Decision Regulatory Impact Statement:

Minimum Energy Performance Standards for Air Conditioners: 2011

Issued by the Equipment Energy Efficiency Committee under the auspices of the Ministerial Council on Energy.

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This Regulatory Impact Statement (RIS) was prepared by EnergyConsult Pty Ltd for the Equipment Energy Efficiency (E3) Committee, which reports to the Ministerial Council on Energy (MCE). The MCE determines end-use equipment energy efficiency regulatory proposals involving all Australian Governments (Commonwealth, State and Territory) and the New Zealand Government.

The proposal discussed in this RIS is for Australia only at this stage.

This document was prepared by:

EnergyConsult PTY LTD

655 Jacksons Track
Jindivick, Victoria 3818
Australia
ABN: 18 090 579 365
Tel: +613 5628 5449
Fax: +613 9923 6175
Email: info@energyconsult.com.au

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Glossary

ABS	Australian Bureau of Statistics
AC	Air Conditioner
AGO	Australian Greenhouse Office
AREMA	Air Conditioning and Refrigeration Equipment Manufacturers Association of Australia
AS/NZS	Australian Standards and New Zealand Standards
BAU	Business-as-usual
BCA	Building Code of Australia
BCR	Benefit-cost Ratio
CBA	Cost Benefit Analysis
CPRS	Carbon Pollution Reduction Scheme
CO_2-e	Carbon dioxide equivalent units
COAG	Council of Australian Governments
COP	Co-efficient of Performance
DCCEE	Department of Climate Change and Energy Efficiency
DEWHA	Department of the Environment, Water, Heritage and the Arts
DR	Demand Response
E3	Equipment Energy Efficiency Committee (formerly NAEEEC)
EER	Energy Efficiency Ratio
EEEP	Equipment Energy Efficiency Program (formerly NAEEEP)
ETS	Emission Trading Scheme
GATT	General Agreement on Tariffs and Trade
GHG	Greenhouse Gas
GWA	George Wilkenfeld & Associates
GWh	Giga Watt hour – 1 million Watt hours
kt	Kilo Tonnes – 1 thousand Tonnes
kWh	Kilo Watt hour – 1 thousand watt hours
kWr	Kilo Watt refrigeration
MCE	Ministerial Council for Energy
MEPS	Minimum Energy Performance Standards
MRA	Mutual Recognition Act
Mt	Mega Tonnes – 1 million Tonnes
NAEEEC	National Appliance Equipment and Energy Efficiency Committee (now E3)
NAEEEP	National Appliance Equipment and Energy Efficiency Program (now EEEP)
NFEE	National Framework on Energy Efficiency
NPV	Net Present Value
NZ	New Zealand
PJ	Peta joules
RIS	Regulatory Impact Statement
SEER	Seasonal Energy Efficiency Ratio
TTMRA	Trans Tasman Mutual Recognition Arrangement
VRF	Variable refrigerant flow multi-split systems

Executive Summary

This decision Regulatory Impact Statement (RIS) has been prepared to communicate the potential impacts, costs and benefits arising from the proposed introduction of more stringent Minimum Energy Performance Standards (MEPS) levels for air conditioners which are covered by existing regulations and within the scope of the Australian/New Zealand Standard AS/NZS 3823.2.

Note, this decision RIS is for Australia only at this stage. If New Zealand decides to proceed with any of the agreed proposals contained within this RIS, a New Zealand discussion document will be released for public consultation at a later date.

Following the introduction of MEPS for air conditioners in 2001, MEPS levels have been periodically revised over the last ten years. The latest changes follow a decision RIS published in 2009 (EES 2009). Technical changes were published in AS/NZS3823.2-2009 and regulation implemented in April 2010. New calculations for annual energy consumption will apply from April 2011.

Subsequent to these changes:

1. in July 2009, the Council of Australian Governments (COAG) agreed to a measure to strengthen the April 2010 air conditioner MEPS by 10% from October 2011, subject to a RIS

2. on 1 September 2009, Queensland (QLD) introduced regulation prohibiting the sale of air conditioners (with a cooling capacity of up to 65kW) with an energy efficiency ratio (EER) of <2.9

3. on 1 January 2010, South Australia (SA) introduced new energy performance standards for air conditioners which are higher than both the current national MEPS and April 2010 MEPS.

The Problem

The use of an increasingly large number of air conditioners in the Australian market is contributing to our greenhouse gas emission impact. The problem has been detailed in the earlier RIS, "Decision RIS: Air Conditioner MEPS and Energy Labelling" (EES 2009).

In summary, the air conditioner market fails in several areas relating to the lack of buyer-friendly information. Consumers lack the ability to interpret the available technical information in order to make optimal decisions regarding air conditioner efficiency and operating costs. Many end-users are excluded from the purchase decision when air conditioners are selected. Also, due to split-incentive issues, the purchasers are often not motivated to consider life-time costs and, hence, energy efficiency. Generally consumers lack the information or the ability to understand and to effectively use the information. Consumers also lack the computation skills, time and motivation required to compare the life cycle costs of different air conditioners, so as to make informed financial choices regarding their air conditioner purchase. The proposed increase in the MEPS for air conditioners seeks to address these problems.

The Objective

The objective of the proposed strategies for air conditioners is to bring about reductions in Australia's greenhouse gas (GHG) emissions below what they are otherwise projected to be (the "business-as-usual" or BAU case), in a manner that is in the broad community's best interests, that is, achieving greenhouse abatement at a lower cost than under other schemes. Within the objective, it must also provide a broad positive financial benefit to end consumers, without compromising equipment quality, safety or functionality.

Options Considered

COAG requested in July 2009, through the Equipment Energy Efficiency (E3) program, to examine the feasibility of a MEPS increase of 10% above the April 2010 MEPS levels (**MEPS2010+10%**), with MEPS based on annualised EER/COP values. The new MEPS levels would be introduced no later than October 2011.

The following alternative options were developed and evaluated alongside the COAG-requested increase for comparison:

- **Proposal A:** MEPS levels increased generally by 10% above the April 2010 MEPS, with discontinuities[1] removed in the MEPS requirements by using one MEPS level for all air conditioners with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. This proposal would be introduced in October 2011

- **Proposal A1:** MEPS levels increased generally by 10% above the April 2010 MEPS. The smaller non-ducted split systems would have a slightly higher MEPS levels than the MEPS2010+10% and the MEPS level for systems >39kW would be lower. This proposal would be introduced in October 2011

- **Proposal B:** MEPS levels increased by more than 10% above the April 2010 MEPS for all but one size of air conditioners. Discontinuities would be removed in the MEPS requirements by using one MEPS level for all air

[1] The discontinuities referred to are when the MEPS levels change abruptly for different sizes or types of air conditioners, potentially meaning very similar air conditioners may need to meet different MEPS.

conditioners, with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. This proposal would be introduced in October 2012, 12 months later than Proposal A

- **Proposal C:** Proposal C is an extension of Proposal A, with an additional increase in the MEPS levels to be introduced in 2014. Again the discontinuities would be removed in the MEPS requirements by using one MEPS level for all air conditioners, with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. The first phase of this proposal would be introduced in October 2011, followed by a second phase in October 2014.

Subsequent to the request by COAG in July 2009, the Ministerial Council on Energy (MCE) at its meeting on 4 December 2009, requested the examination of Queensland and South Australian State-specific MEPS for adoption nationally, as interim MEPS commencing in October 2010 until the introduction of a more substantive MEPS in October 2011 (note that the Queensland and South Australian MEPS for air conditioners are more stringent that the current national MEPS). These options were developed and modelled accordingly, see Appendix 3. However, these options have now been rendered redundant by expiry of the intended commencement date of 1 October 2010.

Impact Analysis

The projected energy savings for the different options are presented in the table below. The MEPS impact is based on an implementation date of October 2011.

Projected Energy Savings (GWh pa) by Scenario and Year

Scenario / Year	2015	2020	2025
MEPS2010+10%	278	605	769
Proposal A	342	743	942
Proposal A1	273	594	756
Proposal B	324	860	1,158
Proposal C	591	1,839	2,652

The projected savings are significant under all the national MEPS options, but there are a number of important differences, including:

- the MEPS2010+10% proposal produces similar levels of savings to those of Proposal A1

- Proposal B, the slightly delayed introduction of the new but higher MEPS levels produced at least 20% greater savings than either the MEPS2010+10% proposal or Proposal A
- Proposal C produced over three times the savings of the MEPS2010+10% proposal, but this assumed products would be available in all categories and this may not prove to be the case.

The options resulted in financial benefits that exceeded costs. The table below shows the energy and emissions impacts, the Net Present Value (NPV) for Australia and the Benefit Cost Ratio (BCR) for all the MEPS options being considered.

Summary Impact Data for Scenarios

Scenario	Energy Saved (cumulative to 2025)	GHG Emission Reduction (cumulative to 2025)	Total Benefit	Total Cost	Net Benefit (energy & peak demand savings)	BCR
Units	**GWh**	**Mt CO_2-e**	**$M**	**$M**	**$M**	
MEPS2010+10%	10,684	8.9	$2,200	$968	$1,232	2.3
Proposal A	12,992	10.9	$3,022	$1,395	$1,627	2.2
Proposal A1	10,506	8.8	$2,248	$1,015	$1,233	2.2
Proposal B	15,137	12.6	$3,443	$1,667	$1,776	2.1
Proposal C	34,119	28.4	$6,349	$4,557	$1,792	1.4

Note: Cumulative values account for the effects on products installed up to 2025, and their associated lifetime energy savings/greenhouse gas emission reductions to 2040. Amounts calculated with a 7% discount rate.

To assess the potential sensitivity of the benefit-costs to the estimated incremental price increase for air conditioners due to the MEPS, a number of options were modelled. The incremental price increase of air conditioners was increased by 50% and decreased by 50%. The BCR remained above 1.0 for Proposal A1. The benefit-cost ratios for all the Australian states were also analysed, for Proposal A1 scenario. In all states, the BCR is above 1.0. The implication is that Proposal A1 MEPS increases will be cost effective in the different jurisdictions.

The following table shows the effect on registered models of the various proposed MEPS options, with the proposed options reducing the range of currently available models between 69 and 97%. Non-compliance rates for the non-state MEPS proposals are similar to those projected in previous RISs that assessed the impact of MEPS for air conditioners in 2006/7 and 2010.

Non-compliant Models with Various Proposed MEPS Options

MEPS Option	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
MEPS 2010+10%	929	387	1,316	71%
Proposal A	1,015	301	1,316	77%
Proposal A1	911	405	1,316	69%
Proposal B	1,121	195	1,316	85%
Proposal C	1,276	40	1,316	97%

Note: These figures are based on data from the Energy Labelling and MEPS registration database as of 5 November 2010.

Trans-Tasman Implications

New Zealand manufacturers who export air conditioners to the Australian market will need to meet the increased proposed MEPS levels. If non-MEPS compliant products are imported via New Zealand, an exemption for the relevant air conditioners would need to be sought by New Zealand under the Trans-Tasman Mutual Recognition Arrangement (TTMRA).

Evaluation and Conclusions

A summary of the alternative MEPS levels assessed in this RIS are shown in the following table. Proposal A, B and C eliminate discontinuities in the MEPS levels, while also improving the efficiency by at least 10%. In fact, Proposal C achieves a 25.2% improvement in efficiency compared to the energy use under the current April 2011 MEPS.

Summary of MEPS Options Examined (Minimum EER/COP)

AC Category	MEPS 2010 (BAU)	MEPS2010 + 10%	Proposal A	Proposal A1	Proposal B	Proposal C
Date Implemented	*Current (Apr 2010/11)*	*Oct 2011*	*Oct 2011*	*Oct 2011*	*Oct 2012*	*Oct 2014*
Non-ducted Split <4kW	3.33	3.66	3.6	3.66	3.7	4.0
Non-ducted Split 4kW to <10kW	2.93	3.22	Slope	3.22	Slope	Slope
Non-ducted unitary <10kW	2.84	3.12	3.1	3.1	3.2	3.5
Non-ducted unitary 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
Ducted <10kW	2.75	3.03	3.1	3.1	3.2	3.5
Non-ducted split 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
Ducted 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
All 19kW to 39kW	3.05	3.35	3.1	3.1	3.2	3.5
All >39kW	2.75	3.03	3.1	2.9	3.2	3.5
Average % efficiency above MEPS2010		10%	12%	10%	15%	25%

Note: The average difference in efficiency between the MEPS 2010 and the alternatives was calculated. The average is weighted by sales in each AC category, so the average efficiency percentage would provide a representative indication of the energy savings for each MEPS option.

The ranking of the MEPS options by their net benefits in Australia is as follows:

- MEPS2010+10%
- Proposal A
- Proposal A1
- Proposal B
- Proposal C.

Proposal A1 was developed from a combination of Proposal A and MEPS2010+10% to take into account stakeholder feedback from the consultation RIS. Proposal A1 addresses stakeholder feedback regarding the availability of efficient air conditioner models within certain categories, while still meeting the sales weighted average increase of 10% over the 2010 MEPS levels.

Conclusions

After consideration of the options it is concluded that a revised MEPS option will be effective in meeting all the stated objectives.

Although MEPS2010+10% and Proposal A both produce greater net benefits than Proposal A1, these proposal also lead to much greater reductions in the numbers of currently registered products that will comply with the MEPS. This is of particular concern in the 4 to 6kW split system, the 19 to 39kW and >39kW product categories where obtaining alternative, more efficient models may be difficult. Consequently, Proposal A1 appears to be a preferable alternative to MEPS2010+10% or Proposal A.

The recommended MEPS Proposal A1 includes the new category of multi-split air conditioners, which will meet the same MEPS levels as all other non-ducted split systems. The test procedure for this category of air conditioners is being finalised and not expected to be adopted in Australia until 2011. Therefore, the MEPS for multi-split air conditioners will apply when Proposal A1 is implemented or as soon as practical after the test procedure is adopted by Standards Australia, and the date notified by State and Territory Government regulators.

It was also concluded that the part-load allowance should be retained but that the introduction of a Seasonal Energy Efficiency Ratio (SEER) MEPS metric be researched. The use of the SEER metric should be explored for future MEPS or for the appliance labelling program to be considered in 2014. If SEER is used in a future MEPS then the need for a part load allowance will disappear. Subject to a further RIS and the investigation of a SEER metric, Option C would be the indicative MEPS levels for 2014.

It was concluded that the use of simulation for compliance with MEPS is to be removed for ducted air conditioners of <30kW.

In summary the recommendations are:

- Proposal A1 requirements be implemented by 1 October 2011, with standard transitional arrangements
- multi-split air conditioners be covered by the new MEPS, and these units be required to meet the same MEPS levels as all other non-ducted split systems
- State and Territory Government regulators notify stakeholders if a delay is required for including multi-split air conditioners within the scope of these MEPS due to the publishing of the internationally accepted test methodology by Standards Australia
- part-load allowance should be retained but that the introduction of a SEER MEPS metric be researched
- Option C will be the indicative MEPS levels for 2014, but be subject to a further RIS and the investigation of a SEER metric
- use of simulation for compliance with MEPS is to be removed for ducted air conditioners of less than 30kW.

Differences between Consultation RIS and Decision RIS

There are a number of differences between the consultation RIS (E3 report 2010/04 on www.energyrating.gov.au) and this decision RIS. This decision RIS includes new data on registered products, updated costs and a modified proposal as a result of stakeholder submissions on the consultation RIS. The cost benefit analysis methodology has been strengthened. References to the potential Interim State MEPS based options have been removed and this analysis now shown in Appendix 3, as previously discussed. Other modifications to this RIS have been based on comments and suggestions provided by the Office of Best Practice Regulation Review of the Department of Finance and Deregulation.

1. Introduction

This decision RIS document has been prepared to communicate the potential costs and benefits arising from the proposed introduction of more stringent MEPS levels for air conditioners which are covered by existing regulations and within the scope of AS/NZS 3823.2. In addition, this RIS also considers the expansion of the MEPS to multi split air conditioners and changes to the existing MEPS requirements relating to part load allowance and the use of computer simulations of performance for compliance in certain categories.

This decision RIS is applicable to Australia only at this stage. If New Zealand decides to proceed with any of the agreed proposals contained within this RIS, a New Zealand discussion document will be released for public consultation at a later date.

Following the introduction of MEPS for air conditioners in 2001, MEPS levels for air conditioners have been increased over the last ten years. The latest changes follow a decision RIS published in 2009 (EES 2009). Technical changes were published in AS/NZS3823.2-2009 and regulation implemented in April 2010. New calculations for annual energy consumption will apply from April 2011.

Subsequent to these changes:

2. in July 2009, COAG agreed to a measure to strengthen the April 2010 air conditioner MEPS by ten % from October 2011, subject to a RIS

3. on 1 September 2009, QLD introduced regulation prohibiting the sale of air conditioners (with a cooling capacity of up to 65kW) with an EER of <2.9

4. on 1 January 2010, SA introduced new energy performance standards for air conditioners which are higher than the current MEPS and April 2010 MEPS for all categories of air conditioner.

In December 2009, the MCE requested QLD and SA prepare a RIS modelling the QLD or SA energy performance standards. It was subsequently agreed that the modelling of adoption of either QLD's or SA's standards, as an interim MEPS commencing October 2010, should be undertaken as part of this RIS. This modelling was presented in the Consultation RIS but has been moved to Appendix 3, of this decision RIS. The MEPS options based on the State MEPS are not presented in this decision RIS as these options were time-critical, with a commencement date of 1 October 2010. With the expiry of the planned commencement date, these options are no longer viable.

A summary of the changes to the levels of the air conditioner MEPS by dates are shown in Table 1. It should be noted that the existing State MEPS are determined on operating efficiency, but that post-April 2011 the national MEPS are determined on annual efficiency. For most air conditioners, an annual efficiency MEPS will be more stringent than an equivalent operating efficiency MEPS of the same level, as annual efficiency measurements include energy used in standby and crankcase operation.

The proposed changes will affect air-cooled air conditioners and so affect almost all refrigerative air conditioners in the residential sector and the majority of refrigerative air conditioners in the commercial sector. The proposed MEPS will not affect evaporative and water cooled air conditioners.

Table 1 - Current State and National MEPS Levels for Air Conditioners (minimum EER/COP)

Product Category	MEPS (2007) (operating efficiency)	MEPS April 2010 (operating efficiency)	MEPS April 2011 (annual efficiency)	QLD MEPS Sept 2009 (operating efficiency)	SA MEPS July 2010 (operating efficiency)
Non-ducted unitary <10kW	2.75	2.84	2.84	2.9	2.9
Non-ducted unitary 10kW to <19kW	2.75	2.75	2.75	2.9	2.9
Non-ducted split <4kW	3.05	3.33	3.33	2.9	3.4
Non-ducted split 4kW to <10kW	2.75	2.93	2.93	2.9	3.0
Non-ducted split 10kW to <19kW	2.75	2.75	2.75	2.9	3.0
Ducted systems – single phase <19kW	2.50	2.75	2.75	2.9	2.9
Ducted systems – three phase <10kW	2.50	2.75	2.75	2.9	2.9
Ducted 10kW to <19kW (Three Phase)	2.75	2.75	2.75	2.9	2.9
All 19kW to 39kW	3.05	3.05	3.05	2.9	3.1
All >39kW to 65kW	2.75	2.75	2.75	2.9	2.9

1.2 Scope

This project considers the development and revision of MEPS for air conditioners in line with the COAG proposal to raise the standards for air conditioners by 10% (COAG 2009). The study has drawn on the work of the *'Regulatory Impact Statement: Consultative Draft: Revision to the Energy Labelling Algorithms and Revised MEPS levels and Other Requirements for Air Conditioners'* (EES 2008b) and the "*Decision RIS: Air Conditioner MEPS and Energy Labelling*" (EES 2009). These RIS' contained recommendations to replace or extend the requirements for MEPS and product labelling.

The development of the RIS involved:

- collecting and obtaining data on the sales and penetration of air conditioners for Australia and New Zealand
- obtaining and using registration data of air conditioners, including the annual energy consumption and star rating data

- investigating the share of stock and new sales (and forecasts) of air conditioners and portable units which are important in determining the direction of potential policy options
- integrating market and energy performance data to determine the overall market energy consumption trends and trends for air conditioners types
- estimating the potential benefits from reduced electricity system peak demand as a result of increased efficiency of air conditioners.

1.3 Background and Market Characteristics

Product Types- Scope of Coverage

The range of product types to be included in the RIS is the full range of air conditioners covered by the Australian/New Zealand Standard AS/NZS3823.2:2009. The air conditioner product types can be divided by both technology characteristics and by size. The principal product classifications and numbers of products registered in November 2010 are:

- three phase units:

1. ducted systems (263)
2. non-ducted split units (22)

- single phase units:

1. ducted systems (213)
2. non-ducted unitary units (108)
3. non-ducted split units (710).

It is the single phase, non-ducted single split systems which make up the majority of refrigerated air conditioner sales, principally to the residential market. However, the Australian Bureau of Statistics (ABS) in 2008 reported that 28% of households now have ducted air conditioning, though many of these will use evaporative air conditioners. Three phase systems are predominantly used in commercial and industrial premises but smaller buildings also use single phase units.

Australian Market

The air conditioner market in Australia has existed for decades and consists of a range of smaller air conditioner products which are principally installed in the residential sector, as well as many larger and specialised air conditioners that service the commercial and industrial sectors.

In the residential sector, penetration rates derived from ABS survey data (ABS, 2008) indicate that ownership rates of reverse-cycle and refrigerative air conditioners are growing rapidly. As indicated in Table 2, the national penetration of air conditioners has doubled in the last ten years.

Table 2 - Australian Penetration Rate of Non-evaporative Air Conditioners in Households

Proportion Households with Non-Evaporative AC	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
2008	50.3%	48.9%	59.0%	61.7%	52.4%	34.1%	74.3%	35.1%	52.4%
2005	45.1%	39.7%	49.4%	59.1%	40.8%	18.0%	73.5%	33.6%	44.2%
2002	36.5%	34.9%	32.9%	56.0%	35.0%	9.6%	71.4%	20.3%	36.2%
1999	21.0%	30.9%	18.2%	34.2%	23.2%	1.8%	68.1%	13.7%	24.0%
1994	25.2%	28.9%	13.3%	46.9%	23.6%	1.4%	59.8%	10.7%	25.2%

The air conditioner market can be divided into the residential and commercial/industrial markets.

The residential market is focused on smaller air conditioners, both ducted and non-ducted and under 20kW in size, though they are generally much smaller than this. The majority of residential purchases are first time purchases, with only approximately 13% of purchases being for replacement purposes, according to BIS Shrapnel (BIS 2006). A third of consumers did not conduct pre-purchase research. For a third of first time purchases of non-ducted air conditioners, key drivers for the purchase were renovation activity or setting up a new household. These were the drivers for around half of the purchases of ducted air conditioner systems.

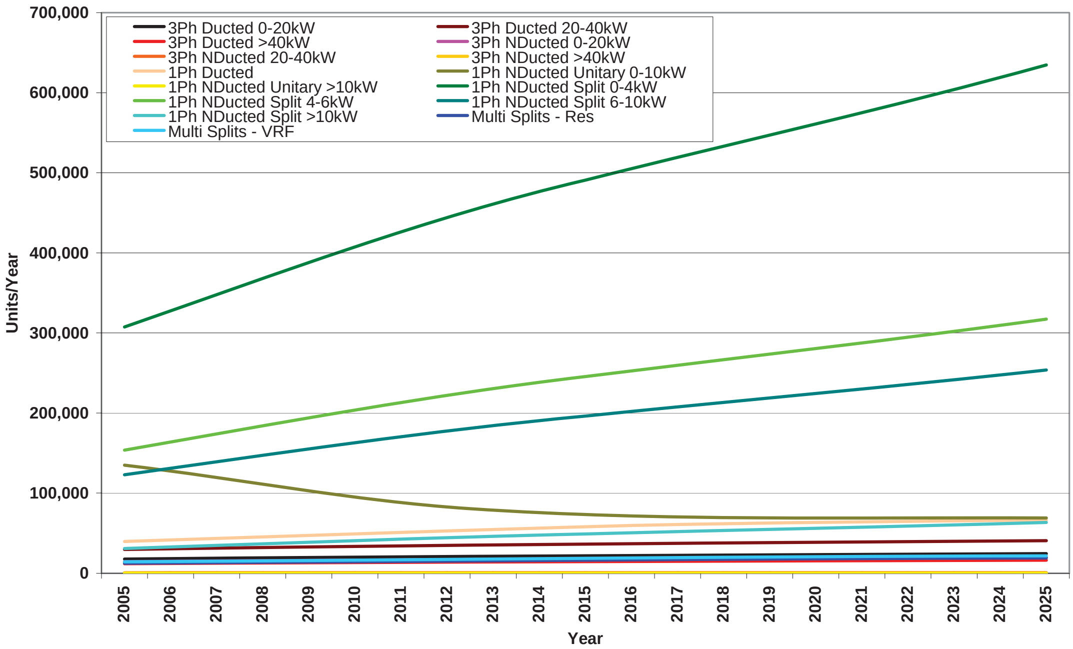
The commercial/industrial air conditioner market consists of smaller units, used for smaller commercial premises and also used for some residential purposes, and larger units, over 20kW, which are used for larger commercial and industrial premises. It is estimated (EES 2009) that the proportion of air conditioners purchased for the residential sector is approximately 70%, with 30% going to the commercial/industrial sector, but as commercial/industrial sector uses much larger units the energy impact of the commercial/industrial outweighs the residential sector.

There is a significant problem with split incentive in the market for air conditioners due to a large proportion of property not being owner occupied. Approximately 28.5% of residential housing (ABS 2008) and 82% of commercial property is leased (Higgins 2007).

The problem with split incentives is likely to be more pronounced in the commercial sector, as more commercial premises are rented, hence, more landlords than end-users will be the purchasers of the air conditioning systems.

The number of installed air conditioners in the market continues to grow rapidly. The following figures indicate the past and projected sales of units by particular type, based on GfK, BIS Shrapnel and other industry data, and provide insight into the extent of this growth.

Figure 1 - Australia: Annual Sales of AC by Category



Suppliers

There are numerous suppliers of air conditioning units. An analysis of the registration database shows that products are registered under approximately 180 different brands, but a significant proportion of suppliers produce 2 or 3 brands so it is estimated that the actual number of suppliers is closer to 100. There are 10 to 15 major suppliers in the market, who supply approximately 80% of units sold, while the remainder are all small suppliers.

There are a small number of air conditioner manufacturers in Australia who concentrate on the larger packaged air conditioning systems, however, the vast majority of air conditioners are imported.

The retailers of air conditioners can be broadly divided into specialist air conditioner retailers, electric and home appliance retailers and retail chains. The retail chains, such as hardware chains, only sell air conditioners on an opportunistic basis and will offer a very limited range of products during the early summer season. The other retailers will carry a range of various products. Another supply avenue is through project home builders who may buy air conditioners in bulk.

2 The Problem

There is an increasingly large number of air conditioners in the Australian market, whose use contributes to our greenhouse emission impact as well as making a significant contribution to peak demand on the electricity system, especially on hot summer days. As has been demonstrated in earlier air conditioner RIS reports, introducing and raising MEPS levels is the most effective method of improving the efficiency of the air conditioners installed. The principal issue for this RIS is to determine whether a 10% increase in the MEPS for air conditioners from the 2010 levels is a cost effective measure.

There are a number of related issues concerning the implementation of the MEPS and labelling for air conditioners, including:

- restricting the use of simulation as the basis for air conditioner registration
- removal of the part load MEPS compliance requirement for air conditioners with inverter technologies
- regulation of multi-split air conditioners.

These problems and issues are discussed in further detail below.

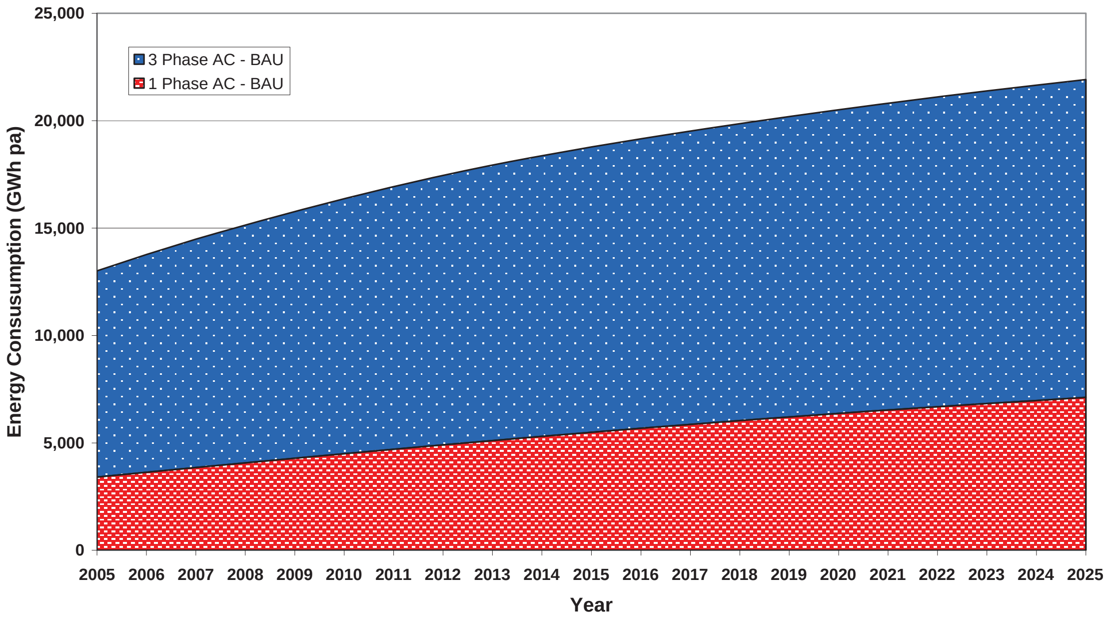
2.1 Increasing Energy Consumption and Greenhouse Emissions

Energy consumed in the operation of equipment and appliances is a major source of energy demand and GHG emissions within the Australian residential, commercial and industrial sectors. The Australian and State and Territory governments have recognised the substantial contribution that improving energy efficiency can make to GHG abatement to address climate change. Improved efficiency will reduce the demand for energy and have flow on effects for security of energy supply, lowering reliance on fossil fuels to meet peak demands and reduced cost to the end user. Other environmental benefits from reduced energy use also include reductions in emissions of sulphur oxide (SO_x), and mercury (Hg).

The estimated energy consumption by space cooling in the residential sector has been reported by in *Energy Use in the Australian Residential Sector, 1986-2020*, (EES, 2008) as ranging from 10.5 to 18PJ pa over the period 2005 to 2020, of which the vast majority is from refrigerative air conditioners. Despite the improvement in the efficiency of air conditioners that has occurred and will continue to occur, the growth in air conditioner numbers and the increasing size of houses is expected to result in an ongoing increase in energy use for space cooling. According to EES (2008) by 2007, space cooling formed 3% of all residential energy consumption, up from 1% in 1990. In the commercial sector, air conditioning represented 21% of the energy end use which is forecast to grow from approximately 50PJ pa in 2005 to 90PJ pa in 2030 (CIE 2007).

The projected growth and breakdown of energy use by air conditioners for Australia is shown in Figure 2 and Figure 3. These growth projections indicate a similar significant growth in energy use for the next fifteen years.

Figure 2 - Projected Energy Consumption for Air Conditioners

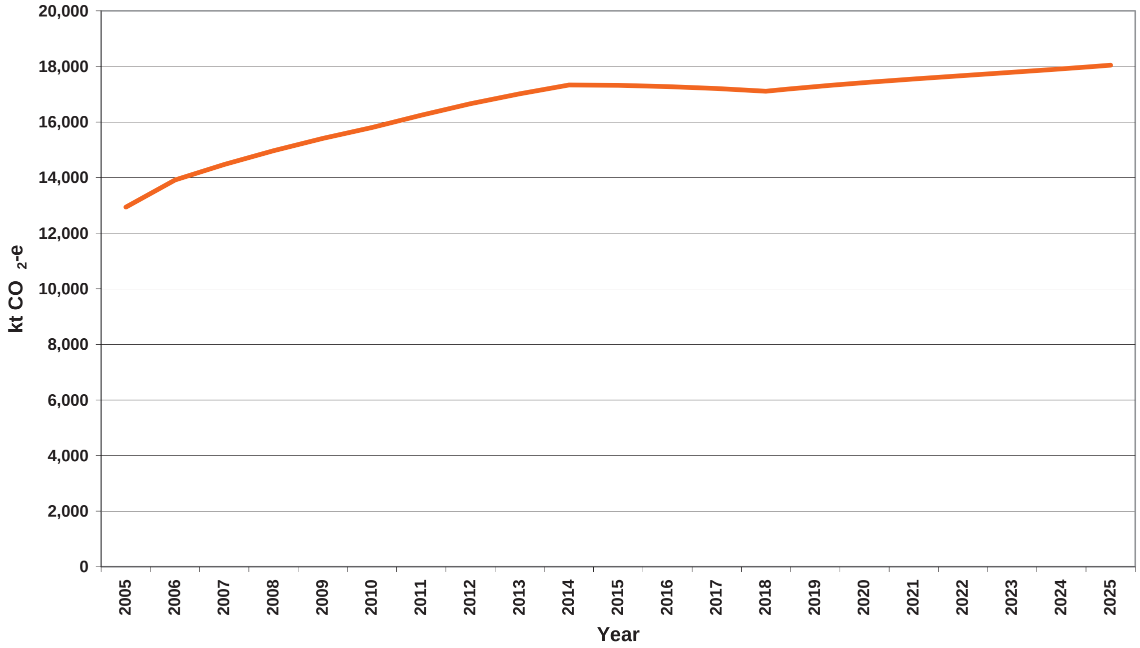


This ongoing growth in energy usage for air conditioners will lead to significant growth in greenhouse gas emissions.

There are a number of initiatives being undertaken to improve the energy efficiency of buildings, such as MEPS for residential buildings, which in turn will decrease the demand for air conditioning. Other initiatives are aimed at reducing the emission intensity of electricity production through the encouragement of the renewable energy generation, which would mean air conditioner use would lead to proportionally less greenhouse emissions. However, these initiatives will not eliminate the demand for air conditioning or the production of greenhouse emissions from their use. Improvements in the energy efficiency if air conditioners will continue to produce marginal benefits via reduced energy use and additional greenhouse emission reductions.

This decision RIS has been prepared on the assumption that a Carbon Pollution Reduction Scheme (CPRS), or a carbon pricing measure with similar impacts on energy prices, would be implemented from 2013. Consequently, the projected growth in emissions, shown in Figure 3, stops after 2016. This is due to the assumption that Australia's emission intensity for its electricity generation would decline in response to a carbon pricing measure, and government encouragement of renewable energy. However, air conditioners can be seen to be an ongoing contributor to the greenhouse environmental problem. In addition, air conditioners will continue to contribute to peak demand, security of energy supply issues and non-greenhouse emission issues.

Figure 3 - Projected BAU Greenhouse Emissions from Air Conditioners



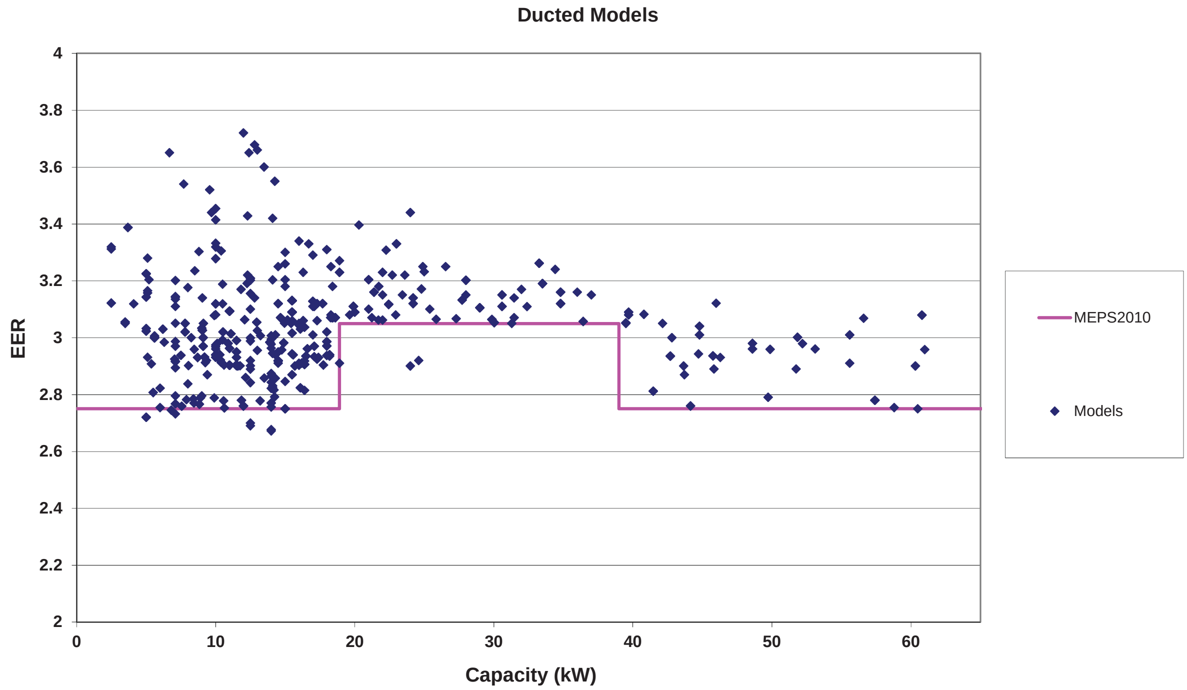
2.2 Market Failures Regarding Energy Efficiency

The failure of the market with regard to the energy efficiency characteristics of air conditioners has been well documented in previous RIS documents, such as in EES 2009 and Syneca Consulting 2005. Some of the key indications of this failure are presented in the following sections.

Energy efficiency variations

There are large variations in the efficiency of air conditioners available on the market in almost all product types and sizes. Figure 4 and Figure 5 show the extent of variation in the cooling EER and heating Coefficient of Performance (COP) which indicate there is considerable potential for consumers to select more efficient air conditioners than at present.

Figure 4 - Efficiency range of current models – Cooling EER



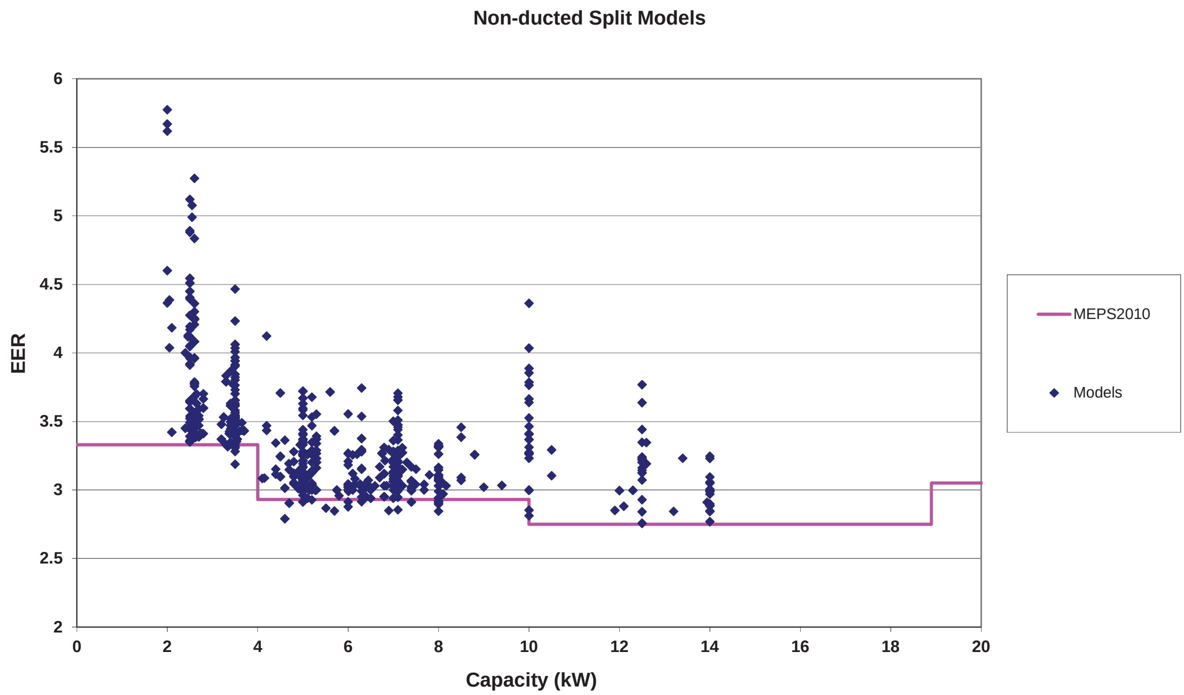
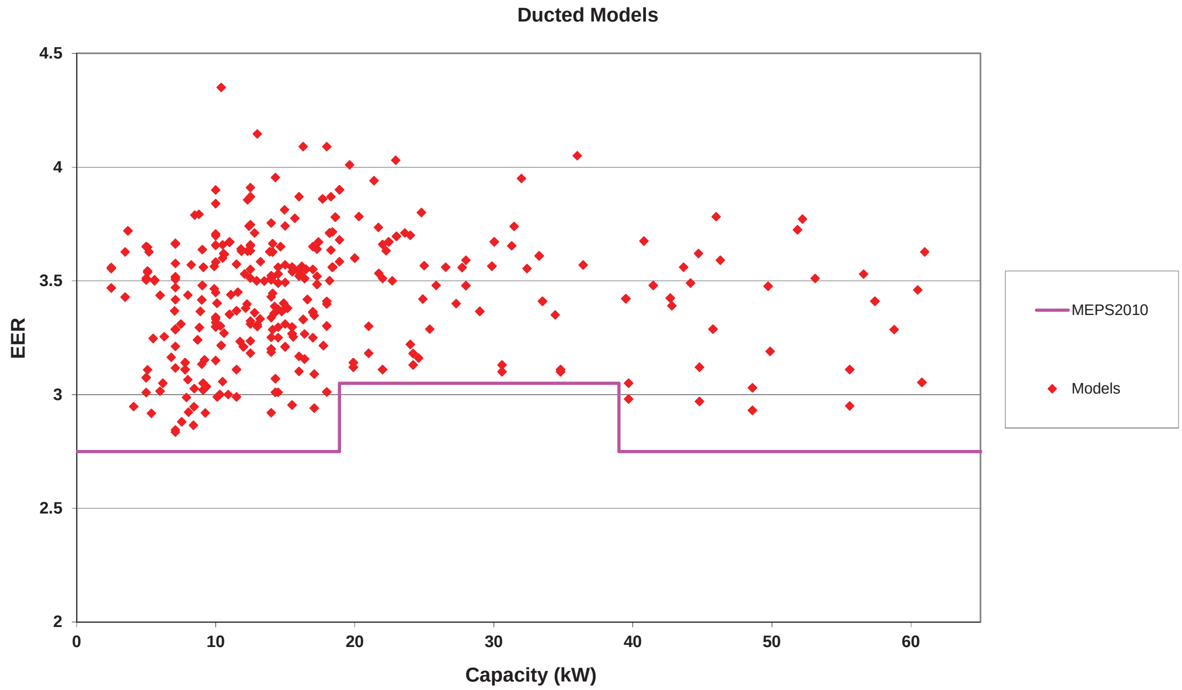
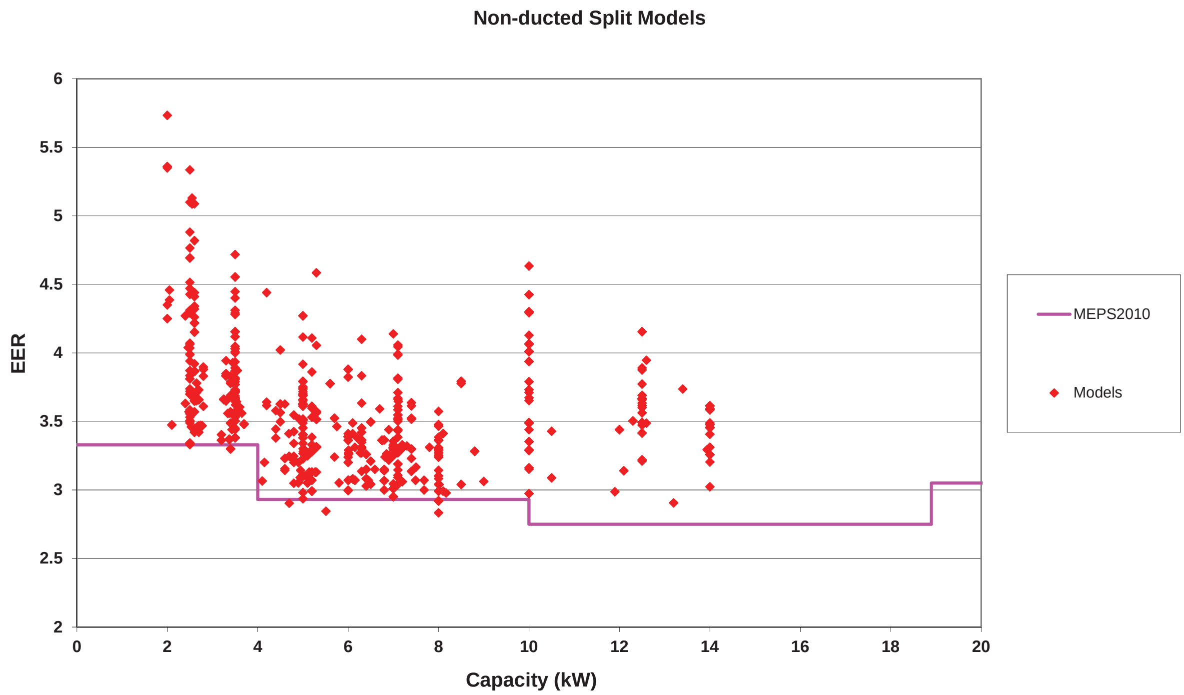


Figure 5 - Efficiency range of current models – Heating COP





However, despite this variation there is no evidence that indicates consumers are predominantly selecting the most efficient products, even though this would be in their financial long term best interests.

Generally, the more efficient air conditioners are also the more expensive ones. An analysis by EES of the relationship between purchase price and appliance efficiency, however, did not reveal that efficiency is related to cost (EES, 2009). The study found that for air conditioners sold during 2006 the correlation coefficient (R^2) between normalised price and energy efficiency ranged from 0.000 to a maximum of 0.042 across all air conditioner categories, where the samples were adequate to analyse. This means there was at best a very weak relationship between air conditioner prices and their efficiency for units in the market in 2006. This suggests that consumers are not strongly energy efficiency conscious in their purchase decisions in relation to air conditioners.

Split Incentives

There is a lack of motivation for many consumers of air conditioners to purchase efficient units, as in many cases the purchaser is not the end-user and, therefore, can ignore the long-term energy cost impacts of the decision. This occurs in the following ways for the air conditioner market:

Builder/owner split: As previously mentioned, in the section regarding Australian Market (page 3), for the residential market approximately a third of air conditioner purchases are for new or renovated homes. It can be assumed that for most of these the builder chooses the unit. The builder will be motivated to keep the purchase and installation costs low and will have no direct interest in the long term energy costs, which the owner will bear. A similar situation in the commercial market is observed, where commercial buildings are built by developers rather than final owner/occupiers.

Landlord/tenant split: Again the commercial or residential landlord has little incentive to purchase efficient air conditioners, but only to purchase those with lower capital costs. As 28.5% of households are rental properties (ABS, 2008), a significant proportion of residential air conditioner sales can be expected to be affected by this landlord/tenant split incentive issue. Also, the vast majority of commercial properties are rented, with only 22% of commercial property privately owned/owner occupied (Office of Fair Trading, 2004). There is no hard data to show the extent to which landlords and tenants do or do not put in place cooperative arrangements which allow them to mutually benefit from air conditioner purchase decisions based on energy efficiency considerations. Theoretically, however, the landlord/tenant split incentive issue is well known in the residential and commercial building sectors. Given the larger size of commercial air conditioners, it is plausible to also suggest that air conditioning energy demand in the commercial sector will be influenced by the landlord/tenant split.

Specialist supplier/owner split: Many air conditioners are supplied by specialist outlets which are typically motivated to sell the units with the greatest margin, and the largest unit that can be justified, so again the owner's interest to obtain an efficient and appropriately sized unit may not be met. Also, all split systems and most large air conditioners must be installed by a licensed refrigerant handler, so this again adds to the separation of the owner from the air conditioner purchase and encourages the use of specialist suppliers. This separation of the owner from the air conditioner purchase will be true for many residential purchases and for the majority of commercial system purchases.

The nature of the air conditioner market, therefore, suggests the majority of air conditioner sales may be affected by a variety of split incentive issues, significantly affecting the efficiency of the air conditioner market and the ability of consumers/end users to act in their own best interests regarding the energy efficiency of air conditioners they operate.

Information Barriers and Sub-optimal Decisions

Information on the efficiency of air conditioners may be available in the form of energy efficiency labels for non-ducted and single-phase air conditioners. However, to fully utilise this information consumers need to be technically capable to both consider the energy labels and be capable of calculating and comparing the life-time energy costs of high efficiency verses less efficient products. This is a complex decision as climate, usage patterns, building design and electricity tariffs must all be considered. Many consumers also appear to lack the time and motivation to consider energy costs. Behavioural economics suggests that individuals do not always make decisions in their best interests based on the information provided. In such instances, it may be necessary to use other policy instruments in conjunction with providing information to overcome this barrier.

Research (BIS Shrapnel 2008) suggests that 28% of consumers did not consider the energy label when purchasing air conditioners, 30% did not research their purchase and 31% were an impulse buy. This suggests that a significant proportion of consumers are not in the position to make an informed economic decision regarding air conditioner purchases.

In addition, around a third of products are not required to carry an energy label, as ducted and larger three phase air conditioners do not need to carry an energy label, so a significant proportion of purchasers may be unaware of the efficiency of the units they are purchasing.

The implication is that, despite the value that the energy labelling scheme has in assisting consumers to make informed decisions regarding the energy efficiency of air conditioners, a significant proportion of air conditioner purchases are made without access to efficiency information, or the ability to make use of that information. The proposed increase in the MEPS for air conditioners seeks to address these problems.

Externalities Ignored

To date the environmental costs of producing and delivering the energy used by air conditioners have not been fully contained in the electricity cost to users. In particular, GHG emission costs have not been a part of retail electricity costs, though this may change under a carbon pricing measure, which is discussed more fully in the next section. If electricity prices were to be increased under a carbon pricing measure to fully reflect the environmental costs of the GHG emissions caused by electricity generation, then this major externality could be removed from the energy market and as a factor distorting the air conditioner market. However, until a carbon pricing measure is introduced, with a carbon price and electricity cost that fully reflects the costs of GHG emissions, the emissions will remain a major externality contributing to the failure of the air conditioner market.

GHG emissions and their impacts are only one of the externalities that are not contained in the present electricity prices. There are other environmental impacts from fossil fuel generation of electricity; such as production of sulphur dioxide and mercury emissions. Air conditioner usage is also driving much of peak demand growth, which results in additional network and security of supply costs, as discussed below.

Peak Demand

The network cost impacts of the peak demand created by air conditioner usage are not adequately conveyed to the consumer by existing tariffs. The vast majority of electricity customers use a flat tariff or a time-of-use tariff with a few predetermined price periods; for example peak, off-peak and shoulder. For these consumers, there is little or no financial incentive to not use their air conditioners during peak demand periods. In addition, most customers would not be aware when a peak demand period has occurred, and very few consumers own systems that would communicate this information to them.

Nevertheless, energy consumption by air conditioners is driving peak electricity demand growth in all States and Territories, except Tasmania, and as a consequence, creating the need for network augmentation and additional investment. This peak demand is threatening security of electricity supply, causing high prices in the wholesale energy market and generally driving up costs. However, just as the vast majority of electricity consumers remain oblivious to the cost impacts of air conditioner energy demands, air conditioner users are certainly not paying the full cost of the electricity they are using or paying for their impacts on the network infrastructure. Unless the consumer is paying the full cost of generating and delivering the energy they use, they cannot make informed choices regarding their selection of electricity using appliances, and in particular air conditioners. So again there is a market failure issue here.

As the efficiency of air conditioners influences their energy demand, their efficiency will influence their contribution to peak demand. Consequently, the impact of higher MEPS levels on peak demand was analysed and treated as a benefit in the methodology discussed on page 34.

Impact of a Carbon Pricing Measure and Increasing Electricity Prices

A CPRS, or a carbon pricing measure with similar impacts on energy prices, if implemented, would be expected to decrease GHG emissions related to electricity production, in part through discouraging the generation of electricity from carbon intensive sources by increasing the costs of such generation, which in turn would raise the cost of electricity to the end-user. For other reasons, such as electricity infrastructure constraints electricity prices are expected to rise regardless of whether a carbon pricing measure is implemented.

If the air conditioner market was efficient, customers would be informed and in a position to recognise the cost effectiveness of more efficient air conditioners and in light of the increasing electricity prices would have a greater incentive to purchase high efficient units. However, the market failures and inefficiencies listed in the previous section will continue to ensure many consumers are uninformed or powerless regarding the selection of air conditioners they operate and pay for, and this situation will not be altered by the introduction of a carbon pricing measure. In particular some issues will continue to add to the inefficiency of the market, including:

- split incentives affecting air conditioner purchases
- lack of information or technical capability to effectively utilise information regarding the efficiency of air conditioners
- difficulties in calculating energy costs of different air conditioners
- little consumer consideration given to the impact of their air conditioner choice on the electricity supply system
- environmental externalities such as sulphur dioxide and mercury emissions are not fully reflected in the price of electricity.

Other aspects of consumer behaviour also reduce the impact of any energy price increases where consumers:

- currently do not seek out and purchase more efficient air conditioners, despite the presence of higher efficiency air conditioner products of similar price to other products in virtually all air conditioner categories (EES 2009)
- regularly ignore operating costs and internal discount rates of 20 to 50% in choosing equipment. According to ACIL Tasman, 2008 a CPRS would lead to a cost increase of 12 to 25%, which would be unlikely to change consumer behaviour.

Consumers are expected to continue to make choices regarding air conditioners which often ignore their long term financial interests. Consequently, the introduction of a carbon pricing measure is not expected to rectify the failures in the air conditioning market regarding energy efficiency or to provide sufficient incentive for consumers to change their purchasing behaviour. Complimentary measures such as MEPS would still be required to encourage more efficient energy use and reduce the overall economic cost of energy supply.

Market Failure: Summary

In summary, the air conditioner market fails in several areas relating to the lack of buyer-friendly information. Consumers lack the ability to interpret the available technical information in order to make optimal decisions regarding air conditioner efficiency and operating costs. Many end-users are excluded from the purchase decision when air conditioners are selected. Also, due to split-incentive issues, the purchasers are often not motivated to consider life-time costs and, hence, energy efficiency. Generally consumers lack the information or the ability to understand and to effectively use the information. Consumers also lack the computation skills, time and motivation required to compare the life cycle costs of different air conditioners, so as to make informed financial choices regarding their air conditioner purchase. In addition, the electricity markets so far have failed to provide electricity at full cost-reflective prices, with the costs of GHG emissions treated as an externality and the peak demand impact of air conditioners largely excluded from the pricing of electricity. Consumers remain largely unaware of the impact of their air conditioner use on peak demand and peak demand electricity pricing, and lack the financial incentive to change their usage behaviour. These findings all point to deficiencies or failures in the market.

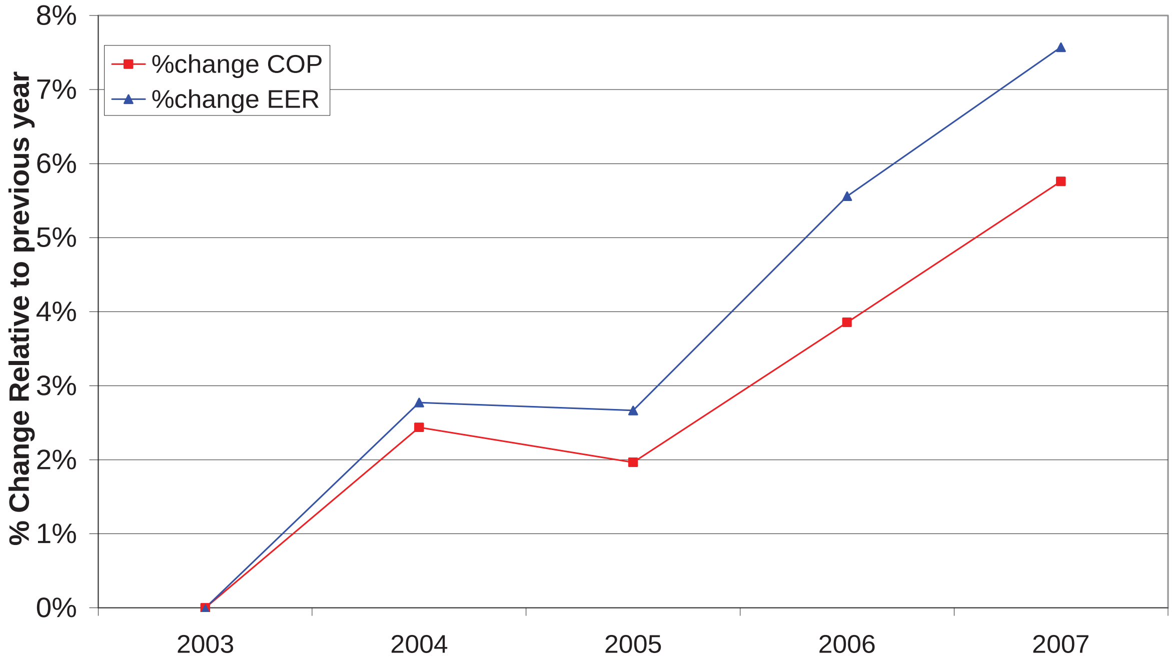
2.3 Effectiveness of Current Regulations for Improving Efficiency

As has been demonstrated in earlier air conditioner RIS reports, introducing and raising MEPS levels is the most effective method of improving the efficiency of the air conditioners installed. Each time the MEPS levels have been raised it was necessary to provide cost benefit analysis and justification of the impacts of the new MEPS levels, so the effectiveness of the MEPS approach has been tested and proven repeatedly over the last decade.

In addition, a preliminary analysis of the change in the sales-weighted efficiency of air conditioners provides evidence that the current regulatory approach is working. The analysis shows a rate of change which is much higher than business-as-usual improvements in technology. Figure 6 shows the annual change in the EER and COP for air conditioners in Australia has improved from 3 to between 6 and 7% since 2003, while a much smaller rate of BAU change of approximately 0.5% (EES 2008, unpublished data), could be expected for an established technology like air conditioners. The reason for the higher rate of change is the introduction of MEPS during this period. Further research was conducted on this topic (EnergyConsult, 2010).

Analysis of the air conditioner registration data and available sales data in 2009 was undertaken to determine the annual percentage improvement in air conditioner efficiency and revealed an increasing rate of efficiency improvement. These trends are displayed Figure 6.

Figure 6 - Percentage Annual Change in Sales-Weighted EER and COP

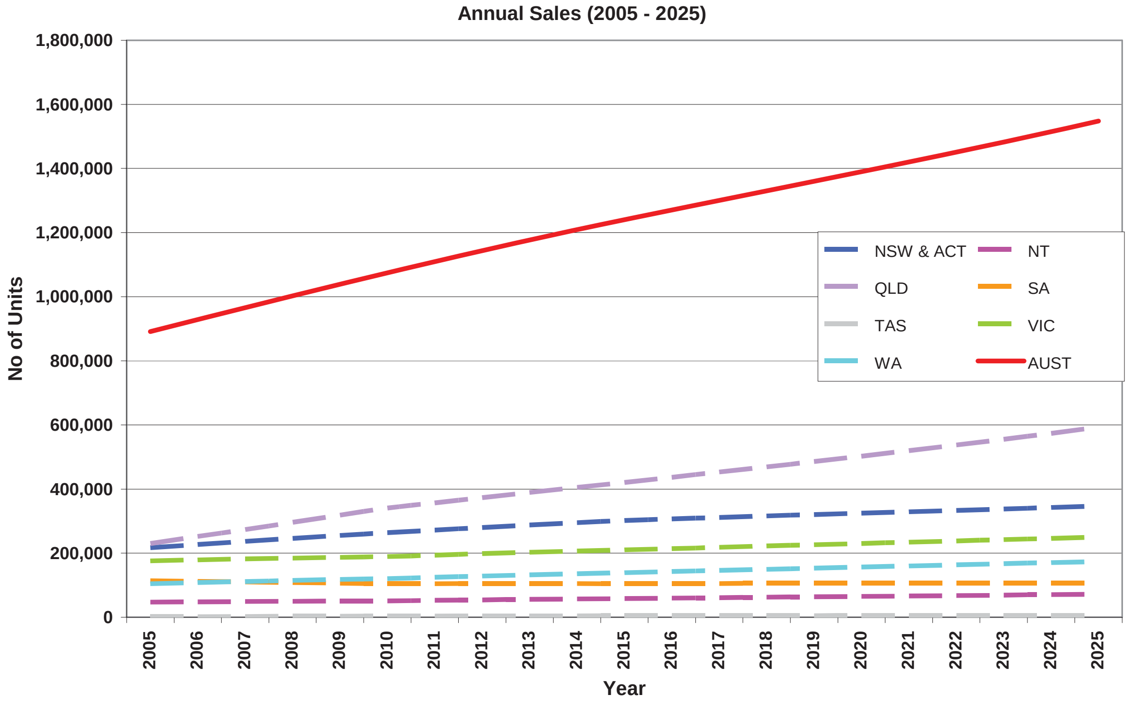


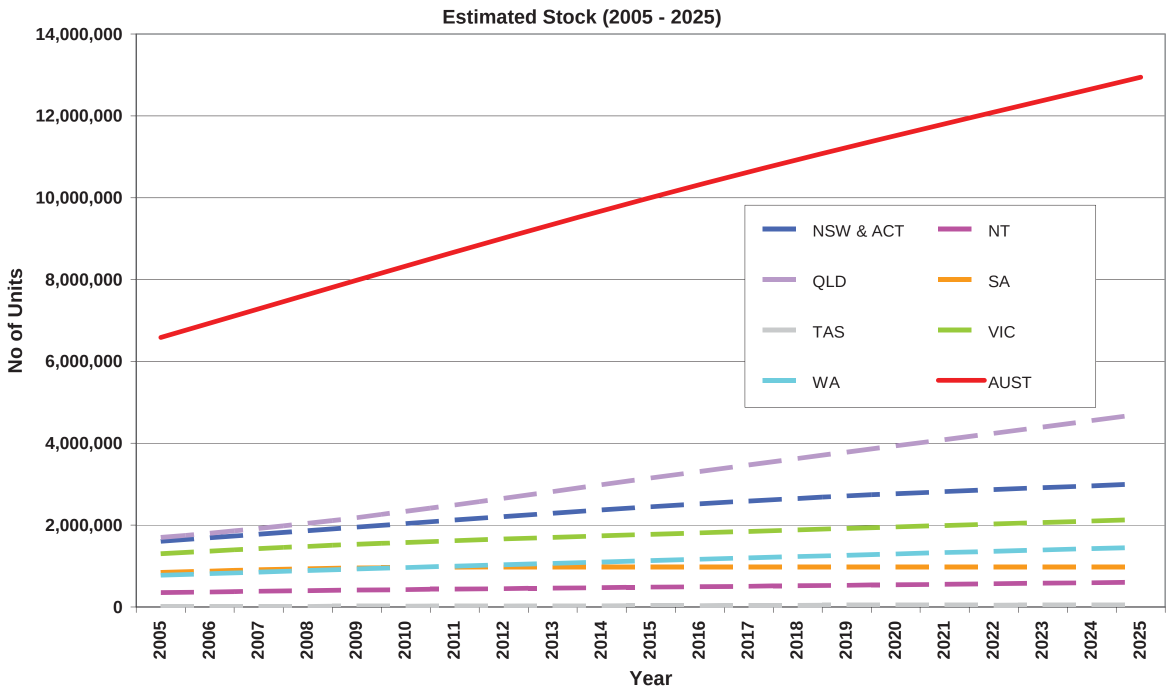
2.4 Ongoing Problems and Limitations of the Current MEPS Levels

The principal issue to be addressed in the current RIS is whether raising the MEPS levels for air conditioners beyond the April 2010 levels to meet the COAG-endorsed objective would be cost effective. The April 2010 MEPS levels have only recently been implemented, however, the MEPS levels were set over three years ago as various issues delayed their introduction. The technical scope to improve the minimal efficiency levels of air conditioners and the cost effectiveness of raising the minimal efficiency levels have both grown over the last three years.

Evidence of the ongoing problem with the energy consumption from air conditioners can be seen from the projected growth (Figure 7) and energy consumption (Figure 2) of air conditioners. The figures reveal that air conditioner stock is growing, though a large proportion of sales will be made to replace existing systems.

Figure 7 - Projected Sales and Stock of Air Conditioners by State





The growth in air conditioner numbers and their energy impacts means that, even with the new MEPS levels being introduced in April 2010 and effectively made more stringent in April 2011, by requiring MEPS to be calculated on an annualised rather than operation basis, air conditioners will continue to add to Australia's overall energy demand and GHG emissions.

MEPS for Multi-split Air Conditioners

Split system air conditioners refer to air conditioners that have indoor units (the heads) as well as an outdoor unit (the condenser unit). Multi-split air conditioners have multiple indoor heads with separate controls for each head, which means each head can have a separate thermostat, timer and other controls.

A fact sheet prepared on multi-split systems (DEWHA, 2009) notes that multi-split systems can be further divided between fixed-head systems, which are predominately used in the residential sector and are usually smaller systems with 2 to 4 heads of under 10kW output and variable refrigerant flow (VRF) multi-split systems, with connections to as much as 48 indoor heads and combined capacities up to 140kW.

Multi-split air conditioners, unlike other split systems, have not been regulated and were specifically excluded from previous MEPS requirements and the associated test standard AZ/NZS 3823.2. The multi-splits were excluded for two main reasons:

- there was no international testing standards developed for these systems and it did not appear to make sense for Australia to develop such standards in isolation
- the number of multi-splits being sold when MEPS were being introduced for other split systems was low.

Since then the situation for multi-split systems has changed. The number of multi-split systems has increased and in 2008 approximately 20,000 fixed head systems and 19,000 VRF systems were estimated to be sold (DEWHA, 2009). In addition an international testing standard has been developed, ISO15042, and an Australian/New Zealand test is being developed based on this test. This means these multi-split systems can be included in the MEPS for split systems, as it is now practical to assess them, and their increasing numbers justify their inclusion. This will establish a level playing field between multi-split and other types of regulated air conditioners.

Consequently, there is a significant need to bring the MEPS requirements of multi-split systems into alignment with other split systems. The impact of including the multi-splits, and the cost benefits of doing this, have been analysed in section 5 Impact Analysis and been shown to be justified. Industry consultation has been undertaken via the Fact Sheet (DEWHA, 2009) and call for submissions, and again stakeholders were asked to comment in reply to the consultation RIS.

3 The Objective of Government Action

Energy efficiency is a key element of the Government's greenhouse response, as are complementary measures designed to address market failures that a price on carbon will not overcome or to ameliorate the distributional consequences of the scheme.

The overarching objective of this proposal is to contribute to Australia meeting its obligations under the Kyoto Protocol and any subsequent greenhouse gas reduction agreements and targets in the most efficient way, by:

- bringing about reductions in greenhouse gas emissions from air conditioners below what they are otherwise projected to be
- reducing the cost of abatement
- assisting businesses and households adjust to the impacts of rising energy prices.

In addition to the environmental issues associated with air conditioner electricity use, air conditioner usage is the major factor leading to rapidly growing peak electricity demand in all jurisdictions, except Tasmania. Escalating peak demand is threatening security of supply, causing high prices in the wholesale energy market, driving network and generation investment and generally forcing up costs. Consequently, a secondary objective of this proposal is to reduce air conditioners contribution to peak demand by increasing their efficiency.

The proposed regulations will act to improve the energy efficiency of the air conditioners being installed in Australia, helping to reduce future electricity use and contribute to a reduction in associated GHG emissions and peak demand.

4 Options Considered For New Measures

4.1 MEPS Options Considered

A range of options were considered to increase the energy efficiency of air conditioners, including the following:

BAU: A BAU approach would involve the continuation of the current MEPS levels, which follow from a decision RIS published last year (EES, 2009). These MEPS levels have been published in AS/NZS3823.2-2009 and were implemented in April 2010. In April 2011 the MEPS will change from being measured in terms of operating efficiency to annual efficiency, which will effectively further raise the MEPS level requirements. The BAU approach would also involve continuation of public education and the energy labelling scheme, where applicable to units.

Voluntary efficiency standards: Voluntary efficiency standards rely on equipment suppliers being effectively encouraged to meet certain minimum energy efficiency levels voluntarily in the absence of regulation. As there are few commercial incentives for doing so, it is unlikely that suppliers would willingly make these changes without significant government incentives. Stakeholder feedback from suppliers from previous consultation has shown that suppliers would not participate in such a scheme as this would affect their competitiveness and may perversely encourage the use of poorer performing lower cost products. This suggests voluntary efficiency standards would result in a minimum amount of equipment complying with the standards.

Voluntary certification program: This would involve suppliers submitting their product to a certification scheme, with high efficiency units being certified as such. However, only high efficiency units are likely to be submitted, so certification is likely to cover only a proportion of the air conditioners available.

Consumer education campaign: Such campaigns have already been enacted and must be considered as part of the BAU option. They will have limited impact due to the split incentive issues (see page 11), and due to information failure in this market.

Levies and financial instruments: Levy options are not currently government policy and, hence, these options cannot be considered until such time as government policy changes to favour levy schemes.

Dis-endorsement labelling: A dis-endorsement labelling scheme involves the assessment of all models and the placement of labels on inefficient models informing consumers the unit is a poor performer. A dis-endorsement labelling scheme will only be seen by a minority of consumers, as only a minority of air conditioners are sold through retail outlets to the end-user. Also the split incentive issues in this market will mean only a limited proportion of air conditioner end-users could potentially be affected by any dis-endorsement label.

Mandatory energy labelling: Energy labelling is used to provide information to consumers on the relative efficiency of air conditioners, with suppliers being mandated to provide the labels on their products. Energy labelling is currently used but has limited impact, for the same reasons that a dis-endorsement label would have limited impact. Mandatory energy labelling must be considered as part of the BAU option, hence, it will not change the current market inefficiencies.

Voluntary energy labelling: Voluntary energy labelling could be used to provide information to consumers on the relative efficiency of air conditioners, with suppliers volunteering to provide the labels on their products. For a voluntary approach to work there must be almost complete industry wide support for introducing the voluntary standards. This can be achieved in a small market with a few suppliers but would be impossible in the air conditioner market due to the hundreds of suppliers operating.

All of these options have been reviewed in the previous decision RIS (EES, 2009), they will not be discussed further here.

Mandatory Minimum Energy Performance Standards

MEPS have been introduced for all air conditioners sold in Australia and New Zealand, with the exception of multi-split systems, portable space conditioners and single-duct portable spot coolers which will be discussed below. The use of this regulatory approach has been justified in previous RIS, but the key reasons why this approach has been used are:

- market failure in the air conditioner market has restricted the ability of consumers to make informed, economic selection of more energy efficient and cost effective air conditioners; especially market failure resulting from the split incentive issue, energy prices not being fully cost-reflective, and information failures
- the large number of air conditioner suppliers and the diverse nature of the market and its products means voluntary measures are very unlikely to be effective or implemented
- impact analyses in previous RIS have repeatedly shown that MEPS are a cost effective method of improving the overall energy efficiency of air conditioners, which rectify at least some of the failures of the market and ultimately provide net benefits to all stakeholders.

This RIS is concerned with changing the levels of the MEPS as a means to improve the overall energy efficiency of air conditioners. The following section provides further details on the MEPS levels being evaluated for this proposal.

4.2 MEPS Options Evaluated

COAG requested in July 2009, through the Equipment Energy Efficiency (E3) program, to examine the feasibility of a MEPS increase of 10% above the April 2010 MEPS levels (**MEPS2010+10%**), with MEPS based on annualised EER/COP values. The new MEPS levels would be introduced no later than October 2011.

The following alternative options were developed and evaluated alongside the COAG-requested increase for comparison:

- **Proposal A:** MEPS levels increased generally by 10% above the April 2010 MEPS, with discontinuities[2] removed in the MEPS requirements by using one MEPS level for all air conditioners with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. This proposal would be introduced in October 2011

- **Proposal A1:** MEPS levels increased generally by 10% above the April 2010 MEPS. The smaller non-ducted split systems would have a slightly higher MEPS levels than the MEPS2010+10% and the MEPS level for systems >39kW would be lower. This proposal would be introduced in October 2011

- **Proposal B:** MEPS levels increased by more than 10% above the April 2010 MEPS for all but one size of air conditioners. Discontinuities would be removed in the MEPS requirements by using one MEPS level for all air conditioners, with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. This proposal would be introduced in October 2012, 12 months later than Proposal A

- **Proposal C:** Proposal C is an extension of Proposal A, with an additional increase in the MEPS levels to be introduced in 2014. Again the discontinuities would be removed in the MEPS requirements by using one MEPS level for all air conditioners, with the exception of non-ducted split systems below 10kW. The smaller 4 to 6kW non-ducted split systems would have a slightly higher MEPS level. The first phase of this proposal would be introduced in October 2011, followed by a second phase in October 2014.

Subsequent to the request by COAG in July 2009, the Ministerial Council on Energy (MCE) at its meeting on 4 December 2009, requested the examination of Queensland and South Australian State-specific MEPS for adoption nationally, as interim MEPS commencing in October 2010 until the introduction of a more substantive MEPS in October 2011 (note

[2] The discontinuities referred to are when the MEPS levels change abruptly for different sizes or types of air conditioners, potentially meaning very similar air conditioners may need to meet different MEPS.

that the Queensland and South Australian MEPS for air conditioners are more stringent that the current national MEPS). These options were developed and modelled accordingly, see Appendix 3. However, these options have now been rendered redundant by expiry of the intended commencement date of 1 October 2010.

A summary of the proposed MEPS levels is presented in Table 3.

Table 3 - Summary of proposed MEPS (Minimum EER/COP)

Category	MEPS 2010 (BAU)	MEPS2010 + 10%	Proposal A	Proposal A1	Proposal B	Proposal C
Date Implemented	*Current (Apr 2010/11)*	*Oct 2011*	*Oct 2011*	*Oct 2011*	*Oct 2012*	*Oct 2014*
Non-ducted Split <4kW	3.33	3.66	3.6	3.66	3.7	4.0
Non-ducted Split 4kW to <10kW	2.93	3.22	Slope	3.22	Slope	Slope
Non-ducted unitary <10kW	2.84	3.12	3.1	3.1	3.2	3.5
Non-ducted unitary 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
Ducted <10kW	2.75	3.03	3.1	3.1	3.2	3.5
Non-ducted split 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
Ducted 10kW to 19kW	2.75	3.03	3.1	3.1	3.2	3.5
All 19kW to 39kW	3.05	3.35	3.1	3.1	3.2	3.5
All >39kW	2.75	3.03	3.1	2.9	3.2	3.5
Average % efficiency above MEPS2010		10%	12%	10%	15%	25%

Note: The average difference in efficiency between the MEPS 2010 and the alternatives was calculated. The average is weighted by sales in each AC category, so the average efficiency percentage would provide a representative indication of the energy savings for each MEPS option.

One of the main differences between the Proposals A, B and C, and the MEPS 2010+10% options is that the Proposals A, B and C all use a variable MEPS level for non-ducted split air conditioners, between 4 to 10kW depending on their output capacity. In Proposals A, B and C, the MEPS level for this category of air conditioner will gradually reduce from 4 to 10kW output capacity, hence, creating a "Slope" or varying MEPS level. The MEPS levels would vary as follows:

- Proposal A: MEPS Level = 3.6 - (unit output in kW-4)/6 *0.5
- Proposal B: MEPS Level = 3.7 - (unit output in kW-4)/6 *0.5
- Proposal C: MEPS Level = 4.0 - (unit output in kW-4)/6 *0.5.

The result of using this 'Slope' or varying MEPS level for non-ducted split air conditioners, between 4 to 10kW is that it removes the discontinuity, or abrupt changes, between the MEPS requirements for units in this power range.

However, the feedback from industry to the consultation RIS and further analysis of the air conditioner models currently available in the market, by product category and size, have shown that the use of the 'Slope' may severely restrict the future availability of the popular 4 to 6kW split systems in the market. Consequently, Proposal A1 was developed which does not use the 'Slope' approach in the 4 to 10kW range. Proposal A1 also uses an annual EER of 2.9 for units of >39kW, as the alternative Proposals could lead to the elimination of products of that size from the market.

The impact and cost benefit of each of these options was modelled and evaluated against a business-as-usual base case. The results are presented in the section 5.

4.3 Other Implementation Issues with Current MEPS

There are two issues concerning the implementation of the MEPS and labelling for air conditioners which are also to be addressed in this RIS, including:

- restricting the use of simulation for air conditioner registration
- removal of the part load MEPS compliance requirement for air conditioners with inverter technologies.

These problems and issues are discussed in further detail below.

Use of Simulation for Air Conditioner Registration

Under the standard AS/NZS3823.2, products which are mandated to carry an energy label must be tested in a calorimeter. A calorimeter is the most accurate method of testing presently available. However, there are practical limits to the size of products that can be tested in these types of facilities (typically around 10 to 12kW).

The other method of physical testing is the air enthalpy method. This is a less accurate method (there is no internal check on the energy balance for the results) but there is usually no limit to the capacity that can be tested (within the scope of products regulated under AS/NZS). While the marginal cost of testing in a calorimeter is not usually much different to the air enthalpy method, a calorimeter is much more expensive to build, particularly for larger sizes.

When MEPS was first introduced for three phase products in 2001, simulation of air conditioner testing results was included as an option instead of physical testing in order to reduce testing costs to industry, especially for large products (typically over 30kW) as it can be expensive to acquire an air conditioner sample and to set this up for test. Requirements for simulation are set out in AS/NZS3823.3. Simulation is currently only permitted for products that do not carry an energy label. However, while the original intent was for simulation to be an alternative for testing of large products, it is now used widely for smaller products, especially smaller ducted systems (around 10kW).

While simulation usually gives a reasonable indication of product efficiency, simulation models by their nature assume optimum operation of many components. Therefore, they can give an optimistic assessment of overall performance and efficiency. This may reduce the effectiveness of the MEPS regulations, as products that would not meet the MEPS if physically tested may pass a simulation assessment.

A cost benefit analysis of the impact of changing the use of simulation has been conducted and the results are presented in the section Cost Benefits of Not Using Simulation, page 46.

Removal of the Part-Load MEPS Compliance Requirement for Air Conditioners with Inverter Technologies

A provision was introduced in the first MEPS regulations in 2001 to allow compliance under part load conditions for variable output air conditioners. The justification for this provision was that variable output products are nominally more efficient during normal use than at rated capacity.

The specifications within the original MEPS were wide and it allowed variable output products to claim MEPS compliance even where they only complied with MEPS levels at 50% output. However, in 2001 only three phase products were regulated and very few products were inverter based, so the issue was not considered to be significant.

This situation changed when single phase air conditioners became subject to MEPS in 2004. Now the vast majority of air conditioners are required to be MEPS compliant and variable output, inverter-driven split systems make up more than 70% of the total air conditioner market sales. This means over 70% of present products by sales volume remain eligible to be assessed as complying with MEPS levels at 50% of their full output.

Following industry concerns, Amendment 3 to AS/NZS3823.2-2005 was introduced in early 2008 to tighten up these part load requirements. All registrations to the "old" part load system were grandfathered in April 2009. Then the requirements of Amendment 3 were carried over into AS/NZS3823.2-2009 for compliance with MEPS in April 2010 and April 2011 at the request of industry. The result is that the minimum requirement is that air conditioners meet 95% of the EER MEPS, if using the part load allowance.

The part load allowance is scheduled for removal in the present proposed MEPS revision, and its removal has the support of some industry representatives. Its removal has been widely canvassed with industry and they are aware of government's desire to delete it. The argument for its removal is that inverter technologies have greatly improved in recent years and most products are able to meet the MEPS requirements at full load so the need for the requirement is limited (only around 10 of 3,000 registrations prior to March 2010 rely on this allowance). Consequently, it was argued in the consultation RIS that there would be minimal impact on product availability and virtually no impact on costs through the removal of the part-load provision, so no cost benefit analysis has been undertaken. The consultation RIS recommended that the removal of the part load allowance proceed as part of this proposed MEPS revision.

The consultation RIS generated considerable feedback from industry stakeholders which challenged these arguments for the removal of the part load allowance. In essence the counter arguments are:

- inverter air conditioners only operate for a small proportion of their annual operating time at full load, but the use of EER in the MEPS means their efficiency is assessed only when operating at full load. However, inverter air conditioners may operate at much greater efficiency at part load, which is how they spend the majority of their time operating. Consequently, for air conditioners using inverter technology, even the annual EER introduced in the April 2011 MEPS can give an inaccurate indication of the annual energy use and efficiency of the units

- a more accurate measure of the annual efficiency of an air conditioner is the Seasonal Energy Efficiency Ratio (SEER), as this approach takes into account the efficiency of units at different load levels and the proportion of the time the units would need to operate at these levels in different climate zones. Versions of the SEER approach are already used in America and are being introduced in Europe. Industry stakeholders are encouraging the introduction of a SEER based MEPS and it is recommended that the SEER measurement approach be introduced in 2014, assuming appropriate research is conducted and the research supports its use

- the continued use of the part load allowance until a SEER MEPS is introduced may reduce disruption in the market that might otherwise occur. If the part load allowance was removed it could lead to air conditioners which require less energy for their annual operation being removed from the market, while less efficient units remain in the market. It could also lead to air conditioners being removed from the market, but these same models potentially being reintroduced if a SEER MEPS in later introduced.

Given this new information, the removal of the part load allowance is not recommended, but further exploration of the introduction of a SEER measurement for MEPS and/or Energy Labelling is recommend.

5 Impact Analysis

This section presents the costs, benefits and other impacts of the MEPS options for air conditioners. The product stock modelling framework is explained in Appendix 1: Stock and Sales.

5.1 MEPS Options Impact Differences

'Slope' or Varying MEPS level for non-ducted split AC

As mentioned in section 4.1, Options A, B and C all involve using a 'Slope' or varying MEPS level for non-ducted split air conditioners, between 4 to 10kW, to remove the discontinuity between the MEPS requirements for units in this power range.

There is greater technical potential for smaller split systems to operate at greater energy efficiency levels than larger systems, which is why the small systems were originally assigned a higher MEPS level. However, the present MEPS mean there can be large differences in the efficiency required of air conditioners which differ only slightly in their capacity, if their power input is around 4 or 10kW. This means there is the potential for suppliers to manipulate the system, by slightly increasing the output capacity rating so the model moves into the next MEPS category with a lower MEPS level.

By introducing a gradually declining MEPS level for non-ducted split air conditioners between 4 to 10kW, these abrupt changes in MEPS requirements are removed and so is the potential to manipulate the system. At the same time however, the sloping MEPS levels ensure the potential technical efficiency of smaller, <4kW spilt systems, is still captured by the MEPS levels. One of the main differences between the Proposals A, B and C, and the MEPS2010+10% options, therefore, is that the MEPS2010+10% approach does not address the discontinuities issue present in the current MEPS, while Proposals A, B and C all do.

However, as previously mentioned, feedback from industry and analysis of the air conditioner models available in the market have shown that the use of the 'Slope' may severely restrict the future availability of the popular 4 to 6kW split systems in the market. Consequently, a new proposal, Proposal A1, was developed which does not use the 'Slope' approach in the 4 to 10kW range.

Other Differences

Other significant differences in Proposals A, A1, B and C, and the MEPS2010+10% are:

- Proposal A1 has an annual EER of 2.9 for units of >39kW, as the alternative Proposals would led to the elimination of that size of products from the market

- Proposal B is initiated one year later than Proposal A, Proposal A1 or MEPS2010+10%, which would give industry greater time to respond to the proposed MEPS
- Proposal C involves a large jump in the efficiency required of air conditioners (about 25% higher than MEPS2010 levels), but at the same time suppliers have around four years to prepare for this change, as there is an intermediate MEPS step in October 2011 equivalent to Proposal A.

These differences are considered when assessing the MEPS options in section 7.1.

5.2 Costs to the Government

The proposed MEPS program will impose program operating costs on governments, but these costs will be the same as those that already exist under the existing MEPS regulation, so there are no additional on-going costs resulting from the new MEPS. However, when the new MEPS levels are first introduced there will initially be additional government costs related to increased compliance and research costs.

These additional costs relate to the need for the government to check and test a greater range of air conditioning units in the first year of the new MEPS in order to confirm that suppliers are complying with the new MEPS levels. These additional costs will total $300,000 to the government in the first year of the new MEPS. As these costs are ultimately passed through to the taxpayers, the consumers, these costs have been included in the cost benefit analysis.

5.3 Industry Costs

Responsibility for compliance with the MEPS lies with the importer or supplier of the product. This analysis assumes that any increases in product design and construction costs will be passed on to customers in the form of higher purchase prices. The Business Cost Calculator (OBPR, 2006) has been used as a basis to the calculation of the costs for compliance with the MEPS. The costs of compliance were identified as follows:

Education: This involves maintaining awareness of legislation and regulations, and the costs of keeping abreast of changes to regulatory details

Permission: This involves applying for and maintaining permission for registration to conduct an activity, usually prior to commencing that activity

Record Keeping: This involves keeping statutory documents up-to-date.

The Purchase Cost category, which involves the costs of all materials and equipment purchased in order to comply with the regulation, was not included in the business compliance costs. This cost category was interpreted as the cost of design changes to the products to ensure that they meet the required power levels and these costs are explicitly included in the costs benefits analysis as increased purchase costs to the consumer.

The tasks, categories and costing assumptions are provided in Table 4.

Table 4 - Business Cost Calculation Inputs

Category	Task	Cost Inputs	Source
Education	Train staff, keep up-to-date with regulations	80 hours/year per supplier	Estimated from other MEPS programs
Permission	Testing each model	$4,000 per model supplied	Based on laboratory costs
Permission	Complete MEPS registration	8 hours per model supplied	Estimated from other MEPS programs
Record Keeping	Maintain documents for 5 years	8 hours per 5 years per supplier	Estimated from other MEPS programs
Other inputs:		Staff costs $40/hr	*Australian Jobs 2010* (DEEWR 2010)

The total costs of business compliance for the MEPS are in proportion to the number of businesses importing/supplying air conditioners and the number of models supplied. Over 1,300 unique models are currently supplied from approximately 70 suppliers, or an average of approximately 19 models per supplier.

The Business Costs Calculator was used to determine the costs per business, and then these costs were allocated on a "per model" basis for the cost-benefit analysis. The RIS cost-benefit analysis models the costs on the basis of each model supplied to the market in a particular year, as this approach provides a greater certainty to the costing of MEPS. The total costs calculated are shown in Table 5.

Table 5 - Business Compliance Costs for MEPS

Category	Task	Costs / model
Education	Train staff, keep up-to-date with regulations	$152
Permission	Testing of models for energy performance	$4,000
Permission	Complete MEPS registration	$520
Record Keeping	Maintain documents for 5 years	$320
Total/model		$3,492
Total Cost	All businesses (approx 1,000 models will require re-testing)	$4.99M

These costs represent approximately $5M to the suppliers in the first year of MEPS, based on the suppliers registering an additional 1,000 models. This cost does not vary between the MEPS options being proposed. This cost-benefit assumes that new models are introduced to the market each year and, hence, are already required to be registered. Sensitivity analysis of these estimated costs shows that if these compliance cost increase by 100%, the effect on the cost-benefit is minimal.

5.4 Supplier Costs

The two supplier costs impacted by changes in MEPS are the compliance costs outlined above, and the increased costs to producing/supplying air conditioners which operate more efficiently. Compliance costs have already been discussed, so the following section outlines the modelling approach used to forecast increases in unit supply costs.

Most energy efficiency regulations envisage an increase in average equipment costs due to changes in the design of the product to improve the energy efficiency of the product. Yet, recent research into the relationship between the cost of air conditioners and their efficiency by EES (2008 RIS p121), as previously discussed, found that overall there was no relationship between efficiency and price. However, industry feedback indicated that this finding was not considered acceptable. On the contrary, it was contended that at the higher efficiency levels, where the current proposed MEPS become relevant, there would be some increased costs with efficiency gains. Consequently, price and efficiency data was reanalysed to test for this relationship.

The results in Table 6 are for the analysis using the most recently available market data (GfK Sales by Models for 2009) for split air conditioners, which constitute the vast majority of air conditioner sales. For split air conditioners operating above an EER of 3.0, there was generally some relationship between efficiency improvements and cost. The relationship varied with different categories of air conditioners but an approximate average for the ratio between efficiency increases and cost increases is 1.5. This is consistent with the majority of industry feedback concerning the relationship of costs to efficiency increases.

Table 6 - Relationship between Cost Increases and Efficiency Increases for Higher Efficiency Air Conditioners

Category	Efficiency Difference (low & high performers)	Cost Difference (low & high performers)	Ratio of Efficiency Gain to Cost Increase
Split Reserve Cycle, 2 – 4 kW	44.7%	66%	1.47
Split Reserve Cycle, 4 – 6 kW	27.0%	16%	0.58
Split Reserve Cycle, 6 – 8 kW	5.0%	8%	1.62

Source: EnergyConsult analysis of air conditioner sales, matched to EER from the Energy Labelling and MEPS registration database

Consequently, for the modelling for the present RIS a correlation of 1.5 between the efficiency and the cost increases of air conditioners was assumed. The impact of assuming this correlation between efficiency and cost is that the modelling assumes that cost of air conditioners increases after the MEPS is introduced, and this cost increase is related to the extent that the MEPS increases the average efficiency of air conditioners sold. This increases the costs to suppliers of air conditioners, who then pass this cost increase on to consumers.

The later sections examine the costs and benefits of the MEPS options from the perspective of consumers. It was assumed that all compliance costs incurred by suppliers are eventually passed on to buyers in the normal course of business. Hence, for the purposes of cost-benefit analysis, the cost impact on product suppliers as a group is neutral. The cost-benefit assessment provided in the following section assumes that the product suppliers recover the costs via an increase in the costs of the product to the consumer. As the benefits of the energy efficiency improvement accrue to the consumer, this approach allows for a consistent treatment of costs-benefits.

5.5 Industry, Competition and Trade Issues

This section reviews the impacts of the proposal/s on suppliers and competition in the industry. In the air conditioner product supply market, there are currently estimated to be approximately 100 suppliers; some are specific suppliers of particular product categories while others are multi-national air conditioning companies. The vast majority of air conditioners are imported into Australia rather than manufactured locally.

One advantage of the current and proposed MEPS program is that it enables suppliers, who generally supply international markets, to use internationally recognised testing standards and certification schemes, thus reducing the need for testing of products for different regions. Other trade, General Agreement on Tariffs and Trade (GATT) and Trans Tasman Mutual Recognition Agreement (TTMRA) issues are discussed in detail in Appendix 4.

Non-Compliant Products

The main impact of the proposed MEPS to the industry and competition is that the new MEPS levels would lead to many current air conditioners becoming non-compliant.

The proposed MEPS will initially reduce the range of models in the market, although the number of models may then increase over time as suppliers with more efficient products target the Australian market or existing suppliers will upgrade their product offerings. However, given the extremely large number of registered products presently available, and for several other reasons discussed below, it is expected a large product range would remain and the MEPS would not significantly affect consumer choice in Australia.

Table 7 shows the effect on registered models of the various proposed MEPS options, with the proposed options reducing the range of currently available models between 9 and 97%. Analysis of the brands affected by the proposals also show a similar range of non-compliance rates and all major brands appear to have similar levels of non-compliant models.

The detailed estimated levels of compliance by product category are shown in Appendix 2: Compliance Rates of Current Models with Future MEPS, although it is important to understand that this reflects products which are currently available. The range of product available in the market when either MEPS2010+10%, Proposals A or B are implemented should be significantly more efficient and, therefore, non-compliance levels of Proposal C would be somewhat less.

Table 7 - Non-compliant Models and Brands with Various Proposed MEPS Options

MEPS Option	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
MEPS2010+10%	929	387	1,316	71%
Proposal A	1,015	301	1,316	77%
Proposal A1	911	405	1,316	69%
Proposal B	1,121	195	1,316	85%
Proposal C	1,276	40	1,316	97%
	Non-Compliant Brands	**Compliant Brands**	**Total Brands**	**Percent Non-Compliant**
MEPS2010+10%	34	36	70	49%
Proposal A	37	33	70	53%
Proposal A1	31	39	70	44%
Proposal B	43	27	70	61%
Proposal C	57	13	70	81%

Note: These figures are based on data from the Energy Labelling and MEPS registration database as of 5 November 2010.

The proposal MEPS2010+10% and Proposal A1 have a similar effect on the availability of product, with Proposal A1 having the lowest impact on model availability. Proposal A produced a slightly greater decrease in model availability but Proposal B and C further reduce the number of compliant models currently registered.

A further difficulty with Proposals A, B and C is that they reduce the availability of current registered 4 to 6kW split systems by over 92% and by 100% for greater than 39kW air conditioners. MEPS2011+10% also reduces the availability of current registered greater than 39kW air conditioners by 100%. This would not matter if alternative, more efficient models could be sourced from the international market or developed locally before the MEPS was introduced. However, in this instance the models do not appear to be available or likely to be developed in time for an October 2011 MEPS.

The lack of models likely to be available in the 4 to 6kW split systems and for greater than 39kW air conditioners product categories is why Proposal A1 was developed. It is the only proposal which will not produce significant reduction in consumer choice for 4 to 6kW split systems and for greater than 39kW air conditioners and has been designed to achieve similar energy savings to the MEPS+10% and Proposal A options.

Looking forward to 2014, Proposal C also reduces the availability of current registered non-ducted window wall air conditioners by 100%; effectively removing all current models from the market. This may cause concerns with consumer choice and have the detrimental effect of encouraging the purchase of portable air conditioners (non-regulated for MEPS) instead of window wall units. However, as there are no technical impediments associated with improving the efficiency of these categories of air conditioners, and these requirements are four years away, the MEPS impact on product availability is likely to be much less.

Past experience with the introduction of new MEPS has indicated that industry adjusts to new MEPS and provides new models that are compliant with greater energy efficiency requirements. For example, the non-compliance rates for the non-state MEPS proposals in the current RIS are similar to those projected in previous RIS, including the 2010 MEPS (EES 2008/09) and the 2008 MEPS for air conditioners (Syneca 2005). In the 2005 RIS, it was noted:

> *"The proposed regulation relates to about 1,750 of the air conditioner models that were registered with the AGO in August 2004. About 96% of these would not comply with the proposed new MEPS" (Syneca 2005, p21)*

However, when the new MEPS levels were implemented approximately five years later in 2010, the industry has responded by supplying models which would meet the MEPS levels. Consequently, it is reasonable to expect that industry may in future years be able to respond to the proposed new MEPS levels of Proposal C. However, as Proposal C includes the MEPS requirements of Proposal A which are to be implemented in October 2011, Proposal C will also create product availability issues in the near term for the 4 to 6kW split system and greater than 39kW product categories.

Further supporting the feasibility of introducing new MEPS, such as Proposal A1, is the fact that current or proposed international MEPS levels are generally consistent with the proposed Australian MEPS. The last study comparing the MEPS levels for air conditioners applicable in other countries was conducted in 2005 (EnergyConsult 2005). Since then a review of the main countries listed in this report shows Korea, Japan and Chinese Taipei have not increased their MEPS levels, but the USA and Canada have updated their MEPS levels for certain categories.

The USA and Canada have increased MEPS levels for air conditioners with a rated output capacity of 19kW and above from 1 January 2010. These air conditioners are now required to generally meet an EER of 3.22 for those up to 40kW, and 3.11 EER for between 40 to 70kW. These latest USA and Canadian MEPS levels are higher (more stringent) than Proposal A1 for those categories with capacity of 19kW or greater. However, Proposal A1 is more stringent than the USA, Canadian and Korean MEPS for those with a rated capacity <19kW. Proposal A1 MEPS levels were based on feedback from stakeholders relating to the availability of product in the currently in the Australian market.

New agreements between the air conditioning suppliers and energy efficiency advocacy groups in the USA (AHRI et al 2009) have proposed that the MEPS levels for most air conditioners be raised to 3.58 EER for units with a capacity of up to 13kW, and 3.43 EER for units with capacity of greater than 13kW in 2016. This is now being debated in the USA. These proposed USA levels are close to or exceed the levels shown for Proposal A1. The implication is that while the Australian MEPS levels may lead those currently enforced in international economies, they are within the range of MEPS levels being considered in the future by these countries. This suggests the international manufacturers of air conditioners may soon be supplying to MEPS levels consistent with the proposed

Australian MEPS and so industry should still be able to supply models that comply with the proposed MEPS.

Implementation of the proposed MEPS requirements may affect the competitiveness of one supplier over another, if suppliers differ in the efficiency of the air conditioners that they can produce or source. It is possible some suppliers may withdraw from the market if their products cannot meet the new MEPS requirements, but given the number of air conditioner models available this does not appear to have been affected by previous MEPS, a decline in supplier numbers seems unlikely. Given the large number of suppliers, the number of suppliers is likely to remain large and the overall competitiveness of the market will remain.

5.6 Impact on Energy Use and Greenhouse Gas Emissions

Methodology for Calculating Energy and Greenhouse Impacts

Energy Consumption

The energy used by air conditioners is a function of average electrical input power, number of operating units and average number of hours of operation. In turn the GHG emission is a function of energy consumption and the emission factors determined by the generation mix.

To calculate the energy consumption under the BAU and MEPS scenarios, a detailed and elaborate stock model of air conditioner units installed and operating was developed. The number of operating units in a particular year is a function of existing stock, replacements and new sales. Estimates of stock and sales were made for all Australia, as detailed in Appendix 1: Stock and Sales. Units were also retired from operation according to a "survival function" that reflected the life span of typical air conditioners. Hence, a complete stock model of the air conditioning market was developed by state and year, with additional details such as category, capacity range, average efficiency (EER or COP and standby power) and year of purchase or installation. These units were multiplied by BAU and MEPS average power input figures and corresponding average number of hours of operation for each category to obtain the total energy consumption by state, category and capacity range.

The operating hours used in calculating energy savings are the not the total number of hours that is estimated that an air conditioners is on, but a fraction equivalent to the number of hours the units will be operating at or near full load. This smaller number is used as the energy savings is calculated by the impact of the revised MEPS on the equivalent energy used when the systems are operating at full load and is shown in Table 37 in Appendix 6. It is worth noting that operating hours vary according to the State and if operating in the business or residential sector.

To determine the average BAU input power to the air conditioners, data on the rated efficiency of the units was used. The input power to air conditioners is a function of the commonly used COP and EER of the air conditioners. The COP/EER and cooling capacity in kW are the commonly used technical attributes of air conditioners. The input power in kW can be calculated as:

$$\text{Input Power (kW)} \quad \frac{\text{Cooling/Heating Capacity (kWr)}}{EERorCOP}$$

Standby and crankcase power consumption (or Non-operational power) was also used in the calculations of total annual energy consumption.

The BAU average efficiency was determined from sales weighted average or model weighted average EER/COP over the last 10 years, and projected to 2025 with an autonomous annual efficiency improvement of 0.5%. Efficiency increases due to the current National and State MEPS were included in the BAU average efficiency. The average efficiency of air conditioning units as a result of the MEPS was determined on the basis of the increase in average Annual EER or COP due to the MEPS scenario being examined for each particular category and capacity range. Details of these assumptions are shown in Table 35 and Table 36 in Appendix 6.

The energy consumption and peak demand were determined for the BAU and MEPS scenarios. The difference in these projections provided the net energy savings and demand reductions used to calculate the impacts reported in this section.

Greenhouse Emissions

Greenhouse emissions can be determined by multiplying the energy used by the air conditioners by the relevant emission factor for the State in which they operate. The emission factor refers to the amount of greenhouse emissions produced through the supply of a given unit of electricity. In the model, the GHG emissions were estimated by using the State energy calculations combined with the GHG Emissions Factors in Appendix 8.

Energy and Greenhouse Impacts

The MEPS impacts have been modelled for the BAU scenario and the MEPS options previously described, these being:

- MEPS2010+10%
- Proposal A
- Proposal A1
- Proposal B
- Proposal C.

Based on calculations described above the projected energy savings for the different options are presented in Table 8. The MEPS impact is based on an implementation date of October for the year that the MEPS commence; hence, energy and greenhouse impacts are modelled to begin occurring in following year. Proposals that results in the elimination of product categories do not have any energy savings included from those product categories in the analyses.

Table 8 - Projected Energy Savings (GWh pa) by Scenario and Year

Scenario / Year	2015	2020	2025
MEPS2010+10%	278	605	769
Proposal A	342	743	942
Proposal A1	273	594	756
Proposal B	324	860	1,158
Proposal C	591	1,839	2,652

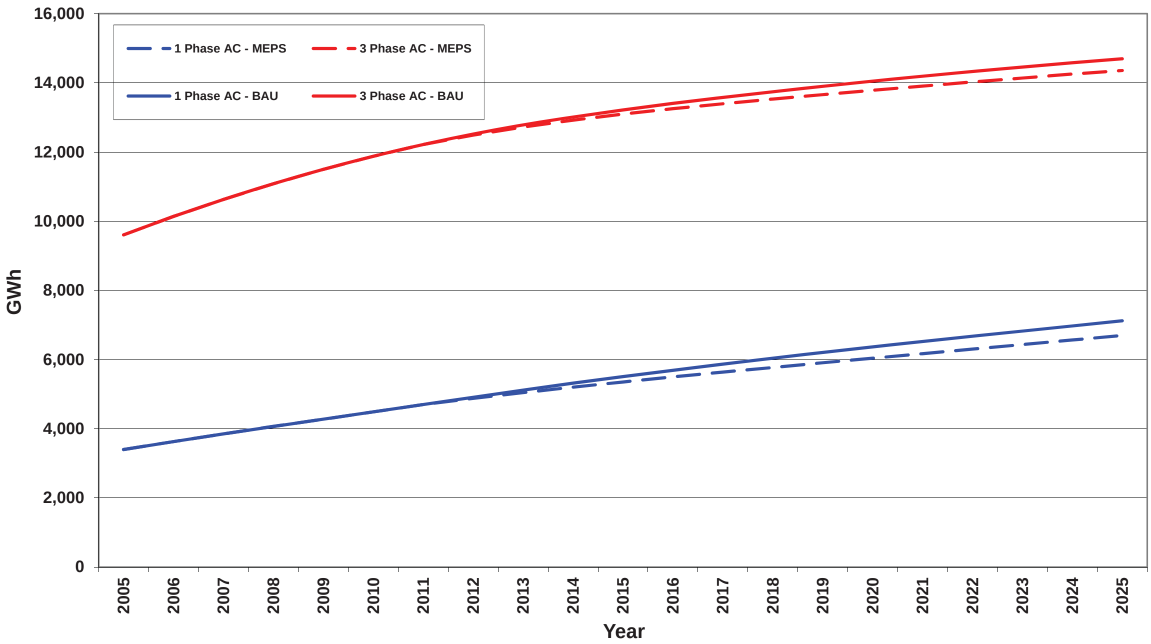
Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6

The projected savings are significant under all the MEPS options, but there are a number of important differences, including:

- the MEPS2010+10% proposal produces similar savings to those of Proposal A1
- Proposal B, the slightly delayed introduction of the new but higher MEPS levels produced over 20% greater savings than either the MEPS2010+10% proposal or Proposal A
- Proposal C, which is implementation of Proposal A and later introduction of MEPS in 2014, produced over three times the savings of the MEPS2010+10% proposal, but this assumed products would be available in all categories and this may not prove to be the case.

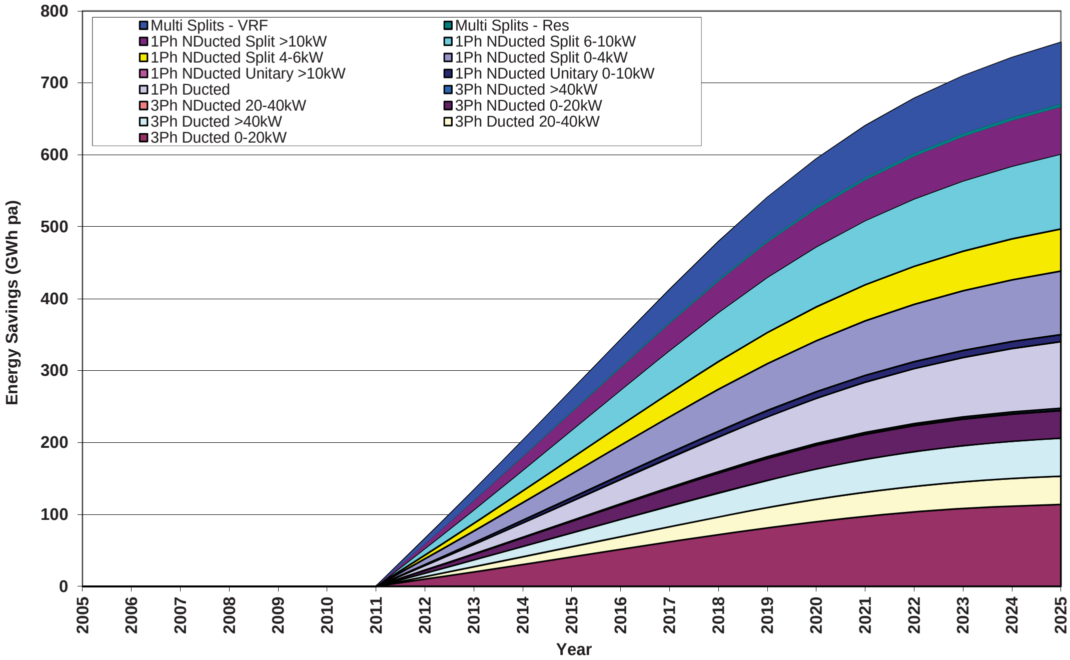
The annual energy consumed under the BAU scenario and under the MEPS Proposal A1 option are shown in Figure 8 and Figure 9. The estimated impact of MEPS is shown as the "MEPS" line and the impact of the MEPS can be seen by comparing this line to the BAU line.

Figure 8 - Annual Energy – BAU and MEPS: Scenario Proposal A1



Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6

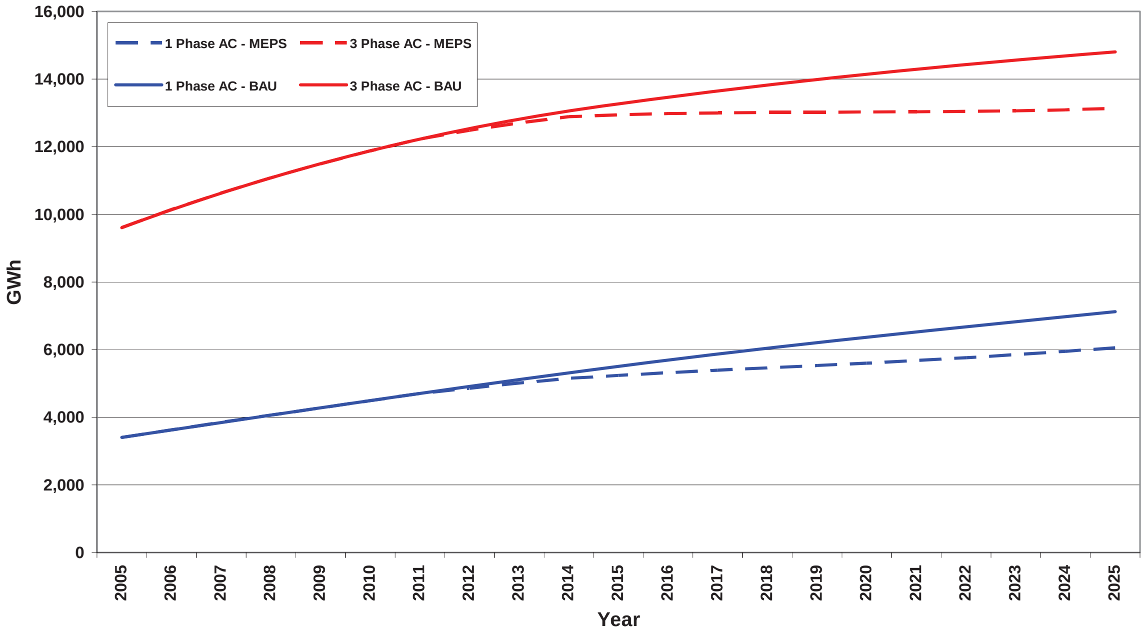
Figure 9 - Potential Energy Savings from MEPS – Australia Proposal A1 Scenario



Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6

The impact for the MEPS scenario Proposal C is shown in Figure 10. This Proposal produces the most energy savings of all the proposals reviewed. However, the analysis assumed products would be available in all categories and this may not prove to be the case, as a result, the savings may be lower.

Figure 10 - Annual Energy – BAU and MEPS: Proposal C



Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6

The GHG emissions reductions resulting from the reduced energy consumption from the various proposals are shown in the Table 9. Again there was only a small long term difference in the impacts of the MEPS2010+10% or Proposal A1. Proposal B produced significantly more emissions reductions than either of MEPS2010+10% or Proposal A1, and Proposal C produced approximately triple the savings of the MEPS2010+10% Proposal.

Table 9 - Projected Annual Greenhouse Gas Reductions (kt CO_2-e pa) by Scenario and Year

Scenario / Year	2015	2020	2025
MEPS2010+10%	257	517	636
Proposal A	316	634	780
Proposal A1	253	507	626
Proposal B	300	734	958
Proposal C	548	1,571	2,194

Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6

5.7 National and State Costs and Benefits

Cost Benefit Methodology

A financial analysis has been conducted on the societal cost benefits of the proposals being reviewed, with the analysis conducted at the State and national level. In the analysis the following costs and benefits are included:

Costs:

- to the consumer due to the incremental price increases of product due to the MEPS
- to the State and Federal governments for implementing and administering the MEPS program
- to the product supply businesses for complying with the requirements of the MEPS program, i.e., testing, administration and training etc.

Benefits:

- due to the avoided consumer electricity purchase costs.

Another benefit is the reduced GHG emissions, due to reduced energy usage, however, the energy prices used for the modelling assume a CPRS or a carbon pricing measure with similar impacts on energy prices has been implemented and that emission costs are now integrated in the electricity prices. Also, the modelling approach does not include the costs associated with the other environmental impacts of electricity use.

In terms of an approach for the cost-benefit analysis, it is necessary to do this from either a consumer or societal perspective. The social approach is the appropriate methodology for the analysis, but the consumer approach can be used where it approximates the results that would be obtained from the societal perspective. As electricity prices closely reflects the marginal cost of producing electricity, due to generators providing power in response to a competitive bidding system for the wholesale energy market, the market price can be used as a proxy for the resources saved in production. Consequently, the results should closely resemble those that would be obtained from an analysis from the social perspective.

Analysis from a consumer or product purchaser perspective involves the use of retail product prices and marginal retail energy prices. Since the objective is to assess whether product buyers (consumers) as a group would be better off, transfer payments such as taxes are included.

For this analysis, a consumer or product purchaser perspective has been assumed as the available data corresponds to that perspective and this is the most readily available information. Retail mark-ups and taxes will be passed onto the consumer and this perspective will simplify the process (while still remaining appropriate), whereas a new set of factors and assumptions have to be introduced, particularly regarding manufacturing costs, if assessing from a resource perspective. The product purchaser approach is also recommended for the development of RIS' associated with the E3 program (NAEEEP 2005). The impact of varying discount rates is very much more difficult to assess from a resource perspective.

However, a complication in using the consumer perspective is that the price consumers pay for their electricity use during the periods when air conditioners are generally used does not fully represent the cost of the electricity they receive. The use of air conditioners has such a large impact on the demand for electricity that, especially during very hot periods, the use of air conditioners creates a peak demand that far exceeds the normal demands on the electricity network and generation capacity.

Consequently, a cost benefit analysis have been undertaken from the consumer perspective which incorporates both the benefits from reduced energy consumption and also estimates of the peak demand cost savings into the benefit analysis. The details and justification of the methodology of both approaches are described below.

In addition, a more conservative cost benefit analysis was undertaken which focuses only on energy cost savings, and ignores the peak demand impacts. This more conservative approach can be regarded a sensitivity test to determine the minimal net benefits from the introduction of MEPS. It used a simple determination of the consumer benefits from reduced electricity use, and calculated the energy cost savings as a multiple of average consumer tariffs by energy saved. The results from this analysis are presented in Appendix 5.

Peak Demand Analysis Methodology

For the cost side of the analyses, the incremental costs of the MEPS proposals are based upon the analysis of sales and efficiency data previously discussed in Supplier Costs section on page 30. These generally showed a ratio of 1.5 of incremental costs to the efficiency improvement (i.e., for each 1% increase in efficiency, the incremental cost is 1.5%). These costs are multiplied by the sales of product to obtain the customer costs. The sum of these customer costs, the supplier costs and government costs provide the total costs for the MEPS option. The energy cost savings post-2025 of cohorts of product installed up until 2025 under the MEPS scenario, are included in the net benefits, as per the Guide to Preparing Regulatory Impact Statements (NAEEEP 2005).

The analytical approach for determining the benefits of MEPS, particularly peak demand impacts, is not available as an off-the-shelf methodology. However, studies across the different States have shown that as much as 25% of the peak demand capacity of the states is related to air conditioner load requirements. For example, research in Western Australia shows the top 20% of demand, hence, of generation and network capacity, is required for only 135 hours annually, and that air conditioning represents 25% of extreme peak demand (Office of Energy 2004). In the SA North Adelaide electricity network, the top 5MVA of load (approximately 25% of total capacity), occurs for only 2% of the year and occurs during extreme weather events (ENA 2005). Similarly in Sydney, Energy Australia estimate 10% of their network capacity is only used for three days per year (ENA 2005).

From the foregoing, it becomes apparent that a large proportion of the infrastructure investment in Australia's electricity system is being devoted to supply the generation and network capacity required to support air conditioning. For example, the Office of Energy, Western Australia (Office of Energy 2004) has estimated that an air-conditioner costing around $1,000 (around 2kW input power) could require around $6,000 of expenditure on new generation and network infrastructure to enable it to be used whenever required. However, as residential and small business consumers largely pay for their electricity use via fixed tariffs, the costs of generation, supply and network capacity to support air conditioners is distributed to both air conditioner users and non-users, and spread over the consumer energy payments which occur throughout the year. As a result, consumer electricity costs during the times when they are not using air conditioners are inflated to pay for the costs of supplying electricity during the periods when air conditioners are used. In other words, the electricity costs that are paid during the periods when air conditioners are used are much lower than if consumers were to pay the full cost of supplying electricity during these periods.

For the cost benefit analysis, the implication of the averaging of electricity costs over the year is that simply using average electricity tariffs, when calculating the electricity cost savings from improved air conditioner efficiency, could result in considerable under estimation of the real cost savings to consumers. Consumers using more efficient air conditioners receive the benefit of not only the cost of the saved electricity but also, because the increased efficiency of the units reduces peak demand, their entire annual electricity costs are reduced as the need to augment the generation and network to cope with more air conditioners is lessened.

Ideally then, the cost benefit analysis of the impact of more efficient air conditioners should capture the impact of reducing energy costs over the peak demand period during which air conditioners are used. Two alternatives methods for better calculating energy cost savings from improved air conditioner efficiency for the cost benefit analysis are to:

- determine an electricity cost/tariff for the periods that air conditioners operate which is reflective of the true costs incurred during these periods, and use this to calculate energy cost saving

- determine the generation and network cost impacts of reducing additional loads during peak demand periods through more efficient air conditioners, and add this to the energy savings costs from more efficient units. As consumer tariffs contain the costs of peak demand periods, averaged over the entire year, to avoid double counting the energy cost savings would need to be calculated on a tariff that is discounted to remove the peak load costs relating to air conditioning.

No research was found to be available to support the first calculation method but research exists which can be used to implement the second method.

The first part of calculating the benefits of air conditioner efficiency is to calculate the energy cost saving, which is determined using the forecasts of energy savings and the consumer tariffs discounted to remove the peak load costs relating to air conditioning. A study by Charles River Associates (CRA 2003) for Integral Energy has found that, using a long run marginal cost approach for capital investment to meet peak demand, it appears that there is a cross-subsidy equivalent to 1.5 to 2.0 cents per kWh from the marginal network cost for the non-peak period to support the peak demand period costs. The implication was that network marginal prices would be a third lower if the peak demand costs were not incurred. Given that network costs form approximately the same proportion of the consumer tariff as do generation costs (ENA 2005 page 6), this implies the non-peak demand period customer tariff is being cross-subsidised by approximately a third. This cross subsidy will vary by State and network, but this estimate would seem to be a reasonable approximation of the cross-subsidy that is likely to exist in the average consumer tariffs. As the network and generation costs form around 90% of retail tariffs(QLD 2010), this implies approximately 30% of the consumer tariffs is the result of increases in peak demand requirements driven by air conditioning.

Consequently, when calculating the energy cost savings from the reduced energy consumption of more efficient air conditioners, a reduction in the average tariffs by 30% has been used. This reduces the risk of double-counting, when determining the impact of air conditioner efficiency improvements. This means that the energy cost savings, without the peak demand impacts on these costs, can be estimated.

The second part of the energy and peak demand analysis involves determining the reduction in peak demand costs that can be attributed to improvements in air conditioner efficiency. This involves first determining the reduction in peak demand and then calculating the costs savings that flow from the reduction.

It is considered that there are three factors which limit the effect of the energy savings from MEPS being converted into peak demand savings, these being:

- diversity of air conditioners, which means only a proportion of air conditioners are switched on during peak periods; this is estimated to be 70% (Swift 2005), except in Tasmania
- the extent to which EER improvements convert into reduced power input, versus increases in capacity of the air conditioners installed
- introduction of Demand Response (DR) control in air conditioners.

The extent of conversion of EER improvements into increased capacity versus reduced power input is not known. Research on non-ducted air conditioner trends and their reaction to previous MEPS was conducted (EnergyConsult 2010). These research results could be interpreted as some of the improvement is converted into increased capacity, as model weighted capacity of air conditioners has increased since MEPS were introduced. Additionally, some of the improvement is converted to reduced power input, as indicated by declining trends for model weighted power input. In light of the lack of definitive information, it has been assumed that 50% of EER improvements for non-ducted air conditioners from the proposed MEPS will be converted into reduced power input. However, for larger ducted systems which do not use inverter technology, EER improvements are unlikely to be converted into increased capacity. These larger units make up approximately half of the Australian air conditioning load. Consequently, on average it has been assumed that 75% of EER improvements for all air conditioners from the proposed MEPS will be converted into reduced power input.

These two factors limit the impact of improvements in EER from higher MEPS levels being converted into lower peak demand. In the impact analysis it has been assumed that their impact can be multiplied, which results in the assumption that 52.5% of the demand reduction from energy efficiency improvements in all air conditioners will be materialised at times of system peak load, in summer for all states except Tasmania[3]. In Tasmania, the demand reduction will impact on winter peak heating load.

In addition, the amount of peak demand reduction attributed to improvements in EER will be reduced by the uptake of DR enabling devices and utility programs targeting air conditioning over the modelling period. Research is currently being undertaken to explore the feasibility of mandating DR enabling device in all single phase air conditioners from 2012. However, as the current RIS and proposed MEPS precede when the DR regulations might be introduced, the impacts of the DR initiative was not included in the current modelling or cost benefit analysis.

The additional benefits of reduced system peak demand need to be estimated if they are to be included in the cost benefit analysis. These benefits are represented by a value of $3,000 per kW of reduced demand, as calculated by George Wilkenfeld, a reputable industry expert, (GWA personal communication April 2010). This calculation approximates the avoided costs of new electricity generation, transmission and distribution capacity and is consistent with the approach being used to model the impacts of demand response for air conditioners. This estimate can be regarded as the difference between production costs in peak periods and revenue from energy tariffs during these periods.

Some additional assumptions made in conducting the analysis include:

- no behavioural changes are assumed to occur in residential usage of air conditioners over the period in which the MEPS impacts are modelled and so the operating hours of air conditioners are assumed to remain constant

[3] This is considered consistent with the conversion assumption of 25 to 50% discussed in the study of demand response requirements for air conditioners, currently being prepared by George Wilkenfeld and Associates

- when the new MEPS levels are introduced that customers continue to purchase a mixture of units of varying efficiency, with the proportions of sales in this mixture being similar to those that were purchased before the MEPS
- existing trends regarding the capacity of air conditioners being purchased continue, and these trends will include the market response to increasing building energy efficiency standards.

These assumptions are used for the energy cost analysis and also the peak demand analysis.

To test the sensitivity of the analysis outputs, scenarios were developed as follows:

- two sales scenarios were modelled – base and low growth
- three usage scenarios were modelled – high, base and low usage
- sensitivity to BAU efficiency increase was also modelled.

5.8 Cost Benefit Analyses Results

The energy and reduced peak demand cost savings, from the greater energy efficiency resulting from the MEPS options were calculated using the modified consumer tariffs and including the benefits of reducing peak loads. Table 10 shows the financial analysis and NPV for Australia for a range of real discount rates. The results show that all proposals produced benefits that exceed costs, for all discount rates. Proposal C produced the lowest benefit cost ratio.

Table 10 - Financial Analysis –National MEPS Scenarios (Various Discount Rates)

Scenario	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
MEPS2010+10%				
Total Costs	$1,719,691,146	$1,326,349,107	$968,310,516	$729,836,189
Total Benefits	$4,815,396,303	$3,366,649,144	$2,199,845,256	$1,512,336,598
Net Benefits	$3,095,705,156	$2,040,300,037	$1,231,534,740	$782,500,409
Benefit Cost Ratio	2.8	2.5	2.3	2.1
Proposal A				
Total Costs	$2,481,369,898	$1,912,557,498	$1,395,088,417	$1,050,655,858
Total Benefits	$6,511,752,514	$4,586,396,441	$3,021,609,841	$2,091,161,072
Net Benefits	$4,030,382,616	$2,673,838,943	$1,626,521,424	$1,040,505,214
Benefit Cost Ratio	2.6	2.4	2.2	2.0
Proposal A1				
Total Costs	$1,802,408,284	$1,389,959,665	$1,014,565,568	$764,562,224
Total Benefits	$4,902,025,224	$3,433,112,135	$2,247,858,375	$1,548,048,869
Net Benefits	$3,099,616,940	$2,043,152,469	$1,233,292,808	$783,486,644
Benefit Cost Ratio	2.7	2.5	2.2	2.0
Proposal B				
Total Costs	$3,095,082,857	$2,344,288,340	$1,667,426,555	$1,222,405,668
Total Benefits	$7,673,389,697	$5,333,068,778	$3,443,487,158	$2,330,155,757
Net Benefits	$4,578,306,840	$2,988,780,438	$1,776,060,604	$1,107,750,090
Benefit Cost Ratio	2.5	2.3	2.1	1.9
Proposal C				
Total Costs	$8,818,509,095	$6,563,335,013	$4,557,253,308	$3,260,899,039
Total Benefits	$14,686,105,415	$10,032,842,605	$6,349,406,626	$4,224,919,167
Net Benefits	$5,867,596,320	$3,469,507,591	$1,792,153,318	$964,020,128
Benefit Cost Ratio	1.7	1.5	1.4	1.3

Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6 and cost benefits detailed in Section 5.7

Australian State Benefit Cost Ratio

The BCRs for all the Australian states are shown in Table 11 under the MEPS2010+10% scenario, with varying discount rates. In all States, benefits exceed costs even at the highest discount rates. The highest BCR occurs in the Northern Territory, where electricity prices are higher and, hence, provide greater consumer benefits. State and Territory program costs are apportioned by household numbers in each State.

Table 11 - BCR for States: Peak Demand Savings for Proposal A1 (Various Discount Rates)

State	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
NSW & ACT	2.5	2.3	2.1	1.9
NT	3.6	3.2	2.8	2.5
QLD	3.0	2.7	2.4	2.2
SA	2.7	2.5	2.2	2.0
TAS	1.7	1.5	1.3	1.2
VIC	2.2	2.0	1.9	1.7
WA	2.8	2.5	2.3	2.1

Source: EnergyConsult modelling based on stock, sales, hours of use and EER assumptions detailed in Section 5.6 and cost benefits detailed in Section 5.7

Summary Data for Alternative MEPS Scenarios

The impact of the various scenarios is shown in Table 12.

Table 12 - Summary Impact Data for Scenarios

Scenario	Energy Saved (cumulative to 2025)	GHG Emission Reduction (cumulative to 2025)	Total Benefit	Total Cost	Net Benefit (energy & peak demand savings)	BCR
Units	**GWh**	**Mt CO_2-e**	**$M**	**$M**	**$M**	
MEPS2010+10%	10,684	8.9	$2,200	$968	$1,232	2.3
Proposal A	12,992	10.9	$3,022	$1,395	$1,627	2.2
Proposal A1	10,506	8.8	$2,248	$1,015	$1,233	2.2
Proposal B	15,137	12.6	$3,443	$1,667	$1,776	2.1
Proposal C	34,119	28.4	$6,349	$4,557	$1,792	1.4

Note: Cumulative values account for the effects on products installed up to 2025, and their associated lifetime energy savings/greenhouse gas emission reductions to 2040. Amounts calculated with a 7% discount rate.

5.9 Cost Benefits of Not Using Simulation

A cost benefit analysis of the impacts of not allowing simulation for air conditioners with a rated capacity of less than 30kW was conducted. This analysis was based around the assumption that the use of simulation permits a small proportion of air conditioners to comply with MEPS requirements that would otherwise not do so. Disallowing the use of simulation would improve compliance with the MEPS and raise the average energy efficiency of the remaining air conditioners.

The analysis further assumed that an improvement in efficiency of 1 to 3% would occur in the affected product categories due to greater compliance with the MEPS. Approximately 20 to 30% of ducted (including packaged) models use simulations for MEPS registration and would be affected by this proposal. This represents about 130 models of air conditioners under current registrations or 50 models after MEPS2010+10% or Proposal A is implemented. The additional benefits assume that those models that are marginally complying with the MEPS under simulation (Note that approximately 50% of the models using simulation are within 3% of the MEPS levels) do not comply when physically tested. These units are, therefore, no longer offered for sale and consumers purchase more efficient models, hence, an increase on the overall weighted average efficiency of 1 to 3% results.

The benefits and costs of the more efficient models are calculated using the same methodology as described earlier in Cost Benefit Methodology, however it is also assumed that approximately $500,000 of additional costs for testing will be incurred by suppliers (due to the need of some suppliers to physically test their models rather than simulate the test). The analysis shows that additional NPV of between 60 and $180M (with a BCR of 11.6 to 12.0) could be achieved, depending on whether an efficiency improvement of 1 to 3% occurred.

Consequently, it is proposed that only air conditioners with a rated output capacity of greater than 30kW, and that do not carry an energy rating label, be permitted to use simulation, as consistent with the original intention of the regulation. A transitional arrangement may be required and would be examined with the industry.

6 Consultation

There has been ongoing consultation with the air conditioning industry over the last decade with regard to the introduction of energy rating labels and MEPS. For the 2010 changes in MEPS levels, a consultative RIS was produced in September 2008 and feedback from industry supplied on the feasibility of that round of MEPS level changes. A decision RIS was produced for the 2010 MEPS, which incorporated stakeholder input, and this MCE decision was communicated to industry in writing in October 2009.

COAG announced in July 2009 their intention to raise MEPS requirements by 10%, subject to an appropriate RIS, and in November 2009 this was communicated by letter to peak air conditioning industry associations along with the intention to include multi-split units in the new MEPS.

Consultation on proposals for multi-split air conditioners has occurred via forums with industry (February 2009) and calls for submissions on fact sheets (DEWHA 2009). No written submissions regarding this topic were received but verbal feedback at the forums indicated stakeholders were agreeable for multi-split systems to be included in the MEPS. The introduction of MEPS for multi-split air conditioners forms part of this RIS and its impacts have been analysed.

The *Consultation RIS Minimum Energy Performance Standards for Air Conditioners: 2011* was released in June 2010. This consultation RIS attempted to present the key issues, questions and potential regulatory options to stakeholders with stakeholders invited to provide comments. The release of the RIS was also followed by a series of workshops and meetings conducted with stakeholders during July 2010. The consultation period for the consultation RIS closed on 6 August 2010, with some stakeholders granted an extension until 13 August 2010 to provide a response.

A total of 18 written submissions were received from various stakeholders, including manufacturers, importers, associations and electricity utilities. Comment from electricity utilities and evaporative air conditioner suppliers were generally supportive of the MEPS proposals. The vast majority of comments from supplier stakeholders requested that:

- SEER be used for the MEPS as opposed to the current annual EER/COP
- more time is needed for industry to comply with new MEPS – industry require at least two years to comply with increased standards
- the cost benefits need to be re-calculated using higher costs for the more efficient units.

The summary of all comments and brief description of the response in the decision RIS are shown in the Table 13, followed by discussion of the major issues and responses.

Table 13 - Summary of Stakeholder Feedback on Consultation RIS

No.	Company	Stakeholder	Supplies/Represents	Country	Comment Summary	DCCEE Response
1	Accent Air	Manufacturer	Ducted split and packaged units	Australia	Strongly objects to the increased MEPS for larger Ducted/packaged units	MEPS reviewed for larger ducted units
2	ActronAir	Manufacturer/Importer	Ducted split and packaged units, non-ducted splits, multi splits	Australia	Objects to proposed EER based MEPS – supports SEER MEPS in 2014, supports including Multi splits. Current + proposed MEPS for rooftop packaged units will increase costs and favour multi-splits	Recommending moving to SEER MEPS in 2014 and retaining part load allowance Support multi splits inclusion noted MEPS reviewed for larger ducted units
3	Air Conditioning and Mechanical Contractors Association of Australia (AMCA)	Association	Mechanical Contractors	Australia	Objects to MEPS as per AREMA	See AREMA comments below
4	Air-conditioning & Refrigeration Equipment Manufacturers Association of Australia (AREMA)	Association	Manufacturers and Importers	All types	Strongly disputes many of the data and assumptions supporting the MEPS proposals. Proposes alternative MEPS based on SEER, and later timeframe. Supports multi-split MEPS, but MEPS for ducted units may force these categories out of the market. Supports removal of simulation, but no CBA in RIS	Clarification of disputed data and assumptions when supported by evidence available Recommending moving to SEER MEPS in 2014 and retaining part load allowance Request to delay MEPS noted. Support multi splits inclusion noted. MEPS reviewed for larger ducted units
5	Australian Duct Manufacturers Alliance (ADMA)	Association	Ducts	Australia	Many comments are not relevant to MEPS for AC – more relevant to ducts and installations	Comments noted.
6	Australian Industry Group (Ai Group)	Association	Manufacturers and Importers	All types	Similar to AREMA submission, disputes many data and assumptions to calculate costs and benefits. Does not support the proposals to mandate world's highest MEPS levels, the	Clarification of disputed data and assumptions when supported by evidence available Recommending moving to SEER

No.	Company	Stakeholder	Supplies/Represents	Country	Comment Summary	DCCEE Response
					implementation time frames. Also models above 65kW will only need to comply with the BCA EER minimum level of 2.6 EER. They propose a 0.3 EER concession for economisers	MEPS in 2014 Request to delay MEPS noted. Economisers are installation specific, so concession is not feasible
7	Bravis Climate Systems	Manufacturer/Importer	Ducted AC, Evaporative coolers, Ducted Gas heaters	Australia	Supports Proposal A, modified Proposal C	Support noted
8	Consumer Electronics Suppliers Association (CESA)	Association	Manufacturers and Importers	Australia	Replicates AREMA submission but adds letter from Minister Ferguson. CESA do not support removal of part load allowance, until SEER based MEPS is implemented. Claims that many suppliers are now using Part load allowance to meet current MEPS levels	See AREMA comments Analysis of registrations shows only 10% models using part load allowance
9	Daikin	Manufacturer/Importer	Ducted and non-ducted splits and packaged units	Australia/Japan	Disputes many data and assumptions in RIS – leading to overstated energy savings and understated costs Does not support inclusion of Peak demand cost savings. Does not support removal of peak load allowance	Clarification of disputed data and assumptions when supported by evidence available Recommending moving to SEER MEPS in 2014 and retaining part load allowance
10	De' Longhi	Importer	Portables, Splits	Italy	Remove State based MEPS, give 4 years notice	Comment noted
11	Electric Energy Society of Australia (EESA)	Association	Engineers (Engineers Australia)	Australia	MEPS may not address peak demand, but supports MEPS in principle. Suggests that a maximum power input be used in conjunction with MEPS	Comment noted
12	Electrolux	Manufacturer/Importer	non ducted unitary air conditioners	Australia	The RIS does not differentiate adequately between product groups and is too simplistic in its analysis. Proposals B and C will eliminate window wall products from the market. Old and flawed data is used for market analysis. Costs are underestimated for window wall units. Australian MEPS will be > other international markets, and	Clarification of disputed data and assumptions when supported by evidence available Request to delay MEPS noted

No.	Company	Stakeholder	Supplies/Represents	Country	Comment Summary	DCCEE Response
					implementation time is too short (need to extend to April 2012)	
13	Energex – QLD	Electricity Distributor/retailer		Australia	Supports MEPS	Support noted
14	Ergon Energy	Electricity Distributor/retailer		Australia	Supports Proposal C	Support noted
15	Heatcraft Australia	Importer	Ducted and non-ducted splits and packaged units	Australia/USA	Objects to MEPS as per AREMA, Need more notice. Supports SEER MEPS	See AREMA Recommending moving to SEER MEPS in 2014 and retaining part load allowance
16	Japan Refrigeration and Air Conditioning Industry Association (JRAIA)	Association	Japanese Manufacturers	Japan	More time – 3 years for proposal A. Use SEER for MEPS in 2014, keep Part load allowance till SEER, Certain categories up to 50% extra costs for Proposal A, 100% to 300% costs increase for Proposal C	Request to delay MEPS noted. Clarification of disputed data and assumptions when supported by evidence available Recommending moving to SEER MEPS in 2014 and retaining part load allowance
17	Mitsubishi Electric Australia	Importer	Many types	Australia/Japan	More time – 2 years for proposal A. Use SEER for MEPS in 2014, keep Part load allowance till SEER, Proposal A is 20% above MEPS for 4.2 -5 kw category, not in accordance with COAG No removal of discontinuity above 10 kw No Proposal C – to high MEPS. EU, Japan, Korea and China introduced SEER MEPS Costs increases are incorrect – 40% to meet 2010 MEPS Mulitiplits need an agreed MEPS method – 100s of combinations	Request to delay MEPS noted. Clarification of disputed data and assumptions when supported by evidence available
18	Seeley International	Manufacturer/Importer	Evaporative coolers, Gas heaters, Ducted, imports some refrigerated units?	Australia	Support proposal C – conditional. Need Oct 2012 for proposal A, then 3 years to Proposal C Support SEER for MEPS, Mulitiplits standards	Request to delay MEPS noted. Clarification of disputed data and assumptions when supported by evidence available

No.	Company	Stakeholder	Supplies/Represents	Country	Comment Summary	DCCEE Response
					still under development. How to treat combinations (100's) Keep part load allowance	Recommending moving to SEER MEPS in 2014 and retaining part load allowance Multi split standard situation investigated

6.1 Response to Feedback

The comments from stakeholders were considered and a number of changes to the consultation RIS were made to address the issues raised. The major issues raised and responses are detailed below.

Timing

Almost all the supplier stakeholders proposed that a minimum of two, ideally three years, would be required to meet an increased MEPS level. Stakeholders noted that the COAG proposal was not legally binding and requested that new MEPS be implemented two years after the Australian Standard is published, expected to be in 2011. The current proposed MEPS implementation date is only six months after the last increment at April 2011, which they consider gives them insufficient time to meet the new MEPS. They have requested MEPS be implemented in 2014 to 2015.

It is noted that the July 2009 COAG announcement preceded the introduction of any revised MEPS in October 2011 by over two years and it is considered that the COAG announcement was sufficient warning of the intention to raise MEPS by 10%.

MEPS Metric

Half of the stakeholders requested that a SEER/COP be used to set the next MEPS level following April 2011.

The main reason for this proposed change to the MEPS metric is the range of efficiency for air conditioners varies according to temperature conditions and that air conditioners operate for the vast majority of time at part load conditions, whereas the current MEPS measures the performance of air conditioners at full load. This means the SEER will provide a better indication of the energy consumption of air conditioners over time than the current annual EER will do.

The SEER approach is currently used in the USA and Japan, and soon to be introduced in the EU, Korea and China. A new ISO standard is being prepared that will allow the performance of air conditioners to be measured at various rating points to determine a SEER.

The use of the SEER approach was considered for the October 2011 MEPS review, but on balance it was decided that further investigation of the impact of converting to a SEER approach is required. One issue that requires investigation is the impact that using SEER for MEPS may have on the full load of complying air conditioners and, hence, on peak load demand from air conditioners. However, it is anticipated that an appropriate form of the SEER approach will be adopted for MEPS in 2014.

MEPS Impact in Particular Categories and Sizes

Stakeholders have advised that particular categories of air conditioners may be adversely affected by the various proposed MEPS. In general, Proposal C removes most products currently on the market, as the latest registration data shows (post April 2010). Also, no products above 35kW currently meet the levels proposed contained in Proposal A and few non-ducted products in the 4 to 6kW range will meet Proposal A requirements.

In addition, many suppliers claim that the cost increases for ducted units to meet the MEPS will make this category uncompetitive when compared to non-ducted splits and multi-splits.

This comment has led to the development of a new MEPS proposal, Proposal A1, which includes revisions of the MEPS levels of Proposal A. Proposal A1 addresses the concerns that some product categories might be adversely affected if Proposal A MEPS levels are used. See section MEPS Options Considered, page 20.

Cost Benefit Analysis

The supplier stakeholders suggest that peak demand should not be included in the cost benefit analysis as it is double counting the benefits. This was also suggested by the Office of Best Practice Regulation (OBPR).

The cost benefit analysis was reviewed to avoid this double counting. The revised analysis is used in the decision RIS. See the section Peak Demand Analysis, page 40.

Stakeholders provided some evidence that the costs of improving efficiency are higher than assumed in the RIS. This evidence was supported by further analysis of the efficiency/price relationship of air conditioners of higher efficiency; see Supplier Costs, page 30. Also, the suppliers provided evidence of higher testing and compliance costs. These additional costs were incorporated into the cost benefit analysis providing results that were used in this decision RIS.

Stakeholders also suggested that development costs associated with bringing new MEPS compliant product to the market should be explicitly identified and included in the CBA. Currently, these development costs are incorporated as a cost increase proportional to EER/COP. This issue was raised with industry experts who pointed out that Australia has no highly specialised or customised imported air conditioner models. New models are developed to meet the much greater international markets, not to meet Australia's specific needs, and so additional product development costs are not relevant for imported products in the Australian market. For larger systems, there may be some additional development costs but these are assumed to be incorporated as a costs increase proportional to EER/COP.

Multi Splits

Most of the submissions supported the introduction of MEPS for multi-split units. However, it was noted that the ISO test standard is only now being finalised and there needs to be some way to determine which product combinations are measured for MEPS purposes. Each supplier may have multiple combinations of outdoor and indoor units.

Expert advice on this issue suggests that these concerns will not be an issue and that the ISO 5042 standard is expected to be published shortly. Suppliers are required to nominate the minimum number of indoor units to be tested for each outdoor unit – this will reduce the number of combinations of multi-splits to the number of outdoor units (which is typically low).

Some stakeholders made claims that multi split sales numbers were inflated, but this issue was difficult to resolve, as the suppliers own data was used to compile the sales numbers. Industry experts suggest the correct sales data has been used.

Part Load Allowance

There was no consensus on the removal of the part load allowance. Several stakeholders requested that this allowance remain until the introduction of a SEER MEPS.

A key argument against the removal of the part load allowance is it might perversely lead to the removal of some air conditioner models from the market whose annual energy consumption is less than similar sized models with higher annual consumption. Also, it could lead to the removal of models now which might then be reintroduced if the MEPS metric moves to a SEER in the future.

Given the feedback from stakeholders, and the argument that the part load allowance can encourage the retention of more efficient air conditioners in the market, it is advised that the part load allowance be retained for the October 2011 MEPS. Assuming that there was a move to SEER MEPS in the future, the need for a part load allowance would disappear and the part load allowance would then be removed. See section Removal of the Part-Load MEPS Compliance Requirement for Air Conditioners with Inverter Technologies, page 25.

De-rating capacity

AREMA and other suppliers raised the issue that units will be de-rated in capacity to meet the new MEPS levels while essentially not changing their product (some units are more efficient at lower loads and, hence, will be rated at this lower level). The result of this is that the units may have a higher load than other units of similar capacity that had not been de-rated, hence, they could have a greater impact on peak demand. However, the retail price of air conditioners is closely related to the rated capacity and, hence, a lower rated capacity will be marketed at a lower price. This essentially discourages the practice of de-rating.

At this stage the potential to de-rate to meet a new MEPS level is academic. In future, market research investigation will be required to establish that this practice is occurring.

Out-dated data

There was a concern about out of date data used for the analysis. For example, the list of registered models used for the analysis of the MEPS impacts was out-dated. In the cases referred to, the data quoted by stakeholders was not available when the consultation RIS was published. New data has been substituted in the analysis and the results updated in this report accordingly.

7 Evaluation and Conclusions

7.1 Assessment

Reduce Greenhouse Gas Emissions Below Business-as-Usual

It is expected that, due to their voluntary nature, the non-mandatory policy alternatives will not reduce GHG emissions. This has been shown repeatedly in previous RIS.

Based on the modelling of the revised MEPS proposals, significant energy savings and GHG emission reductions are possible for all proposals. All revised MEPS options result in reduced GHG emissions below BAU.

Addressing Market Failures and Information Barriers

By requiring the removal of low efficiency product from the market, the revised MEPS will most effectively address market failures and information barriers, so that the average lifetime costs of products are reduced. All other options would rely on voluntary mechanisms and are not as effective in addressing these problems.

The MEPS options would clearly require importers and suppliers of air conditioners to provide complying equipment. These options are not thought to involve significant negative impacts on suppliers as the volume of sales would not be substantially affected and compliance costs are low.

Evaluation of MEPS Options

The various MEPS options proposed and modelled result in varying amounts of energy savings, greenhouse emission abatements, net benefits and percentage of registered air conditioner models made non-compliant. To assess the MEPS options, they were first ranked in terms of their net benefits, which were closely related to their energy and emission savings, and then the impact of the options on model eliminations was considered. The impacts of the options are shown in Table 12 and elimination of models in Table 7.

The difference in the net benefits was first compared and then the ranking of the national MEPS options by their net benefits, in order of magnitude, was determined as follows:

- Proposal C
- Proposal B
- Proposal A
- Proposal A1
- MEPS2010+10%.

Though Proposal A, B, C and MEPS2010+10% produce the same or greater net benefits than Proposal A1, these proposals also lead to much greater reductions in the numbers of currently registered products that will comply with the MEPS. This is of particular concern in the 4 to 6kW split system and >39kW product categories where obtaining alternative, more efficient models may be difficult. Consequently, Proposal A1 appears to be a preferable alternative to MEPS2010+10% or Proposal A.

7.2 Conclusions

After consideration of the policy options it is concluded that a revised MEPS option will be effective in meeting all the stated objectives.

The most effective MEPS, in terms of total net benefits and ability to be implemented with minimal disruption to product availability, is Proposal A1. This option has a higher BCR than Proposal B or C, and a similar BCR to Proposal A. Proposal A1 provides a sales weighted average 10% increase in the MEPS levels over the 2010 MEPS based on a mix of categories. The increase in MEPS is limited in some categories due to model availability and increased above the 10% where there is sufficient range of efficient product. Proposal A1 is based on Proposal A and MEPS2010+10% options, along with feedback from stakeholders, hence, no further consultation is required.

The recommended MEPS Proposal A1 includes the new category of multi-split air conditioners, which will meet the same MEPS levels as all other non-ducted split systems. The test procedure for this category of air conditioners is being finalised and not expected to be adopted in Australia until 2011. Therefore, the MEPS for multi-split air conditioners will apply as soon as practical after the test procedure is adopted by Standards Australia, and the date notified by State and Territory Government regulators.

It was also concluded that the part-load allowance should be retained but that the introduction of a SEER MEPS metric be researched. The use of the SEER metric should be explored for future MEPS or for the appliance labelling program in 2014. If SEER is used in a future MEPS then the need for a part load allowance will disappear. Subject to a further RIS and the investigation of a SEER metric, Option C would be the indicative MEPS levels for 2014.

The use of simulation for compliance with MEPS is to be removed for ducted air conditioners of less than 30kW.

It is recommended that Proposal A1 requirements be implemented by 1 October 2011 and that State and Territory Government regulators notify stakeholders if a delay is required for including multi-split air conditioners within the scope of these MEPS due to the publishing of the internationally accepted test methodology by Standards Australia.

In summary the recommendations are:

- Proposal A1 requirements be implemented by 1 October 2011

- multi-split air conditioners be covered by the new MEPS, and these units be required to meet the same MEPS levels as all other non-ducted split systems
- State and Territory Government regulators notify stakeholders if a delay is required for including multi-split air conditioners within the scope of these MEPS due to the publishing of the internationally accepted test methodology by Standards Australia
- part load allowance should be retained but that the introduction of a SEER MEPS metric be researched
- Option C will be the indicative MEPS levels for 2014, but be subject to a further RIS and the investigation of a SEER metric
- use of simulation for compliance with MEPS is to be removed for ducted air conditioners of less than 30kW.

8 Implementation and Review

The air conditioner MEPS would be implemented under the same State and Territory government regulations as appliance labelling and MEPS, and thus subject to the same sunset provisions. Victoria and SA have general sunset provisions applying to their labelling and MEPS regulations as a whole, hence, all regulations must be reviewed or extended within 10 years, while NSW has sunset provisions applying to the inclusion of some (but not all) items scheduled. Further to these general regulatory processes, there are specific requirements associated with approving, cancelling and grandfathering registrations for MEPS of models. These arrangements will be consistent with past requirements that have been put in place when MEPS levels change.

Once the States and Territories government agree to mandatory requirements, their removal in any one jurisdiction would undermine the effect in all other jurisdictions, because of the relevant MRA in place. Under the co-operative arrangements for the management of the E3 program, States and Territories advise and consult when the sunset of any of the provisions is impending. This gives the opportunity for revised cost-benefit analyses to be undertaken.

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

Transitional Arrangements

Regulators have a well established system of dealing with existing product registrations where new more stringent requirements are subsequently introduced. Existing products in stock that no longer meets the requirements of a new standard are "grandfathered". This means that existing stock can legally be sold in the future without the need to meet new MEPS levels or have new labels attached. Any new products manufactured or imported after the specified date must meet the requirements of the new standard and they must hold a valid registration with regulators to confirm these requirements. The standard includes a requirement for determining the date of manufacture for each model registered which assists in enforcement of this requirement.

The proposed regulatory date for this proposal is as follows:

- as of the 1 October 2011, all products manufactured or imported will have to be registered to the new requirements in AS/NZS3823.2. Any products not meeting these requirements will be grandfathered. Grandfathered products will be on display on the EnergyRating website for only a limited period after October 2011.

- requirements for multi-split air conditioners will be enforced as soon as possible after the publication of the test standard. Regulators will notify the industry of the regulatory date
- as of the 1 October 2011, only ducted air conditioners with a rated capacity of greater than 30kW will be able to use simulations as a method of compliance. Any products not meeting these requirements will be grandfathered. Grandfathered products will be on display on the EnergyRating website for only a limited period after October 2011.

AS/NZS3823.2 will be amended as soon as possible after the appropriate approvals noted in this decision RIS. Work has already begun on the adoption of the intentional test standard for multi-split air conditions in Australia.

Trans Tasman Mutual Recognition Arrangement (TTMRA)

New Zealand is a party to the TTMRA and as a member of the E3 participates in the development and implementation of energy efficiency regulations consistent with the Australian States and Territories. For the present RIS, New Zealand has considered the impacts of adopting this proposal but has not decided whether to proceed to stakeholder consultation. Consequently, this RIS looks at Australian only MEPS.

1. if New Zealand decides to proceed, a separate consultation document will be released for consultation in New Zealand, to highlight impacts for the local market
2. if New Zealand decides not to proceed, it will seek to re-align levels with Australia at a future date.

The consequences for Australia will need to be monitored, to determine whether any future differences in MEPS levels between Australia and New Zealand would affect air conditioners entering the Australian market via New Zealand. If non-MEPS compliant products are imported via New Zealand, E3 regulators may decide to seek an exemption for the relevant air conditioners under the TTMRA.

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Appendices

Appendix 1: Stock and Sales

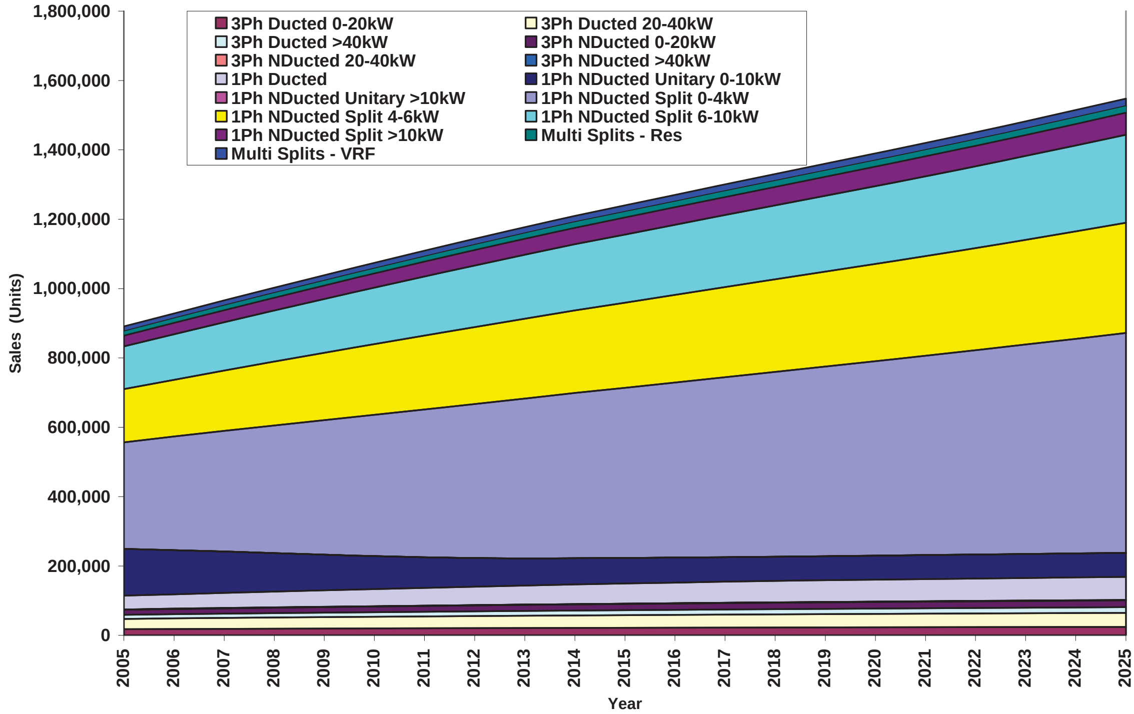
Air Conditioners – Sales Trends

Sales by Category

The sales of air conditioners are a function of economic growth and more specifically a result of business and industrial activity. The sales data from published and unpublished sources has been utilised to determine the most probable forecast that matches the historic data and trends (depending on the category, annual growth rate of around 3 to 7% have been determined).

Figure 11 shows the resulting forecast sales of air conditioners to 2025 in Australia by category for the base sales scenario.

Figure 11 - Forecast Sales of AC by Category – Base Sales Scenario Australia



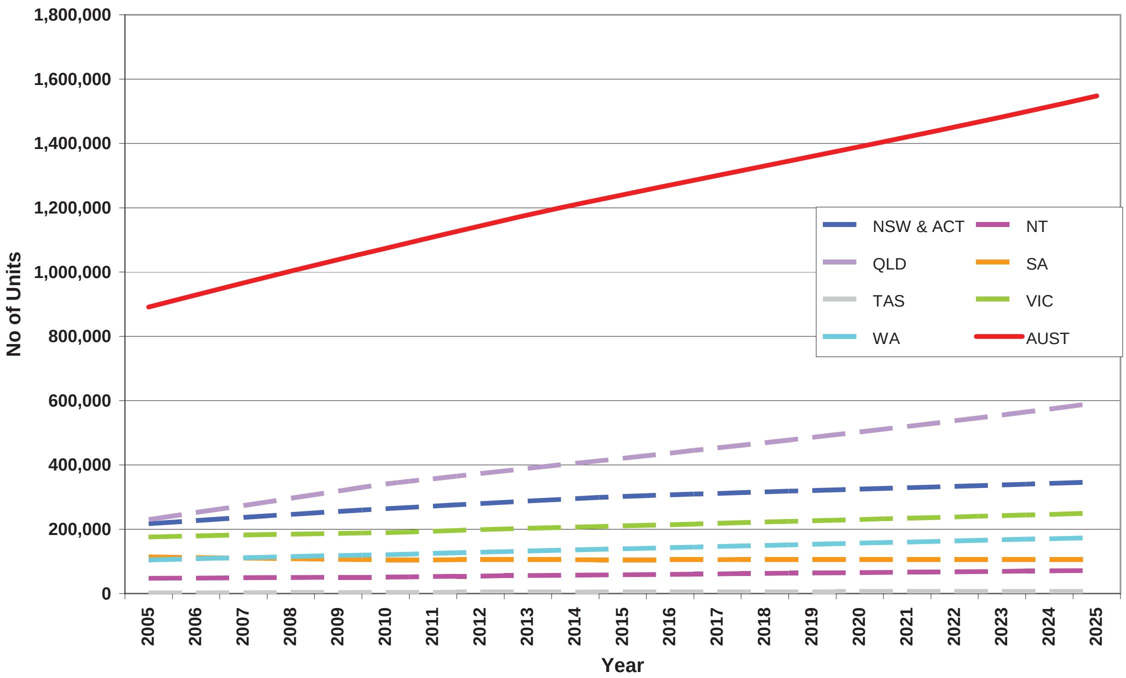
Sales by States

Based on the earlier forecasts of sales and ABS data, the share of sales by State/Territory for the period 2005 to 2025 are shown in Table 14, while Figure 12 graphically illustrates the sales trends.

Table 14 - Total annual sales of AC 2000-2025, by States and Australia as a whole

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST
2000	217,203	47,305	230,173	113,879	1,739	175,944	104,757	**891,000**
2001	227,150	48,209	251,930	111,999	2,085	179,019	108,211	**928,603**
2002	236,835	49,065	273,965	110,118	2,444	181,907	111,567	**965,903**
2003	246,169	49,933	296,170	108,232	2,814	184,579	114,782	**1,002,679**
2004	255,134	50,667	318,453	106,338	3,193	187,029	117,875	**1,038,690**
2005	263,672	51,325	340,665	104,411	3,574	189,219	120,810	**1,073,676**
2006	271,877	52,900	356,923	104,751	3,831	193,859	124,733	**1,108,874**
2007	279,936	54,377	373,304	104,982	4,090	198,366	128,588	**1,143,642**
2008	287,675	55,797	389,538	105,081	4,348	202,647	132,316	**1,177,401**
2009	294,988	57,133	405,445	104,993	4,604	206,604	135,863	**1,209,629**
2010	301,735	58,429	420,844	104,692	4,855	210,145	139,156	**1,239,856**
2011	306,577	59,781	436,900	105,008	4,941	214,276	142,683	**1,270,167**
2012	311,311	61,129	453,126	105,280	5,024	218,380	146,187	**1,300,437**
2013	315,927	62,474	469,494	105,480	5,102	222,409	149,669	**1,330,556**
2014	320,406	63,800	485,937	105,632	5,180	226,342	153,124	**1,360,421**
2015	324,730	65,105	502,439	105,716	5,254	230,185	156,511	**1,389,940**
2016	328,985	66,437	519,689	105,733	5,325	234,026	159,935	**1,420,129**
2017	333,314	67,809	537,327	105,770	5,400	237,975	163,411	**1,451,005**
2018	337,767	69,147	555,397	105,819	5,472	242,000	166,979	**1,482,582**
2019	342,281	70,597	573,891	105,876	5,547	246,071	170,615	**1,514,877**
2020	346,900	72,006	592,870	105,958	5,622	250,240	174,312	**1,547,909**

Figure 12 - Annual sales of AC by State and Australia – Base sales scenario



Air Conditioners – Stock Trends

Stock by Category

Typically, air conditioners have a life span of between 10 and 20 years. Once again to estimate historic and forecast stock, the values for the year 2005 were used as reference. The estimated stock in 2005 and its breakdown by technology and cooling capacity were provided from historical sales and ABS data. An estimated breakdown of various categories of stock in 2005 was used to develop a backwards distribution across 15 to 20 years on the basis of annual sales estimates and a survival function that reflects the life span of different categories of air conditioners. The forecasts of stock were subjected to appropriate "survival functions" for each category and size. Examples of the different survival functions are shown in Figure 13 and Figure 14, where a graphical view is presented of the percentage of air conditioners (Rt) in useful service over the life in years from purchase (t).

Figure 13 - Survival Function of Three Phase Ducted AC for Australia

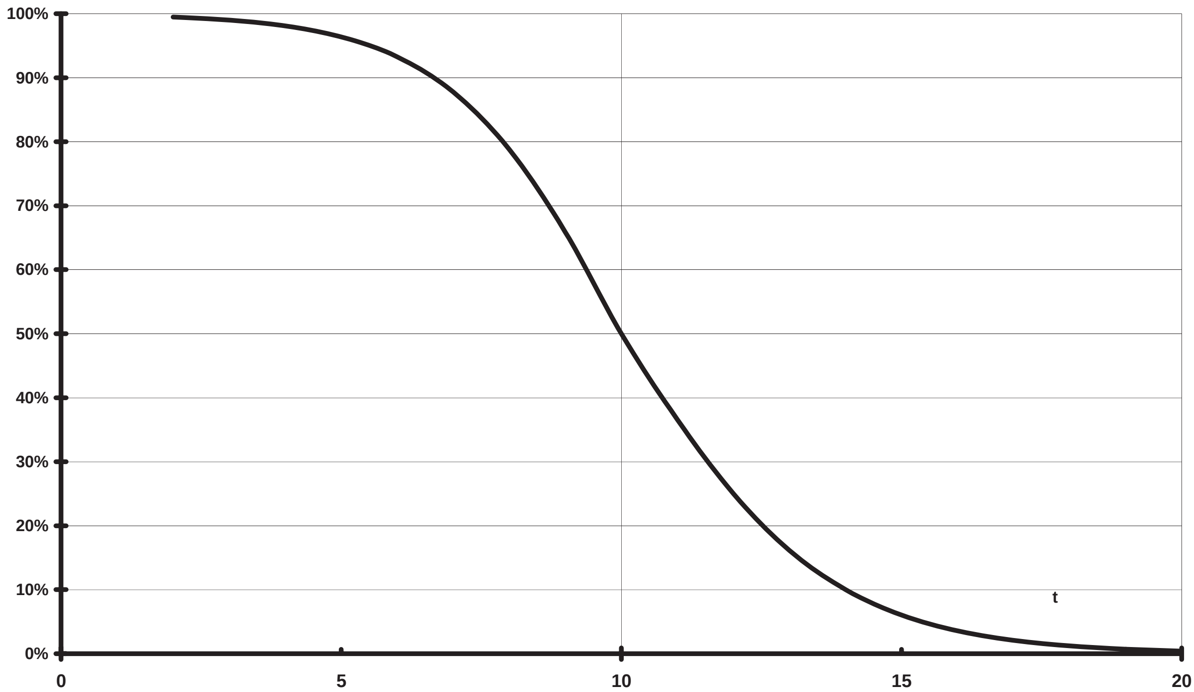
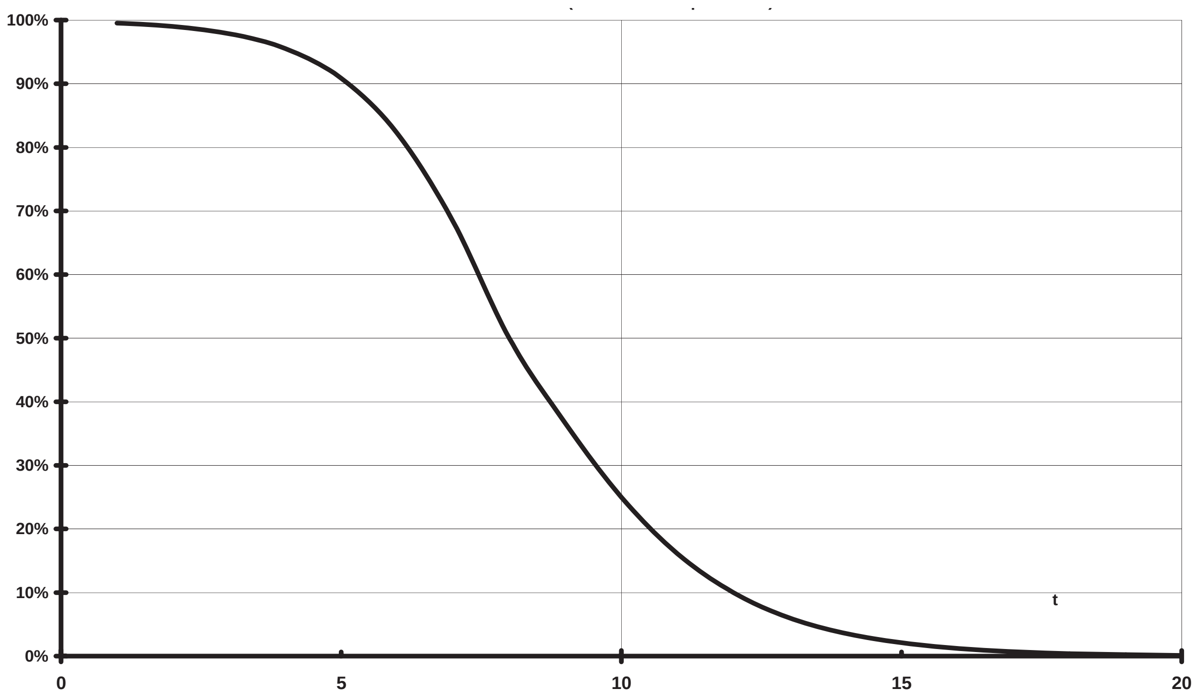
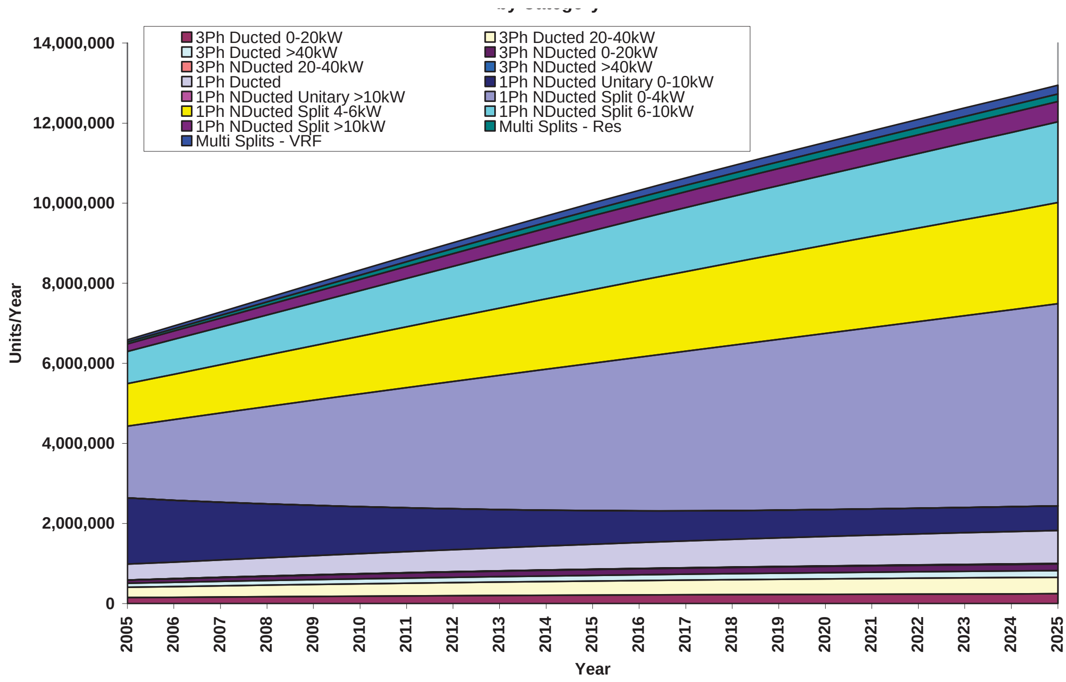


Figure 14 - Survival Function of Single Phase non-Ducted AC for Australia



The resulting estimated stock of AC by category for Australia over the period 2000 to 2020 is shown in Figure 15 for the base sales scenario.

Figure 15 - Forecast Stock of AC – Base Sales Scenario Australia



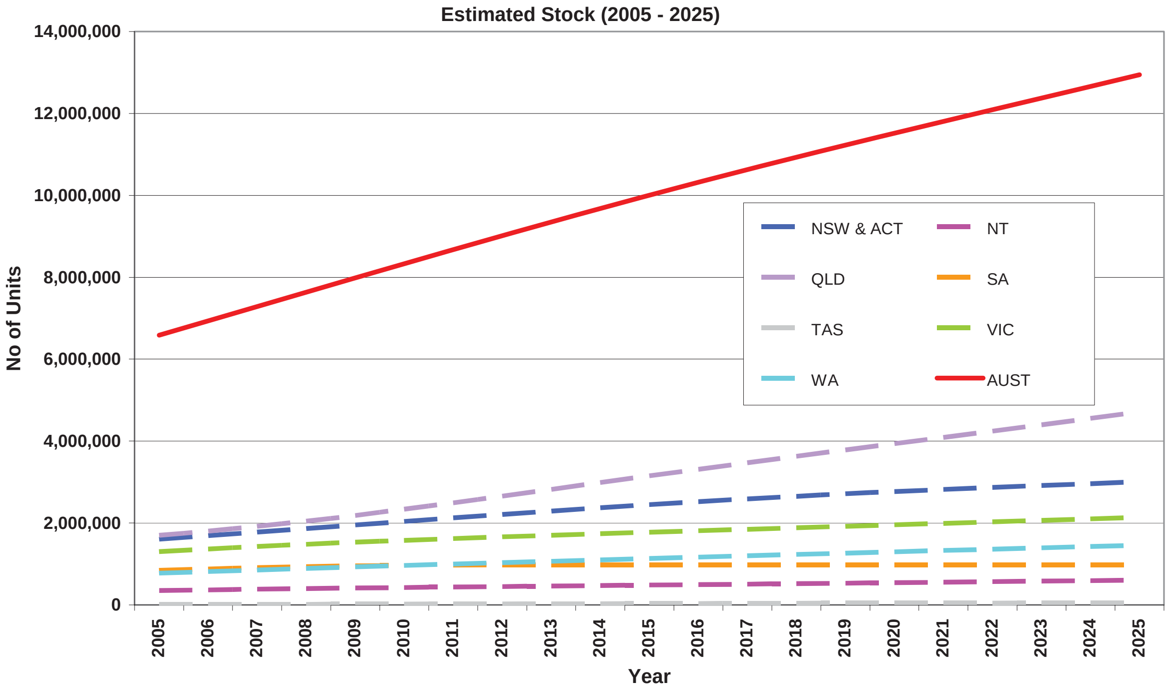
Stock by States

The estimates of AC stock for the period between 2005 and 2025 by States and Australia as a whole are provided in Table 15 while Figure 16 shows the corresponding trend.

Table 15 - Stock of AC 2000-2025, by States and Australia as a whole

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST
2000	1,605,877	349,745	1,701,768	841,956	12,860	1,300,834	774,517	**6,587,557**
2001	1,691,565	367,148	1,803,766	879,801	13,812	1,365,271	814,503	**6,935,866**
2002	1,778,149	383,498	1,918,436	911,188	15,051	1,425,500	853,613	**7,285,437**
2003	1,865,159	398,787	2,045,764	936,082	16,587	1,481,230	891,653	**7,635,262**
2004	1,952,068	412,859	2,185,542	954,464	18,423	1,532,162	928,439	**7,983,957**
2005	2,038,387	425,652	2,337,387	966,414	20,556	1,578,090	963,811	**8,330,298**
2006	2,123,740	438,123	2,494,818	974,466	22,850	1,621,631	998,788	**8,674,418**
2007	2,207,859	450,242	2,656,930	978,977	25,284	1,662,930	1,033,344	**9,015,565**
2008	2,290,170	462,047	2,821,839	980,543	27,820	1,702,163	1,067,387	**9,351,969**
2009	2,370,199	473,638	2,987,212	980,064	30,409	1,739,756	1,100,915	**9,682,194**
2010	2,447,458	485,126	3,151,071	978,171	33,010	1,775,924	1,133,849	**10,004,608**
2011	2,520,192	496,697	3,312,877	976,204	35,426	1,811,814	1,166,581	**10,319,791**
2012	2,588,518	508,432	3,472,148	974,609	37,634	1,847,793	1,199,209	**10,628,344**
2013	2,652,594	520,344	3,628,958	973,543	39,624	1,883,963	1,231,761	**10,930,786**
2014	2,712,577	532,369	3,783,803	972,958	41,402	1,920,205	1,264,191	**11,227,506**
2015	2,768,639	544,464	3,937,147	972,780	42,972	1,956,430	1,296,441	**11,518,874**
2016	2,821,088	556,623	4,090,223	972,877	44,347	1,992,611	1,328,553	**11,806,321**
2017	2,870,443	568,863	4,243,853	973,200	45,550	2,028,837	1,360,593	**12,091,340**
2018	2,917,338	581,130	4,398,780	973,677	46,606	2,065,158	1,392,668	**12,375,358**
2019	2,962,368	593,518	4,555,568	974,217	47,552	2,101,563	1,424,841	**12,659,627**
2020	3,006,065	605,972	4,714,741	974,781	48,412	2,138,121	1,457,172	**12,945,264**

Figure 16 - Trend – Stock of AC 2005 – 2025 by States and Australia as a whole



Appendix 2: Compliance Rates of Current Models with Future MEPS

The tables below detail the percentage of models that are assessed as non-compliant with the proposed MEPS options assessed in this RIS.

The data showing the percentage of total models that are non-compliant with the various scenarios are based on those that are approved for sale in Australia and New Zealand on the registration database on the 5 November 2010.

Table 16 shows the percent of total models that are non-compliant with the MEPS2010+10% scenario.

Table 16 - MEPS2010+10% Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	4	1	5	80%
		Single Split System	157	51	208	75%
	Ducted Total		161	52	213	76%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	458	249	707	65%
		Window Wall	65	43	108	60%
	Non Ducted Total		526	292	818	64%
Single Total			687	344	1,031	67%
Three	Ducted	Packaged	91	12	103	88%
		Single Split System	134	26	160	84%
	Ducted Total		225	38	263	86%
	Non Ducted	Single Split System	17	5	22	77%
	Non Ducted Total		17	5	22	77%
Three Total			242	43	285	85%
Grand Total			929	387	1,316	71%

Table 17 shows the percent of total models that are non-compliant with Proposal A.

Table 17 - Proposal A Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	4	1	5	80%
		Single Split System	175	33	208	84%
	Ducted Total		179	34	213	84%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	542	165	707	77%
		Window Wall	60	48	108	56%
	Non Ducted Total		605	213	818	74%
Single Total			784	247	1,031	76%
Three	Ducted	Packaged	87	16	103	84%
		Single Split System	129	31	160	81%
	Ducted Total		216	47	263	82%
	Non Ducted	Single Split System	15	7	22	68%
	Non Ducted Total		15	7	22	68%
Three Total			231	54	285	81%
Grand Total			1,015	301	1,316	77%

Table 18 shows the percent of total models that are non-compliant with Proposal A1.

Table 18 - Proposal A1 Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	4	1	5	80%
		Single Split System	175	33	208	84%
	Ducted Total		179	34	213	84%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	463	244	707	65%
		Window Wall	60	48	108	56%
	Non Ducted Total		526	292	818	64%
Single Total			705	326	1,031	68%
Three	Ducted	Packaged	75	28	103	73%
		Single Split System	116	44	160	73%
	Ducted Total		191	72	263	73%
	Non Ducted	Single Split System	15	7	22	68%
	Non Ducted Total		15	7	22	68%
Three Total			206	79	285	72%
Grand Total			911	405	1,316	69%

Table 19 shows the percent of total models that are non-compliant with Proposal B.

Table 19 - Proposal B Scenario – Percent Non Compliant

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	5		5	100%
		Single Split System	190	18	208	91%
	Ducted Total		195	18	213	92%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	590	117	707	83%
		Window Wall	66	42	108	61%
	Non Ducted Total		659	159	818	81%
Single Total			854	177	1,031	83%
Three	Ducted	Packaged	101	2	103	98%
		Single Split System	149	11	160	93%
	Ducted Total		250	13	263	95%
	Non Ducted	Single Split System	17	5	22	77%
	Non Ducted Total		17	5	22	77%
Three Total			267	18	285	94%
Grand Total			1,121	195	1,316	85%

Table 20 shows the percent of total models that are non-compliant with Proposal C, taking into account those models that are estimated not to comply with the April 2011 MEPS.

Table 20 - Proposal C Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	5		5	100%
		Single Split System	207	1	208	100%
	Ducted Total		212	1	213	100%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	670	37	707	95%
		Window Wall	108		108	100%
	Non Ducted Total		781	37	818	95%
Single Total			993	38	1,031	96%
Three	Ducted	Packaged	103		103	100%
		Single Split System	160		160	100%
	Ducted Total		263		263	100%
	Non Ducted	Single Split System	20	2	22	91%
	Non Ducted Total		20	2	22	91%
Three Total			283	2	285	99%
Grand Total			1,276	40	1,316	97%

Table 21 shows the percent of total models that are non-compliant with Proposal C, taking into account those models that are estimated not to comply with Proposal A MEPS (if implemented before Proposal C).

Table 21 - Proposal C Scenario – Percent Non Compliant Models Post Proposal A MEPS

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged	1		1	100%
		Single Split System	32	1	33	97%
	Ducted Total		33	1	34	97%
	Non Ducted	Single Split System	128	37	165	78%
		Window Wall	48		48	100%
	Non Ducted Total		176	37	213	83%
Single Total			209	38	247	85%
Three	Ducted	Packaged	16		16	100%
		Single Split System	31		31	100%
	Ducted Total		47		47	100%
	Non Ducted	Single Split System	4	2	6	67%
	Non Ducted Total		4	2	6	67%
Three Total			51	2	53	96%
Grand Total			260	40	300	87%

Table 22 shows the percent of total models that are non-compliant with the Interim QLD State MEPS scenario.

Table 22 - QLD State MEPS Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged		5	5	0%
		Single Split System	47	161	208	23%
	Ducted Total		47	166	213	22%
	Non Ducted	Double/Triple Split	1	2	3	33%
		Single Split System	40	667	707	6%
		Window Wall	2	106	108	2%
	Non Ducted Total		43	775	818	5%
Single Total			90	941	1,031	9%
Three	Ducted	Packaged	3	100	103	3%
		Single Split System	15	145	160	9%
	Ducted Total		18	245	263	7%
	Non Ducted	Single Split System	4	18	22	18%
	Non Ducted Total		4	18	22	18%
Three Total			22	263	285	8%
Grand Total			112	1,204	1,316	9%

Table 23 shows the percent of total models that are non-compliant with the Interim SA State MEPS scenario.

Table 23 - SA State MEPS Scenario – Percent Non Compliant Models

Phase	Configuration 1	Configuration 2	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
Single	Ducted	Packaged		5	5	0%
		Single Split System	47	161	208	23%
	Ducted Total		47	166	213	22%
	Non Ducted	Double/Triple Split	3		3	100%
		Single Split System	104	603	707	15%
		Window Wall	2	106	108	2%
	Non Ducted Total		109	709	818	13%
Single Total			156	875	1,031	15%
Three	Ducted	Packaged	15	88	103	15%
		Single Split System	32	128	160	20%
	Ducted Total		47	216	263	18%
	Non Ducted	Single Split System	8	14	22	36%
	Non Ducted Total		8	14	22	36%
Three Total			55	230	285	19%
Grand Total			211	1,105	1,316	16%

The following charts illustrate the various MEPS levels and the range of efficiency of models currently registered (represented as Annual EER).

Figure 17 - EER and MEPS Levels – current ducted models

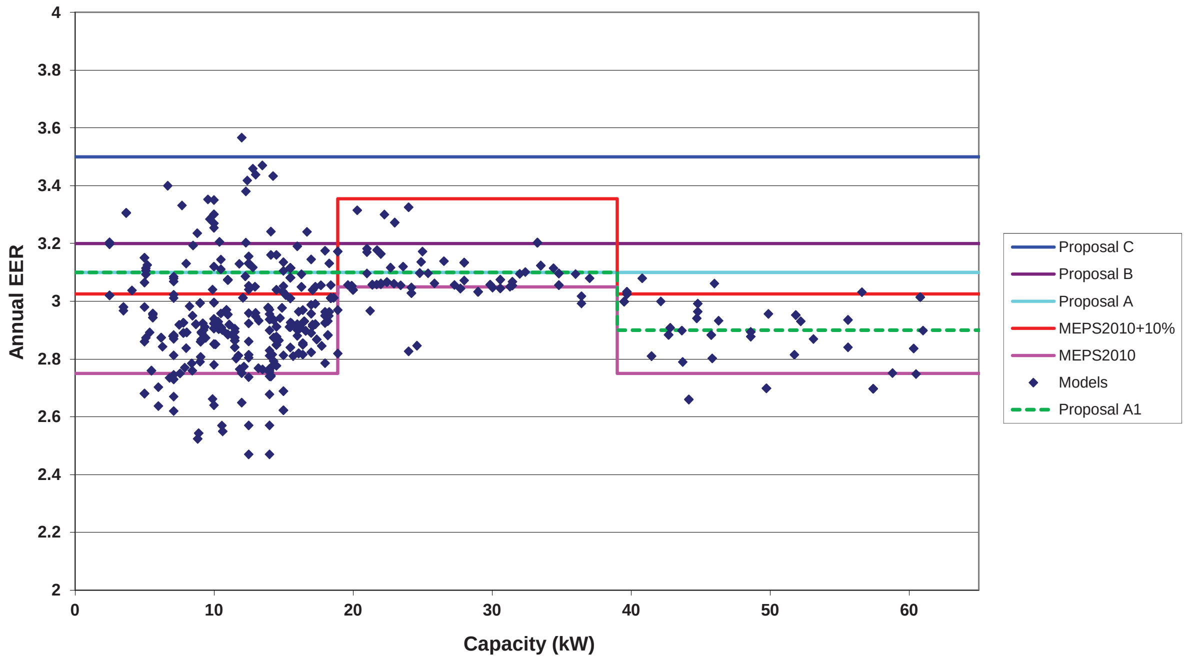


Figure 18 - EER and MEPS Levels – current non-ducted split models

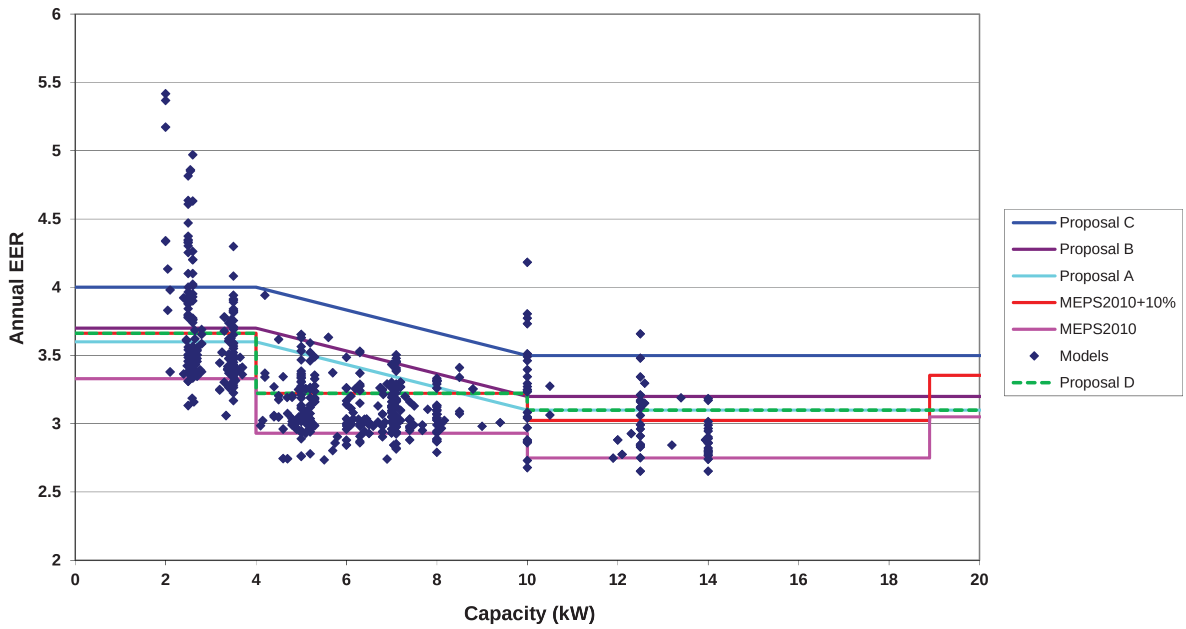
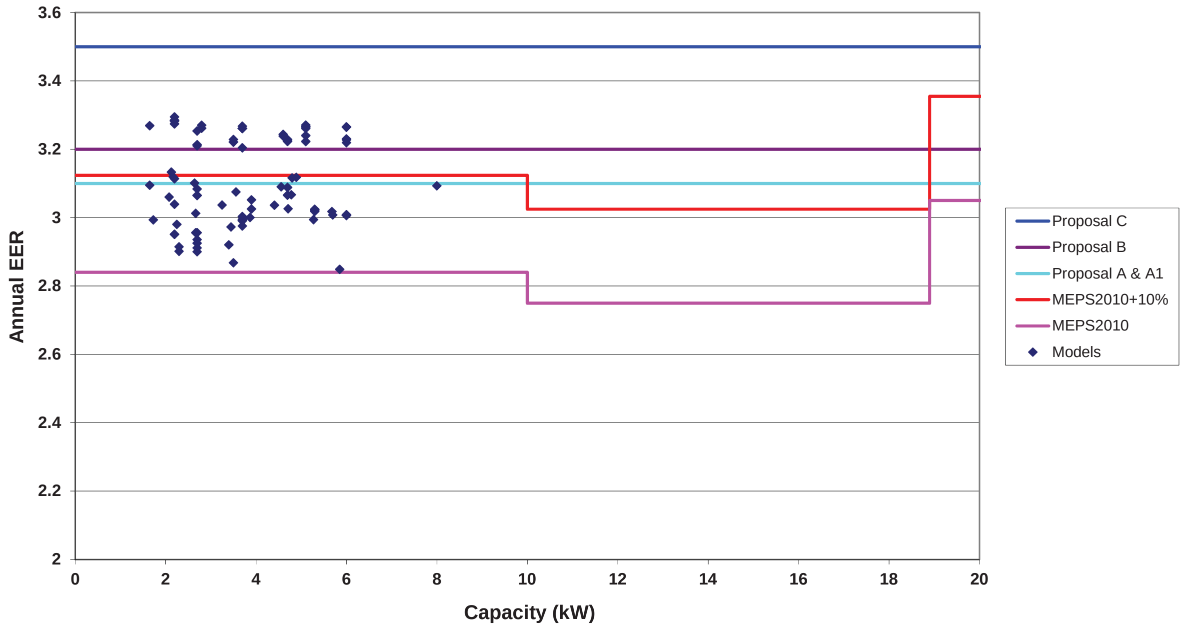


Figure 19 - EER and MEPS Levels – current non-ducted unitary models



Appendix 3: Potential Interim State Based MEPS Options Evaluated in Consultation RIS

In December 2009, the MCE requested QLD and SA prepare a RIS modelling the QLD or SA energy performance standards. It was subsequently agreed that the modelling of adoption of either QLD's or SA's standards, as an interim MEPS commencing October 2010, should be undertaken as part of the Consultation RIS.

Several proposals for changes in the MEPS levels were examined in the Consultation RIS that are no longer relevant to the decision RIS. In the Consultation RIS, a number of options based on the SA and QLD State MEPS were evaluated for national implementation in October 2010, however as this time has now passed they are not considered in this decision RIS. Analysis of the impacts of these options is presented in this Appendix.

MEPS Options Considered

The national MEPS implementation of the SA and QLD State MEPS would be based on MEPS levels measured in operating efficiency and are detailed below:

- **SA State MEPS:** Under this proposal, the SA State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011. The impact of the State MEPS operating nationally during the interim period was examined

- **QLD State MEPS:** Under this proposal, the QLD State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011. The impact of the State MEPS operating nationally during the interim period was examined

- **SA State MEPS & MEPS2010+10%:** Under this proposal, the SA State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011

- **QLD State MEPS & MEPS2010+10%:** Under this proposal, the QLD State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011

- **SA State MEPS & Proposal A:** Under this proposal, the SA State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011

- **QLD State MEPS & Proposal A:** Under this proposal, the QLD State based MEPS levels would be extended and applied nationally in September 2010, until the new MEPS levels are introduced in October 2011.

It should be noted that the State MEPS will be determined on operating efficiency, but that post-April 2011 the national MEPS will be determined on annual efficiency. For most air conditioners, an annual efficiency MEPS will be more stringent than an equivalent operating efficiency MEPS of the same level, as annual efficiency measurements include energy used in standby and crankcase operation

In most cases the QLD and SA levels are identical, except for four categories where the SA requirements are more stringent than the QLD levels. The introduction of the SA MEPS as an interim level would alleviate the need for SA and QLD to seek extensions of their Mutual Recognition Acts (MRA) for their interim State based MEPS levels when they expire (QLD in September 2010, SA in July 2011).

A summary of the proposed MEPS levels is presented in Table 24. The State MEPS proposals are assessed as being implemented at the same time (October 2010) and then converted to the relevant national proposal (MEPS2010+10% or Proposal A) in October 2011. As the State MEPS were not introduced in September 2010, the impact of these interim MEPS operating to October 2011 will be greater than forecast in Table 24 and their impact will continue to decrease the longer their introduction is delayed.

Table 24 - Summary of proposed State Based MEPS in Consultation RIS

Category	MEPS 2010 (BAU)	QLD MEPS	SA MEPS	MEPS2010 + 10%	Proposal A	Proposal A1	Proposal B	Proposal C
Date Implemented	*Current (Apr 2010/11)*	*Oct 2010*	*Oct 2010*	*Oct 2011*	*Oct 2011*	*Oct 2011*	*Oct 2012*	*Oct 2014*
Non-ducted Split <4kW	3.33	2.9	3.4	3.66	3.6	3.66	3.7	4.0
Non-ducted Split 4kW to <10kW	2.93	2.9	3.0	3.22	Slope	3.22	Slope	Slope
Non-ducted unitary <10kW	2.84	2.9	2.9	3.12	3.1	3.1	3.2	3.5
Non-ducted unitary 10kW to 19kW	2.75	2.9	3.0	3.03	3.1	3.1	3.2	3.5
Ducted <10kW	2.75	2.9	2.9	3.03	3.1	3.1	3.2	3.5
Non-ducted split 10kW to 19kW	2.75	2.9	3.0	3.03	3.1	3.1	3.2	3.5
Ducted 10kW to 19kW	2.75	2.9	2.9	3.03	3.1	3.1	3.2	3.5
All 19kW to 39kW	3.05	2.9	3.1	3.35	3.1	3.1	3.2	3.5
All >39kW	2.75	2.9	2.9	3.03	3.1	2.9	3.2	3.5
Average % efficiency above MEPS2010		1%	3%	10%	12%	10%	15%	25%

Note: The average difference in efficiency between the MEPS 2010 and the alternatives was calculated. The average is weighted by sales in each AC category, so the average efficiency percentage would provide a representative indication of the energy savings for each MEPS option.

Impact Analysis

The State proposals also have a number of differences from the other Proposals, including:

- suppliers may incur additional costs in order to comply with the new MEPS because the State options would be implemented almost immediately. As suppliers order one to two years in advance, they may incur costs as they need to change their air conditioner orders and may not be able to sell existing stock. The extent of these additional costs is unknown and so has not been included in the cost benefit analysis

- the State MEPS are expressed in operating EER, and the national MEPS will be expressed in annual EER from April 2011. This means that suppliers may need to incur additional compliance costs and regulatory burden if the State MEPS are used, as compliance to both MEPS levels is required. Some suppliers will already have incurred this cost if they are selling into QLD or SA, so the extent of this cost will vary by supplier and has not been included in the cost benefit analysis.

The main impact of the proposed MEPS to the industry and competition is that the new MEPS levels would lead to many current air conditioners becoming non-compliant.

Table 25 shows the effect on registered models of the various proposed MEPS options, with the proposed State options reducing the range of currently available models between 9 and 16%. Analysis of the brands affected by the proposals also show a similar range of non-compliance rates and all major brands appear to have similar levels of non-compliant models.

The detailed estimated levels of compliance by product category are shown in Appendix 2: Compliance Rates of Current Models with Future MEPS, although it is important to understand that this reflects products which are currently available.

Table 25 - Non-compliant Models and Brands with Proposed State MEPS Options

MEPS Option	Non-Compliant Models	Compliant Models	Total Models	Percent Non-Compliant
QLD State MEPS (Interim 2010)	112	1,204	1,316	9%
SA State MEPS (Interim 2010)	211	1,105	1,316	16%
	Non-Compliant Brands	**Compliant Brands**	**Total Brands**	**Percent Non-Compliant**
QLD State MEPS (Interim 2010)	2	68	70	3%
SA State MEPS (Interim 2010)	2	68	70	3%

Note: These figures are based on data from the Energy Labelling and MEPS registration database as of 5 November 2010.

The projected energy savings for the different options are presented in Table 26. The impact of the State MEPS (Interim 2010) can be conceived as an additional energy savings that occurs through the raising of the energy efficiency of air conditioners sold during the twelve month interim period before the national MEPS Proposals come into effect. The size of these impacts from the State MEPS is the same if forecast as occurring independently or if forecast as a component of the MEPS2010+10%/Proposal A MEPS. Proposals that results in the elimination of product categories do not have any energy savings included from those product categories in the analyses.

Table 26 - Projected Energy Savings (GWh pa) by Interim State MEPS Scenario and Year

Scenario / Year	2015	2020	2025
SA State MEPS (Interim 2010)	11	6	1
QLD State MEPS (Interim 2010)	3	2	1
SA State MEPS and MEPS2010+10%	289	611	770
QLD State MEPS and MEPS2010+10%	281	608	769
SA State MEPS and Proposal A	353	749	943
QLD State MEPS and Proposal A	345	745	942

The introduction of the interim State MEPS produced minor additional energy savings versus the MEPS2010+10% Proposal or Proposal A. The additional savings from the interim State MEPS increased the long term energy savings of the MEPS by approximately 0.1% and the short term savings by 3.9%. However, any impact will now be proportionally lower.

The annual GHG emissions reductions resulting from the reduced energy consumption from the various proposals are shown in the Table 27. The interim State MEPS increased the total greenhouse savings by approximately 0.2%.

Table 27 - Projected Greenhouse Gas Reductions (kt CO_2-e pa) by Interim State MEPS Scenario and Year

Scenario / Year	2015	2020	2025
MEPS2010+10%	257	517	636
Proposal A	316	634	780
Proposal A1	253	507	626
Proposal B	300	734	958
Proposal C	548	1,571	2,194
SA State MEPS (Interim 2010)	10	5	1
QLD State MEPS (Interim 2010)	3	2	0
SA State MEPS and MEPS2010+10%	267	522	637
QLD State MEPS and MEPS2010+10%	260	519	637
SA State MEPS and Proposal A	326	639	780
QLD State MEPS and Proposal A	319	636	780

The energy and reduced peak demand cost savings, from the greater energy efficiency resulting from the MEPS options were calculated using the modified consumer tariffs and including the benefits of reducing peak loads. Table 28 shows these findings for the interim State MEPS and State/National Proposal combinations.

Table 28 - Financial Analysis – Interim State MEPS Scenarios (Various Discount Rates)

Scenario	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
SA State MEPS (Interim 2010)				
Total Costs	$40,209,384	$37,493,856	$34,387,094	$31,725,148
Total Benefits	$63,585,381	$57,159,298	$50,390,332	$45,057,058
Net Benefits	$23,375,997	$19,665,442	$16,003,237	$13,331,910
Benefit Cost Ratio	1.6	1.5	1.5	1.4
QLD State MEPS (Interim 2010)				
Total Costs	$8,660,897	$7,756,381	$6,831,424	$6,119,688
Total Benefits	$14,249,800	$12,382,376	$10,526,748	$9,150,380
Net Benefits	$5,588,903	$4,625,996	$3,695,325	$3,030,692
Benefit Cost Ratio	1.6	1.6	1.5	1.5
SA State MEPS (Interim) and MEPS2010+10%				
Total Costs	$1,759,900,530	$1,363,842,963	$1,002,697,610	$761,561,336
Total Benefits	$4,878,981,684	$3,423,808,442	$2,250,235,587	$1,557,393,656
Net Benefits	$3,119,081,153	$2,059,965,479	$1,247,537,978	$795,832,320
Benefit Cost Ratio	2.8	2.5	2.2	2.0
QLD State MEPS (Interim) and MEPS2010+10%				
Total Costs	$1,728,352,043	$1,334,105,488	$975,141,939	$735,955,876
Total Benefits	$4,829,646,103	$3,379,031,521	$2,210,372,004	$1,521,486,978
Net Benefits	$3,101,294,060	$2,044,926,033	$1,235,230,065	$785,531,101
Benefit Cost Ratio	2.8	2.5	2.3	2.1
SA State MEPS (Interim) and Proposal A				
Total Costs	$2,521,579,282	$1,950,051,354	$1,429,475,511	$1,082,381,006
Total Benefits	$6,575,337,895	$4,643,555,739	$3,072,000,173	$2,136,218,130
Net Benefits	$4,053,758,612	$2,693,504,384	$1,642,524,661	$1,053,837,124
Benefit Cost Ratio	2.6	2.4	2.1	2.0
QLD State MEPS (Interim) and Proposal A				
Total Costs	$2,490,030,795	$1,920,313,879	$1,401,919,841	$1,056,775,546
Total Benefits	$6,526,002,314	$4,598,778,818	$3,032,136,589	$2,100,311,452
Net Benefits	$4,035,971,519	$2,678,464,938	$1,630,216,748	$1,043,535,906
Benefit Cost Ratio	2.6	2.4	2.2	2.0

Summary Data for Alternative MEPS Scenarios

The impact of the various interim State MEPS scenarios is shown in Table 29, however, any impact will now be proportionally lower as this was based on an implementation date of October 2010 in the Consultation RIS.

Table 29 - Summary Impact Data for Interim State MEPS Scenarios

Scenario	Energy Saved (cumulative to 2025)	GHG Emission Reduction (cumulative to 2025)	Total Benefit	Total Cost	Net Benefit (energy & peak demand savings)	BCR
	GWh	Mt CO_2-e	$M	$M	$M	
SA State MEPS (Interim 2010)	112	0.1	$50	$34	$16	1.5
QLD State MEPS (Interim 2010)	38	0.0	$11	$7	$4	1.5
SA State MEPS and MEPS2010+10%	10,796	9.0	$2,250	$1,003	$1,248	2.2
QLD State MEPS and MEPS2010+10%	10,722	9.0	$2,210	$975	$1,235	2.3
SA State MEPS and Proposal A	13,104	11.0	$2,250	$1,003	$1,643	2.1
QLD State MEPS and Proposal A	13,030	10.9	$3,032	$1,402	$1,630	2.2

Note: Cumulative values account for the effects on products installed up to 2025, and their associated lifetime energy savings/greenhouse gas emission reductions to 2040. Amounts calculated with a 7% discount rate. The benefits and impacts of the SA and QLD State MEPS will now be proportionally lower as the proposed implementation date has passed.

The implementation of interim State MEPS on a national basis may increase the total GHG emission reductions and the energy savings by 1% compared to Proposal A. They are also estimated to increase the net benefits by 4 to $16M, or up to 1% of the benefits of Proposal A1. However, as noted earlier these additional NPV benefits do not include additional business compliance costs or benefits associated with meeting the proposed October 2010 implementation date. The net benefits are also proportionally lower as the proposed implementation date is delayed.

Appendix 4: Trade, GATT and TTMRA Issues

Trade

Mandatory energy efficiency regulations apply to all products sold, whether locally manufactured or imported. Nevertheless, it is useful for decision-makers to know whether the proposals are likely to impact on the balance between local manufacture and imports, for example, by affecting one group of suppliers more than another.

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 part of the *GTBT Technical Regulations and Standards* is Article 2: *Preparation, Adoption and Application of Technical Regulations by Central Government Bodies*. These are addressed below.

As almost all of the products addressed in the study are currently imported, MEPS would not favour local supplies 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 should use them, or the relevant parts of them, as a basis for their technical regulations. The energy test procedure adopted by the Australian/New Zealand Standard replicates the ISO test and is comparable to the ARI and EUROVENT certification programmes.

The GTBT urges GATT members to give positive consideration to accepting as equivalent the 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.

The design of the compliance program for the MEPS allows for the acceptance of the results of certifications to the ARI and EUROVENT programmes.

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

TTMRA

The 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. If the two countries have different regulatory requirement for a given product, the less stringent requirement becomes the de facto level for both countries unless the one with the more stringent requirement obtains an exemption under TTMRA.

As the Australia-NZ appliance and equipment markets are closely integrated, TTMRA issues arise if one country proposes to implement a mandatory energy efficiency measure but the other does not, if the planned implementation dates are different, or even if the administrative approaches are different (for example, Australian governments may require products sold locally to be registered with regulators, whereas New Zealand may not, so changing administrative and compliance verification costs).

The consequences for New Zealand where a high efficiency MEPS is implemented only in Australia are expected to be generally positive: More high efficiency air conditioners would become available in the New Zealand market, because the major brands tend to import the same models into both markets. New Zealand has a few manufacturers of air conditioners, who have historically adapted to increasing efficiency requirements, and would most likely continue to export to Australia at the higher MEPS levels. Cheaper models which comply with the MEPS 2010 levels would continue to be sold in New Zealand, and products could be imported from Australia that meet these levels. In the long term however there would be benefits in aligning MEPS levels with Australia in the next few years.

The TTMRA is an issue that may arise if New Zealand does not implement the MEPS requirements, in accordance with the Standard, at the same time as Australian states and territories. However, the Australian and New Zealand regulators are working together within the E3 Committee and, hence, this is not envisaged as an issue.

Appendix 5: Alternative Cost Benefit Analysis Methodology

Energy Cost Analysis Methodology

For the energy cost analysis, the NPV benefits are calculated for each State using the avoided costs of electricity multiplied by the energy savings calculated earlier in Energy and Greenhouse Impacts, page 35. The avoided cost of energy is determined from average consumer tariffs, as shown in Appendix 7.

The incremental costs of the MEPS proposals are based upon the analysis of sales and efficiency data previous discussed in section Supplier Costs, page 30, and generally were a ratio of 1.5 to the efficiency improvement (for each 1% increase in efficiency, the incremental cost is 1.5%). These costs are multiplied by the sales of product to obtain the customer costs. The sum of these customer costs, the supplier costs and government costs provide the total costs for the MEPS option. The energy cost savings post 2025 of cohorts of product installed up until 2025 under the MEPS scenario are included in the net benefits, as per the Guide to Preparing Regulatory Impact Statements (NAEEEP 2005).

Some additional assumptions made, which were also used in the peak demand analysis, include:

- no behavioural changes are assumed to occur in residential usage of air conditioners over the period in which the MEPS impacts are modelled and so the operating hours of air conditioners are assumed to remain constant
- when the new MEPS levels are introduced that customers continue to purchase a mixture of units of varying efficiency, with the proportions of sales in this mixture being similar to those that were purchased before the MEPS
- existing trends regarding the capacity of air conditioners being purchased continue, and these trends will include the market response to increasing building energy efficiency standards.

To test the sensitivity of the analysis outputs, scenarios were developed as follows:

- two sales scenarios were modelled – base and low growth
- three usage scenarios were modelled – high, base and low usage
- sensitivity to BAU efficiency increase was also modelled.

Energy Cost Savings Cost Benefit Analysis Results

The energy cost savings, not including reduced peak demand cost savings, from the greater energy efficiency resulting from the MEPS options were calculated using the average consumer tariffs. Table 30 shows the financial analysis and NPV for Australia for a range of real discount rates and Table 31 shows these findings for the interim State

MEPS and State/National Proposal combinations. The results show that all proposals, except Proposals B and C produced benefits that exceed costs, for all discount rates. Proposals B and C all had costs which exceeded benefits when a low discount rate was used.

Table 30 - Financial Analysis – Energy Cost Savings National MEPS Scenarios (Various Discount Rates)

Scenario	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
MEPS2010+10%				
Total Costs	$1,719,691,146	$1,326,349,107	$968,310,516	$729,836,189
Total Benefits	$3,484,029,110	$2,247,821,870	$1,323,513,183	$823,761,400
Net Benefits	$1,764,337,964	$921,472,763	$355,202,667	$93,925,211
Benefit Cost Ratio	2.0	1.7	1.4	1.1
Proposal A				
Total Costs	$2,481,369,898	$1,912,557,498	$1,395,088,417	$1,050,655,858
Total Benefits	$4,298,164,638	$2,779,457,459	$1,640,657,584	$1,023,183,668
Net Benefits	$1,816,794,740	$866,899,960	$245,569,166	-$27,472,190
Benefit Cost Ratio	1.7	1.5	1.2	1.0
Proposal A1				
Total Costs	$1,802,408,284	$1,389,959,665	$1,014,565,568	$764,562,224
Total Benefits	$3,458,008,049	$2,230,468,307	$1,313,024,120	$817,147,866
Net Benefits	$1,655,599,765	$840,508,642	$298,458,552	$52,585,642
Benefit Cost Ratio	1.9	1.6	1.3	1.1
Proposal B				
Total Costs	$3,095,082,857	$2,344,288,340	$1,667,426,555	$1,222,405,668
Total Benefits	$5,071,510,225	$3,240,905,327	$1,879,159,747	$1,148,740,332
Net Benefits	$1,976,427,368	$896,616,987	$211,733,192	-$73,665,335
Benefit Cost Ratio	1.6	1.4	1.1	0.9
Proposal C				
Total Costs	$8,818,509,095	$6,563,335,013	$4,557,253,308	$3,260,899,039
Total Benefits	$11,219,316,313	$7,101,857,415	$4,068,648,582	$2,459,835,417
Net Benefits	$2,400,807,219	$538,522,402	-$488,604,726	-$801,063,623
Benefit Cost Ratio	1.3	1.1	0.9	0.8

An examination of the cost benefits of the State Interim MEPS proposals showed that the Interim MEPS were not cost effective except at a low discount rate. However, the State MEPS combined with either MEPS2010+10% or Proposal A, showed these options were costs effective for all discount rates. See Table 31 below.

Table 31 - Financial Analysis – Energy Cost Savings Interim State MEPS Scenarios (Various Discount Rates)

Scenario	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
SA State MEPS (Interim 2010)				
Total Costs	$40,209,384	$37,493,856	$34,387,094	$31,725,148
Total Benefits	$29,785,731	$24,110,162	$18,662,293	$14,817,248
Net Benefits	-$10,423,654	-$13,383,694	-$15,724,802	-$16,907,900
Benefit Cost Ratio	0.7	0.6	0.5	0.5
QLD State MEPS (Interim 2010)				
Total Costs	$8,660,897	$7,756,381	$6,831,424	$6,119,688
Total Benefits	$9,970,982	$7,899,426	$5,966,786	$4,642,562
Net Benefits	$1,310,085	$143,045	-$864,637	-$1,477,126
Benefit Cost Ratio	1.2	1.0	0.9	0.8
SA State MEPS (Interim) and MEPS2010+10%				
Total Costs	$1,759,900,530	$1,363,842,963	$1,002,697,610	$761,561,336
Total Benefits	$3,513,814,841	$2,271,932,032	$1,342,175,476	$838,578,647
Net Benefits	$1,753,914,311	$908,089,068	$339,477,866	$77,017,311
Benefit Cost Ratio	2.0	1.7	1.3	1.1
QLD State MEPS (Interim) and MEPS2010+10%				
Total Costs	$1,728,352,043	$1,334,105,488	$975,141,939	$735,955,876
Total Benefits	$3,494,000,093	$2,255,721,296	$1,329,479,969	$828,403,962
Net Benefits	$1,765,648,050	$921,615,808	$354,338,030	$92,448,085
Benefit Cost Ratio	2.0	1.7	1.4	1.1
SA State MEPS (Interim) and Proposal A				
Total Costs	$2,521,579,282	$1,950,051,354	$1,429,475,511	$1,082,381,006
Total Benefits	$4,327,950,368	$2,803,567,620	$1,659,319,876	$1,038,000,916
Net Benefits	$1,806,371,086	$853,516,266	$229,844,365	-$44,380,090
Benefit Cost Ratio	1.7	1.4	1.2	1.0
QLD State MEPS (Interim) and Proposal A				
Total Costs	$2,490,030,795	$1,920,313,879	$1,401,919,841	$1,056,775,546
Total Benefits	$4,308,135,620	$2,787,356,885	$1,646,624,370	$1,027,826,230
Net Benefits	$1,818,104,825	$867,043,005	$244,704,529	-$28,949,316
Benefit Cost Ratio	1.7	1.5	1.2	1.0

To assess the potential sensitivity of the benefit-costs to the estimated incremental price increase for air conditioners due to the MEPS, a number of options were modelled for Proposal A1. These showed that any significant increase in the price of air conditioners would result in costs exceeding benefits for all MEPS options, as the present analysis is already assuming a significant increase in unit costs to achieve the new MEPS requirements.

Australian State Benefit Cost Ratio

The benefit-cost ratios for all the Australian states are shown in Table 32 under the Proposal A1 scenario, with varying discount rates. Under the high discount rate, costs exceed benefits in NSW & ACT, Tasmania and Victoria, and costs exceed benefits for Tasmania and Victoria even for a medium discount rate. The highest BCR occurs in the Northern Territory, where electricity prices are higher and, hence, provide greater consumer benefits. State/Territory program costs are apportioned by household numbers in each state.

Table 32 - Benefit Cost Ratio for States: Energy Saving Proposal A1 (Various Discount Rates)

State	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
NSW & ACT	1.6	1.3	1.1	0.9
NT	3.2	2.7	2.2	1.8
QLD	2.3	1.9	1.5	1.3
SA	1.9	1.6	1.3	1.1
TAS	1.4	1.2	0.9	0.8
VIC	1.2	1.0	0.8	0.6
WA	2.0	1.7	1.4	1.1

Appendix 6: Detailed Assumptions by Category

Table 33 - Annual Sales by Category for Australia

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australia																					
3Ph Ducted 0-20kW	17,820	18,319	18,795	19,246	19,670	20,063	20,444	20,812	21,166	21,505	21,827	22,133	22,421	22,690	22,939	23,169	23,400	23,634	23,871	24,109	24,351
3Ph Ducted 20-40kW	29,700	30,532	31,325	32,077	32,783	33,439	34,074	34,687	35,277	35,841	36,379	36,888	37,368	37,816	38,232	38,615	39,001	39,391	39,785	40,182	40,584
3Ph Ducted >40kW	11,880	12,213	12,530	12,831	13,113	13,375	13,630	13,875	14,111	14,337	14,552	14,755	14,947	15,127	15,293	15,446	15,600	15,756	15,914	16,073	16,234
3Ph NDucted 0-20kW	14,535	14,942	15,330	15,698	16,044	16,365	16,676	16,976	17,264	17,541	17,804	18,053	18,288	18,507	18,711	18,898	19,087	19,278	19,470	19,665	19,862
3Ph NDucted 20-40kW	612	629	645	661	676	689	702	715	727	739	750	760	770	779	788	796	804	812	820	828	836
3Ph NDucted >40kW	153	157	161	165	169	172	176	179	182	185	187	190	193	195	197	199	201	203	205	207	209
1Ph Ducted	39,600	41,501	43,410	45,320	47,223	49,112	50,979	52,814	54,609	56,357	58,048	59,557	60,867	61,963	62,830	63,458	64,093	64,734	65,381	66,035	66,695
1Ph NDucted Unitary 0-10kW	134,946	127,389	119,491	111,366	103,124	94,875	88,233	82,939	78,792	75,641	73,371	71,611	70,322	69,478	69,061	69,061	69,061	69,061	69,061	69,061	69,061
1Ph NDucted Unitary >10kW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1Ph NDucted Split 0-4kW	307,377	327,664	347,979	368,162	388,043	407,445	426,187	444,087	460,962	476,635	490,934	505,171	519,316	533,337	547,204	560,884	574,906	589,279	604,011	619,111	634,589
1Ph NDucted Split 4 to 6kW	153,689	163,832	173,990	184,081	194,021	203,722	213,094	222,044	230,481	238,318	245,467	252,586	259,658	266,669	273,602	280,442	287,453	294,640	302,006	309,556	317,295
1Ph NDucted Split 6-10kW	122,951	131,066	139,192	147,265	155,217	162,978	170,475	177,635	184,385	190,654	196,374	202,068	207,726	213,335	218,882	224,354	229,963	235,712	241,604	247,645	253,836
1Ph NDucted Split >10kW	30,738	32,766	34,798	36,816	38,804	40,744	42,619	44,409	46,096	47,664	49,093	50,517	51,932	53,334	54,720	56,088	57,491	58,928	60,401	61,911	63,459
Multi Splits – Res	12,600	12,877	13,186	13,529	13,908	14,325	14,741	15,153	15,562	15,967	16,366	16,743	17,094	17,419	17,715	17,981	18,233	18,470	18,691	18,897	19,086
Multi Splits - Com	14,400	14,717	15,070	15,462	15,895	16,372	16,846	17,318	17,786	18,248	18,704	19,134	19,536	19,908	20,246	20,550	20,837	21,108	21,361	21,596	21,812
All	891,000	928,603	965,903	1,002,679	1,038,690	1,073,676	1,108,874	1,143,642	1,177,401	1,209,629	1,239,856	1,270,167	1,300,437	1,330,556	1,360,421	1,389,940	1,420,129	1,451,005	1,482,582	1,514,877	1,547,909

Table 34 - Annual Stock by Category for Australia

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australia																					
3Ph Ducted 0-20kW	152,577	159,342	166,061	172,664	179,086	185,263	191,159	196,749	202,018	206,972	211,633	216,022	220,162	224,073	227,770	231,261	234,573	237,730	240,755	243,666	246,486
3Ph Ducted 20-40kW	254,295	265,569	276,768	287,774	298,476	308,771	318,599	327,914	336,697	344,954	352,722	360,037	366,937	373,455	379,616	385,434	390,955	396,217	401,258	406,110	410,809
3Ph Ducted >40kW	101,718	106,228	110,707	115,110	119,390	123,508	127,440	131,166	134,679	137,982	141,089	144,015	146,775	149,382	151,847	154,174	156,382	158,487	160,503	162,444	164,324
3Ph NDucted 0-20kW	76,393	86,714	96,548	105,721	114,058	121,410	127,719	133,055	137,619	141,556	145,013	148,110	150,935	153,546	155,978	158,252	160,395	162,431	164,379	166,258	168,086
3Ph NDucted 20-40kW	2,442	3,056	3,673	4,282	4,866	5,405	5,880	6,289	6,631	6,914	7,150	7,349	7,521	7,674	7,812	7,938	8,054	8,164	8,268	8,368	8,465
3Ph NDucted >40kW	613	769	929	1,091	1,254	1,416	1,575	1,727	1,868	1,994	2,103	2,196	2,274	2,340	2,396	2,445	2,487	2,525	2,561	2,595	2,628
1Ph Ducted	396,291	416,026	436,582	457,906	479,934	502,593	525,797	549,450	573,448	597,674	622,003	646,188	669,970	693,082	715,254	736,218	755,967	774,502	791,840	808,008	823,049
1Ph NDucted Unitary 0-10kW	1,653,509	1,542,884	1,439,828	1,344,308	1,255,494	1,172,193	1,094,590	1,022,669	956,513	896,352	842,538	795,191	754,407	720,137	692,128	670,018	652,962	640,117	630,688	623,967	619,332

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1Ph NDucted Unitary >10kW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1Ph NDucted Split 0-4kW	1,793,989	2,013,855	2,226,322	2,430,597	2,626,722	2,815,639	2,998,648	3,176,648	3,349,525	3,516,928	3,678,046	3,833,232	3,982,785	4,127,038	4,266,395	4,401,342	4,532,968	4,662,393	4,790,684	4,918,765	5,047,438
1Ph NDucted Split 4 to 6kW	1,060,626	1,132,567	1,205,598	1,280,430	1,357,409	1,436,549	1,517,480	1,599,444	1,681,396	1,762,328	1,841,218	1,917,823	1,992,025	2,063,827	2,133,332	2,200,719	2,266,495	2,331,196	2,395,342	2,459,383	2,523,719
1Ph NDucted Split 6-10kW	806,226	873,027	939,858	1,006,812	1,073,975	1,141,399	1,209,009	1,276,498	1,343,286	1,408,789	1,472,359	1,533,916	1,593,438	1,650,973	1,706,627	1,760,562	1,813,193	1,864,957	1,916,273	1,967,506	2,018,975
1Ph NDucted Split >10kW	184,889	205,087	225,039	244,567	263,589	282,109	300,183	317,847	335,053	351,745	367,829	383,333	398,281	412,704	426,639	440,134	453,297	466,239	479,068	491,877	504,744
Multi Splits – Res	48,523	61,009	73,507	85,865	97,860	109,219	119,625	128,851	136,844	143,736	149,756	155,111	159,989	164,526	168,799	172,842	176,678	180,311	183,745	186,984	190,031
Multi Splits - Com	55,467	69,734	84,014	98,135	111,843	124,823	136,715	147,259	156,393	164,270	171,149	177,269	182,845	188,030	192,913	197,534	201,917	206,070	209,994	213,696	217,179
All	6,587,557	6,935,866	7,285,437	7,635,262	7,983,957	8,330,298	8,674,418	9,015,565	9,351,969	9,682,194	10,004,608	10,319,791	10,628,344	10,930,786	11,227,506	11,518,874	11,806,321	12,091,340	12,375,358	12,659,627	12,945,264

Table 35 - Estimated Operational EER by Category for Australia: BAU Scenario

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australia																					
3Ph Ducted 0-20kW	2.80	2.72	2.87	2.89	3.06	3.06	3.07	3.09	3.11	3.12	3.14	3.15	3.17	3.18	3.20	3.22	3.23	3.25	3.26	3.28	3.30
3Ph Ducted 20-40kW	2.90	2.90	3.00	3.05	3.10	3.17	3.19	3.20	3.22	3.23	3.25	3.27	3.28	3.30	3.32	3.33	3.35	3.37	3.38	3.40	3.42
3Ph Ducted >40kW	2.80	2.83	2.89	2.95	2.95	2.97	2.98	3.00	3.01	3.03	3.04	3.06	3.07	3.09	3.10	3.12	3.13	3.15	3.17	3.18	3.20
3Ph NDucted 0-20kW	2.66	2.68	2.93	3.10	3.15	3.16	3.17	3.19	3.20	3.22	3.24	3.25	3.27	3.28	3.30	3.32	3.33	3.35	3.37	3.38	3.40
3Ph NDucted 20-40kW	2.60	2.70	2.75	2.75	2.75	3.06	3.07	3.09	3.10	3.12	3.13	3.15	3.17	3.18	3.20	3.21	3.23	3.25	3.26	3.28	3.29
3Ph NDucted >40kW	2.60	2.70	2.75	2.75	2.75	2.75	2.77	2.78	2.80	2.81	2.82	2.84	2.85	2.87	2.88	2.89	2.91	2.92	2.94	2.95	2.97
1Ph Ducted	2.65	2.70	2.75	2.84	2.94	2.94	2.96	2.97	2.99	3.00	3.02	3.03	3.05	3.06	3.08	3.10	3.11	3.13	3.14	3.16	3.17
1Ph NDucted Unitary 0-10kW	2.54	2.66	2.89	3.03	3.07	3.08	3.09	3.11	3.12	3.14	3.15	3.17	3.19	3.20	3.22	3.23	3.25	3.27	3.28	3.30	3.32
1Ph NDucted Unitary >10kW	2.41	2.52	2.75	2.88	2.91	2.92	2.93	2.95	2.96	2.98	2.99	3.01	3.02	3.04	3.05	3.07	3.08	3.10	3.12	3.13	3.15
1Ph NDucted Split 0-4kW	2.89	3.18	3.27	3.34	3.42	3.46	3.48	3.49	3.51	3.53	3.55	3.56	3.58	3.60	3.62	3.64	3.65	3.67	3.69	3.71	3.73
1Ph NDucted Split 4 to 6kW	2.76	3.03	3.11	3.18	3.26	3.27	3.29	3.30	3.32	3.34	3.35	3.37	3.39	3.40	3.42	3.44	3.45	3.47	3.49	3.51	3.52
1Ph NDucted Split 6-10kW	2.62	2.88	2.95	3.02	3.09	3.12	3.14	3.16	3.17	3.19	3.20	3.22	3.23	3.25	3.27	3.28	3.30	3.32	3.33	3.35	3.37
1Ph NDucted Split >10kW	2.49	2.74	2.81	2.87	2.94	2.96	2.98	2.99	3.01	3.02	3.04	3.05	3.07	3.08	3.10	3.11	3.13	3.15	3.16	3.18	3.19
Multi Splits – Res	2.76	3.03	3.11	3.18	3.26	3.27	3.29	3.30	3.32	3.34	3.35	3.37	3.39	3.40	3.42	3.44	3.45	3.47	3.49	3.51	3.52
Multi Splits - Com	2.62	2.88	2.95	3.02	3.09	3.12	3.14	3.15	3.17	3.19	3.20	3.22	3.23	3.25	3.27	3.28	3.30	3.32	3.33	3.35	3.37

Table 36 - Estimated Operational EER by Category for Australia: Scenario A1

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australia																					
3Ph Ducted 0-20kW	2.80	2.72	2.87	2.89	3.06	3.06	3.07	3.29	3.31	3.32	3.34	3.36	3.37	3.39	3.41	3.43	3.44	3.46	3.48	3.49	3.51
3Ph Ducted 20-40kW	2.90	2.90	3.00	3.05	3.10	3.17	3.19	3.22	3.24	3.25	3.27	3.29	3.30	3.32	3.34	3.35	3.37	3.39	3.40	3.42	3.44
3Ph Ducted >40kW	2.80	2.83	2.89	2.95	2.95	2.97	2.98	3.03	3.04	3.06	3.07	3.09	3.10	3.12	3.13	3.15	3.16	3.18	3.20	3.21	3.23
3Ph NDucted 0-20kW	2.66	2.68	2.93	3.10	3.15	3.16	3.17	3.34	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.48	3.49	3.51	3.53	3.55	3.56
3Ph NDucted 20-40kW	2.60	2.70	2.75	2.75	2.75	3.06	3.07	3.11	3.12	3.14	3.15	3.17	3.19	3.20	3.22	3.23	3.25	3.27	3.28	3.30	3.32
3Ph NDucted >40kW	2.60	2.70	2.75	2.75	2.75	2.75	2.77	2.90	2.92	2.93	2.95	2.96	2.98	2.99	3.01	3.02	3.04	3.05	3.07	3.08	3.10
1Ph Ducted	2.65	2.70	2.75	2.84	2.94	2.94	2.96	3.23	3.24	3.26	3.27	3.29	3.31	3.32	3.34	3.36	3.37	3.39	3.41	3.42	3.44
1Ph NDucted Unitary 0-10kW	2.54	2.66	2.89	3.03	3.07	3.08	3.09	3.23	3.25	3.27	3.28	3.30	3.32	3.33	3.35	3.37	3.38	3.40	3.42	3.43	3.45
1Ph NDucted Unitary >10kW	2.41	2.52	2.75	2.88	2.91	2.92	2.93	3.20	3.21	3.23	3.25	3.26	3.28	3.30	3.31	3.33	3.35	3.36	3.38	3.40	3.41
1Ph NDucted Split 0-4kW	2.89	3.18	3.27	3.34	3.42	3.46	3.48	3.75	3.77	3.79	3.81	3.82	3.84	3.86	3.88	3.90	3.92	3.94	3.96	3.98	4.00
1Ph NDucted Split 4 to 6kW	2.76	3.03	3.11	3.18	3.26	3.27	3.29	3.42	3.44	3.45	3.47	3.49	3.50	3.52	3.54	3.56	3.58	3.59	3.61	3.63	3.65
1Ph NDucted Split 6-10kW	2.62	2.88	2.95	3.02	3.09	3.12	3.14	3.34	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.53	3.54	3.56
1Ph NDucted Split >10kW	2.49	2.74	2.81	2.87	2.94	2.96	2.98	3.23	3.25	3.26	3.28	3.30	3.31	3.33	3.35	3.36	3.38	3.40	3.41	3.43	3.45
Multi Splits – Res	2.76	3.03	3.11	3.18	3.26	3.27	3.29	3.42	3.44	3.45	3.47	3.49	3.50	3.52	3.54	3.56	3.58	3.59	3.61	3.63	3.65
Multi Splits - Com	2.62	2.88	2.95	3.02	3.09	3.12	3.14	3.34	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.53	3.54	3.56

Table 37 - Estimated Equivalent Full Load Operational Hours by State

State	Heating Hours	Cooling Hours
New South Wales & ACT	88	175
Northern Territory	-	1,315
Queensland	44	438
South Australia	88	219
Tasmania	263	88
Victoria	44	131
Western Australia	44	263

Appendix 7: Energy Prices

Table 38 - Marginal Electricity Tariffs 2010

Residential (cent/kWh, real 2010$)

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
NSW+ ACT	23.6	25.1	27.2	28.4	32.1	32.8	33.6	34.6	35.7	36.7	37.8	38.8	39.8	40.9	41.9	42.0	42.1	42.1	42.2	42.3	42.3
NT	18.3	19.2	20.2	21.2	22.6	23.2	23.8	24.4	25.1	25.7	26.4	27.0	27.7	28.3	29.0	29.1	29.1	29.2	29.2	29.3	29.4
Qld	18.8	21.4	22.5	23.6	25.7	26.5	27.3	28.3	29.4	30.5	31.6	32.7	33.7	34.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5
SA	24.1	25.4	26.8	28.6	31.2	32.3	33.3	34.5	35.8	37.0	38.2	39.4	40.7	41.9	43.1	43.1	43.1	43.0	43.0	43.0	43.0
Tas	19.6	20.6	21.7	22.7	24.9	25.8	26.6	27.7	28.7	29.8	30.8	31.9	32.9	34.0	35.0	35.0	35.0	35.0	34.9	34.9	34.9
VIC	20.2	21.2	22.2	23.3	25.5	26.3	27.2	28.3	29.3	30.4	31.5	32.5	33.6	34.7	35.8	35.8	35.9	35.9	36.0	36.1	36.1
WA	18.9	20.8	21.9	23.0	24.5	25.1	25.8	26.6	27.4	28.3	29.1	29.9	30.8	31.6	32.4	32.6	32.8	33.0	33.2	33.4	33.5

Commercial (cent/kWh, real 2010$)

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
NSW+ ACT	17.7	18.8	20.3	21.2	24.9	25.6	26.4	27.2	28.0	28.8	29.7	30.5	31.3	32.1	33.0	33.0	33.1	33.1	33.2	33.2	33.3
NT	6.1	6.4	6.7	7.1	8.5	9.1	9.6	9.9	10.2	10.4	10.7	11.0	11.2	11.5	11.7	11.8	11.8	11.8	11.8	11.9	11.9
Qld	19.6	22.3	23.4	24.6	26.6	27.4	28.2	29.3	30.5	31.6	32.7	33.8	34.9	36.0	37.1	37.3	37.4	37.5	37.6	37.7	37.8
SA	22.0	23.2	24.4	26.1	28.7	29.7	30.8	31.9	33.0	34.2	35.3	36.4	37.6	38.7	39.8	39.8	39.8	39.8	39.8	39.7	39.7
Tas	19.3	20.3	21.3	22.3	24.5	25.4	26.2	27.3	28.3	29.3	30.4	31.4	32.4	33.5	34.5	34.5	34.4	34.4	34.4	34.4	34.3
VIC	17.5	18.4	19.3	20.3	22.4	23.3	24.1	25.1	26.0	27.0	27.9	28.9	29.8	30.8	31.7	31.8	31.8	31.9	31.9	32.0	32.1
WA	18.2	20.0	21.0	22.1	23.6	24.3	24.9	25.7	26.5	27.3	28.1	28.9	29.7	30.5	31.3	31.5	31.7	31.8	32.0	32.2	32.4

Source: Energy & Greenhouse (E3 2010 May), based on tariffs in May 2010 and Energy Price projections corresponding to Treasury CPRS-5 Scenario (assumes ETS commencing 2013). All values include GST

Appendix 8: Greenhouse Gas Emissions Factors

Table 39 - Projected Marginal Emissions Factors: Electricity by State 2005-2025

Region	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
NSW+ ACT	1.04	1.02	1.01	0.99	0.97	0.96	0.95	0.95	0.95	0.94	0.93	0.91	0.90	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87
NT	0.81	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.79	0.79	0.78	0.77	0.76	0.75	0.75	0.75	0.74	0.74	0.74	0.74	0.74
Qld	1.04	1.03	1.02	1.01	1.01	1.00	0.99	0.99	0.99	0.98	0.97	0.95	0.94	0.92	0.92	0.91	0.91	0.90	0.90	0.89	0.89
SA	1.04	1.02	1.01	0.99	0.97	0.96	0.95	0.95	0.94	0.94	0.92	0.90	0.89	0.87	0.87	0.86	0.86	0.85	0.85	0.85	0.84
Tas	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.21
VIC	1.35	1.32	1.30	1.28	1.25	1.23	1.21	1.19	1.17	1.15	1.07	0.99	0.91	0.83	0.80	0.77	0.74	0.71	0.68	0.67	0.66
WA	0.86	0.85	0.85	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83	0.82	0.82	0.82	0.82	0.81	0.81	0.80	0.80	0.80	0.79

Source: Energy & Greenhouse (E3 2010 May), based on Energy Price projections corresponding to Treasury CPRS-5 Scenario (Adjusted for ETS commencing 2013).

Appendix 9: Population and Household Numbers

Table 40 - Population and Household Numbers

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NSW	HH ('000)	2465	2503	2541	2577	2605	2643	2682	2720	2758	2797	2836	2875	2914	2952	2991	3030	3068	3105	3143	3180
	Persons	6575	6634	6693	6752	6811	6869	6924	6978	7032	7087	7141	7192	7243	7294	7345	7396	7444	7492	7541	7589
VIC	HH ('000)	1812	1848	1883	1916	1946	1976	2006	2036	2066	2096	2127	2157	2187	2218	2248	2279	2309	2339	2368	2398
	Persons	4805	4858	4911	4965	5018	5071	5112	5154	5195	5237	5278	5317	5355	5394	5432	5471	5508	5544	5581	5618
QLD	HH ('000)	1404	1435	1471	1510	1544	1583	1623	1663	1704	1745	1787	1829	1872	1914	1958	2001	2045	2088	2132	2175
	Persons	3629	3703	3777	3851	3925	4000	4067	4134	4202	4269	4337	4403	4469	4535	4601	4667	4732	4798	4863	4928
SA	HH ('000)	610	618	626	634	642	649	656	663	670	677	684	690	697	704	710	717	723	729	735	741
	Persons	1512	1518	1524	1531	1537	1544	1548	1552	1556	1560	1565	1568	1571	1574	1577	1580	1583	1585	1587	1590
WA	HH ('000)	721	736	753	771	789	806	824	841	858	876	894	912	930	948	966	984	1001	1019	1037	1055
	Persons	1901	1928	1954	1980	2006	2033	2059	2084	2110	2136	2162	2187	2212	2237	2262	2287	2311	2335	2359	2384
TAS	HH ('000)	192	194	196	198	201	203	205	207	209	211	213	215	217	219	221	223	225	226	228	229
	Persons	472	473	474	475	476	477	477	477	477	478	478	478	478	478	478	477	477	476	476	475
NT	HH ('000)	61	62	63	64	66	67	68	70	71	72	73	75	76	77	78	80	81	82	83	84
	Persons	198	199	201	202	204	205	208	210	212	215	217	219	222	224	226	229	231	233	236	238
ACT	HH ('000)	120	122	124	127	128	130	132	134	136	138	140	142	144	146	148	150	151	153	155	157
	Persons	319	322	325	327	330	333	335	337	340	342	344	346	349	351	353	355	357	359	361	363
AUST	HH ('000)	7385	7518	7656	7797	7920	8057	8195	8333	8472	8612	8754	8895	9036	9177	9320	9461	9602	9741	9880	10019
	Persons	19411	19635	19859	20083	20307	20531	20729	20927	21125	21323	21522	21710	21898	22085	22273	22461	22642	22823	23004	23185
	Persons/HH	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3

Source: ABS 3236 Series III

Appendix 10: Annual Benefit and Cost Data (Proposal A1)

Table 41 - Annual Benefit and Cost Data

Year	Units	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australia																						
BAU Energy use	GWh/yr	13,007	13,770	14,480	15,151	15,779	16,366	16,920	17,433	17,902	18,330	18,725	19,096	19,447	19,784	20,108	20,419	20,718	21,007	21,285	21,554	21,816
With-program energy use	GWh/yr	13,007	13,770	14,480	15,151	15,779	16,366	16,920	17,367	17,768	18,127	18,453	18,753	19,035	19,305	19,567	19,825	20,078	20,328	20,575	20,819	21,060
Energy savings	GWh/yr	0	0	0	0	0	0	0	66	134	203	273	343	412	479	541	594	640	678	710	735	756
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	166.3	182.0	200.2	217.7	235.9	255.1	274.6	293.7	311.7	328.7	344.6	359.4	373.3	381.8
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.3	127.4	191.9	252.5	310.6	365.1	414.6	464.6	507.2	542.8	571.0	593.2	611.3	625.5
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150.73	147.92	144.76	141.26	137.68	134.01	130.27	126.48	122.63	118.90	115.28	111.77	108.36	105.06
NSW&ACT																						
BAU Energy use	GWh/yr	2,751	2,895	3,028	3,152	3,267	3,373	3,470	3,559	3,638	3,711	3,777	3,835	3,887	3,933	3,974	4,010	4,040	4,066	4,086	4,103	4,116
With-program energy use	GWh/yr	2,751	2,895	3,028	3,152	3,267	3,373	3,470	3,546	3,613	3,672	3,725	3,770	3,809	3,844	3,874	3,900	3,922	3,941	3,957	3,970	3,981
Energy savings	GWh/yr	0	0	0	0	0	0	0	13	25	39	52	65	78	90	101	110	118	125	129	133	136
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.4	43.7	47.8	51.5	55.0	58.7	62.4	65.9	69.1	72.0	74.6	77.0	79.1	80.2
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	24.1	36.3	47.9	59.0	69.5	79.0	88.6	96.7	103.4	108.6	112.5	115.4	117.4
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.89	36.14	35.30	34.38	33.23	32.08	30.93	29.79	28.65	27.54	26.48	25.46	24.48	23.54
NT																						
BAU Energy use	GWh/yr	1,441	1,505	1,559	1,604	1,641	1,671	1,698	1,721	1,741	1,760	1,778	1,797	1,816	1,837	1,859	1,882	1,905	1,928	1,950	1,973	1,995
With-program energy use	GWh/yr	1,441	1,505	1,559	1,604	1,641	1,671	1,698	1,713	1,726	1,737	1,748	1,759	1,771	1,785	1,800	1,817	1,835	1,854	1,873	1,893	1,913
Energy savings	GWh/yr	0	0	0	0	0	0	0	7	15	23	30	38	46	53	59	65	70	74	77	80	82
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	9.5	10.8	12.1	13.5	14.9	16.3	17.7	18.9	20.0	21.1	22.0	22.9	23.5
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	11.8	17.8	23.6	29.3	34.7	39.7	44.5	48.5	52.0	54.8	57.0	58.8	60.2
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.17	7.01	6.84	6.66	6.48	6.30	6.12	5.93	5.74	5.56	5.39	5.21	5.05	4.89
QLD																						
BAU Energy use	GWh/yr	3,252	3,535	3,828	4,134	4,452	4,780	5,110	5,435	5,749	6,048	6,333	6,605	6,864	7,110	7,346	7,572	7,789	8,001	8,208	8,411	8,612
With-program energy use	GWh/yr	3,252	3,535	3,828	4,134	4,452	4,780	5,110	5,410	5,699	5,971	6,229	6,473	6,704	6,924	7,134	7,337	7,535	7,729	7,921	8,111	8,300
Energy savings	GWh/yr	0	0	0	0	0	0	0	25	51	77	104	132	160	187	212	235	255	272	287	300	312
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.0	61.5	69.0	76.4	84.3	92.7	101.4	110.1	118.5	126.8	134.7	142.3	149.7	154.8
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.6	50.0	75.9	101.0	125.7	149.5	171.9	194.4	214.2	231.5	246.1	258.6	268.6	277.0
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.20	48.94	48.52	47.95	47.36	46.70	45.97	45.18	44.33	43.51	42.69	41.87	41.05	40.24

Year	Units	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
SA																						
BAU Energy use	GWh/yr	1,620	1,691	1,746	1,784	1,808	1,816	1,815	1,805	1,787	1,763	1,734	1,705	1,676	1,649	1,625	1,602	1,582	1,562	1,543	1,525	1,508
With-program energy use	GWh/yr	1,620	1,691	1,746	1,784	1,808	1,816	1,815	1,800	1,777	1,747	1,713	1,679	1,646	1,614	1,586	1,560	1,537	1,515	1,495	1,477	1,459
Energy savings	GWh/yr	0	0	0	0	0	0	0	5	11	16	21	26	31	35	39	42	45	47	48	49	49
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	16.4	17.6	18.8	20.1	21.4	22.7	24.0	25.1	26.0	26.8	27.5	28.1	28.1
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	9.9	14.8	19.2	23.4	27.2	30.5	33.8	36.5	38.5	39.9	40.8	41.3	41.4
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.84	13.20	12.56	11.93	11.38	10.85	10.33	9.82	9.33	8.85	8.40	7.98	7.57	7.19
TAS																						
BAU Energy use	GWh/yr	23	25	27	29	32	35	38	41	44	48	51	54	57	60	62	64	66	67	68	69	69
With-program energy use	GWh/yr	23	25	27	29	32	35	38	41	44	47	51	54	56	59	61	62	64	65	66	67	67
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.55	0.55	0.55	0.54	0.52	0.50	0.48	0.46	0.45	0.43	0.41	0.40	0.38
VIC																						
BAU Energy use	GWh/yr	1,738	1,824	1,898	1,961	2,013	2,055	2,090	2,118	2,139	2,156	2,168	2,179	2,191	2,202	2,214	2,227	2,240	2,253	2,266	2,278	2,290
With-program energy use	GWh/yr	1,738	1,824	1,898	1,961	2,013	2,055	2,090	2,111	2,125	2,133	2,139	2,143	2,146	2,151	2,157	2,164	2,172	2,182	2,192	2,202	2,212
Energy savings	GWh/yr	0	0	0	0	0	0	0	7	15	22	29	37	44	51	58	63	68	71	74	77	78
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.2	29.8	31.7	33.5	35.5	37.5	39.6	41.6	43.4	45.2	46.8	48.3	49.7	50.5
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	17.1	25.3	31.5	36.5	40.2	42.5	46.1	48.6	50.1	50.7	50.6	51.5	52.1
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.14	25.46	24.72	23.94	23.23	22.50	21.78	21.04	20.31	19.59	18.91	18.24	17.60	16.98
WA																						
BAU Energy use	GWh/yr	2,181	2,294	2,395	2,486	2,566	2,636	2,699	2,754	2,803	2,845	2,884	2,920	2,956	2,991	3,027	3,062	3,096	3,130	3,163	3,195	3,225
With-program energy use	GWh/yr	2,181	2,294	2,395	2,486	2,566	2,636	2,699	2,746	2,785	2,819	2,849	2,876	2,903	2,929	2,957	2,985	3,014	3,042	3,071	3,100	3,128
Energy savings	GWh/yr	0	0	0	0	0	0	0	9	17	26	35	44	53	62	70	77	83	88	92	95	97
Value of energy saved	$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.9	20.8	22.9	24.9	27.0	29.3	31.6	33.8	35.9	37.9	39.7	41.4	42.9	43.9
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	14.4	21.8	29.2	36.6	43.8	50.8	57.0	62.4	66.9	70.5	73.3	75.4	77.0
Additional appliance cost	$M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.95	16.62	16.26	15.85	15.47	15.06	14.65	14.24	13.81	13.39	12.98	12.59	12.20	11.83