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Comparison of International MEPS:

Room Air Conditioners

Prepared for

*The Australian Greenhouse Office:
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Introduction

The purpose of this report is to provide a comparison of international Minimum Energy Efficiency Standards (MEPS) for single phase room type air conditioners. This report updates the analysis of the MEPS options undertaken in 2002 by EnergyConsult for the AGO (EnergyConsult 2002: *International review of Minimum Energy Performance Standards for Air Conditioners*). In addition, recommendations are made with regard to the future of Australia's MEPS levels for these types of air conditioners.

The National Appliance and Equipment Energy Efficiency Program (NAEEEP) is part of the National Greenhouse Strategy that targets the energy efficiency of consumer appliances and industrial and commercial equipment. The main tools of the program are mandatory energy efficiency labelling and minimum energy performance standards, and voluntary measures including endorsement labelling, training and support to promote the best available products. Mandatory minimum energy efficiency performance standards (MEPS) are 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. National product regulation can only be justified where the benefits outweigh the costs to the community; and the cost of improving appliance efficiency is outweighed by the energy savings made over the lifetime of the product.

NAEEEP has followed a policy of adopting 'world's best regulatory practice'. This involves setting MEPS at levels broadly comparable with the most demanding MEPS adopted by Australia's trading partners, but following that lead with a lag of several years. Given Australia's status as a large net importer of electrical appliances and equipment, it is considered inappropriate to take the lead or to otherwise adopt standards that put Australia significantly at odds with its trading partners.

The existing MEPS levels follow the lead provided by Taiwan and the US for single-phase and three-phase units respectively, as recommended in 2002 report. However, recent updates to the MEPS levels of our trading partners and the outcomes of a benchmarking study on air conditioning efficiency in 5 APEC countries (DEM 2004), necessitate an updated comparison internationally of air conditioning MEPS.

Scope

This report reviews the international MEPS applicable to room type air conditioners. The products included in this definition are single phase split systems and window/wall type air conditioners; both are reverse cycle and cooling only. The test conditions were reviewed in the previous comparison (EnergyConsult 2002); hence the focus of this report is the analysis of applicable international MEPS levels and recommendations for Australian MEPS levels.

Relevant Standards – Australia and International

Internationally, the energy performance testing of air conditioners varies only slightly, with most countries closely aligned to the International test procedure ISO5151. Variations are mostly contained to testing tolerances and slight differences in temperature conditions (up to 0.5°C), however most countries (including Australia) require the testing of air conditioners to standard T1 conditions shown in Table 1.

Table 1: Test conditions for the determination of cooling capacity, ISO

Parameter	Standard test conditions		
	T1	T2	T3
Temperature of air entering indoor side (°C)			
dry-bulb	27	21	29
wet-bulb	19	15	19
Temperature of air entering outdoor side (°C)			
dry-bulb	35	27	46
wet-bulb ¹⁾	24	19	24
Condenser water temperature ²⁾ (°C)			
inlet	30	22	30
outlet	35	27	35
T1 = Standard cooling capacity rating conditions for moderate climates T2 = Standard cooling capacity rating conditions for cool climates T3 = Standard cooling capacity rating conditions for hot climates			

1) The wet-bulb temperature is not required when testing air-cooled condensers which do not evaporate the condensate

2) Representative of equipment working with cooling towers. For equipment designed for other uses, the manufacturer shall designate the condenser water inlet and outlet temperatures or the water flow rates and the inlet temperature in the ratings

In Australia, the current testing standard is the AS/NZS 3823 series for *Performance of electrical appliances— Airconditioners and heat pumps*. This series includes methods of testing and rating air conditioners for MEPS and energy labelling. The earlier report on comparison of international MEPS levels (EnergyConsult 2002), details the differences in testing conditions for each country.

International Comparison of MEPS Levels

Summary

MEPS for air conditioners were first introduced in the 1980's. Over 16 countries including Australia have mandatory MEPS, one has voluntary MEPS and one operates a target program. Table 2 details the introduction of air conditioning MEPS around the world (EES 2004).

Table 2 Countries with MEPS for Air Conditioners

Country	Central AC	Room (Window-wall and split)	Large Heat Pump & condensing units	Packaged terminal & Heat Pump	Single-packaged central & Heat Pump	Split-system central & Heat Pump
Australia	M 2001	M 2004	M 2001	M 2001	M 2001	M 2001
Canada	M 1998	M 1995	M 1998	M 1998	M 1998	M 1998
China		M 1998				
Columbia		M 2002				
Costa Rica		M 1996				
Ghana		M 2002				
India		V 1999				
Israel		M 1985				
Japan		T 1979				
Korea		M 1993				
Mexico	M 1998	M 1995				M 1998
New Zealand	M 2001	M 2004	M 2001	M 2001	M 2001	M 2001
Philippines		M 1993				M 2002
Russia		M 1986				
Saudi Arabia		M 2001				
Singapore		M 1998				
Taiwan		M 1991				
USA	M 1992	M 1990	M 1992	M 1992	M 1992	M 1992

Several of these countries have updated their MEPS levels since their introduction and this report examines in detail the current MEPS levels for the following countries, indicating the year for the update in brackets:

- Japan (1979, 1999, 2004/7)
- USA (1990, 2000, 2006)
- China (1988, 2000)
- Korea (1993, 2000, 2004)
- Taiwan (Chinese Taipei) (1991, 2002)
- Singapore (1998)
- Philippines (1992, 2000)

These countries' MEPS levels were compared to the efficiency of current Australian models registered for MEPS and/or labelling where appropriate to the product category. The Singapore and Philippines MEPS were assessed as being lower than the other countries and were not graphically examined in this analysis.

Japan

Japan does not apply minimum energy performance standards, instead opting for a target program known as "Top Runner". The top runner program sets targets using the most efficient models in each appliance category as the benchmark. The COP from the most efficient models becomes the target level for the future. However, this level does not have to be met by all appliances rather the weighted average of units shipped in the fiscal year for each manufacturer and importer is expected to be at or above the target. While not strictly a mandatory program penalties can be evoked for poor performance.

Japanese standards apply to all air conditioners with cooling capacities less than 28kW with the exception of chilled water coolers, those without electric compression, and those used in transportation. In the fiscal year 1997 the penetration of residential air conditioners was 1.8 units per household, with the trend showing penetration continuing to increase for heat pump air conditioners (Murakosh *et al.* 1999). The regulations cover 98% of all units shipped which in the FY1997 equalled 7.701 million air conditioners (Murakosh *et al.* 1999).

MEPS Levels

The last time Air Conditioners were required to meet targets was in 1998. At this time new targets were set according to the results achieved by the best models on the market. Additionally the new round of targets has included regulations for multi-split systems (a single outside unit with the compressor and condenser connected to several inside units in different rooms). The categories for efficiency standards are chosen according to basic function, type, and cooling capacity. The standard is shown as the COP value for cooling only air conditioners and the average of the cooling and heating COPs for heat pump air conditioners. The new targets for heat pump air conditioners need to be achieved by 2004 and will result in a 63% improvement from the 1992 program baseline efficiency. These targets are presented in Table 3. Most air conditioners have until 2007 to achieve the new standard, however reverse cycle non-ducted wall mounted units (split units) must meet these top runner targets by 2004. These targets presented in Table 4 will improve the market by 14% when compared to the 1992 baseline.

Table 3 Top Runner 2004/7 Targets for Heat Pump Air Conditioners

Type of Air Conditioner	Cooling Capacity Category (kW)	Target Level (COP)
Window Wall	All	2.85
Non-ducted wall mounted ¹⁾	2.5	5.27
	3.2	4.9
	4.0	3.65
	7.1	3.17
	28.0	3.10
Other non-ducted type	2.5	3.96
	3.2	3.96
	4.0	3.2
	7.1	3.12
	28.0	3.06
Duct Type	All	3.02
Multi Type	Up to 4.0	4.12
	7.1	3.23
	28	3.07

Sources: Murakosh et al 1999, and ECCJ

1) Reverse cycle non-ducted wall mounted (split units) must meet top runner targets by 2004

Table 4 Top Runner 2007 Targets for Cooling Only Air Conditioners

Type of Air Conditioner	Cooling Capacity Category (kW)	Target Level (COP)
Window Wall	All	2.67
Non-ducted wall mounted	2.5	3.64
	3.2	3.64
	4.0	3.08
	7.1	2.91
	28.0	2.81
Other non-ducted type	Up to 4.0	2.88
	7.1	2.85
	28.0	2.85
Duct Type	Up to 4.0	2.72
	7.1	2.71
	28.0	2.71
Multi Type	Up to 7.1	3.23
	28.0	2.47

Sources: Murakosh et al 1999 and http://www.ecci.or.jp/top_runner/chapter5-17.html

USA

The USA introduced MEPS for Air Conditioners in the early 1990's. The program covers room air conditioners, central air conditioners and heat pumps, and commercial heating and air conditioning equipment. All the standards for air conditioners have been

reviewed and upgraded since the initial implementation of the program. While some of the USA standards rely on EER and COP measurements, others include seasonal energy efficiency ratio (SEER) and heating season performance factor (HSPF). The SEER is defined as the total cooling output (in Btu-British thermal units) provided by the unit during its normal annual usage period, divided by its total energy input (in Watt-hours) during the same period. The HSPF tells you the ratio of the seasonal heating output in Btu's divided by the seasonal power consumption in Watt-hours (USA Department of Energy, 2002 cited in EnergyConsult 2002).

MEPS Levels

The MEPS levels for room air conditioners in the USA were reviewed in 1997 with the new standards becoming effective October 2000. The current levels are presented in Table 5.

Table 5 Room Air Conditioner MEPS for USA

Type of Air Conditioner	Cooling Capacity Category (Btu/h)	MEPS Level (SEER) (Btu/Wh)
Cooling Only		
Louvered Sides	< 20 000	9.7
	≥ 20 000	8.5
No Louvered Sides	< 8 000	9
	≥ 8 000	8.5
Cooling and Heating		
Louvered Sides	< 20 000	9
	≥ 20 000	8.5
No Louvered Sides	< 14 000	8.5
	≥ 14 000	8
Casement Only	All	8.7
Casement Slider	All	9.5

Source: USA Department of Energy 1997

Residential central air conditioner standards have been in place since 1992, although it should be noted that these type of air conditioners are not the same as Australian types. The MEPS levels are presented in Table 6. This standard has broad reaching effects with most new homes built in the USA installing a central air conditioning system. In January 2001 a 30% increase in the standard was approved, and was to become operational in the year 2006. However, a change of government in the USA occurred shortly after the registration of the final rule and the enactment of it has been postponed. In its place the new administration proposed a lower standard be approved, which requires a 20% improvement. The issue was debated extensively in the USA and the original rule was upheld. Table 7 presents the MEPS levels that will be implemented in 2006.

Table 6 Current Residential Central Air Conditioner MEPS for USA

Type of Air Conditioner	Cooling Capacity Category (kJ/h)	MEPS Level (SEER)	MEPS Level (HSPF)
Cooling Only			
Split System	All	10	-
Single Packaged	All	9.7	-
Cooling and Heating			
Split System	All	10	6.8
Single Packaged	All	9.7	6.6

Source: USA Department of Energy 2002 cited in Energy Consult 2002

Table 7 Residential Central Air Conditioner USA MEPS Proposed for 2006

Type of Air Conditioner	Cooling Capacity Category (kJ/h)	MEPS Level (SEER)	MEPS Level (HSPF)
<i>** Final Rule January 2001</i>			
Cooling Only			
Split System	All	13	-
Single Packaged	All	13	-
Cooling and Heating			
Split System	All	13	7.7
Single Packaged	All	13	7.7

Source: USA Department of Energy 2001a, 2001b

MEPS for commercial air conditioners and packaged terminal units became effective in 1994. The standards were issued separately and issued different MEPS levels according to the cooling method employed. The current levels are presented in Table 8. In January 2001 new levels were approved and the standard was simplified. The new standard applies from October 2003 for small commercial units and from October 2004 for large commercial units. These new standards are presented in Table 9.

Table 8 Current Commercial Air Conditioner MEPS for USA

Type of Air Conditioner	Cooling Capacity Category (Btu/h)	MEPS Levels			
		SEER	EER	COP	HSPF
Air Cooled Split System	< 65 000	10			6.8
Air Cooled Packaged System		9.7			6.6
Air Cooled	65 000 ≤ CC < 135 000		8.9	3.0	
	135 000 ≤ CC < 240 000		8.5	2.9	
Water Cooled Evaporative	< 65 000		9.3		
	65 000 ≤ CC < 135 000		10.5		
	135 000 ≤ CC < 240 000		9.6		
Water Source Heat Pump	< 65 000		9.3	3.8	
	65 000 ≤ CC < 135 000		10.5	3.8	
	135 000 ≤ CC < 240 000		9.6		
Packaged Terminal Air Conditioners & Heat Pumps	All		10 ^a		1.3 ^b

(a) $10 - (0.16 \times \text{capacity})/1000$ (b) $1.3 + (0.16 \times \text{min EER})$

Source: USA Department of Energy 2001c, 2002

Table 9 Commercial Air Conditioner MEPS for USA Effective 2003/2004

Type of Air Conditioner	Cooling Capacity Category (Btu/h)	MEPS Levels			
		SEER	EER	COP	HSPF
Air Cooled Split System	< 65 000	10			6.8
Air Cooled Packaged System		9.7			6.6
Air Cooled	65 000 ≤ CC < 135 000		10.3	3.2	
	135 000 ≤ CC < 240 000		9.3	3.1	
Water Cooled Evaporative	< 65 000		12.1		
	65 000 ≤ CC < 135 000		11.5		
	135 000 ≤ CC < 240 000		11.0		
Water Source Heat Pump	< 65 000		12.0	4.2	
	65 000 ≤ CC < 135 000		12.0	4.2	
	135 000 ≤ CC < 240 000		11.0		
Packaged Terminal Air Conditioners & Heat Pumps	All		10 ^a		1.3 ^b

(a) $10 - (0.16 \times \text{capacity})/1000$ (b) $1.3 + (0.16 \times \text{min EER})$

Source: USA Department of Energy 2001c, 2002

China

Air Conditioners were among the first appliances to be subject to MEPS when China introduced standards in 1989. The MEPS cover cooling only and reverse cycle room air conditioners. The standard was last updated in 2000. There are plans to extend this program to cover central air conditioners. Also under consideration is a change to the test method that would allow partial loads to be measured.

MEPS Levels

In 2000 new MEPS levels were established for room air conditioners. These are presented in Table 10.

Table 10 Room Air Conditioner 2000 MEPS for China

Type of Air Conditioner	Cooling Capacity Category (kW)	Target Level (COP)
Cooling only		
Single Package	≤ 4.5	2.2
Split System	≤ 2.5	2.5
	2.5 < CC ≤ 4.5	2.45
	>4.5 CC ≤ 7.1	2.4
	>7.1	2.3
Cooling and Heating		
Single Package	≤ 4.5	2.15
Split System	≤ 2.5	2.4
	2.5 < CC ≤ 4.5	2.35
	>4.5 CC ≤ 7.1	2.3
	>7.1	2.25

Source: *The Limited Values of Energy Efficiency and Evaluating Values of Energy Conservation for Room Air Conditioners in China 2000* cited in EnergyConsult 2002

Korea

MEPS were introduced in Korea in 1992. The standard sets out a two tier system which includes a MEPS level and a more stringent target level know as TEPS. While the aim of the MEPS is to eliminate the most inefficient models from the market, TEPS are in place to encourage manufacturers to increase the efficiency of their products. Typically Korea updates the standards every 3 to 5 years and it is common that the TEPS becomes the new MEPS level. The most recent standard came into effect in 2004. These new MEPS levels are among the most stringent levels in the world.

MEPS Levels

Table 11 presents the latest MEPS and TEPS levels required for air conditioners in Korea.

Table 11 Room Air Conditioner MEPS for Korea

Type of Air Conditioner	Cooling Capacity Category (kW)	2000 MEPS Level (COP)	2004 MEPS Level (COP)
Single Package (window/wall)	All	2.37	2.88
Split System	< 4	2.86	3.37
	4 < CC ≤ 10	2.46	2.97
	>10 CC ≤ 17.5	2.25	2.76

Source: DEM 2004

Taiwan (Chinese Taipei)

Taiwan introduced mandatory MEPS for Air Conditioners in 1991 and recently updated in 2001. There are two standards, one for room air conditioners and one for unitary models. Room air conditioners cover all packaged models that have power consumption less than 3kW. Unitary air conditioners are classified as those models that have power consumption more than 3kW. This category does not include multi split units.

MEPS Levels

Table 12 presents the MEPS standards that are applicable to air conditioners in Taiwan. These levels became effective 1 January 2002.

Table 12 Air Conditioner MEPS for Taiwan

Type of Air Conditioner	Cooling Capacity Category (kW)	MEPS Level (EER)
Room Air Conditioners		
Single Package	< 2.3	2.71
	2.3 < CC ≤ 4.1	2.77
	> 4.1	2.6
Split System	≤ 4.1 Normal Type	2.97
	≤ 4.1 Inverter Type	2.77
	> 4.1 Both Types	2.73
Unitary Air Conditioners		
Air Cooling Type (input >3kW)	All	2.84
Water Cooling Type	All	3.69

Source: Chwan-Shing Huang, Manager, Energy Division, Research Department, Taiwan Electric Research & Testing Centre, confirmed this by email on 30 April 2002.

Philippines

The Philippines first developed a MEPS program in the early 1990's. The Department of Energy and the Bureau of Product Standards jointly runs the program. The regulations specifically for window wall room air conditioners were introduced in 1992 however the requirement for split systems to meet the standard was established in 2000.

MEPS Levels

MEPS levels are prescribed in a different standard to the test procedure. The standard is PNS 396-1:1995 -*Household Appliances Standard for Energy Efficiency Ratio and Labeling Requirement-Part I Room Air-conditioners*. The standard was tightened in 1997 to allow the minimum EER to be increased by 5% every three years. Table 13 presents the current MEPS levels required.

Table 13 Room Air Conditioner MEPS for Philippines

Type of Air Conditioner	Cooling Capacity Category (kj/h)	MEPS Level (EER) (kJ/Wh)
Single Package	< 12 000	9.1
	≥ 12 000	8.6
Split System	< 12 000	9.1
	≥ 12 000	8.6

Source: Egan & du Pont 1998 cited in EnergyConsult 2002.

Singapore

Air Conditioners are the only appliance in Singapore to be covered by MEPS. The program began in 1998 and applies to window type air conditioners only. The Productivity and Standards Board (PSB) is responsible for this program.

MEPS Levels

Table 14 presents the MEPS standards that are applicable to air conditioners in Singapore.

Table 14 Room Air Conditioner MEPS for Singapore

Type of Air Conditioner	Cooling Capacity Category (kW)	MEPS Level (EER) (kJ/Wh)
Single Package	≥ 2.6	8

Source: Pacudan & Gooneratne 2001.

Thailand

Air conditioners have become the first appliance in Thailand covered by MEPS. The Thai Industrial Standard Institute (TISI) developed the MEPS for air-conditioners (TISI

No. 2134-2545), and it became effective on a voluntary basis in August 2003, when it was published in the government gazette. The MEPS will become mandatory in March 2005, as it has been signed by the King, and will be published as a Royal Decree.

The standard covers both window and split-type air-conditioners of size up to 12 kW. The MEPS levels are shown in Table 15.

Table 15 Room Air Conditioner MEPS for Thailand

Type of Air Conditioner	Cooling Capacity Category (kW)	MEPS Level (EER) March 2005 (W/W)	MEPS Level (EER) January 2006 (W/W)
Window Units	CC ≤ 8.0	2.53	2.82
	8.0 < CC ≤ 12	2.53	2.53
Split Units	CC ≤ 8.0	2.82	
	8.0 < CC ≤ 12	2.53	

Source: APEC ESIS, 2005.

Additional Standards

Costa Rica, India, Israel, Russia and Saudi Arabia also have MEPS for room air conditioners. However, given that they have little trade relevance to Australia, these MEPS are not discussed in this report. Additionally, Mexico has MEPS for room, central and split system central and heat pump air conditioning. This report does not provide details on these as they have been aligned so as to replicate those of the USA. From July 2002 MEPS levels for the majority of Canadian air conditioners were also made identical to those of the USA. Therefore this report does not cover Canada's program (EES 2004). Also, Europe has a labeling program for air conditioners; however no MEPS are currently mandated, hence no comparison can be made to the Australian MEPS levels.

Comparison with Overseas MEPS Levels

Approach

General

The international MEPS levels for single phase window/wall and split air conditioners were compared to the registry of models approved for the energy labelling and MEPS in Australia. In general, the test conditions used by the countries chosen for comparison were based on, or close to, the ISO 5151-94 (T1 conditions), therefore it is possible to make relatively direct comparisons with the MEPS levels of these countries and Australia. Korea and Thailand have test their units to slightly different outdoor wet bulb temperature conditions (19.5°C compared to 19.0 °C in Australia) – this difference is estimated to reduce the EER of units by 1.2% (or 0.04 EER) if measured under Australian conditions (DEM 2004). For the purposes of the simple comparisons in the following sections, this difference is considered very small and the countries MEPS levels are reported as stated. This difference in MEPS levels is considered in the recommendations.

The countries selected for comparison were:

- USA – Window/Wall, Split
- Taiwan – Window/Wall, Split
- Japanese – Window/Wall, Split
- Korea – Window/Wall, Split
- Thailand – Window/Wall, Split
- China – Window/Wall, Split

The USA and Japan have different MEPS levels for cooling only and reverse cycle window/wall air conditioners, while the other countries do not differentiate between the cooling only and reverse cycle units (they do however specify a cooling based MEPS). In Japan, the target levels for split units are also different for cooling only or reverse cycle, and the target level specified is based on an equal average of the cooling and heating EER

The two major issues to be addressed in this analysis for the conversion of international MEPS levels are:

- Conversion of MEPS levels in the USA from Seasonal Energy Efficiency Ratio (SEER) to EER.

- Conversion of the Japanese “Top-Runner” combined cooling and heating target EER to an equivalent cooling EER for reverse cycle units.

The methodology applied to address these issues is the same as previously used (EnergyConsult 2002) and hence not repeated in this report.

International Comparison

Summary

Countries were selected for comparison on the basis of (1) they were a major source of air conditioners imported to Australia and (2) there was a MEPS in place or being proposed. For single phase air conditioners there are several countries with MEPS levels in place and all these countries are major sources of units for the Australian market.

The categories of units compared to the Australian market were:

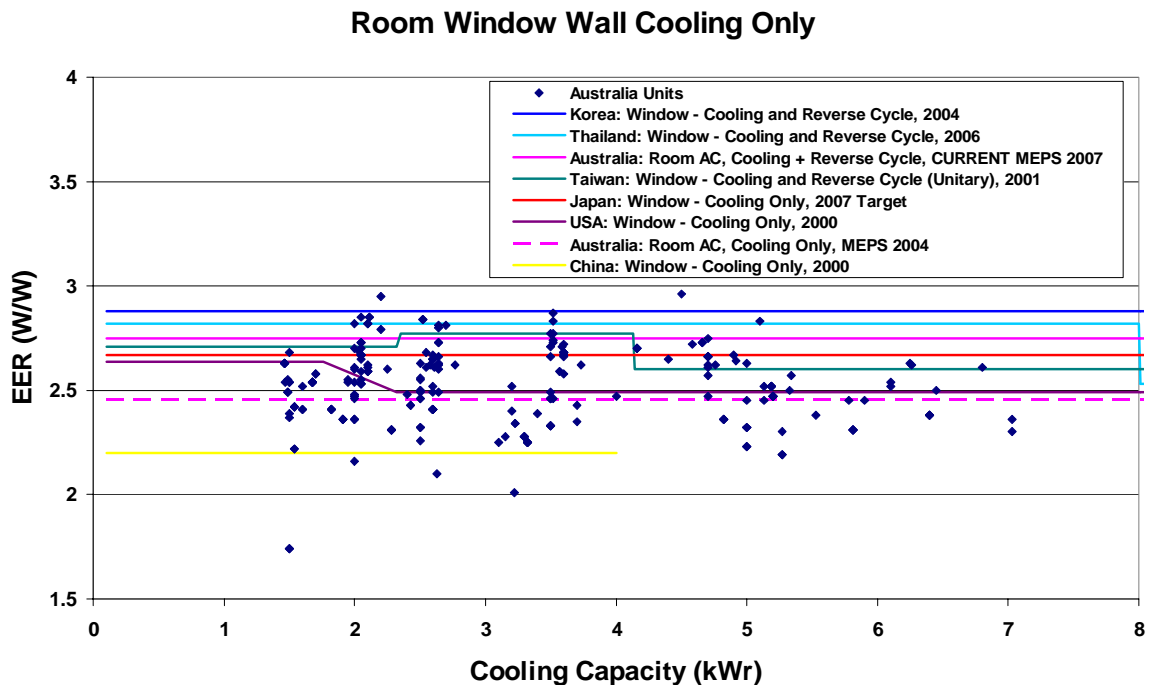
- Single phase unitary room or window/wall units
 - Cooling only
 - Heat pump (reverse cycle)
- Single phase split systems
 - Cooling only
 - Heat pump (reverse cycle)

The international MEPS levels were chosen to represent these categories although many countries did not distinguish between cooling only or heat pump type air conditioners.

For all international comparisons, the current Australia MEPS levels applicable in 2004 and 2007 are also shown.

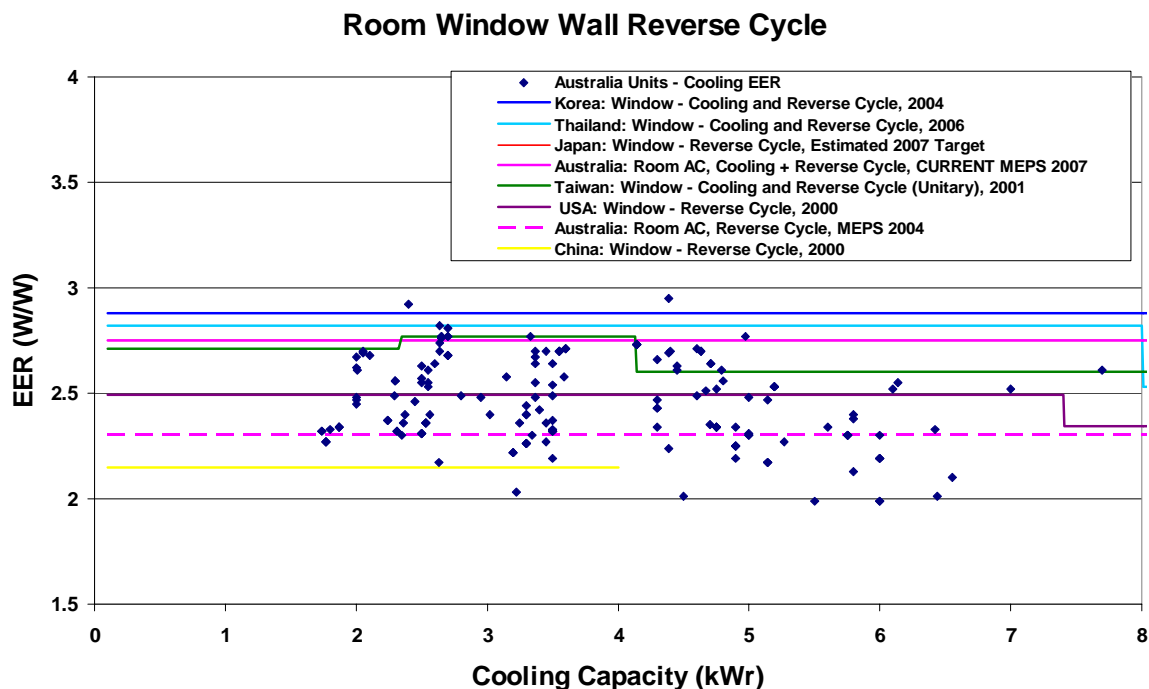
Room or Window/Wall Units (Unitary) - Single Phase

Several countries have MEPS that are applicable to room and window wall air conditioners. Figure 1 shows the comparison of the registered Australian units (as of January 2005) and the international levels currently in force and those proposed for cooling only.

Figure 1: Room AC Cooling Only - Comparison of International MEPS Levels

The most stringent MEPS levels currently in force are those of Korea (from 2004). Thailand's MEPS comes into force on the 1 January 2006. Not shown on the figure is the interim Thai MEPS that are set at 2.53 EER from March 2005. The Japanese "Top-Runner" target comes into force in 2004. Figure 1 shows that Australia's 2004 MEPS level is low in comparison to our Asian trading partners and the current 2007 MEPS level is approximately 5% less than the Korean 2004 MEPS level.

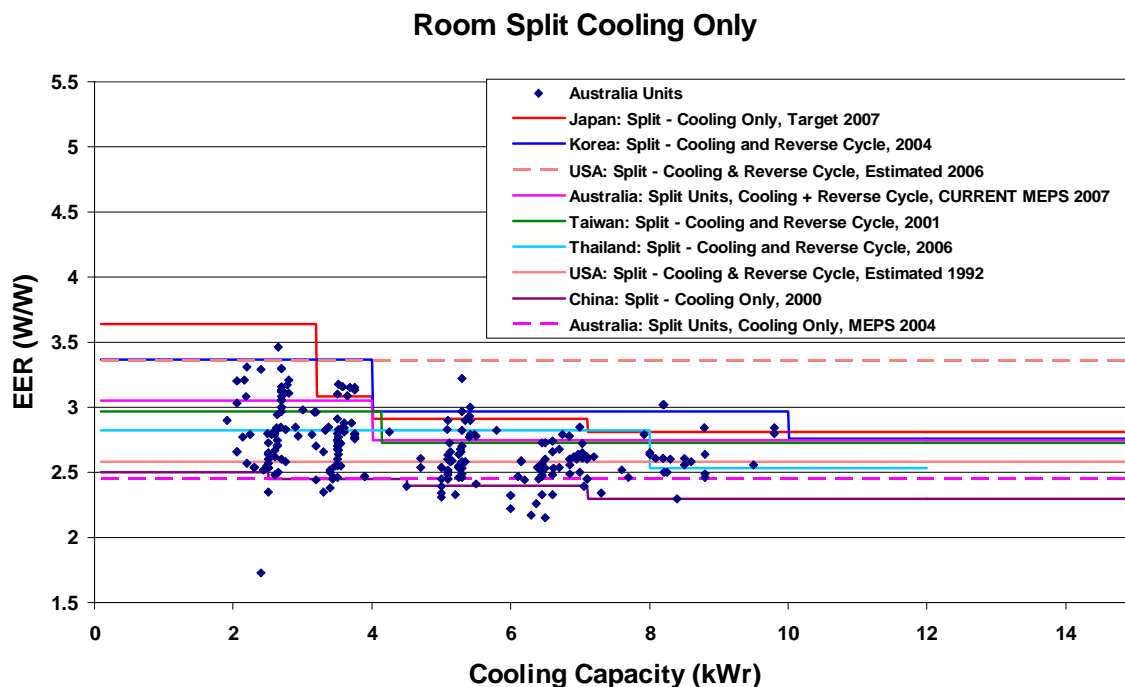
Figure 2 shows the comparison of the Australian MEPS levels, registered Australian units (as of January 2005), the international levels currently in force and those proposed for reverse cycle units.

Figure 2: Room AC Reverse Cycle - Comparison of International MEPS Levels

As was the case for cooling only units, the most stringent MEPS levels currently in force are those of Korea, followed by Thailand. The Japanese “Top-Runner” target comes into force in 2004 and is identical to the current 2007 Australian MEPS level. As the Japanese target is determined by an average of both cooling and heating EER, in this analysis the cooling target has been estimated by taking the average difference between cooling and heating EER for Australian units (found to be an EER of 0.1) and subtracting this from the Japanese target. This is an approximate estimate, however if the difference were much larger, the target cooling EER would be lower. Figure 2 again shows that Australia’s 2004 MEPS level is low in comparison to our Asian trading partners and the current 2007 MEPS level is approximately 5% less than the Korean 2004 MEPS level.

Split Systems - Single Phase

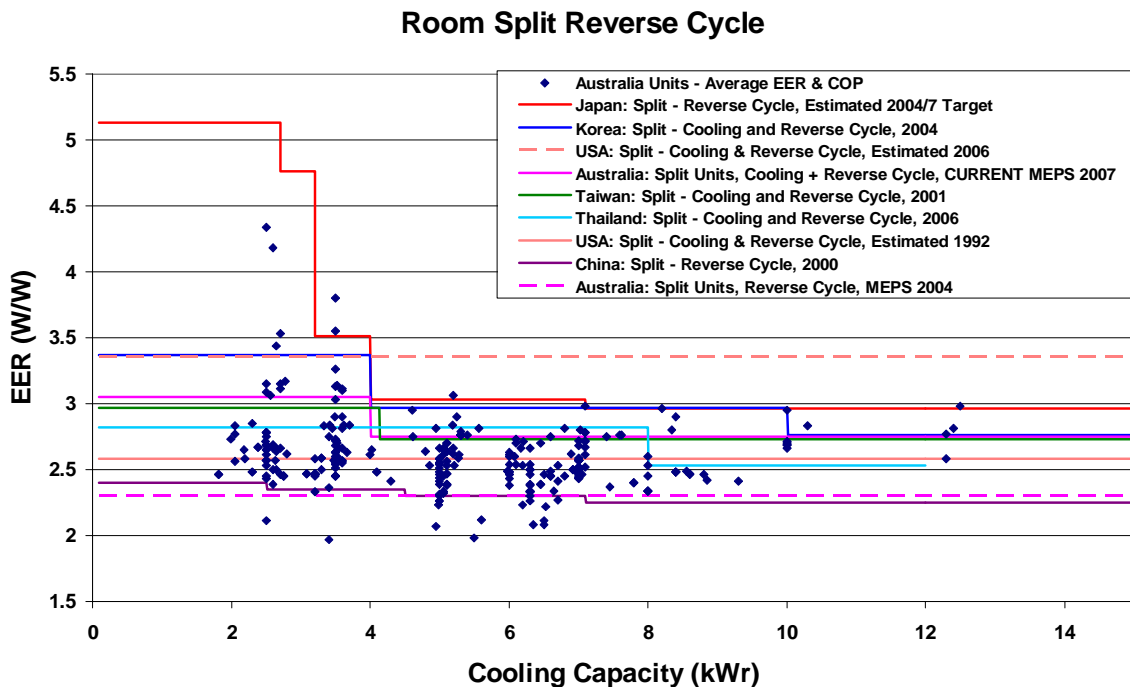
Most of the countries that Australia imports air conditioners from have MEPS that apply to split system air conditioners. Figure 3 shows the comparison of the registered Australian units (as of January 2005) and the international levels currently in force as well as those proposed for cooling only units.

Figure 3: Split System: Cooling Only - Comparison of International MEPS Levels

The most stringent MEPS levels currently in force are those of Korea. The Japanese “Top-Runner” target comes into force in 2007 while the proposed USA MEPS level is scheduled to be implemented in 2006. Figure 3 also shows that Australia’s 2004 MEPS level is low in comparison to our Asian trading partners and the current 2007 MEPS level is approximately 10% less than the Korean 2004 MEPS level for units under 4 kW output capacity; and 7.5% less for units between 4 kW and 10 kW output capacity.

The issues considered in the conversion of the USA and Japanese MEPS levels for this analysis are discussed in the previous report (EnergyConsult 2002).

Figure 4 shows the comparison of the registered Australian units (as of January 2005) and the international levels currently in force as well as those proposed for reverse cycle units.

Figure 4: Split System: Reverse Cycle - Comparison of International MEPS Levels

The most stringent MEPS levels currently in force are those of Korea. The Japanese “Top-Runner” target comes into force in 2004 for units under 4 kW, while the proposed USA MEPS level is scheduled to be implemented in 2006. As the Japanese target is determined by an average of both cooling and heating EER, in this analysis the cooling target has been estimated by taking the average difference between cooling and heating EER for Australian units (found to be an EER of 0.14) and subtracting this from the Japanese target.

Figure 4 once more shows that Australia’s 2004 MEPS level is low in comparison to our Asian trading partners and the current 2007 MEPS level is approximately 10% less than the Korean 2004/USA 2006 MEPS level for units under 4 kW output capacity; and 7.5% less for units between 4 kW and 10 kW output capacity.

Figure 4 also shows a large spread of efficiency of units sold currently in Australia with several already exceeding the current 2007 MEPS level. Compared to the review in 2002, 3 times more units are now available with EERs that exceed the current 2007 MEPS level. The range of EER is particularly high for those units less than 4 kW.

Findings

The MEPS levels of our major trading partners have increased since the last review of international MEPS in 2002. The most stringent MEPS levels are generally now found in Korea, whereas Taiwan was the most stringent in 2002. Australia’s current 2007 MEPS levels are now between 10% and 5% less than the most stringent in the Asia region.

Recommended MEPS levels

Introduction

Australia strives to match the international mandatory best practice MEPS levels (if cost effective) of our major trading partners within a few years of their enforcement in that country. This policy has been part of the NAEEEP since endorsed by Ministerial Council of Energy (comprising of Federal, State and Territory Energy Ministers) in 2001. A Regulatory Impact Statement (RIS) examines the cost effectiveness of the MEPS levels chosen for Australia is provided separately to this report. Hence the focus of the recommendations from this analysis is to identify the “Best practice” MEPS and recommend the MEPS levels for Australia.

In summary, the MEPS levels set by Korea in 2004 are the most stringent of Australia’s trading partners. As noted in *Benchmarking of Air Conditioner Efficiency Levels in Five Asian Countries* (DEM 2004), the vast majority of single phase, Australia’s air conditioners are imported from Northern Asia, primarily China, Korea, Thailand and Malaysia. This report also examined the efficiency of air conditioners being sold in the local markets compared with Australia and concluded that Thailand and Korea returned average energy efficiency ratios (EER) of 3.16 and 3.22 respectively, compared to Australia’s 2.68. Products from Thailand and Korea would easily comply with the current 2007 MEPS.

In addition, the Australian Refrigeration Equipment Manufacturers Association proposed in May 2004 to accelerate the implementation date of 2007 MEPS for certain product types to 2006 (AREMA 2004). The Australian government have welcomed this proposal. The analysis conducted by the AGO (DEM 2004) and the availability of product in Australia (for example, as shown in Figure 4), suggest that the earlier introduction of the 2007 MEPS levels for room air conditioners under 7.5 kW capacity would be easily accommodated.

Therefore it is recommended that:

1. Australia matches the 2004 Korean MEPS levels in 2007, replacing the current MEPS levels for 2007, for all single phase non-ducted air conditioners.
2. Australia bring forward the implementation date of the current 2007 MEPS levels to 2006 for all single phase non-ducted air conditioners up to 7.5 kW output capacity.

In addition, it is recommended that the NAEEEP program of MEPS for single phase air conditioners be aligned with the major Asian trading partners where the units are mostly produced. Therefore the basis of future MEPS should be primarily focused on Korea, Taiwan, Thailand and China; and to provide certainty to the air conditioning supplier industry.

The following sections specify the proposed MEPS levels and compare them with Australian models currently registered for Energy Labelling and MEPS. Note that the models registered include those models that were available for sale and registered before the introduction of the 2004 MEPS levels.

Window/Wall Units (Unitary) – Single Phase MEPS

From the analysis of international standards, the MEPS levels of Korea represent the international best practice for MEPS. As the MEPS level for Korea is already in force and approximately 2% of current Australian models would currently exceed the Korean MEPS, it would be appropriate to use these MEPS as basis for the Australian MEPS levels.

To allow for the difference in Korean test methods, the EER for the equivalent Australian MEPS levels are reduced by 0.04 EER. The proposed MEPS are shown in Table 16. The 2004 MEPS levels currently in place would apply until 2007 for units over 7.5 kW output capacity. However, it is proposed to align both cooling only and reverse cycle unit MEPS levels during the proposed 2006 MEPS update; hence MEPS level applicable to reverse cycle units over 7.5 kW will be increased from 2.3 EER to 2.45 EER.

Table 16 Australia Proposed MEPS for Window Wall Type Room Air Conditioners

Window Wall Air Conditioner	Cooling Capacity (kW)	Current MEPS 2004 Min EER	Proposed MEPS 2006 Min EER	Proposed MEPS 2007 Min EER
Reverse Cycle	< 4.0	2.3	2.75	2.84
	4.0 -7.5	2.3	2.75	2.84
	< 7.5	2.3	2.45	2.84
Cooling Only	< 4.0	2.45	2.75	2.84
	4.0 -7.5	2.45	2.75	2.84
	< 7.5	2.45	2.45	2.84

With these proposed MEPS, around 92% of current registered product would not meet the 2006 levels and 98% would not meet the proposed 2007 levels. The graphical representation of these proposed levels with the current registrations for cooling only and reverse cycle window wall type air conditioners are shown in Figure 5 and Figure 6. The current 2004 MEPS level is also shown.

Figure 5: Proposed MEPS for Single Phase Window Wall AC – Cooling Only

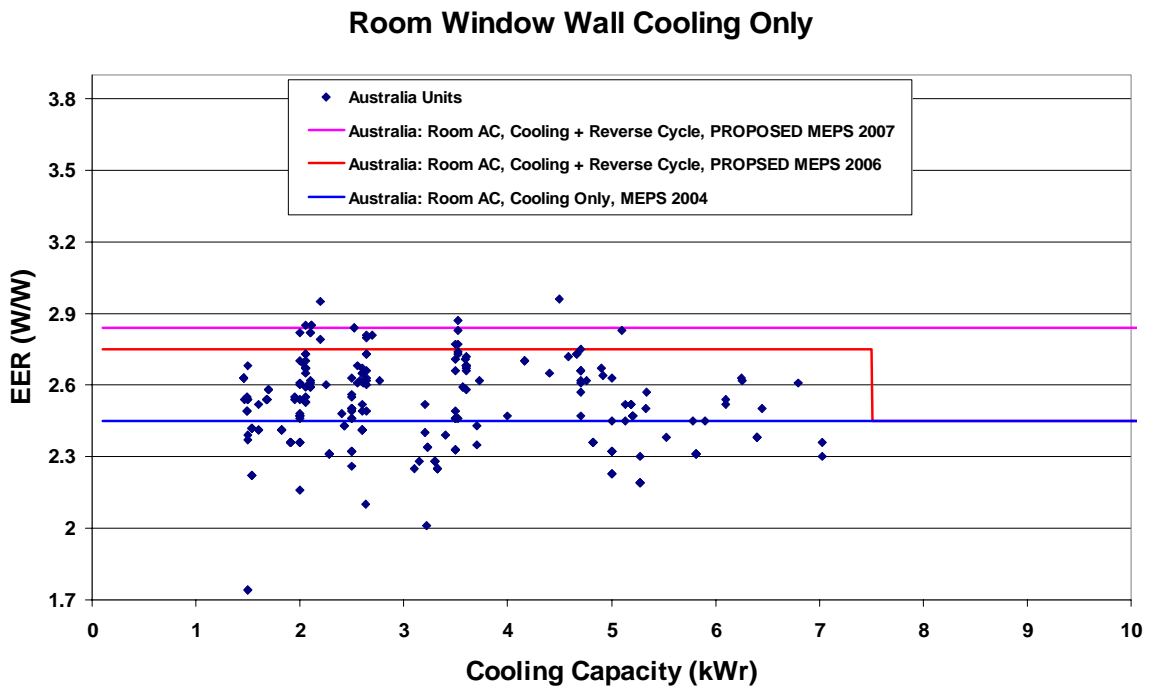
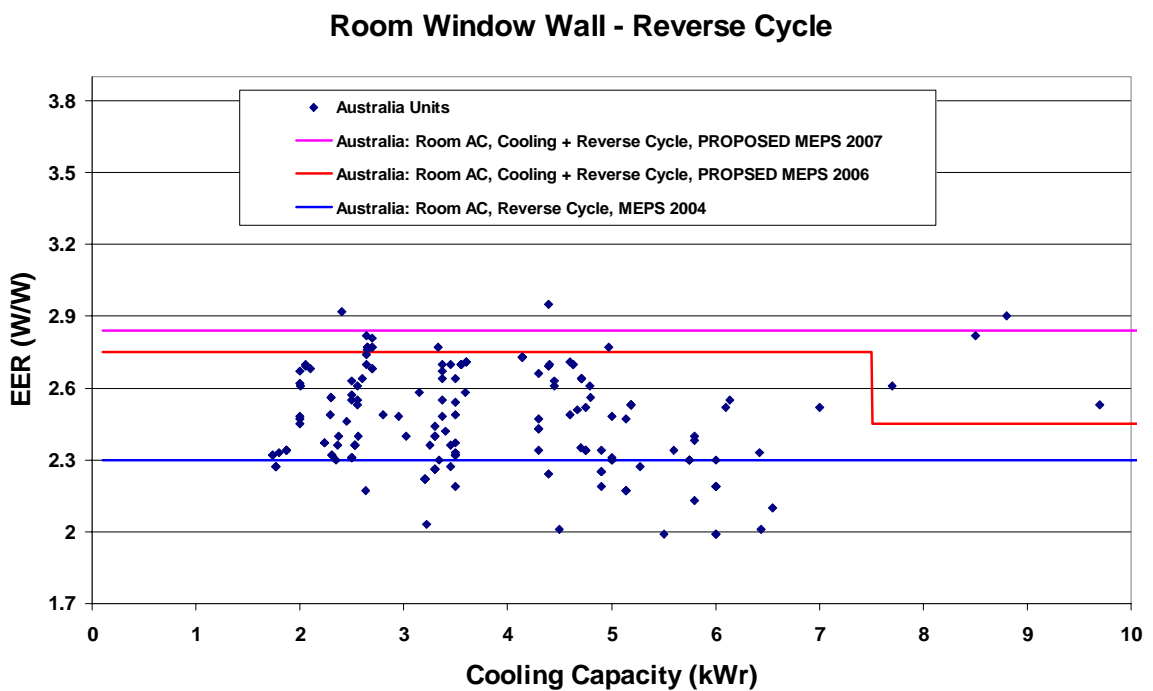


Figure 6: Proposed MEPS for Single Phase Window Wall AC – Reverse Cycle



Split Systems (Non-ducted) - Single Phase MEPS

From the analysis of international standards, the MEPS levels of Korea represent the international best practice for MEPS. Although the Japanese Top Runner targets are more stringent, they are not directly comparable to the Australian MEPS as they are applied to the sales weighted average value of units sold and the EER is estimated for the reverse cycle target. The USA MEPS are similarly not directly comparable as the USA MEPS are based on the SEER and the values shown are estimated empirically. As the MEPS level for Korea is already in force and approximately 7% of current Australian models would currently exceed the Korean MEPS, it would be appropriate to use these MEPS as a basis for the Australian MEPS levels.

To allow for the difference in Korean test methods, the EER for the equivalent Australian MEPS levels are reduced by 0.04 EER. The proposed MEPS are shown in Table 17. The 2004 MEPS levels currently in place would apply until 2007 for units over 7.5 kW output capacity. However, it is proposed to align both cooling only and reverse cycle unit MEPS levels during the proposed 2006 MEPS update; hence MEPS level applicable to reverse cycle units over 7.5 kW will be increased from 2.3 EER to 2.45 EER.

Table 17 Australia Proposed MEPS for Split Type Room Air Conditioners

Non Ducted Split Air Conditioner	Cooling Capacity (kW)	Current MEPS 2004 Min EER	Proposed MEPS 2006 Min EER	Proposed MEPS 2007 Min EER
Reverse Cycle	< 4.0	2.3	3.05	3.33
	4.0 -7.5	2.3	2.75	2.93
	7.6 – 10.0	2.3	2.45	2.93
	< 10.0	2.3	2.45	2.75
Cooling Only	< 4.0	2.45	3.05	3.33
	4.0 -7.5	2.45	2.75	2.93
	7.6 – 10.0	2.45	2.45	2.93
	< 10.0	2.45	2.45	2.75

With these proposed MEPS, around 84% of current registered product would not meet the 2006 levels and 93% would not meet the proposed 2007 levels. The graphical representation of these proposed levels with the current registrations for cooling only and reverse cycle window wall type air conditioners are shown in Figure 7 and Figure 8. The current 2004 MEPS level are also shown.

Figure 7: Proposed MEPS for Single Phase Non-ducted Split AC – Cooling Only

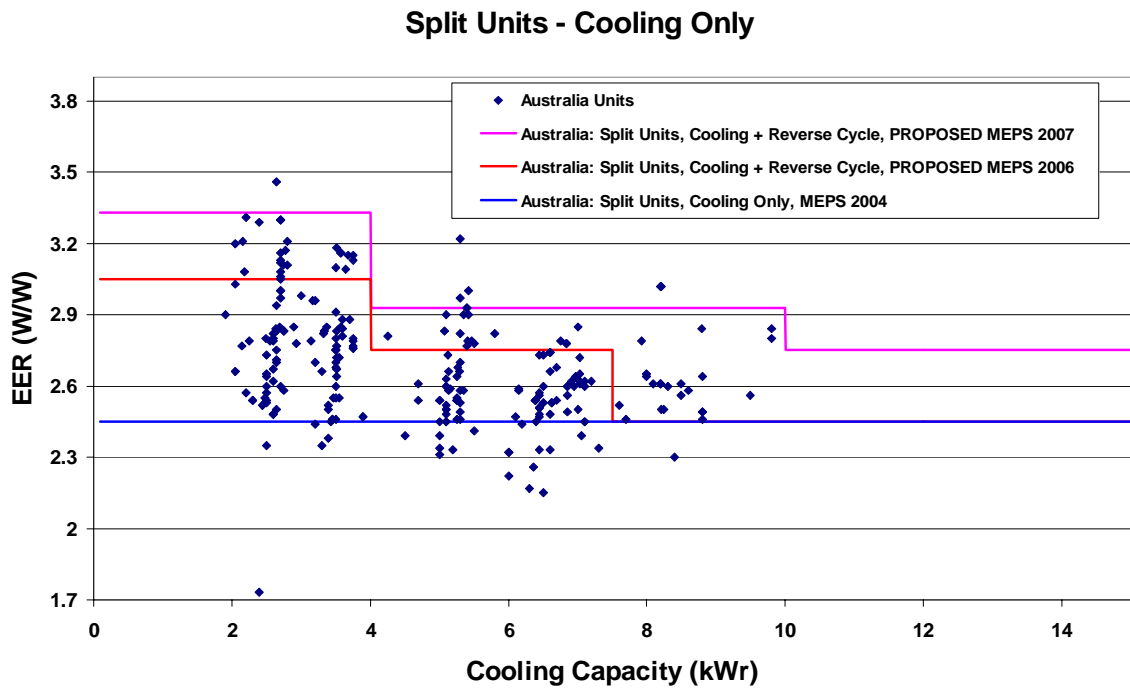
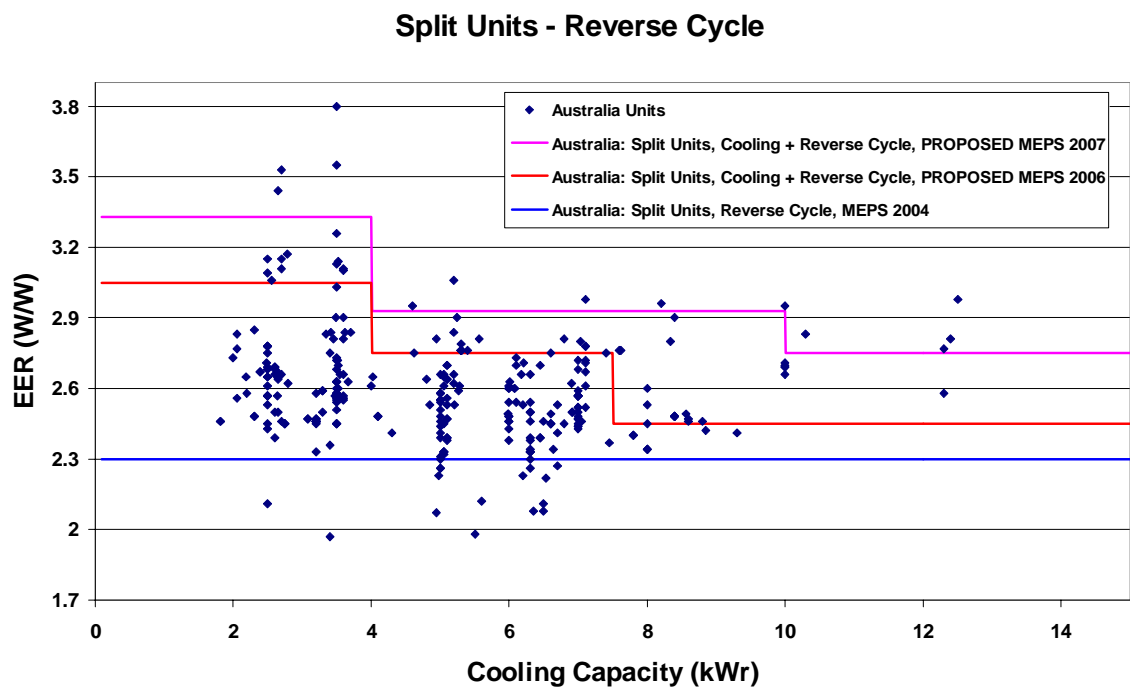


Figure 8: Proposed MEPS for Single Phase Window Wall AC – Reverse Cycle



Impact of MEPS

Since the MEPS criteria apply only to new products entering the market, it will be a number of years before these measures impact on the stock of existing products. Estimates of impacts undertaken for the RIS have shown the following.

- **Proposed 2007 MEPS** – Annual energy savings in 2016 are about 678 GWh per year and emissions by about 0.54 Mt CO₂-e per year
- **Proposed 2006 MEPS (early introduction of current planned 2007 MEPS)** – Annual energy savings due to the earlier introduction of these MEPS levels are estimated to reduce electricity by 131 GWh per year and emissions by 111 kt CO₂-e

These savings are substantial contributions to the goals of NAEEEP.

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