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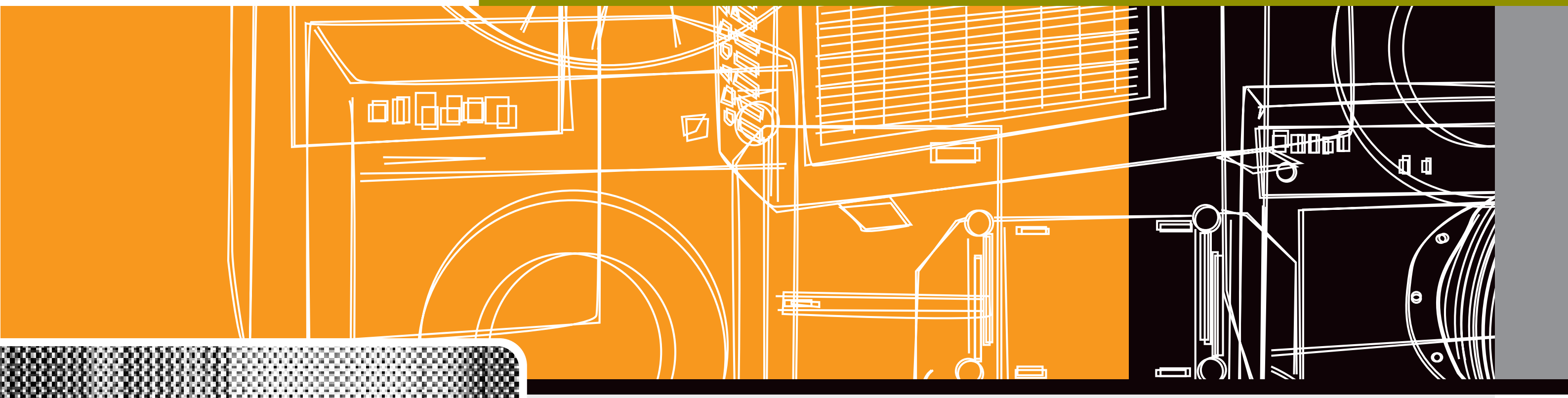
NATIONAL APPLIANCE AND EQUIPMENT
ENERGY EFFICIENCY PROGRAM

THE SCOPE FOR APPLICATION OF MINIMUM ENERGY PERFORMANCE STANDARDS TO ADDITIONAL HOUSEHOLD APPLIANCES



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PREPARED FOR THE NATIONAL
APPLIANCE AND EQUIPMENT ENERGY
EFFICIENCY COMMITTEE

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February 2002

PREFACE

Dear Stakeholder,

In 2001, the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) commissioned a review of existing and the development of new strategies to improve the energy efficiency for a variety of household appliances. Governments want up-to-date advice on whether mandatory and/or voluntary programs should be developed for these appliances.

George Wilkenfeld and Associates undertook this study re-examining the feasibility of adopting minimum energy performance standards (MEPS) for clothes washers, dishwashers, clothes dryers, electric space heaters and air conditioners. In 1993, an earlier study rejected MEPS for these products but recommended mandatory energy labelling for all products except electric space heaters. A separate companion report on electric cooking appliances has also been released by NAEEEC for comment.

NAEEEC is interested in stakeholder views on the results of the study, which advocates examining whether a MEPS regime for three products would satisfy the economic cost benefit requirements necessary to justify national regulation. Specifically, NAEEEC is considering:

- MEPS for all single phase airconditioners;
- MEPS for all washing machines with in-built electric resistance water heating capability (predominantly drum type machines);
- MEPS for vented clothes dryers (both timer and auto-sensing).

In 1993, governments accepted advice not to regulate these products by mandatory performance standards and informed industry and other stakeholders accordingly. NAEEEC, however, proposes to initiate the formal assessment process in 2002 that could result in recommendations to governments to reconsider MEPS in the light of the latest developments and analysis.

As a first step before committing to the regulatory consideration process, NAEEEC seeks the views of stakeholders on:

- the question of regulating these products by MEPS; and
- the assumptions and analysis contained in this consultant's report.

NAEEEC members will discuss the issue with interested parties at a forum on 9 April 2002 at Millennium Hotel Sydney.

Any person may attend the forum but they should advise Gordon Smith at the AGO of their intention to attend. Gordon may be contacted at the AGO by telephone (02) 6274 1119, by facsimile (02) 6274 1884, or by email gordon.smith@ea.gov.au

Yours faithfully

Dr Tony Marker
Chair, NAEEEC

CONTENTS

EXECUTIVE SUMMARY 7

1. BACKGROUND 10

1.1 THE NATIONAL APPLIANCE AND EQUIPMENT ENERGY EFFICIENCY PROGRAM 10

1.1.1 Objectives and Activities 10

1.1.2 Administration 10

1.1.3 Work Program 10

1.2 COVERAGE OF NAEEEP 11

1.2.1 Existing Household Product Coverage 11

1.2.2 Scope for Extension 12

1.3 THIS REVIEW 12

1.3.1 Purpose 12

1.3.2 Review Criteria 13

1.3.3 Application of Assessment Criteria 16

2. CLOTHES WASHERS 22

2.1 ENERGY EFFICIENCY 22

2.1.1 Technology and Use 22

2.1.2 The Energy Test and Star Rating 23

2.1.3 Energy Efficiency 23

2.2 MEPS CONSIDERATIONS 29

2.2.1 MEPS in Comparable Countries 29

2.2.2 Likely Effectiveness of MEPS 30

3. CLOTHES DRYERS 31

3.1 ENERGY EFFICIENCY 31

3.1.1 Technology and Use 31

3.1.2 The Energy Test and Star Rating 31

3.1.3 Energy Efficiency 32

3.2 MEPS CONSIDERATIONS 37

3.2.1 MEPS in Comparable Countries 37

3.2.2 Likely Effectiveness of MEPS 37

4. DISHWASHERS 38

4.1 ENERGY EFFICIENCY 38

4.1.1 Technology and Use 38

4.1.2 The Energy Test 38

4.1.3 Energy Efficiency 39

4.2 MEPS CONSIDERATIONS 41

4.2.1 MEPS in Comparable Countries 41

4.2.2 Likely Effectiveness of MEPS 41

5. AIRCONDITIONERS 42

5.1 ENERGY EFFICIENCY 42

5.1.1 Technology and Use 42

5.1.2 Energy Labelling and MEPS in Australia 43

5.1.3 The Energy Test 43

5.1.4 Efficiency Trends 43

5.2 MEPS CONSIDERATIONS 47

5.2.1 MEPS in Comparable Countries 47

5.2.2 Likely Effectiveness of MEPS 48

6. ELECTRIC SPACE HEATERS 53

6.1 TECHNOLOGY AND USE 53

6.2 MEPS CONSIDERATIONS 54

7. CONCLUSIONS AND RECOMMENDATIONS 55

7.1 CONCLUSIONS 55

7.2 RECOMMENDATIONS 59

REFERENCES 60

EXECUTIVE SUMMARY

The purpose of this review is to assess the case for adopting Minimum Energy Performance Standards (MEPS) for the following household appliances:

- Clothes washers
- Dishwashers
- Clothes dryers
- Electric space heaters
- Airconditioners

All of these products except electric space heaters are already subject to mandatory energy labelling. The criteria for consideration of MEPS are:

- Contribution to energy and greenhouse gas emissions;
- Adequacy of existing measures and programs (principally energy labelling);
- Relationship with MEPS in other countries, given the objective, endorsed by Energy Ministers, of matching "world's best practice" MEPS levels where appropriate; and
- Any special factors assisting or hampering MEPS.

The findings of a previous review of the case for MEPS for these products, carried out in 1993, were also taken into account.

CONTRIBUTION TO ENERGY AND GREENHOUSE GAS EMISSIONS

The five appliance groups under review accounted for 11.2% of household greenhouse gas emissions (6.2 Mt CO_2-e) in 2000, and this is projected to increase to 11.8% (7.2 Mt CO_2-e in 2015. Therefore the group constitutes a worthwhile target for more stringent energy efficiency measures.

Within the group, airconditioners are projected to account for nearly all of the additional greenhouse gas emissions. Emissions from the other appliances are projected to remain at about the 2000 levels.

On this criterion, airconditioners emerge as the highest priority for MEPS, especially given their increasing contribution to peak loads on electricity supply systems.

ADEQUACY OF EXISTING MEASURES

For the four products subject to energy labelling, it is possible to judge the effectiveness of labelling on the basis of three indicators:

- The trends in sales-weighted energy efficiency between 1993 and 2000, compared to business-as-usual (BAU) projections, gives some indication of the past indicate the effectiveness of labelling;
- The comparison of sales-weighted and model-weighted efficiency in 2000 gives an indication of the present effectiveness of labelling; and
- The star rating spread for models on the market in 2001 (after the change to the new rating system) is one leading indicator of the future effectiveness of labelling.

Labelling appears to be working best for dishwashers. The rate of improvement in sales-weighted efficiency has been higher than projected, although it has slowed recently. Sales-weighted efficiency is lower than model-weighted, implying consumer preference for the higher-rating products. There continues to be a relatively wide range of 3.0 in star ratings, which helps maintain consumer interest.

Labelling appears to be have been fairly effective for clothes washers, but the impact has declined. The rate of improvement in sales-weighted efficiency has been significant, but not as high as projected, and has begun to reverse. Analysis of model-weighted and sales-weighted efficiency suggests consumer indifference to star ratings. However, there continues to be a range of 2.5 to 3.0 in star ratings, so consumer response to labelling could be reinforced.

Labelling appears to have been fairly effective for airconditioners. There is no information on sales-weighted efficiency trends, but model-weighted efficiency has improved steadily, and there is reason to believe that this has carried through to sales-weighted efficiency. There continues to be a range of 3.0 to 5.0 in star ratings, which helps maintain consumer interest.

Labelling appears to have made little impact on the clothes dryer market. Sales-weighted energy consumption has not fallen below, and has recently started to climb above, BAU projections. Consumers appear to be indifferent to star ratings, and this indifference would be reinforced by the narrow spread of ratings, from 0.5 to 1.0 stars.

There is no labelling or other existing program measure for electric space heaters, but nether labelling nor MEPS would be practical.

On the criterion of adequacy of existing measures, clothes dryers emerge as the highest criterion for MEPS, followed by clothes washers and airconditioners.

RELATIONSHIP WITH MEPS IN OTHER COUNTRIES

For top loader clothes washers, ANZ-made products are already more efficient than top loaders imported from countries with MEPS. Therefore adoption in Australia of the typical MEPS levels in the countries of origin is likely to have no effect on efficiency levels for top-loading washers.

For front loader clothes washers, the large number of models from Europe, and the nature of the sales-weighted efficiency agreements negotiated between the EC and the appliance industry, raises the possibility that some suppliers may continue to produce less efficient models for longer than otherwise if they can still export units to non-MEPS markets (such as Australia) and still meet their sales-weighted targets in the EU.

Only two countries have MEPS for clothes dryers: Canada and the USA. The few US-made models on the Australian market appear to be somewhat less efficient than the model range average. Therefore there appears to be no advantage in adopting the North American MEPS levels.

Nearly all the dishwashers imported to Australia are manufactured in Europe; so only the European MEPS regime is relevant. In 2000 the EC negotiated a sales-weighted agreement on dishwasher energy efficiency with European manufacturers. This introduces similar dynamics as for front-loading clothes washers. Because of the nature of the voluntary MEPS regime applying in Europe, the source of all of the imported dishwasher sold in Australia, there may be some risk that less efficient models may be diverted to non-MEPS markets such as Australia.

All household size airconditioners sold in Australia are imported, two third of them from countries with MEPS regimes for those products. Most countries have MEPS only for "room", or single-phase household type units – indeed, Australia is the only country with an airconditioner MEPS regime where this category is not covered. The countries with airconditioner MEPS are progressively making them more stringent. The fact that Australia does not have MEPS for these product classes, while being completely dependent on imports, introduces a risk that models which do not meet MEPS levels in their countries of origin could be diverted to Australia and other no-MEPS countries.

No country has a MEPS regime for electric resistance space heaters. To sum up, the impact of overseas MEPS regimes is as follows:

- For clothes washers, clothes dryers, dishwashers and airconditioners, absolute MEPS regimes (ie minimum efficiency levels applying to all models) exist in at least one other trade-related country;
- For clothes washers, clothes dryers and dishwashers there would be little advantage in adopting MEPS levels in use elsewhere, either because the energy tests and products are so different or because efficiency levels in Australia are already higher;
- Many countries have absolute MEPS levels for airconditioners. Nearly all are set at different levels (apart from North America, where they are tending to be harmonised). There is no single "indicator" MEPS level which it would be advantageous to adopt: the most appropriate level for Australia would need to be established; and
- There are risks of negative impacts from MEPS regimes for the following imported products: for front-loader clothes washers and dishwashers, the risks come from the target MEPS regimes adopted in the EU; for airconditioners, the risks come from the increasing stringency MEPS regimes in some Asian countries and in North America. The adoption of absolute MEPS levels for these products (at levels to be determined) would eliminate the risk of non-complying models being diverted to Australia.

SPECIAL FACTORS ASSISTING OR HAMPERING MEPS

Any case for MEPS for top-loader clothes washers is undermined by the increasing tendency of householders to wash in cold water, which means that in-use energy consumption is becoming increasingly decoupled from tested consumption, and the real energy differences between models is declining.

MEPS for electric space heaters is neither necessary (all models convert electricity to heat with an efficiency close to 100%) nor practical, given the difficulty of devising a representative set of heating conditions.

COMPARISONS WITH 1993 REVIEW

The case for MEPS for four of the product classes was also reviewed in 1993. For top loading clothes washers, the conclusions of the present review are similar to those in 1993: there is no case for MEPS. Front loader clothes washers, for which there is now a case for MEPS, were not considered as a separate category in 1993.

MEPS was recommended for clothes dryers in 1993, on the basis that labelling was ineffective. However, the recommendation was not taken up, partly because of the variability of the energy test. The present review has found that labelling still appears ineffective for dryers. Recent changes to the energy test have reduced the variability. Therefore MEPS should be reconsidered for clothes dryers.

For dishwashers, the problems with the test identified in 1993 have now been largely overcome, but the higher than expected average energy improvement mean that there is now no immediate case for MEPS. However, the market should be monitored for possible negative consequences of the EU MEPS regime. The benchmark program for labelling of dishwashers will be changing to "normal" in late 2002, so the impact of this and the subsequent market reaction should be re-assessed in 3 to 5 years time.

For airconditioners, it was recommended in 1993 that the issue of MEPS should be re-examined after a review of the energy test and energy efficiency rating algorithms. These have now occurred, and there is a strong case for considering MEPS, especially given the widespread adoption of MEPS by our major trading partners.

RECOMMENDATIONS

It is recommended that:

1. MEPS should be considered for all clothes washers with an internal heating element;
2. The determination of the optimum MEPS level for internally-heating clothes washers should take into account the objective of eliminating the possible leakage of low-efficiency products from European markets;
3. MEPS should be considered for vented clothes dryers (both timer and auto-sensing);
4. MEPS should not be considered for dishwashers for the time being;
5. The dishwasher market should be closely monitored for the effects of re-labelling to "normal" cycle consumption, and for any evidence of leakage of low-efficiency products from European markets;
6. MEPS should be considered for all airconditioner classes now subject to mandatory energy labelling (ie single phase products) as well as multi-split models, once the test procedure is finalised;
7. For airconditioners, the determination of the optimum MEPS level should take into account the increasing stringency in other countries' MEPS levels, and the objective of eliminating the possible leakage of low-efficiency products from other markets;
8. MEPS should not be considered for electric resistance space heaters;
9. Where MEPS is adopted it should cover all energy use: standby and off-mode energy consumption as well as operating-mode energy; and
10. Even where operating-mode MEPS is not adopted, consideration should be given to MEPS for standby and off-mode energy.

1. BACKGROUND

1.1 The National Appliance and Equipment Energy Efficiency Program

1.1.1 OBJECTIVES AND ACTIVITIES

One of the objectives of the National Greenhouse Strategy (NGS 1998) is to improve the energy efficiency of energy-consuming household appliances, industrial and commercial equipment. The measures by which Commonwealth, State and Territory governments aim to achieve this objective are known collectively as the National Appliance and Equipment Energy Efficiency Program (NAEEEP).

The activities covered by the NAEEEP tend to be categorised as either legislative action, or support for voluntary action by stakeholders.

The principal forms of legislative action are mandatory energy labelling and mandatory Minimum Energy Performance Standards (MEPS).

Voluntary initiatives supported by the NAEEEP include:

- Information programs to support energy labelling: eg the "Reach for the Stars" campaign to promote consumer preference for more energy efficient products, and the maintenance of websites listing all appliances with their energy ratings;
- Financial Support and recognition for suppliers of energy efficient products: eg the national "Galaxy Awards";
- Support for voluntary information and labelling programs such as Energy Star; and
- Research and general industry development activities.

1.1.2 ADMINISTRATION

The NAEEEP is administered by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC), comprising representatives from two types of government agencies:

- State and Territory regulatory agencies responsible for administering mandatory energy efficiency labelling and performance standards called into legislation in their respective jurisdictions; and
- Commonwealth, State and New Zealand agencies with a mandate to encourage sustainable energy use and reduce greenhouse gas emissions.

NAEEEC reports to a committee of senior government officials, the Energy Management Task Force (EMTF), which is responsible for developing policies and allocating funding. Both NAEEEC and EMTF advise the Ministerial Council on Energy (MinCOE: the successor to the Australian and New Zealand Minerals and Energy Council).

1.1.3 WORK PROGRAM

The range of household and non-household products currently and potentially covered by the NAEEEP is very wide, so its activities need to be carefully targeted and prioritised. In 1999 the NAEEEC adopted a three year work program (NAEEEC 1999). The work program for the third year (calendar 2001) was:

> Review existing or develop and implement new strategies (regulatory and/or voluntary) to improve the energy efficiency of:
>
> - Dryers, dishwashers, clothes [washers];
> - Space heating and cooling equipment (all fuel types);
> - Electric cooking appliances; and
> - Swimming pool equipment (ie motors, pumps, gas and solar pool heaters).

The present study forms part of this task. It covers dryers, dishwashers, clothes washers, airconditioners and electric space heating equipment. Before detailing the scope of the study, it is necessary to place it in the wider context of the NAEEEP.

1.2 Coverage of NAEEEP

1.2.1 EXISTING HOUSEHOLD PRODUCT COVERAGE

The current application of the legislated elements of the NAEEEP to household electrical products is summarised in Table 1. The table only covers mandatory programs for electric appliances intended for household use. It does not cover:

- Non-mandatory programs for household appliances, notable energy labelling for gas water heaters, space heaters and central heaters, which is operated by the Australian Gas Association;
- Mandatory programs targeting primarily non-household products, which may nevertheless be purchased for household use (eg three-phase air conditioners, for which MEPS took effect in October 2001 and fluorescent lamp ballasts, for which MEPS are proposed to take effect in mid 2003); or
- Voluntary programs such as Energy Star (targeting computers and household electronic devices such as VCRs) and the One-Watt program, targeting standby and off-mode energy use.

TABLE 1 ACTIVE AND PROPOSED MANDATORY ENERGY EFFICIENCY MEASURES FOR HOUSEHOLD ELECTRICAL APPLIANCES, AT END OF 2001

Household appliance (electric)	Commencement of Energy Labelling (a)	Commencement of MEPS
Refrigerator	1986	October 1999; More stringent MEPS levels proposed to take effect January 2005 (GWA 2001c)
Freezer	1987	October 1999; More stringent MEPS levels proposed to take effect January 2005 (GWA 2001c)
Dishwasher	1988	No MEPS
Airconditioner	1987(b)	No MEPS
Clothes washer	1990	No MEPS
Clothes dryer	1990	No MEPS
Mains pressure storage water heaters >= 80 litres	No labelling	October 1999; MEPS level 70% of then standard heat loss; MEPS revision to match US levels proposed to take effect mid-2005 (NAEEEP 2001d)
Mains pressure storage water heaters < 80 litres	No labelling	October 1999; MEPS level 100% of then standard heat loss; MEPS revision to 70% of current heat loss proposed to take effect January 2005 (GWA 2001b)
Miscellaneous storage water heaters	No labelling	MEPS comparable to levels for main pressure storage water heaters proposed to take effect mid-2005 (NAEEEP 2001e)

(a) Year in which mandatory labelling commenced in at least one State (either NSW or Victoria) and for at least one subcategory of product. For some appliances, labelling was phased in over several months, and some States and Territories did not make labelling mandatory until several year later.

(b) In 2000, scope of labelling changed from products with cooling capacity of 7.5 kW or less to all products taking single-phase electricity supply.

1.2.2 SCOPE FOR EXTENSION

There are two distinct ways in which NAEEEP coverage of household appliances can be extended:

- Requiring energy labelling for products not previously labelled; and
- Requiring MEPS for products for which MEPS was not previously required.

MEPS and labelling tend to be closely linked, in that they depend on common test standards, regulations and administrative structures, but are in fact independent: products may be subject to labelling only, to MEPS only, or to both. There should be no presumption that labelling is a first step that necessarily leads to MEPS – indeed, this progression has so far only occurred with refrigerators and freezers. The most appropriate option for each product should be determined in relation to its specific market and technology. For some products, it may turn out that neither labelling nor MEPS is warranted. This was the conclusion reached for evaporative air conditioners (NAEEEP 2001c).

1.3 This Review

1.3.1 PURPOSE

The purpose of this review is to assess the case for adopting MEPS for the following household appliances:

- Clothes washers
- Dishwashers
- Clothes dryers
- Electric space heaters
- Airconditioners (single phase)

All of these products except electric space heaters are already subject to mandatory energy labelling (Table 1).

The Australian Greenhouse Office (AGO), which commissioned the study on behalf of NAEEEC, specified that the following be taken into account in the review:

- The magnitude of household energy and emissions represented by these products, both current and projected, based on the study Australian Residential Building Sector Greenhouse Gas Emissions, 1990-2010 (EES at al 1999);
- Recent trends in energy efficiency of the models on the Australian market, as documented in market monitoring by GfK (for clothes washers, dishwashers and clothes dryers), changes in the energy labelling register (for air conditioners) and other readily available information;
- The adequacy of existing measures to increase appliance efficiency, notably energy labelling where applicable;
- Whether other countries with which Australia trades have MEPS for these products, and if so the comparison of their MEPS levels with market energy efficiency levels in Australia;
- The existence of any special technical, market or administrative factors which may facilitate or hamper MEPS for these products; and
- The findings on these products in the report *Benefits and Costs of Implementing Minimum Energy Performance Standards for Household Electrical Appliances in Australia*, (GWA et al 1993).

The review is to make recommendations on whether MEPS should be part of NAEEEP strategy for these products.

1.3.2 REVIEW CRITERIA

Not all household appliances can be covered or need to be covered by the NAEEEP. Apart from the fact that program resources are limited, the overall integrity and effectiveness of the NAEEEP could be reduced if products with low energy use or no differentiation in efficiency were labelled, or if products which could not be reliably tested were subject to MEPS.

The criteria for coverage by energy labelling were first articulated in 1983 (NECP 1983) and the criteria for coverage by MEPS in 1993 (GWA at al 1993). Although the criteria have been refined considerably since then, in general they can still be reduced to three threshold issues:

1. Should the product class be included in the NAEEEP at all?
2. Should it be covered by the mandatory elements of the program?
3. If so, should it be subject to energy labelling, MEPS or both?

COVERAGE BY NAEEEP

The criteria for the inclusion of an appliance class in the NAEEEP are as follows:

- The appliance should be a significant contributor to national energy consumption. This means in effect that it should be both common (ie present in a large proportion of households) and a high energy user under its typical usage profile. Refrigerators, for example, have both characteristics. Products which are present in a minority of households but are high energy users (eg swimming pool equipment) may still be suitable for inclusion, especially for labelling, since buyers should be receptive to information that will enable them to reduce operating costs.

  As appliance ownership, technology and usage are dynamic, it is necessary to regularly monitor and project ownership and energy use for key products, since those with relatively modest ownership at present may be at the beginning of their adoption curve.

  Alternatively, products which have shown a trend towards reduction in energy use could be subject to a reversal of the trend, because the market preference shifts to larger or more highly featured models, or if the market supply shifts from higher to lower quality products.

  In some cases the "significant contributor to national energy consumption" may be a component or a function present in many products, rather than a distinct appliance type: eg small electric motors, or the standby mode;

- Significant contributor to national greenhouse gas emissions. The form of energy used by appliances largely determines their greenhouse impact. In Australia, electricity has by far the highest greenhouse impact per unit of energy (except in Tasmania, where the electricity supply is dominated by hydro). Natural gas has a much lower greenhouse impact per unit of energy and wood, as a renewable fuel, has a greenhouse impact near zero. In general, electric appliances are the highest priority on the greenhouse impact criterion; and

- Opportunities for cost-effective improvements in the sales-weighted energy efficiency of products sold new. The average energy efficiency of new products can be improved in three distinct ways: increasing the efficiency of the most efficient products on the market, increasing the efficiency of the least efficient (eg by setting minimum standards) or influencing consumers to prefer the more efficient (eg by requiring all products to be labelled). However, the benefits of increasing sales-weighted efficiency should outweigh any increases in average appliance prices, including increases due to the costs of administration of the program itself. This would not be so if the more efficient products were so much more expensive that consumers could not recover the additional expenditure through reduced energy costs. (At present, reduction in energy costs is the sole monetary benefit used in NAEEEP analyses: it is possible that other benefits such as reductions in greenhouse gas emissions could also be given monetary value).

MANDATORY REQUIREMENTS

Products can be and have been included in the NAEEEP via voluntary measures only. For example, there is no obligation for suppliers of home computers or VCRs to ensure that their products meet the Energy Star criteria for standby power consumption, or if they do, to communicate that fact to prospective buyers via the Energy Star label.

The mandatory elements of the NAEEEP have a more significant impact on the market, since they impose mandatory costs on suppliers (which are mostly passed on to buyers) and/or restrict the range of products available to consumers. The following criteria need to be met:

- Evidence of some form of failure in the market. Ideally, prospective purchasers of a product that provides an energy service should be aware of both the purchase price and the operating costs, and should be in a position to make an informed choice between alternative models, alternative fuels or alternative options for obtaining the equivalent energy service. However, this is rarely the case.

  There may be information failure. Prospective purchasers may not be aware that a product is a high energy user, or there may no consistent form of energy labelling (indeed, some suppliers may well be making claims that are deliberately confusing), or the cost of obtaining relevant information during the pre-selection research period may be unacceptably high (eg for water heaters, where speed of replacement drives the decision).

  There may also be other forms of market failure, which would remain even if the information failures were addressed. The most common is a variant of the "landlord-tenant" or "split decision" situation where one party selects the product but a second party bears the running cost;

- Administrative feasibility. There is no possibility of mandatory coverage of a product unless there is a recognised and reliable energy test (preferably in an Australian or Australian/New Zealand Standard), a regulatory structure capable of giving the Standard mandatory force, a system of test laboratories that can independently confirm results, and an administrative framework and resources for managing the process;
- Compatibility with patterns of product manufacture and supplier competition. Although mandatory NAEEEP requirements are often neutral with respect to competition, since they are imposed on all local manufacturers and importers and can be recovered from consumers, some markets could be disrupted if compliance costs fall disproportionately on a few suppliers, or if meeting a given MEPS level requires access to proprietary technology;
- Compatibility with patterns of product purchase and usage. The mandatory requirement should not lead to the design of products which are inconsistent with consumer preference with regard to appearance, features, size, quality or other key attributes. In addition, there should be reasonable confidence that buyers will use the product in a way that is consistent with the energy test, so that the energy saving objectives of the mandatory measure are realised; and
- Demonstration of likely cost-effectiveness.

Since 1995, the Council of Australian Governments (CoAG) has required that all proposals for regulation be subject to a Regulatory Impact Statement (CoAG 1997). Mandatory energy labelling and MEPS for the household appliances covered by the NAEEEP have been subject to a number of Regulatory Impact Statements (RISs), including the following:

- *Regulatory Impact Statement: Energy Labelling and Minimum Energy Performance Standards for Household Electrical Appliances in Australia* (GWA 1999). This endorsed the proposed continuation of mandatory energy labelling for refrigerators, freezers, dishwashers, airconditioners, clothes washers and clothes dryers, and the adoption of the MEPS (at the 1999 levels) for refrigerators, freezers and main pressure electric storage water heaters; and
- *Regulatory Impact Statement: Energy Labelling and Minimum Energy Performance Standards for Household Electrical Appliances in Australia. Supplementary cost-*

benefit analysis on transition to a revised energy label (GWA 1999a). This endorsed the proposed revision of the energy tests and energy label designs for refrigerators, freezers, dishwashers, airconditioners, clothes washers and clothes dryers, which took effect in 2000.

These RISs have endorsed the mandatory application of energy labelling to four of the product classes covered by this review: airconditioners, dishwashers, clothes washers and clothes dryers. However, they did not consider the issue of MEPS for these products.

OPTIMUM PROGRAM APPROACH

For any product for which coverage by the NAEEEP is warranted, the optimum program approach is the one most likely to meet the NAEEEP's overall objectives. The RISs state this in the following terms (example from RIS on increasing MEPS levels for refrigerators and freezers, GWA 2000c):

Objective

The primary objective of the proposed regulation is to bring about reductions in Australia's greenhouse gas emissions from the use of [this class of appliance] below what they are otherwise projected to be (ie the "business as usual" case) in a manner that is in the community's best interests.

Assessment Criteria

The primary assessment criterion is the extent to which an option meets the primary objective.

The following secondary assessment criteria have been adopted:

1. Does the option address market failures, so that the average lifetime costs of obtaining [energy] services are reduced, when both capital and energy costs are taken into account?
2. Does the option minimise negative impacts on product quality and function?
3. Does the option minimise negative impacts on manufacturers and suppliers?
4. Is the option consistent with other national policy objectives, including in this case the objectives of the National Appliance and Equipment Energy Efficiency Program to match "world best practice" standards?

The application of these criteria may result in a finding that only labelling is warranted for a given product, that both labelling and MEPS are warranted, or neither is warranted, in the event that neither is likely to meet the stated objective.

POLICY WITH REGARD TO MEPS

In 1999 ANZMEC endorsed a new approach to MEPS, summarised as follows in *National Appliance and Equipment Energy Efficiency Program: Future Directions 2002-04* (NAEEEP 2001b):

> "*In 1999 ANZMEC agreed that Australia would match the best MEPS levels of our trading partners after taking account of test method differences and other differences (eg climate, marketing and consumer preference variations). This new policy represented a radical change of direction from the previous Australian practice of debating the technical possibilities of MEPS levels with all stakeholders. The new policy covered any product regulated by mandatory labelling or MEPS programs in other developed countries.*"

There is no suggestion that cost-effectiveness criteria should be abandoned, or that MEPS cannot be applied to a product in Australia if that product is not subject to MEPS anywhere else. Nevertheless, the logic of this approach implies the following steps in considering new MEPS, or revisions to existing MEPS, for any given product:

1. establish what MEPS levels, if any, apply in the countries with which there is significant Australian trade;
2. take account of test method differences and other differences (eg climate, marketing and consumer preference variations), and adjust MEPS levels accordingly;
3. subject the adjusted MEPS levels to cost-benefit, greenhouse reduction and other appropriate analyses;
4. consult with main stakeholders; and
5. if the adjusted MEPS levels pass the appropriate tests, adopt them.

1.3.3 APPLICATION OF ASSESSMENT CRITERIA

For clothes washers, clothes dryers, dishwashers and airconditioners, the case for the NAEEEP coverage and mandatory labelling has already been established, most recently in a 1999 Regulatory Impact Statement (GWA 1999). Therefore the issue is whether MEPS are warranted.

The following section re-examines the importance of these product classes in terms of existing and projected energy use and greenhouse gas emissions. The other elements of the analysis are covered in separate chapters for each product. The findings are summarised in Conclusions and Recommendations.

Electric space heaters are not at present covered by the NAEEEP. Therefore the threshold issues previously identified are addressed.

1 Should the product class be included in the NAEEEP at all?

2 Should it be covered by the mandatory elements of the program?

3 If so, should it be subject to MEPS? (Whether the products should be subject to energy labelling rather than MEPS, or to both, has not been considered).

Again, the following section reviews the importance of those product classes in terms of existing and projected energy use and greenhouse gas emissions. The other elements of the analysis are covered in a separate chapter on electric space heaters. The findings are summarised in Conclusions and Recommendations.

TABLE 2 RECOMMENDATION AND OUTCOMES OF 1993 MEPS STUDY

Product	Recommendation	Outcome
Refrigerators, refrigerator-freezers, freezers	MEPS formulae recommended for 8 product classes; MEPS recommended to start in 1996	MEPS commenced in October 1999; recommended formulae modified
Clothes dryers	MEPS formula recommended	No MEPS adopted
Clothes washers	No MEPS recommended – product does not meet criteria for MEPS	No MEPS adopted
Dishwashers	No MEPS recommended for time being, pending review of energy tests and basis for efficiency calculations	No MEPS adopted
Airconditioners (household)	No MEPS recommended for time being, pending review of energy tests and basis for efficiency calculations	No MEPS adopted
Electric storage water heaters >= 80 litres	MEPS recommended: 55% of current standing heat loss, to commence in 1996	MEPS commenced in October 1999; MEPS level 70% of then standard heat loss
Electric storage water heaters < 80 litres	MEPS recommended: 70% of current standing heat loss, to commence in 1996	MEPS commenced in October 1999; MEPS level 100% of then standard heat loss (a)

Source: GWA et al (1993). (a) This still had an effect, since before MEPS heat loss of most models was 110-150% of the standard.

PREVIOUS CONSIDERATION OF MEPS

The case for MEPS for clothes washers, clothes dryers, dishwashers and airconditioners has been considered before. In 1993 the author completed a study of the benefits and costs of MEPS for all the electrical appliances which were then labelled, and for electric storage water heaters (GWA et al 1993). The recommendations of that study are summarised in Table 2. MEPS were not adopted for the four product classes concerned, for a range of reasons which are reviewed in the chapters dealing with each of those products.

APPLIANCE OWNERSHIP

The present and projected ownership of the appliances under consideration in this review is illustrated in Figure 1. Clothes washer ownership is near "saturation", ie the appliance is present in close to 100% of Australian households. Clothes dryer, dishwasher and air conditioner ownership are all projected to increase. The proportion of households using electricity as their main form of space heating is projected to decline, largely as a result of the increasing ownership of gas heating, but electric space heaters are also used as a secondary form of heating in many households.

FIGURE 1 PROJECTED OWNERSHIP OF APPLIANCES COVERED IN THIS REVIEW

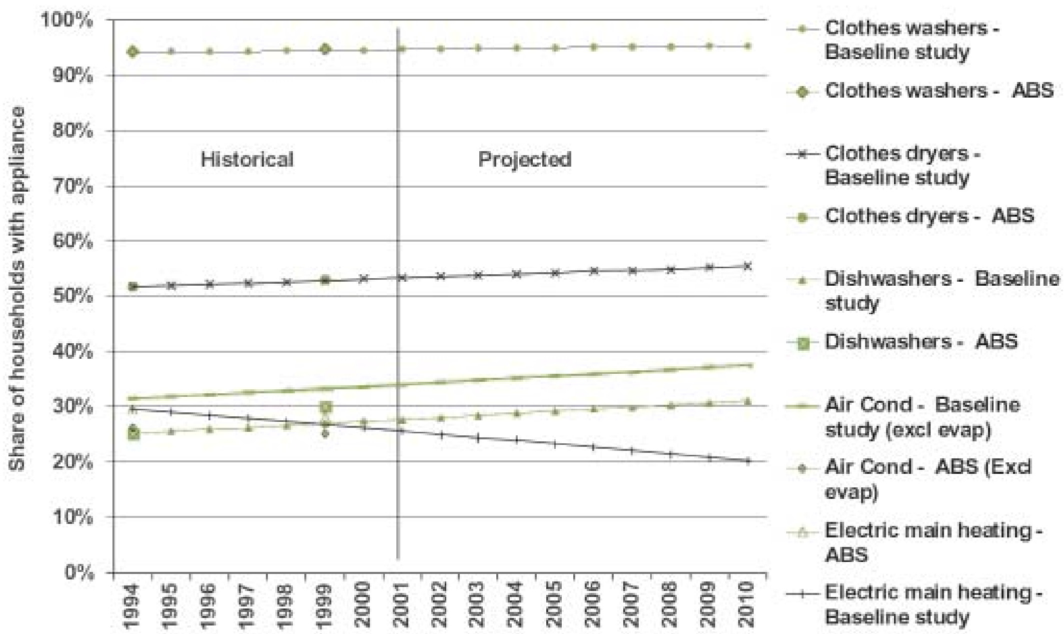
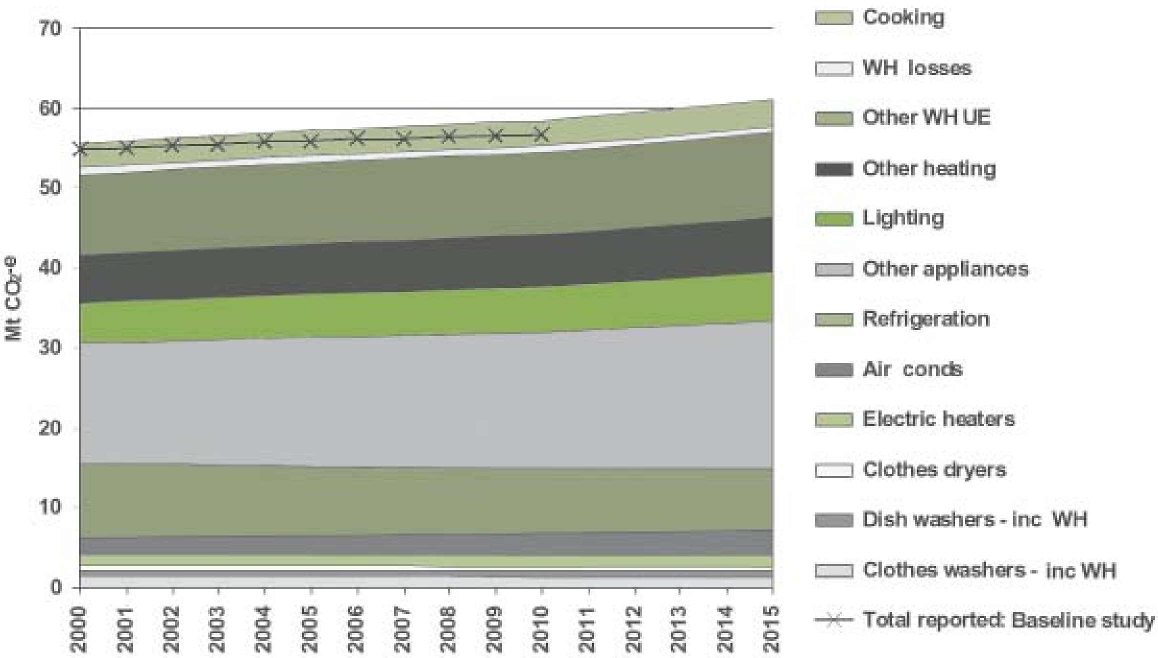


FIGURE 2 PROJECTED GREENHOUSE GAS EMISSIONS FROM THE RESIDENTIAL SECTOR, 2000-15



CONTRIBUTION TO GREENHOUSE GAS EMISSIONS

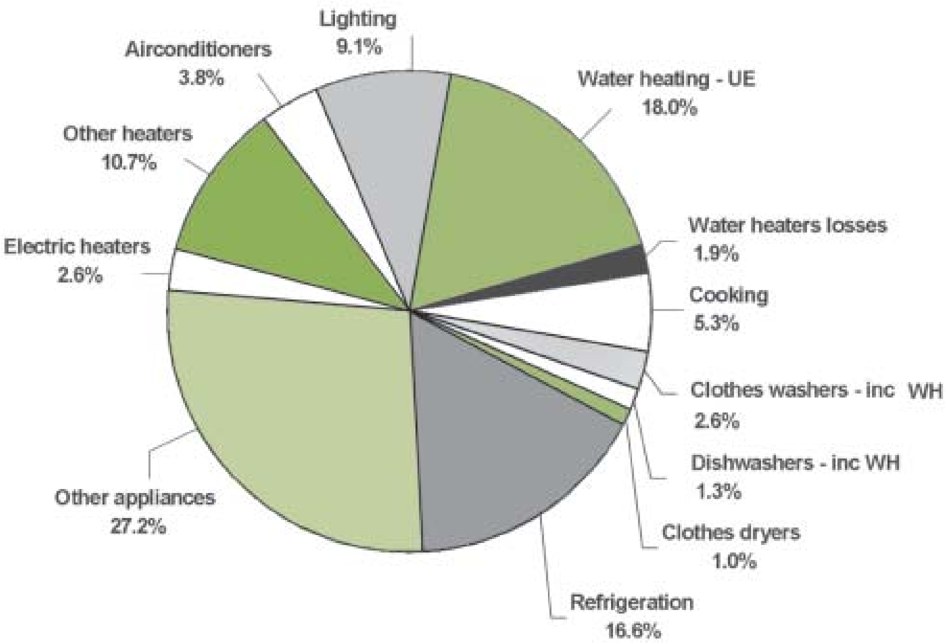
The contribution of the appliances under review to greenhouse gas emissions gas been modelled, using as a starting point the study *Australian Residential Building Sector Greenhouse Gas Emissions, 1990-2010* (EES et al 1999). The following additional modelling has been incorporated:

- More recent, and somewhat higher projections of average greenhouse gas coefficients for electricity, taken from GWA (2001b), have been used;
- The full greenhouse impact of clothes washers and dishwashers has been identified, by adding in the emissions associated with the consumption of externally heated water by those appliances (assuming that in each State the distribution of water heater fuel types among clothes washer and dishwasher owners is the same as the State average. Residual hot water use is termed "other water heating useful energy" (UE), and standing losses from electric water heaters are separately identified); and
- The projections have been extended to 2015

Figure 2 illustrates the projected contribution of major appliance groups to household greenhouse gas emissions over the period 2000-15. It is estimated that in 2000, the use of clothes washers (including their consumption of externally heated water) accounted for about 2.6% of household sector greenhouse gas emissions, clothes dryers for 1.0%, dishwashers (including their consumption of externally heated water) for 1.3%, airconditioners for 3.8% and electric space heaters for 2.6%: ie the products covered by this review account for a total of 11.2% of household emissions (Figure 3).

Airconditioners is the only one of these five appliance groups for which a significant increase in emissions is projected: from 2.1 Mt CO_2-e in 2000 to 3.2 Mt CO_2-e in 2015. For the others, it is

FIGURE 3 CONTRIBUTION OF APPLIANCES TO GREENHOUSE GAS EMISSIONS, 2000



projected that emissions will remain steady or fall (Figure 4). Although the emissions associated with the electricity consumed by the appliances is projected to increase slightly, this will be more than offset by a fall in the emissions associated with externally heated water (Figure 5), as an increasing proportion of that water is heater by natural gas and solar energy, rather than electricity.

Figure 6 and Figure 7 have more information on the estimated share of energy use by the cleaning appliances. About 19% of energy used by clothes washers in 2000 was electricity consumed directly by machines while washing (this includes both motor energy and energy used by internal heating elements), 10% was electricity consumed while in standby mode (which is only present in newer machines) and 71% was embodied in imported hot water. Imported hot water accounted for only 60% of the greenhouse emissions, because a large share of it was heated non-electrically. It is projected that in 2015 direct energy will account for 23% of clothes washer energy, standby mode for 19% and imported hot water for 58% (and only 44% of greenhouse emissions).

For dishwashers, About 43% of energy used in 2000 was electricity consumed directly by machines while washing (this includes both motor energy and energy used by internal heating elements), 7% was electricity consumed while in standby mode and 50% was embodied in imported hot water (accounting for 25% of greenhouse emissions, because a large share of it was heated non-electrically). It is projected that in 2015 direct energy will account for 39% of dishwasher energy, standby mode for 11% and imported hot water for 50% (and only 18% of greenhouse emissions).

For dryers, about 82% of energy was used while operating in 2000, and 18% on standby. The standby share is projected to increase to 38% in 2015. For electric space heaters and airconditioners, standby energy is estimated to have accounted for less than 4% of total energy in 2000, and is projected to remain at about the same level.

FIGURE 4 PROJECTED EMISSIONS ASSOCIATED WITH APPLIANCES UNDER REVIEW, 2000-15

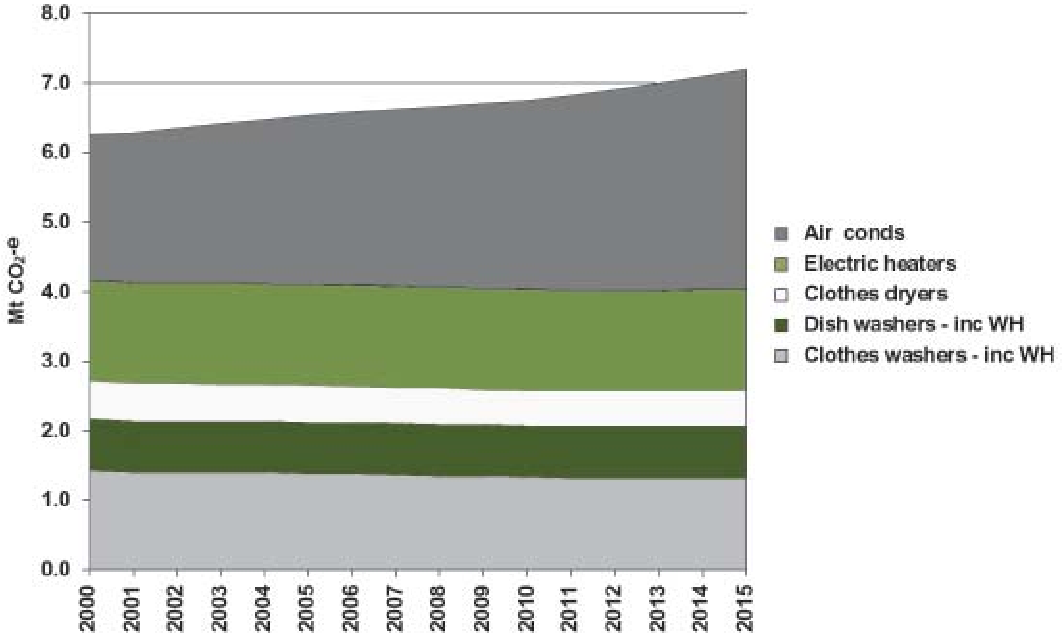


FIGURE 5 PROJECTED EMISSIONS ASSOCIATED WITH CLEANING APPLIANCES, 2000-15

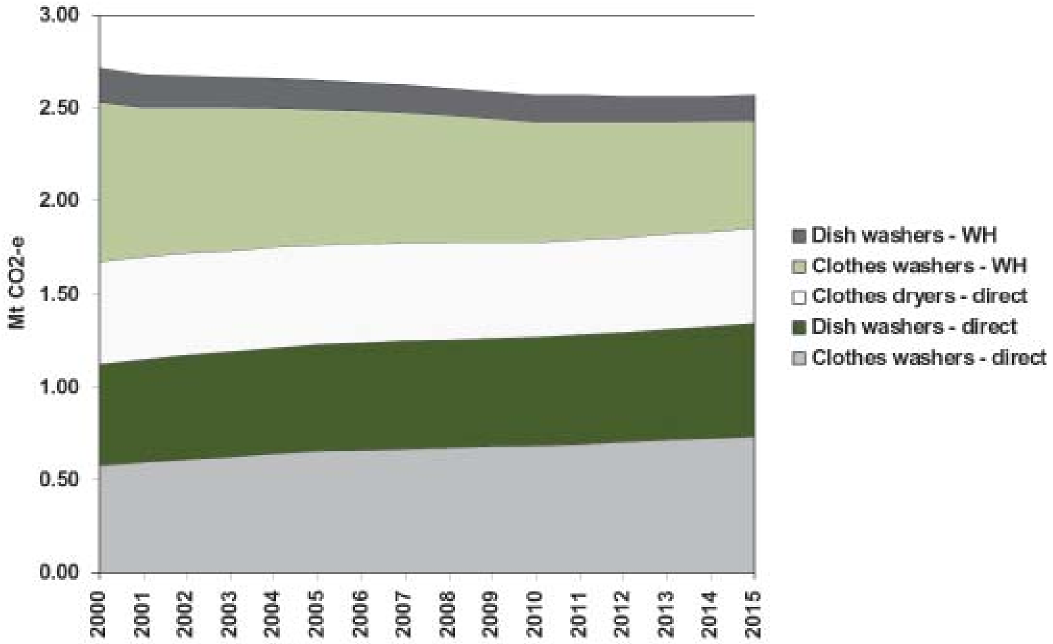


FIGURE 6 PROJECTED ENERGY USE BY CLEANING APPLIANCES, 2000-15

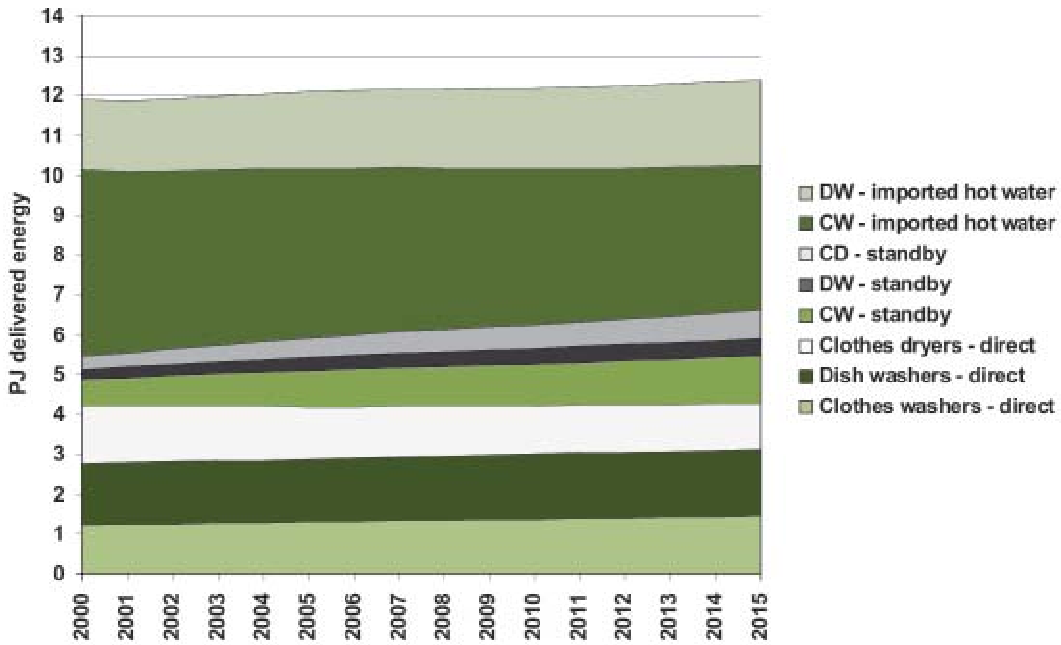
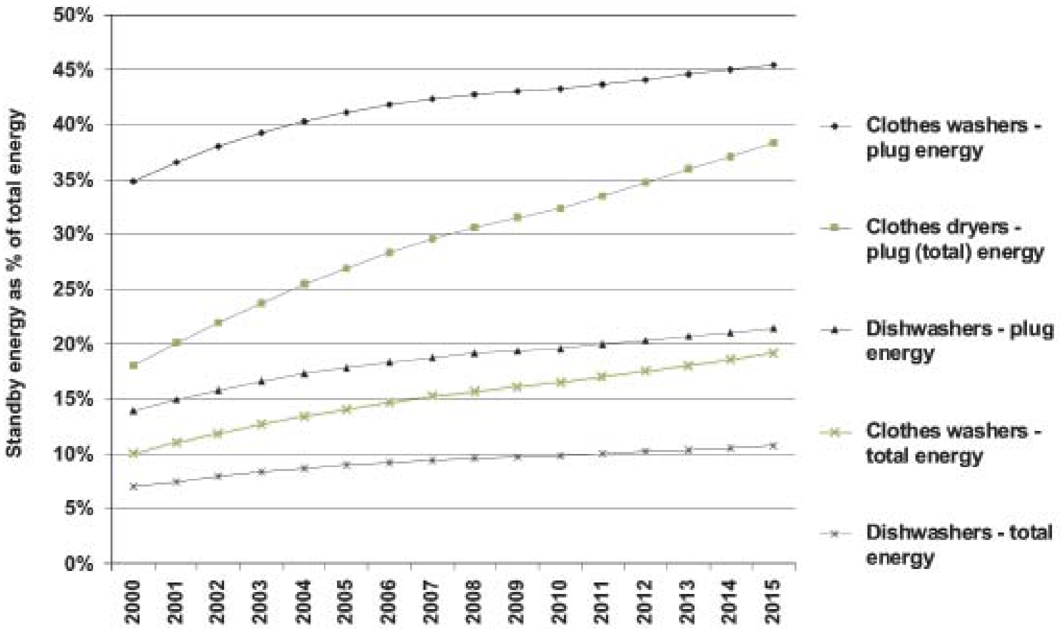


FIGURE 7 STANDBY ENERGY AS PERCENTAGE OF PROJECTED PLUG AND TOTAL ENERGY, CLEANING APPLIANCES 2000-15



2. CLOTHES WASHERS

2.1 Energy Efficiency

2.1.1 TECHNOLOGY AND USE

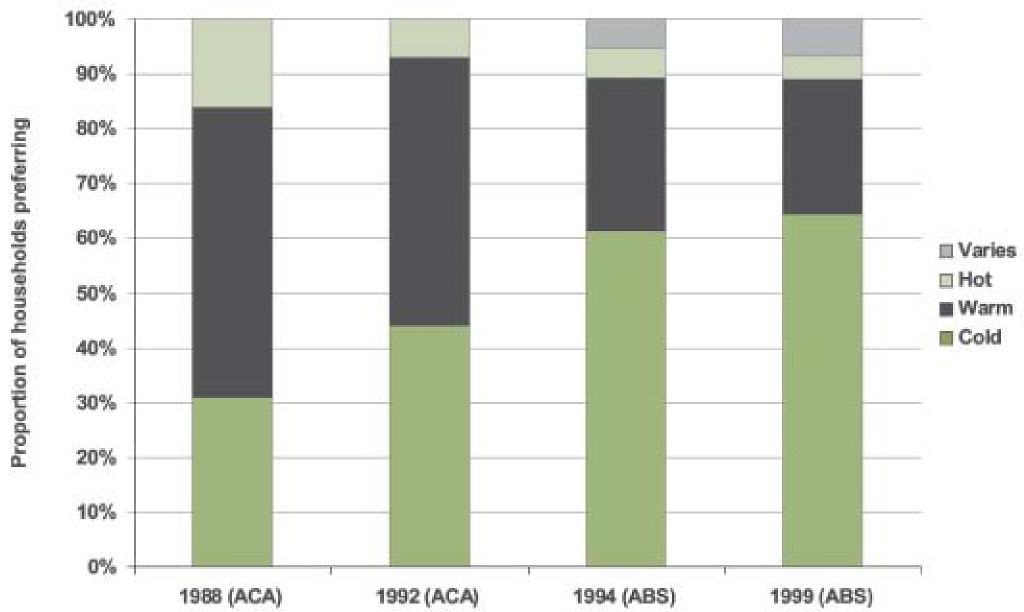
There are two main clothes washer configurations: top loading and front loading. These correspond with two distinct types of wash technology – vertical axis machines where the wash load is moved by an impeller or agitator, and horizontal axis machines, where the entire drum revolves. There are a few exceptions: some newer top loading washers are in fact horizontal axis machines, with a loading hatch in the side of the drum. There are also twin-tub designs, but now only a handful of models remain on the market.

Top loading machines generally use more water per wash when fully loaded, since the load must be completely immersed. In horizontal axis machines the drum tumbles the load through the water, so less water is needed.

The apparent energy advantage of front loading machines is due almost entirely to their lower water use, since less energy is required to heat a smaller amount of water to a given temperature. If warm wash is used, then a fully loaded front loader will generally use less energy than a fully loaded top loader of similar capacity (although the most efficient top loaders have lower energy use than the least efficient front loaders).

If cold wash is used, however, there is no real energy difference between top and front loaders, since the only energy use is for motors and pumps. Surveys by the Australian Consumers Association (ACA) indicated an increasing preference for cold water wash between 1988 and 1992 (GWA et al 1993), and more recent surveys by the Australian Bureau of Statistics indicates that the trend is continuing (ABS 1999). Between 1988 and 1999, the proportion of householders indicating that they wash with cold water increased from 31% to over 64% (Figure 8). (The energy projections in Figure 6 embody the assumption that the tendency to cold washing will continue).

FIGURE 8 PREFERRED WASH TEMPERATURES REPORTED BY HOUSEHOLDERS, 1988 TO 1999



Even for warm washes, other issues complicate the actual energy differences between top- and front-loaders, and between high star rating and low star rating models:

- Energy use is tested with a full load. In practice, many wash loads are partial, and most top-loaders allow the user to adjust (and in some cases adjust automatically) by using less water. Since front-loaders already use a smaller amount of water, the scope for further reduction for partial loads is limited. Therefore, the front loader's energy advantage per kilogram of wash load is less for partial loads than for full loads; and
- Front-loaders tend to take in cold water only and heat it internally, using an electric resistance element, which is the most greenhouse-intensive way to heat water (except in Tasmania). Even front loaders with hot water connections tend to import only part of their hot water requirement. Most use internal heaters as well. Nearly all top-loaders import hot water, which may be heated in a less greenhouse-intensive way (eg gas, or solar-boosted electric) and only a few heat water internally.

2.1.2 THE ENERGY TEST AND STAR RATING

The energy test for clothes washers (AS/NZS2040) is carried out with a full load of soiled cloth swatches, and with a minimum wash temperature of 35˚C. The washer must achieve a prescribed level of soil removal in order to qualify for an energy label.

The energy consumption indicated on the label comprises two components:

1. The actual electricity consumption of the clothes washer itself (both mechanical and thermal, if any water is heated internally);
2. The energy content of the imported hot water, if any, calculated with reference to a cold water supply temperature of 20˚C.

The kWh value on the label indicates the tested value multiplied by 365, nominally equivalent to 365 washes per year. The calculation of the energy label star rating for the model is based on its actual kWh energy consumption, plus a further factor:

3. The energy that would be used in an electric tumble dryer to remove the moisture remaining in the test load after the last spin cycle.

The effectiveness of moisture removal is indicated by the "spin index" – the lower the value, the less moisture remains in the load and the higher the star rating, all else being equal. The spin index was incorporated in the star rating scheme in order to signal the energy consequences when the load is dried in a tumble dryer.[1] However, while nearly 95% of households have a clothes washer, about 55% have a dryer, and even in those households not all wash loads are tumble dried. When the wash is line dried, the washer's spin performance does not actually impact on energy use.

2.1.3 ENERGY EFFICIENCY

DATA SOURCES

There are several general indicators of clothes washer energy efficiency, including kWh/kg load, which reflects washing energy only, the spin index, which reflects spinning efficiency only, and the star rating, which reflects both. Another indicator is the market share of front loaders, which are generally more energy efficient (at least on warm wash).

The actual sales-weighted trends in these values are monitored by the NAEEEC, which commissions Energy Efficient Strategies to analyse market data collected by the company GfK. The information in the present review is taken from the latest analysis, covering the years from 1993 to 2000 inclusive (NAEEEP 2001f).

The data indicate the actual trend only, not what the trend would have been in the absence of NAEEEP measures - in this case the energy labelling requirement. Projections of without-labelling trends were carried out for the 1993 study on MEPS (GWA et al 1993). It is the difference between these two trend lines that indicates the estimated impact of labelling.

1 The weighting given to washer spin performance was downgraded in 2000 (relative to the original 1990 requirement), but it is still an important marginal factor in determining the star rating.

TRENDS

The market share by configuration is indicated in Figure 9. The front loader market share increased between 1993 and 1997, but has remained constant since, at 12 to 13%. The market share of twin-tub models halved, from about 4% in 1993 to 2% in 2000, and the configuration is likely to eventually disappear from the market. In the subsequent analyses, trends for twin-tub models are not separately indicated, although they are included in the "all identified model" sales-weighted averages.

Figure 10 indicates that the nominal capacity of both top- and front- loading washers has been increasing, which is somewhat surprising given that the average number of persons per household is declining. (NAEEEP 2001f) reports that:

> Anecdotal evidence suggests that there is strong competition in the market place for large capacity top loading machines and that this attribute is now a key selling point. There is no doubt that to achieve these increases in rated capacity, manufacturers are pushing their designs to the limit and it is necessary to increase the energy consumption to maintain reasonable performance.

An increase in washer capacity is usually accompanied by a decline in litres used per kg wash, and this has indeed occurred (Figure 11). All else being equal, this would mean that less water would need to be heated per kg of wash, and so energy use (which is dominated by water heating energy) should also decline. However, the actual energy consumed per kg wash has been increasing (Figure 12). This supports the hypothesis above: manufacturers may be setting their machines to achieve the required minimum wash performance by either increasing the average wash temperature during the cycle, or by extending the agitation, or both. This would carry an energy penalty during the

FIGURE 9 MARKET SHARE BY CLOTHES WASHER CONFIGURATION, 1993-2000

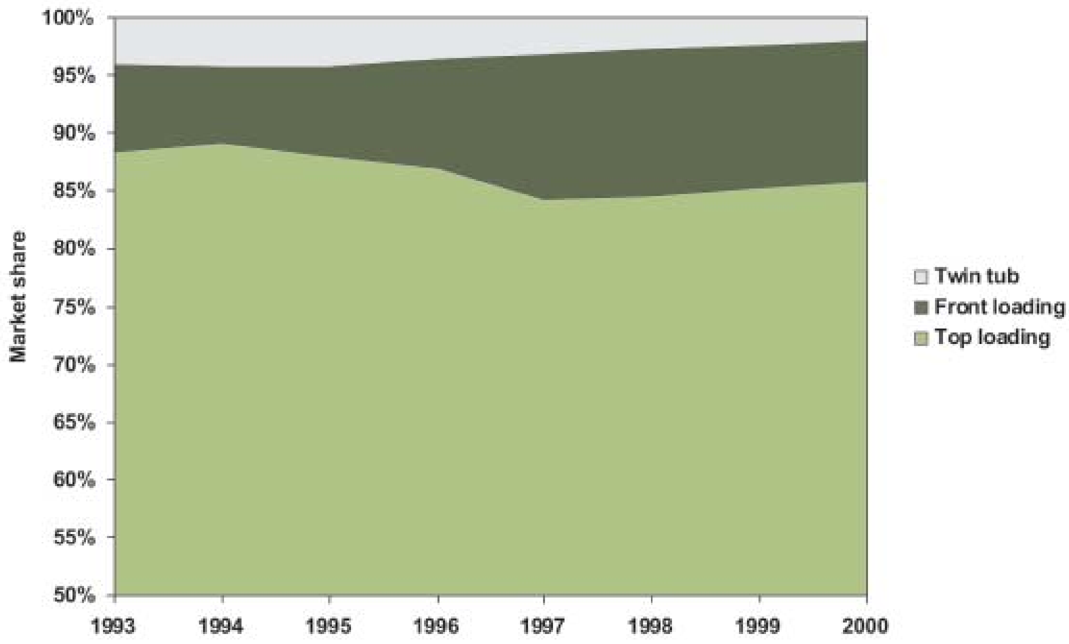


FIGURE 10 SALES-WEIGHTED AVERAGE CAPACITY FOR NEW CLOTHES WASHERS, 1993-2000

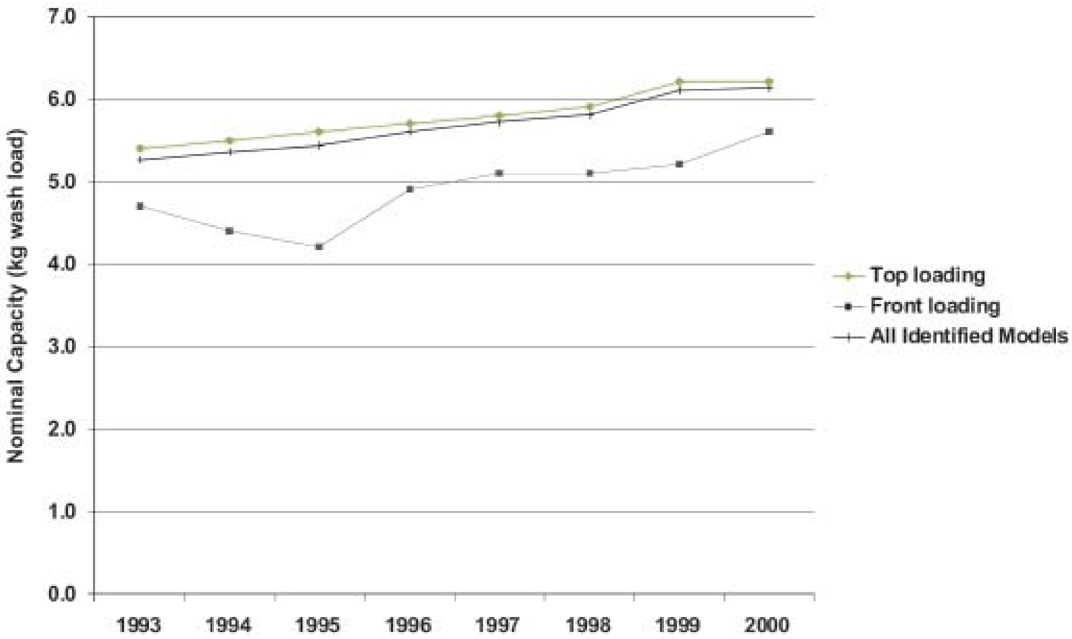


FIGURE 11 SALES-WEIGHTED AVERAGE WATER USE PER KG WASH LOAD CAPACITY FOR NEW CLOTHES WASHERS, 1993-2000

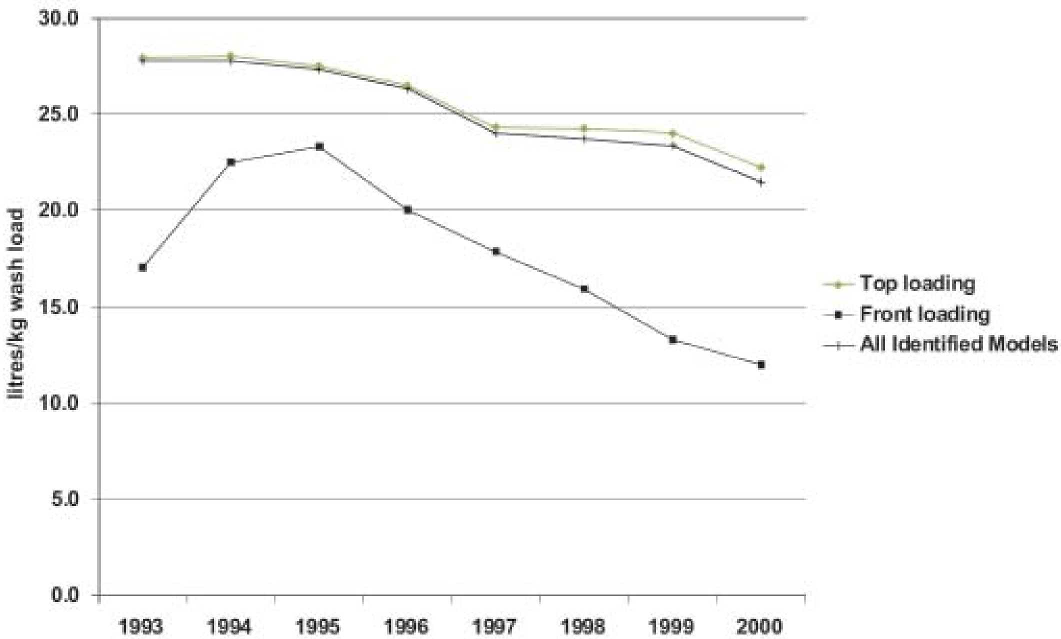


FIGURE 12 SALES-WEIGHTED AVERAGE ENERGY USE PER KG WASH LOAD FOR NEW CLOTHES WASHERS, 1993-2000

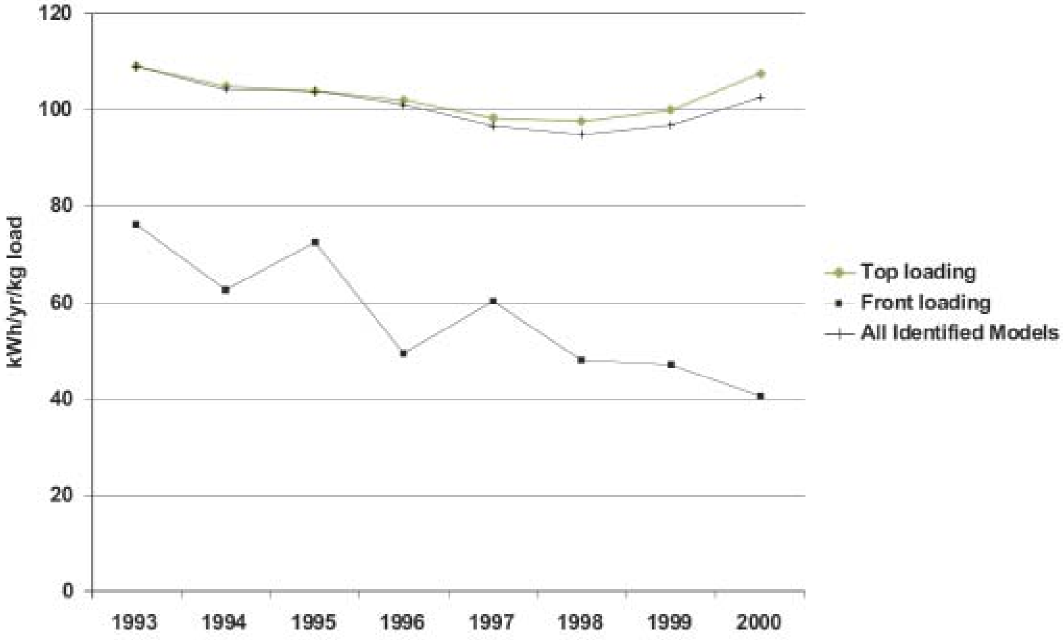


FIGURE 13 SALES WEIGHTED STAR RATINGS FOR NEW CLOTHES WASHERS, 1993-2000

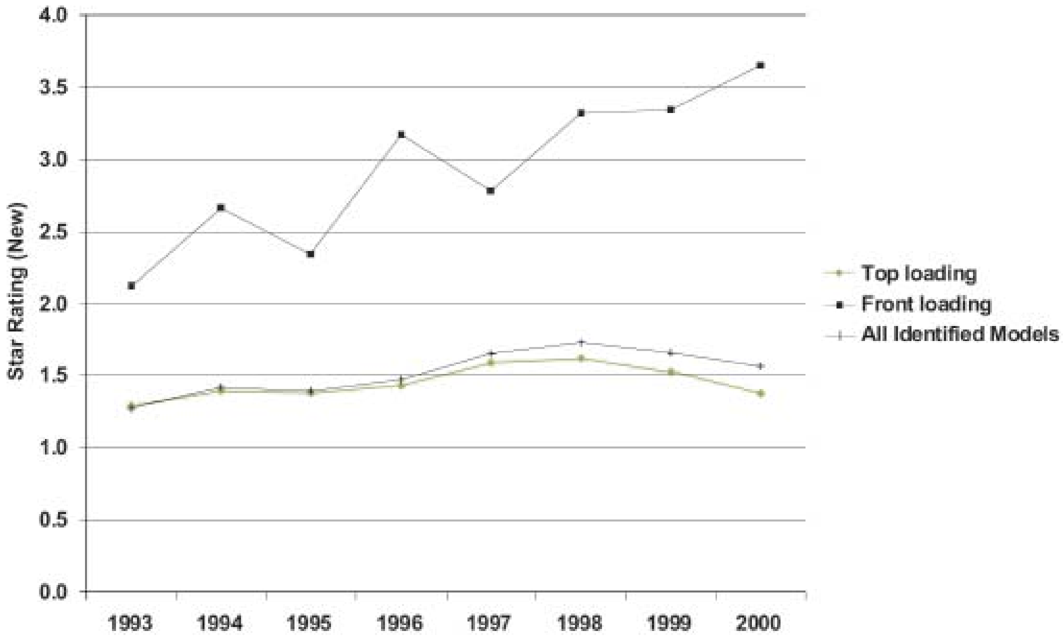
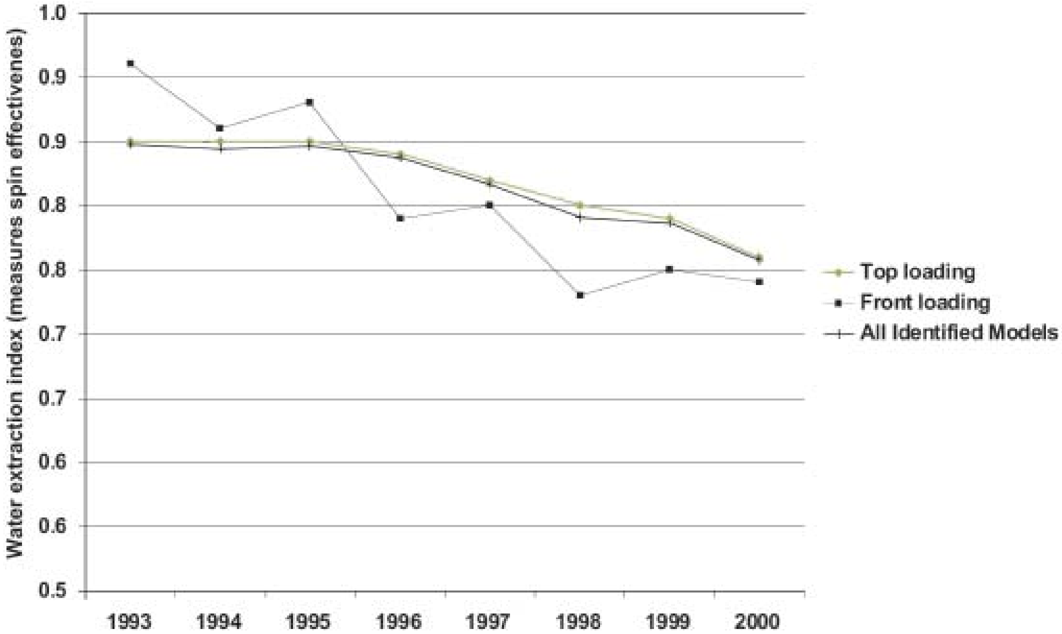


FIGURE 14 SALES-WEIGHTED SPIN INDEX FOR NEW CLOTHES WASHERS, 1993-2000



AS/NZS 2040 test, and is reflected in a reduction in label star ratings (Figure 13). If there were a reduction in spin effectiveness, this would also contribute to a reduction in star ratings, but this does not appear to have been the case. Average spin index has continued to fall (improve) even for top-loaders (Figure 14).

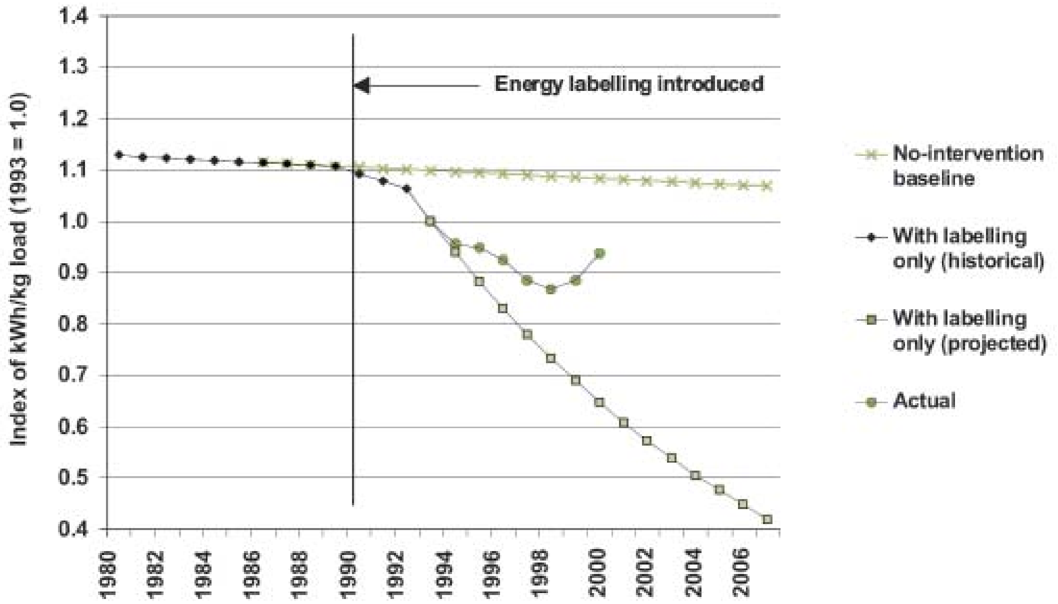
The range of model star rating indices (SRI) the model averages at the end of 2001, and the sales-weighted averages for 2000, are summarised in Table 3. The sales-weighted SRIs were somewhat lower than the model-average SRIs, suggesting that models with lower SRIs outsold those with higher SRIs. If so, there is still significant scope for labelling or other measures to shift consumer preference towards more efficient models.

TABLE 3 STAR RATING INDEX AVERAGES AND RANGES FOR CLOTHES WASHERS

Configuration	Number of models, 2001 (a)	Average SRI of models	Sales-weighted SRI 2000	Highest SRI, 2000	Lowest SRI, 2001
Top loader(a)	102	1.55	1.38	3.83	0.81
Front loader	103	3.75	3.65	4.91	1.59

Source: derived from energrating.gov. (a) all drum machines grouped under "front loader"

FIGURE 15 PROJECTED AND ACTUAL TRENDS IN KWH/KG LOAD, CLOTHES WASHERS



Finally, the actual change in new washer energy efficiency (as indicated by kWh/kg load) is compared with the historical trends before labelling was introduced and the projections developed in 1993 (GWA et al 1993), before the actual GfK data became available (Figure 15). The values are indexed to 1993 for simplicity. The diagram suggests that:

- energy labelling had a significant impact on the market;
- the impact was less than envisaged by the projections prepared in 1993 (which assumed that the market would shift to front loading washing machines); and
- the impact of labelling appears to be declining.

However, it is by no means clear how these trends have affected the actual energy use of new clothes washers, because of the divergence from the conditions of the AS/NZS 2040 test with regard to preferred wash temperature, and probably load sizes. If most washes are partial loads and in cold rather than warm water, the energy penalties which manufacturers are incurring in order to maintain wash performance at full load would impact less in use than in the Standard test. Partial load washing may well be becoming more common, since as washer capacities are increasing as household size is declining.

2.2 MEPS Considerations

2.2.1 MEPS IN COMPARABLE COUNTRIES

The countries with MEPS for clothes washers are listed in Table 4. The European Union does not have absolute MEPS (in which all products have to conform) but an agreement negotiated between the European Commission and the appliance industry association, under which the sales-weighted average energy consumption of clothes washers was to be reduced by 20% (EES & EC 2001).

Most of the top loading clothes washers sold in Australia are manufactured in Australia or New Zealand. Of the other models, most are imported from China, Korea, USA, Japan and the EU, nearly all of which have MEPS for clothes washers. However, these MEPS levels do not appear to be particularly stringent. Of the 102 top loader models, the 31 made in Australia or New Zealand have an average SRI of 1.85, whereas the 67 made in the countries listed in Table 4 have an average SRI of 1.43. The highest-rated top-loader models are ANZ-made (if the three horizontal axis top-loader models are grouped with the front-loaders) and the lowest-rated are imported from Korea and the USA. Therefore adoption in Australia of the typical MEPS levels in the countries of origin is likely to have no effect on efficiency levels for top-loading washers.

All 103 front loader models on the Australian market in 2001 were imported, including those sold under the brands of ANZ-based companies. All but 7 of those models were imported from countries listed in Table 4, and therefore influenced by their domestic MEPS regimes in some way. European designs dominate the Australian front loader market: of the 103 models on the register, 75 are made in EU countries, and a further 7 in Turkey or Slovenia, which export a large proportion of their production to the EU. The other 21 models came from Korea or China, which have their own MEPS for clothes washers.

The large number of models from Europe, and the nature of the sales-weighted efficiency agreements negotiated between the EC and the appliance industry, raises the possibility that some suppliers may continue to produce less efficient models for longer than otherwise if they can still export units to non-MEPS markets (such as Australia) and still meet their sales-weighted targets in the EU.

TABLE 4 COUNTRIES WITH MEPS FOR CLOTHES WASHERS

Country	MEPS and year introduced
Canada	M 1995
China	M 1989
European Union	V 1997
Israel	M 1986
Korea	M 2001
Mexico	M 1996
Poland	M 1999
USA	M 1994

Source: EES & EC (2001) M=Mandatory, V=Voluntary

2.2.2 LIKELY EFFECTIVENESS OF MEPS

There appears to be little point in adopting a MEPS regime covering all clothes washers, for a number of reasons.

- There is evidence that clothes washers consume less energy in actual use than in the energy tests, so the actual energy savings and cost-effectiveness of a MEPS regime based on the standard test (as would necessarily be the case) would be lower;
- Where cold water is used (as it is in the majority of washes) and where the load is dried on the line rather than in a dryer (as it may well be in the majority of washes), the differences in the amount of energy used by the clothes washer are negligible. Under those circumstances, a top-loading clothes washer with a low SRI will use about the same amount of energy for the wash and dry operation as a front-loader with a high SRI. Therefore it is difficult to justify an absolute MEPS regime which would exclude the former; and
- Even if it could be established via consumer research that there is a stronger link than appears to be the case between SRI and in-use energy consumption there would still be little point in adopting the top-loader MEPS levels which currently apply in the countries from which Australia imports top-loaders, because, the SRIs of models imported from countries with MEPS are on average lower than the SRIs of ANZ-made models.

However, there is a case for considering MEPS for front-loaders.

Because of the nature of the voluntary MEPS regime applying in Europe, the source of most of the front-loader models sold in Australia, there may be some risk that less efficient models may be diverted to non-MEPS markets such as Australia.

The strongest case for MEPS would be for those clothes washers which are most likely to favour warm/hot water washing, and so would have higher energy consumption in use, and – of that group – those which are most likely to be associated with electric water heating rather than with less-greenhouse intensive alternatives.

Front loaders meet both these criteria. Since they are designed for the European market, where completely cold washing is rare (partly because of lower cold water supply temperatures) most models use heated water for at least part of their wash cycle, even on the coolest program setting. Furthermore, even where hot water can be imported, most of the water heating task is still carried out within the unit. Therefore the water heating is largely undertaken by electricity, so passing up the greenhouse advantage of non-electric hot water supply systems.

This would suggest that MEPS should considered for all water heaters with in-built electric resistance heating, whether front-loading or top-loading.

3. CLOTHES DRYERS

3.1 Energy Efficiency

3.1.1 TECHNOLOGY AND USE

All electric clothes dryers are essentially rotating drums heated by electric resistance elements, into which damp clothes are placed until they are dry.[2] They are distinguished mainly by the mode of control of the length of the drying process and the way in which the water vapour is removed.

In most dryers sold, the user estimates the length of time required to dry the load and presets the timer accordingly. These are known as "timer" dryers. In other types, the dryer continuously monitors the moisture content of the load and terminates operation when it is dry. These are known as "automatic" or "autosensing" dryers. What constitutes "dry" is determined by the manufacturer, and is typically in the range 2% to 8% moisture content: some models allow the user to select different moisture contents depending on whether the intention is to iron the clothes or fold them away.[3]

In the great majority of dryers sold in Australia, the water vapour is vented outside the dryer cabinet directly into the room. These are known as "vented" dryers. Some models allow a vent tube to be connected so that the vapour can be directed outside.

Recently, a number of European-made "condenser" dryers have been introduced to the Australian market. These pass the water vapour over a condenser coil or plate, and remove the water to a drain. Their advantage is that they do not vent water vapour into the room. Their disadvantage is that they are more complex and costly, and need a plumbing connection.

There are three main size categories of dryer "small" or "compact" (up to 3.5 kg), "standard size" or "medium" (4.0-5.0 kg) and large. At present, the largest unit energy labelled for household use has a capacity of 10kg.

GfK monitored the sales of only 9 units in 2000, but these were estimated to account for 87% of the market. The data indicate that the weighted average capacity of timer dryers sold in 200 was about 4.3 kg, and that this has declined only slightly from 1993, when the average was 4.4kg.[4] About one third of dryer sales are in the small size range, and nearly two thirds in the medium size range, with only moderate sales of larger models. The market share of auto dryers has been increasing, from about 10% in 1993 to over 20% in 2000 (Figure 16). Whether timer or auto controlled, the great majority of dryers sold are of the vented rather than the condenser type. The following analyses refer to vented dryers only, not condensing dryers.

3.1.2 THE ENERGY TEST AND STAR RATING

The energy test for clothes dryers is in AS/NZS 2442. The test begins with a full load at 90% moisture content. For timer dryers, the test is stopped when the moisture content falls to 6%. For auto dryers, the cycle is permitted to stop automatically. This penalises automatic machines which over-dry their load. (Machines which stop before reaching 6% would fail the stipulation in the Standard that the load must be dried in one cycle, and so would not meet the criteria for energy labelling).

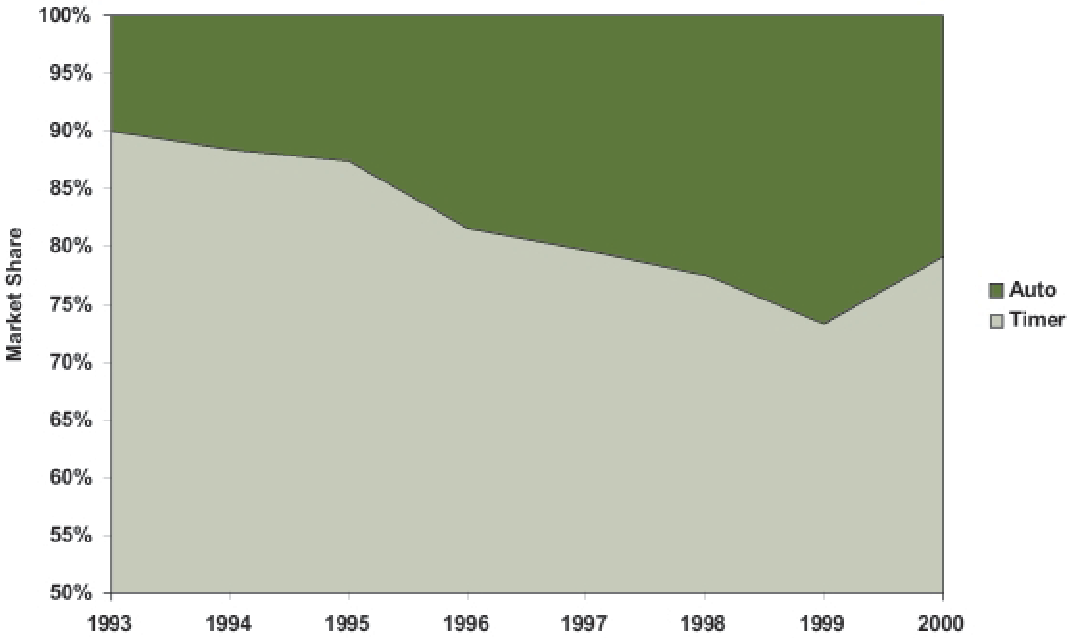
Timer dryers are considered to use more energy in the field than in the laboratory test, because users are not able to judge the drying time accurately, and therefore tend to either set too long a time, or find that the load is still damp and so set a second cycle. Either way, there is an energy penalty. This is reflected by applying a "field use factor" of 1.1: the tested energy consumption of the clothes dryer is increased by 10% for the label (which now indicates the nominal energy use for 52 cycles, compared

2 There is one model on the market which uses as a heat pump as a heat source rather than a resistance element. It has less than half the average energy consumption per kg of clothes dried, and star rating of 6.0 under the more stringent star rating system introduced in 2000.

3 The moisture content is measured relative to the mass of the load in the "bone dry" state.

4 In 2000, GfK identified only 8 vented dryer models, compared with 28 models registered at the end of 2001, and only one auto model, compared with 26 registered, at the end of 2001. Even though the identified models are the largest selling ones, the data probably give a less reliable indication of the market than the data for clothes washers or dishwashers.

FIGURE 16 MARKET SHARE OF TIMER AND AUTO DRYERS, 1993-2000



with 150 cycles formerly). The field use factor also affects the star rating, so comparing the raw water removal efficiency of clothes dryers is best done using the actual tested energy values rather than the star ratings or the labelled energy values.

3.1.3 ENERGY EFFICIENCY

EFFICIENCY TRENDS

The improvement in the energy efficiency of new clothes dryers sold between 1993 and 2000 was modest. Figure 17 indicates the trend in sales-weighted kWh per litre of water removed, and Figure 18 the trend in sales-weighted kWh per kg dryer capacity. Figure 19 indicates that the improvement in dryer efficiency has fallen short of the fairly modest expectations incorporated in projections carried out in 1993 (GWA et al 1993).

MARKET ANALYSIS

For most models on the market at present, the difference in actual energy use per kg of water removed, or per kg of load dried, is relatively small. There are 55 models on the energy labelling register, and 51 of them have a tested energy consumption in the range 0.88 to 1.11 kWh/kg.[5] Nevertheless, the differences between clothes dryer models and the apparent ineffectiveness of energy labelling does warrant consideration of other possible NAEEEP measures such as MEPS.

Figure 20 and Figure 21 indicate the kWh/kg capacity of the vented dryer models available at the end of 2001, for timer and auto models respectively. The slope of the trend lines indicates that efficiency increases with capacity, so it is important to allow for capacity effects when comparing the energy consumption of dryers. Another reason for analysing capacity groups separately is that most prospective buyers shop for a specific dryer size to match their clothes washer, or to fit in the available laundry space.

5 The high-use outlier is 1.21 kg/kWh, and the low-use outliers are 0.78, 0.70 and 0.47 kWh/kg (the last being the heat pump model).

FIGURE 17 SALES-WEIGHTED AVERAGE KWH.LITRES OF WATER REMOVED, VENTED CLOTHES DRYERS

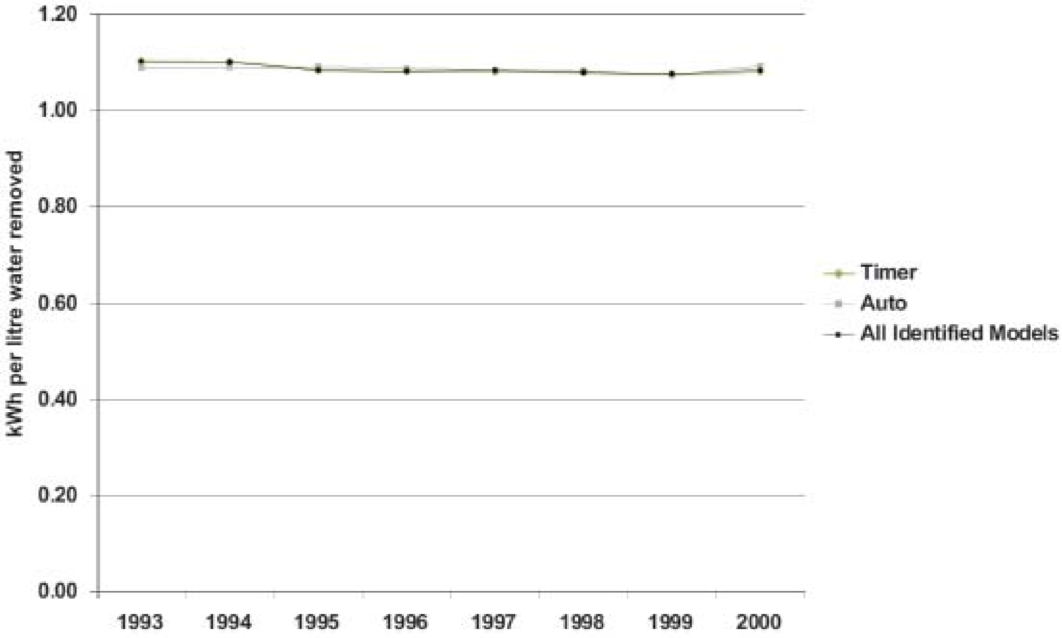


FIGURE 18 SALES-WEIGHTED AVERAGE KWH/KG CAPACITY, VENTED CLOTHES DRYERS

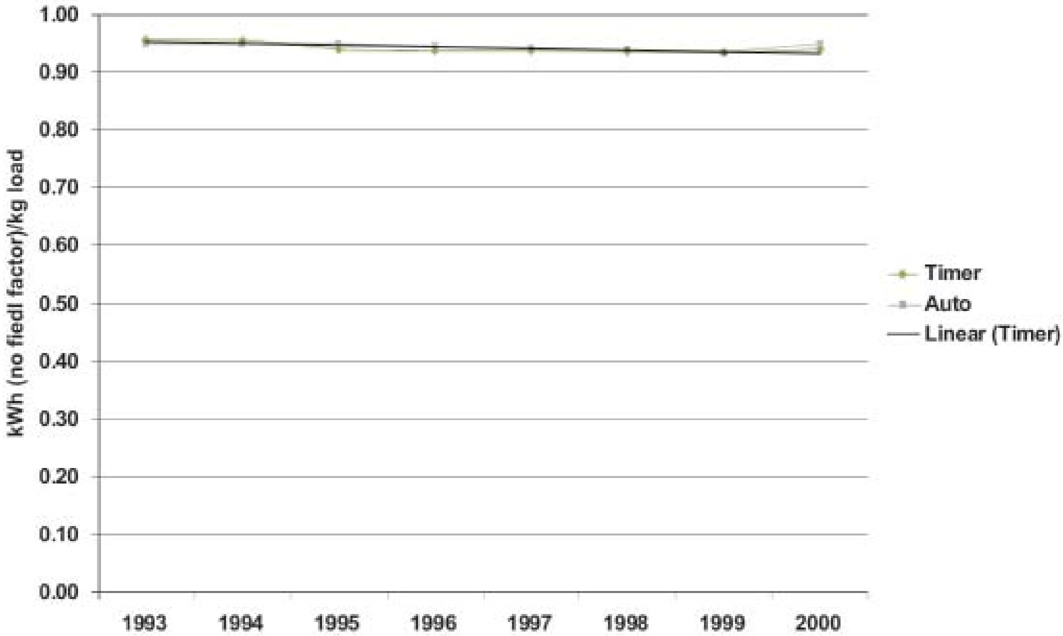


FIGURE 19 PROJECTED AND ACTUAL TRENDS IN KWH/LITRE REMOVED, CLOTHES WASHERS

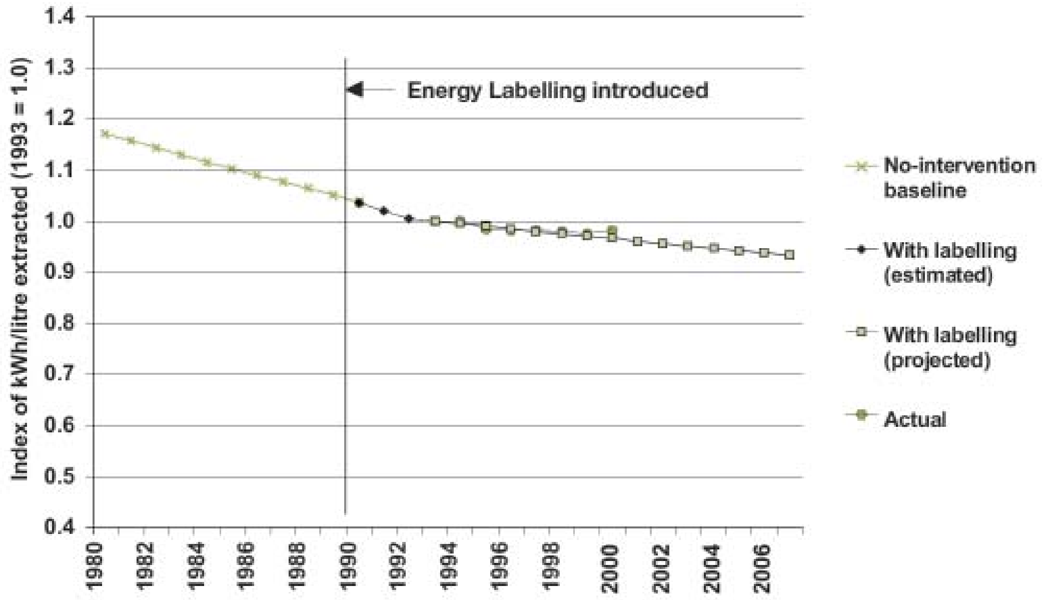


FIGURE 20 KWH/KG, TIMER VENTED DRYERS ON THE MARKET AT END OF 2001

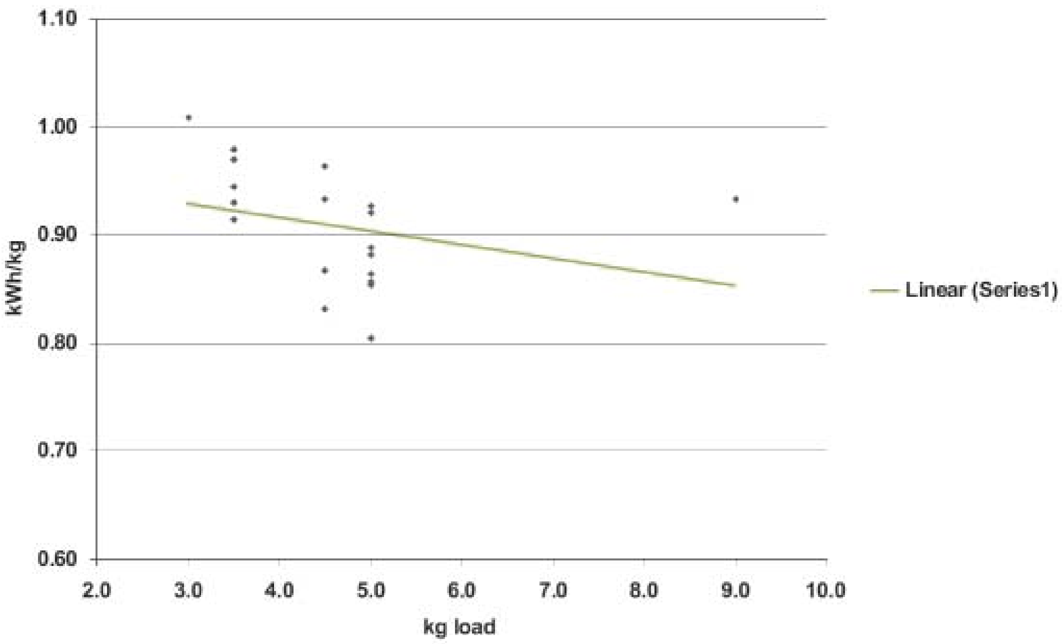
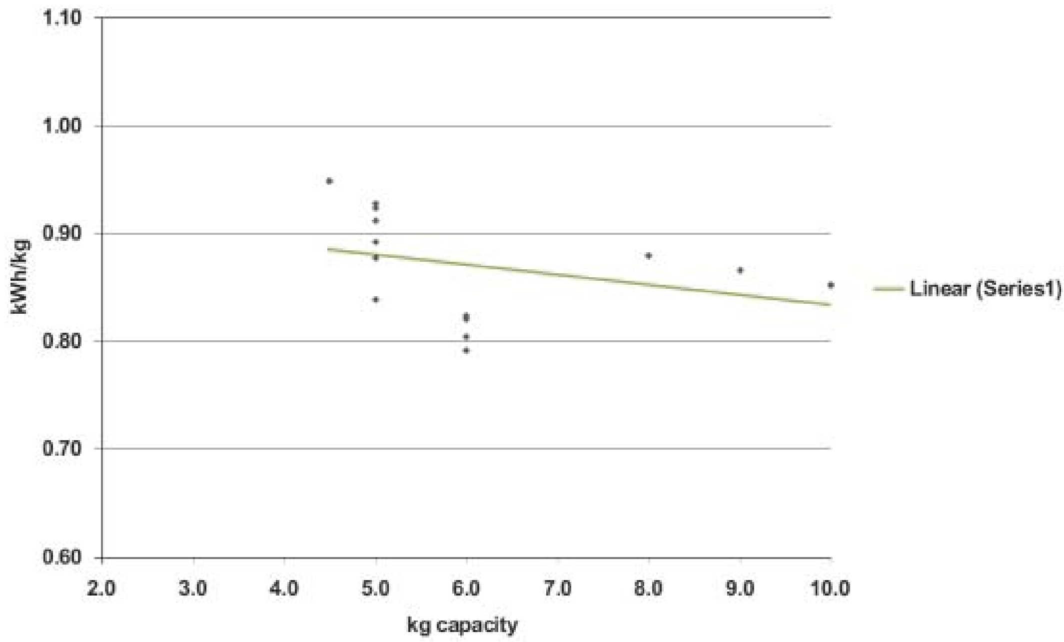


FIGURE 21 KWH/KG, AUTO VENTED DRYERS ON THE MARKET AT END OF 2001



There is little difference between the tested energy efficiency of timer and auto models of similar capacity, if the field use factor is excluded. Indeed, for medium capacity models, timer dryers appear to have a small energy advantage (see Table 5, which compares kWh/kg capacity, and Table 6, which compares kWh/litre of water removed[6]).

A medium sized dryer of medium capacity used weekly will consume about 250 kWh per year (see Table 7) without allowing for any field use advantage. Assuming that timer dryers in the field do in fact use 10% more energy per cycle as assumed, then the advantages of, say, setting a MEPS regime which excludes timer models in favour of auto models would have an average benefit of about 25 kWh per year, with a value to the householder of about $ 3.00 (at 12c/kWh). Given that the average price premium of auto dryer sold in 2000 was $ 100, it is inconceivable that this could be recovered over the dryer's operating lifetime.

However, the range from highest to lowest annual consumption for units of the same nominal capacity ranges from about 20 kWh per for small units to about 40 kWh for large units (see Table 7). This suggests that if a MEPS regime were set towards the high end of the range within each type (ie separate MEPS levels for timer and auto), it may be feasible to achieve a reduction of about 7-10% in new dryer operating energy consumption with a small enough cost penalty for the regime to be cost-effective. It would be necessary to analyse the relationships between efficiency and price for all models on the market, to estimate what the price impact might be.

The comparatively narrow spread of efficiencies for clothes dryers is both cause and effect of the relatively low impact on buyers of clothes dryer labelling. Nearly all vented dryers are labelled with between 1.0 and 2.0 stars, so buyers have little incentive to seek more efficient models. In turn, the

6 The values are slightly different because some of the models were tested with a starting moisture content of 90%, and some 100%. Initial moisture affects kWh/kg but not kWh/kg moisture removed.

TABLE 5 TESTED KWH/KG CAPACITY, VENTED DRYERS

	Small <=3.5 kg				Medium 4.0-5.0 kg				Large > 5.0 kg				All	Sales Wt(b)
	No.	Low	Avg	High	No.	Low	Avg	High	No.	Low	Avg	High	Avg	
Timer(a)	7	0.91	1.05	1.11	14	0.80	0.88	0.96	1	0.93	0.93	0.93	0.91	0.94
Auto	0	NA	NA	NA	8	0.93	1.00	1.05	7	0.88	0.93	0.98	0.97	0.95

Source: derived from www.energrating.gov.au. Excludes condensing dryers. (a) Tested energy only – excludes 10% multiplier for field use factor. (b) Derived from NAEEEP (2001f) – excludes field use factor

TABLE 6 TESTED KWH/LITRE REMOVED, VENTED DRYERS

	Small <=3.5 kg				Medium 4.0-5.0 kg				Large > 5.0 kg				All	Sales Wt(b)
	No.	Low	Avg	High	No.	Low	Avg	High	No.	Low	Avg	High	Avg	
Timer(a)	7	1.07	1.15	1.25	14	0.98	1.06	1.11	1	1.07	1.07	1.07	1.09	1.08
Auto	0	NA	NA	NA	8	0.97	1.08	1.16	7	0.92	1.01	1.10	1.01	1.09

Source: derived from www.energrating.gov.au. Excludes condensing dryers. (a) Tested energy only – excludes 10% multiplier for field use factor. (b) Derived from NAEEEP (2001f) – excludes field use factor

TABLE 7 NOMINAL KWH PER ANNUM CONSUMPTION, VENTED DRYERS

	Small <=3.5 kg				Medium 4.0-5.0 kg				Large > 5.0 kg				All Models	
	Cap. (b)	Low (c)	Avg (c)	High (c)	Cap. (b)	Low (c)	Avg (c)	High (c)	Cap. (b)	Low (c)	Avg (c)	High (c)	Cap. (b)	Avg (c)
Timer(a)	3.4	179	187	198	4.9	223	246	268	9	480	480	480	4.6	238
Auto	0	NA	NA	NA	4.9	239	257	271	7.3	333	351	370	6.0	303

Source: derived from www.energrating.gov.au. Excludes condensing dryers. (a) Includes 10% multiplier for field use factor. (b) Average capacity of registered models. (c) Average capacity x tested kWh/kg value in Table 7 x 52 cycles (x 1.1 for timer dryers). Derived from NAEEEP (2001f) low level of buyer interest in energy efficiency reduces the incentive for suppliers to increase efficiency. This is different from the dishwasher market, for example, where there is a wide efficiency range and high buyer interest in the star rating. Therefore MEPS may be the only effective driver for efficiency improvements in clothes dryers.

3.2 Meps Considerations

3.2.1 MEPS IN COMPARABLE COUNTRIES

Only two countries have MEPS for clothes dryers: Canada and the USA, which have a common MEPS regime. It is not possible to gauge the influence of those MEPS on products the capacity preferred by Australian buyers. The two US-made models on the Australian market have capacities of 9kg, so their size alone should give them a lower kWh/kg value. However, this does not appear to be the case: the units are somewhat less efficient than the linear regression line would suggest (see Figure 20 and Figure 21). Therefore there appears to be little advantage in adopting the North American MEPS levels for dryers.

3.2.2 LIKELY EFFECTIVENESS OF MEPS

The 1993 MEPS study (GWA at al 1993) recommended MEPS for clothes dryers. The recommendation was not followed up, partly because - according to the industry - the AS/NZS 2442 energy test was not sufficiently accurate to support a MEPS regime where all products would be relatively close to the cutoff line.

In 2000, NAEEEP commissioned a round of tests in which a timer model clothes dryers and an auto model clothes dryer were subject to verification testing in three separate laboratories (NAEEEP 2001g). The highest and lowest test values obtained for the timer model were about +3% of the average value, and for the auto model they were about +5%. This order of variability would be too large to support a MEPS regime where all models were close to the MEPS line.

A number of improvements to the test method have been suggested. For timer dryers, "using the revised method, clothes dryer energy consumption tests can be reproduced with a maximum variation of approximately 1.5%" (NAEEEP 2001g). For the auto dryer, there was some difficulty in achieving test termination at the same moisture content each time, but if this could be achieved, the variation in test results should be restricted to 1%. It is understood that the proposed revisions are currently being incorporated in AS/NZS 2442 (EES, pers comm).

There is no significant difference in design approach or materials content between vented timer models as a group, or between vented auto models as a group. Energy performance is as much determined by the quality of the overall design as by the quality and cost of components. (Apart from auto-dryers, where the quality of sensors has an important influence on accuracy. A model with a poor sensor could conceivably fail a given MEPS level solely as a result of gross over-drying). Given sufficient lead time, it is likely that manufacturers could alter their designs to obtain worthwhile energy savings at minimal cost.

4. DISHWASHERS

4.1 Energy Efficiency

4.1.1 TECHNOLOGY AND USE

All dishwashers currently on the market work on the same principle. The load of dishes is cleaned with a sequence of hot or cold water washes and rinses. Totally cold water dishwashing is not yet practical, although improvements in detergents have gradually allowed average wash temperatures and water quantities to decline. Users select the program depending on their judgement about how soiled the load. The heavier the soiling, the higher the average wash temperatures and the longer the wash sequence within the selected program.

Most dishwashers sold are of the "standard" size: about 600mm wide and 850mm high, and designed to fit under a kitchen bench top. These are able to wash between 9 and 14 standard place settings, depending on their internal stacking arrangements and baskets. There are also models of different configurations: either narrower (eg 450mm wide), half-height (eg the "dish drawer" which can be installed as a single unit or stacked into the equivalent of standard unit) or over-bench. There are 126 standard size models on the labelling register compared with 15 non-standard models. GfK monitors the sale of 65 models, which accounted for 87% of sales in 2000.

4.1.2 THE ENERGY TEST

The test procedure is set out in AS/NZS 2007, which is closely aligned with the international test standard. The unit is tested with a standard soiled load. The total energy consumption of the dishwasher is the sum of the electrical energy consumption of the dishwasher itself (for both pumps and internal heating elements), and the energy content of any imported hot water. Some dishwashers have a single hose connection, that can be attached either to cold (in which case the internal electric resistance element heats water when required) or hot (in which case washing is fast but there is an energy penalty since all washes and rinses are hot – but the house hot water may be heated by a cheaper and/or less greenhouse gas intensive means than electricity). Some models have a single hose that must be connected to hot or cold, as specified. Some have two hose connections.

When dishwasher MEPS were last considered, the main reasons for recommending against MEPS were ambiguities in the test method (GWA at al 1993). Some suppliers were over-stating the number of place settings in order to gain a more favourable star rating, to the extent that the only way that test laboratories were able to achieve the stated loading was to pile items on top of each other, with the result that wash and dry performance in check tests often failed to meet the minimum criteria.

A second source of ambiguity was the supplier's ability to nominate any program as the basis of the energy label, provided that the washing and drying performance on that program cycle met the minimum levels specified. Some suppliers nominated programs that were unusual or hard for users to access. Apart from misleading consumers, this made it more difficult to relate the labelled energy consumption of some dishwashers to their energy consumption in use. However, the potential differences between labelled and in-use performance for dishwashers is nowhere near that for clothes washers that are used with cold water.

These ambiguities have now been addressed. AS/NZS 2007 has been amended in a number of ways, including the addition of a requirement that "all specified load items shall be supported" – ie there must be a distinct rack or basket position for each one. This has limited extravagant capacity claims: unlike the mid 1990s, there are no more claimed 15 place models on the labelling register.

With regard to the second problem, it has been decided that from October 2002, all dishwashers are to be relabelled using the "normal" program. There have also been other technical changes to the test method to make it more reproducible and repeatable (eg use of a reference machine and longer soil drying times). In short, all the test-related barriers to the adoption of MEPS for dishwashers now appear to have been overcome.

4.1.3 ENERGY EFFICIENCY

EFFICIENCY TRENDS

Dishwashers have shown a high rate of increase in sales weighted energy efficiency and, unlike clothes washers, there has been no sign of reversal in this trend. Figure 22 indicates the trend in average water consumption per cycle.

The rate of reduction in energy and water use is slowing, as dishwashers reach the lower limits of water use with current washing and detergent technologies. The lowest water use per cycle on the label register is now 11 litres, although the

FIGURE 22 AVERAGE WATER USE PER (LABELLED) CYCLE, DISHWASHERS

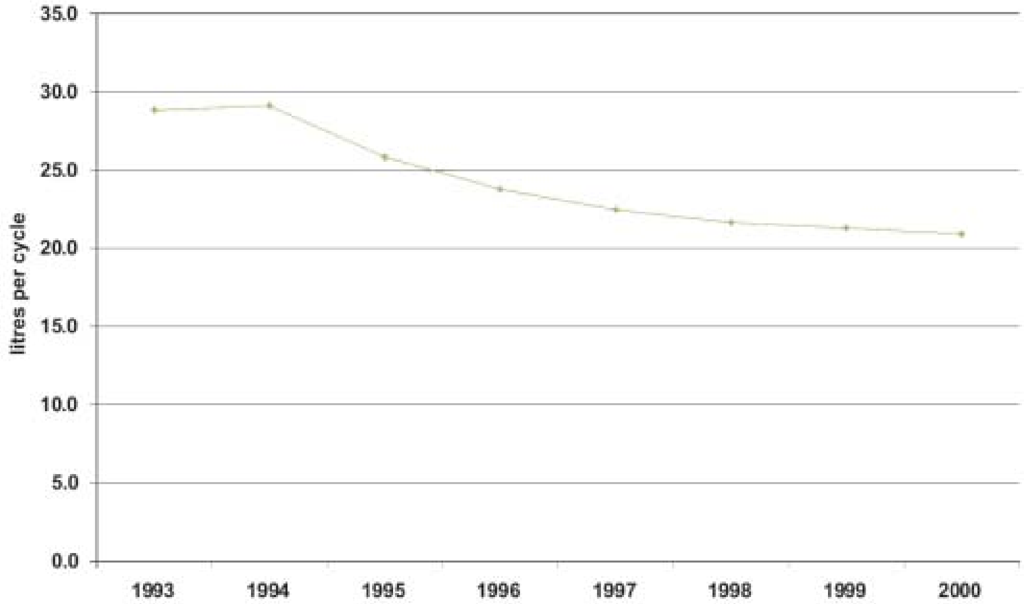


FIGURE 23 AVERAGE ENERGY USE PER (LABELLED) CYCLE, DISHWASHERS

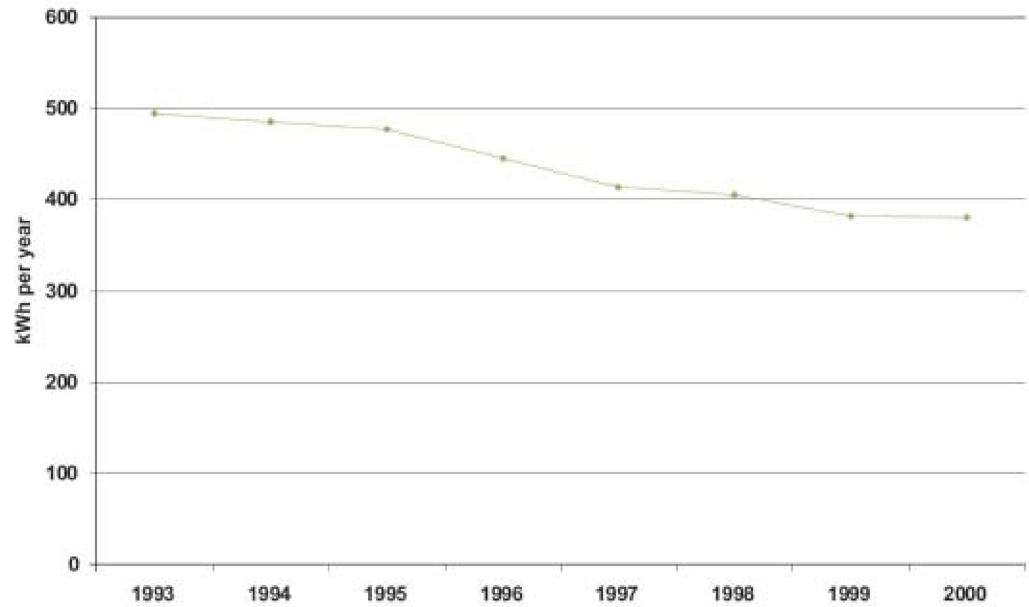
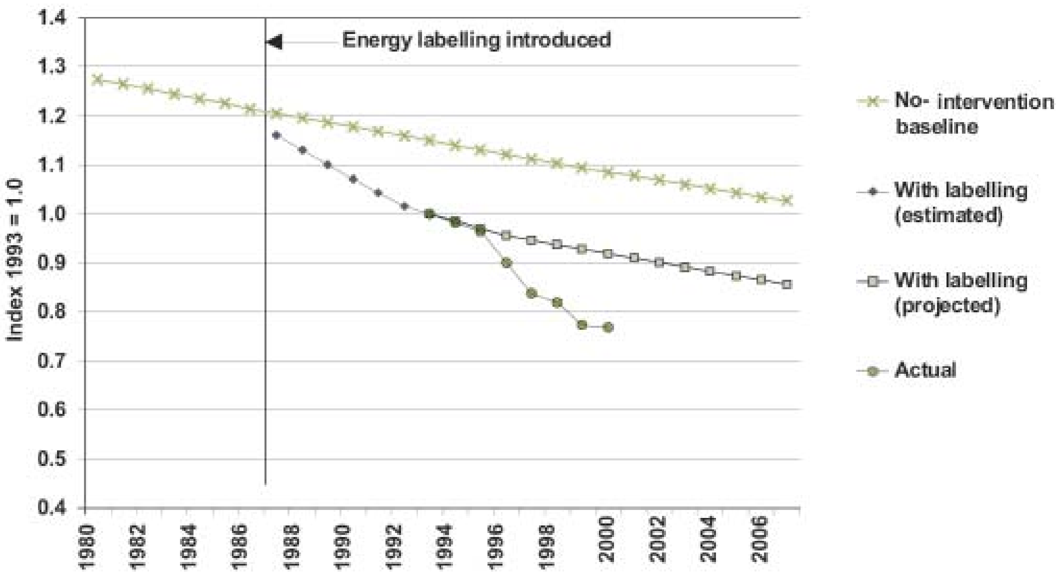


FIGURE 24 PROJECTED AND ACTUAL TRENDS IN KWH/ANNUM, DISHWASHERS



highest star-rated models use 14 to 19 litres. The rate of reduction in new model energy use has significantly exceeded the projections made in 1993 (Figure 24: these trends may be revised slightly once all models report water and energy use on the "normal" program).

MARKET ANALYSIS

Even with the general reduction in energy use, very large differences remain between models. The lowest star rated standard size dishwasher has a labelled energy consumption per place setting that is three times as great as the highest rated, giving an energy efficiency ratio of 3 to 1. This is about the same ratio as for the top- and front-loader clothes washers. The comparable ratios for vented clothes dryers is only 1.2 to 1.

The range in the main characteristics of the dishwasher models on the market in 2001 is shown in Table 9. The wide range of energy efficiencies contributes to the effectiveness of energy labelling in the dishwasher market, since label-aware buyers are faced with clear energy differences between products.

TABLE 8 MAIN CHARACTERISTICS, DISHWASHER MODELS ON MARKET AT END OF 2001

Type	No.	Capacity (place settings)			Water use (litres/cycle)			Energy use (kWh/year)		
		Low	Avg	High	Low	Avg	High	Low	Avg	High
Standard	126	9	12.9	14	11	19.2	30	228	399	588
Other	15	4	7.5	9	8	14.8	19	162	299	431

Source: energyrating.gov.au

4.2 MEPS Considerations

4.2.1 MEPS IN COMPARABLE COUNTRIES

The countries with MEPS for dishwashers are listed in Table 9. North American dishwasher MEPS have no impact on the Australian market, since no models are imported from North America. In any case, it is difficult to establish the relationship of the Canadian or US MEPS levels to Australian efficiency levels, since the test is carried out with a clean load, and can give anomalous results. On the other hand, it is straightforward to gauge the equivalence with European products. Of the 126 standard size dishwasher models on the market at the end of 2001, 22 models were made in Australia and New Zealand, and all the rest in EU member countries or, in Turkey, which has close ties to the EU market.[7]

TABLE 9 COUNTRIES WITH MEPS FOR DISHWASHERS

Country	MEPS and year introduced
Bulgaria	M 2000
Canada	M 1995
European Union	V 2000
Israel	M 1990
Russia	M 1987
USA	M 1994

Source: EES & EC (2001) M = Mandatory, V = Voluntary

The average Star Rating Index (new scale) for all standard size dishwasher models on the register at the end of 2001 was 2.30. The average for ANZ-made models was 2.49, and for European models it was 2.26.

4.2.2 LIKELY EFFECTIVENESS OF MEPS

Of all of the four labelled product categories covered in this review, energy labelling appears to be working most effectively for dishwashers (see Table 17). During the period of dishwasher labelling efficiency has improved significantly, at a greater rate than expected (Figure 24). Even though the rate of improvement has slowed, labelling may well continue to drive the market to further increases in efficiency.

However, there are some risks to this trend. Dishwasher ownership continues to increase (Figure 1), and the market may be in transition from a luxury market, which originally attracted relatively high-price and high-efficiency European imports, to more of a commodity appliance market, which attracts lower-price imports. The increase in the number of less efficient European models on the register suggests that this may be occurring. Of the 69 models with SRI below the average value of 2.30, 59 are European imports and 10 are ANZ-made.

In 2000 the EC negotiated a sales-weighted agreement on dishwasher energy efficiency with European manufacturers. This introduces similar dynamics as for front-loading clothes washers. Because of the nature of the voluntary MEPS regime applying in Europe, the source of all of the imported dishwasher sold in Australia, there may be some risk that less efficient models may be diverted to non-MEPS markets such as Australia.

This risk alone does not constitute sufficient grounds for recommending MEPS for dishwashers at present. However, the matter should be reviewed from time to time.

7 The number of distinct models is somewhat lower. Several listed models are in fact the same basic model (eg some built-in and free-standing variants, or enamel finish and stainless steel finish variants with different numbers are separately registered).

5. AIRCONDITIONERS

5.1 Energy Efficiency

5.1.1 TECHNOLOGY AND USE

Airconditioners come in a large number of configurations and capacities. There is no universal classification or nomenclature, so they tend to be described in different ways in different countries. However, some common descriptions are:

- Window/wall units: where all operating parts are enclosed in a self-contained cabinet, that needs to have access to both the outside air and the conditioned space;
- Split units: where the compressor and condenser (which rejects heat during the cooling cycle) is installed in a separate cabinet from the evaporator (which absorbs heat from the conditioned space during the cooling cycle), and the two are connected by refrigerant lines; and
- Reverse cycle: where the airconditioner is capable of pumping heat from the outside air into the conditioned space, as well as from the conditioned apace to the outside, via a reversal of the refrigerant flow. (Some older models can heat via electric resistance elements, but these are not reverse cycle). Units which are not reverse cycle are termed "cooling only" or heating only (rare in Australia).

There are many variations. For example, all operating elements could be in a central unit, from which the conditioned air is ducted to a number of rooms. Alternatively, the central air handling system may itself be a split unit, with the compressor at a remote location. Another option for conditioning several spaces is a "multi-split", where heating/cooling units in each room are connected by refrigerant lines (not air ducts) to a single outside compressor.

Airconditioners designed for household use invariably reject heat to the outside air during cooling and (if capable of reverse cycle operation) absorb heat from the outside air during heating. There are also units capable of accepting heat from or rejecting heat to water or the earth, but these are rarely used in household applications in Australia, and will not be considered further here. Also, evaporative coolers (which rely on sensible cooling by evaporation of water) are sometimes also grouped with airconditioners (which operate on the vapour compression cycle). NAEEEP has considered and rejected MEPS for evaporative coolers (NAEEEP 2001c).

It is estimated that about 35% Australian households currently have an airconditioner, and this penetration is projected to increase to around 37% by 2010 (EES at al 1999). The energy consumed by household airconditioners is projected to increase more rapidly than the ownership, because:

- the stock of air conditioners is somewhat higher than the penetration would suggest, because those households with air conditioners own an average of 1.25 units, and the trend to multiple ownership appears to be increasing; and
- newer air conditioners are tending to be of higher output capacity serving more rooms, and also are more likely to be reverse cycle, and so capable of winter as well as summer operation.

The energy efficiency of an airconditioner is indicated by its Energy Efficiency Ratio (EER) in cooling mode and Coefficient of Performance (COP) in heating mode under standard heating conditions. The higher the COP or EER value, the more energy-efficient the unit. (In Australia, both COP and EER are expressed in Watts per Watt, but the USA and parts of Asia use different units like BTUs per Watt or KJ per Watt so great care is required when making international comparisons).

The growth in summer airconditioner energy use has become a particular problem for the electricity supply systems in the States with high airconditioner ownership: notably Victoria and SA, and NSW and WA to a lesser extent. These States also tend to be the most affected by peak electricity demand constraints, which tend to occur on the days of highest cooling load. Although non-household cooling accounts for the majority of airconditioner energy demand on those days, the growth in household use is in some ways a greater problem for the utilities. Many large airconditioner users are at least partly exposed to time variations in electricity price, whereas householders are not.

5.1.2 ENERGY LABELLING AND MEPS IN AUSTRALIA

Mandatory energy labelling of window-wall and split airconditioners with cooling capacities up to 7.5 kW was introduced in 1987. The star rating on the label are based on the cooling EER and, for reverse cycle units, there is separate star rating scale for the heating COP. The label also indicated the energy consumed for 500 hours operation at full load: eg a unit with a cooling output of 4.5kW and an EER of 2.1 would consume 4.5/2.1 = 2.14 kW when operating at full load, or 1071 kWh over 500 hours.

The following changes have been made to the energy label in recent years:

- The criterion for mandatory labelling was changed to all units taking single-phase electricity supply: this change clarified the scope of units to which MEPS would apply (see below);
- The star rating scale was revised to show fewer stars for the same COP; and
- Because of the great variation in patterns of use. the 500 hr energy value was replaced with a "kWh per hour at full load" value: eg the label for the example model used above would now indicate "2.14 kWh per hour" rather than "1071 kWh for 500 hrs".

In October 2001, MEPS came into effect for all air conditioners up to 65kW cooling capacity that take three-phase electricity supply. MEPS covers those units with a single outdoor unit (one or more compressors) and one or more indoor units, and with a single indoor control. This includes packaged units, packaged ducted units, double and triple split systems and single split systems. It does not cover multi-split systems or portable systems without an exhaust duct. Suppliers also have the option of labelling three phase air conditioners, in which case the same labelling requirements apply as for single-phase units.

5.1.3 THE ENERGY TEST

The relevant test standard is AS/NZS 3823 Performance of electrical appliances- air conditioners and heat pumps. The various parts of the standards described the indoor and outdoor conditions to be maintained during physical testing, the energy labelling requirements and the MEPS levels for three-phase units. For some configurations, there is also the option to demonstrate compliance with MEPS using computer simulation rather than full physical testing.

AS/NZS is largely based on international ISO standards (ISO 5151 and ISO 13253), as are nearly all other test standards for air conditioners around the world. This allows comparison of airconditioner COPs and EERs across countries, although subtle differences between test procedures means that some units still need to be retested for energy labelling or MEPS purposes in some countries.

5.1.4 EFFICIENCY TRENDS

DATA SOURCES

The Australian Refrigeration and Airconditioner Manufactures Association (AREMA) retains a monitoring company (Informark) to monitor the brand shares of sales in the various airconditioner categories, but this data is for the use of AREMA members and is not published. (GfK has only collected sales data for airconditioners since 1999, and coverage of the market for vapour compression airconditioners is still low.)

Overall sales for the four major household airconditioner categories in the 1999-2000 financial year have been estimated for the present review. Airconditioner sales vary considerably from year to year depending on factors such as how hot the summer is and the condition of the economy. 1999-2000 was an unusually high sales year due to the strength of the housing market in the lead-up to the introduction of the Goods and Services Tax.

The most useful historical sources of information on the efficiency of airconditioners are the published lists of labelled airconditioners. Four of these lists, spanning 12 years, have been analysed:

- November 1989 listing of 147 models, published by the State Electricity Commission of Victoria;
- EnergyGuide for new Appliances 1993, listing 214 models, published by the Commonwealth of Australia and Australian Consumers' Association;
- May 1997 listing of 380 models, published by the NSW Sustainable Energy Development Authority; and
- The latest electronic listing of 863 household type models (as well as several larger models for which the suppliers had taken up the option of labelling), published on the internet site www.energyrating.gov.au

These allow the calculation of "model-weighted" values for cooling capacity, cooling EER, heating capacity and heating COP, but not "sales-weighted" values, since the sales of each model are not known.

Table 10 indicates that national sales of household size airconditioners were about 370,000 in the 1999-2000 financial. About 40% of these were window/wall units and 60% were split units, and 62% of all units sold were reverse cycle. Table 11 indicates that the share of model types on the register closely resembled the sales of units on the market. This suggests that the model list is a reasonable proxy for the pattern of new airconditioners purchased, and trends in sales-weighted efficiency are likely be follow changes in model-weighted efficiency.

TRENDS

The number of models on register increased markedly between 1989 and 2001 (Figure 25), even allowing for the fact that some models are identical, and rebadged under more than one brand name. The composition of the market has also changed. Window/wall units constituted about 70% of models on offer in 1989, but only about 40% in 2001 (Figure 26). Cooling only models constitute a declining share of the market: from 46% of models in 1989 to 42% in 2001.

The trends in model average cooling EERs and heating COPs is illustrated in Figure 27. These increased for all most product categories, with the greatest rate of increase being for split units. This is consistent with the fact that this was the fastest-

TABLE 10 ESTIMATED SALES OF AIRCONDITIONERS UP TO 7.5 KW COOLING CAPACITY, 1999-2000

	Cooling Only	Reverse Cycle	Total	Cooling only/total	Reverse cycle/total	CO as % of this type
Window/wall	94,000	57,000	151,000	25 %	15 %	62 %
Splits	48,000	171,000	219,000	13 %	47 %	22 %
	142,000	228,000	370,000	38 %	62 %	38 %

Source: derived from data supplied by AREMA

TABLE 11 AIRCONDITIONER MODELS ON REGISTER AT END OF 2001

	Cooling Only	Reverse Cycle	Total	Cooling only/total	Reverse cycle/total	CO as % of this type
Window/wall	175	156	331	20 %	18 %	53 %
Splits	185	347	532	22 %	40 %	34 %
	360	503	863	42 %	58 %	42 %

Source: www.energyrating.gov.au

growing sector of the market, and hence would have attracted more product innovation and development. There were also slight increases in the average cooling and heating capacity of all product types (Figure 28) , which would have contributed to some extent to the increase in average COPs: in general the larger the capacity, the higher the COP, all else being equal.

The market shift towards split units assisted the rate of improvement in overall model-average cooling EER. The equivalent rate of improvement was about 1.2% per annum.

FIGURE 25 NUMBER OF MODELS ON LABELLING REGISTER, 1989 TO 2001

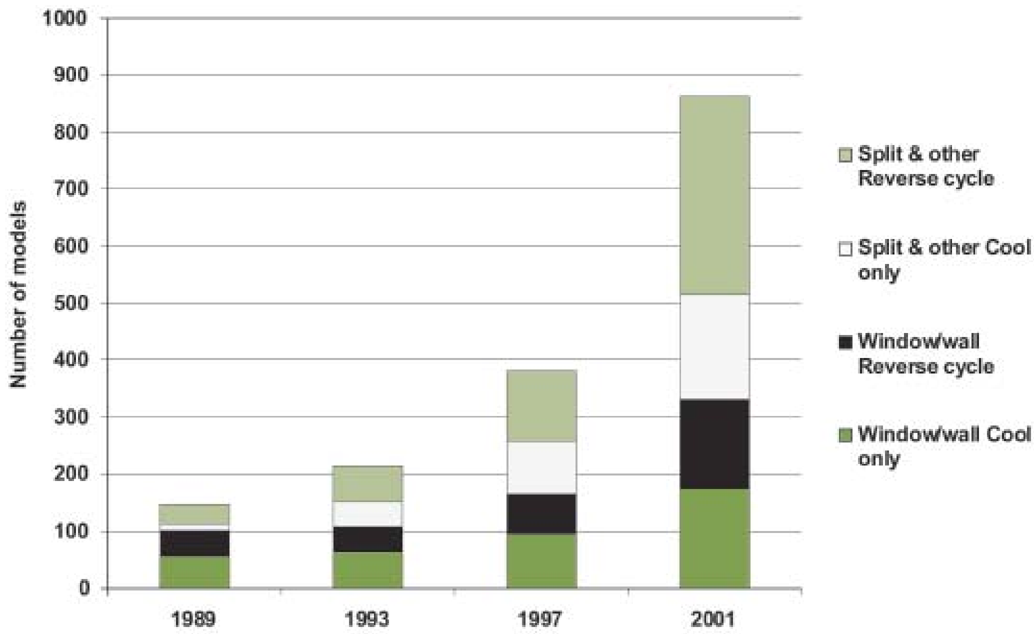


FIGURE 26 SHARE OF REGISTERED MODEL BY TYPE, 1989 TO 2001

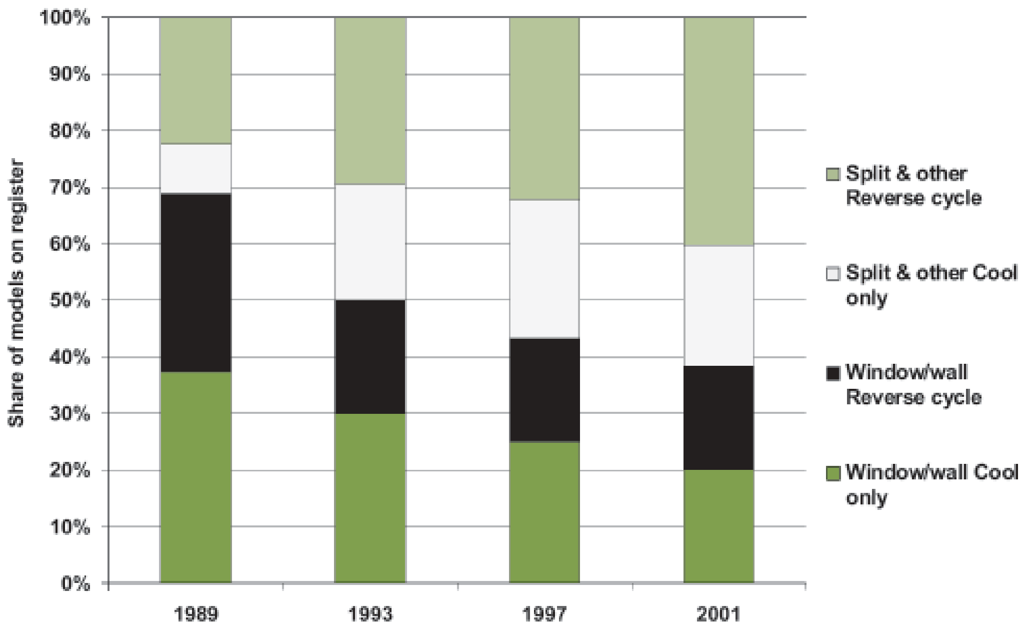


FIGURE 27 MODEL AVERAGE COOLING EERS, 1989 TO 2001

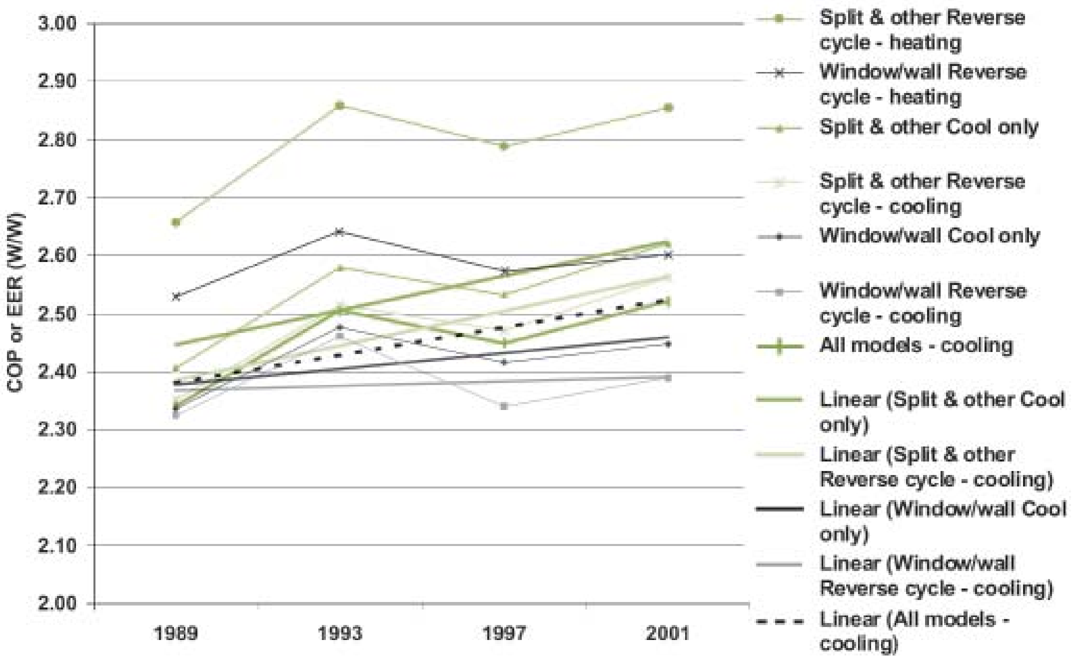
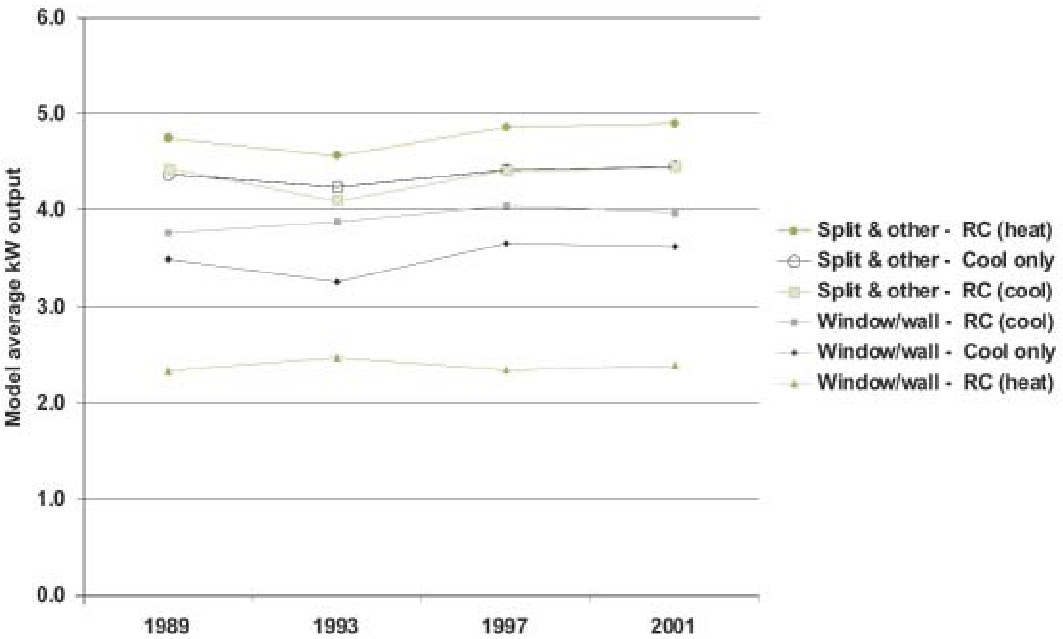


FIGURE 28 MODEL AVERAGE COOLING AND HEATING CAPACITIES, 1989 TO 2001



5.2 MEPS Considerations

5.2.1 MEPS IN COMPARABLE COUNTRIES

COVERAGE

After household refrigerators, airconditioners are the products most widely covered by MEPS around the world. Table 12 lists the countries where MEPS are in force and the airconditioner types covered. Only Canada and the US have MEPS for all classes of airconditioner; Most countries have MEPS only for "room", or household type units – indeed, Australia is the only country with MEPS where this category is not covered. The years indicate the commencement of the MEPS regime. In many countries MEPS levels have been raised at least once since the year of introduction.[8]

TRADE EFFECTS

All single-phase airconditioners now sold in Australia are imported. The last remaining local manufacturer of these products, Email (now Electrolux) ceased local production in 1999 and now sells rebadged imports. Some Australian-made Email models remain on the energy labelling register so that any remaining stocks can be lawfully sold.

Table 13 indicates the countries of manufacture for the models on the register at the end of 2001. Nearly a quarter of all models were made in China,

TABLE 12 COUNTRIES WITH MEPS FOR AIRCONDITIONERS

Country	Central	Room (Window-wall and split)	Large HP & condensing units	Packaged terminal & HP	Single-packaged central & HP	Split-system central & HP
Australia	M 2001		M 2001	M 2001	M 2001	M 2001
Canada	M 1998	M 1995	M 1998	M 1998	M 1998	M 1998
China		M 1998				
Costa Rica		M 1996				
India		V 1999				
Israel		M 1985				
Japan		T 1979				
Korea		M 1993				
Mexico	M 1998	M 1995				M 1998
Philippines		M 1993				M 2002
Russia		M 1986				
Saudi Arabia		M 2001				
Singapore		M 1998				
Taiwan		M 1991				
USA	M 1992	M 1990	M 1992	M 1992	M 1992	M 1992

Source: EES & EC (2001) M=Mandatory, V=Voluntary, with year first introduced. In many countries cases MEPS levels have been raised at least once since year of introduction.

8 The Japanese "Top Runner" program is unusual in that it is no longer backed by legislation, but continues by agreement between government and industry. There are 32 product categories, and the highest efficiency achieved in each category in 1998 becomes the sales-weighted target for all units sold in that category in 2004 (2007 for the less common categories). Japanese manufacturers have driven improvements in split unit energy efficiency, through technologies such as electronic controls and variable speed drives. Efficiency levels were already high in 1998, so the target of further improvement is an ambitious one.

TABLE 13 COUNTRIES OF ORIGIN FOR MODELS ON ENERGY LABEL REGISTER, 2001

Country of origin	Window/wall		Split & other		All models	
	Cool only	Rev cycle	Cool only	Rev cycle	Number	%
Australia (a)	52	46		1	99	11.5%
China	34	34	23	116	207	24.0%
France				8	8	0.9%
Indonesia				2	2	0.2%
Israel			3	8	11	1.3%
Italy		1	7	5	13	1.5%
Japan	8	3	26	43	80	9.3%
Korea	41	37	43	51	172	19.9%
Malaysia	12	10	19	24	65	7.5%
Saudi Arabia	5	6		4	15	1.7%
Singapore	4	5	12	12	33	3.8%
Taiwan	11	6	9	9	35	4.1%
Thailand	8	8	43	62	121	14.0%
Not indicated				2	2	0.2%
Total	175	156	185	347	863	100.0%
Countries with MEPS	59%	58%	63%	70%	64%	64%
(Aust excluded)	84%	83%	63%	70%	72%	72%

(a) Models no longer manufactured in Australia but still on label register

Korea and Thailand supplied 58% of the models: 65% if the Australian models are excluded. Some of these were made in factories and to designs owned by the Japanese, Korean and other global brands, but many were country-specific brands and designs. Rebadging is very common in the airconditioner market, and the same model may be manufactured in several countries.

Combining the data in Table 12 and Table 13 indicates that 64% of models on the Australian market originate in countries with MEPS for these airconditioner classes – 72% if the Australian-made models are excluded.

5.2.2 LIKELY EFFECTIVENESS OF MEPS

The fact that Australia does not have MEPS for these product classes, while being completely dependent on imports, introduces a risk that models which do not meet MEPS levels in their countries of origin could be diverted to Australia and other no-MEPS countries. This is even more of a risk with airconditioners than with, say, front loader washing machines, on which the local market is also fully import-dependent.

TABLE 14 INDICATIVE AIRCONDITIONER MEPS LEVELS IN COUNTRIES OF ORIGIN FOR AUSTRALIAN IMPORTS

	MEPS EER limits for Window-wall (a)	MEPS EER limits for Split (a)
China	2.2 to 2.32	2.3 to 2.44
Israel	2.4 to 2.6	2.4 to 2.6
Korea	2.56 to 2.91	2.56 to 3.14
Singapore	2.34	3.14
Taiwan	2.41 to 2.58	2.53 to 2.82
Range extremes	2.2 to 2.91	2.3 to 3.14

Source: APEC (1999), EES & EC (2001) All values are minimum W/W cooling EERs, at comparable operating conditions. (a) Each MEPS regime covers different size categories and configurations.

This is because whitegoods manufacture requires relatively high levels of capital investment, and there is pressure to increase production volumes by eliminating low-volume models. Therefore, although models which no longer meet local MEPS could be kept in production longer if non-MEPS export markets exist, it could be expected that over time new models will be designed to meet local MEPS, and eventually these models will also be exported. Therefore local MEPS levels should ultimately filter through to export markets as well (although this is less certain where the local MEPS regime is sales-weighted rather than absolute MEPS, as is the case in the EU).

The airconditioner market has different dynamics. Airconditioners are very widely manufactured and traded. It is not technically difficult or capital-intensive to set up a factory, or to continue to make distinct models for different markets. Given the large number of regional suppliers and models, the Asia-Pacific airconditioner market is very competitive, and models at the low cost end will most likely be built to the minimum standard allowable in the target. As airconditioner MEPS levels continue to increase in the Asia-Pacific region, as they have been, there will be an increasing risk that products which fail to meet MEPS levels in their countries of origin, or in other target markets, will continue to be exported to Australia.

Table 14 indicates the range of absolute airconditioner MEPS levels applying in the countries from which Australia imports, where comparable tests are used as the basis for MEPS.[9]

Figure 29 to Figure 32 indicate the MEPS ranges in Table 14 in relation to the extremes of the models on the Australian register in 1989, 1993, 1987 and 2001. These suggest that the least efficient models on the Australian market in 2001 are less efficient than would be allowed under the least demanding of the MEPS regimes of the main airconditioner trading partners. Conversely, the most efficient models are only slightly better than the minimum that would be required by the most stringent of these regimes.[10]

It is also notable that the lowest COPs in each category have fallen since 1989, despite the influence of energy labelling. This suggests that there continues to be a market for airconditioners of low efficiency, and that MEPS could be valuable in addressing this market, provided that the value of cost savings exceed any increases in the price of products.

9 The Japanese levels are not shown, because both the tests and the MEPS regimes are different There are sales-weighted targets, so some units sold will have higher EERS than the target value and some lower. Also, som of the EERs are seasonal, or weighted by heating as well as cooling performance. Even so, Japanese airconditioner efficiency levels are acknowledged as the highest in the world.

10 There is one Japanese brand split unit on the Australian market with a stated COP of 5.2, compared with 3.63 for the next most efficient model. This has been plotted as an outlier in Figure 32. If the claimed value is correct, the model would be among the most efficient commercially available in the world).

FIGURE 29 HIGHEST, LOWEST AND AVERAGE COP VALUES, WINDOW-WALL MODELS (COOLING ONLY), 1989 TO 2001

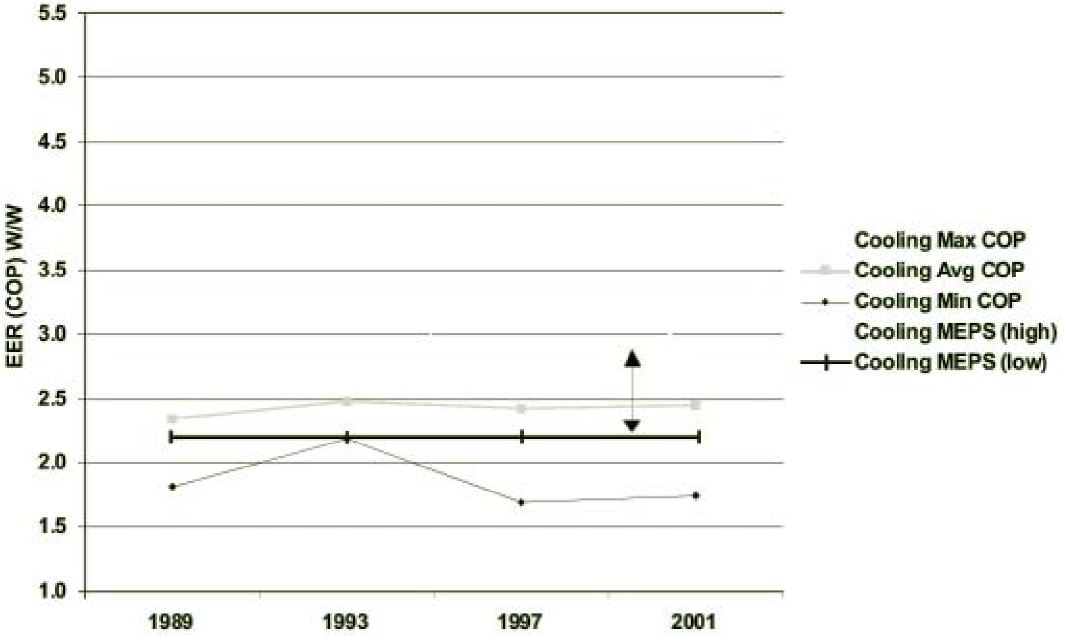


FIGURE 30 HIGHEST, LOWEST AND AVERAGE COP VALUES, WINDOW-WALL MODELS (REVERSE CYCLE) 1989 TO 2001

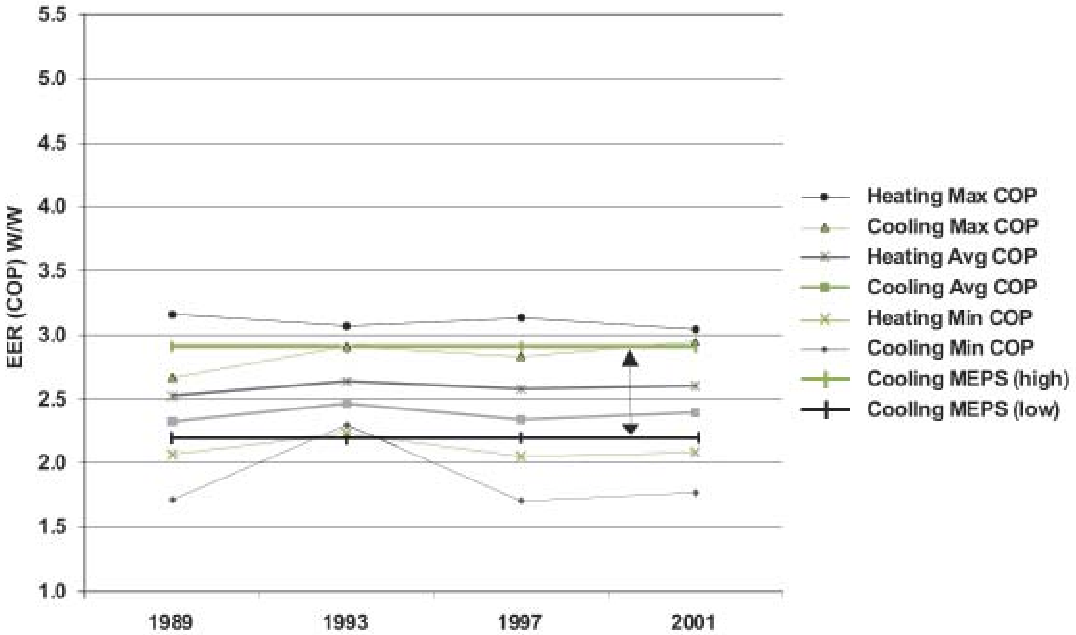


FIGURE 31 HIGHEST, LOWEST AND AVERAGE COP VALUES, SPLIT MODELS (COOLING ONLY), 1989 TO 2001

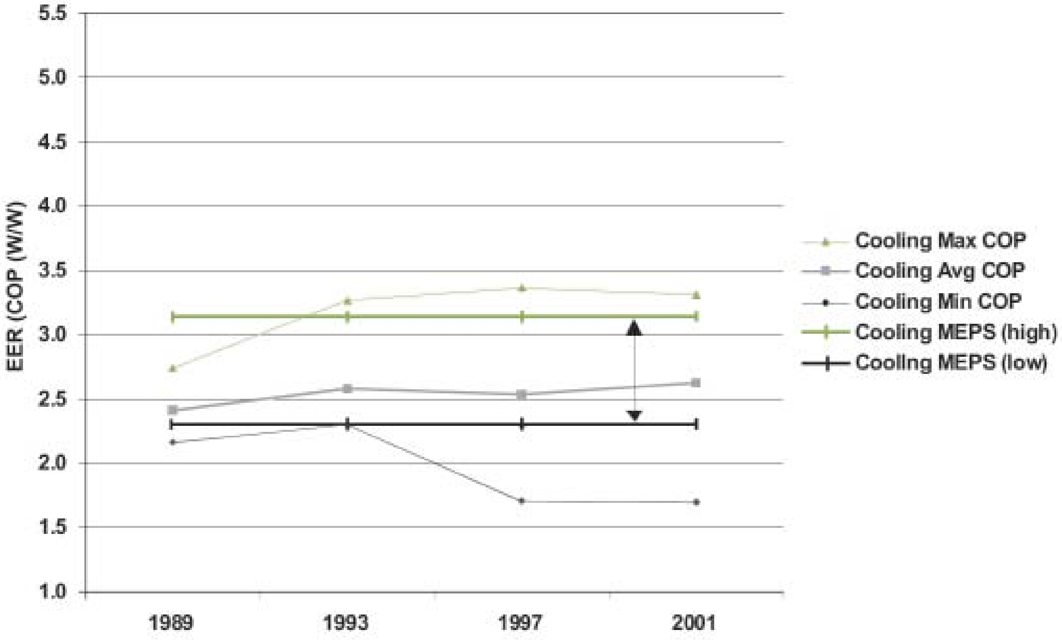
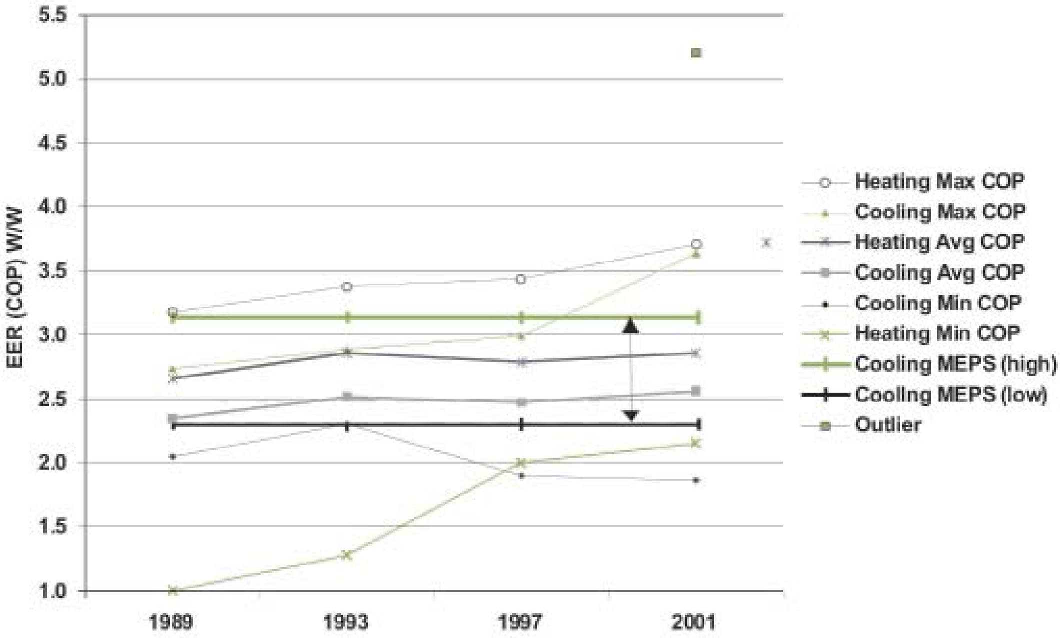


FIGURE 32 HIGHEST, LOWEST AND AVERAGE COP VALUES, SPLIT MODELS (REVERSE CYCLE) 1989 TO 2001



The optimum level MEPS thresholds for single-phase airconditioners would need to be determined by cost-benefit analysis. Table 15 indicates the number and proportion of models on register at end of 2001 passing the following indicative MEPS levels:

- EER of 2.25: this is the Australian MEPS level for three-phase airconditioners of 7.6 to 10.0 kW cooling capacity, which took effect in October 2001. 89% of current models would meet this MEPS level;
- EER of 2.5: this is likely to be the least stringent value that will apply in those countries with MEPS for these products by 2004. 55% of current models would meet this MEPS level; and
- EER of 2.65: this is the Australian MEPS level for three-phase airconditioners of 45.1 to 2.65 kW cooling capacity, which took effect in October 2001. 70% of current models would meet this MEPS level.

The ratio of split models passing any given MEPS level is notably higher than the ratio of window-wall units, so it is likely that a higher MEPS levels would be cost-effective for split systems than for window-wall units. Also, model average EERs have been are increasing by 0.025 W/W per year, so given an implementation lead time of 2 years (which would be adequate, since all models are imported and there are clearly many higher-EERS models on the market) the EER values should be about 0.5 higher than determined to be cost-effective for the current product range.

If the decision were taken by mid 2002 to introduce MEPS levels in mid-2004, the optimum MEPS levels would probably be about 2.5 EER for window-wall units and 2.7 EER for split units. It should not be necessary to specify minimum COPs for heating performance. The only MEPS regimes which specify this are in those countries where there is a market for heating-only models (eg Canada) or where airconditioners impact significantly on electricity system peak demand in winter as well in summer (eg Japan). Neither of these conditions applies in Australia. In any case, the design features that contribute to higher cooling energy efficiency generally also lead to higher heating energy efficiency.

TABLE 15 NUMBER OF AIRCONDITIONER MODELS EXCEEDING SELECTED EERS, 2001

Cooling EER	Window/wall		Window/wall cooling only		Split & other reverse cycle		Split & other cooling only		All models reverse cycle	
	Number	%	Number	%	Number	%	Number	%	Number	%
EER below 2.25	18	10%	35	22%	17	9%	27	8%	97	11%
EER below 2.5	100	57%	110	71%	49	26%	130	37%	389	45%
EER below 2.65	144	82%	134	86%	106	57%	223	64%	607	70%
EER 2.65 or above	31	18%	22	14%	79	43%	124	36%	256	30%
All models	175		156		185		347		863	

6. ELECTRIC SPACE HEATERS

6.1 Technology and Use

Electric space heating encompasses all forms of heating with electricity other than reverse cycle air conditioning, which was covered in the preceding Chapter.

The many types of electric space heater can be divided into two main groups: portable and fixed. Under the electrical wiring and safety regulations, portable plug-in heaters are limited to single phase supply and a maximum current of 10 amps (hence a maximum power consumption of 10A x 240V = 2,400 VA = 2.4 kW assuming a power factor of 1). The main types are:

- bar radiators, which heat by radiation and operate best when the user is in line of sight of the heater;
- forced convection, or "fan heaters", where air is drawn over an electrically heated element and expelled into the heated space by a fan; and
- oil-filled convection, or "column" heaters, where the elements are surrounded by an oil jacket, the metal casing of which is intended to be cool enough not to be a safety or a fire hazard. The heat is usually transferred from the surface of the heater to the room by natural convection, although some models have a fan as well.

Fixed electric heaters are hard-wired to the three-phase supply, and can have power consumption of 10kW or more. They include large electric radiators and under-floor heating installations, where the resistance elements are embedded in the concrete. The fixed electric heater market has declined considerably since the spread of natural gas and the proliferation of reverse cycle airconditioners. A plug-in single phase airconditioner with a COP of 3 can achieve a heating output equivalent to a 7.2 kW fixed electric heater, at one third the running cost and without the need for three-phase wiring.

There is a great variation between electric heater models with regard to range of settings (from "on only" to continuously variable outputs), timers for preset on/off, presence of fans, and thermostats, which reduce heat output once the conditioned space has reached a selected temperature. However, all electric space heaters share one fundamental characteristic: they all use electric resistance heating elements which are close to 100% efficient in converting electricity to heat. Unlike airconditioners, there is no significant difference in the efficiency with which electricity is used to produce heat.

Of course, different models may be more or less suited to different heating applications. Where instant heat is required for one stationary user (eg a child doing homework in an otherwise unheated room for an hour or two) – the most efficient mode of electric heating may be a simple bar radiator. A fan heater may be unacceptably noisy or dehydrating if the airstream is directed at the person. If a column heater were used, even with a timer preset and thermostat, it may need to be on for several hours to get the room up to temperature and so use much more energy.

6.2 MEPS Considerations

There appears to be no case for MEPS for electric space heaters. In the first place, there is no inherent technical difference in the energy efficiency of electric resistance elements. There may well be differences in the amount of energy which different type of electric heater consume in meeting a defined heating task, but the range of typical electrical heating tasks is so wide as to defy standardisation.

Even for a single heating task, it would be necessary to define:

- The heated space, or "test room", with regard to length, breadth, ceiling height floor and wall materials, size, position and covering of glazing;
- Whether the heating task is convective (ie the air temperature will be monitored) or radiative (ie the temperatures at the surface of the "user" will be monitored), or a mix between the two;
- The position of the heater within the room and the position of the temperature monitoring devices, and whether temperatures are averaged whether measuring points lower in the room are given more weight than those near the ceiling, which would penalise heaters with no fan and those with poor air distribution; and
- The duration of the test and the temperature settings.

There has been some effort to standardise these conditions for gas space heaters, for the purpose of determining their efficiency for energy labelling. However, gas space heaters tend to be used in a limited range of heating applications – usually heating a large space from a single fixed position over long operating periods, during which temperatures can stabilise. By contrast, electric space heaters tend to be used in various positions for shorter periods. Furthermore there are significant differences between gas heaters with regard to their efficiency of conversion of the energy in gas to heat, as well in how they transfer that heat to the heated space. so testing and energy labelling gives potential buyers useful information.

To sum up, there is no case for MEPS for electric space heaters. Not surprisingly, no country in the world has applied MEPS or energy labelling to electric space heaters.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

This section summarises the conclusions for each product with regard to the factors and criteria which NAEEEC specified should be taken into account in this review:

CONTRIBUTION TO ENERGY AND GREENHOUSE GAS EMISSIONS

The five appliance groups under review accounted for 11.2% of household greenhouse gas emissions (6.2 Mt CO_2-e) in 2000, and this is projected to increase to 11.8% (7.2 Mt CO_2-e in 2015. Therefore the group constitutes a worthwhile target for more stringent energy efficiency measures.

Within the group, airconditioners are projected growth to account for nearly all of the additional greenhouse gas emissions. Emissions from the other groups are projected to remain at about the same levels as in 2000.

On this criterion, airconditioners emerge as the highest priority for MEPS, especially given their increasing contribution to peak loads on electricity supply systems.

ADEQUACY OF EXISTING MEASURES

Four of the products under review are subject to energy labelling. While a full review of the effectiveness of electrical appliance labelling has not been carried since 1991(GWA at al 1991), it is possible to judge the effectiveness on the basis of three indicators:

- The trends in sales-weighted energy efficiency between 1993 and 2000, compared to BAU projections, gives some indication of the past indicate the effectiveness of labelling;
- The comparison of sales-weighted and model-weighted efficiency in 2000 gives and indication of the present effectiveness of labelling; and
- The star rating spread for models on the market in 2001 (after the change to the new rating system) is one leading indicator of the future effectiveness of labelling.

Labelling appears to be working best for dishwashers. The rate of improvement in sales-weighted efficiency has been higher than projected, although it has slowed recently (Figure 24). Sales-weighted efficiency is lower than model-weighted, implying consumer preference for the higher-rating products (Table 17) and there continues to be a range of 3.0 in star ratings, to maintain consumer interest (Table 16).

Labelling appears to be have been effective for clothes washers, but the impact has declined. The rate of improvement in sales-weighted efficiency has been significant, but not as high as projected, and has begun to reverse (Figure 15). Sales-weighted efficiency is lower than model-weighted for top loaders, and about the same as model-weighted for front loaders, implying consumer indifference or even preference for lower-rating products (Table 17). However, there continues to be a range of 2.5 to 3.0 in star ratings, to maintain consumer interest (Table 16).

Labelling appears to have been fairly effective for airconditioners. There is no information on sales-weighted efficiency trends, but model-weighted efficiency has improved steadily (Figure 27), and there is reason to believe that this has carried through to sales-weighted efficiency. There continues to be a range of 3.0 to 5.0 in star ratings, to maintain consumer interest (Table 16).

Labelling appears to have made little impact on the clothes dryer market. The rate of improvement in sales-weighted energy efficiency has not fallen below, and has recently started to climb above, BAU projections (Figure 19). Sales-weighted efficiency on the largest selling segment of the market is the same as model-weighted, implying consumer indifference to ratings (Table 17). This indifference would be reinforced by the narrow spread of star ratings: from 0.5 to 1.0 (Table 16).

TABLE 16 RANGE IN ENERGY EFFICIENCY OF MODELS ON THE MARKET AT END OF 2001: ALL PRODUCTS

Product	Sub-class	Identified models	Registered models	Lowest star rating	Highest star rating	Range
Clothes washers(a)	Top loader	57	102	1.0	3.5	2.5
	Front loader	15	103	1.5	4.5	3.0
Clothes dryers (vented)(b)	Timer (small)	8	7 (b)	1.0	1.5	0.5
	Timer (medium)		11(b)(c)	1.0	2.0	1.0
	Auto (medium)	1	8 (b)	1.5	2.5	1.0
	Auto (large)		7 (b)	2.0	3.0	1.0
Dishwashers	Standard	65	126	1.0	4.0	3.0
	Smaller	0	15	1.0	3.0	2.0
Airconditioners	Window-wall CO	NA	175	1.0	4.0	3.0
	Window-Wall RC	NA	156	1.0 (d)	4.0 (d)	3.0
	Split units CO	NA	185	1.0	5.0	4.0
	Split units RC	NA	347	1.0 (d)	6.0 (d)	5.0

(a) Twin tub models not included. (b) Condenser dryers not included. (c) 1 large vented time model also on register (d) Cooling star rating only.

TABLE 17 AVERAGE MODEL-WEIGHTED AND SALES WEIGHTED ENERGY EFFICIENCY OF MODELS ON THE MARKET AT END OF 2001: ALL PRODUCTS

Appliance type and sub-type	Units	Model-weighted average(a)	Sales-weighted average(b)	Ratio of sales- to model-weight
Clothes washers – top loading	kWh/kg/yr	100.3	107.4	1.07
Clothes washers – front loading	kWh/kg/yr	41.2	40.4	0.98
Clothes dryers – vented timer	kWh/kg/yr	48.8	48.8	1.00
Dishwashers – standard size	kWh/place/yr	31.4	28.8	0.92

(a) Average for all models of that type listed on www.energyrating.gov.au at end of 2001. (b) From NAEEEP (2001g).

There is no labelling or other existing program measure for electric space heaters, but nether labelling nor MEPS would be practical (see Chapter 6).

On the criterion of adequacy of existing measures, clothes dryers emerge as the highest criterion for MEPS, followed by clothes washers and airconditioners.

RELATIONSHIP WITH MEPS IN OVERSEAS COUNTRIES

For top loader clothes washers, ANZ-made products are already more efficient than top loaders imported from countries with MEPS. Therefore adoption in Australia of the typical MEPS levels in the countries of origin is likely to have no effect on efficiency levels for top-loading washers.

For front loader clothes washers, the large number of models from Europe, and the nature of the sales-weighted efficiency agreements negotiated between the EC and the appliance industry, raises the possibility that some suppliers may continue to produce less efficient models for longer than otherwise if they can still export units to non-MEPS markets (such as Australia) and still meet their sales-weighted targets in the EU.

Only two countries have MEPS for clothes dryers: Canada and the USA, which have a common MEPS regime. The few US-made models on the Australian market appear to be somewhat less efficient than the model range average. Therefore there appears to be no advantage in adopting the North American MEPS levels.

Nearly all the dishwashers imported to Australia are manufactured in Europe; so only the European MEPS regime is relevant. In 2000 the EC negotiated a sales-weighted agreement on dishwasher energy efficiency with European manufacturers. This introduces similar dynamics as for front-loading clothes washers. Because of the nature of the voluntary MEPS regime applying in Europe, the source of all of the imported dishwasher sold in Australia, there may be some risk that less efficient models may be diverted to non-MEPS markets such as Australia.

All household size airconditioners sold in Australia are imported, two third of them from countries with MEPS regimes for those products. Most countries have MEPS only for "room", or household type units – indeed, Australia is the only country with an airconditioner MEPS regime where this category is not covered. The MEPS levels are progressively being tightened. The fact that Australia does not have MEPS for these product classes, while being completely dependent on imports, introduces a risk that models which do not meet MEPS levels in their countries of origin could be diverted to Australia and other no-MEPS countries.

No country has a MEPS regime for electric resistance space heaters.

To sum up, the impact of MEPS regimes is as follows:

- For clothes washers, clothes dryers, dishwashers and airconditioners, absolute MEPS regimes (ie minimum efficiency levels applying to all models) exist in at least one other trade-related country;
- For clothes washers, clothes dryers and dishwashers there would be little advantage in adopting MEPS levels in use elsewhere, either because the energy tests and products are so different or because efficiency levels in Australia are already higher;
- Many countries have absolute MEPS levels for airconditioners. Nearly all are set at different levels (apart from North America, where they are tending to be harmonised). There is no single "indicator" MEPS level which it would be advantageous to adopt: the most appropriate level for Australia would need to be established; and
- There are risks of negative impacts from MEPS regimes for the following imported products: for front-loader clothes washers and dishwashers, the risks come from the target MEPS regimes adopted in the EU; for airconditioners, the risks come from the increasing stringency MEPS regimes in some Asian countries and in North America. The adoption of absolute MEPS levels for these products (at levels to be determined) would eliminate the risk of non-complying models being diverted to Australia.

There are risks of negative impacts from MEPS regimes for the following imported products: for front-loader clothes washers and dishwashers, the risks come from the target MEPS regimes adopted in the EU; for airconditioners, the risks come from the increasing stringency MEPS regimes in some Asian countries and in North America. The adoption of absolute MEPS levels for these products (at levels to be determined) would eliminate the risk of non-complying models being diverted to Australia.

SPECIAL FACTORS ASSISTING OR HAMPERING MEPS

Any case for MEPS for top-loader clothes washers is undermined by the increasing tendency of householders to wash in cold water, which means that in-use energy consumption is becoming increasingly decoupled from tested consumption, and the real energy differences between models is declining.

MEPS for electric space heaters is neither necessary (all models convert electricity to heat with an efficiency close to 100%) not practical, given the difficulty of devising a representative set of heating conditions.

COMPARISONS WITH 1993 CONCLUSIONS

The case for MEPS for four of the product classes was also reviewed in 1993 (GWA et al 1993).

For top loading clothes washers, the conclusions of the present review are similar to those in 1993: there is no case for MEPS. Front loader clothes washers, for which there is now a case for MEPS, were not considered as a separate category in 1993.

MEPS was recommended for clothes dryers in 1993, on the basis that labelling was ineffective. However, the recommendation was not taken up, partly because of the variability of the energy test. The present review has found that labelling still appears ineffective for dryers. Recent changes to the energy test have reduced the variability. Therefore MEPS should be reconsidered for clothes dryers.

For dishwashers, the problems with the test identified in 1993 have now been overcome, but the higher than expected average energy improvement mean that there is now no immediate case for MEPS. However, the market should be monitored for possible negative consequences of the EU MEPS regime.

For airconditioners, it was recommended in 1993 that the issue of MEPS should be re-examined after a review of the energy test and energy efficiency rating algorithms. These have now occurred, and there is a strong case for considering MEPS.

STANDBY AND OFF-MODE ENERGY

As well as reductions in operating energy, MEPS would also contain the projected growth in standby power consumption, which is projected to be significant for all cleaning appliances, especially clothes dryers (see Figure 6 and Figure 7).

It is understood that the AGO is currently supporting IEC moves to develop a global standard for measurement of appliance off-mode and standby-mode consumption, and this could be completed by the end of 2003. Once this was adopted as an Australian and New Zealand Standard, it would be possible to determine an energy consumption for each appliance covered by MEPS that would be the sum of its AS/NZS operating energy and the standby energy tested in accordance with the proposed new standard. This compound energy value would then have to meet the set MEPS levels.

7.2 Recommendations

It is recommended that:

1. MEPS should be considered for all clothes washers with an internal heating element;
2. The determination of the optimum MEPS level for internally-heating clothes washers should take into account the objective of eliminating the possible leakage of low-efficiency products from European markets;
3. MEPS should be considered for vented clothes dryers (both timer and auto-sensing);
4. MEPS should not be considered for dishwashers for the time being;
5. The dishwasher market should be closely monitored for the effects of re-labelling to "normal" cycle consumption, and for any evidence of leakage of low-efficiency products from European markets;
6. MEPS should be considered for all airconditioner classes now subject to mandatory energy labelling (ie single phase products) as well as multi-split models, once the test procedure is finalised;
7. For airconditioners, the determination of the optimum MEPS level should take into account the increasing stringency in other countries' MEPS levels, and the objective of eliminating the possible leakage of low-efficiency products from other markets;
8. MEPS should not be considered for electric resistance space heaters;
9. Where MEPS is adopted it should cover all energy use: standby and off-mode energy consumption as well as operating-mode energy; and
10. Even where operating-mode MEPS is not adopted, consideration should be given to MEPS for standby and off-mode energy.

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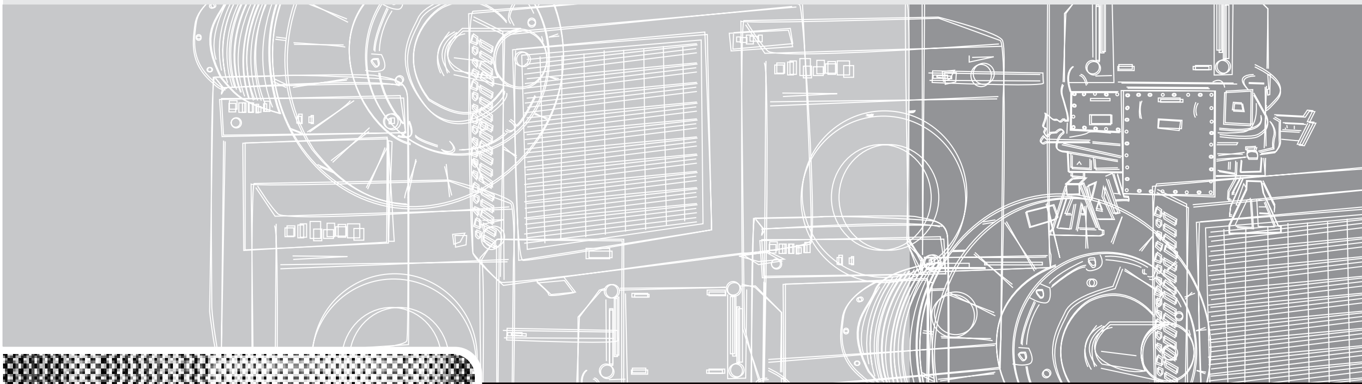

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