Appliance Efficiency Programs in Australia: Labelling and Standards

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Abstract

Household appliance penetration and ownership in Australia is higher than in western Europe, and close to North American levels. Most products are manufactured locally, by firms with international links and with access to both European and North American designs and technology. A significant share of the market is imported, mainly from New Zealand, Asia and Europe. Because of the relative mildness of the climate, appliances that carry an energy label (such as dishwashers, clothes washers, clothes dryers and refrigerators & freezers) account for a greater share of household energy use than in most other developed countries.

The energy efficiency of appliances in Australia increased steadily during the early 1980's, but the introduction of mandatory energy labelling in 1986 in some states saw a significant increase in the rate of change. The mandatory government energy labelling program, which is in force in most states, now includes refrigerators, freezers, room air conditioners, dishwashers, clothes washers and clothes dryers. A voluntary industry based gas appliance energy labelling program is also in place for gas water heaters and flued space heaters.

The Australian energy labelling program is widely regarded as among the most informative and salient in the world, and it may be extended to New Zealand over the next few years (many products in NZ already carry the label as the Australian and NZ markets are closely integrated). Label recognition and use is very high among recent and prospective appliance purchasers. The use of a static efficiency scale on the label, while assisting recognition and comprehension, has also reduced the competitive pressure on suppliers, as efficiency improvements have pushed many models to the top of the rating scale.

In 1995, Australian energy ministers agreed to implement minimum energy performance standards (MEPS) for refrigerators, freezers, and electric storage water heaters, to take effect in 1999. The levels are relatively moderate, and the effect will be to complement the energy labelling program rather than to transform the energy efficiency of the market.

Background

Australia has a population of some 18 million, in a country similar in area to the USA. It spans a wide range of climates, from cool temperate in the south to tropical in the north. The appliance market is essentially a national one and there are only minor variations in the types of appliances sold by region. This creates challenges for manufacturers in the design of appliances that are influenced by climate, such as room air conditioners and refrigerators.

In most of the heavily populated areas, the climate is very mild for a large part of the year and as a consequence, few houses are centrally heated or cooled. This means that appliances like refrigerators have to operate satisfactorily for extended periods at ambient temperatures as low as 10^{o}C and as high as 35^{o}C (or in more extreme cases, 40^{o}C). These extremes may not be frequent, but they can persist for weeks in some cases. Thus refrigerator performance standards developed by Standards Australia[a] tend to be more demanding than their ISO[b] counterparts.

The appliance industry in Australia has gone through a major restructuring over the past 15 years and has now consolidated into three major local groupings. The three major companies are Email Ltd, Southcorp Ltd (which also controls a significant share of the US water heater market) and Fisher & Paykel (a New Zealand based company with major manufacturing facilities in both Australia and New Zealand). There are now virtually no trade barriers between Australia and New Zealand and their markets are gradually merging.

The three major manufacturers hold some 70% to 80% of the clothes washers, dishwasher and refrigerator markets, and around 90% of the clothes dryer market. The balance is imported from a wide range of sources including Europe, the USA and Asia. Email is the only local manufacturer of household size room air conditioners, and 65% of the market is imported, mainly from Japan and other north Asian countries. In this sense, the Australian market is subject to a wide range of international influences and it tends to have a wide cross section of technologies from other countries.

A Brief History of Energy Labelling in Australia

Energy labelling for major appliances in Australia was first proposed in the late 1970s, by the State governments in New South Wales (NSW) and Victoria (the two largest of Australia's six states and two territories). When the NSW government first rAised the matter with the appliance industry in 1982, there was considerable resistance, on the grounds that any program should be uniform nationally rather than risk different State approaches, and that it should be voluntary rather than mandatory.

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a Standards Australia is a not for profit organisation, established in 1922. It operates formally under a Royal Charter as the Standards Association of Australia and has recognition as the peak Standards body in Australia. Standards Australia is the national member of the IEC and ISO. Standards are preapred by committees of experts from government, industry and user groups. Many Australian Standards made mandatory by state and federal regulations.

b ISO stands for the International Standards Organisation, based in Geneva, Switzerland.

In order the ensure national uniformity, the NSW government referred the matter to the joint Commonwealth-States council of energy ministers. Despite three years of negotiation, government and industry could not agree on a mutually satisfactory voluntary labelling program. Finally, the NSW and Victorian state governments announced in late 1985 they would make energy labelling mandatory in those States. NSW and Victoria (which contain Australia's two largest cities - Sydney and Melbourne) account for some 60% of the national appliance market, so the bilateral scheme became a de-facto national program.

Energy labelling for refrigerators and freezers[c] became mandatory in late 1986. In 1987 and 1988, room air conditioners and dishwashers were included in the regulations. After a change of government in NSW in 1988, Victoria pressed on alone with labelling for clothes dryers in 1989 and clothes washers in 1990. In 1991, the State of South Australia introduced labelling regulations for all 5 major appliances.

Most of the remaining States and Territories now have energy labelling regulations in force, finally giving formal nationwide backing for a program which has effectively been in place for 10 years. Major manufacturers and importers now recognise the commercial value of energy labelling, and are generally very supportive of the program. However, there is still some resistance to extending it to new appliance groups.

Australian Appliance Test and Performance Standards

The energy labelling program relies on Australian Standards to define test procedures for the measurement of energy consumption, and to set minimum performance criteria which appliances must meet before qualifying for labelling. While ISO standards do specify minimum performance requirements for refrigerators (temperature operation test), minimum performance requirements, which are absent from corresponding IEC[d] energy test standards for other appliances, are important consumer protection features of the Australian labelling program. They prevent appliances claiming a low energy consumption solely because, say, they do wash dishes or clothes sufficiently clean. A program of check tests against these standards are conducted on a regular basis by state and territory governments, who contract accredited laboratories to undertake the tests. The performance requirements in the Australian Standards are summarised in Table 1.

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[c] Refrigerators, freezers and their combinations - these are treated as a single appliance group.

[d] IEC stands for the International Electrotechnical Commission, based in Geneva, Switzerland.

Table 1: Mandatory Performance Requirements for Appliances in Australia

Appliance	Performance Requirement	Description
Refrigerator	Pull down Operation	Reach specified internal temperatures in 6 hours, at 43^{o}C ambient Maintain specified internal temps under wide range external temps
Clothes washers	Soil removal Water removal Wash severity	Achieve minimum 80% swatch soil removal criteria - AS9 Maximum allowable moisture on final spin (1.1 now, 0.9 in 1998) Maximum allowable fray index on fray cloth of 0.5
Clothes dryers	Single setting Efficiency Scorching External temp	Achieve 6% final moisture content in a single program/setting Maximum specific energy of 1.36 kWh/kg water removed Maximum allowable clothes/drum temperature of 130^{o}C Maximum allowable external temp of 90^{o}C ++
Dishwashers	Washing Drying	Minimum wash index of 0.7 Minimum dry index of 0.5
Room air conditioners	Capacity Max operation	Claimed cooling/heating capacity within strict limits Acceptable performance under extreme heat conditions

Note ++:This requirement is soon to be deleted as it is now covered by relevant IEC safety standard.

Australian Standards are regularly updated to keep pace with changes in international standards, changes in technology and in manufacturing practice. The standards used for appliance energy labelling in Australia, and their related international standards, are listed in Table 2.

Table 2: Australian Standards for Appliance Energy Labelling

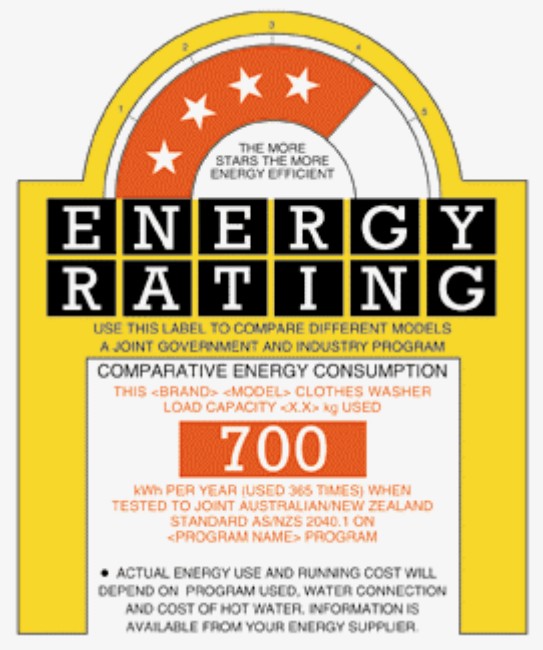
Appliance	Australian Standard	Related International Standard
Refrigerators and freezers	AS1430 - Performance AS2575.2 Energy consumption	Broadly based on ISO7371, ISO8561, ISO8187 and ISO5155 but with local external (tropical) and internal temperature requirements **
Clothes washers	AS2040	Broadly based on IEC456 (except use of AS9 swatches, inclusion of top loading machines)
Clothes dryers	AS2442	Based on USA AHAM A197.6 - new IEC1121 is under consideration
Dishwashers	AS2007	IEC436 (but local equivalent soiling agents)
Room air conditioners	AS1861.1	ISO5151 ++

Note: ** Temperature conditions for refrigerators are broadly equivalent to US DOE requirements.
++ ISO859 was withdrawn and replaced by ISO5151 in late 1994.

The Energy Label

The energy labelling regulations require peel-off labels on all units offered or displayed for sale (suppliers label all units on the production line). An example of a clothes washer energy label is shown in Figure 1. The label is designed to stand out well from a white background, with black, yellow and red components. The two key items of information are the comparative energy *consumption* (expressed as kWh/year) and the "star rating". The comparative energy consumption is an estimate of the annual energy consumption of the appliance, based on the tested energy consumption (measured against the relevant standard) together with information about the typical use of the appliance in the home. The star rating gives a quick comparative assessment of the model's energy *efficiency*. The star rating is a non-dimensional measure of energy service per unit of energy consumption and is calculated using an algorithm which takes into account energy consumption and volume or capacity.

Figure 1: Example of a Clothes Washer Energy Label



The star rating system is a "closed" rating system[e] in that all units, however efficient or inefficient, rate from 1 to 6 stars. This has had the advantage of salience and good consumer comprehension, but has also led to “crowding” at the top of the range, and a lack of differentiation between the better mainstream products and innovative, very efficient models. There is general agreement that the scale needs to be overhauled, and a debate has recently started about whether to extend the scale to, say, 10 stars or to revise the algorithms so that all existing models rate not more than three stars, so opening up the top of the range again. Either approach has advantages and disadvantages, and the transition to new labels will need careful management. Government, industry and consumer organisations will be involved in the possible redesign of the energy labelling algorithms.

The star rating formula is dependent primarily on the measured energy consumption of the appliance when tested in defined operating conditions or over a single performance cycle (eg a washing or drying operation). However, some star rating algorithms include assumptions about user behaviour. For example, a "field use factor" applied to clothes dryers gives a 10% penalty to timer dryers when compared with auto-sensing dryers, on the assumption that manual operation leads to over-drying and hence excessive energy consumption in use.

For clothes washers, the star rating is based on the total energy (mechanical and water heating) per kg of clothes washed, together with a factor based on the spin index, on the assumption that a proportion of users will dry the clothes in an electric clothes dryer. Hence a clothes washer with a good spin performance will achieve a higher star rating than an equivalent machine that uses the same energy but with a lower spin performance.

The energy consumption test is done with warm water, and this exaggerates the actual energy differences between models for householders who wash with cold. Recent market research data suggest that more than 50% of Australian households now regularly use cold washing for clothes (over 60% in warmer states such as Queensland). In response to this, a cold water wash test is now being developed, and will become an option for the labelling program.

The other key feature of the energy label is that it shows the estimated annual energy consumption of the appliance when operated under standard conditions. This value, derived from the laboratory tests, has been found to correspond reasonably well (within 10%) to in-use energy consumption for refrigerators and freezers. The energy consumption for other appliances is highly dependent on whether actual frequency and duration of use corresponds to the values assumed for labelling. The main information used to calculate the comparative energy consumption is shown in Table 3.

Energy labelling is made mandatory in Australia by state government legislation and regulations which give force to the relevant Australian Standards and outline the requirements for energy labels for appliances. Regulations also set out offences and penalties if a party does not comply with the requirements. While this approach has

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[e] Closed in this context means that the highest achievable efficiency rating does not move even when some products on the market are able to exceed this level.

worked well in the past, it has created some problems as there is a lot of technical material regarding the energy label and algorithms in regulations. As there are 8 states and territories with 5 appliance groups (potentially 40 sets of regulations), minor (but at this stage insignificant) differences in requirements between states have already resulted from differences in drafting. Where changes are planned, amending so many regulations in a uniform manner is a daunting task.

Table 3: Key Usage Assumption Used to Calculate Comparative Energy Consumption

Appliance	**Assumed CEC Usage**	**Other Information on the Label**
Refrigerators and freezers	Continual operation	Volume (**)
Clothes washers	365 warm washes per year	Load (kg) and program used
Clothes dryers	150 loads dried per year	Load (kg) and program used
Dishwashers	365 washes per year	Load (place settings) and program used
Room air conditioners	500 hours cooling 500 hours heating (if applicable)	Cooling capacity in kW Heating capacity in kW (if appl.)

Note ** While the label does not explicitly state the cabinet volume, AS1430 requirements mean that most model numbers are generally reflective of the volume in litres.

The potential introduction of Minimum Energy Performance Standards (MEPS) in Australia prompted a rethink and the development of a new approach to energy labelling regulation. This rethink fitted in comfortably the revitalisation of energy labelling that had been occurring since 1991. The new proposed structure creates an additional part to each Australian Standard for each appliance which contains the detailed technical requirements for energy labelling and MEPS (if applicable). This part of the standard, while it is drafted by the relevant standards committee, is under the effective joint control of the energy labelling regulators from each state who have to approve the standard prior to publication. This part of the standard includes data on how to calculate star ratings and CEC for each appliance, details on the number of units to be tested, application forms, check testing procedures, design and shape of the energy label and so on. Energy labelling regulators are also actively involved in all relevant standard committees which deal with energy labelled appliances. Such a system has much to recommend it as it provides a uniform technical basis for the development of an energy labelling program. It allows uniformity to be maintained across a wide range of jurisdictions when changes to the program are implemented.

As an adjunct to the new parts of the appliance standards, a set of model regulations have been developed by governments, in consultation with appliance manufacturers, to complement and give force to the appliance performance and energy labelling standards. The introduction of model regulations in each State and Territory will lead to a consistent approach to standards (and hence labelling and efficiency standard) across each of the governments in Australia. It is hoped that model regulations and all relevant energy labelling standards will have been republished before early 1997.

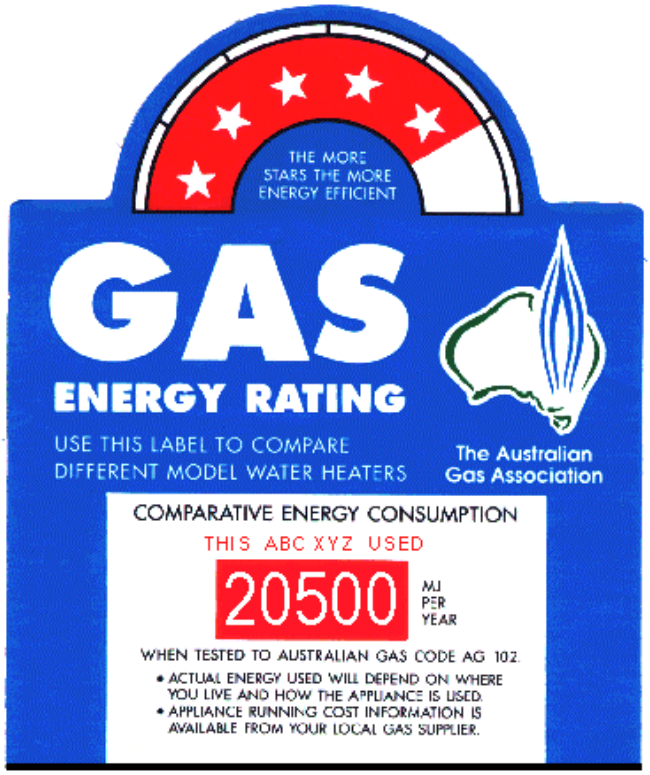
Gas Energy Labelling Program

The Australian Gas Association (AGA) has members from both the gas utility sector and gas appliance manufacturers. The AGA has promoted various forms of energy efficiency labelling for flued gas space heaters and gas water heaters (both storage and instantaneous) since the early 1980s (Orlowski 1990). In 1988 the AGA introduced labels similar in format to those for electrical appliances, except blue in colour and with energy shown in MJ. The gas labelling program has been voluntary until recently and the level of compliance has varied considerably from state to state.

The AGA has now made labelling of all units a requirement for technical approval. This effectively makes the collection of data required to produce a label mandatory, since the AGA is responsible for the entire gas industry including utilities, local appliance manufacturers and importers. (There is no single organisation with comparable coverage in the electricity industry, so only government regulation can ensure complete compliance with electrical appliance labelling). However, some labels are either not affixed by manufacturers or appear to be removed at the point of sale.

The energy tests, label requirements and relevant performance for gas water heaters are part of AGA standard AG102, and those for gas space heaters are in AG103. These standards were originally based on British Gas appliance approval specifications, but have been modified substantially since.

Figure 2: An example of the Water Heater Gas Energy Label



Impact of Energy Labelling on Energy Efficiency

The energy label has very high visibility and recognition. Recognition of the label among randomly surveyed adults is consistently over 65% throughout Australia. Awareness among appliance buyers is even higher: in 1993 nearly 90% of recent and intending appliance purchasers said they were aware of the energy label, and 45% said they used the information on it to compare appliances prior to purchase (GWA et al 1993). The labelling program is supported by take-home guides which list all models, so that energy-aware customers can be made aware of the most energy-efficient models on the market, and prompted to search for them even if they do not come across them in a particular showroom.

Awareness in a similar survey of gas appliance purchasers was not nearly as high (approximately 50%), in part due to the non-mandatory nature of that program, the fewer appliance types labelled and the operation of the gas market (fewer customers examine products in a showroom) (GFCV 1991b).

There is also evidence that labelling has raised the priority given to energy efficiency in purchase. A 1991 survey showed that 28.4 % of respondents around Australia considered the energy efficiency rating to be the most important factor when purchasing a new appliance (IPC 1991). This was the most frequently reported "most important" factor. Running costs was nominated as most important by a further 13.5% of respondents, so about 42% of customers reported energy efficiency or related factors as being *the most* important consideration in the purchase of an appliance. Some 86% of customers reported energy efficiency as “extremely” or “fairly” important, while only 14% considered it “not particularly” or “not at all” important. This gave energy efficiency equal importance with other key appliance characteristics such as size, brand and price.

While surveys of this kind indicate that the label is comprehensible and salient to customers, they cannot be used to directly estimate energy savings. This requires detailed modelling of the appliance market, and estimates of rates of efficiency improvement before and after the implementation of labelling. It has been estimated if labelling had not been introduced, the annual electricity consumption of all new appliances (of the types labelled) in 1992 would have been about 11% higher than it was, and the total household electricity consumption in Australia would have been about 1.6% higher (Wilkenfeld, 1993).

One method for examining the effectiveness of the labelling program, the impact of the introduction of MEPS and other measures is to monitor changes to consumers' purchasing patterns over time. Increases in energy efficiency in the appliance market may be the result of these programs as well as natural changes due to technology development or market pull. However, quantifying the total market change in efficiency provides a bound within which the influence of each of these can be estimated.

To monitor these changes, Energy Efficient Strategies is developing a sales weighted appliance tracking system for the State and Federal governments as part of the national monitoring program. The system incorporates individual appliance model sales data from a commercial data collection agency together with labelling data from State based

registers. This will allow the impacts of current and future appliance energy efficiency programs to be more accurately assessed.

Minimum Energy Performance Standards (MEPS)

While energy labelling has prompted the introduction of more efficient models, and shifted consumer preference towards them, it has not been successful in eliminating the least efficient models from the market. These models are less cost-effective for purchasers, and are often bought by those who are unwilling or unable to purchase more efficient products, due to capital cost constraints or market failure (such as the so called split incentives or landlord tenant dilemma). This "market failure" applies to a major segment of the appliance market such as institutional and until recently, many government purchasers, where lowest initial cost has been the overriding consideration. (The Federal government in Australia now has a formal policy of purchasing high efficiency products where these are available). The exclusion of low efficiency products from the market may lead to a slight increase in average prices, but this would be more than offset by the value to consumers of electricity savings. It would also result in cost-effective reductions in national greenhouse gas emissions.

In 1992/93, Australia's Energy Ministers commissioned a consultancy study to examine the introduction of minimum energy performance standards (MEPS) for electric appliances in Australia. The study recommended the introduction of uniform nationwide MEPS for refrigerators, freezers and electric storage water heaters (GWA 1993). (Refrigerators and freezers are already energy labelled. Water heaters are not labelled, but subject to some utility-imposed heat loss limits).

MEPS for dishwashers, clothes dryers and room air conditioners were found to be feasible, but the energy savings were found to be relatively small. MEPS for clothes washers was not recommended due to the increasingly large proportion of households in Australia which choose to use cold water washing - this action eliminates some 90% of clothes washing energy consumption, and so virtually eliminates the case for any efficiency standard.

In March 1995, Energy Ministers agreed to the adoption of MEPS for refrigerators, freezers and storage water heaters. The MEPS levels proposed for refrigerators are broadly in alignment with those currently being considered by the European Commission (Harrington 1994). The MEPS levels for electric storage water heaters will effectively increase cylinder insulation to about 50mm of polyurethane for units of 80 litres and more (GWA 1993).

Refrigerator and Freezer MEPS

The initial refrigerator and freezer MEPS levels proposed were set using a statistical analysis of the Australian market, where the market was split into a large number of sub-groups and the least efficient appliances within each sub-group were progressively eliminated. The impact of any projected increases in average product price were monitored against the net present value of energy savings for a range of make-up

scenarios to replace models that were eliminated. In virtually all scenarios, MEPS resulted in a significant net increase in benefits.

The MEPS levels proposed were modest, and they would have affected no more than a third of the models on the market in early 1995, and substantially less by 1999. Yet, at the time of the initial analysis, some 50% of models available in 1992 would have been eliminated by the proposed MEPS levels. The conservative assumption was made that the price-energy relationships evident at the time of the analysis (1992) would persist, so the new models replacing those eliminated through MEPS would cost more. In fact, the likelihood is that with sufficient lead time, suppliers will redesign the models which would fail MEPS so that they pass, and the efficiency gains will be made at little or no cost. MEPS will act to focus the appliance industry on satisfying that criterion among many others, just as laws to eliminate CFCs focused the industry on satisfying that criterion.

Prior to their formal consideration by government, there was an extensive process of discussion and consultation with manufacturers regarding the precise cut-off levels proposed for refrigerators. Industry made use of this opportunity to refine the MEPS levels to more accurately reflect engineering design constraints within each of the cabinet Groups. The modified cut-offs proposed by industry where found to provide an equivalent level of energy savings and were the ones formally adopted by Energy Ministers.

The MEPS cut-off formulae for refrigerators are expressed as a fixed annual consumption allowance plus a variable allowance based on the adjusted volume of the cabinet. This is similar in form to the formulae used in the USA and those proposed for Europe, although the actual values vary substantially. (See Harrington (1994) for a detailed discussion on this issue). To comply with MEPS, the tested energy consumption of a refrigerator or freezer model must be less than or equal to the MEPS level in the following formula:

$$MEPS = F + Vadj. \times A$$

Where:

MEPS	=	maximum allowable comparative energy consumption - kWh/year to AS2575.2
F	=	MEPS intercept (fixed allowance) for its Group, shown in Table 4 - kWh
A	=	MEPS slope (variable allowance) for its Group, shown in Table 4 - kWh per litre of adjusted volume
Vadj.	=	Adjusted Volume of the cabinet in accordance with AS2575.2 - litres
	=	Vff + Vfz * FAF where: Vff = volume of fresh food compartment Vfz = volume of the freezer compartment

Note: The Australian standard for refrigerator energy consumption is being revised to include a test method and adjusted volume calculation for all possible compartment configurations and door combinations.

Table 4 - Australian Refrigerator MEPS Cutoff Formulae
Group Descriptions and Operating Temperatures

Australian Standard Group	Fresh Food ^{o}C	Freezer temp ^{o}C	MEPS intercept kWh	MEPS Slope kWh/litre adjust. Vol.	Freezer Adjustment Factor	Description
0 & 1	3	N/A	368	0.892	N/A	cellar or all refrigerator * (no freezer)
2	3	-2	300	0.728	1.2	cyclic defrost (one door) * with icemaker
3	3	-9	330	0.800	1.4	cyclic defrost (one door) * with short term freezer
4	3	-15	424	1.020	1.6	refrigerator freezer - cyclic/manual defrost *
5 (excl. 5S)	3	-15	424	1.256	1.6	refrigerator freezer - no frost (incl. top/bottom freezer)
5S	3	-15	465	1.378	1.6	refrigerator freezer - no frost (side by side configurations)
6C	NA	-15	248	0.670	1.6	separate freezer (chest) - manual defrost
6U	NA	-15	439	0.641	1.6	separate freezer (upright) - manual defrost
7	NA	-15	439	1.020	1.6	separate freezer - no frost

Source: GWA 1994, Harrington 1994
Notes: Fresh food and freezer temperatures are target temperatures (ie the maximum compartment temperatures for the determination of energy consumption). Note all tests are performed at an ambient temperature of 32^{o}C. No frost in this table is equivalent to automatic defrost and usually involves forced air in the freezer compartment. Group 5 units have an additional allowance of 120 kWh for a through the door ice and water dispenser where provided. Additional doors in all Groups have an allowance for extra throat losses based on liner width. Anti-sweat heaters are operated on their maximum setting for all tests.

The following additional allowances have also been included:

- additional 120 kWh/year for models with a through the door ice maker and chilled water dispenser (these are still comparatively rare in the Australian market);

- additional door allowance for models which have more doors than the designated number of reference doors for the product group in the Australian Standard.

Electric Storage Water Heater Minimum Energy Performance Standard

Australia has had a form of MEPS for water heaters for nearly 20 years, based on a maximum allowable standing heat loss under static conditions, contained in the Australian Standard AS1056 Part 1. While not mandatory in a legislative sense, this requirement has become a defacto mandatory standard for water heater manufacturers, since a number of the major electricity utilities required water heaters to comply fully with the Australian Standard if they are to be connected to an off peak tariff (off peak tariffs account for more than 50% of all electric water heating in Australia).

The standing heat loss is measured at 20^{o}C ambient air temperature and a water storage temperature of 75^{o}C (for most tanks), giving a ΔT of 55^{o}C. The test measures the

energy consumed over a number of complete thermostat cycles, and this is normalised to a heat loss per 24 hour period.

The allowable heat loss limits recommended in GWA (1993) were calculated using a simplified engineering analysis, which established the most cost-effective insulation thickness based on the cost of manufacturing inputs and the value of energy saved. The recommended MEPS limits were 55% of the allowable heat loss in AS1056 Part 1 - 1991 for tanks of 80 litres rated capacity and greater, and 70% of the allowable heat loss for tanks of less than 80 litres. These correspond to approximately 75 mm of polyurethane foam for tanks of 80 litres and above and 50 mm for smaller tanks.

The requirement for smaller tanks was less stringent because many of them are installed in confined positions under sinks and in cupboards. Increasing their size substantially could mean major difficulties in the replacement market. Hence less stringent insulation levels were recommended despite the fact that the average value per kWh saved would be much higher, since smaller tanks are generally connected to day-rate, rather than low cost off-peak tariffs.

After extensive discussion between government and manufacturers, it was agreed to reduce these requirements to 70% of the allowable heat loss in AS1056 Part 1 1991 for tanks of 80 litres and above and 100% for smaller tanks (ie forcing those few models on the market which do not comply with the existing standard to fall into line). This equates to 50 mm of polyurethane for tanks of 80 litres and above (roughly equivalent to the current US MEPS levels for electric storage water heaters), and about 32 mm of foam for smaller tanks.

These compromise MEPS levels are projected to save about 45% less energy than those recommended in the original study. As part of a package of measures to make up some of these lost savings, Energy Ministers are examining the costs and benefits of introducing energy labelling for water heaters, adjustable thermostats for electric storage water heaters and an information campaign encouraging wrap blankets and water efficient products. The allowable heat losses for tanks of less than 80 litres are also to be reviewed in the light of a detailed engineering and technical assessment of this product group. The historical progress of standing heat loss requirements of AS1056 in Australia for a range of common electric storage water heater sizes are shown in the Table 5.

Table 5: Allowable Standing Heat Loss (kWh/day) Electric Storage Water Heaters from 1977 to 1999, Australia

Rated Hot Water Delivery Litres (a)	Allowable Heat Loss 1977	Allowable Heat Loss 1985	Allowable Heat Loss 1999 MEPS
25	1.8	1.4	1.4
50	2.3	1.7	1.7
80	2.7	2.1	1.47
125	3.1	2.5	1.75
160	3.4	2.8	1.96
250	3.9	3.4	2.38
315	4.2	3.8	2.66
400	4.5	4.1	2.87

Source: AS1056-1977, AS1056.1-1985 & 1991, author calculations based on ANZMEC recommendation (AS1056.1 Draft Amendment 3, 1996)

Notes to Table 5

The above allowable heat losses are for unvented displacement water heaters only (mains pressure). Note that allowable heat losses for tanks less than 80 litres are still subject to review. Allowable heat losses in AS1056.1-1991 are the same as those in AS1056.1-1985.

(a) Rated delivery capacity is the volume of water that can be delivered at not more than 12^{o}C below the thermostat set point, at a flow rate of 12 litres per minute (lower rates for small tanks). The rated storage capacity is usually about 10% less than the gross tank volume, but depends on the level of stratification during draw off.

Next Steps

A range of other measures is being developed as part of an integrated appliance efficiency program. The most important are:

- examination of the feasibility and value of energy labelling electric water heaters in conjunction with MEPS (such a program is likely to include heat exchanger water heaters, electric heat pump water heaters and solar units);
- implementation of new model energy labelling regulations and standards on a national basis throughout to 1997;
- development of an electronic database of all appliances registered for energy labelling in Australia, and access to the database via telephone inquiry services, the Internet etc;
- development and refinement of an impact evaluation methodology for appliance labelling and MEPS, including sales weighted estimates of efficiency changes;
- improved surveys of appliance ownership and use;
- revision of the clothes washer and refrigerator energy labelling algorithms;
- commencement of an engineering analysis of appliance efficiency as a basis for developing the next levels of MEPS for water heaters and refrigerators.

See: http://www.dpie.gov.au/netenergy and
http://www.dpie.gov.au/netenergy/standards/standards.html for information.

Appliance energy efficiency is now a key program area for governments, serving greenhouse gas reduction, economic efficiency and resource conservation policies. Governments, the appliance industry and consumer groups are now all playing key roles in promoting greater appliance energy-efficiency in Australia. Once initial difficulties were overcome, the high degree of co-operation and consultation between all parties has resulted in the rapid and harmonious development of the program.

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