% total efficiency

For convection and radiant heaters, the 60% minimum efficiency applies with the fan off, and the 70% with the fan on and at all fan speeds.

The gas energy rating labelling requirements described in the standard for non-ducted space heaters include the Annual Energy Consumption (AEC) which 'is based on a heater performing the task of releasing heat into a room for a heating period of 5 hours per day, (2½ hours at high setting and 2½ at low [turndown] setting), with a standby period of 19 hours per day for a heating season of 100 days per year. The Annual Energy Consumption is calculated to represent the comparative energy consumption of the space heater when operated for one heating season. The calculation is based on a reference heater of identical energy input and having an effective thermal efficiency of 80%.'

Regarding flueless space heaters, technical regulators and suppliers recommend, and in some Australian States mandate, a minimum level of ventilation for these heaters. This requirement will add to heat loss from the rooms where the heaters are used, and therefore decrease the overall net efficiency of these heaters when operated. This is not recognised in the present testing and rating system, making the energy ratings of the flueless space heaters artificially high.

Flueless portable cabinet heaters are not included in the standard.

Decorative Gas Fuel Effect Appliances

The standard for decorative gas log-fire and fuel effect appliances is as follows:

> AS 4558 – 2000 (AG 108 – 2000) applies to 'appliances that are designed primarily to have a decorative appearance. An appliance that is intended for space heating (in the form of radiant or convection heater) shall be certified to the requirements of AS 4553 / AG 103 – Gas space heating appliances'. These requirements apply to decorative fuel effect appliances with gas consumptions not exceeding 72 MJ/h. Also indoor flueless appliances are excluded from the scope of the Standard.

The standard also contains a methodology for measuring gas consumption, but no MEPS or minimum efficiency requirements.

New Zealand

At this stage there are no controls relating to the energy efficiency of gas space heating appliances. The Gas Regulations (1993) and standards and codes for the gas sector only apply to the safety of an appliance. There are no links between product safety and the energy efficiency of a product. However, opportunities to include such provisions into the New Zealand legal framework are possible through amendments to the Building Code and the Energy Efficiency (Energy Using Products) Regulations 2002. Gas Water heaters were included in these Regulations in June 2011.

There are a number of Acts, regulations, standards and codes that relate to gas appliances and installations. These include:

- Gas Act (1992)
- Gas regulations (1993)
- NZS 5442 Specification for reticulated natural gas
- NZS 5435 Specification for liquefied petroleum gas (LPG)
- NZ 5263 Gas detection and odorization
- AS/NZS 60079.10.1 Hazardous Area Classification
- NZS 5261 Gas Installation
- NZS 5262 Gas Appliance Safety
- GCP 1 Inspection, Testing and Certification of Gasfitting Work Done Under Supervision

Regulations Impacting on Energy

Australia

The regulations that impact on energy use of non-ducted gas heating are fairly limited. The gas energy labelling program was initially an industry voluntary scheme that was once managed by the Australian Gas Association (AGA) but has since become a mandatory, co-regulated scheme. Now all State and Territory regulators prohibit the sale of gas space heaters that are not registered and certified to comply with the certification requirements of the AGA, SAI Global or IAPMO R&T Oceana Pty Ltd schemes. These certification schemes all require that, space heaters should meet the safety and minimum thermal efficiency requirements specified in AS 4553. This standard also details how the energy rating label parameters are calculated and displayed. However there are no enforceable regulations that require the display of the energy rating label in retail stores. Decorative gas appliances are also required to be registered and certified but in reference to AS 4558 – 2000.

The main gas appliance regulations concern safety issues for flueless gas heaters, so in Victoria there are restrictions on the installation of natural gas flueless heaters and other States have ventilation requirements. In addition the Australian Standard AS 5601-2004 (AG 601-2002) requires that flueless gas heaters are not to be installed in the following locations: bedroom; bathroom; toilet; sauna or caravan.

In July 2004, NSW introduced the mandatory requirement to undertake a Building Sustainability Index (BASIX) assessment on new dwellings. This assessment includes how home heating in NSW might impact on heating energy use, but so far the trend has been towards air conditioning, and maybe slightly away from gas heating. So the impact of the BASIX requirement appears to be minimal on gas heating so far. However, 30% of homes assessed for BASIX have no heating system and some of these may convert to flueless gas heaters in the future, which could create a trend for increasing gas space heating. The analysis of the GfK sales data (GfK 2008) shows that sales of flueless gas space heaters have increased from 25,000 units in 2006 to 27,000 units in 2008.

New Zealand

Energy Efficiency and Conservation Act 2000

The Energy Efficiency and Conservation Act 2000 provides the legislative framework for the New Zealand Energy Efficiency and Conservation Strategy (NZEECS), the Energy Efficiency and Conservation Authority and regulations pertaining to energy using products and services (discussed further below).

The NZEECS states the Government's policies, objectives, targets and the means to achieve those policies and objectives with respect to energy efficiency, energy conservation and the use of renewable sources of energy.

The Act established the Energy Efficiency and Conservation Authority (EECA). EECA is a standalone Crown Entity, subject to the Crown Entities Act 2004. The function of EECA is to "… encourage, promote, and support energy efficiency, energy conservation and the use of renewable sources of energy…".

Energy Efficiency (Energy Using Products) Regulations 2002

The Energy Efficiency (Energy Using Products) Regulations 2002 are provided for under section 36(1) of the Energy Efficiency and Conservation Act 2000. They are administered by the Ministry of Economic Development.

MEPS are regulated under the Energy Efficiency (Energy Using Products) Regulations. The purpose of MEPS is to improve energy performance by requiring certain appliances and equipment to meet specified energy performance levels.

Schedule 1 and Schedule 2 of the Regulations contain the appliances subject to the minimum energy performance requirements. Schedule 1 is for products subject to MEPS and Schedule 2 lists products subject to mandatory energy performance labelling.

The various amendments to include new products that have been made to the Energy Efficiency Regulations are below.

Schedule 1: List of product classes subject to MEPS

- Ballasts for fluorescent lamps
- Close Control Air conditioners
- Commercial Chillers
- Distribution transformers
- Dry-type distribution transformers
- External power supplies
- Gas water heaters
- Household refrigerating appliances
- Low-pressure copper thermal storage electric water heaters
- Refrigerated display cabinets
- Set top boxes
- Single-phase ducted air conditioners and air-to-air heat pumps
- Single-phase non-ducted air conditioners and heat pumps
- Storage water heaters (electrically heated)
- Three-phase air conditioners and heat pumps
- Three-phase cage induction motors
- Tubular fluorescent lamps

Schedule 2: List of product classes subject to mandatory energy rating labelling

- Clothes washing machines
- Dishwashers
- Household refrigerating appliances
- Rotary clothes dryers
- Single-phase non-ducted air conditioners and air-to-air heat pumps

Amendments would be required to the Energy Efficiency (Energy Using Products) Regulations 2002 in order to introduce mandatory energy performance standards for gas heating appliances.

Building Act 2004

The *Building Act 2004* replaces the *1991 Building Act*. The new Act incorporates a movement towards sustainable building practices; however both the 1991 Act and the 2004 Act include energy efficiency in their guiding principles.

Section 400 provides powers to set minimum performance standards for new buildings in regulations called the building code. The building code is found in Schedule 1 of the *1992 Building Regulations*, which originally came into force under the 1991 Building Act and continues in force via section 415 of the *2004 Building Act*.

Section 172 requires the chief executive of the Department of Building and Housing (NZ) to appoint a building advisory panel that has members that specialise in a number of matters relating to the building industry. These include consumer, cultural, disability, energy efficiency, health and safety, heritage, or sustainable development

issues. The purpose of the building advisory panel is to provide independent, specialist advice on trends in building design, quality and performance, building technology, sustainability, urban planning and consumer issues. This panel has the potential to influence the building industry in relation to the energy efficiency of gas heaters.

Building Code

The *Building Code* is the first schedule of the *Building Regulations Act 1992*. The *Building Code* is a performance based regulation that sets the standards building work must meet. It covers a variety of building aspects including structural stability, fire safety, access, moisture control, durability, services and energy efficiency.

Clause H1 of the building code prescribes energy efficiency performance standards. The objective of Clause H1 is to facilitate the efficient use of energy. The functional requirement is that 'Buildings must be constructed to achieve an adequate degree of energy efficiency' when that energy is used for modifying temperature or humidity, or both (H1.2 Building Code).

Performance standards are provided to ensure that the objective and functional requirements are met. At this stage there are energy efficiency provisions for the thermal envelope, hot water systems (which may include gas hot water systems), heating and ventilation systems for commercial buildings, and artificial lighting in commercial buildings. The only energy efficiency requirements for gas appliances in the *Building Code* relate to water heating. The Department of Building and Housing references the standard NZS 4305, Energy efficiency – domestic type hot water systems, which sets minimum efficiencies for storage and continuous flow water heaters.

There are no energy efficiency requirements in the *Building Code* for space heating in houses and amendments to the *Building Code* would be required to include such provisions (pers comm. Nick Locke, Department of Building and Housing).

Resource Management Act 1991

The *Resource Management Act 1991* (RMA) is the main environmental management legislation for New Zealand. Part II of the RMA sets out the purpose and principles of the Act. The overriding purpose of the Act is to 'promote the sustainable management of natural and physical resources (S5(1)). Sections 6, 7 and 8 contain the key considerations that a local government authority has to take into account when making decisions about how the environment will be managed.

International Standards

Space Heaters

Internationally the energy focus has tended to be directed toward heating furnaces and boilers, with little attention on space heaters. Despite this, some standards and labels have been introduced, and some of the countries which have voluntary or mandatory standards or energy labelling programs are listed below[5].

Table 21 - International MEPS and Labelling of Space Heating

	USA	Canada	Europe	UK	Russia	Israel	Brazil	Australia
MEPS	Yes		Yes	Yes	Voluntary	Yes		Yes
Energy Label	Yes	Mandatory	No	No		Yes	Voluntary	Yes

In addition, Japan operates the Top Runner standards program, which is a voluntary, but industry wide program that progressively raises the average energy efficiency performance across the products produced by an industry. The Top Runner program is operating for space heaters.

The Canadian Government introduced mandatory energy labelling for Gas Fireplaces (Vented) from late 2003. The new EnerGuide label lists the Fireplace Efficiency (FE) for all gas fireplaces, whether they are decorative units or models used for space heating. The FE is a measurement that reflects the overall operation of the fireplace, taking into account how fireplaces are typically used in the home during an entire heating season. The Canadian Standards Association (CSA) P.4.1-02 'Testing Method for Measuring Annual Fireplace Efficiency' is used to

[5] Further information on the standards can be found in Mark Ellis et al, 2002, 'Energy Labelling and Minimum Energy performance Standards for Domestic Gas Appliances'.

determine the FE for all gas fireplaces. All ratings are reported to Natural Resources Canada, and listed on the website (NRCAN 2009) which lists over 1,000 models containing FE measurements (ranging from 2.6% to 80.1%).

Decorative Appliances

While there appears to be no efficiency requirements specifically tailored for decorative appliances, it also is not clearly apparent if international regulatory schemes affecting space heaters exclude decorative appliances. This suggests that existing MEPS schemes for space heaters may apply to decorative appliances in the USA, Europe, UK and Israel. The only standard that explicitly specifies decorative units is the Canadian CSA P.4.1-02.

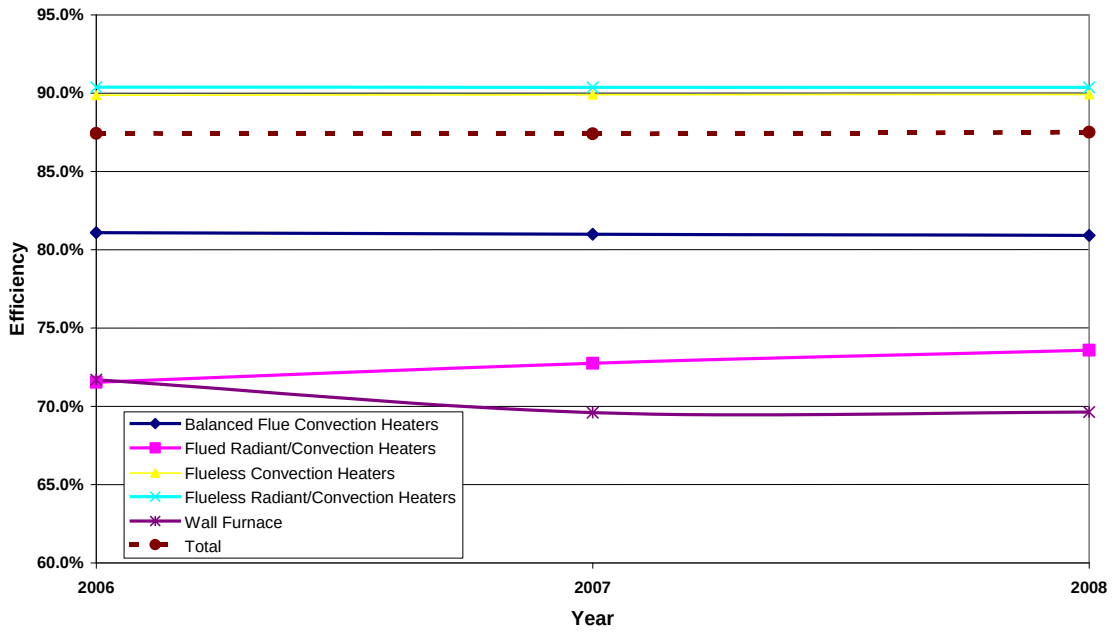
6. Energy Use and Improvement Potential

Sales Weighted Average Efficiency for Australia

The sales weighted average thermal efficiency for space heaters was determined by meticulously matching GfK sales data by model with the performance characteristics of the models from the *Directory of AGA Certified Products* (various editions from 2006 to 2008). This allows an accurate estimate of the sales weighted average thermal efficiency for space heaters by category from 2006 – 2008, as shown in Figure 21 and

Table 22. No such data was available for New Zealand.

Figure 21 - Sales Weighted Average Net Efficiency by Category 2006 – 2008



It appears that average net efficiency of appliances is relatively stable, remaining steady from year to year, except for:

- flued radiant/convection heaters where efficiency is increasing at approximately 1% pa; and
- wall furnaces where efficiency is decreasing at approximately 1% pa.

However, this is only three years worth of data and it is difficult to determine if these changes represent long term trends. The net efficiency of flueless convection and radiant/convection heaters is close to their theoretical maximum of 90.4%.

Table 22 - Sales Weighted Average Net Efficiency by Category 2006 -2008

Category	2006	2007	2008
Balanced Flue Convection Heaters	81.08%	80.99%	80.91%
Flued Radiant/Convection Heaters	71.53%	72.75%	73.58%
Flueless Convection Heaters	89.86%	89.90%	89.91%
Flueless Radiant/Convection Heaters	90.38%	90.36%	90.37%
Wall Furnace	71.70%	69.60%	69.63%
*Decorative**	*15%*	*15%*	*15%*
Total (excluding Decorative)	87.42%	87.40%	87.50%
Total (including Decorative)	77.27%	77.31%	77.14%

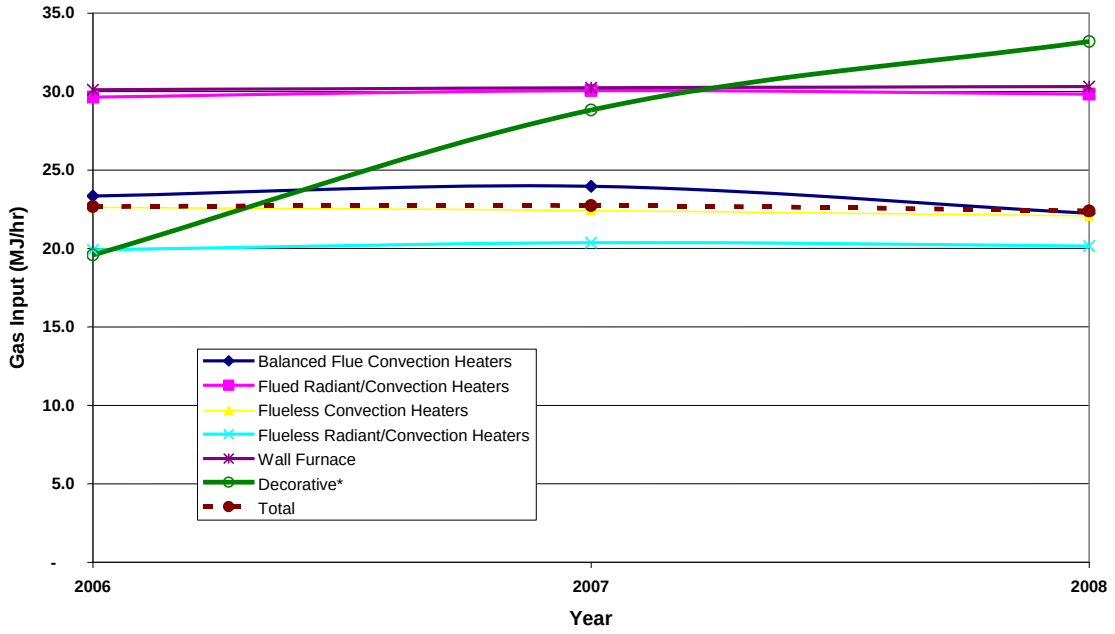
Source: Analysis of GfK Sales and AGA model data

**Decorative net efficiency determined from product information on heat output and input gas consumption.*

As shown in

Table 22, the weighted average net efficiency of all heaters is based on GfK data, however decorative appliances were estimated as they are not required to be tested for efficiency. The estimated efficiency was determined by calculating the heating output (based on product literature for these appliances which range from 35 to 50 m²) and dividing this by the gas input (which ranges from 30 – 70 MJ/h). The fact that some of these decorative appliances are marketed with an 'area heated' is contrary to the requirements of AS 4558, if they are to be marketed for 'decorative effect' only.

Figure 22 - Sales Weighted Average Gas Input by Category, 2006 – 2008 (MJ/h)



*Source: Based on GfK 2008. * Decorative sales were below 200 p.a. and hence this is not a reliable estimate.*

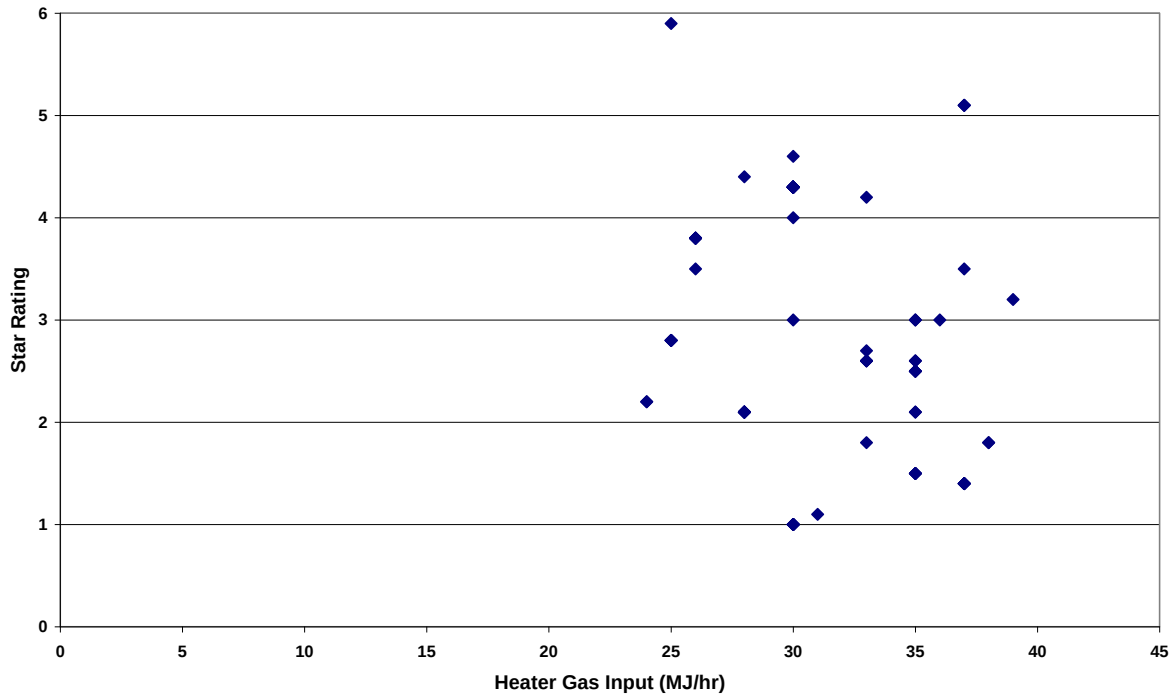
From the analysis of sales weighted average efficiency, it appears that in the past 3 years there is not a significant trend in the average energy efficiency of the gas space heaters. There is also very little change in the share of various product categories, which due to the differences in their category efficiency, can also influence the overall average efficiency of space heaters.

Range of Efficiency by Model

The range of star ratings by model and gas input (MJ/h) is shown in the following figures for each category of heater in Australia (no data was available for New Zealand). The heaters listed in these figures are the models that are currently on the market for the period 2006 to 2008.

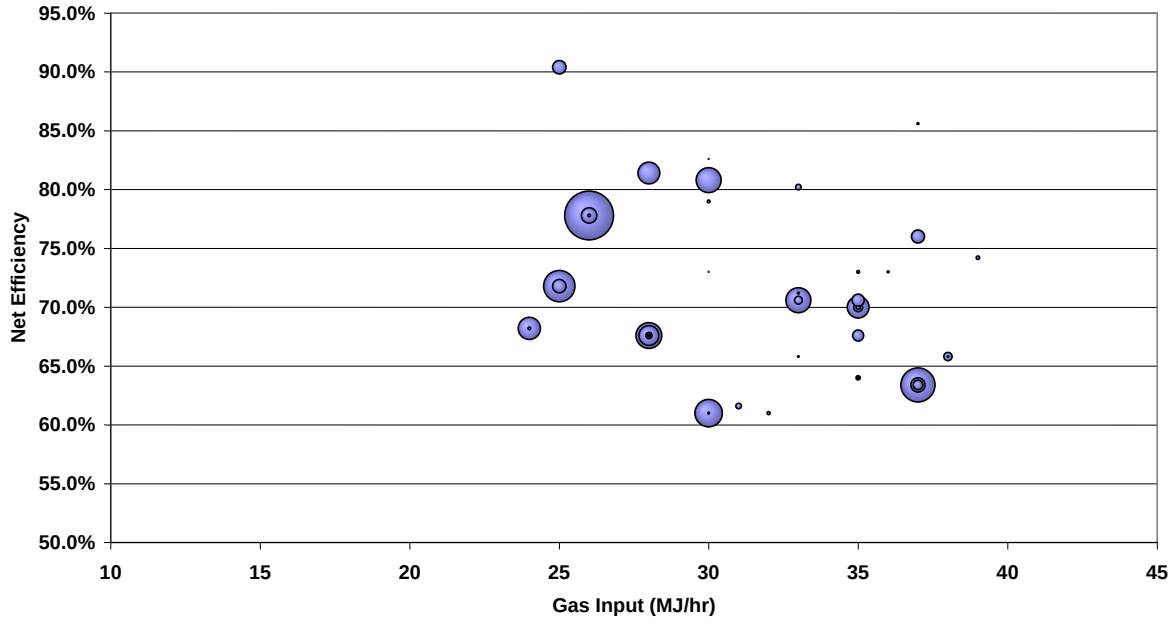
Although there is a range of efficiency over the five categories of heaters, the flued radiant/convection heaters show the largest spread of star ratings by model, while the flueless heaters provide the smallest range of star rating.

Figure 23 - Star Rating by Model and Gas Input - Flued Radiant/Convection Heaters



As shown in Figure 23, there is a wide range of star ratings for flued radiant/convection heaters, with a spread of models from 1 to almost 6 stars. This indicates that there is potential for consumers to choose a more efficient heater from the available models. As illustrated in the bubble chart Figure 24, where the size of the bubble indicates greater sales, there are significant sales of heaters with a net efficiency of less than 67% or 2 stars.

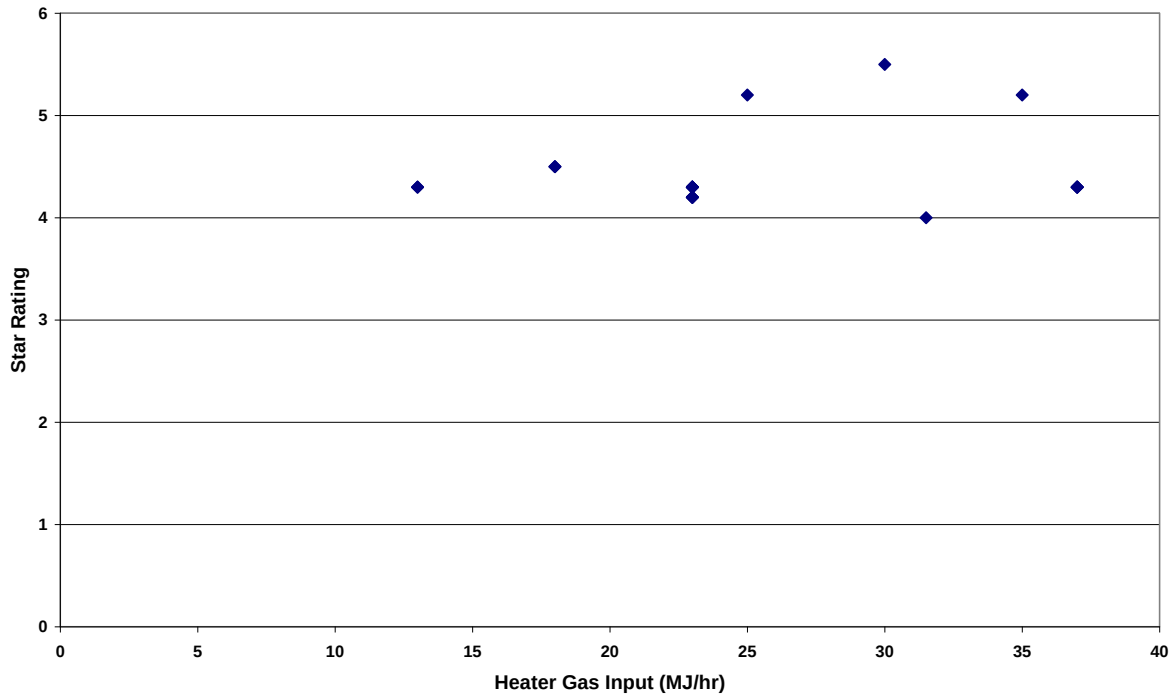
Figure 24 - Net Efficiency and Sales by Model (2006 – 2008) & Gas Input - Flued Radiant/Convection Heaters



Note: The size of the bubbles provides an approximation of the relative annual sales.

Balanced flue convection heaters are designed to draw air for combustion from outside the home and heat is transferred to the room via a heat exchange. These types of heaters are generally more efficient and all models are 4 stars or more, as shown in Figure 25.

Figure 25 - Star Rating by Model and Gas Input - Balanced Flue Convection Heaters



Flueless heaters demonstrate a very small range of star ratings (Figure 26 and Figure 27).

Figure 26 - Star Rating by Model and Gas Input - Flueless Convection Heaters

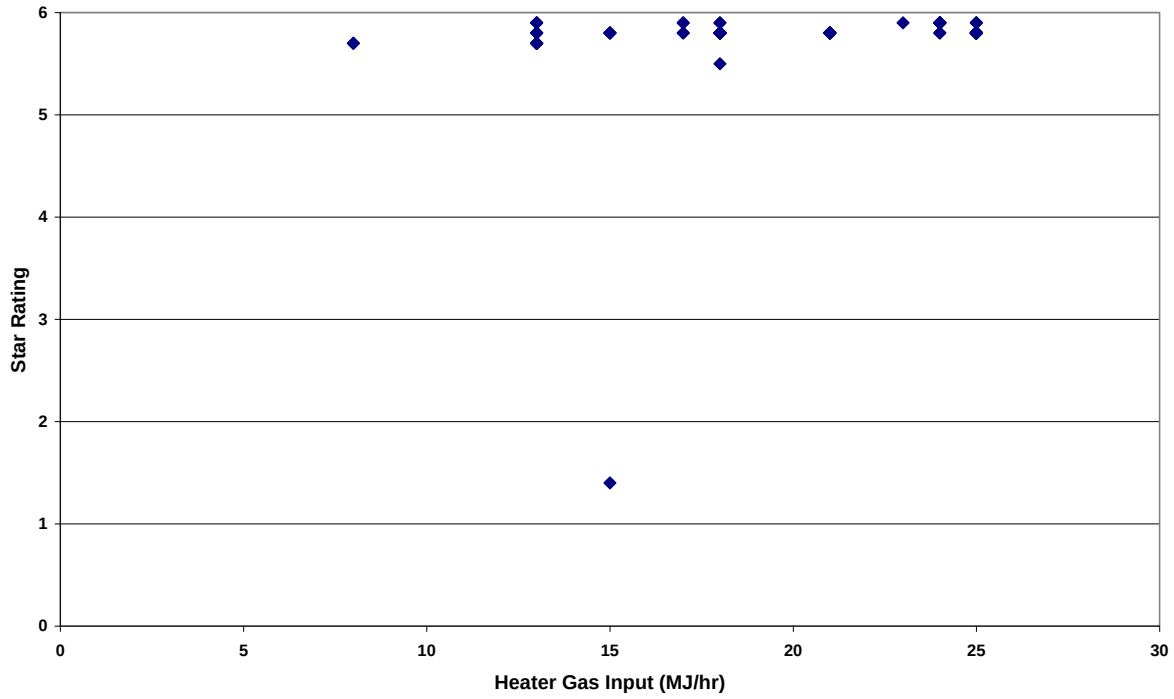
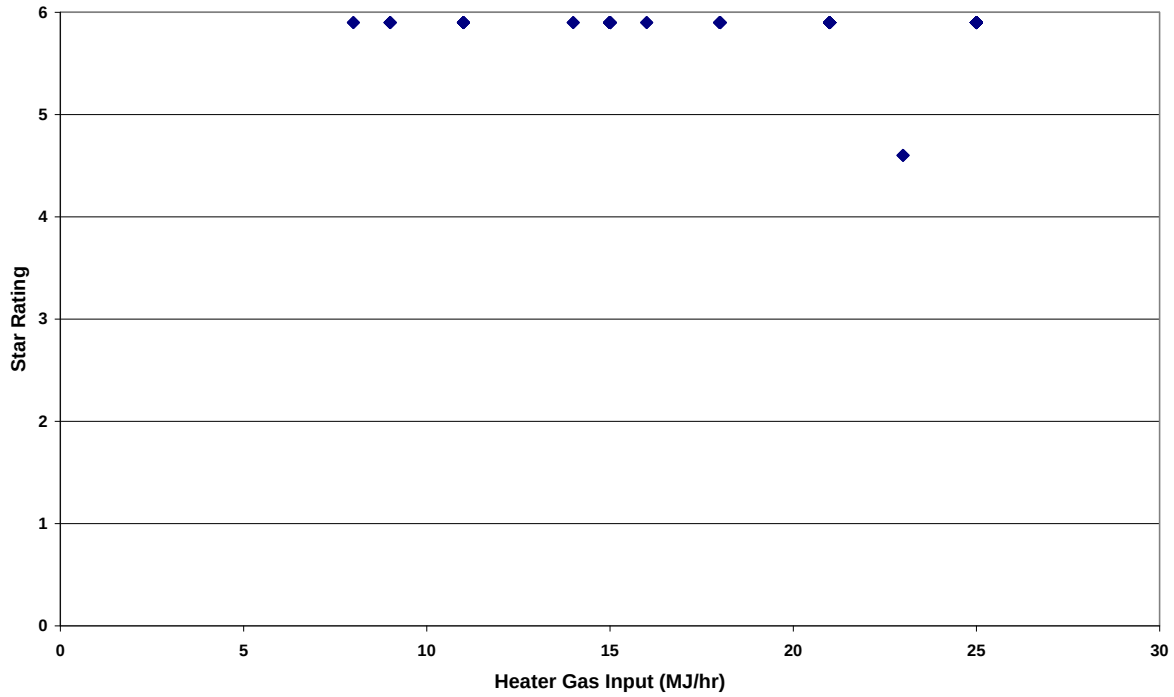
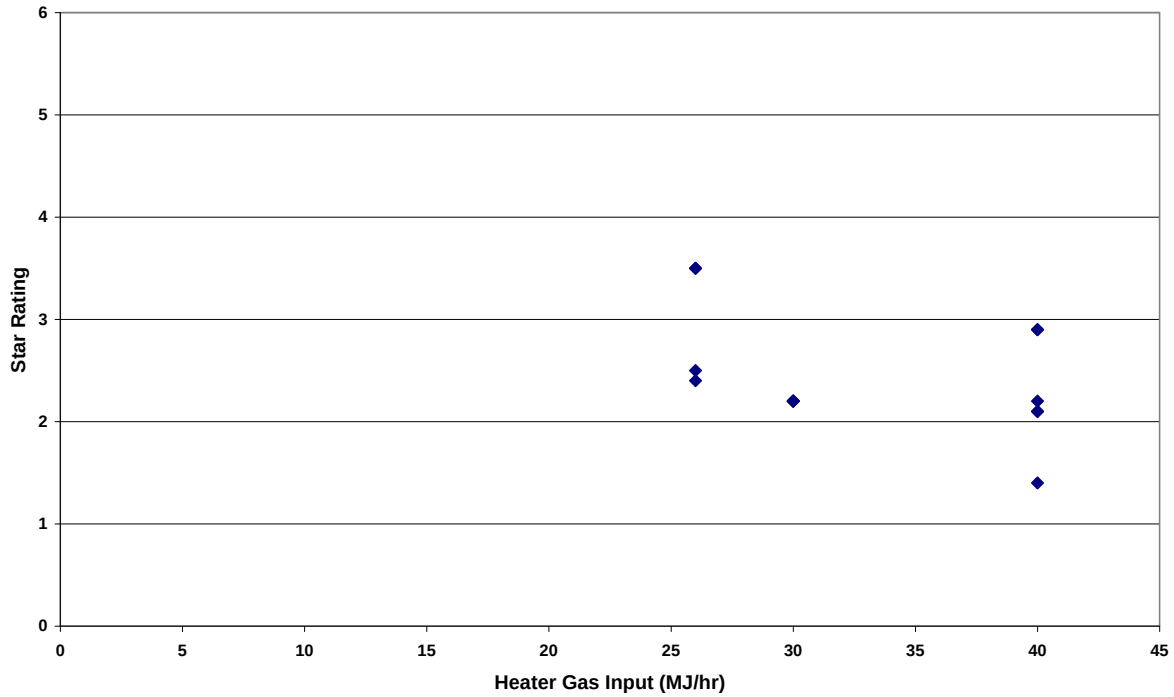


Figure 27 - Star Rating by Model and Gas Input - Flueless Radiant/Convection Heaters



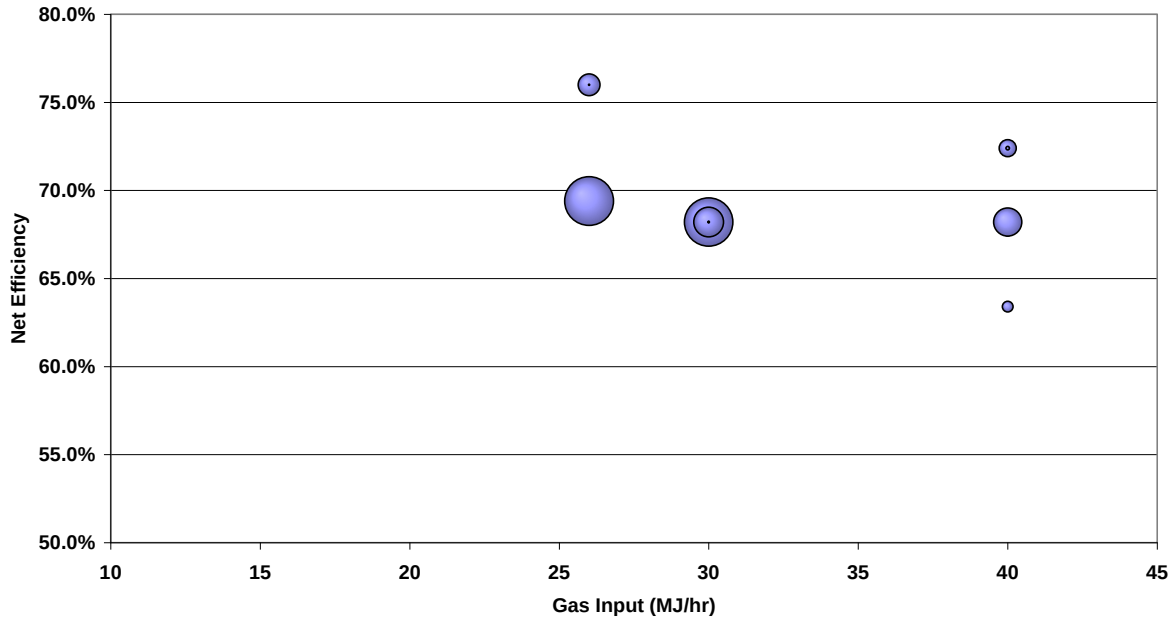
Wall finance type heaters range from 1 to 3.5 stars as shown in Figure 28.

Figure 28 - Star Rating by Model and Gas Input - Wall Furnace



The majority of sales of wall furnace heaters are in the 65% to 70% range, as shown in the bubble diagram Figure 29 - Net Efficiency and Sales by Model (2006 - 2008) & Gas Input - Wall Furnaces, however there are very few models on the market.

Figure 29 - Net Efficiency and Sales by Model (2006 - 2008) & Gas Input - Wall Furnaces



Note: The size of the bubble provides an approximation of the relative annual sales.

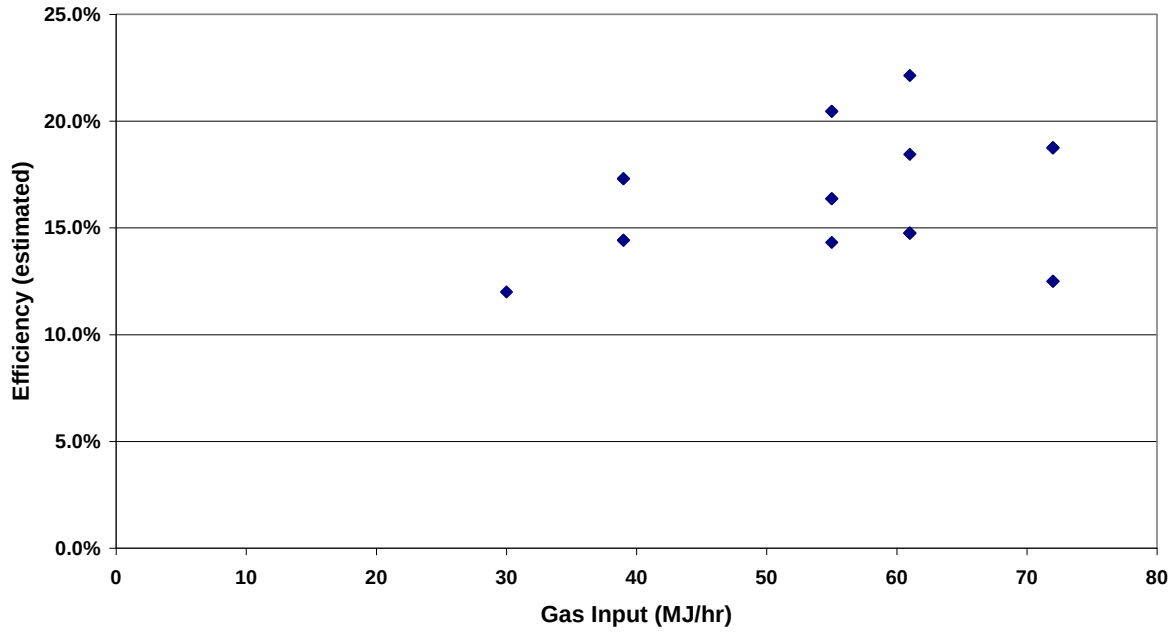
As can be observed from the range of efficiency of gas space heaters, the potential for improvement in the overall average efficiency is greatest with the flued radiant/convection category of heaters. Some gains could also be made by encouraging the sales of balanced flue convection heaters (which currently are less than 5% of total space heater sales) which would be competing with the flued radiant/convection category of heaters.

The estimated efficiency of decorative appliances (of 15%) offers a substantial potential for improvement. Many flued radiant/convection models (certified to AS 4553) are titled as, and advertised 'decorative' or 'log effect', and have a much higher average net efficiency. These heaters could potentially be an effective heating substitute for the true decorative appliances (certified to AS 4558) for many consumers who wanted a decent heating output. According to industry sources, the majority of decorative appliances are installed in a house with ducted gas or other central heating systems and are not expected to have a significant heating effect. However, the marketing brochures obtained for this study show that many are being marketed with a stated heating capacity. This suggests that some suppliers of decorative units also market the appliance as a 'heater' which contradicts the claim that they are purely for decorative purposes.

Regardless of the use of these appliances, if the decorative appliances did provide greater heat output, the energy used by the central system in these homes could be reduced. For decorative appliances that are sold to provide heat, increasing the heating efficiency of these appliances could result in reduced energy use.

The range of estimated efficiencies of current models within the decorative appliance category in the AGA database is relatively low, as shown in Figure 30. There may be opportunities to increase the efficiency of decorative appliances by the addition of fan assisted convective heat exchangers (steel or cast iron firebox) surrounding the decorative burners. Some suppliers offer these as options with their products and, when applied to the decorative appliance, the unit can be sold as a gas space heater that meets the requirements of AS 4553.

Figure 30 - Estimated Efficiency by Model and Gas Input - Decorative Appliances



Source: Estimated efficiency from product literature for decorative appliances

In conclusion, the following opportunities provide the greatest scope for improving the efficiency of gas space heaters and decorative appliances:

- increase the average efficiency of products within the flued radiant/convection heaters category, as they exhibit the greatest range of efficiency by model and represent approximately 6% of total energy consumption;
- increase the average efficiency of decorative appliances by either improving the efficiency of these products or encouraging consumers to purchase flued radiant/convection or balanced flue heaters; and/or
- increase the average efficiency of products within the wall furnaces category, as they exhibit a range of efficiency by model and represent approximately 22% of total energy consumption.

There is little potential improvement of the efficiency of flueless products due to their inherent higher efficiency. However there may be merit in testing the net efficiency of these appliances with adequate ventilation, representing a safe operating environment. Further investigation is warranted.

7. Policy Options

There are several potential policy options that could improve the efficiency of gas space heaters and decorative appliances, and two of these have been explored in this report: mandatory Minimum Energy Performance Standards (MEPS) and energy rating labels to provide consumers with more effective energy efficiency and energy use information. These options are explored below.

MEPS: theoretical efficiency levels and energy savings

There are two measures of efficiency used in the AS 4553 standard for gas space heaters – thermal efficiency and net efficiency. The standard specifies the minimum thermal efficiency levels for gas space heaters sold in Australia. The net efficiency is used to determine the star rating and Annual Energy Consumption for the Energy Rating Label. The net efficiency builds on the thermal efficiency by including the energy used by the pilot light and electrical energy used by the fans and controls (including standby power loads) and is calculated on the basis of 5 hours of use per day, (2½ hours at high setting and 2½ at low or turndown setting), with a standby period of 19 hours per day, over 100 days per year.

The issue of which efficiency measure to use was discussed in earlier reports (MEA 2002 and SEAV 2003), however no decision has been made. Although standby power consumption and pilot burner gas consumption is included in the calculation of net efficiency in AS 4553, it does not technically represent the actual proportion of energy use attributed to in-use energy consumption and the energy consumption of the appliance when not in-use. By calculating the net efficiency on a daily basis, the effect of annual pilot light gas consumption and the annual standby power consumption is under estimated. This is not significant (only a 1% difference) for typical pilot gas consumption and standby power consumption, but could be more significant if the pilot gas consumption and/or standby power is much larger than typical. Additionally, no allowance has been made for the reduction in net efficiency that venting unflued heaters causes.

The potential for increasing the efficiency levels for gas space heaters was addressed in the MEA 2002 study, which recommended that efficiency levels be set for net efficiency. The level set should remove the least efficient models, up to a target share of the market, a strategy which has been used to set MEPS levels for other categories of appliances covered by the E3 program. The indicative MEPS levels proposed were higher than those in place since 1983, because the efficiency of heaters had improved significantly. It is now over 25 years since these efficiency levels were established and the spread is wide enough to support an increase in the efficiency for both sets of product. Flued radiant/convection heaters and wall furnaces could be targeted for increased efficiency, and these requirements extended to New Zealand. For simplicity, a MEPS could apply to all gas space heater product categories. Hypothetically, if a MEPS for gas space heaters were to be based on net efficiency of 2 stars, (67% net efficiency) this would remove or improve the lowest 20% of the current products in the market. Theoretical savings would be approximately 130 TJ p.a. of gas by 2020 or a reduction of 0.8% of energy consumption compared to business as usual (BAU) in 2020. The impacts are not significant as the categories of heaters most affected by the MEPS are those with a small share of the market. If the MEPS were raised to 3 stars, most currently available wall furnace models and 50% of the flued radiant/convection models would not be available for sale. The savings would increase to approximately 290 TJ p.a. by 2020 or a reduction of 1.7% of energy consumption compared to BAU in 2020 (assuming that currently available models were replaced with MEPS compliant models or higher efficiency). Alternatively, the MEPS levels could be set for each category of heater based on the range of efficiency for that particularly category.

If it was decided to extend a space heater minimum efficiency level to decorative appliances, this is where theoretically, the greatest potential improvement in BAU energy consumption would occur. Their current average net efficiency is approximately 15%. One possible action would be to introduce a minimum efficiency level for this product category with a similar efficiency standard to other space heaters (e.g. 60%). However this would require that almost all decorative appliances currently on the market to be re-designed or have convection assisted heat exchangers (fire boxes) installed to improve the efficiency to this level. Effectively it would be forcing the decorative appliances to become heaters, thereby reducing consumer's choice.

An alternative approach may be to impose a maximum gas consumption rate standard on all decorative appliances. This would still allow for the design flexibility currently available in this product, but would decrease the current trend for some of these products to be presented or used as 'heaters'. Hypothetically, if a maximum consumption rate of 30MJ per hour was applied, this would reduce the amount of gas used by these appliances, as the vast majority are rated between 40 MJ and 70 MJ per hour. Importantly, consultation with industry will be required to ensure that decorative gas appliances can be supplied if a maximum gas input is regulated.

If a maximum input rate of, for example, 30MJ was imposed in 2010, this could potentially provide significant savings of approximately 370 TJ p.a. by 2020 or a reduction of 2.2% of energy consumption compared to BAU.

Although energy savings are theoretically possible under a MEPS scheme, further modelling on all these impacts is recommended.

Energy Labelling: possible benefits and requirements

Energy rating labels already apply to gas space heaters in Australia, but not to decorative appliances, and are not required in New Zealand. The gas Energy Rating Label has not been redesigned since it was introduced in Australia in the 1990's for gas space heaters. Some discussions have been held with the industry on the effectiveness of the gas label as research has shown that the label 'failed to spark any significant level of recognition amongst consumers' (MCE 2006). To date, no changes have been suggested. However consumer recognition of and desire for efficiency has increased in the last few years, as has the desire from suppliers to market more efficient products. Therefore a review of the mandatory energy rating label would be worth investigating further, which could also be extended to the New Zealand market.

The spread of star ratings from the Australian database of flued heater categories appears to be sufficient to allow consumers choice of more efficient models (see Figure 23 to Figure 28), however, the star ratings for almost all flueless heaters are between 5.7 and 5.9, with the vast majority at 5.9 stars. This is essentially due to the nature of these types of heaters, as no heat is lost in the flue gas. However, considerable ventilation must be used in rooms heated by flueless heaters, resulting in heat loss, so the ratings do not indicate the real effectiveness of the flueless heaters. Therefore, the star rating for these types of heaters using the current method in the Australian Standard does not provide useful information to help consumers choose between models. However, the Annual Energy Consumption does provide an indication of the total energy consumption and hence running costs of the heater.

For decorative appliances, there is no published comparative information on the gas input. The standard (AS 4558) does require that appliances be marked with the words 'PRIMARILY A DECORATIVE APPLIANCE NOT CERTIFIED AS A SPACE HEATER', and this requirement only applies to products sold in Australia. The supplier's product literature for these types of appliances does not always specify that the appliance is not a space heater, and sometimes includes the area that can be heated (in m^2). The Canadian Government has included both space heaters and decorative appliances within their labelling programme and elements of this approach could be applicable to Australia and New Zealand. For consumers, a direct comparison should be possible between the decorative appliance and the competing space heaters (typically flued radiant/convection heaters). The energy savings possible from introducing energy rating labels for decorative appliances could be substantial if this has the typical dual effect of creating market pull (consumers choosing more efficient appliances) and market push (suppliers improving the efficiency of the products). The main issue surrounding the star rating for decorative appliances is that many models will not achieve a 60% net efficiency, but the current space heater standard AS 4553 would still allocate/award them a 1 star rating due to the design and calculation of the label. For heaters with less than 60% , the label could be changed as follows:

- to indicate 'zero' stars; and/or
- a statement included that warns the consumer that this model does not meet the minimum requirements for the space heating label; and/or
- the net efficiency is displayed on the label of all heaters (however, this is unlikely to be meaningful to most consumers).

Even if a maximum consumption rate is regulated for decorative appliances, there will remain a need to label the appliances appropriately to ensure they are not mistakenly used for heating purposes and to ensure consumers are informed of their, generally, extremely poor heating efficiency.

Currently, the AGA Certified Product Directory is the most comprehensive source of comparative performance information on gas space heaters in Australia. It is presented as a 200+ page Adobe PDF file which lists the heaters

according to their category (AS 4553, AS 4558, etc) and is republished periodically throughout the year with appropriate changes (new models or changes to the registration status). The Directory lists the product supplier name, model name/numbers, certification number/date, Annual Energy Consumption, Star Rating/degrees shading and gas type (Liquefied Petroleum Gas, Tempered Liquefied Petroleum Gas, Town Gas, Natural Gas). The Directory is not suitable for consumers to compare products, and it does not list the output (kW) of the heater. There is no similar list for New Zealand, and further investigation into a similar approach is recommended.

For New Zealand, the Ministry of Economic Development provides an online searchable database of *Supplier Declaration of Compliance*[6], which details the gas appliance type, declaration ID, supplier name, model number and several other details. The database reports supplier declared values and does not generally report gas consumption or output. It has been observed that many appliances are not categorised correctly to the Australian Standard (AS) definitions of appliance types, as the suppliers are not required to use AS or AGA standards.

The provision of easily accessible comparable information on gas space heaters could increase the effectiveness of the gas labelling programme, as consumers would be able to search for and compare the heat output, gas input and efficiency (star rating) of various types of heaters, and decorative appliances would be clearly marked as unsuitable for space heating. The implementation of a web enabled searchable database of heaters would increase the information available to consumers especially if they could search and compare gas space heaters by category, output (kW), gas consumption (MJ/h), Star Rating and Annual Energy Consumption.

It may be possible to encourage a voluntary approach for the provision of performance information, similar to the Energy Rating web site for electric appliances, as the AGA is responsible for recording the gas space heaters certified in Australia. The AGA Directory could be transformed into a web based searchable database of the products already labelled in the Directory (and adding the gas input, heat output and product designations and warnings).

Although energy savings are theoretically possible under a mandatory labelling scheme, further modelling on all these impacts is recommended.

Voluntary or Endorsement Labelling

An alternative or addition to mandatory energy labelling would be voluntary energy labelling and/or the use of endorsement labelling such as ENERGY STAR. Any voluntary scheme would operate in parallel with the present Australian mandatory comparative labelling scheme as, in the absence of any action from government, the current Australian gas energy labelling scheme would continue.

The main disadvantage of any voluntary labelling scheme is that it is generally only the high efficiency products which are labelled and, while it would make it easier for consumers to identify these products, they would not be able to compare the performance and benefits with the lower efficiency products. Also, endorsement schemes need to be supported by a robust compliance regime and considerable marketing and promotion if consumers are going to use and have confidence in endorsement labels.

The New Zealand government runs an active ENERGY STAR scheme for a number of electrical appliances, but not as yet gas appliances. An active promotion, compliance and enforcement regime is required to ensure the ENEGRY STAR endorsement is used correctly, to maintain the relationship with the US programme. An ENERGY STAR specification for gas space heaters may be possible for the New Zealand market, based on a MEPS standard, but further investigation is needed. It is easier to run the programme where an existing standard can be used as a basis. The programme relies on industry partners actively promoting the endorsement mark and using it in the correct manner.

This could be valuable adjunct to a mandatory labelling scheme, though there is a risk that in Australia using two labelling approaches might confuse consumers.

Voluntary endorsement labelling schemes are likely to only apply to the highest efficiency models on the market, so may only motivated a limited proportion of suppliers to improve the efficiency of their products. An endorsement labelling scheme also conveys less information to consumers than a comparative scheme. Such schemes also suffer from the same limitations as a mandatory labelling scheme – in that a large part of the market is covered by a split incentive (where the appliance is purchased by someone who isn't the householder or bill payer). Consequently, it

6 http://www.ess.govt.nz/

is difficult to see why an endorsement labelling scheme would be preferred over a comparative labelling scheme, especially in Australia where an existing mandatory comparative labelling scheme exists.

Financial Incentives

Governments could provide financial incentives to encourage consumers to purchase high efficiency appliances. As noted above, one current example of this is the Victorian Energy Efficiency Target Scheme, a "white certificate" scheme which allocates tradeable certificates for the installation of gas space heaters with greater than 4 stars[7]. However, a prerequisite for such schemes is some form of mandatory energy performance rating scheme, so governments can have confidence that they are rewarding the better performing products on the market.

Data collected from the Australian market suggests that a government funded rebate scheme could be quite costly. An incentive of around $200 would probably be required to motivate a significant proportion of consumers to upgrade to a more efficient heater. This means shifting say 10,000 sales p.a. of low efficiency heaters to the heaters with one more star level using a $200 rebate would cost $2 million per annum, or a total cost of $20 million over a 10 year period. It would be difficult for governments to justify this high outlay given that there are many different types of appliances which might benefit from such an incentive. Consequently it is unlikely financial incentives will be as cost effective as a comparative labelling and MEPS scheme, nor likely to produce the same energy and greenhouse emission savings.

In New Zealand, a scheme of this nature called Warm Up New Zealand: Heat Smart has been provided through the Energy Efficiency and Conservation Authority. This programme has provided an incentive of NZ $500 to home owners to install a clean heat device, including AGA Four Star or better, flued gas heaters. Uptake of this option has not been high.

It is also relevant to note that under a financial incentive scheme the taxpayer bears some of the cost of purchasing a higher efficiency heater, but the financial benefit of the energy savings goes only to the household receiving the incentive. In the case of a MEPS regime, the household bears the additional cost but also receives the financial benefit.

[7] To date, this has driven little activity in the gas space heater market with about 100 units achieving a VEET certificate. A 4 Star heater will generate around 10 certificates but the current certificate price is fairly low (around $15). The VEET "rebate" of around $150 is not currently large enough to overcome the somewhat higher cost of 4 Star models.

8. Conclusions

The conclusions of this product profile are:

- Further investigation into gas space heaters and decorative appliances being added to the E3 MEPS programme is warranted because of theoretical energy savings and greenhouse gas reductions. This research should consider the energy savings from different test methods, efficiency levels, and extending labelling provisions to New Zealand and for decorative products. Industry feedback on this Product Profile is encouraged, and will be valuable.
- There may be potential for a small reduction in the energy consumption of the flued category of space heaters by improving product efficiency.
- Flueless space heaters are responsible for 46% of energy consumption of gas space heaters and decorative appliances in Australia, and there is limited capability to further improve their energy efficiency as the average net efficiency is 89%. However, the measurement of their efficiency ignores the necessary, and in some States mandatory, requirement for ventilation of the space in which flueless heaters operate, which will significantly reduce their real 'net' efficiency. This needs to be recognised in the standards when testing and rating these units. Additionally, flueless portable heaters should be covered by any potential measure.
- Aligning the provisions for efficiency between New Zealand and Australia would be beneficial to ensure effective trade in these appliances between both countries.

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