DRAFT FOR PUBLIC COMMENT

REGULATORY IMPACT STATEMENT:

Minimum Energy Performance Standards and Alternative Strategies for AIRCONDITIONERS AND HEAT PUMPS

Prepared for the Australian Greenhouse Office

by

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Executive Summary

Air conditioners fall into three broad categories single unit systems, packaged air conditioners (PACs) and larger commercial and industrial cooling towers. Single unit systems are purchased and used in small commercial buildings and dwellings. Packaged airconditioners (PACs) the main focus of this regulatory statement provide heating, cooling and airconditioning residential (HVAC) in small to medium commercial and institutional buildings, and in larger residential dwellings. Larger air cooling towers are used in medium to larger commercial and industrial buildings.

The demand for cooling and heating services in these sectors is increasing rapidly, and as PACs run on electricity, the most greenhouse-intensive energy form, this leads to high growth in greenhouse gas emissions.

The lifetime electricity cost represents a large component – in most cases the major part – of the cost of owning and operating air conditioning systems. It would be expected that purchasers would give at least equal weight to energy consumption as to capital cost in the purchase of such systems. This, however, does not appear to be the case for purchasers of packaged air conditioners. The air conditioner market appears to be subject to information failure – where users do not have access to accurate and consistent information about product energy efficiency or the full costs of owning and operating products. In the case of single use systems, the purchaser is usually the user, and the information problem can be resolved by a system of mandatory product labelling. However, where the purchaser of a product is unlikely to use it (as in the owner of a small to medium sized industrial or commercial premise), mandatory labelling is unlikely to influence their purchasing decisions. Purchase price is likely to be the ultimate arbiter of overall energy consumption, and hence greenhouse gas emissions.

In this case, mandatory minimum energy efficiency performance standards (MEPS) may be needed to overcome the market failure regarding whole-of-life costs and to meet the objectives of both increasing energy efficiency and reducing greenhouse gas emissions.

The prospect of MEPS for airconditioners was first raised within government in 1994, and first formally discussed between government and the industry in March 1995. Since that time, dialogue between stakeholders and government has focussed on the actual levels of MEPS

The National Greenhouse Strategy states that "improvements in the energy efficiency of domestic appliances and commercial and industrial equipment will be promoted by extending and enhancing the effectiveness of existing energy labelling and minimum energy performance standards [MEPS] programs." (NGS 1998).

The Proposal

The proposal is to introduce minimum energy performance standards for airconditioners and heat pumps falling within the scope of the joint Australian and New Zealand Standard AS/NZS 3823.

The Standard requires that airconditioners taking a three-phase electricity supply and with a cooling capacity up to 65kW meet or exceed specified energy efficiency ratios (EERs), when tested in accordance with the Standard. The draft Standard containing the MEPS levels was published in March 2000. It is expected that the final Standard, incorporating the same MEPS levels, will be published in October or November 2000.

The proposal would be given effect if all States and Territories agreed to amend the schedule of products in the existing regulations that govern energy labelling and MEPS in their jurisdictions.

Regulatory Impact Statement

The Council of Australian Governments (COAG) requires that proposals of this type be subject to a Regulatory Impact Statement (RIS).[1] The present RIS estimates the benefits, costs and other impacts of the proposal, assesses the likelihood of the proposal meeting its objective, and considers a range of alternatives to the proposal.

The primary objective of the proposed regulation is to bring about reductions in Australia's greenhouse gas emissions from the use of airconditioners and heat pumps below what they are otherwise projected to be (ie the "business as usual" case).

The following alternative options are considered in the RIS:

1. Status quo (termed business as usual, or BAU)

2. The proposed regulation (mandatory MEPS) which adopts the energy and non-energy requirements contained in the Australia Standards

3. An alternative regulation which only adopts those parts of the Australian Standards that are essential to satisfy regulatory energy objectives (targeted regulatory MEPS)

4. Voluntary MEPS where industry is not compelled to adhere to the proposed levels

5. Another regulatory option involving a levy imposed upon inefficient equipment to fund programs to redress the greenhouse impact of household equipment

[1] The COAG Guidelines state that:
"The purpose of preparing a regulation impact statement (RIS) is to draw conclusions on whether regulation is necessary, and if so, on what the most efficient regulatory approach might be. Completion of a RIS should ensure that new or amended regulatory proposals are subject to proper analysis and scrutiny as to their necessity, efficiency and net impact on community welfare. Governments should then be able to make well-based decisions. The process emphasises the importance of identifying the effects on groups who will be affected by changes in the regulatory environment, and consideration of alternatives to the proposed regulation.
Impact assessment is a two step process: first, identifying the need for regulation; and second, quantifying the potential benefits and costs of different methods of regulation. In demonstrating the need for the regulation, the RIS should show that an economic or social problem exists, define an objective for regulatory intervention, and show that alternative mechanisms for achieving the stated objective are not practicable or more efficient" (COAG 1997).

6. A levy on electricity reflecting the impact it has on greenhouse gas emissions abatement.

In addition to assessing whether the alternatives would meet the primary objective of the proposed regulation, they were also reviewed according to the following secondary objectives:

1. Does the option address market failure, so that the average lifetime costs of airconditioners are reduced, when both capital and energy costs are taken into account?

2. Does the option address information failure, so that buyers have ready access to product descriptions that are consistent and accurate with regard to cooling capacity and energy efficiency?

3. Does the option minimise negative impacts on product quality and function?

4. Does the option minimise negative impacts on manufacturers and suppliers?

Benefits and Costs

The RIS estimates the costs and benefits of implementing the proposed MEPS levels using a detailed computer model of the market, and using data on product energy efficiency, sales and prices provided by the industry.

Table S1 compares the projected costs and benefits, integrated over a 16 year period. The projected monetary benefits are about 6 times as great as the projected costs (at a 10% discount rate). These ratios are high for a program of this type, and favourable for all jurisdictions.

Table S1 Net present value of projected costs and benefits

Undiscounted		5% discount rate		10% discount rate	
Costs $ M	Saving $ M[b]	Costs $ M	Saving $ M[b]	Costs $ M	Saving $ M[b]
157	1994	107	922	78	480
Benefit/cost ratio 13		Benefit/cost ratio 9		Benefit/cost ratio 6	

No monetary value given to emissions.

Table S2 provides a summary of the magnitude and timing of the estimated costs to industry, and hence to consumers. The costs in the first 4 years are estimated at about $35.2 M, of which the costs to government are estimated at about $ 0.3 M. Energy savings are projected to build up rapidly, so reducing the projected expenditure on energy by airconditioner owners. The greenhouse reductions associated with the electricity savings are projected to reach about 0.53 Mt CO_2-e per annum in 2010, the midpoint of the Kyoto Protocol commitment period, and then peak at over 0.93 Mt per annum (Figure S1).

Table S2 Indicative costs, costs allocation and timing

	Fixed costs – industry [a]	Variable costs – industry and government[b]	Total costs	MEPS impact
1999/2000	$ 7.7 M	NA	$ 7.8 M	No impact
2000/2001	$ 7.8 M	$ 6.3 M	$ 14.1 M	1/3 impact
2001/2002	NA	$ 6.5 M	$ 6.5 M	2/3 impact
2002/03	NA	$ 6.8 M	$ 6.8 M	Full impact

(a) Estimate of $100,000 per affected model, spread over 2 years (b) $ 100 per unit, all airconditioner sales, for additional materials and higher quality components.

Table S3 provides a summary of the projected energy and Mt CO_2-e emission savings from the current MEPS targets. With an implementation date of the 1st of July, 2001 and a 15 year scope the expected reductions are 7.8% to a Business as Usual (BAU) trend with a reduction of 14.6 Mt CO_2-e. The potential financial benefits of reducing greenhouse gas emissions at these levels has not been incorporated in this regulatory impacts assessment or the cost /benefit assessments to date.

Table S3 Projected energy and emission savings

Period modelled	Implement-ation date	GWh energy saved during projection period	% of BAU energy saved	Mt CO_2-e saved during period	Emission saving 2010 Mt CO_2-e
2000 – 2015	1 July 2001	15,095	7.8%	14.6	0.53

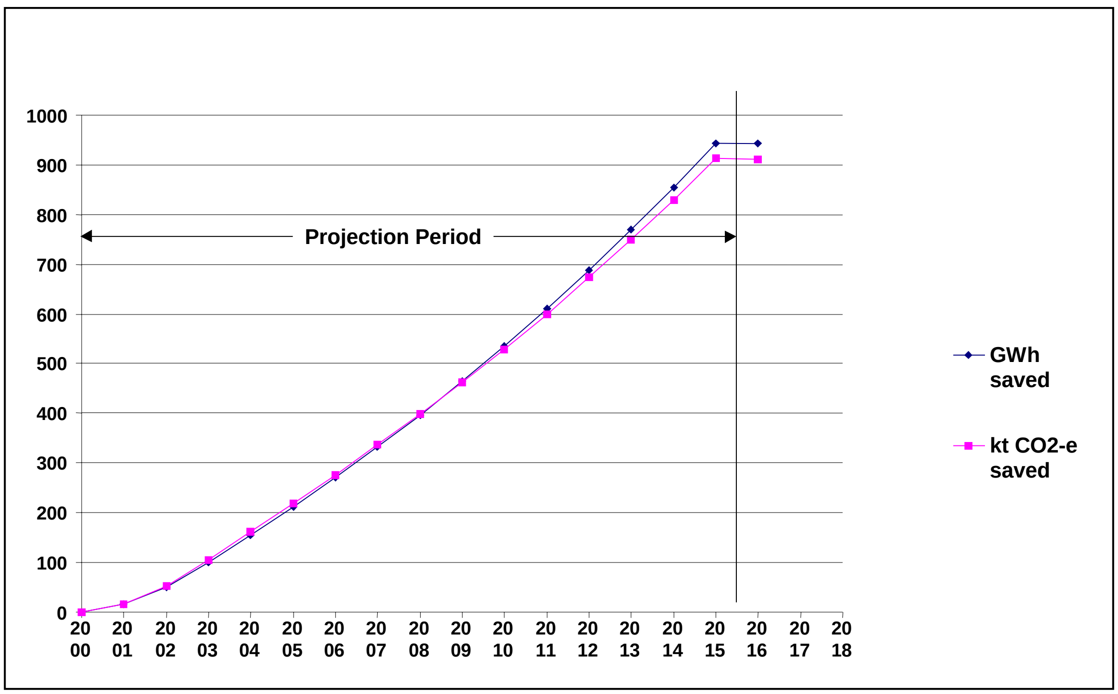

Figure S1 Projected program energy and emissions savings

The projections were based on a 1 July 2001 implementation date. Some stakeholders suggest modifying the commencement date from 1 March 2001 to later in 2001 to facilitate industry import patterns and acceptance. If implementation were deferred to 1 December 2001, the accumulation of benefits would also be deferred by at least a half a year and possibly more, since the July-December period represents more than half of the annual sales. Total energy and greenhouse savings over the period 2000-2015 would be reduced by about 9%, and the emissions savings in 2010 would be about 35 kt (7%) lower.

Supplier and Trade Issues

It is estimated that about 20% of PACs sold in Australia are locally assembled (with the compressor and sometimes other major components imported). The rest are fully imported.

Firms have a range of response options in the event that their products fail to meet the MEPS level. If the product is imported the firm can request the supplier to improve it, to substitute a more energy efficient model from the existing range, or - if the importer is not tied to a particular brand – the firm could change suppliers. Airconditioners are freely traded, particularly the smaller sizes up to about 18 kW. Industry sources suggest it is not difficult to obtain product of different price and energy efficiency levels, given reasonable notice.

If the product is locally made manufacturers will usually have a range of options to improve its energy efficiency at moderate cost: eg larger heat exchange surfaces, higher performance pipework and heat exchange materials, more efficient compressors (which manufacturers purchase from international suppliers who offer a wide range of efficiencies), and improved controls. In fact, carrying out a physical test or a computer simulation to determine a product's capacity and EER will often reveal any obvious shortcomings of the design.
Those suppliers with higher numbers of non-complying models will clearly need to spend more on product testing and improvement that those with few or no non-complying models. Therefore the cost impact will fall most on the least efficient products. However, as these tend to compete against each other rather than with higher cost, more efficient models, the impact on competition is likely to be minor.

The available market data suggest that:

- the compliance costs for *brands* that are wholly or predominantly locally manufactured may be somewhat higher than the costs for brands that are wholly or predominantly imported;

- the number of models and suppliers may be affected to some extent after the introduction of a MEPS;

- airconditioners are not subject to direct competition from other fuel and technology options with respect to cooling, but there could be some effects on fuel/technology competition with respect to heating;

- the above effects are likely to be very small and have little effect on price and supplier competition, or the competition between imports and local manufactures

It is possible that one or more smaller firms might find the cost of compliance so onerous that they are forced to withdraw from the market. Given the size and flexibility of the industry, this is unlikely to cause any significant reduction in competition.

The introduction of MEPS could help overcome information failure. The output capacity and energy efficiency of all products, determined under a consistent test condition, will be readily available to the public (assuming that governments were to make the product register information public, as is the case with household appliances).

The RIS concludes that the proposed regulations are fully consistent with the GATT *Technical Barriers to Trade* Agreement.

Although 10 APEC countries have mandatory MEPS for airconditioners, direct comparison of MEPS levels is only possible with Korea, Taiwan, Canada and the USA, and for some model categories only. For products up to 40 kW, the proposed Australian levels are in all cases less stringent than the corresponding values in other MEPS regimes. For products over 40 kW, the Australian levels (proposed to take effect in 2001) are more stringent than the current US levels (which were implemented in 1995) but fall within the range of the Canadian levels (implemented in 1999).

Assessment

Objective: Reduce greenhouse emissions below business as usual

The proposed regulation is the only option for which the extent of likely reduction can be quantified with any degree of confidence and the one where the reduction has the highest probability of occurring.

Address market failures

The proposed regulation would address the market's lack of concern with operating costs by forcing investment in more efficient products so that the total life cycle cost of air conditioning energy services to users would be lower than otherwise, irrespective of whether users change purchase behaviour.

An efficiency-related levy on appliances could theoretically address the market failure by making the more efficient products cheaper than the less efficient, and so encourage their purchase by all buyers, including those concerned exclusively with capital cost. If such an option could be implemented – and there is no obvious legal or taxation mechanism at present- the cost to suppliers would be no lower, and the administrative costs much higher than under the proposed regulations.

An emissions-related levy on electricity prices would be less effective than the efficiency-related levy on appliances, since it addresses running costs rather than capital costs. It would have economy-wide implications that are beyond the scope of the present analysis. Given that any decision to implement such a levy would need to be taken at the highest levels of Government, it is not considered a direct alternative to the proposed regulation.

Address information failures

One consequence of the proposed regulation would be to place reliable data on the output capacity and energy efficiency of every airconditioner model in the public domain for the first time. Some of the other options could also achieve this objective, though not necessarily as effectively or as cost-effectively.

Minimise negative impact on product quality

None of the options are expected to have any significant effect on product quality or function.

Minimise negative impacts on suppliers

The proposed regulation would clearly require suppliers to withdraw, replace or improve non-complying products. The other options would have lower costs for suppliers but they would be less effective in bringing about energy and environmental outcomes. At the extreme, the voluntary MEPS option would have least impact on suppliers because it is unlikely that any would take it up.

Conclusions

After consideration of the proposed regulation and the provisions of the Australian/New Zealand Standard 3823, it is concluded that:

1. Mandating AS/NZ 3823 is likely to be effective in meeting its objective.

2. None of the alternatives examined appear as effective in meeting the objective.

3. The projected monetary benefits of the proposed regulation appear to exceed the projected costs by a ratio of about 6 to 1 without assigning any monetary value to the reductions in CO_2 emissions that will occur.

4. Given that AS/NZ 3823 detailing the proposed MEPS levels have been in the public domain since June 1998, and issued in a draft standard in March 2000, the program could be implemented as early as 1 March 2001. Implementation in December 2001 would reduce the projected energy and CO_2 savings in the period to 2015 by about 9%.

Recommendations [Draft]

It is recommended that States and Territories implement the proposed mandatory minimum energy performance standards by mandating AS/NZ 3823 under the existing regulations governing appliance energy labelling and MEPS in each State and Territory.

1. The amendments should alter the schedules which currently require airconditioners to be labelled, to
    - extend the scope of the regulation to all airconditioners up to 50 kW cooling capacity
    - require compliance with Parts 1, 2 and 3 of the proposed joint Australian-New Zealand Standard AS/NZS 3823:2000 [on the proviso that the final Standard, to be published in October or November 2000, is consistent with the draft published in March 2000]

2. Governments make the register of airconditioner model characteristics publicly accessible, so that prospective purchasers can compare their energy efficiencies.

There is currently a lack of proper scientific testing facilities for units of 65kW cooling capacity and it is invisaged that initial testing standards will be developed via simulated energy performance.

Governments investigate the costs and benefits of expanding airconditioner testing capability in Australia to units of 65 kW cooling capacity.

Proposed Consultations

The following consultations are planned between late October and mid November:

- When the draft RIS is completed, the AGO will send out copies to known interested parties, advertise its availability in national newspapers, and hold public meetings in Sydney, Melbourne, Perth and Adelaide in late October.

- Invite written comments until early November.

- The AGO will review and address written comments received and revise the final RIS that will be submitted to the Australian and New Zealand Minerals and Energy Council for decision in late 2000 or early 2001.

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Contents

Glossary

AGO	Australian Greenhouse Office
ANZMEC	Australian and New Zealand Minerals and Energy Council
APEC	Asia-Pacific Economic Cooperation
AREMA	The Air Conditioning and Refrigeration Equipment Manufacturers Association of Australia
AS/NZS	Australian Standard/New Zealand Standard
BAU	Business as usual
COAG	Council of Australian Governments
COP	Coefficient of Performance
EER	Energy Efficiency Ratio
GATT	General Agreement on Tariffs and Trade
HVAC	Heating, ventilating and air conditioning
IPCC	Intergovernmental Panel on Climate Change
MEPS	Minimum energy performance standards
NAEEEC	National Appliance and Equipment Energy Efficiency Committee
NGGI	National Greenhouse Gas Inventory
NGS	National Greenhouse Strategy
PAC	Packaged air conditioner
RIS	Regulatory Impact Statement
UNFCCC	United Nations Framework Convention on Climate Change

1. The Problem

COAG Guidelines:

- ***Statement of the problem:*** *why is government action being considered in the first place? What is the problem being addressed? For example, this should state the market failure that the proposal seeks to remedy.*

1.1 Energy-Related Greenhouse Gas Emissions

In recognition of the risks and costs of climate change, the Australian government is cooperating with other countries on a global strategy to reduce greenhouse gas emissions below what they would otherwise be. The Commonwealth, State and Territory governments have adopted a National Greenhouse Strategy to give effect to this objective (NGS 1998).

The United Nations Framework Convention on Climate Change (UNFCCC) was agreed in 1992 and came into force in 1994. It places most of the responsibility for taking action to limit greenhouse gas emissions on the developed countries, including Australia, which are referred to collectively as Annex I countries. Annex I countries are required to report each year on the total quantity of their greenhouse gas emissions and on the actions they are taking to limit emissions.

The Kyoto Protocol to the UNFCCC was agreed in December 1997, but has yet to be ratified by its signatories, which include Australia. When ratified, it will place a legally binding obligation on Annex I countries to limit their average annual greenhouse gas emissions during the "first commitment period" 2008 – 2012 to agreed targets, expressed as a proportion of their 1990 emissions. Australia's target would be 108% of its 1990 emissions. While this is higher than the average for Annex 1 countries, it is nevertheless challenging, representing a reduction of more than 20% compared with business-as-usual projections (NGS 1998).

Table 1 summarises Australia's greenhouse gas emissions in 1990 and 1998, the latest year for which a national greenhouse gas inventory (NGGI) has been prepared. Net emissions increased by 16.9% over the period, and the energy sector accounted for nearly all of this increase.[2] It indicates that the growth in electricity generation emissions was 39.5 Mt CO_2-e or nearly 60% of the total net increase in Australia's emissions. The next highest contributor to emissions growth was road transport (15% of the total net increase). Slowing, and ultimately reversing the growth in electricity-related emissions is a high priority in Australia's greenhouse gas reduction strategy.

1.2 Contribution of Air Conditioning to Emissions

Table 1 does not indicate directly the contribution of economic sectors (eg the commercial or services sector), end uses (eg space heating) or technology types (eg

[2] By convention, emissions from land use change are reported separately. These were substantially lower in 1998 than in 1990.

airconditioners) to national greenhouse gas emissions. Further analysis is required, especially the allocation of electricity use to sectors, end uses and technology types.

Table 1 Change in Greenhouse Gas Emissions, 1990 to 1998

	1990 Mt CO_2-e	1998 Mt CO_2-e	Change 1990 to 98 Mt CO_2-e	Change 1990 to 98 %	% of Energy Sector change
1A Fuel Combustion	270.0	331.3	61.3	22.7%	96.9%
1A1 Energy Industries	142.3	187.9	45.6	32.1%	72.1%
Electricity generation	129.1	168.6	39.5	30.6%	62.4%
Other	13.2	19.3	6.2	46.7%	9.7%
1A2 Manufacturing & Construction	50.3	51.7	1.4	2.7%	2.2%
1A3 Transport	61.5	72.6	11.1	18.0%	17.5%
Road	54.9	64.8	9.9	18.1%	15.7%
Other	6.6	7.8	1.2	17.7%	1.9%
1A4 Small combustion	14.2	16.7	2.5	17.4%	3.9%
1A5 Other	1.7	2.4	0.7	43.0%	1.1%
1B Fugitive	29.5	31.5	2.0	6.7%	3.1%
Solid Fuels	15.9	18.7	2.8	17.4%	4.4%
Oil and Natural Gas	13.6	12.8	-0.8	-5.8%	-1.3%
Sector 1. All Energy (sum of 1A, 1B)	299.6	362.9	63.3	21.1%	100.0%
Sector 2. Industrial Processes	12.0	9.8	-2.2	-18.4%	
Sector 4. Agriculture	90.6	92.2	1.6	1.8%	
Sector 5 (part). Forestry and Other (a)	-27.2	-24.5	2.7	-10.1%	
Sector 6. Waste	14.9	15.5	0.6	4.2%	
Gross emissions	417.1	480.4	63.3	15.2%	
Net emissions	389.8	455.9	66.1	16.9%	

Source: NGGIC 2000a (a) Land use change excluded. Sector 3, Solvent and Other Product Use, contains only indirect greenhouse gases that fall outside the scope of the Kyoto Protocol.

The necessary information can be extracted from two studies commissioned by the AGO, *Australian Residential Building Sector Greenhouse Gas Emissions 1990 – 2010* (EES at al. 1999) and *Baseline Study of Greenhouse Gas Emissions from the Commercial Buildings Sector with Projections to Year 2010* (EMET and Solarch, 1999). Table 2 and Table 3 summarise the energy use and emissions associated with energy consumption in buildings.

The projections are based on “business as usual” (BAU) assumptions, including the effects of all energy efficiency programs in place by 1999.

In 1990, emissions from energy use in residential and commercial buildings combined accounted for about 80.8 Mt CO_2-e (Table 3). This represented 30% of national fuel combustion emissions (270 Mt CO2-e, Table 1) or two-fifths of all non-transport fuel combustion emissions.

Under BAU assumptions, building operating energy emissions are projected to increase to 48% over their 1990 levels by 2010. This is much higher than the “Kyoto target” increase for Australia’s total emissions, ie 8%. Emissions from commercial building energy use are projected to increase by 95% between 1990 and 2010, compared with 17% for residential building energy use.

The largest single contributor to building energy emissions in 1990 was electric appliances (30.6%) followed by electric heating, ventilating and air conditioning (HVAC, 24.1%), water heating (23.3%), lighting (13.1%) and non-electric space heating (8.9%). However, these end uses are projected to grow at different rates. Table 4 indicates that electric HVAC is projected to account for nearly half the increase in commercial sector emissions, although only a small amount of the increase is in residential sector emissions.

Table 2 Estimated building energy consumption by end use, 1990-2010

	1990		2000		2010	
	Residential	Commercial	Residential	Commercial	Residential	Commercial
HVAC – electric (a)	7.1	59.4	8.4	83.3	9.1	110.3
Heating - fuels	91.5	46.5	121.8	65.0	143.3	85.5
Water heating & cooking	90.2	9.8	105.3	13.1	114.7	16.6
Lighting	12.9	22.4	15.8	35.3	17.7	52.5
Appliances and other	68.7	13.1	84.2	18.3	94.5	24.0
Total	270.4	151.2	335.5	214.9	379.3	288.9

Source: Derived by author from ES at al (1999) and EMET and Solarch (1999). All values PetaJoules (PJ). Covers "operating energy" only, and excludes "embodied energy" used in the manufacture of building materials and the construction and demolition of buildings. (a) HVAC = Heating, Ventilating and Air Conditioning: includes electric resistance heating.

Table 3 Estimated emissions from building energy by end use, 1990-2010

	1990		2000		2010	
	Residential	Commercial	Residential	Commercial	Residential	Commercial
HVAC – electric (a)	2.1	17.4	2.3	24.4	2.4	32.4
Heating - fuels	4.2	3.0	5.6	4.1	6.5	5.3
Water heating & cooking	17.5	1.3	17.9	1.8	17.4	2.3
Lighting	3.9	6.7	4.6	10.5	4.8	15.7
Appliances and other	20.9	3.8	24.2	5.4	25.7	7.1
Total	48.6	32.2	54.6	46.2	56.8	62.8

Source: Derived by author from ES at al (1999) and EMET and Solarch (1999). All values Mt CO_2-e. (a) HVAC = Heating, Ventilating and Air Conditioning: includes electric resistance heating.

Table 4 Estimated change in emissions from building energy by end use, 1990-2010

	Projected Mt CO_2-e increase			Projected % increase		
	Res	Comm	Both	Res	Comm	Both
HVAC – electric (a)	0.3	15.0	15.3	14.3%	85.9%	78.2%
Heating - fuels	2.3	2.4	4.7	54.8%	80.2%	65.3%
Water heating & cooking	-0.1	1.0	0.9	-0.6%	73.9%	4.6%
Lighting	0.9	9.0	9.9	23.0%	134.1%	93.1%
Appliances and other	4.8	3.3	8.1	23.0%	85.0%	32.6%
Total	8.2	30.6	38.8	16.9%	94.8%	47.9%

Derived from Table 3. (a) HVAC = Heating, Ventilating and Air Conditioning: includes electric resistance heating.

In the commercial sector, electric HVAC services are provided by two main technology types:

- “packaged air conditioners” (PAC), generally in the size range 10 to 65 kW cooling capacity[3]; and

- purpose built installations generally incorporating central cooling towers, serving larger buildings.

Most installations provide both cooling and heating using a heat pump process. Heat from inside the building is pumped out during cooling mode operation, whereas heat from the outside is pumped into the building during “reverse cycle” operation. In some cases, the heating mode is provided by electric resistance heaters, which are less energy-efficient than heat pumps.

About 15% of the packaged air conditioner units sold are capable of cooling only, and either the building has no need for heating (eg in tropical areas) or there are non-electric means of heating (eg natural gas), which may be either completely separate systems, or supply heated air for distribution via the electric HVAC system.

It is estimated that about half the HVAC electricity consumption in the commercial sector is used by packaged units; two thirds of this (ie one third of total HVAC energy) in the cooling mode, and the rest in the heating mode.

The air conditioners used in the residential sector tend to be smaller capacity packaged units, ranging from about 3 kW cooling capacity (for single rooms) up to about 12 kW (for whole-house ducted units). Air conditioners up to 7.5 kW cooling capacity have been included in the scope of the mandatory energy labelling program since 1986 (GWA 1999a,b,c). The labelling requirements are set out in Appendix 1.

[3] A typical office building with 50% glazed walls would have a cooling load of about 150 watts per square metre (w/m^2). Therefore a 30 kW capacity airconditioner would serve 200m^2 of floor space: say a 2 story building measuring 10m per side (excluding service zones and stairs).

1.3 The Industry and the Market

Energy Efficiency and Product Selection

The packaged air conditioner (PAC) market appears to be subject to both information failure – where users do not have access to accurate and consistent information about products or the full costs of owning and operating products – and to market failure – where the most cost-effective products and solutions are passed up because of distortions in the market.

For purchasers and users of air conditioners, the lifetime electricity cost represents a large component – in most cases the major part – of the cost of owning and operating an airconditioner. The estimated average annual energy consumption for units installed in 1998 was 9,680 kWh (Unisearch 1998). Assuming a 15 year operating life, and a constant commercial electricity price of 14c/kWh (about the Australian average for small to medium sized consumers) the net present value of the lifetime energy consumption would be $ 10,305 (at 10% discount rate) or about twice the purchase price (Table 5).

Under the circumstances it would be expected that rational decision makers would give at least equal weight to energy consumption as to capital cost in the purchase of packaged air conditioners. However, this does not appear to be the case.

The running cost of airconditioners are borne by the occupants of commercial buildings, either directly (where the airconditioner serves their zone exclusively and its energy appears on their tenant power bill) or indirectly (where all tenancies contribute to “house” light and power or the costs are simply hidden in the rent).

Table 5 Average capital and lifetime energy costs, packaged air conditioners

	Discount rate		
	0%	10%	20%
Capital cost	$5,135	$5,135	$5,135
NPV 15 year energy cost	$25,457	$10,305	$6,335
Total NPV	$30,592	$15,440	$11,469
Energy cost/total NPV	83%	67%	55%

Source: Derived from Unisearch (1998)

Occupants are rarely in a position to influence the choice of airconditioner, which is usually made by the developer or builder before the identity of the tenant is known. Subsequent decisions about replacements are usually made by the building owner or the property manager, and the occupant is rarely consulted.

The ways in which occupants who are energy-aware can influence the selection of airconditioners are:

- Directly - if they commission the building, or become involved in the design and specification at a sufficiently early stage; or

- Indirectly - if they seek information about the running costs of buildings before they enter tenancy agreements, and favour those buildings with more efficient equipment and hence lower running costs. If sufficient tenants do this, then - over time – building developers and owners would be able to recover the costs of installing more efficient airconditioners (and other fixed equipment) through a higher building sale price and higher rents.

In practice, the nature of the existing market relationships between builders, owners and tenants means that additional capital costs are very difficult to recover, and efficiency options that are cost-effective over the lifetime of the installation are generally passed up.

Unisearch (1996) reported that: "It is widely acknowledged in the industry that:

- the air conditioner market as a whole is far more concerned with capital cost to the total exclusion of running costs or lifetime operating cost;

- speculative builders and landlords are preoccupied with capital cost to the total exclusion of running costs (ie there is ample evidence of the "landlord/tenant" or split incentives factor);

- false claims about product capacity are common; companies which state the cooling (or heating) capacity of their products according to the Australian Standard tend to be at a commercial disadvantage, since customers are under the impression that they are getting more for their money from suppliers who over-state capacity."

Correction of the information failure (eg via mandatory disclosure or labelling) would not by itself correct the market failures.

AREMA introduced a form of information disclosure in 1989. The main objective of the program was to ensure that all statements about the capacity of packaged air conditioner models made by AREMA members were consistent and referred to the same standard tests. To this end AREMA commenced publishing a directory of certified unitary air conditioning equipment.[4] The listing for each model includes the energy efficiency (COP) on cooling as well as the cooling capacity (and heating capacity, where applicable) but this information appears to be of less concern to both suppliers and buyers than the capacity.

The airconditioner industry

The airconditioner manufacture/import industry is divided into a number of segments. About 15 firms, most of them members of the Air Conditioning and Refrigeration Equipment Manufacturers Association of Australia (AREMA), account for 80 - 85% of the market. The balance is supplied by 15 to 25 smaller firms. The number is imprecise because of the fluid and complex nature of the industry. Some companies

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[4] The AREMA Directories are the most important sources of information about the models on the market in Australia, even though they do not list all models of AREMA members and not all suppliers are members of AREMA. The latest Directory was published in 1999.

design and manufacture all their products in Australia. Some manufacture or assemble products under licence to overseas brands, import products to sell under their own brand, or both. Some firms are the local branches of, or have exclusive distribution arrangements with, major overseas manufacturers who supply all their products.

It is estimated that about 20% of PACs sold are locally manufactured or assembled. The extent of local content varies. All components can be sourced locally except for compressors, which are no longer manufactured in Australia.

Most suppliers are based either in Sydney or Melbourne, but some are located in Perth, Adelaide and Brisbane. The industry is subject to continuing change. Between 1996 and 1999, there were instances of firms ceasing manufacture and going to fully imported products, of import distribution rights changing hands, and firms taking over other companies and merging their product ranges.

The total value of the PAC market varies significantly from year to year. Based on an estimated “trend” market volume of 60,000 units in 2000, and an estimated average price of $5,135 (excluding installation costs and taxes – see Table 5), the value of the market is about $ 340 M.

2. Objectives

- ***Objective:*** *the objective which the regulation is intended to fulfil must be stated in relation to the problem. The objectives of a regulation are the outcomes, goals, standards or targets which governments seek to attain to correct the problem.*

2.1 Primary Objective

The primary objective of the proposed regulation is to bring about reductions in Australia's greenhouse gas emissions from the use of airconditioners and heat pumps below what they are otherwise projected to be (ie the "business as usual" case).

2.2 Secondary Objectives

The following secondary objectives have been adopted:

1. Does the option address market failures, so that the average lifetime costs of airconditioners are reduced, when both capital and energy costs are taken into account?

2. Does the option address information failures, so that buyers have ready access to product descriptions that are consistent and accurate with regard to cooling capacity and energy efficiency?

3. Does the option minimise negative impacts on product quality and function?

4. Does the option minimise negative impacts on manufacturers and suppliers?

3. Options

COAG Guidelines:

- ***Statement of the proposed regulation and alternatives:*** *this should describe the proposed regulation and distinct alternatives in sufficient detail to allow comparative assessment and evaluation in the rest of the RIS.*

The following options for achieving the objectives were considered.

1. Status quo (termed business as usual, or BAU);

2. The proposed regulation (mandatory energy performance standards MEPS);

3. A regulation which only adopts those parts of the Australian Standards that are essential to satisfy regulatory objectives (targeted regulatory MEPS);

4. Voluntary MEPS;

5. Another regulatory option involving a levy imposed upon inefficient equipment to fund programs to redress the greenhouse impact of household equipment;

6. A levy on electricity reflecting the impact it has on greenhouse gas emissions abatement.

The following sections describe the options in more detail, and assess the non-MEPS options (5 and 6). The MEPS options (2,3 and 4) have been subject to detailed cost-benefit analysis, which is reported in the next chapter.

3.1 Status quo (BAU)

Improvements in energy efficiency are likely to take place even in the absence of any market intervention. A “BAU” air conditioning energy use projection has been developed to take account of likely improvements in both average product energy efficiency and in building shell efficiency. This projection forms the baseline for quantitative analyses of the impacts of the MEPS options.

The Status Quo option would, by definition, fail to meet the objective of the regulation. There would be no reduction in Australia’s greenhouse gas emissions below the BAU case, and there would be no correction of identified market failures or information failures. On the other hand, there would be no negative impact on product quality or function, or negative impacts on manufacturers, suppliers and consumers.

3.2 Mandatory MEPS

Proposal

The proposal is to introduce minimum energy performance standards (MEPS) for airconditioners and heat pumps falling within the scope of the joint Australian and New Zealand Standard AS/NZS 3823, *Performance of household electrical appliances – airconditioners and heat pumps.* The Standard was devised after extensive analysis and consultation (see Appendix 2). A number of related initiatives are being pursued to reduce greenhouse gases such as ways to improve energy efficiency in buildings (see Appendix 2). Appendix 3 provides details of the Standard for air conditioners and heat pumps. The proposed MEPS levels are set out in Table 6 and apply to the cooling capacity range 7.6 to 65.0 kW.

The MEPS values in AS/NZS 3823 Part 2 (Table 6) were recommended following an analysis of the market which considered the costs and benefits of five alternative MEPS options (Unisearch 1998). They are the only MEPS levels under consideration in this RIS. It is not within the scope of this RIS to consider other MEPS levels.

The Standard would be put into effect by amending the schedule of products in the regulations governing energy labelling and MEPS in each State and Territory (see example at Appendix 4). The amended schedules would refer to all parts of the revised AS/NZS 3823, and so would make compliance with *all* the Standard requirements mandatory.

Table 6 Proposed MEPS levels

Cooling Capacity (kW)	Minimum cooling EER
7.6-10.0	2.25
10.1-12.5	2.30
12.6-15.5	2.35
15.6-18.0	2.40
18.1-25.0	2.45
25.1-30.0	2.50
30.1-37.5	2.55
37.6-45.0	2.60
45.1-65.0	2.65

Source: AS/NZS 3823.2:2000 (forthcoming).
EER = Energy Efficiency Ratio (watts electricity/watts cooling)

If it were decided to limit (or extend) the scope of the regulations in some way it would be necessary to specify this. For example, if governments decided to limit the scope of MEPS to units of less than 50 kW cooling capacity because of current limitations of testing laboratories, this would need to be specified in the regulations. Without such a limitation, reference in the regulations to AS/NZS 3823 Part 2 would extend MEPS to units up to of 65 kW cooling capacity.

Under a mandatory MEPS regime, products would be required by existing State and Territory regulations to comply with the minimum energy efficiency ratios (EERs) proposed for the revised AS/NZS 3823 Part 2. The target date for implementation is 1 July 2001, although 1 December 2001 is also a possibility.

If the regulation is framed in a similar way to the existing regulations for household appliances, suppliers would also have to comply with the following provisions in the Standard:

- All statements about cooling and heating capacity, energy consumption and energy efficiency to be consistent;
- the values to be determined under the test conditions specified in Part 1;
- Products to meet requirements of the maximum cooling test in Part 1;
- Products to be registered with a State or Territory energy agency;
- Statements about cooling and heating capacity, energy consumption and energy efficiency to be subject to check testing, using the procedure specified in Part 2;
- Permanent marking of MEPS complying appliances.

The Standard would also offer the following options to suppliers of three-phase airconditioners:

- Use of performance simulation (in Part 3) as an alternative to the physical tests specified in Part 1;
- Optional labelling – but if this option is taken all requirements of Part 2 apply.

Background to Proposal

The National Greenhouse Strategy states that “improvements in the energy efficiency of domestic appliances and commercial and industrial equipment will be promoted by extending and enhancing the effectiveness of existing energy labelling and minimum energy performance standards [MEPS] programs. This will be pursued by … developing minimum energy performance standards for a broader range of new appliances and equipment” (NGS 1998).

A high priority in the work program of government through the National Appliance and Equipment Energy Efficiency Committee is to “establish timetables for the introduction of MEPS for packaged air conditioners, electric motors and fluorescent lamp ballasts” (NAEEEC 1999). Each of these products has been the subject of detailed cost-benefit studies, which recommended that MEPS be introduced.

It is a COAG requirement that where Australian Standards are cited in regulations there should be reference to a specific edition, so that that supplier obligations cannot change without due re-examination of the issues. In this instance there is an agreement between the Commonwealth and State Governments and Standards Australia covering the mode of revision of standards bearing on energy efficiency, so the content of AS/NZS 3823 cannot change without government agreement.

3.3 Targeted regulatory MEPS

"Targeted regulatory MEPS" may be defined as "a regulation which only adopts those parts of the Australian Standards that are essential to satisfy regulatory objectives".

It needs to be established whether the adoption of all parts of the Standard, as would be the effect of the regulations in the form currently proposed, is necessary to meet the objectives, or whether it would be sufficient to only adopt the MEPS levels specified in Section 3 of Part 2 of the Standard, together with the physical energy test procedures in Part 1 to which the MEPS levels refer.

The relevance of the other parts to meeting the objective of the regulation is considered in Chapter 4.

3.4 Voluntary MEPS

Under a voluntary MEPS regime, product suppliers would be encouraged to meet certain minimum energy efficiency levels without regulation. These levels would require them to incur the costs of changing their model range to eliminate less efficient models and introduce more efficient models sooner than they would otherwise have done. Otherwise, "voluntary MEPS" is in effect "business as usual".

Suppliers would presumably only incur these costs if there were commercial incentive for them to do so. Whether such incentive exists or could be created is considered in Chapter 4.

3.5 Equipment levy

Another option involves "a levy imposed upon inefficient appliances to fund programs to redress the greenhouse impact of household appliances." Two variations of this option have been considered:

a) the proceeds from the levy are diverted to greenhouse-reduction strategies unrelated to appliance efficiency (ie the levy is "revenue-positive"); or
b) the proceeds are used to subsidise the costs of the more efficient appliances, so that any cost differentials between more and less efficient appliances are narrowed or eliminated (ie the levy is "revenue-neutral").

Imposing and disbursing the levy

Any levy would obviously have to be mandatory. A threshold question for both the "revenue-neutral" and "revenue-positive" options is whether the Commonwealth or State tax regimes could support the raising of the levy. The recent abolition of wholesale sales tax, which could be levied at different rates, in favour of a single-rate GST, removed the most likely vehicle for imposing a levy.

Once funds were raised, then under a "revenue-positive" option they would be applied to a greenhouse reduction activity determined by government – perhaps under competitive project bidding such as the AGO's current Greenhouse Gas Abatement Program (GGAP). The "revenue-neutral" option would be more complex, in that it would require a mechanism for applying the funds raised to the desired objective of narrowing the cost differential between more and less efficient appliances.

Possible approaches include:

- energy-efficiency-weighted scaling of tariffs and duties (but this would only affect imports);
- payments to manufacturers or importers according to a formula based on sales and efficiency;
- rebates direct to the purchasers of the energy-efficient products: for example "$100 cashback for purchase of a 5 star airconditioner, $50 for purchase of a 4 star" (for products not labelled it would be necessary to give buyers other means of identifying qualifying products).

Because most suppliers offer products with a wide range of efficiencies, they may be largely unaffected by the levy (ie their required contribution to revenues may be close to their nominal receipt of benefits). Alternatively, where suppliers are net recipients they may use the revenues to support product prices in ways that conflict with the objectives of the levy. The only way to ensure that the funds are actually applied to the purchase price of the more efficient appliances would be to offer rebates direct to purchasers. However, this would create the following difficulties:

- high fixed costs to establish a publicity, verification and payment infrastructure;
- administrative and transaction costs would probably be high in relation to the value of each payment to buyers;
- "free riders": a large number of buyers who would have bought the more efficient appliances in any case will claim payments.

Conclusions

There are no readily apparent means for raising the proposed levy. It is not likely that differential taxation rates can be implemented under existing Commonwealth or State taxation or licensing laws. A levy would only become feasible if general provisions were introduced to enable import duties or other tax rates to be linked to specific product characteristics, in this case energy efficiency.

The product registration, check testing and ongoing administrative costs to business and government would be no less than under mandatory MEPS.

In the "revenue-positive" case, where the funds raised by the levy were applied to greenhouse gas reduction programs outside the appliances sphere, there is no evidence that potential greenhouse gas reductions from other possible application of the funds would be more cost-effective, or even equally cost-effective, to MEPS.

In the "revenue-neutral" case, where the funds raised were to be applied to reducing the cost differential between more- and less-efficient appliances, it would be difficult and/or administratively costly to ensure that payments to appliance suppliers and/or purchasers were targeted as intended.

If the framework could be established, a “revenue-neutral” levy would act as a form of mandatory MEPS in which regulations would enforce the payment of the levy rather than prescribe characteristics to be met for lawful sale. Suppliers would be free to sell products less efficient than the reference level, but each sale would carry a financial cost. With the MEPS regime currently proposed, suppliers who sell non-compliant products would also be subject to financial penalty. The main difference is that the levy provides an in-built mechanism for scaling the penalty to the extent by which MEPS is exceeded, whereas the current MEPS proposals do not. However, if such a feature is considered desirable it may be more straightforward to incorporate it into the MEPS regulations than to establish a levy regime.

The proposed levy, even if legally feasible, appears to offer no cost savings, no greater greenhouse gas reductions (in fact, probably less greenhouse gas reductions) and probably higher lifetime appliance costs to purchasers, compared with the MEPS proposals. Some form of levy *in association with* MEPS may produce greater energy savings, but more information about the form and design of a levy proposal would be necessary in order to form a judgement.

3.6 Electricity levy

At present, the electricity prices faced by consumers reflect – however imperfectly - the cost of the capital invested in the electricity generation and distribution system, operating and maintenance costs, and taxes. They may also reflect the costs of controlling pollutants such as oxides of nitrogen and sulphur (NOx and SOx), for which emissions standards are currently in force in some areas. They do not reflect the value of greenhouse gas emissions, or rather they implicitly assign a value of zero to such emissions. In other words, greenhouse costs are not internalised in the electricity price.

It may be possible to introduce a levy on the price of electricity to reflect the cost of greenhouse gas emissions from the production and combustion of the fuels used to generate it – in effect, a carbon tax. Alternatively, if a cap and trade emissions permit scheme were implemented, electricity generators and other major emitters would have to obtain sufficient permits to cover their emissions. Some of these may be obtained free (ie by “grandfathering”) and some may have to be purchased, but if there is an open market then all permits will ultimately have the same monetary value. The permit value would thus be reflected in the price of electricity and all greenhouse-intensive goods and services. The effect of a permit trading scheme would be similar to a carbon tax in its pervasiveness, but the magnitude of the electricity price impact would vary with the market price of permits.

The decision to introduce an electricity levy or an emissions trading scheme is a matter for the highest levels of Commonwealth, State and Territory Government. In that respect these options are not direct alternatives to the proposed mandatory MEPS regime.

4. Costs, Benefits and Other Impacts

COAG Guidelines:
- ***Costs and benefits:*** *there should be an outline of the costs and benefits of the proposal(s) being considered. This should include direct and indirect economic and social costs and benefits. There should also be analysis of distinct alternatives (including ' do nothing') to the proposed regulation.*

The major economic benefit of mandatory energy performance standards MEPS would be the value of the electricity cost savings. The major economic cost would be the increase in the average price of airconditioners as a result of redesigning and reengineering the models which fail MEPS. This chapter summarises the cost-benefit modelling carried out to estimate these benefits and costs. Mandatory, targeted and voluntary mandatory energy performance standards MEPS are examined.

A reduction in electricity consumption would also produce social benefits in the form of lower greenhouse gas emissions. These are estimated, but not given monetary value. Although the economic costs and benefits are likely to be passed on to airconditioner buyers, owners and operators, there will also be impacts on manufacturers, importers and exporters. These are also covered in this chapter.

4.1 Benefits and Costs of Mandatory MEPS

The purpose of the cost-benefit modelling is to project the costs of airconditioner purchase costs and running costs in the medium term, both nationally and at a State or regional level, and hence to compare the net present value of owning and operating airconditioners under business as usual and "with-MEPS" scenarios.

Data

The costs and benefits of the proposed MEPS levels have been projected using a computer model first developed by Unisearch (1998). The data sources include the AREMA *Directories of Certified Unitary Air Conditioning Equipment* (last published in 1996 and 1999, plus unpublished 1997 updates) and estimates of sales by product type, capacity and state marketing area.[5] The key assumptions and outcomes are detailed in Appendix 5.

The latest market data supplied by the industry indicate that about 75,000 packaged air conditioners in the range 7.5 to 65 kW cooling capacity were sold in the year to May 2000. Sales vary considerably from year to year, depending on the rate of building construction and, for smaller units, by whether the early part of summer is hotter or cooler than average. The year ended May 2000 included an unusually hot early summer, and also a building boom partly induced by the desire to complete contracts before the introduction of the GST. These conditions would have increased sales well over the underlying trend market, which is estimated at about 60,000 units in the year 2000. The market is growing in size from year to year, but its composition appears to be reasonably stable in terms of share by type and capacity range (see

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[5] The assistance of AREMA in providing this data is gratefully acknowledged.

Figure 1 and Figure **2**, which also indicate the closeness of fit between the modelled market and the actual sales data).[6]

Figure 1 Actual vs Modelled Market Share by Type (no MEPS)

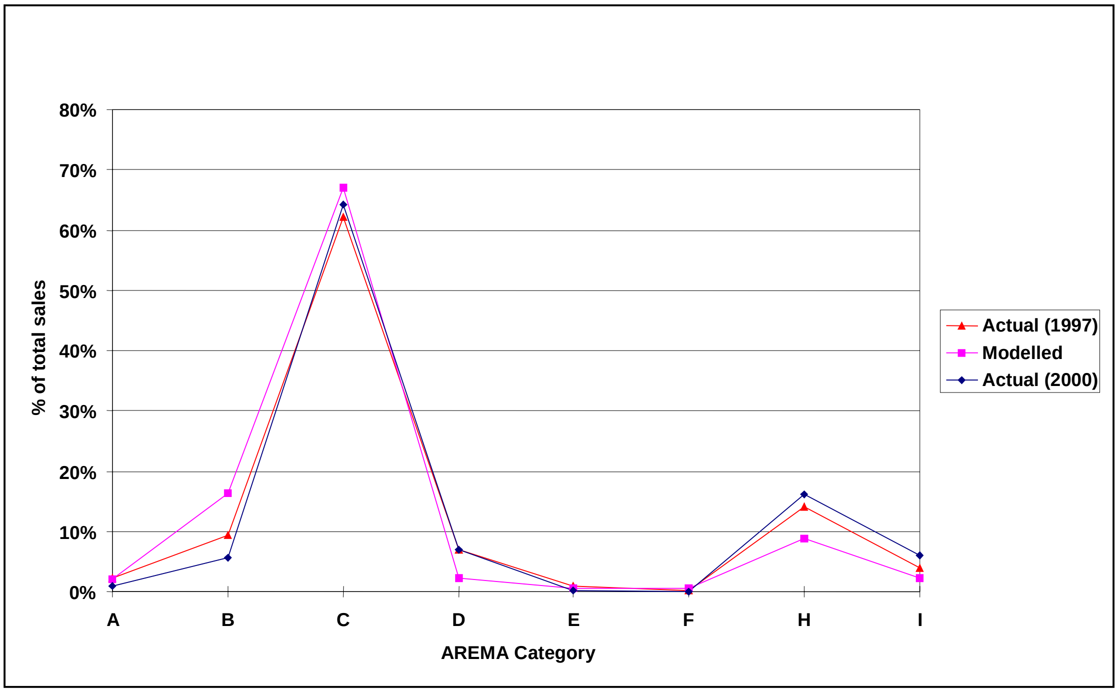
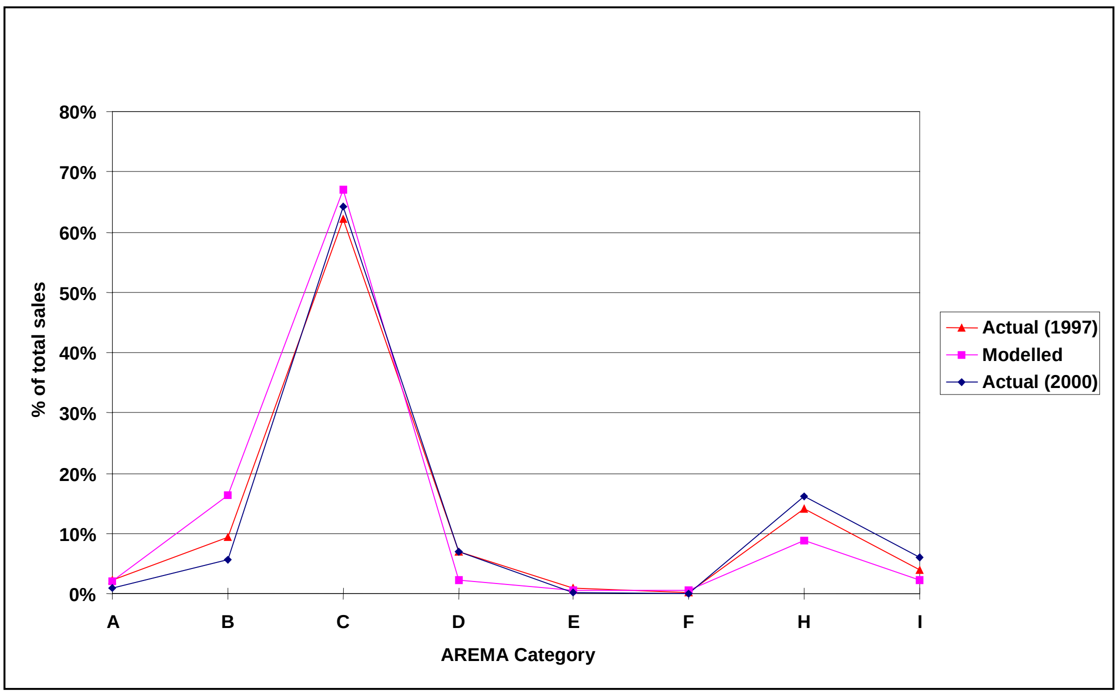


Figure 2 Actual vs Modelled Market Share by Capacity (no MEPS)



[6] (A) Single package - cooling only. (B) Single Package - heat pump. (C) Split system - ducted - heat pump. (D) Split system - ducted - cooling only. (E) Packaged - remote condenser - cooling only. (F) Packaged - remote condenser - heat pump. (H) Split system - non-ducted - heat pump (I) Split system - non-ducted - cooling only.

The State shares of the national market is shown in Table 7. The NSW+ ACT share increased considerably over the last three years, indicating that a high proportion of the overall market growth took place there – consistent with the high rate of building activity. The heat pump share of the national market was fairly stable: about 88% in 1997 and 86% in 2000. Cooling-only models represented a minority of the market in all areas expect the NT.

Table 7 Market share by state, and heat pump share of each market

	NSW+ ACT	Vic+Tas	Qld	SA+Bro-ken Hill	WA	NT	Total
Share of national market, 1997	28.5%	23.8%	16.5%	15.0%	14.5%	1.6%	100.0%
Share of national market, 2000	37.8%	17.5%	18.5%	13.6%	11.5%	1.1%	100.0%
Heat pump/total 1997	95.9%	81.4%	79.4%	97.1%	87.9%	31.5%	87.7%
Heat pump/total 2000	96.4%	75.1%	66.8%	97.8%	90.2%	26.5%	85.9%

Estimating benefits

The computer model of the airconditioner market operates in the following way (the model parameters are fully documented in Unisearch (1998)).

1. The airconditioner market is divided into 8 types (see Figure 1). The sales for each type are further subdivided into between 4 and 9 cooling capacity ranges (see **Figure 2**) following the structure of the market data collected by the industry, making 62 sub-categories in all. Using additional brand share data supplied in confidence by various firms, a sales-weighted Coefficient of Performance (COP – now termed EER) is estimated for each category and for the market as a whole.

2. The number of airconditioners in each sub-category sold in each of 6 sales areas (NSW+ACT, Vic+Tas, Qld, SA+Broken Hill, WA and NT) in the "base year" is calculated. The "base year" is the one preceding the announcement of the intention to implement MEPS: in this case 1999/2000.

3. Formulae have been developed which relate airconditioner cooling energy use to local climate in each of the six marketing areas. Four sets of formulae are used for each marketing area: typical commercial use, typical household use, and for each use, energy demand for current building standards and for "low-energy" buildings.

4. From the estimated share of national sales in each marketing area, and the share of airconditioners installed in household and commercial use (predominantly the latter), the total electricity consumed by all airconditioners sold new in the base year (a "cohort") is calculated. Each new cohort of airconditioners is assumed to use the same amount of electricity in each of the 15 years (average) that the units remain in service.

5. A "BAU" projection is developed, estimating the cooling energy that will be consumed by all airconditioners sold in the period 1999/2000 to 2014/15 (ie 16 years' sales in all), on the assumption that the national market will grow at about 4.5% per annum for commercial airconditioners, and 2.5% per annum for residential (different growth rates were assumed for different marketing areas – see Appendix 5). It is assumed that over this period, the cooling energy

requirements per unit of building floor area falls by 0.25% per annum because of changes in building design practices and BAU improvements in the average cooling EER of airconditioners.

6. The net present value of the cooling energy is calculated, using a range of discount rates (0%, 5% and 10%) and the electricity prices in Table 8, which are assumed to remain constant in real terms. The associated greenhouse gas emissions are also calculated, using projections of the greenhouse intensity of electricity supply in each State (see Appendix 5).

Table 8 Estimated electricity prices

	Commercial $/kWh tariff	Residential $/kWh tariff
NSW and ACT(a)	$ 0.135	$ 0.113
Vic and Tas (b)	$ 0.143	$ 0.125
Qld	$ 0.115	$ 0.092
SA	$ 0.140	$ 0.120
WA	$ 0.140	$ 0.123
NT	$ 0.120	$ 0.120

See further details in Appendix 5. (a) NSW and ACT treated as one region, with NSW electricity price, since benefits and costs not separable. (b) Victoria and Tasmania treated as one region, with Vic electricity price, since benefits and costs not separable.

7. Steps (5) and (6) above are repeated to project energy consumption, energy costs and greenhouse emissions for the "with-MEPS" scenario.[7] It is assumed that suppliers begin to phase out sub-MEPS models in the "lead-in" period between announcement and actual implementation, so the "with-MEPS" trend line first diverges from the BAU trend in 2000/01.

8. The difference between the net present value (NPV) of electricity costs in the BAU and the with-MEPS scenario represent the monetary benefit of introducing the proposed MEPS. The difference in greenhouse gas emissions are also calculated, but not given monetary value.[8]

From this modelling, it is estimated that the value of electricity saved between 2000 and 2015 in the "with-MEPS" scenario is $480 M at 10% discount rate (see Table 11). Benefits to greenhouse emissions are discussed in grater detail elsewhere in this report.

In previous modelling, a number of MEPS scenarios were examined – various levels of stringency, and various profiles (ie a uniform level for all types, or varying by

[7] If an airconditioner is excluded from the market because its cooling EER does not match or exceed the selected MEPS level, the computer model allocates the "purchase" to a notional product with the *average* EER and cooling capacity characteristics of all models remaining in that market segment which *do* pass MEPS. This simulates a situation where buyers who would have purchased the excluded product randomly select from what is left on the market, and new products are designed to meet average prevailing efficiency levels rather than just to meet MEPS.

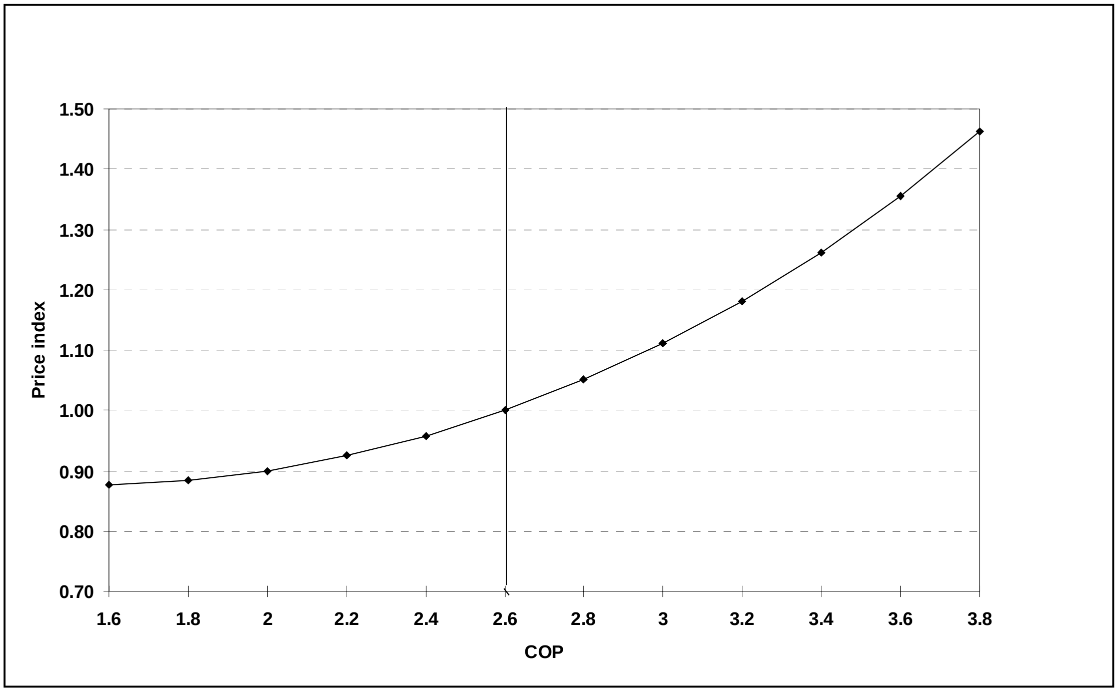
[8] There may be other benefits in reducing electricity consumption, such as less noise and reduction of other pollutants apart from greenhouse gases, but these are difficult to value and are not analysed.

product class, by capacity or both). The effects on the market and on total energy use were analysed. For the present RIS, only the proposed MEPS levels are modelled.

Estimated costs

It is difficult to estimate the impact on the capital cost of products of increasing average efficiency, because of the weakness of the relationship between price and efficiency at the relatively modest efficiency levels where MEPS is being considered (Unisearch 1998). The price-efficiency curve in Figure 3 was derived from the products of one of the few suppliers with models of similar capacities spanning a wide range of efficiencies.

Figure 3 Ratio of Price to Energy Efficiency Ratio (Standardised at EER = 2.6)



Discussions with manufacturers, and with University of NSW staff involved in the testing and design of commercial airconditioners, suggest that:

- high EER models are often priced at a premium (as shown at the right hand side of Figure 3) but this does not necessarily reflect their cost of manufacture. In fact, in some cases the higher EER model is cheaper to manufacture, because its design allows savings in materials.

- at low EERs, models can often be significantly improved by simple low-cost or even cost-free design changes (as shown at the left hand side of Figure 3), which can be identified during the course of physical testing and/or computer modelling.

Rather than attempt to derive costs from very limited information on price-efficiency relationships in the current PAC market, it is more helpful to identify the costs of specific elements in the implementation of and responses to a new MEPS regime.

There would need to be some *additional* testing or computer simulation of product performance beyond what suppliers would undertake in any case. (It is assumed that all models for which data are listed in the AREMA directory have already been physically tested or simulated). Some of this additional testing will be undertaken by suppliers, to confirm compliance or in the process of redesign to achieve compliance, and some will be undertaken by Government to check compliance.

The magnitude of the additional testing cost will be roughly proportional to the number of models failing to pass MEPS. There will also be some redesign, re-engineering and retesting costs imposed on the suppliers of models which fail to meet MEPS.[9] These costs are fixed, in that they will be much the same whether the model sells in large or small numbers, so they can be estimated from the number of models failing to pass a given MEPS regime.

For the purpose of the cost/benefit calculation, it is estimated that the fixed costs of additional testing, redesign and re-engineering amount to $ 100,000 per model failing to pass MEPS (Unisearch 1998). The market model indicates that about 155 air conditioner models (or about a quarter of those on the market in 1999) will fail to meet MEPS, so expenditures of $ 15.5 M, spread over 2 years, are projected.[10] This represents an impost of about $ 120 per unit sold over the two years (assuming suppliers recover it from all sales, not just the sales of the redesigned models).

The market model indicates that MEPS will affect about a third of the *units* sold even though it affects a quarter of the *models*. This is because the MEPS-affected models sell in somewhat greater number, on average, than the MEPS-compliant models. This is derived from actual brand-share and model-share analysis, and is consistent with the reported buyer preference for cheaper, less efficient models.

It is estimated that the costs of better materials and components, and more careful manufacturing will add an average of $ 300 (about 6% of the present average retail price) to the price of the units that need to be improved to meet MEPS, about one third of the market.

All products manufactured or imported after the implementation date nominated in the regulations would have to comply with MEPS. When MEPS were introduced for household refrigerators and water heaters in October 1999, it was with a changeover period of one year: products manufactured or imported before the implementation date can still be sold up to October 2000.

If the same arrangements apply to airconditioners, then many of the products sold in 2001/02, the year after the planned implementation date of 1 July 2001, will still be sub-MEPS. The first year in which all new sales should conform will be 2002/03.

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[9] A "model" may be a family of closely related models that share key components or design features.
[10] The estimate of 155 models failing includes both models listed in the AREMA directory (of which 68 failed in 1999) and models not listed in the directory.

Benefit/cost ratios

Table 9 summarises the magnitude and timing of the costs to industry, and hence to consumers in the first 4 years. The NPV of these costs over the full 16 year period modelled is $ 78 M (at 10% discount). Table 10 indicates the cost impact per unit sold, under two extreme assumptions: if suppliers choose to recover the adjustment costs from all their sales, and if they choose to recover them only from purchasers of those products that actually have to be redesigned to meet MEPS.

The costs to government are so small in comparison with industry costs that they are negligible for the purposes of benefit/cost modelling. Given that the standards are now finalised, the main implementation costs to government are the RIS consultation process and the preparation of amendments to existing regulations – say $ 50,000 in all. The main ongoing cost is the extension of the National Appliance Equipment Energy Efficiency Committee's (NAEEEC) household appliance check testing program to packaged airconditioners. This would be important, especially in the first years of the program, and could cost about $100,000 per year.

Table 9 Indicative costs, costs allocation and timing

	Fixed costs – industry [a]	Variable costs – industry and government[b]	Total costs	MEPS impact
1999/2000	$ 7.7 M	NA	$ 7.8 M	No impact
2000/2001	$ 7.8 M	$ 6.3 M	$ 14.1 M	1/3 impact
2001/2002	NA	$ 6.5 M	$ 6.5 M	2/3 impact
2002/03	NA	$ 6.8 M	$ 6.8 M	Full impact

(a) Estimate of $ 100,000 per affected model, spread over 2 years (b) $ 100 per unit, all airconditioner sales, for additional materials and higher quality components.

Table 10 Costs per unit sold

	Spread over all units sold				Spread over sub-MEPS units only			
	Fixed costs	Variable costs	Total costs	% of avg price[(a)]	Fixed costs	Variable costs	Total costs	% of avg price[(a)]
1999/2000	$ 120	NA	$ 120	2.1%	$ 480	NA	$ 480	8.5%
2000/2001	$ 120	$ 100	$ 220	3.9%	$ 480	$ 300	$ 780	13.8%
2001/2002	NA	$ 100	$ 100	1.8%	NA	$ 300	$ 300	5.3%
2002/03	NA	$ 100	$ 100	1.8%	NA	$ 300	$ 300	5.3%

(a) All-product average price of $ 5,130 plus 10% GST

Table 11 Net present value of projected costs and benefits, 2000-2015

Undiscounted		5% discount rate		10% discount rate	
Costs $ M	Saving $ M[a]	Costs $ M	Saving $ M[a]	Costs $ M	Saving $ M[a]
157	1994	107	922	78	480
Benefit/cost ratio 13		Benefit/cost ratio 9		Benefit/cost ratio 6	

(a) No monetary value given to emissions.

Table 11 compares the projected costs and benefits, integrated over a 16 year period. The projected monetary benefits are about 6 times as great as the projected costs, at a discount rate of 10%.

It is possible to carry out a simple cross-check on these findings in the following way.

- According to Unisearch (1998), the sales-weighted market average EER in the base year was 2.55;

- MEPS would reduce the energy consumed by air conditioners in the projection period by about 7.8% (Table 12). If applied to a single air conditioner, the NPV of 8.1% reduction in lifetime energy cost (at a discount rate of 10%) would be 7.8% of $10,305 (Table 5), ie $ 804;

- All else being equal, this would be similar to raising COP by 8.1% - ie from 2.55 to 2.76 in the base year. Figure 3 indicates that this would increase the cost from about 0.98 of the "standard" price to about 1.04 – a rise of 6%. Since the average price of an airconditioner in 1996/97 was $ 5,135 the increase would be $308;

- The benefit/cost ratio would therefore be 804/308, or 2.6 (at 10% discount rate).

This compares with a "whole-program" estimated benefit/cost ratio of 6, at a 10% discount rate (Table 11). This is not inconsistent, for the following reasons:

- The cost curve in Figure 3 is derived from few data points and is indicative only – it is equally valid to assume per-model and per-unit sold costs.

- Even if the costs curve were generally valid, many MEPS-affected products would end up not at or above the market average but at a lower COP point, just clearing their MEPS hurdle. Therefore they would be traversing a flatter region of the curve - the region of cheapest improvement options - with perhaps half the cost increase per COP increment.

Given these uncertainties, it is reasonable to conclude that the actual benefit/cost ratios for the proposed MEPS will lie in the range 3 to 6 (at 10% discount rate). This is highly favourable for a program of this type. The RIS on the implementation of energy labelling and minimum energy performance standards for household appliances estimated that the marginal benefit/cost ratio of adding MEPS to the pre-existing energy labelling program was in the range 2.4 to 2.7 (at a discount rate of 8%, so slightly lower for 10%) (GWA 1999a).

While MEPS would apply to cooling performance only, it is likely that the design changes needed to increase cooling EER to comply with MEPS would also lead to higher efficiency in the heating performance of heat pump units, and hence further energy savings at no additional cost. This would increase the effective benefit/cost ratio of the program, but has not been analysed.

Energy and greenhouse savings

The projected annual energy consumption by each year's cohort of new airconditioners, under BAU and with-MEPS assumptions, is illustrated in at cohort's life, and so on.

Figure 4. The difference between the two values represents "locked in" energy savings that persist for the operating life of that cohort, estimated at 15 years on average (some units will be in service for much shorter periods, and others for much longer). In the following year a further cohort is added, and its energy savings are locked in for that cohort's life, and so on.

Figure 4 Projected cohort energy consumption

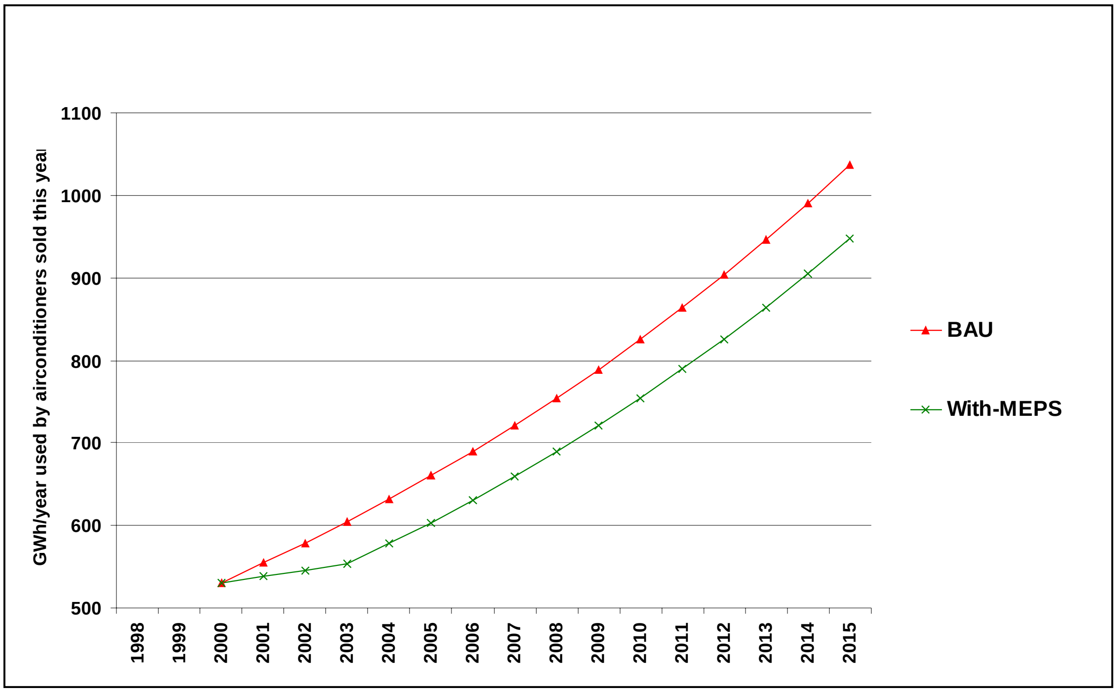
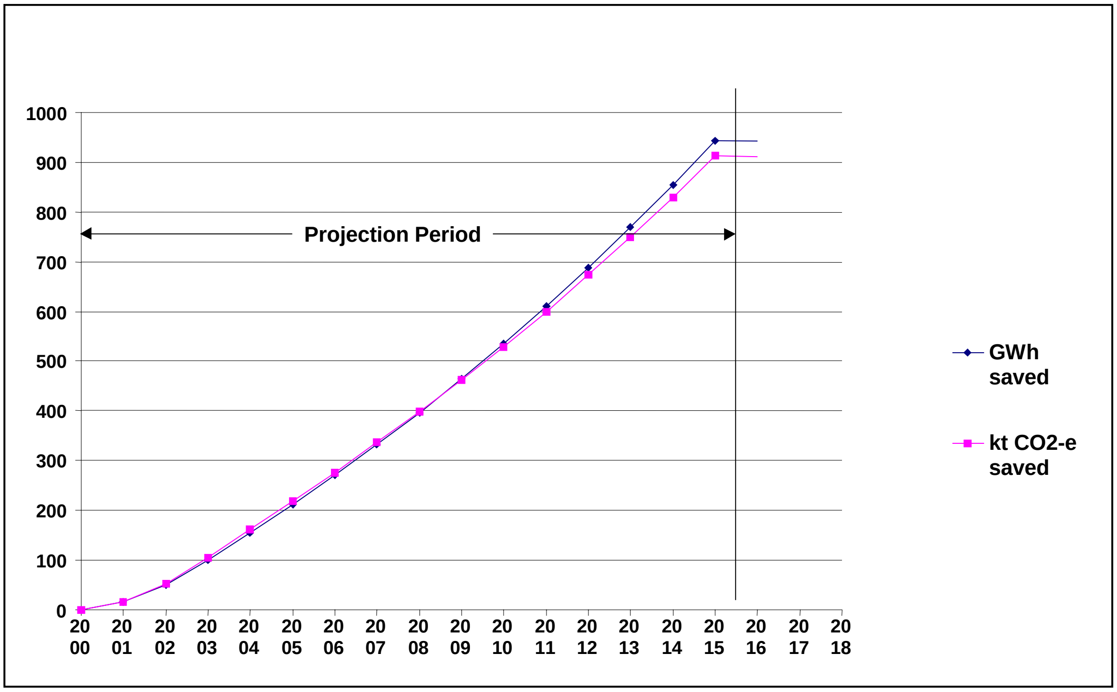


Figure 5 Projected program energy and emissions savings



The accumulation of these savings follows the curve in Figure 5, and is summarised in

Table 12. The reduction in Australia's emissions in 2010, the central year of the Kyoto Protocol commitment period, is projected to be 0.53 Mt CO_2-e.

The apparent decay in annual savings after 2015 reflects both a modelling effect (the end of the projection period), and the fact that BAU energy trends would eventually catch up, and so erode the impact of any given MEPS level. On the other hand, it is possible that more stringent MEPS levels might be found to be cost-effective and implemented some time after the MEPS proposed in this RIS.

Table 12 Projected energy and emission savings, 2000-15

Period modelled	Implement-ation date	GWh energy saved during period	% of BAU energy saved	Mt CO_2-e saved during period	Emission saving 2010 Mt CO_2-e
2000 – 2015	1 July 2001	15,095	7.8%	14.6	0.53

State and territory impacts

The impacts, benefits and costs for those States and Territories which can be separately modelled are given in Table 13. The NT has the highest benefit/cost ratio by far, because of the high average energy use per unit. The greatest monetary and emission savings are projected to be in NSW+ACT because of the size of the market. The lowest benefit/cost ratio, for Victoria+Tasmania, is still favourable at 4.2. There would clearly be no emissions savings for Tasmania, but the program is still almost certain to be cost-effective, since most packaged airconditioners are installed in commercial applications where cooling demand dominates, even in Tasmania's climate.

Table 13 Impacts, benefits and costs by State and Territory

	NSW+ ACT	**Vic+Tas**	**Qld**	**SA**	**WA**	**NT**	**Australia**
Sales, 2000-15	528611	255295	279346	176623	160466	17186	1417527
GWh BAU	60769	26323	46517	20923	27977	10780	193289
GWh MEPS	55309	24655	43213	19042	25853	10121	178194
GWh saved	5460	1667	3304	1881	2124	659	15095
NPV$M saved[a]	174	59	90	65	73	20	480
NPV$M costs[a]	29.2	14.1	15.4	9.8	8.9	0.9	78.3
kt CO_2-e saved	4785	2189	3259	1939	2048	420	14640
kWh saved/unit[b]	10329	6532	11827	10649	13236	38373	10649
NPV$ saved/unit[b]	329	230	321	368	457	1137	339
% energy saved	9.0%	6.3%	7.1%	9.0%	7.6%	6.1%	7.8%
Saving/cost[a]	6.0	4.2	5.8	6.7	8.3	20.6	6.1

(a) NPV at mid-2000, at 10% discount rate (b) Over 15 year operating life

4.2 Industry, Competition and Trade Issues

The previous section examined the costs and benefits of the MEPS option from the perspective of airconditioner buyers and users. It was assumed that all compliance costs incurred by suppliers are eventually passed on to buyers in the normal course of business, so for the purposes of cost-benefit analysis the cost impact on suppliers as a group is neutral. However, it is likely that some suppliers will be more affected by the MEPS option than others. This section considers the impact on firms, with respect to both domestic and international competition.

Effects on suppliers

About 20% of the units sold on the Australian market are locally manufactured (although the compressors at least, and often other major components, are imported). The other 80% of units are fully imported.

Firms have a range of response options in the event that their products fail the MEPS level. An importer can request the supplier to improve the design, to substitute a more efficient model from the supplier's range, or - if the importer is not tied to a particular brand – it could change suppliers. Airconditioners are manufactured in all developed countries and many of the developing countries in the Asia-Pacific region, and are freely traded, particularly the smaller sizes up to about 18 kW. It is not difficult to source product of different price and efficiency levels, given reasonable notice.

If the product is locally made, the manufacturer will usually have a range of options to improve its energy efficiency without basic redesign, including:

- larger heat exchange surfaces;
- higher performance pipework and heat exchange materials;
- more efficient compressors (manufacturers purchase from international suppliers who offer a wide range of efficiencies);
- improved controls.

In fact, carrying out a physical test or a computer simulation to determine a product's capacity and EER will often reveal any obvious shortcomings of the design. The University of NSW, which carries out the testing of products for the AREMA Directory, concluded that:

> "Early indications are that the removal of models as a result of any reasonable "low-level" MEPS is an unlikely outcome. A large proportion of the least efficient models suffer from design shortcomings that are relatively easy to identify and inexpensive to rectify. The physical testing and/or simulation regime could assist the manufacturers of the less efficient models to improve their designs so that they meet the required MEPS level." (Unisearch 1996)

Table 14 summarises the number of models of each brand listed in the 1996 and 1999 AREMA Directories that would pass or fail their designated MEPS levels. A to O represent "branded products" - imported or locally made – supplied by AREMA members. Group P comprises the "dummy models" with averaged characteristics representing the products of non-members of AREMA for the purposes of modelling costs and benefits. It is not known how closely the characteristics of Group P models approximate the products of non-members of AREMA, which are estimated to account for 15-20% of total sales.

The main points from Table 14 are:

- Between a fifth and a quarter of branded models fail to comply with MEPS;
- Of the 15 brands appearing in either the 1996 or 1999 AREMA Directory, 6 had fully complying models in one or other year. (No brand showed fully complying models in both years, but that could be due to changes in the brands listed);
- 3 brands had high (>60%) non-compliance rates in one or both years. Two of these were import brands;
- 6 brands had low to moderate non-compliance rates in one or both years;
- Of the 8 brands with entries in both directories, 6 had a lower share of non-complying models in 1999 than in 1996;
- The impact on brands with wholly or predominantly locally made products is somewhat higher than the impact on brands with wholly or predominantly imported products (although only 1999 data are available).

This suggests that the impact of the proposed regulations is moderate overall, relatively widely spread, but difficult to predict for specific firms, since the model range changes.

Table 14 Estimated number of models affected by proposed MEPS regulations

	From 1996 AREMA Directory				From 1999 AREMA Directory			
Brands	Models	Number passing	Number failing	% failing	Models	Number passing	Number failing	% failing
A	63	57	6	10%	32	29	3	9%
B	24	1	23	96%	NA	NA	NA	NA
C	40	40	0	0%	37	32	5	14%
D	51	42	9	18%	74	71	3	4%
E	57	52	5	9%	NA	NA	NA	NA
F	70	27	43	61%	29	9	20	69%
G	71	60	11	15%	24	24	0	0%
H	43	36	7	16%	17	17	0	0%
I	8	8	0	0%	NA	NA	NA	NA
J	30	25	5	17%	NA	NA	NA	NA
K	9	3	6	67%	12	7	5	42%
L	9	5	4	44%	9	5	4	44%
M	NA	NA	NA	NA	9	9	0	0%
N	NA	NA	NA	NA	53	33	20	38%
O	NA	NA	NA	NA	24	24	0	0%
P	62	26	36	58%	62	26	36	58%
All products	537	382	155	29%	382	286	96	25%
All branded	475	356	119	25%	320	260	60	19%
Wholly or predominantly local manufactured brands					131	103	28	21%
Wholly or predominantly import brands					189	157	32	17%

Figure 6 Model EER in relation to proposed MEPS level (scatter plot)

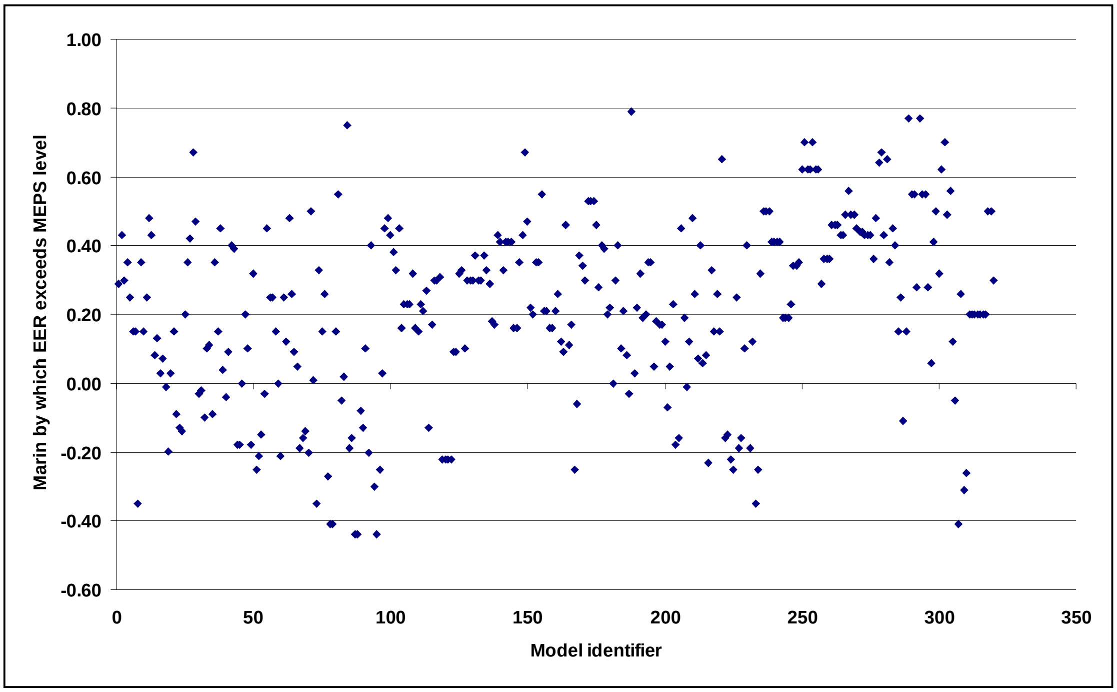
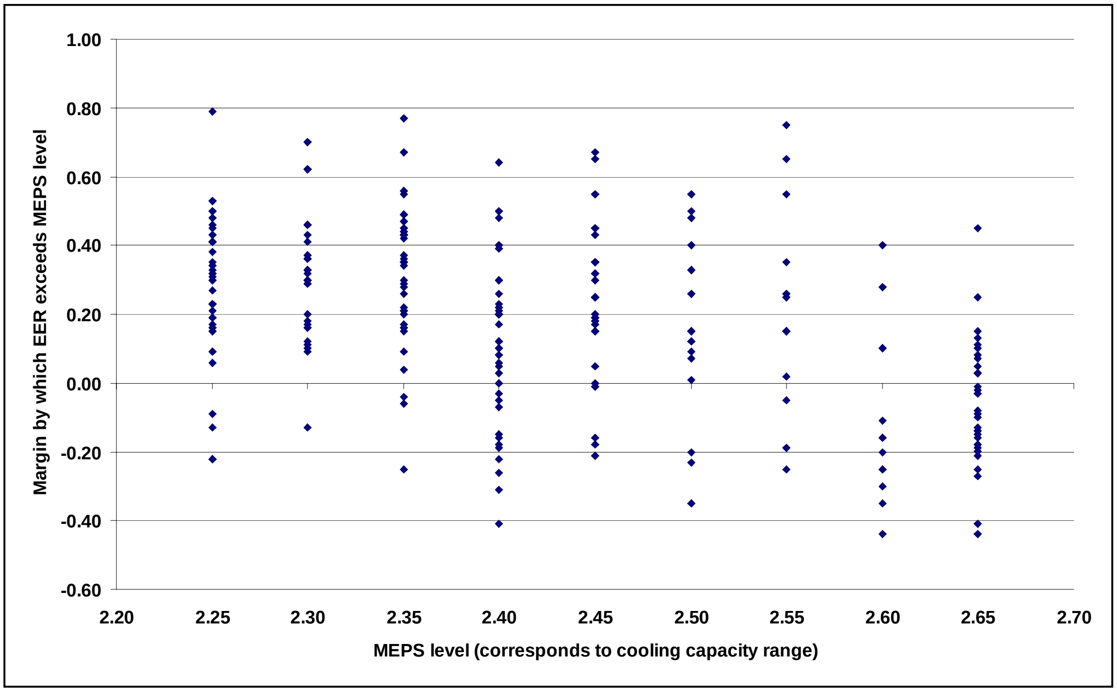


Figure 7 Model EER in relation to proposed MEPS level (by MEPS level)



The number of non-complying models is not the only indication of the impact of MEPS on suppliers: the extent of non-compliance also indicates the burden on industry. Analysis of the 1999 AREMA directory indicates that, for branded products, the extent of non-compliance is generally small. Figure 6 and Figure 7 illustrate the margins by which the EER of each model exceeds (positive values) or falls short of (negative values) its proposed MEPS level. Figure 7 indicates the spread at each MEPS level, which is in effect the spread at each capacity range. There is no information on the extent of non-compliance in the models not included in the AREMA directory, but it is likely to be greater.

Effects on supplier competition

Those suppliers with a higher numbers of non-complying models will clearly need to spend more on product testing and improvement than those with few or no non-complying models. Therefore the cost impact will fall most on the least efficient products, which tend to compete against each other rather than with the higher cost, more efficient products.

It is possible that one or more smaller firms might find the cost of compliance so onerous that it is forced to withdraw from the market. This is most likely to be the case for very small manufacturers, and importers who operate on an irregular or opportunistic basis, eg those that bring in containers of airconditioners from time to time. Such firms are likely to employ relatively few workers and be located in the capital cities where the industry is based. The impacts on regional areas or areas of high unemployment is likely to be small – although this cannot be known until there is a complete register of the efficiencies of all models of all brands.

Given the size and flexibility of the industry, there is not likely to be any significant reduction in supplier or price competition even in the event of the withdrawal of some smaller firms.

One aspect of the mandatory MEPS option could enhance competition by helping to overcome information failure. The output capacity and energy efficiency of all products, determined for the first time under common same test criteria, can be made available to the public if governments make the product register information public, as is the case of household appliances. Products will thus be comparable on a consistent basis, so ending a practice that has been pervasive in the industry: the tendency by some suppliers to mis-state or exaggerate product characteristics.

Effects on product and fuel competition

The mandatory MEPS option is likely to lead to a small increase in the average price of packaged air conditioners. This could place airconditioners at some disadvantage against competing products not subject to MEPS. However, there are no direct competitors to packaged air conditioners in their cooling mode. Evaporative coolers are used in commercial applications in some arid areas, but unsuitable in coastal areas, and for many building types, so the extent of actual competition is limited. Evaporative coolers are already so much cheaper to purchase than refrigerative airconditioners that small price shifts are not likely to have any impact on the market.

An increase in average purchase price may see the installation of fewer airconditioners, or a reduction in the market share of heat pump units (if buyers respond to higher product costs by forgoing this feature, even though there is only a small cost increment involved). If so, there may be small increase in the use of alternative means of heating, in particular electric resistance heating (which would have higher costs and emissions per unit of useful energy) or natural gas (which would have lower costs and comparable emissions).

GATT issues

One of the requirements of the RIS is to demonstrate that the proposed test standards are compatible with the relevant international or internationally accepted standards and are consistent with Australia's international obligations under the General Agreement on Tariffs and Trade (GATT) *Technical Barriers to Trade* (GTBT) Agreement. The relevant parts of the GTBT *TECHNICAL REGULATIONS AND STANDARDS Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies* are addressed below.

The regulations would apply equally to imports and locally manufactured products, and so do not discriminate against imports.

It is a particular concern of the GTBT that where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations.

Australia has taken a lead role in APEC moves to harmonise test procedures and standards for air conditioners (APEC 1999b). The capacity and energy test procedures and conditions in AS/NZS 3823.1 are fully consistent with, and in some cases reproduced verbatim from, the most widely used international standards (Appendix 3). Since many countries have air conditioner test standards based on the same international models, it will be possible for many importers to use pre-existing test data.

With regard to the labelling requirements and MEPS levels in AS/NZS 3823.2, there are no international standards. With regard to AS/NZS 3823.3, there are no international standards but this part is based on widely used public domain software developed by US National Laboratories.

The GTBT urges GATT members to give positive consideration to accepting as equivalent the technical regulations of other Members, even if these regulations differ from their own, provided they are satisfied that these regulations adequately fulfil the objectives of their own regulations.

There may be scope for accepting the results of tests conducted in other countries under International Organisation for Standardisation ISO 5151, which is the model for AS/NZS 3832.1.[11] However, there is no scope for accepting a product that may comply with MEPS in its country of origin, even if it's EER was established using a test standard similar to AS/NZS 3823.1. Countries with airconditioner MEPS have set different levels according to their own requirements, except for the North America Free Trade Association (NAFTA) countries (Canada, Mexico and USA), who have agreed to harmonise MEPS levels.

In summary, the proposed regulations are fully consistent with the GATT *Technical Barriers to Trade* Agreement, and follow international standards where possible.

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[11] There are minor differences between the forthcoming version of AS/NZS 3823.1 and the current ISO 5151, because AS/NZS 3823.1 anticipates changes which the ISO has agreed to incorporate in future revisions of ISO 5151. Any apparent discrepancies should disappear over time.

Other trade issues

There is a significant amount of trade in energy-using equipment between APEC economies. A study of trade in air conditioners, refrigerators, electric motors and lighting products found that air-conditioner trade among APEC economies was worth about US$ 3,000 – 3,300 million in 1996 (APEC 1998).[12] Window/wall air conditioners represented about 40% of the value of trade, and other types (split system and ducted types) about 60%.

The value of Australia's airconditioner imports and exports in 1996 given in the APEC study is summarised in Table 15. This covers all capacities, and much of the trade by volume will be products less than 7.5 kW, which do not fall within the scope of MEPS.

Most airconditioner trade is affected in some way by minimum energy performance standards (MEPS) and energy labelling programs. Imports into APEC economies that have mandatory MEPS and/or labelling programs for airconditioners accounted for 76% of the value of intra-APEC air conditioner trade. If economies with voluntary programs are included, then more than 95% of intra-APEC air conditioner trade is destined for economies with MEPS and/or labelling programs. Table 16 indicates the APEC countries which have, or are planning, MEPS for air conditioners - although generally for lower capacity units than under the proposed regulations.

Table 15 Value of airconditioner trade, 1996

	Imports, by value (1996 US $M)				Exports, by value (1996 US $M)			
	W/wall	Other	Total	%	W/wall	Other	Total	%
Brunei						0.1	0.1	0.3%
Canada		0.1	0.1	0.1%				
Chile						0.1	0.1	0.2%
China	0.2	0.6	0.9	0.7%	0.0	0.8	0.8	2.6%
Hong Kong	0.0	0.7	0.7	0.5%	0.4	2.8	3.2	10.1%
Indonesia	0.0	0.6	0.6	0.5%	0.1	0.5	0.5	1.6%
Japan	1.9	24.2	26.2	20.0%		0.0	0.0	0.0%
Korea	6.5	4.0	10.5	8.0%	0.1	0.4	0.5	1.5%
Malaysia	7.4	12.9	20.3	15.5%	0.6	0.6	1.2	3.7%
Mexico	0.0	0.1	0.1	0.1%				
New Zealand	0.6	3.2	3.8	2.9%	0.8	3.9	4.8	15.0%
Papua New Guinea					0.3	1.3	1.6	5.1%
Philippines					0.0	0.7	0.7	2.3%
Singapore	1.0	1.6	2.6	2.0%	0.7	1.9	2.5	8.0%
Taipei	6.5		6.5	5.0%	0.0		0.0	0.0%
Thailand	10.5	17.3	27.8	21.3%	0.3	3.1	3.4	10.8%
USA	1.5	6.4	7.9	6.0%	0.2	1.0	1.2	3.8%
Total APEC	**36.2**	**71.8**	**108.0**	**82.6%**	**3.6**	**17.1**	**20.6**	**65.1%**
Non-APEC	**13.7**	**8.9**	**22.7**	**17.4%**	**1.1**	**10.0**	**11.1**	**34.9%**
World	**49.9**	**80.7**	**130.7**	**100.0%**	**4.6**	**27.1**	**31.7**	**100.0%**

Source: APEC (1998)

[12] Motors trade was worth US$ 2,500 – 3,000 million, refrigerator and freezer trade US$ 1,000 – 1,100 million, discharge and fluorescent lamps US$ 400 – 600 million and ballasts for discharge lamps US$ 500 – 600 million. The study was carried out before Peru, Russia and Vietnam joined APEC.

A traded product must comply with mandatory requirements in all the markets where it is sold, and the authorities in each market will usually ask for evidence that it does so. This means that an airconditioner exporter may need to have each model tested several times to demonstrate that it complies with the MEPS requirements in all the markets where it is sold and that the information on the energy labels in each market is correct. The exporter (or its local representative) will also have to ensure that each product carries the correct energy label for that market.

Table 16 APEC Economies with Air Conditioner Energy Efficiency Programs

Economy	Comparison label	Endorsement label	MEPS	Other
AUSTRALIA	M(1987)	V(AREMA)	UC(2001)	
CANADA	M		M(1995-98)	Province MEPS
CHINA		V(2000)	M (1989)	
HONG KONG, CHINA	V(1996,97) M(UC)		M(UC)	
JAPAN				TEPS (2004-7)
KOREA	M		M(1996,99)	
MALAYSIA			M(UC)	
MEXICO	M(1995,98)	V(1997)	M(1995,98)	
NEW ZEALAND	V(1987) M(UC)		M(UC)	
PHILIPPINES	M(1994)		M(1994)	
RUSSIA			M(1986)	
SINGAPORE		V(1996, 1998)	M(1996)	
CHINESE TAIPEI	UC	V	M(1991)	
THAILAND	V(1995) M (UC)		M(UC)	
UNITED STATES OF AMERICA	M	V	M(1990-95)	
VIETNAM	V(UC)		V(UC)	

M = Mandatory, V = voluntary, UC = Under Consideration. TEPS = Target energy performance standards. Dates given are actual/proposed implementation or latest/next revision.

The cost and time needed to comply with different energy efficiency programs can add significantly to the cost of traded air conditioners, and can constitute a barrier to trade. The cost-effectiveness of energy efficiency programs for APEC economies as a group would be higher if the compliance costs for traded air conditioners were minimised. This would be so if the following conditions were met:

- All economies defined air conditioner product classes in the same way;
- All markets had identical MEPS requirements (eg expressed as minimum EER) for each product class;

- All authorities accepted the same energy test results as proof of compliance with the MEPS requirements;
- All energy labels were identical, so that the one label could be placed on the product as it left the factory, irrespective of where it was ultimately sold.

These conditions are not likely to be met in the near future. However, there are several practical options for reducing energy program compliance costs, to the benefit of all countries participating in airconditioner trade. In late 1999, APEC initiated work on reducing differences between airconditioner test regimes (APEC 1999b). The proposed regulations may have some impact on the source countries for airconditioner imports. It is likely that all products originating in Japan, Korea, USA, Canada and Mexico, which have more stringent MEPS levels, will comply, but some other products may not.

With regard to airconditioner exports from Australia, it is possible that the need to comply with domestic MEPS may increase the price of some products. However, it may be open to suppliers to use increased energy efficiency to gain some competitive advantage in the export market. As more countries adopt MEPS and MEPS levels increase, any competitive disadvantage from bearing testing and compliance costs should diminish.

The Trans-Tasman Mutual Recognition Agreement (TTMRA) states that any product that can be lawfully manufactured in or imported into either Australia or New Zealand may be lawfully sold in the other jurisdiction. The New Zealand government is currently considering implementing MEPS for a range of products, including packaged air conditioners. If so, the NZ MEPS would have the same basis as the proposed Australian MEPS, ie AS/NZS 3823.[13] If Australia implements MEPS and New Zealand does not, it may be necessary to obtain exemption from TTMRA to prevent the possibility of non-complying products being imported via NZ. ANZMEC has previously endorsed TTMRA exemptions for the Australian mandatory energy labelling program and for household appliance MEPS.

Comparison with overseas MEPS

The proposed MEPS are not expected to reduce import competition in Australia even though airconditioner energy testing in nearly all countries, including Australia is based on the same international standards (ISO 5151). Comparisons with MEPS regimes in other countries is difficult, for a number of reasons. In the first instance, some MEPS regimes apply to cooling performance only (eg Korea), some set separate levels for cooling and heating (eg Canada), while others set MEPS as an average of both (eg Japan).

The categorisation of products for MEPS purposes is also different. The proposal for Australia is a capacity-related categorisation, irrespective of type. In other countries both type and capacity categories are used, and the capacity ranges tend to vary from country to country (except for the three NAFTA economies, where most elements of airconditioner MEPS have been harmonised). The maximum cooling capacity to which MEPS applies is 73 kW in the USA and Canada, but only 10.5 kW in Korea

[13] Energy Efficiency and Conservation Authority, New Zealand (Personal communication, June 2000).

and about 8.5 kW in Taiwan (where the scope is actually defined in terms of electrical power, rather than cooling capacity). A particular difficulty is comparison with Japan, where the market is dominated by “inverter” products which have a DC motor to achieve variable compressor speeds.

Table 17 indicates the comparable MEPS levels for those countries with which direct comparisons are possible, ie the product technology is similar and the MEPS are expressed as single minimum EER values.

Table 17 Comparison with overseas MEPS levels

Country and year of implementation	Cooling capacity range (kW)	Minimum EER range (w/w)	Corresponding Minimum EER range: Australian proposal(b)
Canada (Jan 1999)	19-40	2.60 – 3.07 (a)(c)	2.45 – 2.60
	40 - 73	2.43 – 2.81 (a)(c)	2.60 – 2.65
Korea (Jan 1997)	< 10.5	2.56	2.25 – 2.30
Mexico (Jan 1996)	5.9 - 10.5	2.40	2.25 – 2.30
USA (Jan 1995)	19-40	2.61	2.45 – 2.60
	40 - 73	2.49 (c)	2.60 – 2.65

Source: APEC (1999) (a) Values within this classification vary with product type. (b) Values within classifications vary with product capacity. (c) Also subject to heating MEPS.

For products up to 40 kW, the proposed Australian levels are in all cases less stringent than the corresponding values in other MEPS regimes. For products over 40 kW, the proposed Australian levels are more stringent than the current US levels (which were implemented in 1995) but fall within the range of the Canadian levels (implemented in 1999). However, both Canada and the USA apply heating MEPS levels to these products as well, whereas the Australian proposals apply to the cooling function only. In this respect, compliance is somewhat less onerous under the Australian proposal.

Conclusions with Regard to Competition

The MEPS option would have some impact on the competition between suppliers, since the suppliers of less efficient products would need to incur development costs that the suppliers of more efficient products need not incur (or rather, have already incurred).

The available market data suggest that

- the compliance costs for *brands* that are wholly or predominantly locally manufactured may be somewhat higher than the costs for brands that are wholly or predominantly imported;

- the number of models and suppliers may be affected to some extent after the introduction of a MEPS;

- airconditioners are not subject to direct competition from other fuel and technology options with respect to cooling, but to there could be some effects on fuel/technology competition with respect to heating;

- the above effects are likely to be very small and have little effect on price and supplier competition, or the competition between imports and local manufactures.

4.3 Targeted and Voluntary MEPS

Targeted MEPS

The provisions of Standard AS/NZS 3923 that would be made mandatory by the proposed regulation are reviewed below, to determine whether they are in fact necessary to achieve the objectives of the regulation. If this is not the case, the proposed regulation would need to be targeted more narrowly to avoid introducing unnecessary requirements.

The issues examined in relation to the Standard are: maximum cooling test, registration, check testing procedures, permanent marking, performance simulation option, labelling option and limitation of scope.

Maximum Cooling Test

The existing labelling and MEPS requirements for household products include some performance requirements to ensure that product are not engineered to obtain a high rating on the energy test at the cost of a reduction in performance, which buyers will not be aware of until after purchase. The inclusion of the maximum cooling test as a mandatory requirement protects consumers against a deterioration in product function.

Registration

It might be feasible for suppliers to satisfy themselves that their products meet the MEPS provisions in the Standard, but not notify or register that information with any party. Historically, the administration of the household appliance labelling and MEPS program has been based on State-level registration. A product for which mandatory energy labelling is required can only be lawfully sold in a State or Territory if an energy label is registered for it in that or another State or Territory. All jurisdictions recognise each other's registrations. NSW, Victoria, Queensland and SA maintain an active registration capability, but the other States and Territories do not. The fees are fairly modest, last for 5 years and are renewable.

Applications for registration must be accompanied by copies of the energy test results. This provides some initial quality control over the testing, and errors are often picked up at this stage. Registration is also required for products where MEPS applies but not labelling, currently only water heaters.

These provisions increase the likelihood that suppliers will test their products accurately and ensure the veracity of statements about capacity, efficiency and other aspects of product performance. There have been some instances of "compliance shopping" where some suppliers have registered products in States with apparently lower standards of initial scrutiny, but if problems are detected in check testing, the other States apply pressure to withdraw or modify the registration.

For airconditioners, the alternative to registration would presumably involve a form of self-certification. The responsible authority would decide whether to conduct random checks, or to act only if suspected non-compliance were brought to its attention. If non-compliance were proven, the authority would need to take action against the supplier and require the modification of the product, its withdrawal from the market, or a change in energy label if the supplier has labelled inaccurately but the product still meets MEPS.

Compliance under a self-certification regime is not likely to be as high as under a registration regime. The possibility of deregistration is a powerful sanction against a supplier, and has been found in practice to promote compliance.

One area where registration has clear advantages is in the preparation of guides listing all labelled products, and in program monitoring. The Australian Greenhouse Office website has a complete register of labelled products to assist consumers. The AGO also carries out an annual tracking survey which matches sales to registrations to allow calculation of sales-weighted energy efficiency trends. These data are used for purposes such as cost-benefit modelling of enhanced MEPS levels. Without registration, the responsible authority would not even necessarily know about the existence of a product unless it was brought to its attention.

On balance, the requirement for mandatory registration is not onerous for suppliers, and is of considerable value for administration of the regulation and for obtaining information for consumers which would not otherwise be accessible.

Check testing procedure

Governments currently have a random check testing program for registered energy labels. If the results indicate that the efficiency is lower than the registered value, by more than a specified tolerance margin, further testing is undertaken. If this confirms the variance the original label registration is withdrawn and the supplier must register a new label indicating the lower efficiency. The supplier must also ensure that all units displayed for sale from that point must carry the new label, not the old one.

For products where energy performance must be registered to demonstrate MEPS compliance, the ultimate consequence of a failure to meet MEPS on check testing would be deregistration, which means that the product can no longer be lawfully sold in Australia. Given the commercial importance of this, it is in suppliers' interests that the procedures for check testing form part of the regulations, so that both governments and suppliers are clear about the tolerance margins that will apply.

Permanent marking

A permanent mark on the compliance plate (which is fixed to every unit in any case) to the effect that the product complies with the MEPS requirements in AS/NZS 3823 Part 2 assures buyers about product performance and reinforces the incentive for supplier compliance, in that deliberate mis-statements would contravene the Trade Practices Act. The mark is not coupled to the registration process – there is no reference to a registration number – so the requirement would not cause delay in the introduction of new models. On balance, this requirement is useful although not essential. The costs to suppliers is negligible..

Performance simulation option

This is not an essential requirement for the introduction or enforcement of MEPS, which could be based on physical testing alone. However, there are only three laboratories in Australia capable of testing airconditioners, so reliance on physical testing alone could create difficulties during the introduction phase for Australian manufacturers, who do not have access to laboratories in other countries.[14]

The costs to suppliers of carrying out simulations is also lower than the costs of physical tests, although some initial investment in software and training is required.

The retention of the simulation option (by allowing cross-reference to Part 3 of the Standard) is therefore in the interests of suppliers, and will help reduce compliance costs.

Labelling option

At present, energy labelling is mandatory for airconditioners within the scope of AS/NZS 3823 up to 7.5 kW cooling capacity, irrespective of whether they take single-phase or three-phase power. However, there are very few 3-phase models of less than 7.5 kW capacity. Conversely, there are very few single-phase models above about 9 kW capacity.

The proposal to base labelling requirements on mode of power supply rather than cooling capacity was suggested by the industry. It makes it easier for a supplier to determine whether a product will be liable for labelling during the development stage, when the final output capacity is yet to be confirmed.

A power supply phase criterion also make it easier for suppliers to determine whether a product will be liable for MEPS, and unless the same boundary criterion is applied to labelling there could be a region where some products are subject to neither labelling nor MEPS, and so may enjoy an unfair competitive advantage over models of slightly higher and slightly lower capacity.

The change in criterion is likely to lead to a slight increase in the number of airconditioner models liable to mandatory labelling. However, if the 7.5 kW cooling boundary were retained then these additional single-phase units would be subject to MEPS, and so would have to be tested and registered in any case. The benefit to both suppliers and program administrators of adopting a clearer boundary definition is significant, and would outweigh the small additional costs of physically labelling more units.

The Standard also imposes a requirement that if a supplier of a three-phase product *chooses* to label, then all the labelling requirements apply, ie suppliers cannot use a different label format, avoid registering the label or be exempt from check testing. This is clearly necessary to maintain the integrity and credibility of the label.

[14] The laboratories are at the University of NSW in Sydney, the University of SA in Adelaide and VIPAC Engineers and Scientists Ltd in Melbourne. After the initial startup period, the laboratory capacity may be adequate for the normal rate of new model introduction.

Limitation of scope

The only area where the proposed regulation could benefit from targeting – ie departing from the text and scope of AS/NZS 3823 Parts 1,2 and 3 – is with regard to the maximum capacity of three-phase products liable to MEPS. The Standard specifies a maximum of 65 kW cooling. However, that the maximum capacity that can be physically tested in Australia is currently 50 kW. This present the following options to governments, who are responsible for compliance monitoring:

- Arrange for at least one laboratory to increase its physical testing capability to 65 kW units; and

- Limit the scope of the regulation to 50 kW until such time as for the time as the enhanced capability become available.

Otherwise, it would not be possible to determine MEPS-compliance for products over 50 kW which do not meet the criteria for performance simulation (see Table 22), and even for products over 50 kW which can simulated, it would not be possible to carry out the full check testing procedure, which relies on physical testing as a backup.

Voluntary MEPS

Under a voluntary MEPS regime, product suppliers would incur the costs of changing their model range to eliminate less efficient models and introduce more efficient models sooner than they would otherwise have done.

Suppliers would presumably only take such action if there were commercial incentive for them to do so. Such incentive might perhaps come from the industry association. If suppliers considered membership of the association a commercial advantage, and the association perceived adoption of MEPS to be in the collective interest of all suppliers, it may be feasible for the association to urge or require its members to adopt some level of MEPS.

However, this does not appear to be the case with the airconditioner industry. Following consultations with suppliers, Unisearch (1996) reported:

> "There is some tension between AREMA, whose membership consists mainly of the larger and medium companies, and the smaller firms in the industry. Apart from resistance to the costs of AREMA membership, the smaller companies have also shown resistance to the AREMA certification program. The reasons include reservations about preserving the confidentiality of the designs of products submitted for testing, and in some cases a perception that the program would limit the kind of product performance claims they are in the habit of making**…**
>
> Because of these tensions between AREMA members and non-members it was recognised - by AREMA as well - that the proposed PAC energy efficiency program should be developed as a government rather than an AREMA program."

Alternatively, an incentive for voluntary adoption of MEPS might conceivably come from customers. Voluntary compliance might be commercially advantageous for suppliers if buyers thought that MEPS compliance was a desirable product attribute. Since airconditioner customers as a group give energy efficiency a low priority, a proprietary "MEPS compliance mark", or use of the Standards Australia compliance mark would have little value to customers unless it were very heavily promoted.

Experience with the energy rating label suggests that government endorsement gives value and credibility, so it may well be less costly for governments to promote a MEPS compliance mark to a given level of public awareness and acceptance than for industry associations or standards bodies, and certainly less costly than for individual firms.

There have been instances of successful introduction of compliance marks with the support of government or other agencies. The US Environment Protection Agency introduced the *Energy Star* label, initially for office equipment, in the early 1990s. The label now has high recognition in the USA and low to moderate recognition in Australia (GWA et al 1996). Most office equipment suppliers have products that qualify for the label. However, the greatest force for compliance was the decision of the US Government, the single largest corporate purchaser of office equipment in the world, to give tender preference to qualifying products, so establishing a form of "Government MEPS". This is clearly only feasible for products where government represents a large proportion of the market. This is not the case with airconditioners. The costs of establishing and supporting a compliance mark without government purchase leverage would be substantial, and would add significantly to the overall costs of the MEPS program.

Another possible means of establishing a form of voluntary MEPS might be for government to directly meet the costs of increasing the efficiency of sub-MEPS products to the target level. Unisearch (1998) considered this option.

> "It is conceivable that suppliers with sub-MEPS models might voluntarily undertake to make the improvements necessary for those models to meet a given MEPS if there were strong incentives, eg if financial support for the necessary reengineering were available. If the program were to rely on the availability of such support for voluntary implementation, it would raise the issues of:
>
> - the financial support would certainly not come from other suppliers, so the Government would have to meet the costs, either from general revenue or some form of special levy on PAC purchasers;
> - there would be little incentive to manage the costs of product changes (which on our estimate should be low) and every incentive to overstate them to take up whatever level of support might be offered;
> - the lesser beneficiaries and non-beneficiaries of such support (ie those who have most or all of their products already meeting the MEPS level) would feel justifiably aggrieved that their competitors were being rewarded for not having invested in product development.

> Given these drawbacks the only practical form of implementing MEPS for PACs is by mandatory means. This would give affected suppliers every incentive to minimise the costs of product changes and would place all suppliers on an equal footing."

As Table 16 shows, 9 of the 10 APEC economies which have implemented MEPS for airconditioners have done so via regulations. The exception is Japan, where sales of models of lower efficiency are permitted so long as the sales-weighted average for each manufacturer exceeds the required value. Monitoring compliance requires considerable information and cooperation from the suppliers (APEC 1999b). The penalties for non-compliance include both publicity and fines, but publicity is apparently the more powerful sanction in Japan. This arises from conditions which do not apply in Australia - a close historical relationship between government and industry that extends to a willingness to share confidential sales data, and the acute sensitivity of corporations to adverse publicity.

There is no working example of a voluntary MEPS program for airconditioners anywhere in the world, and there is no reason to believe that voluntary MEPS would be effective in Australia. On the contrary, it is likely that compliance would be low, and possibly negligible unless governments met the promotional costs of raising consumer awareness of energy issues and/or underwriting recognition of a MEPS compliance mark.

While energy cost savings under a voluntary MEPS scenario would be lower than in a mandatory one, average product costs should also be lower, in that consumers would still be free to prefer less efficient, and presumably less costly products. Program costs such as publicity and market monitoring (to determine whether MEPS was having any impact on the market) would be much higher, since there would be no central register of products.

The product range and the extent of competition in the market may ultimately be no different under a mandatory or a (successful) voluntary regime. If a high level of voluntary compliance were achieved, suppliers may rationalise their product ranges and reduce inventory costs by withdrawing non-compliant models. This occurred with the quasi-voluntary WaterMark labelling program for electric water heaters in NZ (Energetics and GWA, 1994).

In short, it appears that:

- The chances of a successful voluntary implementation of MEPS appears remote; and
- if a voluntary MEPS program could be implemented successfully, the ultimate outcome for competition and consumer choice may be similar, but obtained at a far higher program cost.

Under voluntary implementation, the outcome would be uncertain for several years, so the risk that the program would fail to contribute sufficiently to national greenhouse gas reduction objectives would be high.

5. Consultation

COAG Guidelines:

- ***Consultation:*** *a RIS must outline who has been or will be consulted, and who will be affected by the proposed action. On a case by case basis, this may involve consultation between departments, with interest groups, with other levels of government and with the community generally.*

5.1 Consultations

The issues related to energy efficiency programs for air conditioners generally, and MEPS in particular, have received considerable exposure over the last 6 years.

Chronology of previous reports and consultations

April 1994	Packaged air conditioners identified as one of the products potentially suitable for MEPS and/or labelling, in Energetics 1994.
March 1995	DPIE holds meeting in Sydney to discuss issues related to air conditioners. Attended by representatives of AREMA, 4 suppliers electricity utilities, professional and standards associations and governments.
February 1996	Unisearch organises meeting in Sydney to discuss proposed MEPS program. Principles of "low-level" MEPS discussed, but actual levels not yet determined. Attended by representatives of AREMA, 19 suppliers (out of 65 invited).
March 1996	Unisearch reports to DPIE on changes affecting the air conditioner market since 1994, and on feedback from industry meetings.
June 1998	Unisearch reports to DPIE on energy efficiency program for air conditioners, including recommended MEPS levels and information disclosure provisions.
November 1999	Mechlab reports to AGO on proposals for revision of AS3823 Part 2 and a new Part 3 to give effect to recommended MEPS levels and option of computer simulation testing.
March 2000	Standards Australia issues drafts of new AS/NZS 3823 Part 1.2, revised AS/NZS 3823 Part 2, new AS/NZS 3823 Part 3. Comment period closed 30 April 2000.
March 2000	Before preparing the draft RIS, the GWA presents issues paper (GWA 2000) to a steering group comprising members of AREMA.
August 2000	Preliminary draft RIS circulated to AREMA members. GWA presents preliminary findings at AREMA meeting

In addition, there have been several meetings between representatives of AEEMA, officers of AGO, NAEEEC and the consultants involved in developing the energy efficiency and MEPS programs – at various times Unisearch, Mechlab and GWA.

Proposed consultations

The following further consultations are planned between early October and mid November.

- When the draft RIS is completed, the AGO will send out copies to known interested parties, advertise its availability, and hold public meetings in Sydney and Melbourne (and possibly Perth and/or Adelaide, if there is demand), probably in mid October, at which the consultant will make presentations.

- Written comments will be received up to the end of October.

- The consultant will review and address written comments received, propose responses, discuss them with the AGO and revise the final RIS as agreed.

5.2 Comments

Comments received prior to publication of draft RIS

Unisearch (1998) reported the following industry views, distilled from nearly four years of meetings and consultations:

> "There was support in the industry for a program which increases the tendency of customers to purchase more efficient products, since this could increase the value of the industry's sales. However, suppliers expressed the view that information (ie labelling) programs would have little impact given the market's lack of interest in running costs, and that only a mandatory standards program would be effective…
>
> False claims about product capacity are common; companies which state the cooling (or heating) capacity of their products according to the Australian Standard tend to be at a commercial disadvantage, since customers are under the impression that they are getting more for their money from suppliers who over-state capacity.
>
> There was strong support in the industry for measures which enforce a common basis for statements about capacity. This is the objective of the AREMA certification program, and it was recognised that a systematic PAC energy efficiency program would also have this benefit, provided that any test regime were cost-effective and fair…
>
> Many suppliers acknowledged that the energy efficiency of products on the Australian market is somewhat lower than for comparable products in the USA or Japan…
>
> It was said that the "efficiency gap" is often greatest for the products of the smaller local firms (although some of the local subsidiaries of US or Japanese firms acknowledged some differences between their local product range and the range in the home country).

> Some pointed out that the inherent energy-efficiency of the PAC is only one factor in the actual energy efficiency of a given air conditioning installation…While the energy consumption of any PAC installation is likely to be reduced if attention is paid to these factors, there was no suggestion that apparent differences in energy efficiency between models would be reversed: eg a model with a lower tested coefficient of performance (COP) will have a higher energy consumption in use, all else being equal."

Comment in recent consultations has concentrated on the implications and scope of the revised Standard, and how some product categories may be at a disadvantage (eg models which are designed to deliver through ductwork must use high power fans, which contribute to energy consumption and so reduce apparent efficiency). Some concern has also been expressed at the magnitude of the testing task for suppliers with large product ranges, even if they use simulation models, updated versions of which have only recently become available. The proposed MEPS levels themselves have not been questioned.

Comments on draft RIS

[This section will address comments received on the draft RIS]

6. Evaluation and Recommendations

COAG Guidelines:

- ***Evaluation:*** *there should be an evaluation of the relative impacts of the proposal and any alternatives, to show that the desired policy objective cannot be achieved at a lower cost to business and the community at large.*

6.1 Assessment

A summary assessment of the six alternatives considered in this RIS against the objectives of the mandatory MEPS option is given in Table 18.

Reduce greenhouse emissions below business as usual

The mandatory MEPS option is the only one for which the extent of likely reduction can be quantified, and the one where reductions have the highest probability of occurring. This conclusion is consistent with the findings of a number of studies of the scope for encouraging the supply and purchase of more efficient airconditioners in Australia (Energetics 1994, Unisearch 1996, Unisearch 1998; these are detailed in Appendix 2). All of these studies have recommended the adoption of mandatory minimum energy performance standards.

Address market failures

The mandatory MEPS option would address the market's lack of concern with operating costs by enforcing investment in more efficient products so that the total life cycle cost of air conditioning energy services to users would be lower than otherwise.

An efficiency-related levy on appliances could address the market failure by making the more efficient products cheaper than the less efficient, and so encourage their purchase by all buyers, including those concerned exclusively with capital cost. If such an option could be implemented – and there is no obvious legal or taxation mechanism - the cost to suppliers would be no lower, and the administrative costs higher than under the proposed regulations.

An emissions-related levy on electricity prices would be less effective than the efficiency-related levy on appliances, since it addresses running costs rather than capital costs. It would have economy-wide implications that are beyond the scope of the present analysis. Given that any decision to implement such a levy would need to be taken at the highest levels of Government, it is not considered a direct alternative to the proposed regulation.

Address information failures

One consequence of the mandatory MEPS option would be to put reliable data on the output capacity and energy efficiency of every airconditioner model in the public domain for the first time. Buyers could access this via the State government registers of products (assuming these are made public, as is now the case of household appliances) and via energy labels, where suppliers choose to take up the labelling option in the regulations. Some of the other options could also achieve this objective, though not necessarily as cost-effectively.

Minimise negative impact on product quality

None of the options are expected to have any significant effect on product quality or function (ie apart from energy-efficiency).

Minimise negative impacts on suppliers

The mandatory MEPS option would clearly require suppliers to withdraw, replace or improve non-complying products. The other options would have lower costs for suppliers to the extent that they were less effective in bringing about these outcomes. At the extreme, the voluntary MEPS option would have least impact on suppliers because it is unlikely that any would take it up.

Conclusions [Draft]

After consideration of the mandatory MEPS option and the provisions or the Standard in this RIS, it is concluded that:

1. The mandatory MEPS option is likely to be effective in meeting the stated objectives

2. None of the alternatives examined appear as effective in meeting all objectives, some would be completely ineffective with regard to some objectives, and some appear to be far more difficult to implement.

3. The projected monetary benefits of the mandatory MEPS option appear to exceed the projected costs by a ratio of about 6 to 1, without assigning monetary value to the reductions in CO_2 emissions that are likely to occur.

4. Given that the proposed MEPS levels have been in the public domain since June 1998, and issued in a draft standard in April 2000, the program could be implemented as early as 1 July 2001. Implementation in December 2001 would reduce the projected energy and CO_2 savings in the period to 2015 by about 9%.

Table 18 Assessment of alternatives against objectives

Objective and assessment criteria	A. Status quo	B. Mandatory MEPS	C. Targeted Regulatory MEPS[(a)]	D. Voluntary MEPS	E. Levy on Inefficient Appliances	F. Levy on electricity
Objective: Reduce emissions below BAU	No	Significant reduction projected (higher than in original studies)	Retention of supporting features in standard contributes to this objective	Extent of reduction uncertain – most likely far less than under proposed regulation	Extent of reduction uncertain – if funds raised go to other programs, they are not likely to be as effective as MEPS	Extent of any reduction uncertain
Address market failures	No	Yes – projected to reduce costs of air conditioning services	Retention of supporting features in standard contributes to this objective	Fails to address market failure; relies on raising consumer and supplier concern with energy	May address market failure, but large price differentials would be necessary to affect purchase decisions	Large price increase necessary to affect purchase decisions
Address information failures	No	Potentially – makes comparable data available, relies on regulators to disseminate	Retention of labelling option contributes to this objective	Needs agreement on data consistency – AREMA has had limited success with this so far	Potentially – makes comparable data available, relies on regulators to disseminate	Would help draw attention to running costs
Minimise negative impact on product quality	No effect	Maximum cooling test in Standard contributes to this objective	Retention of maximum cooling test contributes to this objective	No effect	No effect	No effect
Minimise negative impacts on suppliers	No effect	Most suppliers will have some non-complying models, so costs are fairly widely distributed. Costs of improving products likely to be moderate. Range of supplier responses possible.	Retention of check test procedures and option of (lower-cost) simulation contributes to this objective	Would minimise supplier costs, since few suppliers likely to opt in	Supplier costs no less than for mandatory MEPS. Administrative costs likely to be higher	Would minimise supplier costs
Other issues			Targeting scope of regulation to maximum 50 kW cooling recommended	True voluntary MEPS has not been successfully introduced anywhere in the world	No readily apparent legal means of raising the levy. At best, would be a form of non-mandatory MEPS with higher costs	Not a true alternative – decision does not rest with ANZMEC

(a) "Targeting" implies omission from regulation of the following elements: Maximum cooling test, Registration, Check testing procedure, Permanent marking, Performance simulation option (Part 3 of Standard), Labelling option.

6.2 Recommendations [Draft]

It is recommended that:

1. States and Territories implement the proposed mandatory minimum energy performance standards.

2. The mode of implementation be through amendment of the existing regulations governing appliance energy labelling and MEPS in each State and Territory.

3. The amendments should alter the schedules which currently require airconditioners to be labelled, to
   - extend the scope of the regulation to all airconditioners up to 50 kW cooling capacity
   - require compliance with all of Parts 1, 2 and 3 of joint Australian-New Zealand Standard AS/NZS 3823:2000 [on the proviso that the final Standard, to be published in October 2000, is consistent with the draft published in March 2000]

4. Governments investigate the costs and benefits of expanding airconditioner testing capability in Australia to units of 65 kW cooling capacity

5. Governments make the register of airconditioner model characteristics publicly accessible, so that prospective purchasers can compare their energy efficiencies.

7. Review

COAG Guidelines:

- ***Review:*** *there should be consideration of how the regulation will be monitored for amendment or removal. Increasingly, sunset provisions are regarded as an appropriate way of ensuring regulatory action remains justified in changing circumstances.*

Air conditioner MEPS would be implemented under the same State and Territory regulations as household appliance labelling and MEPS, and so subject to the same sunset provisions, if any. Victoria and SA have general sunset provisions applying to their labelling/MEPS regulations as a whole, while NSW has sunset provisions applying to the inclusion of some (but not all) items scheduled.

Once the States and Territories agree to mandatory requirements, their removal in any one jurisdictions would undermine the effect in all other jurisdictions, because of the Mutual Recognition agreements between the States and Territories (GWA 1999a). Under the cooperative arrangements for the management of the National Appliance and Equipment Energy Efficiency Program, States advise and consult when the sunset of any of the provisions is impending. This gives the opportunity for fresh cost-benefit analyses to be undertaken and consultation.

The Australian Standards called up in State and Territory labelling MEPS regulations are also subject to regular review. The arrangements between the Commonwealth, State and Territory governments and Standards Australia provide that the revision of any Standards called up in energy labelling and MEPS regulations are subject to the approval of the governments.

Therefore any proposal to make the MEPS in Part 2 of the standard either more or less stringent would need the cooperation of both the Standards bodies and of the regulators.

NAEEEC has foreshadowed consideration of raising the MEPS levels for packaged airconditioners to an EER of about 2.75, around current US levels (NAEEEC 2000). NAEEC has adopted the principles that there should be a MEPS "stability period" of at least 4 years, and that a cost-benefit analysis would be undertaken before any revisions are proposed (NAEEEC 1999). The earliest possible timing of any change to the MEPS regulations discussed in this RIS would therefore depend on date of their implementation. If they are implemented in July 2001, the earliest possible revision would be July 2005.

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Appendix 1 Energy Labelling for Airconditioners

Packaged air conditioners up to 7.5 kW cooling capacity have been included in the scope of the mandatory energy labelling program since 1986 (GWA 1999a,b,c). All models must be tested according to AS/NZS 3823. The test is carried out by installing a sample unit in a temperature-controlled room (a "calorimeter"), operating it at its maximum output under cooling conditions T1 (and also heating condition H1, if the unit is capable of heating). The following values are measured:

- The maximum cooling capacity when operating at cooling condition T1. This value is expressed in kW;

- The "energy efficiency ratio" (EER) when operating at cooling condition T1.[15] This is a dimension-less value (eg 2.25) indicating energy efficiency: the higher the value, the more energy-efficient.

For reverse cycle air conditioners the following are also measured:[16]

- The maximum heating capacity when operating at heating condition H1. This value is expressed in kW;

- The "coefficient of performance" (COP) when operating at heating condition H1. This is a dimension-less value (eg 2.25).

The energy label attached to each unit is required to carry the following information.[17]

- The kW maximum cooling capacity for that model

- The kW maximum heating capacity for that model (if applicable)

- The comparative energy consumption (CEC) for cooling: the kWh electrical energy consumed over one hour of operation at maximum cooling output (simply equal to the rated electrical power consumption at maximum cooling capacity);

- The comparative energy consumption (CEC) for heating, if applicable: the kWh electrical energy consumed over one hour of operation at maximum heating output (simply equal to the rated electrical power consumption at maximum heating capacity);

- The kWh electrical energy consumed over one hour of operation at maximum heating output, if applicable (ie simply the heating output divided by the COP).

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[15] The proposed revision of AS/NZS 3823 designated cooling COP as Energy Efficiency Ratio (EER), in line with US practice. However, the method of measurement and the units (kW output/kW electricity) are unchanged.

[16] For heating-only units, of which there are none on the Australian market, these are the only tests.

[17] The following refers to the new label format described in the forthcoming AS/NZS 3823.2:2000, which will apply to all new energy labels registered after September 2000.

- A cooling star rating index (SRI) calculated according to the formula

  SRI cooling = [(Tested average EER x 10) – 17]/3

- A heating star rating index (SRI) if applicable, calculated according to the formula

  SRI heating = [(Tested average COP x 10) – 20]/3

The SRIs are indicated graphically by the number of complete and half stars on the label.

All models are required to meet one additional performance requirement in order to qualify for an energy label – a “maximum cooling test” that indicates the model’s ability to continue to operate under extreme temperature conditions.

Appendix 2 Previous Studies of Air Conditioner Energy Efficiency Programs

A study was carried out in 1994 of the market conditions in Australia for mass-produced energy equipment which accounted for a large share of total energy use in the industrial and commercial sectors (Energetics 1994). After applying a number of evaluation criteria, the study concluded that market intervention was warranted, as a matter of priority, for electric motors, fluorescent lamps ballasts, packaged airconditioners and office equipment.

The scope of the air conditioner recommendations covered "split systems, cassette and ducted systems with motors of up to 18 kW", corresponding to cooling capacities of about 40 to 50 kW, depending on COP. The recommendations were:

1. "A minimum performance standard to be introduced to eliminate the bottom 15-20% of the market by volume of sales based on coefficient of performance (COP).

2. The program to be aligned with the Air Conditioning & Refrigeration Manufacturers Association (AREMA) labelling process which would ensure that all equipment at point of sale carried:

   - Standards compliance information
   - Information on the actual COP measured by standard test.

3. Measures to be taken to ensure that all packaged air conditioner advertising materials only quote efficiencies based on the standards test and carry a compliance mark.

4. An information program be introduced to show the benefits of selecting higher efficiency packaged air conditioners." (Energetics 1994).

In 1996 the then Department of Primary Industries and Energy (DPIE) commissioned a project to further investigate the scope of an energy efficiency program for packaged air conditioners. The first stage of the project reviewed the findings and recommendations in the Energetics (1994) study in the light of additional information and made new recommendations where appropriate. It reported:

> "The stakeholders contacted during this stage supported the general objectives of the proposed packaged air conditioner energy efficiency program. No stakeholders expressed the view that a program of the type proposed would harm the industry." (Unisearch 1996)

The first stage report made the following recommendations:

1. "that the scope of the proposed energy efficiency program for packaged air conditioners be redefined as all products in the range 7.5 to 65 kW cooling capacity;

2. that DPIE convey to Standards Australia the scope of the proposed energy efficiency program for packaged air conditioners, and request that Standards Australia take this into account in the further development of the Building Code of Australia;

3. that DPIE proceed with Stage 3 of this project" (Unisearch 1996).

Stage 2 of the project involved consideration of these recommendations by the Energy Management Task Force (EMTF), a committee of senior officers in the Commonwealth, State and Territory energy agencies, which reports to the Australian and New Zealand Minerals and Energy Council (ANZMEC).

The first recommendation recast the scope of the air conditioners program in terms of cooling product capacity rather than motor size. This is administratively simpler, since product specifications always include output capacity but do not always indicate motor capacity, and is the approach used in nearly all existing air conditioner energy efficiency programs in Australia and other countries. EMTF accepted the recommendation.

The second recommendation referred to proposals, then current, to amend the Building Code of Australia (BCA). There was an apparent risk that inconsistent requirements for air conditioner energy performance could emerge from these proposals. However, the BCA amendment process did not proceed at the time.[18]

EMTF accepted the third recommendation, and commissioned Unisearch (1998) to investigate detailed MEPS levels. The issues addressed in the study were:

- Cost/benefit of MEPS for PACs of 7.5 to 65 kW, mainly in commercial applications but, for the smaller size ranges, also in residential applications;

- Performance rating by calorimeter testing and computer modelling;

- Estimated energy savings and greenhouse gas reduction for a range of MEPS levels; and

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[18] The Building Code of Australia (BCA) is a national document that applies to all new buildings and refurbishments above prescribed sizes. It does not specify the performance of the services within buildings except those that directly affect health, safety or amenity. The only energy-related measures are found in Victoria and ACT additions, which specify minimum insulation levels and equivalent performance measures, expressed as Nationwide House Energy Rating Scheme (NatHERS) ratings.

The CSIRO has recently completed a study for the AGO of how energy provisions could be incorporated in the BCA (AGO 1999). The study concluded that "energy efficiencies leading to substantial greenhouse gas emissions abatement can be achieved by the inclusion of minimum energy performance requirements in the BCA."

The main recommendations for housing were that the building envelope should satisfy either a minimum star rating requirement using an acceptable rating tool, or elemental requirements covering insulation and glazing performance. The main recommendation for new non-residential buildings was that they satisfy system performance requirements for the building envelope, lighting and HVAC systems. It is likely that these measures will be pursued, but given the need for further research and the development of Australian Standards that can be referenced in the BCA, it may be 3 years or more before a revised BCA comes into force.

- Program implementation and administration.

The selection of MEPS levels were based on analysis of the market. Five potential MEPS regimes (called Cases 1 to 5) were developed, and analysed in relation to the following criteria:

- is the MEPS level likely to lead to worthwhile energy savings, in comparison with the “Business as Usual” projection (“Case 0” in which there is still some projected improvement in average PAC efficiency)?

- is the impact on the industry (in terms of the number of models to be redesigned to meet MEPS) acceptable?

- are the monetary benefits likely to outweigh the monetary costs?

- is the way the MEPS level is calculated for a given model likely to lead to confusion or ambiguity for suppliers, buyer or compliance monitors?

Five separate MEPS cases regimes were proposed and their likely energy savings, benefits and costs were investigated in detail (Table 19).

Table 19 Net Present Value of Projected Costs and Savings, Trial MEPS Cases

	Undiscounted		5% discount rate		10% discount rate	
Case	Costs $ M	saving $ M	Costs $ M	saving $ M	Costs $ M	saving $ M
1	52.7	1019	35.9	481	26.5	258
2	65.6	1548	47.6	731	37.2	392
3	51.6	1201	34.9	567	25.5	304
4	59.2	1485	41.8	701	31.8	376
5	63.7	1557	45.9	735	35.6	395

Source: Unisearch (1998)

The 5 regimes were found to have benefit/cost ratios in the range 19 to 25 for a zero discount rate and 10 to 12 for a discount rate of 10% (Table 20). There was some uncertainty in the cost of product re-design to meet the MEPS levels proposed. However, sensitivity tests indicated that significant net benefits can be achieved even if the program costs are up to ten times the estimated costs, or benefits one tenth as great.

Table 20 Projected Saving/Cost Ratios, Trial MEPS Cases

Case	Savings/costs (undiscounted)	Savings/costs (5% discount)	Savings/costs (10% discount)
1	19	13	10
2	24	15	11
3	23	16	12
4	25	17	12
5	25	16	11

Source: Unisearch (1998)

The estimated market impact depended on consumer and supplier response to the program. If consumers who would have bought the less efficient products excluded from the market by MEPS switched their purchases to products that only just meet the MEPS level the benefit/cost ratio of the program would be reduced to about half of the above levels. The benefit/cost ratios estimated under this worst case scenario, in which customers remained indifferent to energy efficiency and suppliers only met the MEPS levels and no more (unless the product already exceeds MEPS) were 4 to 5 at a 10% discount rate.

The study projected the energy and greenhouse savings compared to the "business as usual" case and are summarised in Table 21. These estimates took into account likely supplier responses to MEPS but not the potential *additional* energy benefits which optional energy labelling could bring, by enabling buyers to select the more efficient models of the wide range still remaining on the market after MEPS were implemented.

Table 21 Projected Energy and Greenhouse Impacts, Trial MEPS Cases

	Savings, Year 1		Saving, 1988 - 2015(a)			Savings, 2010
Case	GWh saved	% BAU saved	GWh saved	% BAU saved	Mt CO_2-saved	Mt CO_2-saved
1	18.3	4.6%	7788	5.6%	7.3	0.37
2	37.5	9.4%	11790	8.5%	11.0	0.55
3	24.7	6.2%	9111	6.6%	8.5	0.43
4	35.1	8.8%	11273	8.1%	10.5	0.53
5	37.7	9.5%	11830	8.5%	11.1	0.56

Source: Unisearch (1998) (a) Includes energy use after 2015 of units installed up to 2015

The study recommended that:

1. "a national energy efficiency program be implemented for single package and split system, ducted and non-ducted packaged air conditioners (PACs) of 7.5 to 65 kW cooling capacity.

2. for the purposes of the program, the classification of product types and capacity ranges should be the same as currently used by the Air-conditioner and Refrigeration Manufacturers' Association (AREMA);

3. the program should have two main elements: mandatory minimum energy performance standards (MEPS) and a complementary information program;

4. MEPS should be expressed in terms of minimum permissible cooling COPs

5. both cooling-only and heat pump models should meet the same cooling COP MEPS levels;

6. the following MEPS levels [in Table 6, corresponding to "Case 4"] should be adopted, on the basis that they provide the best fit with the assessment criteria:

7. the recommended MEPS levels should come into effect on 30 June 1999;

8. the existing State and Territory energy labelling regulations should be used as the implementation vehicle for MEPS and energy "labelling";

9. compliance with the adopted MEPS levels and registration of each MEPS-compliant model should be mandatory from the implementation date;

10. a public register should be established and maintained such that key data for each model, together with their estimated annual energy consumption under a range of locations and operating conditions, are published on the Internet;

11. physical energy labels should be mandatory for models of 7.6 to 12.5 kW cooling capacity, wherever they are displayed for sale;

12. the form, content and star rating algorithms of the physical labels should be similar in all respects to the labels currently used for residential air conditioners, except that the annual energy consumption values should be based on the calculations in the present report;

13. for models of greater than 12.5 kW cooling capacity, suppliers should have discretion to affix physical labels, of the same form as the labels for products of less than 12.5 kW;

14. all labels should be registered;

15. the details of PAC energy testing and labelling should be incorporated in new Australian Standards, or amendments to existing standards;

16. simulation of performance using an approved computer program should be accepted as an alternative to physical testing, for the purposes of initial registration of a product;

17. check testing should always involve at least one physical test, although simulations should be permitted as part of the initial filtering process;

18. physical testing, simulation and check testing procedure should be based, as far as practical, on those used in the AREMA Certification Program

19. Governments should invite AREMA to administer the registration, directory maintenance and check testing functions of the program, on a fee for service basis (to the extent that the costs are greater than those AREMA currently incurs for its Certification Program);

20. Governments should undertake an initial publicity campaign to launch the program; this could take place before June 1999, provided enough models are labelled." (Unisearch 1998).

By the time the study was complete, the AGO had been established and had taken over the project. The AGO accepted the above recommendations, and in 1999 commissioned Mechlab at the University of NSW to develop revisions of the relevant Australian Standard as the means for putting the program into effect (Mechlab 1999).

The AGO, Mechlab and AREMA agreed that the standard covering energy testing, labelling and MEPS for air conditioners of greater than 7.5 kW to 65 kW cooling capacity should be integrated with the standard that covered energy testing and labelling for air conditioners of up to 7.5 kW cooling capacity: *AS/NZS 3823, Performance of household electrical appliances – Room air conditioners.*

The AGO, Mechlab and AREMA also agreed on the following principles:

- The revised Standard would require energy labelling for all air conditioners designed for a single-phase power supply, irrespective of cooling capacity. This is a change from the existing standard, which requires energy labelling for all units up to 7.5 kW cooling capacity, irrespective of whether the power supply is single- or three-phase;

- The revised Standard would set MEPS levels for all air conditioners designed for a three-phase power supply, irrespective of cooling capacity, up to 65 kW. This is a change from the previous studies, which envisaged that MEPS would commence at 7.5 kW cooling capacity, irrespective of whether the power supply was single- or three-phase;

- Energy labelling would be optional for air-conditioners designed for three-phase supply, but if the supplier opts to label, the same labelling and verification provisions apply as for single-phase models;

- A computer simulation technique would be developed for use as a lower-cost alternative to the physical testing of three-phase air conditioners.

The draft revision of the Standard, in three parts, was issued for public comment on 1 March 2000. Comments closed 30 April 2000. It is understood that the comments received did not lead to substantive alterations to the draft, that the final Standard is currently being distributed for postal ballot, and if approved will be issued in early October or November 2000.[19] The remainder of this document is based on text of the draft Standard, on the assumption that the provisions relating to labelling and MEPS will remain unchanged. However, this will need to be confirmed after publication of the final Standard.

[19] Mr Vincent Aherne, Standards Australia, personal communication 6 July 2000.

Appendix 3 Relevant Sections of Australian Standard AS/NZS 3823

Parts of the Standard

The title of the proposed Standard is *Australian/New Zealand Standard AS/NZS 3823, Performance of household electrical appliances – Air conditioners and heat pumps*.[20] It is published in three parts, the first of which is in two sub-parts:

> AS/NZS 38231.1:1998 *Non-ducted airconditioners and heat pumps – Testing and rating for performance* (no revision of the 1998 edition is proposed at present)
>
> AS/NZS 3823.1.2 *Ducted airconditioners and air-to-air heat pumps – Testing and rating for performance* (new part based on International Standard ISO 13253:1995, released as draft DR00066; publication planned for 2000)
>
> AS/NZS 3823.2 *Energy labelling and minimum energy performance standard requirements* (released as draft DR00067; publication planned for 2000 to supersede AS/NZS 3823:2000 published early in the year, which specifies a new label design but does not include reference to MEPS).
>
> AS/NZS 3823.3 *Calculation of performance for minimum energy performance standard requirements* (new part, released as draft DR00068; publication planned for 2000).

In the remainder of this RIS, the four documents are referred to as Part 1.1, Part 1.2, Part 2 and Part 3 of the Standard.

In brief, Part 1 describes how the physical tests to determine heating and cooling capacity are to be carried out. Part 2 describes how the test results are to be presented in labels and the MEPS requirements which products must meet. Part 3 offers a computer simulation alternative to the physical tests in Part 1, for the purpose of determining whether a unit complies with the MEPS requirements. Energy labels must be based on physical tests only.

Scope of Products Covered

Some Parts of the Standard exclude certain types or categories of products. Part 1.2 "is limited to systems which use a single refrigeration circuit and have one evaporator and one condenser". Specified exclusions are:

a. Individual assemblies for separate use (ie condenser and evaporator units which together might make up a split system, but which may be sold separately)

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[20] The word "household" appears in the title because the standard was prepared by Joint Standards Australia/New Zealand Committee EL/15, Quality and Performance of Household Electrical Appliances. It does not restrict the scope to airconditioners installed in households – it is not possible to predict the ultimate location or use of any particular type of airconditioner. In this context an "airconditioner" is capable of cooling only, and a "heat pump" is capable of both cooling and heating by means of a vapour compression cycle, or of heating only.

b. Equipment using the absorption refrigeration cycle

c. Non-ducted airconditioners and non-ducted heat pumps (these are covered in Part 1.1)[21]

d. Water-source heat pumps.

Part 2 covers "three-phase ducted and non-ducted airconditioners of the vapour compression type intended for household, commercial and similar use, up to a rated cooling capacity of 65 kW. It covers only those units with a single refrigeration circuit with one evaporator and one condenser".

Part 3 "sets out a method for determining the performance of three-phase airconditioners using a mathematical model of the refrigerant cycle and measurements of the appliance operating characteristics". It covers only those units with a single refrigeration circuit with one evaporator and one condenser. It does not cover multiple split appliances or evaporative coolers. Specified exclusions are:

a. Water-source heat pumps

b. Multiple split-system airconditioners and heat pumps (eg where one outdoor condenser unit is connected to several indoor evaporator units)

c. Mobile (windowless) appliances having a condenser exhaust fan

d. Unitary systems where there is a thermal interaction between the evaporator and condenser.

The combined effects on the scope of the Standard as a whole are summarised in Table 22. The "single refrigeration circuit" scope limitation means that models which have two or more circuits will have to be excluded from any MEPS program. On the basis of the market data in Unisearch (1998) it is estimated that this will exclude about 5% of models in the 7.5 to 65 kW category, but since these are the larger capacity models in the range the share of total air conditioner energy used excluded may be somewhat greater. This matter will be considered in the cost-benefit analysis.

The "thermal interaction" limitation in Part 3 mean that for unitary systems the only available means of demonstrating MEPS compliance will be a physical test. The maximum capacity which Australian test laboratories can currently handle is about 50kW cooling (Unisearch 1998). Therefore this may need to be set as the practical limit of a MEPS program until such time as testing capability increases.

The exclusion of equipment using the absorption refrigeration cycle and water-source heat pumps has little practical effect since such products represent a negligible part of the market for the time being, but if such products gain significant market share the costs and benefits of labelling and/or MEPS may need to be considered.

[21] Ducted airconditioners may be either single units (in which the evaporator, condenser, compressor and all fans are in the one cabinet) or split units. The distinguishing feature is that the conditioned air is designed to discharge to ductwork rather than freely into the conditioned space.

Table 22 Application of Energy Labelling and MEPS to Types of Airconditioners[(a)]

MEPS Class[1]	AREMA designation[2]	Power supply	System Configuration	Indoor air discharge	System capability[3]	Physical Test[4]	Computer Simulation[5]	Labelling[6]	MEPS compliance[7]
1	SP-A, SPY-A	Single phase	Unitary	Non-ducted	Cooling only	Part 1.1	Not available	Mandatory	Not applicable
2	HSP-A				Heat Pump	Part 1.1	Not available	Mandatory	Not applicable
3	Several possible			Ducted	Cooling only	Part 1.2	Not available	Mandatory	Not applicable
4	HSP-A				Heat Pump	Part 1.2	Not available	Mandatory	Not applicable
5	RCU-A-CB		Split	Non-ducted	Cooling only	Part 1.1	Not available	Mandatory	Not applicable
6	HRCU-A-CB, HRC-A-CB, HRCU-A-C				Heat Pump	Part 1.1	Not available	Mandatory	Not applicable
7	Several possible			Ducted	Cooling only	Part 1.2	Not available	Mandatory	Not applicable
8	HRCU-A-CB, HRC-A-CB, HRCU-A-C				Heat Pump	Part 1.2	Not available	Mandatory	Not applicable
9	SP-A, SPY-A	Three phase	Unitary	Non-ducted	Cooling only	Part 1.1	Not available	Optional	Mandatory
10	HSP-A				Heat Pump	Part 1.1	Not available	Optional	Mandatory
11	Several possible			Ducted	Cooling only	Part 1.2	Not available	Optional	Mandatory
12	Several possible				Heat Pump	Part 1.2	Not available	Optional	Mandatory
13	RCU-A-CB		Split	Non-ducted	Cooling only	Part 1.1	Part 3	Optional	Mandatory
14	HRCU-A-CB, HRC-A-CB, HRCU-A-C				Heat Pump	Part 1.1	Part 3	Optional	Mandatory
15	Several possible			Ducted	Cooling only	Part 1.2	Part 3	Optional	Mandatory
16	HRCU-A-CB, HRC-A-CB, HRCU-A-C				Heat Pump	Part 1.2	Part 3	Optional	Mandatory

(a) General scope: Initially, single compressor and single refrigeration circuit units up to 50 kW cooling capacity (possibly increasing to 65kW cooling capacity and extending to multiple circuit and/or multiple compressor units in the future if test facilities and/or simulation techniques become available)
1. Classification proposed for convenience of reference in this RIS – no status in Standard
2. Used in Airconditioning and Refrigeration Equipment Manufacturers Association (AREMA) *Directory of Certified Unitary Air Conditioning Equipment.* The AREMA and the AS/NZS classification systems are quite different, and additional information is needed to determine a model's AS/NZS category. (SP-A: Single Package, RCH-A: Refridgeration Chassis, SPY-A: Year Round Single Package, RC-A: Remote Condenser, RCY-A: Year Round Remote Condenser, RCU-A-C: Condensing Unit Coil Alone, RCU-A-CB: Condensing Unit Coil and Blower, RCUY-A-CB: Year Round Condensing Unit and Blower, HSP-A: Single Package Reverse Cycle, HRC-A-CB: Single Package plus Remote Air Cooled Condenser Reverse Cycle, HRCU-A-CB: Split System Reverse Cycle, HRCU-A-C: Split System with No Indoor Fan Reverse Cycle).
3. A "heat pump" is capable of both cooling and heating by means of a vapour compression cycle, or of heating only. "Cooling only" may have supplementary heating by electric resistance or fuel source.
4. The part of AS/NZS 3823 describing the physical test for output capacity and energy efficiency.
5. Whether AS/NZS 3823 Part 3 offers a computer simulation alternative to physical testing.
6. AS/NZS 3823 Part 2 refers. If suppliers of three-phase units opt to label, relevant parts of AS/NZS 3823 Part 2 apply.
7. AS/NZS 3823 Part 2 refers.

Standard Requirements

A product that falls within the scope of AS/NZS 3823 must meet the following requirements to comply with the Standard.

If it is single-phase, it must be tested under cooling capacity test condition T1 in Part 1 (Table 23) and heating capacity test condition H1 if applicable, and labelled in accordance with Part 2;

If it is three-phase, it must be tested under cooling capacity test condition T1 in Part 1 (Table 23) and must meet the minimum EER levels corresponding to its cooling capacity, as specified in Part 2.

If it is three-phase, then a mark or logo and text indicating that the product complies with the minimum performance requirements in AS/NZS 3823.2 is to appear on the compliance plate of all units produced.

It must meet the requirements of the maximum cooling test (Table 23). The unit must operate under these conditions for one hour “without any indication of damage” and “without tripping of the motor-overload protective devices”.

“Where the relevant regulatory authority requires registration or approval of energy labels or minimum energy performance requirements” an application for registration accompanied by a test report must be submitted in the format specified in the Standard.

The standard also specifies a “check testing” procedure for verifying whether a model complies with the performance claimed for it (within specified tolerance limits). If it is determined through this procedure that the information on the energy label is inaccurate, the relevant authorities would require a revised label to be registered. If it is determined through this procedure that the product does not in fact comply with MEPS, then any statement (on the compliance plate or elsewhere) to the effect that it complies with AS/NZS 3823.2 would, at the very least, be in breach of the Trade Practices Act. If compliance with the MEPS provisions in AS/NZS were made a mandatory requirement, as proposed, then failure to comply would mean that the product could not lawfully be sold.

Table 23 Standard Test Conditions

		Cooling capacity test condition T1	Maximum cooling test condition T1(a)	Heating capacity test condition H1
Temperature of air entering indoor side	Dry bulb	27°C	32°C	20°C
	Wet bulb	19°C	23°C	15°C
Temperature of air entering outdoor side	Dry bulb	35°C	43°C	7°C
	Wet bulb	24°C	26°C	6°C
Condenser water temperature (equipment designed for use with cooling towers)	Inlet	30°C	34°C	NA
	Outlet	35°C	(b)	NA

(a) If maximum cooling operating temperature conditions for cooling are specified in the manufacturer’s equipment specification sheets, those are to be used in lieu. (b) Not specified, but same water flow rate as in cooling capacity test

Appendix 4 Extract from Typical State Regulations

NSW Electricity Safety Act (1945)
Electricity Safety (Equipment Efficiency) Regulation 1999

Part 2 Standards

5 Minimum standards

(1) An electrical article listed in Schedule 2 must comply with the performance criteria set out in Part 2 of the relevant standard when tested, in accordance with Part 1 of that standard, by an accredited laboratory.

(2) An electrical article listed in Schedule 3 must comply with the energy efficiency requirements set out in the relevant standard.

(3) In this clause, accredited laboratory means a laboratory:

(a) accredited by the National Association of Testing Authorities, or

(b) approved by the Corporation.

Part 4 Labelling of electrical articles

15 Electrical articles to be appropriately labelled when sold

(1) A person must not sell an electrical article listed in Schedule 2 unless an approved energy efficiency label is displayed on the article in accordance with Part 2 of the relevant standard. Maximum penalty: 20 penalty units.

(2) In the case of an air conditioner that is sold in a package, the approved energy efficiency label may instead be displayed on the package.

(3) This clause applies in respect of the sale of new articles, whether by wholesale or retail, but does not apply to the sale of second-hand articles.

SCHEDULE

(Clauses 7 and 19)

Item	Fee
For registration of an electrical article	$150
For transfer of registration of an electrical article	$50
For provision of an extract from the Register	$50

Schedule 2 Standards for electrical articles that require registration and labelling

Article: (Clause 5 (1))

Relevant standard:

Clothes washing machine Australian/New Zealand Standard, "Performance of household electrical appliances Clothes washing machines Part 1: Energy consumption and performance", AS/NZS 2040.1:1998, and Australian/New Zealand Standard, "Performance of household electrical appliances Clothes washing machines Part 2: Energy labelling requirements", AS/NZS 2040.2:1998.

Dishwasher Australian/New Zealand Standard, "Performance of household electrical appliances Dishwashers Part 1: Energy consumption and performance", AS/NZS 2007.1:1998, and Australian/New Zealand Standard, "Performance of household electrical appliances Dishwashers Part 2: Energy labelling requirements", AS/NZS 2007.2:1998.

Refrigerating appliance Australian/New Zealand Standard, "Performance of household electrical appliances Refrigerating appliances Part 1: Energy consumption and performance", AS/NZS 4474.1:1997, and Australian/New Zealand Standard, "Performance of household electrical appliances Refrigerating appliances Part 2: Energy labelling and minimum energy performance standard requirements", AS/NZS 4474.2:1997.

Room airconditioner Australian/New Zealand Standard, "Performance of household electrical appliances Room airconditioners Part 1.1: Non-ducted airconditioners and heat pumps Testing and rating for performance", AS/NZS 3823.1.1:1998, and Australian/New Zealand Standard, "Performance of household electrical appliances Room airconditioners Part 2: Energy labelling requirements", AS/NZS 3823.2:1998.

Rotary clothes dryers Australian/New Zealand Standard, "Performance of household electrical appliances Rotary clothes dryers Part 1: Energy consumption and performance", AS/NZS 2442.1:1996, and Australian/New Zealand Standard, "Performance of household electrical appliances Rotary clothes dryers Part 2: Energy labelling requirements", AS/NZS 2442.2:1996.

Schedule 3 Standards for electrical articles that require registration only

Article: (Clause 5 (2))

Relevant standard:

Storage water heater unvented without an attached feed tank Australian Standard, "Storage water heaters Part 1: General requirements", AS 1056.1:1991, Clause 2.4 "Thermal Insulation".

Appendix 5 Key Modelling Assumptions and Outcomes

Models Passing

The most consistent way to monitor product characteristics is the *AREMA Directory*, since all suppliers who submit listings have agreed to use the same basis for testing capacity and energy efficiency. There were 12 brands and 475 models listed in the 1996 *Directory*, and 11 brands with 320 models listed in the 1999 *Directory*; 8 brands were listed in both directories. For this RIS, an analysis was carried out of the average energy efficiency (cooling EER) of models in both *Directories.*
The 1996 Directory contained 475 actual models, and 62 "Other Brands" dummy models were generated for the purposes of complete market modelling (see below). The 1999 Directory contained 320 actual models, and the characteristics of the original 62 dummy models were retained for purposes of analysis.

Sales data covering most brands (including some non-members of AREMA) are available for various discontinuous periods between 1994 and mid 1997, and for the complete 12 months to May 2000. Average price data and market share data were available for the 5 month period to May 1997, but not for later periods. The data were reviewed to ensure that there were no changes or discontinuities in the market over the 3 years which would invalidate use of any of the data set. This proved not to be the case, so data and analyses from the two Directories were combined where appropriate.

Table 24 and Figure 8 indicate the average cooling energy efficiencies for the four product types which together account for more than 80% of airconditioner sales. There was very little change in average energy efficiency over the period. For the brands included in the *Directory* both years, the average EER increased from 2.57 to 2.63, but only one product type showed a significant increase – efficiency in the other three remained steady or declined. The average for the three brands added to the *Directory* in 1999 (which were not new to the market, but either new to or returned to the *Directory*) was very close to the other brands. Figure 9 shows a brand by brand analysis of average model efficiencies for 1996 to 1999.

Table 24 Average energy efficiency (cooling), airconditioner models in AREMA directory

Type[a]	**8 brands present both years, Average EER 1996**	**8 brands present both years, Average EER 1999**	**Annualised rate of change**	**Average EER, 3 brands added 1999**	**Average EER, All 11 brands present 1999**
Type A	2.21	2.72	7.2%	NA[b]	2.72
Type B	2.60	2.61	0.1%	2.54	2.58
Type C	2.59	2.57	-0.3%	2.55	2.57
Type D	2.83	2.78	-0.6%	2.72	2.77
Average of above	2.57	2.63	0.8%	2.57	2.61

(a) See footnote 6 (b) Brands did not list models of this type.

The relatively small "business-as-usual" change in average energy efficiency over the three year period leads to two important conclusions:

1. the potential for energy savings due to the recommended MEPS levels was no less in 1999 than in 1996; and
2. The structure of the airconditioner remained fairly stable, so earlier price and sales data could, to some extent, be combined with later data.

Figure 8 Model Average Cooling EER by Type, 1996 and 1999

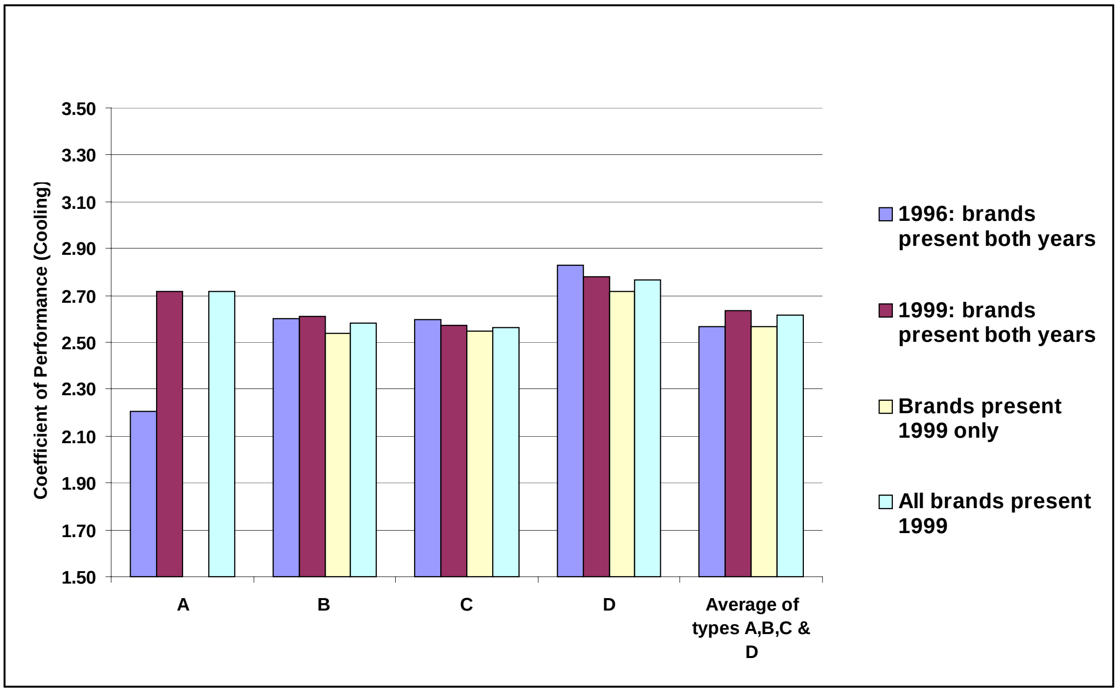
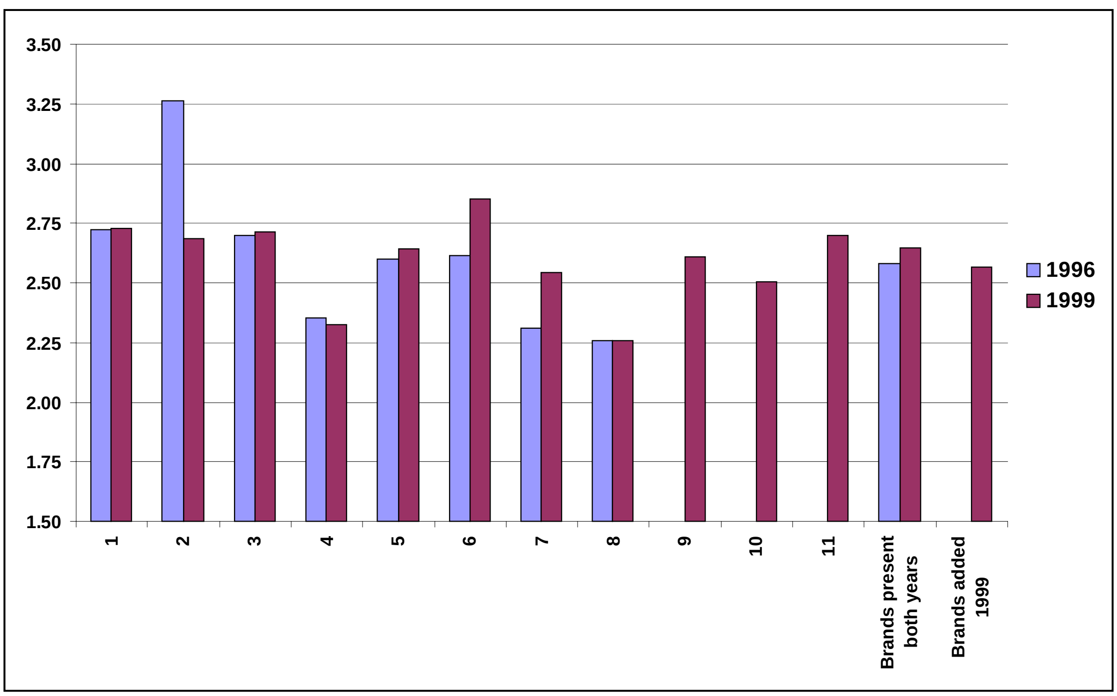


Figure 9 Model Average Cooling EER by Brand, 1996 and 1999



The proportion of branded models passing the recommended MEPS levels is indicated in Table 25. Although the impact on the brands present in both Directories appeared to decline, the overall impact in 1999 (79% of branded models passing, 73% of all models passing) is hardly changed from 1996 (75% of branded models passing, 71% of all models passing).

Table 25 Proportion of models passing recommended MEPS levels

	1996 AREMA Directory		1999 AREMA Directory	
	Number of models	% passing MEPS[a]	Number of models	% passing MEPS
All brands in this Directory	475	75%	320	79%
8 brands present in both Directories	356	76%	234	83%
3 brands in 1999, but not in 1996	NA	NA	86	67%
4 brands in 1996, but not in 1999	119	72%	NA	NA

(a) Actual models only – 42% of the 62 "dummy" models pass – see Table 14.

Projected airconditioning energy demand

It is estimated the total electricity demand for heating, ventilating and airconditioning (HVAC) in 2000 is 91.7 PJ, or 25,470 GWh. The projected annual increase in HVAC electricity demand in the period 2000 to 2010 indicated in Table 2 is about 2.7% per annum (660 GWh). The study from which the data are derived took into account "the level of abatement expected to be achieved through natural improvement on technologies and systems" (EMET 1999).[22]

In addition, retiring airconditioners need to be replaced. The calculation of the energy impacts of retirements is complex, and needs to take into account the number of units installed in each previous year, their annual energy efficiency and consumption, and their average service life – information which is not easily available. Given that mean service life is about 15 years, and the number of units in service has been growing, it would be expected that between 1/20 and 1/25 of the total HVAC energy used in 2001 (1,000 to 1,200 GWh) would be used in installations where airconditioners retired in that year and had to be replaced. With both product replacement and service expansion, the annual energy consumed by airconditioners installed in 2000 would be about 1,660 to 1,880 GWh.

It is not known what proportion of this energy is used by packaged airconditioners of the size range 7.5 to 65 kW capacity, and what proportion by smaller units or larger installations – generally whole-building systems with cooling towers. The market model, based on 60,000 units in 2000 and a calculated average annual consumption of 9,680 kWh *on cooling* indicates that the new packaged air conditioners installed in 2000 consume about 580 GWh annually on cooling, or about a third of the 1,660 to 1,880 GWh estimate. The energy consumption on heating has not been modelled, but it would be significantly lower than the cooling energy. If it were 50% of cooling energy, then packaged airconditioners would account for about half the electricity use, and larger (cooling tower) installations for the other half.

[22] If it is assumed that average new airconditioner efficiency is increasing at 0.25% per annum, then the increase in the output of HVAC energy services would be about (2.7+0.25=2.95)% per annum.

To match the projected increase in demand for electric HVAC services in EMET (1999), it was necessary to assume fairly high growth rates for the airconditioner market, as indicated in Table 26.

Table 26 Estimated airconditioner market characteristics

	Share of national market 2000	Residential share of sales 2000	Projected annul growth in sales - Commercial	Projected annul growth in sales - Residential
NSW+ACT	33%	10%	6.0%	3.0%
Vic+Tas	21%	8%	3.0%	2.0%
Qld	17%	9%	5.0%	3.0%
SA	14%	11%	3.0%	2.0%
WA	13%	9%	3.0%	2.0%
NT	1%	6%	3.0%	2.0%
National	100%	10%	4.5%	2.5%

Packaged air conditioners, 7.6 to 65 kW cooling

Electricity prices, emissions values and product prices

The commercial and residential electricity prices used in the analysis are summarised in Table 27. It is assumed that these prices remain constant in real terms over the projection period. The same prices were used in Unisearch (1998) and there is no reason to revise them: around Australia there are dozens of tariff structures available even to smaller commercial users, and larger users tend to be on individual contracts.[23] Therefore the value of a kWh saved from installing a more efficient airconditioner depends on a wide range of factors, including the time of day. As annual electricity demand peaks are increasingly driven by airconditioning load, it is likely that the prices in Table 27 understate the real economic value of the saving.

Table 27 Estimated electricity prices

	Commercial $/kWh tariff	Residential $/kWh tariff
NSW and ACT(a)	$ 0.135	$ 0.113
Vic and Tas (a)	$ 0.143	$ 0.125
Qld	$ 0.115	$ 0.092
SA	$ 0.140	$ 0.120
WA	$ 0.140	$ 0.123
NT	$ 0.120	$ 0.120

(a) NSW and ACT treated as one region, with NSW electricity price, since benefits and costs not separable. (b) Victoria and Tasmania treated as one region, with Vic electricity price, since benefits and costs not separable.

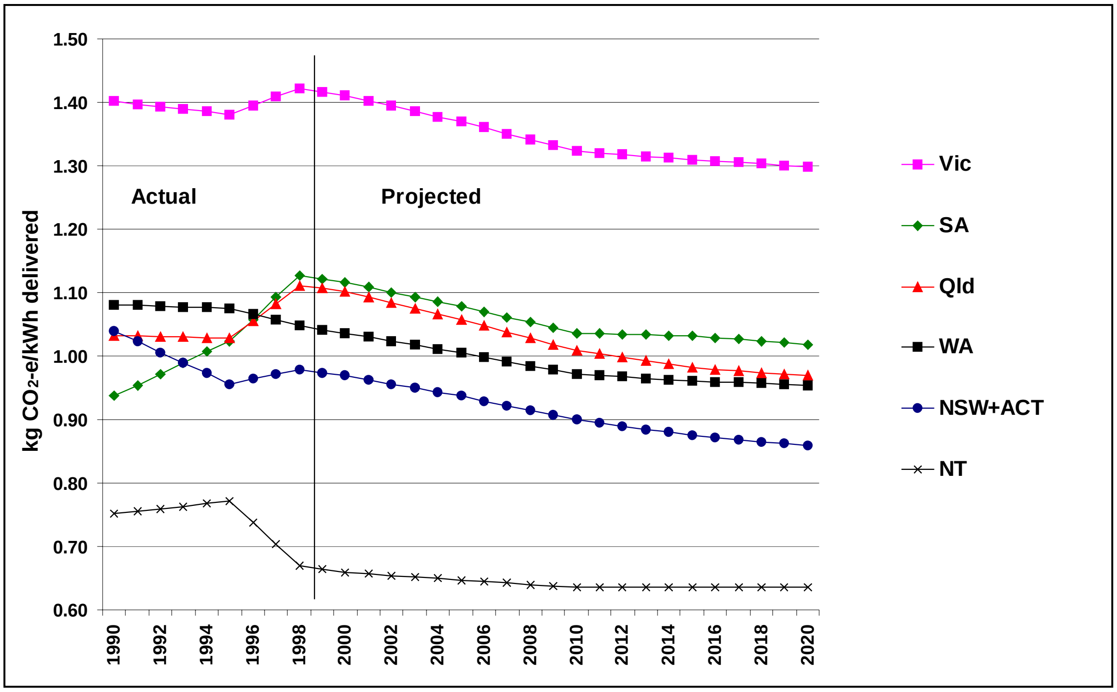
Greenhouse Gas Emissions

The projection of electricity system CO_2 intensities used in the RIS, illustrated in Figure 10, are taken from GWA (2000a). The intensities are projected to decline due

[23] For example, EnergyAustralia's General Supply tariff from 1 July 2000 is 11.03 c/kWh. The low voltage time-of-use tariff is 15.72 c/kWh 7am-9am and 5pm-8pm on working weekdays, 11.03 c/kWh 9am-5pm and 8pm-10pm on working weekdays and 4.85 c/kWh at other times.

to an eventual preference for natural gas, and the impacts of two Commonwealth initiatives, the "2% renewables" measure and power station efficiency standards.

Figure 10 Projected emissions-intensity of electricity supply by State, 1990-2020



Timing and scope of MEPS

Under mandatory MEPS, all products manufactured or imported after the implementation date nominated in the regulations would have to comply. When MEPS were introduced for household refrigerators and water heaters, there was a changeover period of one year when products manufactured or imported before the implementation date could still be sold.

If the same arrangements apply to airconditioners, then many of the products sold in 2001/02, the year after the implementation date of 1 July 2001, will still be sub-MEPS. The first year in which all sales should fully conform will be 2002/03. There will be some energy saving in the year prior to implementation (ie in 2000/01) as suppliers begin to phase out or reengineer models. The time profile of impacts is summarised in Table 9.

The effective scope of the program is somewhat narrower than previously envisaged, because a smaller share of the energy use of the largest and smallest categories (see Table 28) is covered. The coverage of the smallest category is reduced by redefining the lower bound from "7.5 kW cooling" to "three-phase power supply". An analysis of the 1996 AREMA *Directory* suggests that about half the models in this category are single phase, and so their energy use would be excluded from the scope of MEPS. However, many of these would be installed for residential rather than commercial use, and so would use less energy. It is estimated that the scope would be reduced by one third of the energy use of this category, ie by 2.4% of total energy consumption.

Table 28 Share of energy by capacity range

Capacity range kW cooling	Share of cohort energy
7.6-10.0	8.4%
10.1-12.5	9.1%
12.6-15.5	14.8%
15.6-18.0	21.0%
18.1-25.0	10.9%
25.1-30.0	8.9%
30.1-37.5	6.7%
37.6-45.0	8.8%
45.1-65.0	11.3%
	100.0%

Source: Unisearch (1998)

The sales of larger airconditioners fall off rapidly as capacity increases, so well over half the sales in the 45.1 - 65 kW range would be below 50 kW, the suggested upper cutoff for MEPS. Of course, the average energy use of these units is also likely to be less than of the units in the 50-65 kW range. If the scope of the regulation were limited to 50 kW cooling capacity units, it is estimated that the energy saving would be reduced by about 5.7%. Therefore the combined effect of narrowing the scope at both the top and bottom of the capacity range would be a reduction of about 8% in energy use, and hence in energy savings. Accordingly, a “scope multiplier” of 92% has been used to calculate benefits.

Effects of deferment

The projections have been developed on the basis of a 1 July 2001 implementation date. If implementation were deferred to 1 December 2001, the effect would be to defer the accumulation of benefits by at least a half a year: possibly more, since the July-December period represents more than half of the annual sales. If the curve illustrated in Figure 5 were shifted half a year to the right, the total energy and greenhouse savings would be reduced by about 9%, and the emissions savings in 2010 would be about 35 kt (7%) lower.

On the other hand, supplier inventories at implementation date should be lower, so the changeover period during which the sale is permitted of sub-MEPS products manufactured or imported before that date may be shortened somewhat.

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