Report No 2008/11

Equipment Energy Efficiency Committee

Regulatory Impact Statement

Consultation Draft

Minimum Energy Performance Standards and Alternative Strategies for Close Control Air Conditioners

Discussion draft for stakeholder comment issued under the auspices of the Ministerial Council on Energy

SEPTEMBER 2008

Prepared by EnergyConsult Pty Ltd

This Consultation Regulatory Impact Statement (RIS) was prepared by EnergyConsult Pty Ltd for the Equipment Energy Efficiency 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.

Stakeholders are invited to comment on the efficiency and effectiveness of the proposal, likely costs and benefits of the proposal as well as on the merits of the alternatives. While in no way limiting stakeholder comments, the Executive Summary concludes with a list of queries on which stakeholder may wish to comment.

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Glossary and Abbreviations

ABS	Australian Bureau of Statistics
AGO	Australian Greenhouse Office
AREMA	Air Conditioning and Refrigeration Equipment Manufacturers Association of Australia
ARI	Air-Conditioning and Refrigeration Institute
AS/NZS	Australian Standards and New Zealand Standards
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BAU	Business-as-usual
BCA	Building Code of Australia
BCR	Benefit-cost Ratio
CBA	Cost-Benefit Analysis
CEC	California Energy Commission
CCAC	Close Control Air Conditioner
CO_2-e	Carbon dioxide equivalent units
COAG	Council of Australian Governments
CPRS	Australian Carbon Pollution Reduction Scheme
DEW	Department of the Environment and Water Resources
DEWHA	Department of the Environment, Water, Heritage and the Arts
DoE	Department of Energy (USA)
E3	Equipment Energy Efficiency Committee (formerly NAEEEC)
EC	European Commission
EECA	Energy Efficiency and Conservation Authority (New Zealand)
EEEP	Equipment Energy Efficiency Program (formerly NAEEEP)
EER	Energy Efficiency Ratio
ETS	New Zealand Emission Trading Scheme
EU	European Union
EUROVENT	EUROVENT Certification Programme
GATT	General Agreement on Tariffs and Trade
GHG	Greenhouse Gas
GTBT	General Agreement on Tariffs and Trade (GATT) Technical Barriers to Trade
GWA	George Wilkenfeld & Associates
GWh	Giga Watt hour – 1 million watt hours
IEA	International Energy Agency
IEC	International Energy Commission
kt	Kilo Tonnes – 1 thousand tonnes
kWh	Kilo Watt hour – 1 thousand watt hours
kWr	Kilo Watt refrigeration
MCE	Ministerial Council of Energy
MEPS	Minimum Energy Performance Standards
MRET	Mandatory Renewable Energy Target
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
NGS	National Greenhouse Strategy

NPV	Net Present Value
NZ	New Zealand
RH	Relative Humidity (%)
RIS	Regulatory Impact Statement
TTMRA	Trans Tasman Mutual Recognition Arrangement
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Purpose of Consultation Regulatory Impact Statement (RIS)

The primary role of the RIS is to improve government decision-making processes by ensuring that all relevant information is presented to the decision makers when a decision is being made or agreement is otherwise being sought. A RIS, under the COAG requirements, is a two stage process involving a RIS for consultation and a RIS for the decision makers.

The RIS for consultation canvasses the regulatory options being considered in order to determine the relative costs and benefits of those options. The consultation RIS aims to elicit views from affected parties prior to the development of final recommendations for decision makers.

This is a consultative regulatory impact statement (RIS), released to stakeholders, for comment on the proposed introduction of Minimum Energy Performance Standards (MEPS) and Energy Rating labels in Australia and New Zealand for Close Control Air Conditioners (CCAC).

Stakeholders are invited to comment on the efficiency and effectiveness of the proposal, likely costs and benefits of the proposal as well as on the merits of the alternatives. While in no way limiting stakeholder comments, the Executive Summary concludes with a list of queries on which stakeholder may wish to comment.

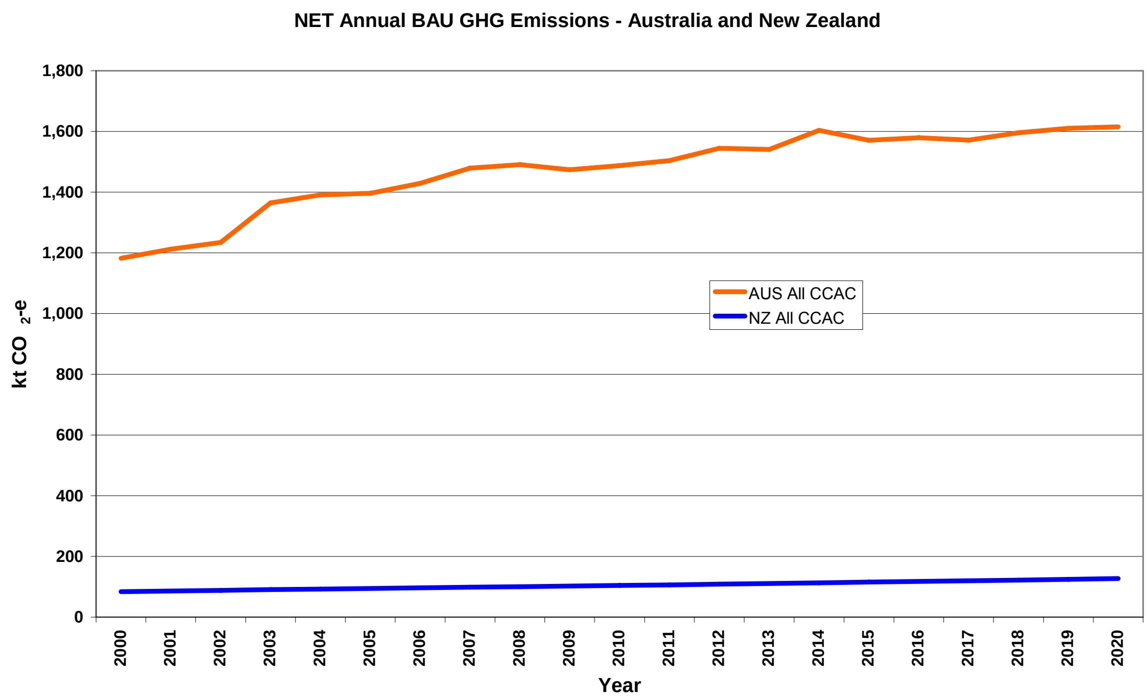
Background to Proposal

CCACs were exempted from MEPS and Energy Labelling of three phase air conditioners when introduced in 2001, due to the need to develop specific test measurements that are tailored to these types of air conditioners. In 2003, the National Appliance & Equipment Energy Efficiency Committee (now the E3 Committee), requested a review of the application of international MEPS for CCAC to enable an informed decision to be made about compliance of these types of air conditioners with the Australian MEPS. A plan was published by NAEEEC in October 2004 for improving the efficiency of CCAC which proposed that mandatory regulations might better meet the Australian and New Zealand governments' efficiency goals. Since this time, significant industry and government consultation has occurred to provide a suitable framework for the introduction of proposed MEPS.

The Problem

CCACs operate under different conditions to those air conditioners generally providing comfort for persons. CCAC are a central air conditioner specifically designed for use in data processing areas, typically maintaining an internal temperature of approximately 22ºC and a relative humidity of approximately 52 per cent. These air conditioners are designed to cool equipment rather than people; hence they are specifically designed to remove more sensible heat rather than latent heat from the controlled environment. CCAC are also termed "process", "precision" or "computer room" air conditioners. The sale of these products has been steadily increasing by approximately 3 per cent annually from around 850 in 2000 to over 1,000 in 2006 in Australia. The installed stock of all types of CCAC is estimated at around 9,700 in Australia and 970 in New Zealand in 2006.

The annual direct electricity consumption of all these products for the year 2006 has been estimated to be 1,380 GWh/yr in Australia and 138 GWh/yr in New Zealand. The net energy resulting from the use of CCAC is projected to grow to over 1,820 GWh/yr in Australia and 182 GWh/yr in New Zealand by the year 2020. Currently the overall electricity used by CCAC accounts for nearly 3 per cent of total commercial electricity usage. The share of CCAC of overall electricity-related greenhouse gas (GHG) emissions is expected to remain constant at around 0.7% over the period 2006–2020 in Australia. The following figure provides the estimated annual 'business as usual' (BAU) GHG emissions by CCAC in Australia and New Zealand to 2020.



The choice of a close control air conditioner can affect the energy usage requirements of a data centre or telecommunications facility. For example, calculations show that $4,200 per annum can be saved due to the selection of more efficient CCAC (see Table 8). There is also considerable technical scope to increase the energy efficiency of close control air conditioner.

Purchaser behaviour suggests that there are deficiencies in the close control air conditioner market. Feedback from suppliers also suggests market deficiencies exist, as they report that rarely are ongoing operating costs considered in purchase decisions, despite lifecycle energy costs being typically five times purchase costs. An analysis of the market and feedback from suppliers suggests these market deficiencies are being caused by one or more of the following:

- incomplete information available to consumers
- a focus on up-front purchase price, rather than the on-going energy costs, of equipment.

Feedback from CCAC suppliers and an analysis of the market indicate that the above factors have contributed to inefficiencies in the market and contributed to the market failing to improve the energy efficiency of close control air conditioner as fast as is potentially possible.

The Objective

The objective of the proposed strategies for CCAC is to bring about reductions in Australia's and New Zealand's greenhouse gas emissions below what they are otherwise projected to be (i.e. the 'business-as-usual' case), in a manner that is in the broad community's best interests. Within the objective, the proposal must provide the greatest net benefits to the community, without compromising equipment quality or functionality.

The Proposal

The proposed strategy involves introducing mandatory MEPS for CCAC from July 2009. The regulation would stipulate the minimum energy efficiency levels for these products in order to be sold in the Australian and New Zealand market. MEPS aim to remove the worst performing products from the marketplace, rather than promoting the best. This Australian/New Zealand MEPS reflects international requirements, while also addressing local industry technical issues. In this regard, the proposed MEPS has been developed in close consultation with the CCAC supply industry over the period 2004 to 2008. It is important to highlight during meetings held in 2006 and 2007, that CCAC suppliers[1] (representing 95% of the market) supported the introduction of the proposed MEPS.

The proposed MEPS includes minimum requirements for an Energy Efficiency Ratio (EER) when measured or simulated to the new Australia/New Zealand Standard. The proposed MEPS does not differentiate between types of heat rejection (water cooled or air cooled) or size.

Assessment

In the analysis, two annual sales growth scenarios have been analysed:

[1] See sub section 1.6: Australian and New Zealand Market Players on page 8 for more information.

- a base sales scenario that is used for the RIS with product sales increasing at approximately 2.9 per cent per annum from 2007; and
- a low sales scenario with sales increasing at only 0.4 per cent from 2007.

Australia

The following table summarises the analyses for Australia for the period 2007 to 2020. The data presented is based upon Net Present Value (NPV) calculations at a real discount rate of 7.5 per cent.

Summary Data for Alternative BAU Sales Australia – 7.5% Discount Rate

Scenario	Base Sales	Low Sales
Energy Saved (cumulative)	1,748 GWh	1,569 GWh
GHG Emission Reduction (cumulative)	1.6 Mt CO_2-e	1.5 Mt CO_2-e
Total Benefit	$188M	$166M
Total Cost	$30M	$26M
Benefit Cost Ratio	6.4	6.3

Even at a higher discount rate of 10 per cent, for the base and low sales scenario, benefit-cost ratios are positive at 5.8. If the incremental costs of improved product to meet the MEPS are increased by 10 per cent from the values assumed in the RIS analysis, the benefits are still approximately 5.8 times the costs under the base sales scenario.

Although the future carbon price under the proposed Carbon Pollution Reduction Scheme (CPRS, previously known as an Emissions Trading Scheme (ETS)) is uncertain at present, emissions trading will mean the estimated benefits will always be higher than without emissions trading (i.e., the benefits will always be higher when the carbon price is above zero). The benefit-cost ratio increases to 4.4 for the base sales scenario if the benefits of reducing GHG emissions under the CPRS are included from 2012 (see Appendix 8)

New Zealand[2]

The following table summarises the analysis for New Zealand for the period 2007 to 2020. The data presented is based upon Net Present Value calculations at a discount rate of 5 per cent.

[2] The proposed implementation date for the MEPs is 1 April 2009.

Summary Data for Alternative BAU Sales New Zealand – 5% Discount Rate

Scenario	Base Sales	Low Sales
Energy Saved (cumulative)	175 GWh	157 GWh
GHG Emission Reduction (cumulative)	122 kt CO_2-e	109 kt CO_2-e
Total Benefit	$24.8M	$21.8M
Total Cost	$3.9M	$3.4M
Benefit Cost Ratio	6.4	6.4

Note that NZ Govt requires analysis of alternative proposals with 5% discount rate

Alternative Options

The alternative options considered for achieving the objective are:

- voluntary efficiency standards;
- levies and emissions trading;
- a certification program;
- dis-endorsement labelling; and
- mandatory energy labelling.

Voluntary efficiency standards rely on equipment suppliers being effectively encouraged to meet certain minimum energy efficiency levels voluntarily, i.e. 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 was that suppliers would not participate in a voluntary scheme if by doing so they might lose market share as their competitors might supply less efficient but cheaper products.

Levy options are not currently government policy and would require extensive consultation at the highest levels of government. Hence these options are not considered practicable until such time as government policy changes to favour levy schemes.

The Australian Government has announced that a domestic CPRS will be implemented no later than 2010. The New Zealand Government is also proposing to introduce an ETS. This could eventually lead to the full cost of GHG emissions impacts being reflected in energy prices. However, it is unclear whether a CPRS/ETS alone and the energy price rises that might flow from it would lead to improvements in the energy efficiency of CCAC purchased, without other changes in the market.

Certification is unlikely to succeed as the program is likely to cover only a proportion of the CCAC available.

A dis-endorsement labelling scheme is unlikely to be effective for CCAC, as these products are not a retail item but are sold on the basis of their technical specifications and price. It would therefore appear to be unjustified and inappropriate in Australia and New Zealand.

CCAC are sold on the basis of their technical specifications and price, and energy consumption does not appear to be a significant factor in the purchasing decision (i.e. in the absence of readily available information). While energy rating labels may go some way to providing such information to consumers (and hence correct a market failure) this RIS assessing that the proposed MEPS is the most effective options concerning satisfying the objectives. Nevertheless, it is a purpose of this RIS to receive stakeholder feedback concerning the likely efficacy of an energy labelling regime for CCAC, or energy labels use in conjunction with the proposed MEPS.

A finding of this RIS is that the impact of the other non-MEPS options for Australia and New Zealand would not deliver the level of net benefits to the community compared to the BAU case.

Recommendations (draft)

It is recommended that the Ministerial Council on Energy (MCE) agree:

1. To implement mandatory energy performance standards for CCAC in regulation.
2. That products covered by this RIS include all those defined as CCAC in the scope of the new Australian/New Zealand Standard, Performance Close Control Air Conditioners (AS/NZS 4965, Part 1.1).
3. To use the test method of the new Australian/New Zealand Standard, Performance Close Control Air Conditioners (AS/NZS 4965, Part 1.1), which specifies methods of testing of CCAC to verify the capacity, power and efficiency requirements at a specific set of conditions.
4. That CCAC must meet or surpass the energy performance requirements that are proposed in this document and will be set down in Australian and New Zealand Standard AS/NZS 4965, Part 2: Minimum Energy Performance Standard (MEPS) Requirements.
5. That the amendments take effect not earlier than 1 July 2009 in Australia and New Zealand.
6. To have all jurisdictions take the necessary administrative actions to ensure that the suite of regulations can take effect from the proposed implementation dates.

Comments on the Proposal

Notwithstanding the draft recommendations above, the Department of Environment, Water, Heritage and the Arts (DEWHA) welcomes and encourages comments on the proposal. While in no way limiting comments, stakeholders may wish to comment on:

- factors influencing and priorities for the purchase of CCAC units, particularly the extent to which consumers consider energy use in their purchase decision;
- the extent to which energy use characteristics are used by suppliers in their promotion mix;
- information availability and quality on CCAC units for making purchase;
- the effectiveness of an energy efficiency labelling scheme. Would such a scheme be as effective as the proposed MEPS or would the MEPS proposal be complemented from energy efficiency labelling;
- the market dynamics and linkages of the sales of Close Control Air Conditioner (CCAC) units with the IT/Communications installations sector;
- proportion of unit sales undertaken by end-user organisations or their contractor;
- trends in the EER of units sold over the last ten years;
- proportion of CCAC units sold that will meet the proposed MEPS standards;
- while a Carbon Pollution Reduction Scheme (CPRS) is currently being considered, feedback is sought on likely impacts or interaction of such a scheme with the proposed MEPS;
- the timeframes suggested in this RIS.

1 Scope

1.1 General

This Consultation Regulatory Impact Statement (RIS) has been prepared to investigate the potential options for improving the energy performance of this type of energy-using equipment, in accordance with the *COAG Best Practice Regulation* (COAG 2007). A RIS is required whenever such investigations include the consideration of new or more stringent mandatory measures as options which might be proposed by government. Under the guidelines agreed by all Australian jurisdictions and New Zealand, product regulation is undertaken only where the benefits outweigh the costs to the community; and the cost of improving appliance efficiency is outweighed by the energy and greenhouse gas emissions savings made over the lifetime of the product.

This Consultation RIS has been prepared to investigate regulatory and non-regulatory options, including regulation, to improve the energy performance of CCAC, and follows extensive stakeholder consultation over the period 2004 – 2008.

1.2 Australian and New Zealand Policy Responses to Global Warming

This regulatory proposal cannot be assessed in isolation; it forms part of a coordinated response by governments who are undertaking regulatory measures for any energy-using product that are cost-effective and meet agreed environmental and energy goals.

Australia's Response to Climate Change

Australia's greenhouse abatement and climate change policies have evolved consistently for more than 15 years, since the release of the National Greenhouse Response Strategy in 1997. The paper received overall bi-partisan support, including support for national energy efficiency measures. Appendix 2 records some of the more important stages in that development.

In May 2007, the Prime Minister's Task Group released its report on the Introduction of an Australian Emissions Trading system, which endorsed the support of complementary measures as a means to address market failures where an Emissions Trading Scheme was not effective:

> *"Beyond information-based policies, energy efficiency policies could target areas where market barriers are likely to be more fundamental and enduring. This is likely to be in areas where consumers make infrequent decisions and where it is difficult to judge the energy and emissions implications. There is a good case for continuing the development of well-designed and consistent regulated minimum energy standards for buildings and households appliances. Purchase of energy-efficient products can have a large impact on aggregate emissions over time, and reduce the impact on household budgets of any rise in carbon prices".* (DPMC 2007 pp135)

Similarly in July 2007, the Prime Minister released "Australia's Climate Change Policy – our economy, our environment, our future (ACCP 2007)". The policy again reasserted that energy efficiency regulation remains a key element of cost effective greenhouse abatement:

> *"Energy efficiency is an important way to reduce greenhouse gas emissions cheaply. Demand for electricity in Australia is expected to more than double by 2050. Improvements in energy efficiency have the potential to lower that projected growth, and avoid greenhouse gas emissions. They can also deliver a net financial gain for firms and consumers. … The MEPS programme is one of the main success stories of the National Framework for Energy Efficiency (NFEE). The NFEE was developed cooperatively across jurisdictions and covers a range of policy measures, designed to overcome market barriers to energy efficiency."* (pp. 16-17)

Most recently on 11 March 2008, Australia's ratification of the Kyoto Protocol was officially recognised by the United Nations Framework Convention on Climate Change (UNCCC). Under Kyoto, Australia is obliged to limit its greenhouse gas emissions in the period 2008–2012 to 108 per cent of 1990 emission levels. The Australian Government has also released a report demonstrating how Australia intends to measure the reductions in emissions required under Kyoto titled *Australia's Initial Report under the Kyoto Protocol.*

New Zealand's Response to Climate Change

New Zealand climate change policies have a similar history of long-term support by government. New Zealand ratified the Kyoto Protocol in 2002, and has committed to reducing its greenhouse gas emissions back to 1990 levels, on average, over the period 2008 to 2012 (or to take responsibility for any emissions above this level if it cannot meet this target).

In October 2007 the New Zealand Minister of Energy released the New Zealand Energy Efficiency and Conservation Strategy (NZEECS), which proposes ways to promote energy efficiency, energy conservation and the use of renewable sources of energy. It includes measures to reduce electricity demand, address energy use in transport, buildings and industry, and promote greater consideration of sustainable energy in the development of land, settlements and energy production. The strategy is available at http://www.eeca.govt.nz/eeca-library/eeca-reports/neecs/repor t/nzeecs-07.pdf

The New Zealand Energy Efficiency and Conservation Strategy (NZEECS) is a key part of the government's response to meeting its energy, climate change, sustainability and economic transformation goals. It has been written as a companion document to, and will give effect to a number of the objectives set out in, the New Zealand Energy Strategy (NZES).

The introduction of minimum energy performance standards and labelling for household appliances continues to form part of New Zealand's climate change strategy, as part of implementing the New Zealand Energy Efficiency and Conservation Strategy (NZEECS).

The MCE Moves beyond "No Regrets" Energy Efficiency Measures

In October 2006, the Ministerial Council on Energy (MCE) of Australian federal, state and territory and New Zealand government energy ministers agreed to new criteria for assessing new energy efficiency measures. The MCE replaced its previous *"no regrets"* test (that a measure have private benefits excluding environmental benefits which are greater than its costs) with the criteria that the MCE would consider *"new energy efficiency measures which deliver net public benefits, including low cost greenhouse abatement measures that do not exceed the cost of alternate measures being undertaken across the economy"*.

This policy means the MCE will consider new regulatory measures that may have net up-front costs but have greater private economic and greenhouse benefits over the long term. The policy is based on the principle that prudent investment now may avoid more costly intervention later. This bipartisan agreement demonstrates the on-going commitment of all participating jurisdictions to using regulatory measures that deliver effective, measurable abatement.

International Energy Agency Sees Improving Energy Efficiency as Top Priority

Australian and New Zealand policy is in accord with international endeavours in this field.

> *"The IEA estimates that under current policies, global emissions will increase 50% by 2030 and more than double by 2050. However, if we act now, this unsustainable and dangerous pattern can be curbed. IEA findings show that emissions could be returned to current levels by 2050 and even reduced thereafter, while an ever-growing demand for energy services, notably in developing countries, can be fully satisfied. Improving energy efficiency in the major consuming sectors – buildings and appliances, transport and industry – must be the top priority. While alleviating the threat of climate change this would also improve energy security and have benefits for economic growth."* Claude Mandil, Executive Director, International Energy Agency (IEA), Paris, February 2007.

Australian and New Zealand policies are at the forefront of international work to improve the energy efficiency of globally traded equipment, with lower trading costs while still delivering environmental and economic benefits.

Equipment Energy Efficiency Program

In Australia, regulatory intervention in the market for energy-using products was first introduced with mandatory appliance energy labelling by the NSW and Victorian Governments in 1986. Between 1986 and 1999 most state and territory governments introduced legislation to make energy labelling mandatory, and agreed to co-ordinate labelling and minimum energy performance standards (MEPS) decision making through the MCE. New Zealand has participated in monitoring the Australian program for more than a decade and has been a partner in decision-making for several years. Regulatory interventions have consistently met the requirements to demonstrate the actual benefit of increasing energy efficiency standards, which address market failure relating to life-time energy cost information for appliances and equipment.

The proposed regulation is an element of the Equipment Energy Efficiency Program (E3), formerly known as National Appliance and Equipment Energy Efficiency Program (NAEEEP). E3 embraces a wide range of measures aimed at increasing the energy efficiency of products used in the residential, commercial and manufacturing sectors in Australia and New Zealand. E3 is an initiative of the MCE comprising ministers responsible for energy from all jurisdictions, and is an element of both Australia's National Framework for Energy Efficiency (NFEE) and New Zealand's National Energy Efficiency and Conservation Strategy. It is organised as follows:

- implementation of the program is the direct responsibility of the Equipment Energy Efficiency Committee (the E3 Committee), which comprises officials from Australian federal, state and territory government agencies and representatives from New Zealand. These officials are responsible for implementing product energy efficiency initiatives in the various jurisdictions.

- the E3 Committee reports through the Energy Efficiency Working Group (E2WG) to the MCE and is ultimately responsible to the MCE.

- The MCE has charged E2WG to manage the overall policy and budget of the national program.

- The Australian and New Zealand members of the E3 Committee work to develop mutually acceptable labelling requirements and MEPS. New requirements are incorporated in Australian and New Zealand Standards and developed within the consultative machinery of Standards Australia.

- The program relies on state and territory legislation for legal effect in Australia, enforcing relevant Australian Standards for the specific product type. National legislation performs this task in New Zealand.

The broad policy mandate of E3 has been regularly reviewed over the last decade and was most recently examined in 2004. During this process, CCACs were specifically nominated for regulatory impact assessment.

To be included in the program, appliances and equipment must satisfy certain criteria relating to the feasibility and cost effectiveness of intervention. These include potential for energy and greenhouse gas emissions savings, environmental impact of the fuel type, opportunity to influence purchase, the existence of market barriers, access to testing facilities, and considerations of administrative complexity. Policy measures are subject to a cost-benefit analysis and consideration of whether the measures are generally acceptable to the community.

E3 provides stakeholders with opportunities to comment on specific measures as they are developed by issuing reports (including fact sheets, technical reports, cost-benefit analysis and regulatory impact statements) and by holding meetings. As previously stated, regulation of CCAC has been a topic of discussion with key industry leaders for many years.

1.3 Close Control Air Conditioner Products

This RIS focuses on close control air conditioning, which are also known as computer room air-conditioners or precision cooling air conditioners.

Close Control Air Conditioning Product Description

CCAC operate under different conditions to those air conditioners generally providing comfort for persons. CCACs are a central air conditioner specifically designed for use in data processing areas, typically maintaining an internal temperature of approximately 22ºC and a relative humidity of approximately 52 per cent. These air conditioners are designed to cool equipment rather than people; hence they are specifically designed to remove more sensible heat compared to latent heat. Air conditioners used for cooling spaces, which are predominately occupied by people, are usually termed 'comfort' air conditioners.

Systems are usually air cooled direct expansion type air conditioners, however water cooled and glycol cooled computer room air conditioners are available. The latter type is generally more expensive than air cooled, however they are inherently more efficient.

Energy consumption from CCAC is estimated to be over 1,380 GWh/yr in Australia and over 138 GWh/yr in New Zealand in 2006.

1.4 Australian/New Zealand Policies and Programs

National product regulation can only be justified where the benefits outweigh the costs to the community; where the costs of improving efficiency is outweighed by the energy savings made over the lifetime of the product. To date, the cooling cycle of three phase air conditioners are regulated for MEPS and single phase (domestic) air conditioners are regulated for MEPS and energy labelling. In addition, the Building Code of Australia and the New Zealand Building Code has been updated to include Minimum Energy Performance Standards for chillers in new non-residential buildings and the introduction of MEPS for chillers is now in progress. CCAC are currently exempt from air conditioner MEPS or labelling requirements.

Three Phase Air Conditioners

Since 1 October 2001, three phase air conditioners with a cooling capacity of up to 65kW manufactured in or imported into Australia must comply with Minimum Energy Performance (MEPS) requirements, which are set out in AS 3823.2-2001. MEPS covers three phase non-ducted or ducted room air conditioners of the vapour compression type of up to 65kW cooling (commercial or residential). These MEPS levels increased in October 2007. It covers only those units with a single compressor with a single indoor control such as single packaged units, packaged ducted units, double and triple split systems and single split systems. It does not currently cover multi-split systems, portable systems without an exhaust duct or evaporative coolers. Manufacturers can choose to label three phase air conditioners, but this is not mandatory.

Single Phase Air Conditioners

From 1 October 2004, all single phase air conditioners manufactured in or imported into Australia or New Zealand were required to comply with MEPS requirements, which are set out in AS/NZS 3823.2-2003. MEPS covers single phase non-ducted or ducted room air conditioners of the vapour compression type (commercial or residential) within the scope of AS/NZS 3823.1.1 or AS/NZS 3823.1.2. These MEPS levels were further increased for many non-ducted single phase models effective from April 2006 and for other units from October 2007.

As previously stated, CCAC have to date also been exempt for the MEPS for single phase air conditioners.

Commercial Building Code

The development of the Building Code Australia (BCA) and the New Zealand Building Code (NZBC) energy efficiency provisions for commercial buildings has proceeded in two stages. Firstly, provisions for Class 2, 3 and 4 buildings (e.g., apartments and hotels) were included in BCA 2005. Secondly, provisions for Class 5, 6, 7, 8 and 9 buildings (e.g., offices, shops, warehouses, factories, health care buildings, auditoriums and schools) were included in BCA 2006. These provisions include MEPS for chillers and comfort air conditioners installed in new buildings only.

Close Control Air Conditioners

In 2003, NAEEEC requested a review of the application of international MEPS for CCAC to enable an informed decision to be made about compliance of these types of air conditioners with the Australian MEPS. This review recommended that the MEPS for CCAC should be considered in the proposed 2007 MEPS for three phase air conditioners. Subsequently a report, *Analysis of the Potential Policy Option: Close Control Air Conditioners* (EnergyConsult 2004), recommended the introduction of MEPS for CCAC in line with the Californian Energy Commission MEPS levels, as these are the most appropriate international MEPS levels. Further consultation with the close control air conditioner industry between 2005 and 2007 has refined the MEPS approach to Australian conditions and market characteristics (see Section 6).

1.5 Close Control Air Conditioner Market

Australian and New Zealand Market Characteristics

No published data is available on the characteristics of the Australian and New Zealand market for CCAC; however by surveying the suppliers (see section 1.6) the following characteristics were found[3]:

- The demand for CCAC stems from the need to provide conditioned environments for data management equipment, hence the market is driven by replacement demand and the growth in data centres.
- Approximately 1,000 units were sold in Australia in 2006 and 100 units in New Zealand.
- Estimated installed stock is 9,700 units in Australia and 970 units in New Zealand in 2006.
- Approximately 60 per cent are air cooled and 40 per cent water cooled.
- Average size is approximately 50kWr.
- Two or more identical units are generally installed at each site, to provide redundancy should a unit fail or require maintenance.
- The units at a site are rotated through an operating cycle, i.e. regularly switched on and off, to ensure a similar operating life for all units and no units are kept solely as standby or backup units.
- Though the set of CCAC units at any site generally operate 24 hours/day, all year, any given unit operates approximately 65 per cent of this time at full capacity.
- There is one local manufacturer and four importers, all from Europe, in the current Australian and New Zealand market.

The survey information provided by industry found that the average Energy Efficiency Ratio (EER) of CCAC was an EER of between 2.1 and 3.0, when operating at the design conditions. It is also estimated from industry that the average life of a close control air

[3] Two surveys were undertaken. The first was a quantitative survey provided to four suppliers in 2007, who represent over 95 per cent of the CCAC market. Questions were asked in relations to sales, installed base units, and likely cost increases associated with the proposed MEPS. Follow-up qualitative interviews were conducted over the phone and in personal in relation to suppliers and consulting engineers. A second qualitative survey was conducted in late 2007/early 2008 amongst six consulting engineers and data centre operators. This survey was conducted by way of site interviews and asked questions in relation to purchasing decisions (including knowledge of energy use), operation of units and estimated lifecycle.

conditioner is around 10 years considering they are operating continuously. This estimate is consistent with the expected life of comfort air conditioners which range from 10 to 15 years (Syneca 2003).

The following information is provided to give a comparison of some of the market characteristics of a similar category of air conditioners (three-phase packaged air conditioners were regulated for efficiency in 2001)

- 3000 roof-top packaged air conditioners are sold each year in Australia (over 18kWr), with the average size of 50 kWr (Informark 2004). Hence the market for CCAC is approximately 30 per cent of this market.
- Average energy consumption of CCAC is typically 2 to 4 times more than comfort air conditioners.
- The efficiency of close control air conditions can not be directly compared to comfort air conditions as they are designed to operate under differing temperature and humidity conditions.

1.6 Australian New Zealand Market Players

There is one local manufacturer/importer and four importers, who all source units from Europe, in the current Australia and New Zealand market. There appears to be no suppliers of USA air conditioners; however industry representatives noted that suppliers from China are entering the market. The companies identified as supplying CCAC in Australia and New Zealand are:

- Emerson Network Power – importer and local manufacture
- Stulz – importer
- Hirotec – importer
- Uniflair – importer and
- RC Group - importer or agent

The industry representatives noted that the same suppliers provided units to the New Zealand market, with no differences in the product being offered.

2 The Problem

The United Nations Framework Convention on Climate Change (UNFCCC) was agreed in 1992 and came into force in 1994. It places much of the responsibility for taking action to limit greenhouse gas emissions on the developed countries, which are collectively referred to as Annex 1 countries, including New Zealand and Australia. Annex 1 countries are required to report each year on the total quantity of their greenhouse gas emissions and on the actions they are taking to limit those emissions.

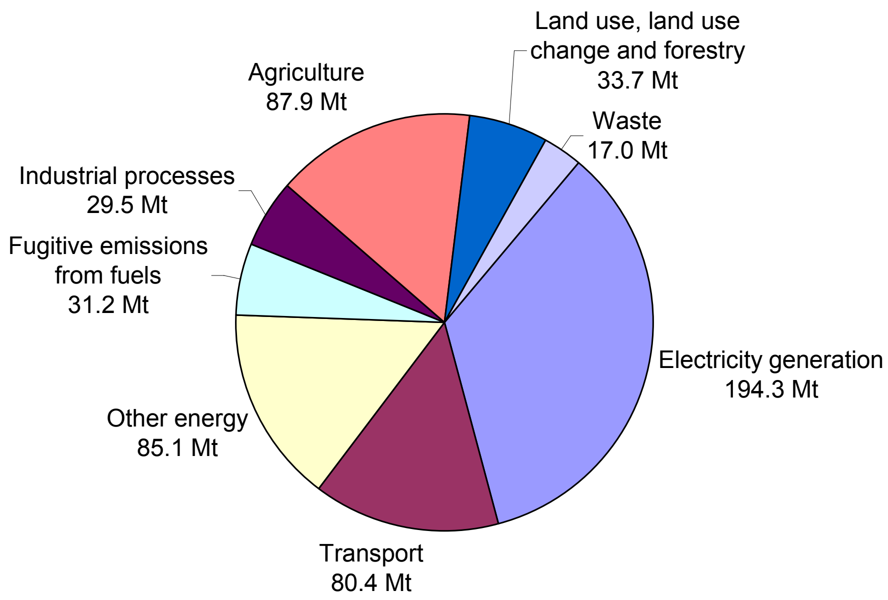
The Kyoto Protocol to the UNFCCC was agreed in December 1997, and came into force in 2005. Australia ratified the Kyoto Protocol on 3 December 2007 and has committed to reduce its greenhouse gas emissions by 60 per cent of 2000 levels by 2050.

New Zealand ratified the Kyoto Protocol on 19 December 2002, and has committed to reducing its greenhouse gas emissions back to 1990 levels, on average, over the period 2008 to 2012 or to take responsibility for any emissions above this level if it cannot meet this target. The introduction of minimum energy performance standards for inefficient energy consuming equipment continues to form part of Australia and New Zealand's climate change strategy.

2.1 Energy and Greenhouse Gas Emissions

Figure 1 shows estimated Australian greenhouse gas emissions by sector for 2005. The estimated total greenhouse gas emissions for 2005 are 559.1 million tonnes of CO_2-e (NGGI 2007). The electricity sector represents the greatest contribution to Australia's greenhouse gas emissions.

Figure 1: Australian Greenhouse Gas Emissions by Sector 2005 (Source: NGGI 2007)

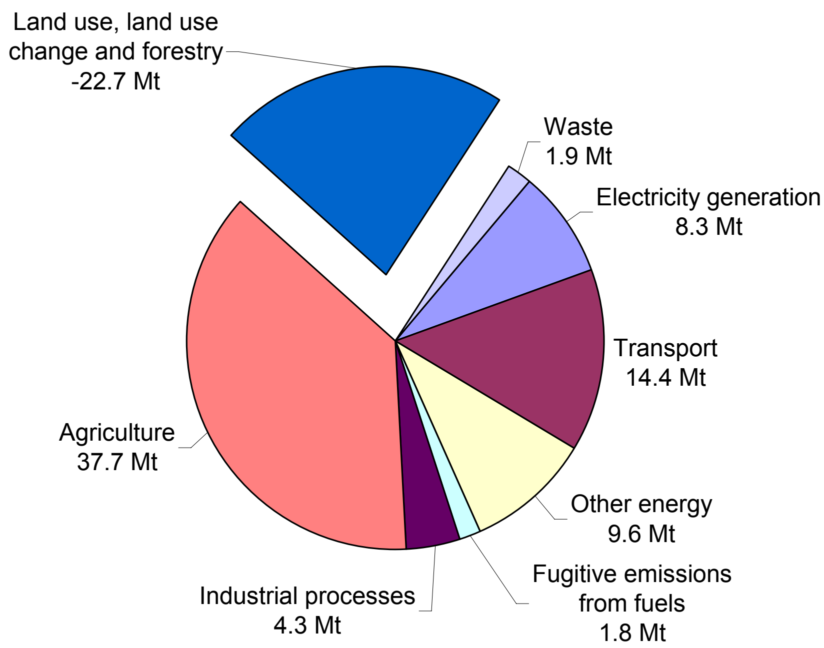


The largest contribution to stationary energy emissions comes from the generation of electricity (69.5 per cent). Electricity generation accounted for 194.3 Mt or 34.7 per cent of national emissions in 2005. Electricity generation emissions increased by 0.7 Mt (0.4 per cent) from 2004 to 2005, and by 64.8 Mt (50.1 per cent) from 1990 to 2005.

The Australian Bureau of Agricultural and Resource Economics projects total electricity use to increase by an average of 2.2 per cent p.a. between 2004/05 and 2010/11 (ABARE 2006). Electricity use in the residential sector is projected to account for around 23 per cent of the increase in total electricity use over the period to 2030. Slowing, and ultimately reversing, the growth in electricity-related emissions is thus a high priority in Australia's greenhouse gas reduction strategy.

In New Zealand, thermal electricity generation accounted for 24.4 per cent of CO_2 emissions from the energy sector in 2006 (MFE NZ 2008). In 2005, emissions from this source increased significantly by 35.2 per cent compared with 2004 due to increased consumption of coal (MED NZ 2006). In total, thermal electricity generation produced 8.3 Mt CO_2-e in 2006. Total greenhouse gas emissions from the energy sector are projected to grow by about 30 per cent between 2005 and 2030 (MED NZ 2006b). Figure 2 shows estimated New Zealand greenhouse gas emissions by sector for 2006. The estimated total greenhouse gas emissions for 2006 are 55.1 million tonnes of CO_2-e including land use, land use change and forestry. Therefore, electricity generation accounts for 15 per cent of the total GHG emissions in New Zealand.

Figure 2: New Zealand Greenhouse Gas Emissions by Sector 2006 (Source: MFE NZ 2008)



2.2 Contribution of Close Control Air Conditioners to Energy Use and Emissions

Like any electrical appliance, the contribution of CCAC to energy use and emissions is a function of number of units in operation, technical attributes of the units, and usage behaviour of the users. Given that the data management centres which use CCAC operate 24 hours a day, 365 days a year and require continuous cooling, CCAC contribute much more to the total greenhouse emissions related to air conditioning than their numbers alone would suggest.

As previously discussed, there are an estimated 9,700 CCAC operating in Australia and 970 in New Zealand in 2006, with an annual growth in stock of around 1,000 units per annum in Australia and approximately 100 units in New Zealand.

The net annual energy consumption of all CCAC in 2006 is estimated at 1,380 GWh/yr in Australia and 138 GWh/yr in New Zealand. The net energy resulting from the use of CCAC is projected to grow to over 1,820 GWh/yr in Australia and 182 GWh/yr in New Zealand by 2020.

Table 1 provides the estimated net energy consumption for all Australian states and territories, Australia as a whole, and New Zealand for the years 2000 to 2020 under the BAU conditions. The total estimated net energy consumption by size category and type of close control air conditioner is shown in Figure 3 for Australia and Figure 4 for New Zealand. Figure 5 provides the estimated GHG emissions by product category in Australia and Figure 6 for New Zealand.

Table 1: Net annual BAU energy consumption of CCAC by States, Australia as a whole and New Zealand (GWh)

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2000	314	12	241	145	24	290	181	**1,207**	**121**
2001	322	12	247	148	25	297	186	**1,237**	**124**
2002	329	13	253	152	25	304	190	**1,267**	**127**
2003	337	13	259	156	26	311	194	**1,297**	**130**
2004	345	13	265	159	27	318	199	**1,326**	**133**
2005	352	14	271	163	27	325	203	**1,355**	**136**
2006	360	14	277	166	28	332	208	**1,384**	**138**
2007	367	14	283	170	28	339	212	**1,413**	**141**
2008	375	14	288	173	29	346	216	**1,441**	**144**
2009	382	15	294	176	29	353	221	**1,470**	**147**
2010	390	15	300	180	30	360	225	**1,500**	**150**
2011	398	15	306	184	31	367	229	**1,529**	**153**
2012	405	16	312	187	31	374	234	**1,559**	**156**
2013	413	16	318	191	32	382	238	**1,590**	**159**
2014	421	16	324	195	32	389	243	**1,621**	**162**
2015	430	17	331	198	33	397	248	**1,653**	**165**
2016	438	17	337	202	34	404	253	**1,685**	**169**
2017	447	17	344	206	34	412	258	**1,718**	**172**
2018	455	18	350	210	35	420	263	**1,752**	**175**
2019	464	18	357	214	36	429	268	**1,786**	**179**
2020	473	18	364	219	36	437	273	**1,821**	**182**

Figure 3: Net annual BAU energy consumption by Product Categories - Australia

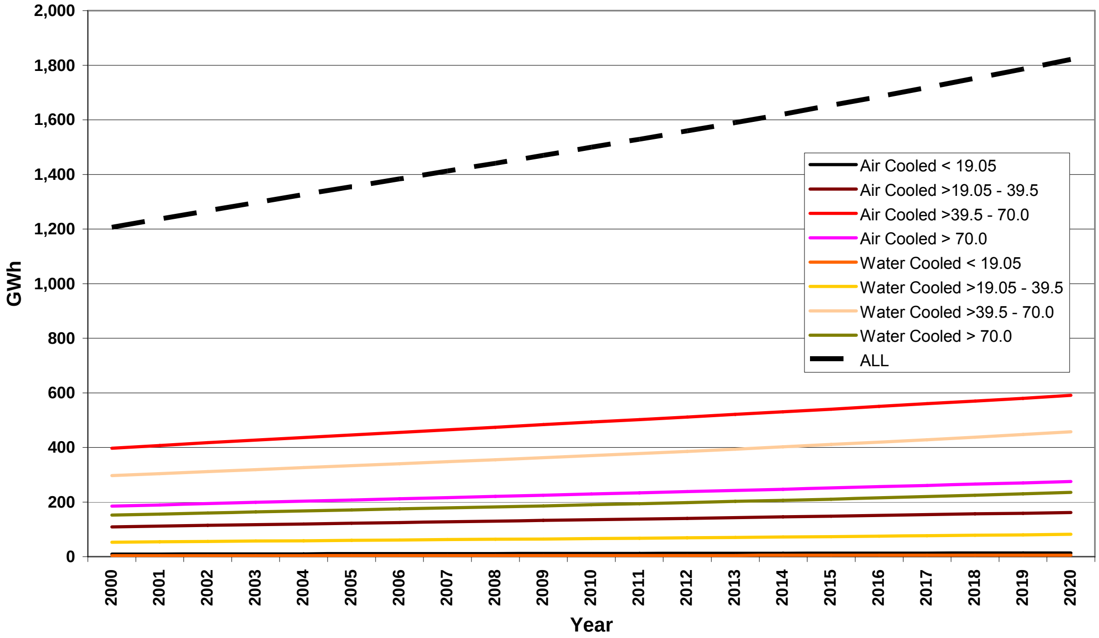
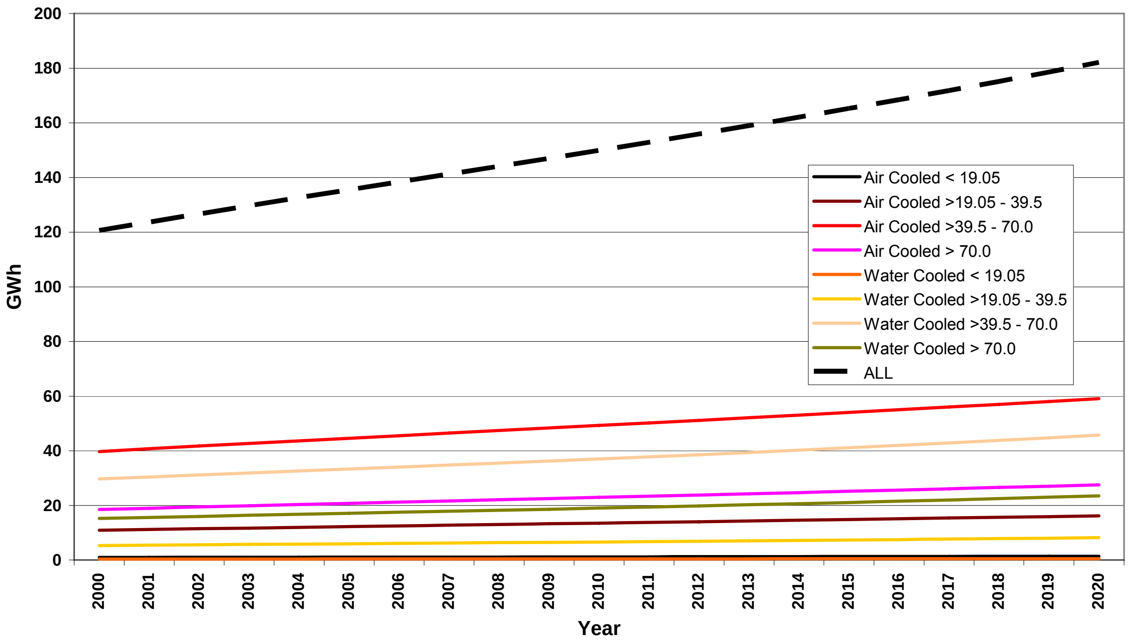


Figure 4: Net annual BAU energy consumption by Product Categories – New Zealand



It is evident from Figure 3 and Figure 4 that the growth in net annual energy, which is closely related to annual sales, is relatively constant from 2000 to 2020.

Figure 5: Annual BAU GHG emissions by Product Categories – Australia

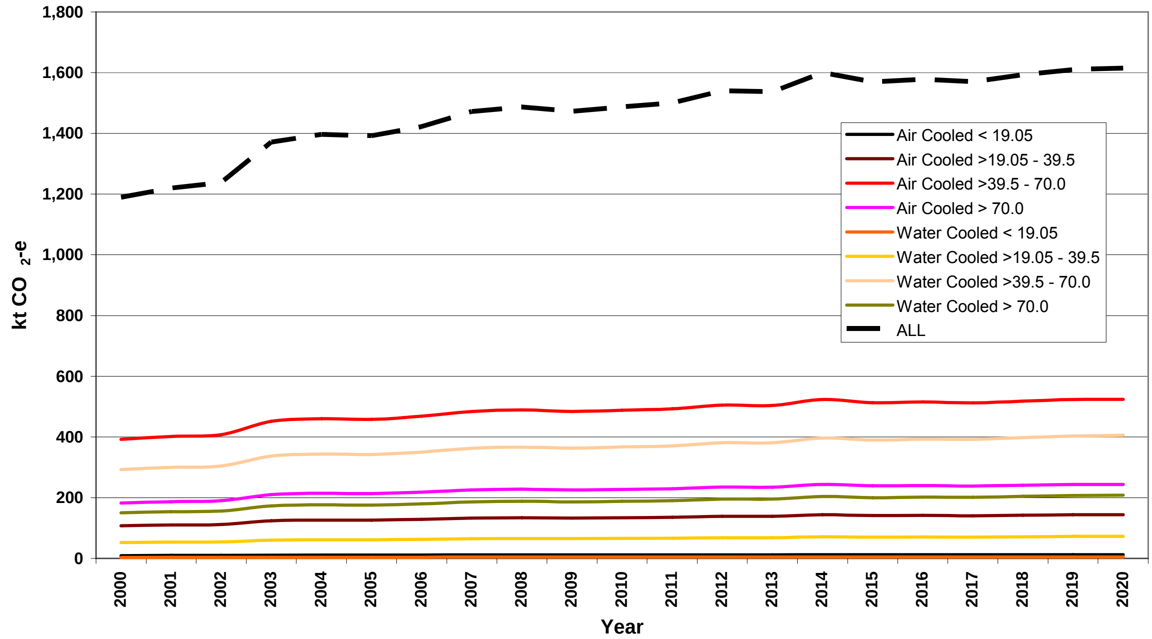
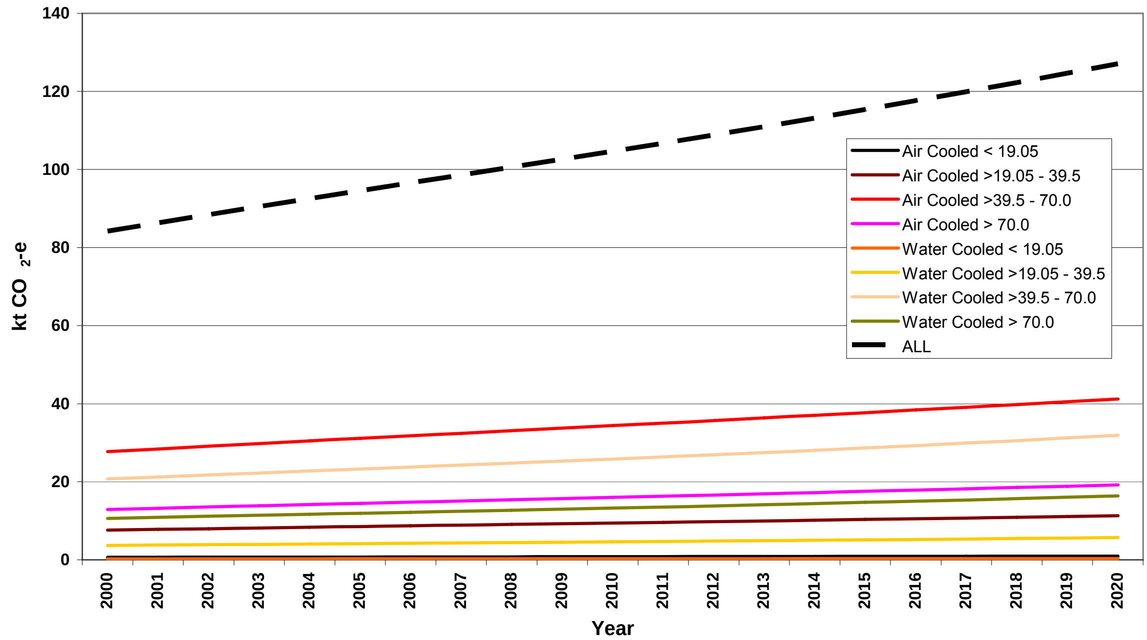


Figure 6: Annual BAU GHG emissions by Product Categories – New Zealand



Currently the overall electricity used by CCAC accounts for nearly 2.9 per cent of total commercial electricity usage in Australia (EMET 2004). The share of CCAC energy use of overall commercial sector energy consumption is expected to rise to 3 per cent by 2010. Similarly, for Australia the share of CCAC of overall electricity-related GHG emissions is expected to grow from 0.8 per cent in 2006 to 0.9 per cent in 2020.

In New Zealand the overall electricity used by CCAC accounts for 2 per cent of total commercial/storage sector electricity usage in 2002 (EECA 2007). Therefore, the share of total electricity related GHG emissions in New Zealand from CCAC was approx 0.4 per cent in 2002.

2.3 Close Control Air Conditioners Technologies and Energy Efficiencies

Range of Close Control Air Conditioner Efficiencies

Close control air conditioner efficiency is measured as the Energy Efficiency Ratio (EER). EER is defined as "the ratio of the rate of heat removal to the rate of energy input". This measurement is often quoted at full load capacity. In Australia and New Zealand, based on consultation with major suppliers, the estimated average efficiency for close control units are shown in Table 2. This data reveals that in comparison with the CEC standards (see Appendix 3, Table 18), Australian units are consistently less efficient than the de facto benchmark.

Table 2: Close Control Air Conditioner Efficiency in Australia and New Zealand (estimated in 2006)

Type	Capacity (kWr)	Average EER of Australian Units
Air Cooled	< 19.05 kWr	2.26
	≧ 19.05 - < 39.5 kWr	2.17
	≧ 39.5 - < 70.0 kWr	2.10
	≧ 70.0 kWr	2.37
Water Cooled	< 19.05 kWr	2.26
	≧ 19.05 - < 39.5 kWr	2.17
	≧ 39.5 - < 70.0 kWr	2.10
	≧ 70.0 kWr	2.37

Source: G. Groppenbacher 2006, based on survey response by suppliers with over 90% total market share

Table 2 presents the average efficiencies based on ASHRAE 127-2007 and includes data only for the indoor unit. However the range of individual unit efficiency for CCAC is large, with the EER for air cooled units ranging from below 2.0 to almost 3.0, according to the industry surveys. This suggests around a 50 per cent variation in unit energy efficiency.

There are no requirements for the efficiency of CCAC in the Building Code of Australia (BCA) or New Zealand Building Code.

Close Control Air Conditioner Cost versus Efficiency

For close control units between 19 and 70 kWr, the additional cost for choosing a higher efficiency unit over standard efficiency is between 8 per cent and 12 per cent ($3,000 - $4,000). This estimate is based on the results of interviews with industry representatives.[4] This implies that energy savings over the life of the close control unit would need to produce energy cost savings greater than 8-12 per cent of the cost of the close control unit to produce a positive cost benefit.

Testing Standards for Close Control Air Conditioners

CCAC operate under very different indoor air conditions to those of air conditioners providing comfort for persons. Hence, separate test conditions are either under development or established internationally for CCAC.

Australia and New Zealand

In Australia and New Zealand, the testing standard AS/NZS 3823 for *Performance of electrical appliances— Airconditioners and heat pumps* has been used as a guide for the development of a new standard for Close Control Air Conditioners (AS/NZS 4965) which follows the newest ASHRAE Standard 127-2007 -- *Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.* The indoor room rating points in the new ASHRAE standard are 23.9ºC/45%RH compared to the the previous rating point of 22ºC/50%RH. The new Australian Standard will cover both air cooled and water cooled units.

For air cooled systems the ASHRAE and other test methods are based on the indoor unit being matched to an air cooled condenser. Because of the accepted practice in Australia for consulting engineers to select the indoor unit separately from the outdoor unit the majority of installations would more than likely not utilise a matched set that has been tested and rated for MEPS.

For this reason, only the indoor unit will be part of the MEPS program. This will allow consultants to choose the most appropriate air cooled condenser for the particular application. It should be noted that over 95 per cent of the energy used is by the indoor unit.

Because the outdoor unit will not be included in the Australian MEPS, a direct comparison to other MEPS programs around the world is not possible.

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[4] This information was obtained from a quantitative survey in 2007 conducted, which included four suppliers, who represent over 95 per cent of the CCAC market (see page 8).

In addition, the required climate conditions for computer rooms are specified in the Australian Standard 2834-1995 *Computer Accommodation*. This standard specifies that computer rooms should be maintained at an optimum temperature of 23 °C (range from 18 -26°C) with a relative humidity of 50 per cent (±5 per cent).

USA

The ASHRAE standard used in North America is currently Standard 127-2001 -- *Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners (ANSI Approved).* A new version of the ASHRAE standard 127-2007 has recently been published for close controlled air conditioners and is the most recent and acceptable standard. This standard is supported by all the major CCAC suppliers in Europe, as well as USA suppliers.

Europe

The European test method is CEN: prEN 14511-2. The test conditions specified for CCAC are the same as those of EUROVENT certification directory of outdoor 35°C dry-bulb and 24°C wet-bulb and indoor air at 24°C dry-bulb and 17°C wet-bulb. To date this standard does not seem to be widely adopted by the market, with only one company currently registered as using the standard.

Summary

Australia and New Zealand are using the most up to date rating standard ASHRAE 127-2007 as the basis for the proposed MEPS program. The Australia and New Zealand testing standard has been developed specifically for this proposed MEPS and has been developed to provide rating of only the indoor unit. This more closely reflects the market conditions in Australia and New Zealand where the outdoor units are varied according to client's specific requirements. The outdoor units also contribute to only a minor part of the total CCAC unit's energy consumption.

2.4 Assessment of Market Deficiencies and Failures

There is considerable technical scope to increase the energy efficiency of close control air conditioner. The analysis of the spread of the EER of different units in each size category indicated a potential 10 per cent to 50 per cent improvement in efficiency being possible with existing commercial technologies (see Section 2.3). In addition, the choice of a CCAC can significantly affect the energy usage requirements, with potential saving of thousands of dollars per annum in energy costs per site if more efficient air conditioners were used (see Table 8).

A survey of industry suppliers suggests that the BAU improvement in the efficiency of the close control air conditioner units sold is only 1 per cent per annum. This is clear evidence that market forces alone have been unable to deliver the potential energy efficiency improvements, despite the technical scope to improve energy efficiency by 10 per cent to 50 per cent and the potential cost saving for consumers of $1,000's per annum per unit in reduced energy costs.

The behaviour of this market suggests that there are deficiencies in the close control air conditioner market. Feedback from suppliers, consulting engineers and data centre operators also suggests market deficiencies exist, due to one or more of the following:

- Incomplete information available to market consumers: There is no readily available information for purchasers on the energy efficiency of close control air conditioner units, according to a recent survey of data centre managers or unit suppliers, which can be used to compare the performance of different units. Unit efficiency ratings are not on any product labels and no life cycle energy cost information is provided to consumers. In addition, consumers receive little in the way of price signals or cost information even when they have installed the units, unless the energy usage of the units is separately metered. Consequently for many users there is no easily accessible or transparent source of information concerning closer control air conditioner operating costs or energy efficiency and this lack of information can be expected to affect all unit purchases.

- CCAC suppliers and consulting engineers report that the up-front cost of the units are still the critical determinant in a unit sale, and efficiency a secondary consideration. Consultation with the industry suggests that approximately 50 per cent of the purchasers in the market lack detailed knowledge of CCAC (because purchasing decisions are infrequent), and consequently have minimal knowledge of CCAC energy use and specifications. In this segment of the market especially, the upfront cost of units determines sales.

In light of the above, the concept of 'bounded rationality' may be relevant. This concept accounts for the fact that perfectly rational decisions are often not feasible due to the finite computational resources available to decision makers (i.e., purchasers of CCAC). This concept states that decision procedures are dependent upon algorithms (i.e., decision making frameworks) and heuristics (i.e. learning by doing or 'trial and error'). With respect to purchasing decisions of CCAC, given that they are infrequent purchases, say once every 10 years, and that technology can change over this period, buyer decisions are not based on heuristics to any large degree. Similarly, given that energy efficiency information is not readily available, such information is unlikely to form a part of the decision making algorithm. Finally, despite the savings associated with more efficient CCAC over their life cycle, it is suggested that suppliers are not promoting this aspect because energy efficiency is not a criterion in the purchaser's decision-making framework.

The feedback from CCAC suppliers, consulting engineers and data centre managers, and an analysis of the market, indicate that the above factors have contributed to inefficiencies in the market. This means the opportunity for unit purchasers to make energy cost savings has not been a sufficient driver to improve the energy efficiency of CCAC, and cannot be expected to become a sufficient driver without a market transformation occurring.

3 Objectives of Strategies

3.1 Objective

The objective of the proposed strategies for CCAC is to bring about reductions in Australia and New Zealand's greenhouse gas emissions below what they are otherwise projected to be (i.e. the "business-as-usual" case), in a manner that is in the broad community's best interests.

To be effective for manufacturers and suppliers the proposed strategy should be in accord with international test methods and marking requirements as these are internationally traded goods.

Within the objective, the proposal must provide the greatest net benefits to the community, without compromising equipment quality or functionality.

4 Proposed Strategies

The range of potential strategies considered for achieving the objective of reducing the power consumption of close control air conditioning included:

- Status Quo or business as usual (BAU);
- Voluntary efficiency standards;
- Voluntary certification program;
- Levies and financial instruments;
- Dis-endorsement labelling;
- Mandatory energy labelling; and
- Mandatory Energy Performance Standards.

These options will be discussed below.

4.1 Status Quo (BAU)

Net energy consumption from all types of close control air conditioner products in Australia is currently estimated to be approximately 1,380 GWh per annum, equivalent to annual greenhouse emissions of 1.4 Mt CO_2-e in 2006. Correspondingly, the net energy consumption from all types of close control air conditioner products in New Zealand have been estimated to be approximately 138 GWh per annum, equivalent to annual greenhouse emissions of 97 kt CO_2-e in 2006.

If the current market and technology trends continue, the net energy resulting from the use of CCAC is projected to grow to over 1,820 GWh in Australia and around 182 GWh in New Zealand by the year 2020. These estimated BAU projections of energy usage depend on assumptions and data regarding the sales, power consumption and usage characteristics of CCAC. Detailed projections of sales are provided in section 5.5, while Appendix 6 and Appendix 11 provide the power consumption and usage characteristics. In summary, the BAU EER for CCAC by category was estimated to increase by 1.0 per cent per annum over the period of the analysis (2000 – 2020), with the EER figures shown in Table 2 used for the 2006 BAU EER. These EER data were obtained by surveying the suppliers shown in Section 1.6. This data suggests that the average EER for close control units has only increased marginally over the last decade and compares to the BAU energy efficiency improvement used in previous comfort air conditioning RIS of 0.4 per cent per annum (Syneca 2003).

Usage of CCAC is based on consultation with Australian/New Zealand suppliers. Sensitivity analysis of the usage data was not conducted as there is very little variation in the loads cooled by these units (computer and communications equipment that operate constantly). The BAU scenario assumes that usage does not change over the forecast period.

Table 1, page 12, provides the estimated net energy consumption for all Australian states and territories, and New Zealand for the years 2000 to 2020 under the BAU conditions.

4.2 Voluntary Efficiency Standards

Voluntary efficiency standards are a policy option that encourages equipment suppliers and/or manufacturers to voluntarily meet certain minimum energy efficiency levels, i.e. in the absence of regulation.

This option can be effective when there are a relatively small number of suppliers with highly similar products and they are willing to agree to the introduction of the voluntary efficiency standards for a product. This may occur when the few suppliers perceive there will be advantages in meeting such standards in terms of public relations and brand positioning. However, when there are large numbers of suppliers it is more difficult to obtain agreement to the voluntary efficiency standards from a sufficient number of suppliers for the voluntary efficiency standards to have a significant impact on the energy efficiency of the products entering the market.

It is estimated that there are 4 importers and one local manufacturer of CCAC serving the Australian market and 4 importers in New Zealand. In theory then it might be possible to get all the suppliers to agree on a voluntary efficiency standards. However consultation with industry stakeholders indicated that suppliers did not unanimously support the use of voluntary efficiency standards and without such support the standards would not be effective.

The reason suppliers would not support a voluntary standard is that those who complied with the standard expect they will be penalised and loose market share to those who do not comply and who supplied cheaper, but less efficient products, Without full support from the industry a voluntary performance standard approach will fail, so a voluntary standard is not a viable option for the Australian/New Zealand market.

Surveys of CCAC industry stakeholders, including suppliers, and data centre operators, revealed:

- Any equipment standards introduced should be mandatory and that MEPS should be implemented for Australia;
- The mandatory MEPS should apply to the internal CCAC unit, both water and air cooled, but not the external condensers or other components as these are varied to suit each clients requirements; and
- A voluntary program might be effective in raising awareness of energy efficiency issues. However, it was generally felt that without code and legislative reinforcement there was no ongoing incentive to maintain compliance, especially from what is considered the "bottom end" of the close control air conditioner market place.

There appears to be no international examples of voluntary energy efficiency standards relating to CCAC.

4.3 Voluntary Certification Program

A voluntary electrical performance certification program involves suppliers submitting their products for objective testing and, if the products perform satisfactorily, then the products can be labelled as 'certified' to fulfil the required energy efficiency performance requirements or listed as certified products on a relevant website etc. The intention is that this provides information and encouragement for purchasers to purchase more efficient products and motivates suppliers to improve the efficiency of their products.

Internationally, manufacturers of air conditioners have participated in the testing and rating of their products by using standards such as those of the Air Conditioning and Refrigeration Institute (ARI) who represent North American suppliers and EUROVENT, who represent European air conditioning, ventilating and refrigeration manufacturers. There is only one supplier currently registered on the EUROVENT database of certified products and the EER of these product are not listed (EUROVENT 2007). The ARI certification program does not cover CCAC. Therefore, there seems to be limited application of the international models for certification programs applicable to CCAC.

The purpose of these rating or "certification programmes" is to create a common set of criteria for rating products. Through specification of certified products, the engineer's tasks are made easier, since there is no need for carrying out detailed comparison and performance qualification testing. Consultants, specifiers and users can select products with the assurance that the catalogue data is accurate.

These international programs do not act as certification programs in the sense of signifying that the products have met a specific minimum energy efficiency requirement. The programs act to rate the performance of the CCAC against agreed international standards.

It might be possible to convince all close control air conditioner suppliers to use the "certified" ratings of the CCAC to develop a voluntary certification program for the Australia and New Zealand. "Certified" products could be listed on a website and an education campaign conducted in the industry to raise awareness of the certification program.

The difficulty with the voluntary certification program is that like other voluntary information-type programs, there is a tendency for only the better performing products to participate in the program in an attempt to gain a marketing advantage over cheaper and poorer performing products. There is no market advantage for less efficient products to participate in the program, or even for producers who have products that vary from efficient to less efficient to participate, so any program is likely to cover only a proportion of the CCAC available.

Another difficulty for a voluntary certification program is that this type of program will work best in a market where consumers are actively looking for efficient products but, as previously discussed, the energy efficiency of CCAC is unlikely to be the primary driver in the selection of most CCAC. Consequently there is no strong underlying market driver which a certification program can tap into and use to produce a market transformation towards the use of more efficient CCAC.

4.4 Dis-endorsement Label

The principle of a dis-endorsement label is to highlight that a product is energy inefficient. Manufacturers and suppliers will not apply such a negative label on their products voluntarily, so this must be a mandatory scheme. Manufacturers and suppliers would be expected to strongly oppose the introduction of such a scheme.

A dis-endorsement label is very unlikely to be effective for CCAC, as they are not a retail item but are sold on the basis of their technical specifications and price. Consequently the label would not be seen until the product is being installed, and it would only be seen by the installation contractor and probably not by the end-purchaser, the building owner or developer. The resulting impact of the dis-endorsement label scheme is therefore likely to be minimal.

The introduction of a dis-endorsement label program would therefore appear to be unjustified and inappropriate in Australia and New Zealand.

4.5 Levies and Emissions Trading

One way of increasing the uptake by the market of more energy efficient CCAC is to increase the purchase cost or operating costs of the inefficient products from the consumer's perspective. This can be done by raising the price of the CCAC via a levy or by raising the price of the electricity the product consumes via a levy or an emissions trading scheme. These options are discussed below.

Equipment Levy

The equipment levy involves imposing a levy upon inefficient CCAC which would raise their price and fund programs which would redress the greenhouse impact of equipment energy use. Two variations of this option are considered:

- The proceeds from the levy are diverted to greenhouse-reduction strategies unrelated to product efficiency (i.e. the levy is 'revenue-positive').
- The proceeds are used to subsidise the costs of more efficient products so that any cost differentials between these and inefficient CCAC are narrowed or eliminated (i.e. the levy is 'revenue-neutral').

There are significant issues surrounding the measurement of equipment, the costs of collecting such a levy and the allocation of the resulting funds which would need to be addressed in order to implement this option. It is also unclear how such a levy scheme could be efficiently managed and whether the costs of implementing such a scheme could be justified in terms of its impact. It is also understood that the use of such levies are not currently government policy, so this option will not be considered further.

Electricity Levy

At present, the electricity prices faced by consumers reflect – however imperfectly - the cost of the capital invested in the electricity generation and transmission systems, operating and maintenance costs and taxes. They may also reflect the costs of controlling pollutants such as oxides of nitrogen and sulphur (NO_x and SO_x), for which emissions standards are currently in force in some areas. They do not reflect the value of greenhouse gas emissions, or rather they implicitly assign a value of zero to such emissions. In other words, greenhouse costs are not internalised in the electricity price. However, through the Federal Government MRET program and New South Wales' NGAC programs, some cost of greenhouse gas emissions is imposed.

The Australian Government has decided to implement an emissions trading scheme and therefore it is very unlikely that an electricity levy would also be considered.

A low level electricity levy is currently already applied in New Zealand. The revenue from this levy is presently used to fund the operations and functions of the Electricity Commission, including some targeted electricity efficiency research and capital upgrade projects. However, none of these projects currently relate to the use or efficiency of CCAC.

Carbon Pollution Reduction Scheme (CPRS)

In 2007, the Australian Government formally announced its intention to introduce a Carbon Pollution Reduction Scheme (CPRS) (previously known as the Emissions Trading Scheme) by 2010. Economic literature suggests such a scheme can be used as an effective policy tool for internalising the costs associated with greenhouse gas emissions. However, even under a CPRS, there may still be a role for complementary policies.

Energy efficiency measures have been proven in some circumstances as a cost-effective method for households and businesses to reduce energy consumption while delivering greenhouse gas abatement. All other things being equal, the increase in costs of energy resulting from a CPRS should encourage households and businesses to improve the efficiency of their energy use. However, in some instances, market failures and/or other factors may act to mitigate some of the impacts of a CPRS, and therefore complementary energy efficiency measures may be appropriate.

For example, the presence of split incentives (such as between building owners and tenants) may lessen the effectiveness of a CPRS in delivering an 'optimal' investment in energy efficiency in tenanted dwellings.

In other instances, the transactions costs of investing in energy efficiency may outweigh the marginal benefits of such investments, even in a CPRS environment. For example, the potential energy savings to consumers may be small, relative to the time and effort required to calculate the associated life cycle costs when purchasing a product. In this circumstance, it is possible that a CPRS will not deliver an optimal investment in energy efficiency. A similar situation can arise if there is imperfect information, such as a lack of comparative energy consumption data on energy bills.

Taking into account the above factors, in some situations it is possible that the increase in electricity prices induced by a CPRS may result in a relatively small rise in demand for energy efficient products. Therefore it is possible that the carbon abatement costs induced by complementary energy efficiency measures may be lower than those induced solely under a CPRS. In such cases, it may be beneficial to consider energy efficiency policies, including MEPS and energy labelling, in conjunction with a CPRS.

In terms of general policy, this is consistent with MEPS complementing the CPRS, as noted in the *Report of the Task Group on Emissions Trading* (Australian Government 2007):

> *"Emissions trading is not a panacea. A comprehensive response will involve complementary measures that address market failures not corrected by the emissions trading scheme. ... There will also be a continuing role for policies that improve information, awareness and adoption of energy-efficient vehicles, appliances and buildings." (p 12)*

> *"Beyond information-based policies, energy efficiency policies could target areas where market barriers are likely to be more fundamental and enduring. This is likely to be in areas where consumers make infrequent decisions and where it is difficult to judge the energy and emissions implications. There is a good case for continuing the development of well-designed and consistent regulated minimum energy standards for buildings and household appliances. Purchases of energy-efficient products can have a large impact on aggregate emissions over time, and reduce the impact on household budgets of any rise in carbon prices." (p 135)*

More recently, in June 2008 Professor Garnaut released a draft report on CPRS and stated in that report:

> *"The introduction of an emissions trading scheme will increase returns from adopting opportunities to lower emissions. However, market failures will impede adoption of opportunities that may be privately cost-effective. Policies that tackle these market failures would lower the cost of mitigation across the economy."*[5]

While the design details of an Australian CPRS a currently being developed, a possible methodology is suggested and indicative cost-benefit calculations are made in Appendix 8

[5] Garnaut CLIMATE CHANGE REVIEW, Draft Report, June 2008 P442

to illustrate the possible impacts of such a scheme. It should be stressed that these calculations are indicative only.

New Zealand Emissions Trading Scheme

In September 2007, the New Zealand Government announced an in-principle decision to use an Emissions Trading Scheme (ETS or scheme) as its core price-based measure to reduce greenhouse gas emissions and enhance forest carbon sinks. The intent is to introduce a scheme covering all sectors and all gases.

Public submissions on the Climate Change (Emissions Trading and Renewable Preference) Bill are currently being considered by a Parliamentary Select Committee which is due to report on 10 June 2008. The legislation is expected to introduce a New Zealand specific emissions trading scheme and to create a preference for renewable electricity generation by implementing a moratorium on new fossil-fuelled thermal electricity generation - except to the extent necessary to ensure the security of New Zealand's electricity supply.

The draft legislation proposes to implement the scheme from 2008, with various sectors phased in over the years to 2013. It was proposed that the first sector included will be forestry, followed by liquid fossil fuels, then stationary energy and industrial processes, followed by agriculture, and waste. It is expected that New Zealand units would be the primary domestic unit of trade and would allow purchase from, and sale to, international trading markets.

Feedback from stakeholders, including Maori, will inform ultimate decisions on coverage staging and design of the scheme, and the form of legislation required to implement it.

The scheme is one of a wide range of policies and measures – including the New Zealand Energy Strategy and the Energy Efficiency and Conservation Strategy - to reduce domestic greenhouse gas emissions and contribute to sustainable outcomes for New Zealand. Together the measures are intended to bring net emissions below business-as-usual levels and comply with New Zealand's international obligations, including existing commitments under the Kyoto Protocol.

Conclusions

The two levy options proposed are not currently government policy and would require extensive consultation at the highest levels of government. Hence these options are not worthy of consideration until such time as government policy changes to favour levy schemes.

The introduction of an emissions trading scheme is Australian Government policy, but it is unclear if a CPRS alone will impact on the energy efficiency of CCAC.

4.6 Mandatory Energy Labelling and Performance Information

Mandatory energy labelling requires the application and display of a comparative energy performance label on products and packaging. It is to provide consumers with a visual display of the performance of one product relative to another. Energy labelling requires the establishment of relative energy levels and a rating system.

As CCAC are business products and are sold on the basis of their technical specifications and price. Stakeholder consultation suggests that energy use characteristics are not important in influencing purchasing decisions. Therefore, energy efficiency labelling is not likely to affect the market for more efficient CCAC units. Mandatory Energy Rating Labelling for business products has not been implemented in Australia for these reasons. While it is voluntary for three-phase air conditioners which are sold into the business/commercial market, there is no evidence to date that suppliers are labelling or using the program. This is further supported by the international review of programmes (see Appendix 3), where it was found that no international labelling programmes exist for this product group. The resulting impact of the mandatory energy labelling scheme is therefore likely to be minimal.

Providing performance information to purchasers in some other way, perhaps through a website listing all products and their performance characteristics, or through printed information supplied with the product specifications, might be more appropriate for the CCAC market. Such information is likely to be used by the approximately 50 per cent of the market who are regarded by suppliers as sophisticated customers, and it may marginally influence their choice of equipment. However, these customers tend to buy from more high-quality suppliers, who already supply information on their equipment performance. So the mandatory presence of this information may not greatly affect the decisions of these customers.

For the less sophisticated 50 per cent of customers, it is unclear the extent that the supply of performance information will influence their purchasing behaviour. Suppliers believe that the upfront price of equipment is the major determinant of these equipment purchasers, hence performance information may have little impact on the efficiency of CCAC equipment purchased.

Mandatory performance information for CCAC therefore may influence the purchase decision of some customers of CCAC but it is considered unlikely on its own to greatly affect equipment efficiency in the market. The effect of a Mandatory Energy Labelling and Performance Information was modelled and is shown in Table 3. As the benefit cost ratio is very low and the impacts small, this option was not examined any further. Sensitivity of the assumptions was tested and even when government promotion costs were reduced to zero, the BCR was still below 0.6.

Table 3: Summary Data for Mandatory Energy Labelling and Performance Information

Item	Australia – 7.5% Disc Rate	New Zealand – 5% Disc Rate
Energy Saved (cumulative)	26 GWh	3 GWh
GHG Emission Reduction (cumulative)	25 kt CO_2-e	2 kt CO_2-e
Total Benefit	$2.5M	$0.3M
Total Cost	$5M	$0.6M
Benefit Cost Ratio	0.5	0.5

Assumptions: BAU Efficiency is improved by 5%, Incremental equipment costs of efficient equipment are 2% higher. Government costs are increased by $200,000/year to cover promotion and marketing.

The calculations in Table 3 above were based on the following cost assumptions:

- Costs of government administration and promotion of a labelling scheme were estimated at $200,000 per annum. This is based on costs of administering and promoting labelling of domestic appliances.
- Unit costs (to the consumer) were based modelled with a very conservative ratio of every 1% increase in efficiency required a 0.5% in costs of equipment. The same ratio of improvement of efficiency to incremental costs of equipment from the survey found that the every 1% increase in efficiency required a 1.5% increase in costs. The survey ratio was used in the MEPS modelling
- Sensitivity was undertaken and if the ratio of efficiency to incremental cost used for MEPS is applied, the BCR reduces to 0.2. Compared to 0.6 used to illustrate the labelling program effects in the RIS. There is no reason to undertake further sensitivity when the best case figure only shows a BCR of 0.6

Market Response to Labelling

The labelling program is estimated to increase the efficiency of CCAC by 5% above BAU. The Modelling of the MEPS Programme uses 10%. The 5% efficiency is also a best case assumption (assumed to have half the impact compared to MEPS). Sensitivity testing on the lower efficiency improvements would not be necessary.

Notwithstanding the above, if the cause of CCAC buyers making sub-optimal purchasing decisions is primarily caused by an information gap (rather than being operating cost-insensitive), then a labelling scheme or information provision may have some merit. Such information could be provided on a stand-alone basis or in conjunction with a MEPS. As with any proposed information provision campaign it is extremely difficult to gauge likely behavioural responses. The analysis throughout this RIS suggests that the mandatory nature of MEPS is likely to provide the greatest response (and hence benefits) compared to the alternatives, however, it is a purpose of this RIS to receive stakeholder feedback concerning the likely efficacy of an energy labelling regime or information provision for CCACs.

4.7 Mandatory Minimum Energy Performance Standards

MEPS aims to remove the worst performing products from the marketplace, rather than promoting the best. In Australia and New Zealand this is achieved by including the energy performance criteria within an Australian/New Zealand Standard which is mandated through legislation. A proposed MEPS that covers all CCAC is described in the following section.

Internationally, the only MEPS levels for CCAC currently established are those set by the Californian Energy Commission. The post-2004 levels are more stringent than the US Department of Energy (DOE) specified levels for commercial unitary air conditioners, as:

- the minimum EER is higher than those set by the DOE; and
- the test conditions (ASHRAE 127-2001) result in lower EERs.

It is proposed that a MEPS be established for CCAC in Australia and New Zealand with the following characteristics:

- MEPS levels will be based on the revised ASHRAE Standard 127-2007 rating points;
- Only the indoor air conditioning unit will be rated;
- The external air conditioner condenser can be selected to suit the specific jobsite requirements;
- A fixed condensing temperature will be used for both air and water cooled units, which will level the playing field between the two technologies;
- All units will be rated at 50PSI external static pressure.

The value of the recommended MEPS levels and the estimated improvement on the energy efficiency are shown in the table below.

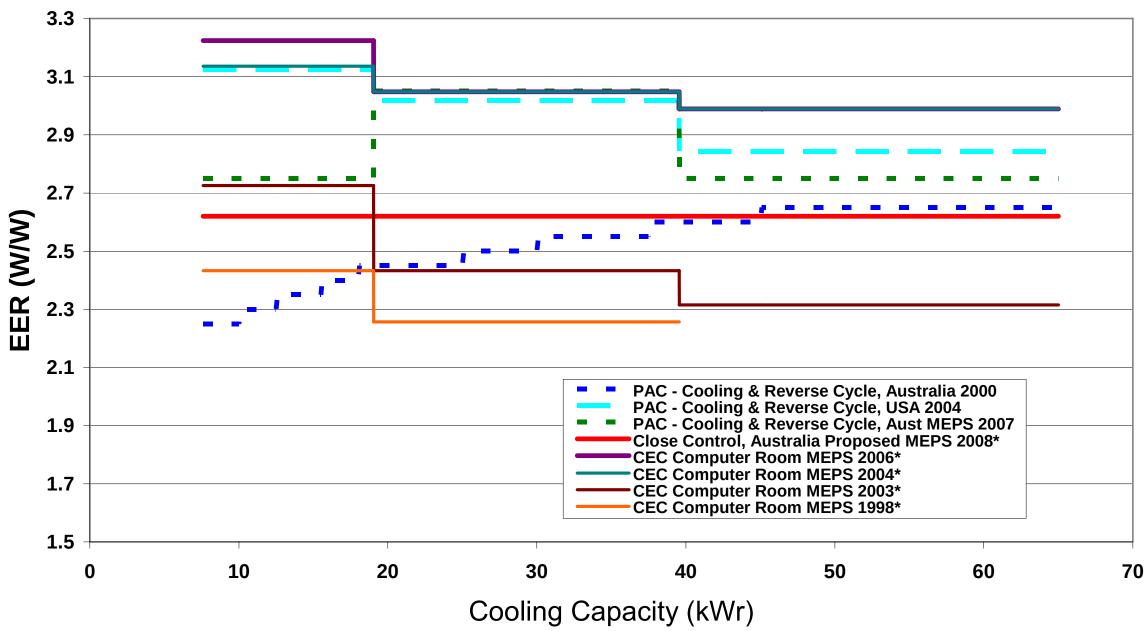
Table 4: Current Average and Proposed MEPS for Close Control Air Conditioner (Rating Indoor Unit Only)

Unit Size kWr	Current Average	Proposed MEPS	% Improvement
<19.05	2.26	2.62	16.1%
>=19.05< 39.5	2.17	2.62	20.5%
>=39.5< 70.0	2.10	2.62	24.8%
>=70.0	2.37	2.62	10.4%
Weighted Average	2.12	2.62	23.6%

Figure 7 shows the various MEPS levels of the Australian/New Zealand, USA DOE and CEC in comparison. The proposed Australia and New Zealand close control air conditioner MEPS levels for 2008 are shown as a solid red line.

Although the test for computer room air conditioners produces lower EERs (compared to the ISO test standard for comfort air conditioners), the CEC MEPS in 2004 for computer room air conditioners are approximately equal to those in force for packaged air conditions in Australia/New Zealand in 2007. The proposed Australia/New Zealand close control MEPS levels are between the CEC 2004 and 2003 computer room air conditioner MEPS levels.

Figure 7: CEC MEPS levels for Computer Room AC and Package AC Units



Note: The * indicates that the test for the CEC Computer Room MEPS is not based on the same test conditions

Initially, the proposed MEPS levels for CCAC were based on the findings presented in the report *Analysis of the Potential Policy Option: Close Control Air Conditioners* (EnergyConsult 2004). Following extensive consultation with the suppliers, these MEPS levels were modified to take into account local product availability and the way that product is specified in Australia and New Zealand. In particular, the proposed MEPS levels from the 2004 report were identical to the California MEPS levels, where the MEPS programme that had been operating for several years and progressively increased. The proposed MEPS levels were reduced to allow for the fact that earlier levels had not been applied in Australia, and as the majority of CCAC product sold in California was now glycol or water cooled, and hence technically more capable of meeting these more stringent levels.

Testing Standards and Program for MEPS

For the proposed MEPS to be introduced a testing standard for the internal units of CCAC would need to be developed.

After consultation with stakeholders, it is recommended that the testing standard be based on the revised ASHRAE Standard 127-2007. The testing standard will need to be published as a new Australian/New Zealand Standard. A working group to develop this standard has been established under EL15/16.

The compliance and testing program for the MEPS will involve:

- The suppliers' computer simulation software will be used for registration, as is currently done under the Californian Energy Commission MEPS system;
- Physical testing of units will be done under the E3 Check Testing Programme; and
- Close control air conditioning units must be registered to comply with MEPS on the MEPS implementation date.

4.8 Conclusions

A preliminary conclusion of this consultation RIS is that the voluntary options presented in the earlier sections are either not effective or practical, or else they are not appropriate. Also importantly, they would not be supported by industry suppliers. These alternative options are assessed as less effective at reducing GHG emissions from BAU. In addition, mandatory labelling is not practical or appropriate for CCAC.

The proposed MEPS regime for CCAC is to be a mandatory scheme, as when industry was consulted there was concern raised that a voluntary scheme would not be effective as a mandatory scheme which produces a level playing field.

In conclusion, the most effective way to reduce GHG emissions for CCAC is to introduce MEPS. This is the option that is subsequently assessed in this study in terms of costs, benefits and impacts on consumers, taxpayers and industry.

5 Cost-Benefit and Other Impacts

This section presents the costs, benefits and other impacts of the MEPS for CCAC. Most of the assumptions that apply to Australia also apply to New Zealand, as the products likely to be sold in New Zealand are similar to Australia. As such, results that are commonly applicable to both Australia and New Zealand do not contain a direct reference to either country. In other cases, results and discussions are provided concurrently for both countries as the analysis reflects the results based on differing conditions specific to each country. The product stock modelling framework is explained in Appendix 4: Stock and Sales. All NPV analysis performed in the RIS uses real discount rates.

5.1 Costs to the Taxpayer

The proposed MEPS program will impose costs on governments. Some of these are fixed and some vary from year to year. The government costs comprise:

- Administration of the program by government officials (salaries and overheads, attendance at E3 and Standards meetings etc);
- Cost of maintaining a registration and approval capability;
- Random check testing to protect the integrity of the program;
- Costs of producing leaflets and other consumer information; and
- Consultant costs for standards development, market research and analysis, Regulatory Impact Statements, etc.

The government costs have been estimated as follows, which are similar to the allocations made for other products regulated by E3:

- Salary and overheads for officials administering the program: $50,000 per year;
- Check testing, research and other costs underpinning the program: $75,000 per year, half of it borne by the Commonwealth and the other half by other jurisdictions in proportion to their population, in accordance with long-standing cost-sharing arrangements for E3 activities; and
- Education and promotional activities at $25,000 per year.

Hence total government program costs are estimated to be $150,000 per annum. These costs have been included in the national cost-benefit analyses in later sections.

5.2 Business Compliance 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 – which involves maintaining awareness of legislation and regulations, and the costs of keeping abreast of changes to regulatory details.
- Permission – which involves applying for and maintaining permission for registration to conduct an activity, usually prior to commencing that activity.
- Record Keeping – which involves keeping statutory documents up-to-date.

The Purchase Cost category – which involves the costs of all materials, equipment, etc, 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 cost-benefit analysis as increased purchase costs to the consumer.

Therefore the tasks, categories and costing assumptions are provided in Table 5.

Table 5: 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 to AS/NZS	$2500 per model supplied	Previous RIS (Syneca 2003)
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 2006*

The total costs of business compliance for the MEPS are in proportion to the number of businesses importing/supplying CCAC and the number of models supplied. Overall, some 82 models are estimated to be currently supplied from approximately five suppliers, or an average of approximately 16 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 6.

Table 6: Business Compliance Costs for Close Control Air Conditioner MEPS

Category	Task	Costs / business	Costs / model
Education	Train staff, keep up-to-date with regulations	$3,200	$195
Permission	Testing to AS/NZS	$41,000	$2,500
Permission	Complete MEPS registration	$5,248	$320
Record Keeping	Maintain documents for 5 years	$320	$20
Total		$49,768	$3,035

These costs represent approximately $248,840 to the suppliers in the first year of MEPS, based on five close control air conditioner suppliers. This cost-benefit assumes that approximately 20 per cent of the models are replaced each year and hence are required to be registered. Sensitivity analysis of these estimated costs shows that if these compliance costs increase by 100 per cent, the effect on the cost-benefit is minimal. Appendix 12: Annual Cost Inputs for RIS Model shows the annual cost inputs for the RIS analysis.

5.3 Industry, Competition and Trade Issues

Industry Issues

This section reviews the impacts of the proposal/s on suppliers. In the close control air conditioner product supply market, there are estimated to be 5 major suppliers; with one supplier manufacturing in Australia and the remaining suppliers import product into Australia/New Zealand. These importers and manufacturers vary in size, however those consulted during stakeholder meetings have responded that they have the internal capacities to respond to the costs that the proposed regulations will place on them. There is no reason to assume that new entrants to the market would not also have similar internal capacities, so these costs should not be a barrier to greater competition. The costs of efficiency testing will be incurred by the businesses as they will be required to test their product to the new Australia/New Zealand Standard (which is based on ASHRAE 127-2007 and is currently in draft).

Most energy efficiency regulations envisage an increase in average equipment costs due to changes in the product components to improve the energy efficiency of the product. This is likely to be the case with CCAC. Retail/contractor price increases due to the requirements of the close control air conditioner MEPS are modelled in the RIS and range from 8 per cent – 12 per cent for both air cooled and water cooled CCAC. These incremental price increases are modelled to gradually reduce by 5 per cent per annum from 2009 to reflect increasing competitiveness of the industry due to greater availability of MEPS compliant product. This gradual reduction in the incremental costs associated with more efficient MEPS compliant CCAC results in an incremental cost increase of 5 – 7 per cent by 2020. To test the sensitivity of this parameter, the gradual reduction in the incremental costs was removed and the overall benefit cost ratio changed from 6.4 (as shown in Table 15) to 5.1.

It should be noted that the cost data used in the analysis was provided via surveys of suppliers indicated in Section 6. These costs are considered to be very high compared to the 1.5 per cent increase in costs used in the previous RIS for three-phase air conditioners (Syneca 2003). Table 7 presents the estimated incremental price increase due to the MEPS requirements by year for the Base scenario modelled in the RIS.

Table 7: Incremental Price Increase Due to MEPS Requirements by Year

Category (kWr)	2009	2010	2011	2012	2013	2014	2015	2020
Air Cooled < 19.05	$1,760	$1,672	$1,588	$1,509	$1,434	$1,362	$1,294	$1,001
Air Cooled >19.05 - 39.5	$2,900	$2,755	$2,617	$2,486	$2,362	$2,244	$2,132	$1,650
Air Cooled >39.5 - 70.0	$4,200	$3,990	$3,791	$3,601	$3,421	$3,250	$3,087	$2,389
Air Cooled > 70.0	$7,440	$7,068	$6,715	$6,379	$6,060	$5,757	$5,469	$4,232
Water Cooled < 19.05	$1,680	$1,596	$1,516	$1,440	$1,368	$1,300	$1,235	$956
Water Cooled >19.05 - 39.5	$2,700	$2,565	$2,437	$2,315	$2,199	$2,089	$1,985	$1,536
Water Cooled >39.5 - 70.0	$3,800	$3,610	$3,430	$3,258	$3,095	$2,940	$2,793	$2,161
Water Cooled > 70.0	$6,000	$5,700	$5,415	$5,144	$4,887	$4,643	$4,411	$3,413

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 Section 5.4 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.

The supplier's ability to use internationally recognised testing standards may reduce the need for testing of products supplied from or to different regions.

Trade, GATT and TTMRA issues are discussed in detail in Appendix 7.

Competition

Implementation of the proposed MEPS requirements is unlikely to affect the competitiveness of one supplier over another. The proposed MEPS addresses the energy efficiency performance of the close control air conditioner, not the overall performance of the unit, so consumer choice regarding performance features and characteristics will not be affected. Industry representatives have reported that CCAC that meet the required MEPS are readily available. They have also noted that about 25 per cent of currently available models would not meet the proposed MEPS levels. This percentage of non-compliant models is similar to the reduction in models found under other air conditioning MEPS (Syneca Consulting 2003). Also, given that the majority of CCAC units are already imported and existing suppliers would welcome the introduction of a MEPS, is unlikely the MEPS will affect competition by penalizing importers.

It is suggested that the MEPS is implemented as early as possible, but not before 1 July 2009, which provides 4 years from the announcement of the proposal to enable industry to comply with these levels. Government/industry consultation has suggested that a 4 year period is appropriate for MEPS notification, based on product development lifecycles (i.e., the time required to adjust product design to meet the new MEPS levels). However, the industry has reported that MEPS compliant CCAC are available for use now and would be easily available by the suggested implementation date of July 2009.

The proposed MEPS is expected to remove the 25 per cent of the least efficient models from the market, so this will affect consumers' choice of models. However, the proposed MEPS does not penalise products with additional features, as the MEPS only affect the efficiency which is not generally dependant on the features or other characteristics available in the product. Consequently, MEPS is unlikely to cause any significant impact on the availability of additional features in models and hence consumer choice regarding such features and characteristics in New Zealand and Australia.

The proposed introduction of MEPS in Australia and New Zealand, combined with other international programmes, may provide a spur for increased innovation and performance. As all importers will have the same requirements for their products, they will all be on an equal footing and still be able to compete in their normal market processes.

5.4 Consumer Costs and Benefits

The assessment of costs and benefits from the perspective of the consumer is examined in this section. The benefits to the consumer include the estimated electricity cost savings from a more energy efficient product, while the costs include the estimated incremental price increase due to suppliers meeting the MEPS requirements.

Consumer Perspective

Calculations of the cost-benefit performed with the RIS model are shown in Figure 8 for Australia and in Figure 9 for New Zealand. The undiscounted benefits peak at $33M for Australia and $3.5M for New Zealand in 2019, while the highest costs are estimated in 2009 at $4.6M for Australia and $0.5M for New Zealand.

Figure 8: Consumer Cost-Benefit of MEPS (Aus)

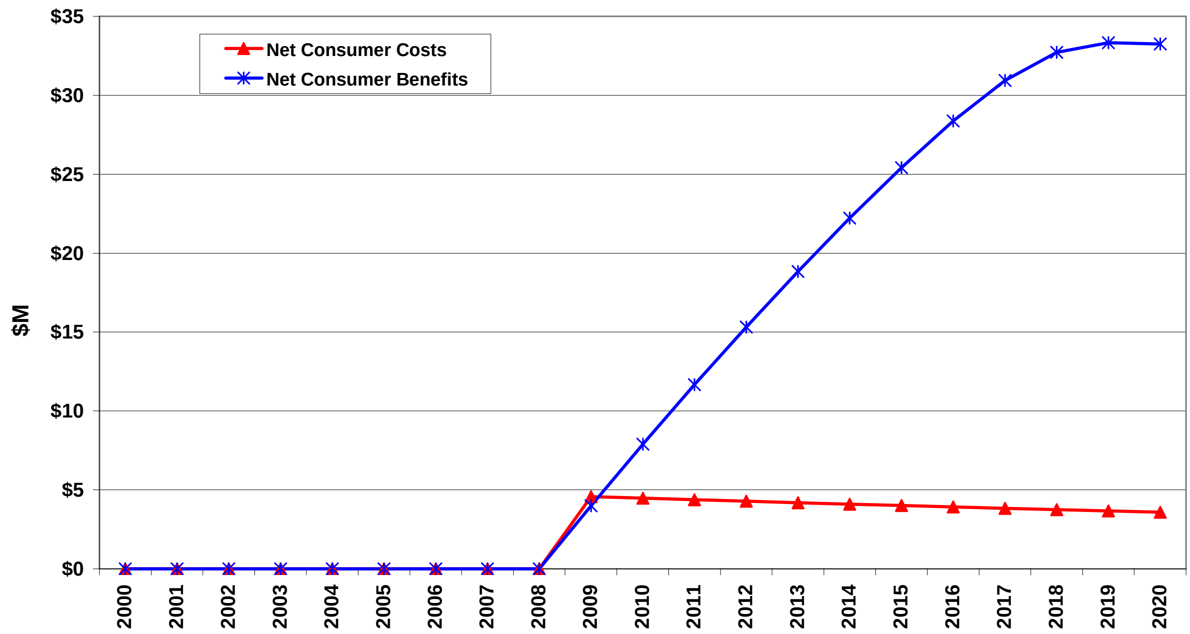
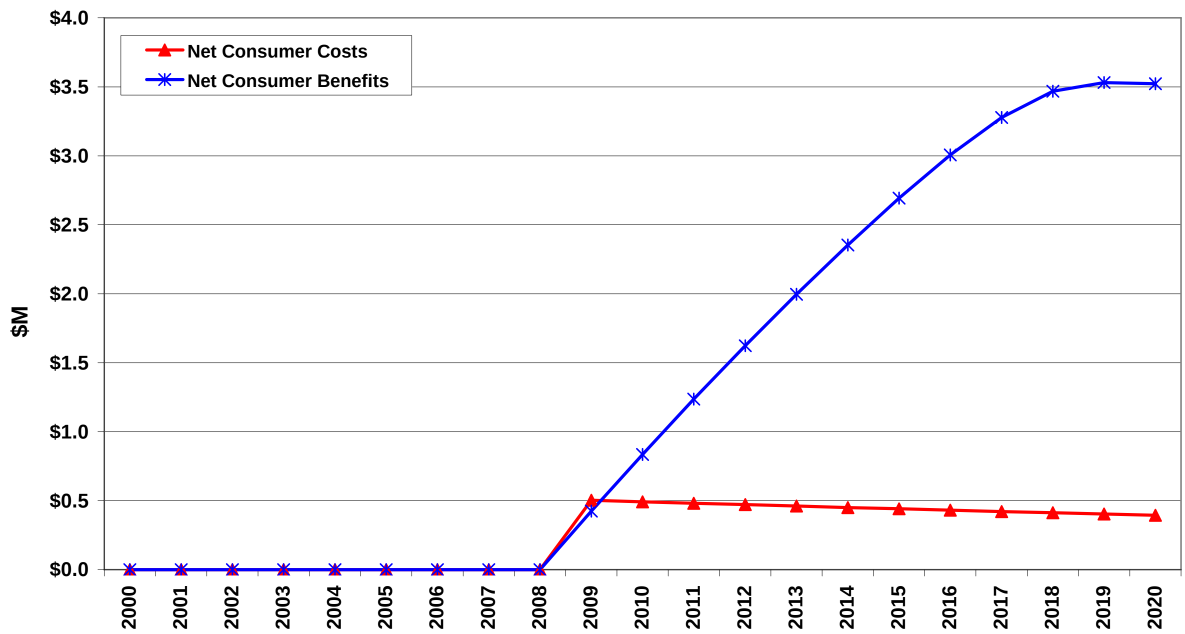


Figure 9: Consumer Cost-Benefit of MEPS (NZ)



The benefits increase from 2008 to 2020 in line with the increase of the MEPS compliant product in the overall stock of CCAC. The consumer benefits continue to grow as a result of cohorts of new, more efficient products (compared to the BAU) coming into use each year, peaking in 2019 as the increase in BAU efficiency comes closer to the MEPS induced efficiency gains.

As noted earlier in Section 5.3, the estimated cost increase due to the MEPS could be up to 12 per cent in 2008 and then it gradually reduces. The net consumer cost shows this gradual reduction from 2008 to 2020. The data for New Zealand shows a similar result.

The individual consumer costs and benefits of the MEPS in 2008 are shown in Table 8. The present value of the benefits is discounted over an estimated average 10 service year life of the products (see Appendix 4).

Table 8: Present Value Costs and Savings – Close control air conditioner MEPS, 7.5% Disc Rate

Category	Incremental Price Increase	Estimated Annual Energy Savings (kWh/yr)	Energy Costs Savings/year[1]	Present Value Cost Savings (10yrs)[1]
Air Cooled < 19.05	$1,760	4,003	$640	$4,396
Air Cooled >19.05 - 39.5	$2,900	15,084	$2,413	$16,566
Air Cooled >39.5 - 70.0	$4,200	32,374	$5,180	$35,555
Air Cooled > 70.0	$7,440	24,276	$3,884	$26,661
Water Cooled < 19.05	$1,680	4,003	$640	$4,396
Water Cooled >19.05 - 39.5	$2,700	15,084	$2,413	$16,566
Water Cooled >39.5 - 70.0	$3,800	32,374	$5,180	$35,555
Water Cooled > 70.0	$6,000	24,276	$3,884	$26,661

1. The costs savings are based on an Australian and New Zealand average tariff of 16.0c/kWh.

As Table 8 demonstrates, the value of the benefits are substantially larger (by a factor of at least 2.5) compared to the costs regardless of the product category. Many of the product categories demonstrate benefits that are 6 to 8 times greater than the costs.

Cost of Forgoing Product Features

The design of CCACs are controlled by standards/specifications covering areas such as electrical safety, refrigerants and other performance issues. The MEPS does not affect the power consumption of various features of products and hence there is no forgoing of product features due to the MEPS. The improvement to energy efficiency required to meet the MEPS can easily be achieved by changes to the design of the product and will not result in the loss of product features. Consultation with suppliers confirmed this conclusion.

Distributional Impact

This section typically provides an analysis of impacts on consumers with respect to patterns of usage different to the base model used for the RIS analysis. These impacts are not modelled in this RIS as industry representatives confirm that CCAC are always operated under similar conditions by different consumer groups. For instance the units are the same whether installed for telecommunications facilities or computer server rooms. Also the operation times for these units do not differ by different customer uses. Therefore, due to the nature of the load, the RIS model is based on a percentage of close control units operating for 24 hrs every day of the year, with little variation in the devices/room being cooled. It is estimated and modelled in this RIS that 65 per cent of units are operating at full capacity, 24 hours/every day, regardless of the user group.

5.5 Impact on Energy Use and Greenhouse Gas Emissions

Sales Forecasts

Since the MEPS criteria apply only to new products entering the market, it will be a number of years before these measures impact on the stock of existing products to any major extent. Therefore two scenarios have been modelled in the RIS: a Base Sales scenario with product sales continuing to increase at a rate of approximately 2 – 3 per cent per annum and a Low Sales scenario with sales only increasing by 0.4 per cent per annum from 2009. Forecast sales of CCAC to 2020 by category are shown in Figure 10 for Australia and in Figure 11 for New Zealand.

Annual sales by category of product are forecast from trends produced from surveys of sales provided by industry. The historical and forecast sales figures developed for the RIS take into account the mix of effectively competing technologies (air cooled and water cooled CCAC). Recent trends show that the sales of water cooled CCAC are increasing marginally and will probably continue to increase over the next 10 to 15 years. The increasing sales trend is linked to the need to cool increasing numbers of end-user equipment, typically communications and IT/computer related installations. The cooling loads for this type of equipment and the sales/stock of servers and similar installations affect the sales of CCAC. Detailed assessment of the sales of CCAC is provided in Appendix 4: Stock and Sales.

Figure 10: Forecast Sales of Close Control Air Conditioners - Base Sales Scenario Australia

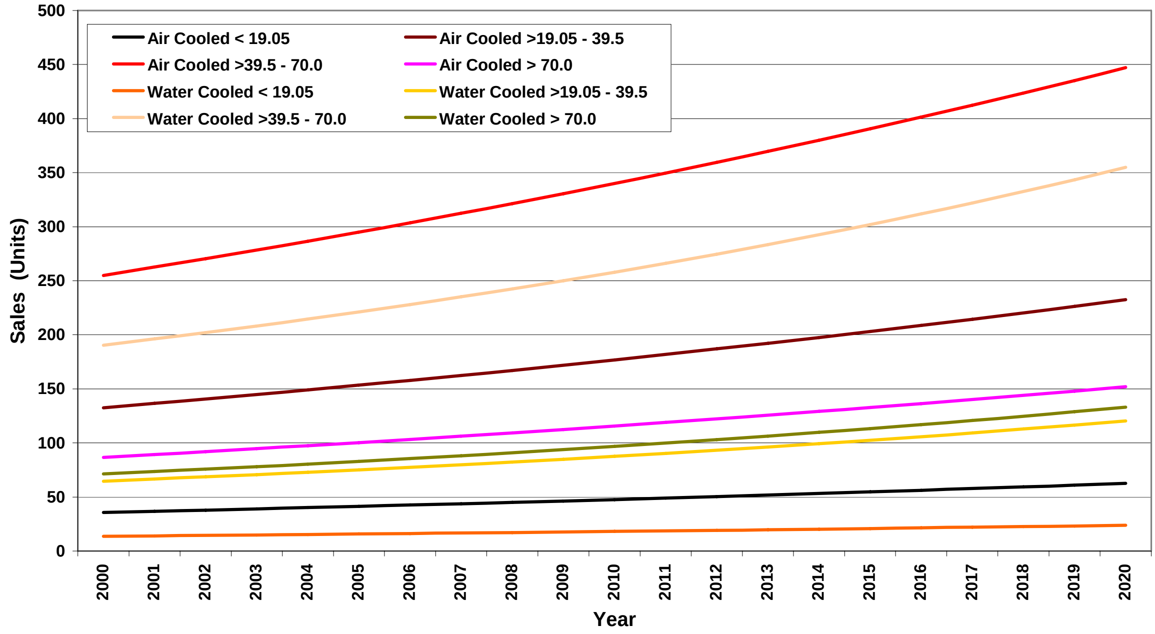
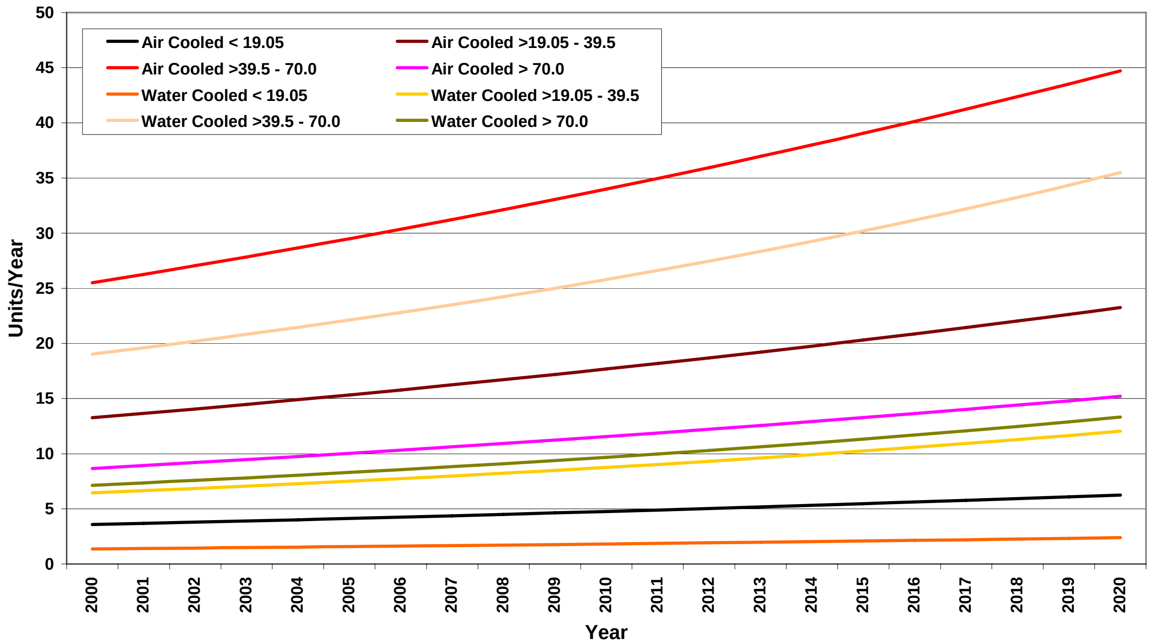


Figure 11: Forecast Sales of Close Control Air Conditioners - Base Sales Scenario New Zealand



The current trends indicate that the Base Sales scenario is more likely, however many factors can influence these projections. For example if a slow down in the telecommunications or data centre sector occurs, the sales growth would also reduce.

To simulate the impact of slowing in sales growth, a forecast for CCAC under a Low Sales scenario for Australia and New Zealand was undertaken and are shown in Figure 12 and Figure 13 respectively. It is considered unlikely that this scenario would develop given the historical sales of new product in Australia and New Zealand, so this low sales forecast scenario is utilised for sensitivity analysis of the RIS impact projections.

Figure 12: Forecast Sales of Close Control Air Conditioners - Low Sales Scenario Australia

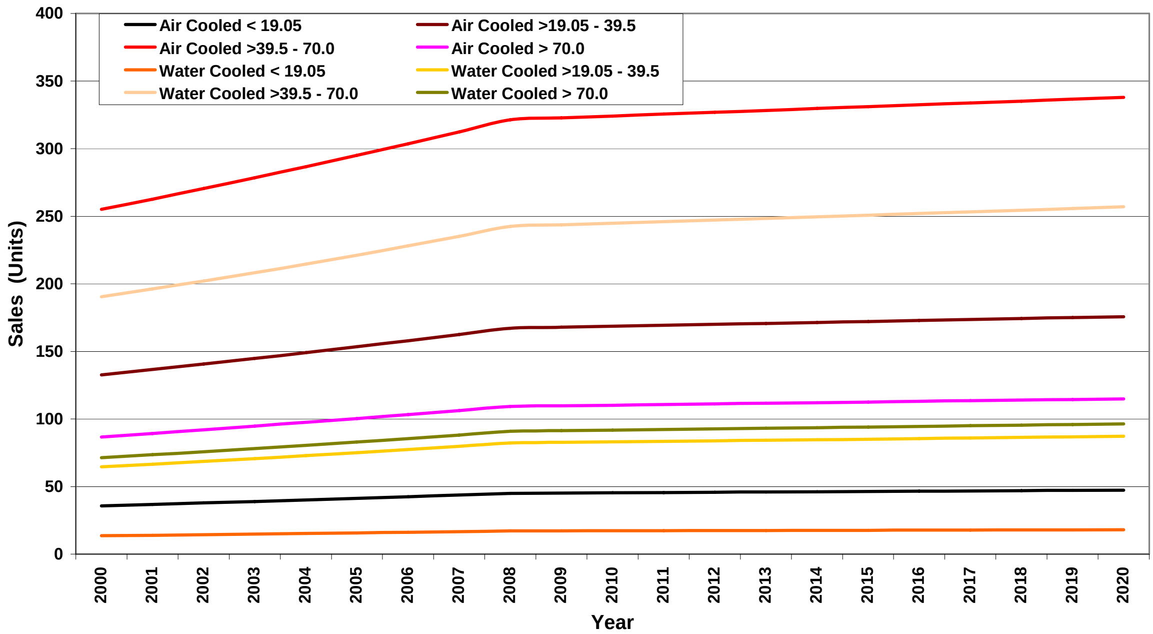
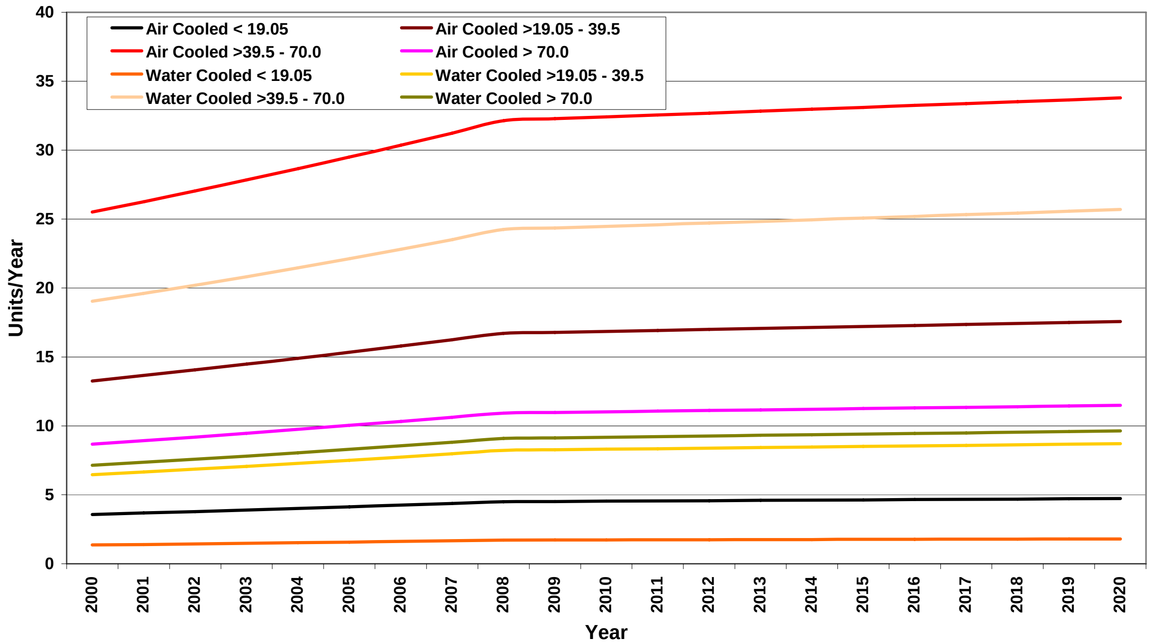


Figure 13: Forecast Sales of Close Control Air Conditioners - Low Sales Scenario New Zealand



Energy and Greenhouse Impacts

The MEPS impact is based on an implementation date of July 2009; hence energy and greenhouse impacts are modelled to begin occurring in 2009. For the Base Sales scenario, the net energy impact of the proposed MEPS for each category of close control air conditioner is shown in Figure 14 for Australia and in Figure 15 for New Zealand. The estimated impact of MEPS is shown as the "MEPS" line compared to BAU. Annual net energy savings are estimated at 220 GWh per year for Australia and 22 GWh per year for New Zealand by 2020 for all products as a result of the MEPS. The greatest proportion of these savings result from air cooled CCAC representing approximately 58 per cent of the total net energy savings in both Australia and New Zealand.

Figure 14: Net Annual Energy - BAU and MEPS: Australia Base Sales Scenario

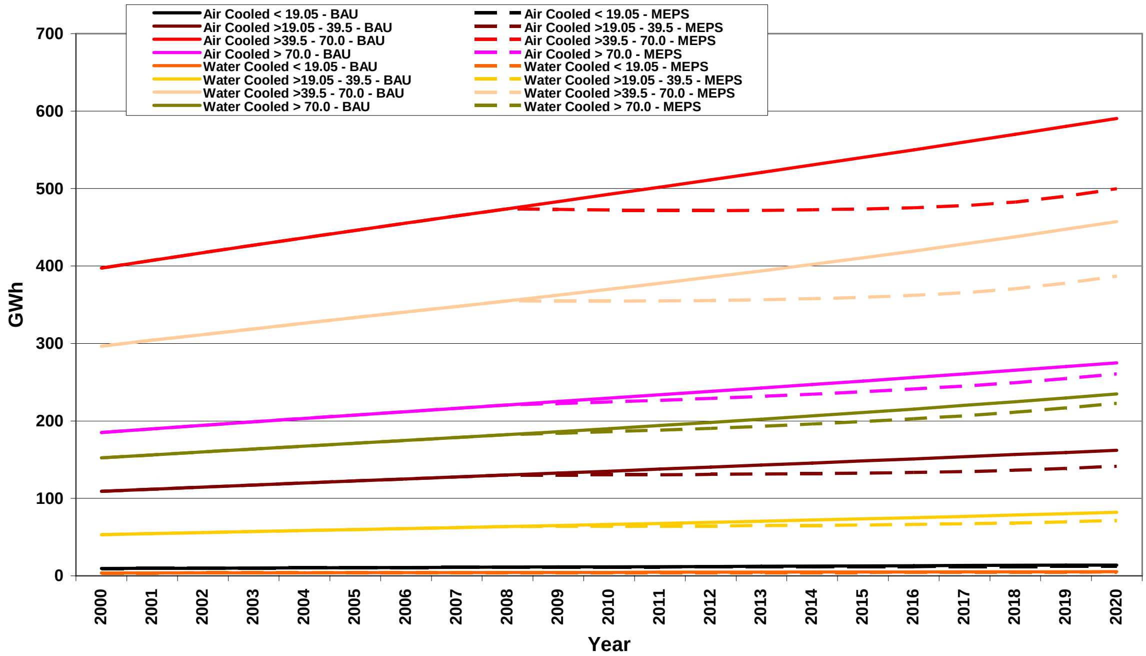
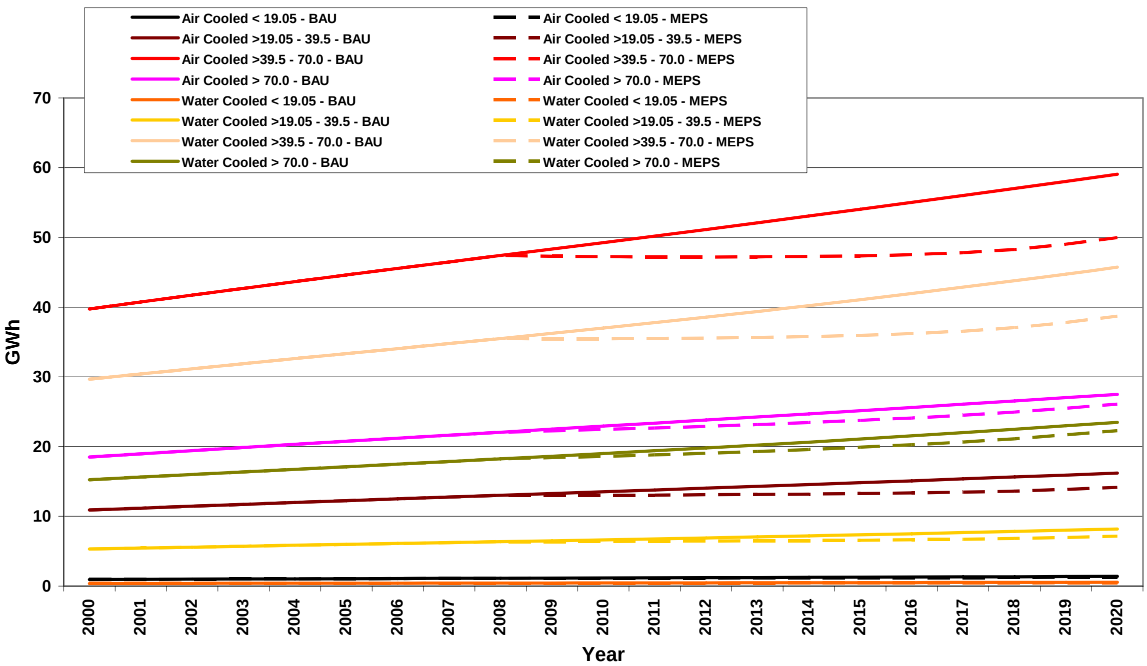


Figure 15: Net Annual Energy - BAU and MEPS: NZ Base Sales Scenario



The MEPS impact for the Low Sales scenario is shown in Figure 16, for Australia and in Figure 17 for New Zealand with total net energy savings of 190 GWh per year for Australia and 19 GWh per year for New Zealand by 2020.

Figure 16: Net Annual Energy - BAU and MEPS: Australia Low Sales Scenario

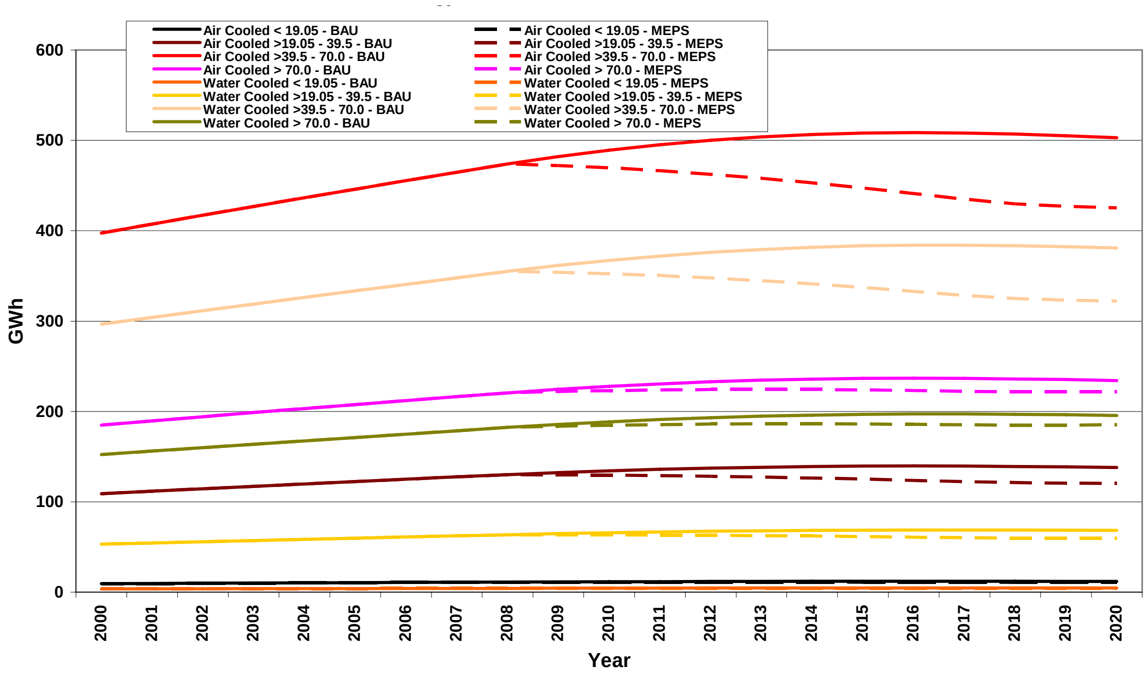
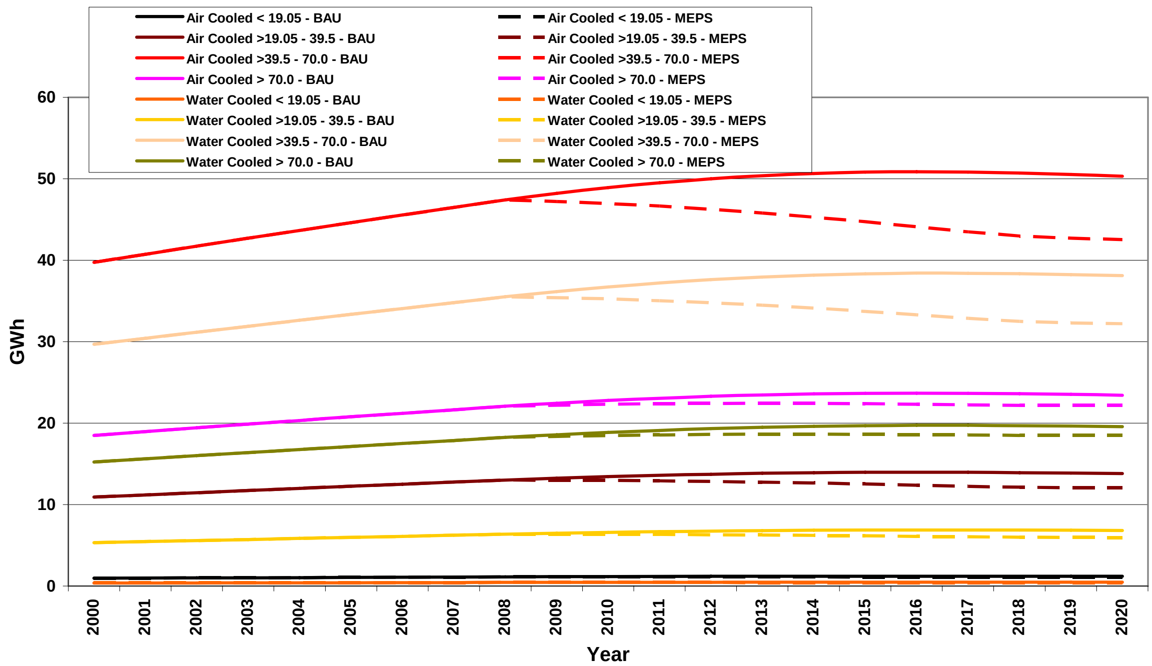


Figure 17: Net Annual Energy - BAU and MEPS: New Zealand Low Sales Scenario



For Australia the resulting estimated GHG emission reduction from the proposed MEPS is shown in Figure 18, with estimated GHG emission reductions for all CCAC of 220 kt CO_2-e/yr under the Base Sales scenario in 2020. For New Zealand the resulting estimated GHG emission reduction from the MEPS for CCAC is shown in Figure 19, with a 22 kt CO_2-e/yr emission reduction in 2020 for the Base Sales scenario.

Figure 18: GHG Emissions - BAU and MEPS: Australia Base Sales Scenario

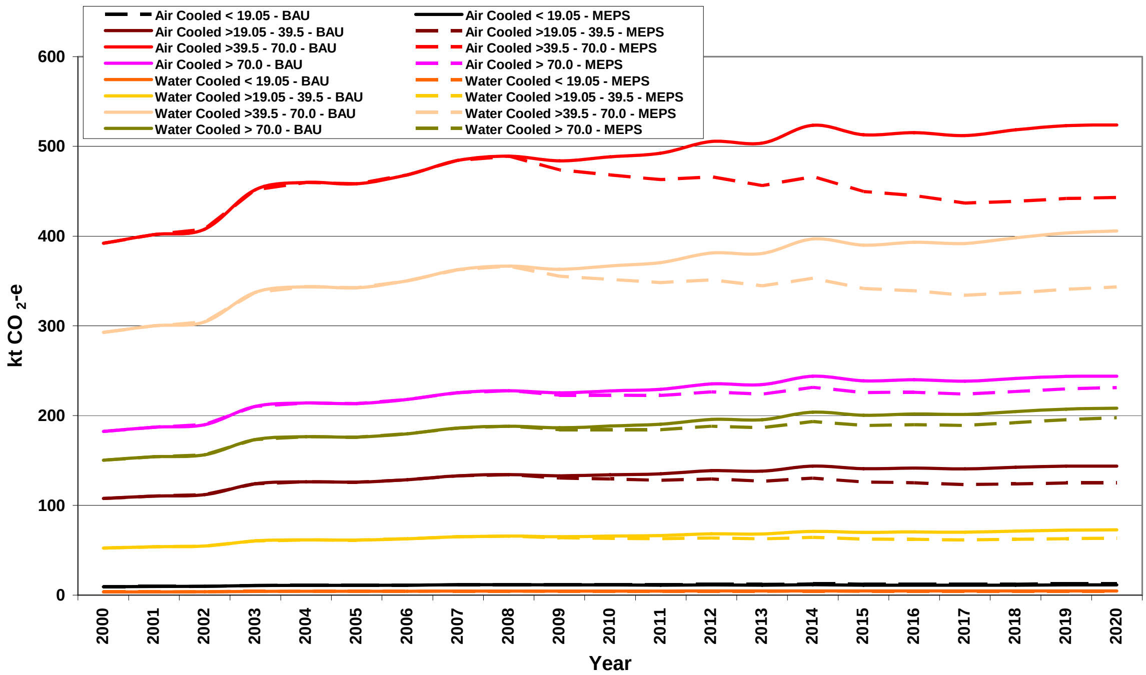


Figure 19: GHG Emissions - BAU and MEPS: NZ Base Sales Scenario

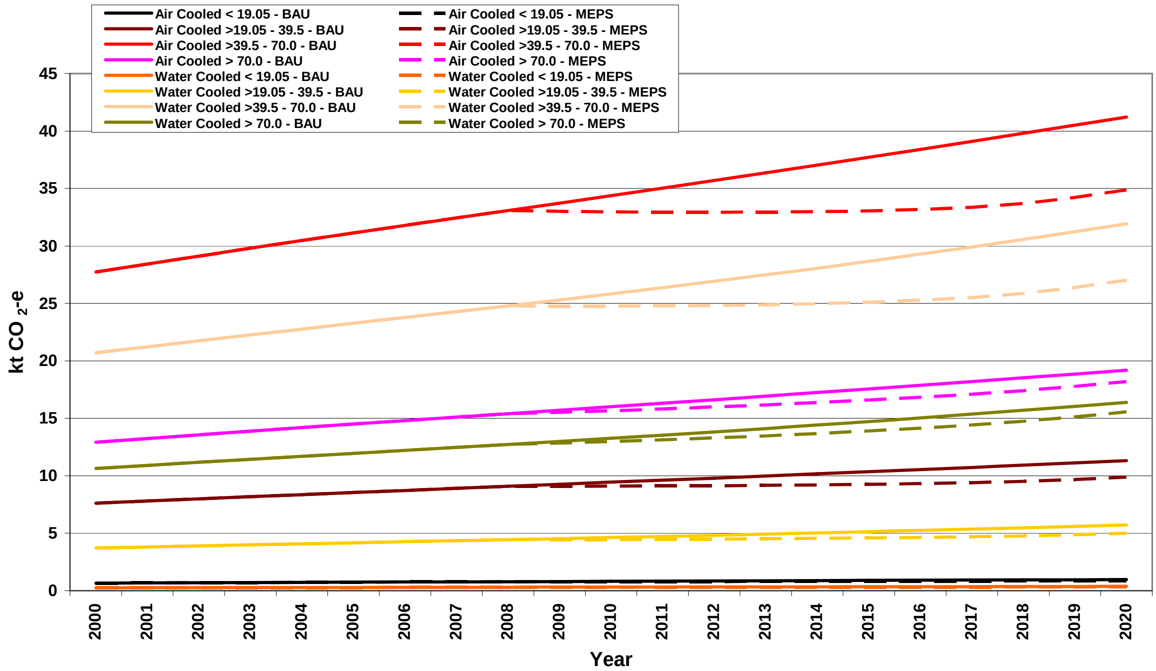


Figure 20 shows the resulting GHG emission reduction for the Low Sales scenario for Australia. It is estimated that greenhouse emissions would be approximately 33 kt CO_2-e lower in 2020 if the MEPS is implemented compared to BAU under this scenario. Figure 21 shows the resulting GHG emission reduction for the Low Sales scenario for New Zealand. It is estimated that greenhouse emissions would be approximately 3 kt CO_2-e lower in 2020 if the MEPS is implemented compared to BAU under this scenario.

Figure 20: GHG Emissions - BAU and MEPS: Australia Low Sales Scenario

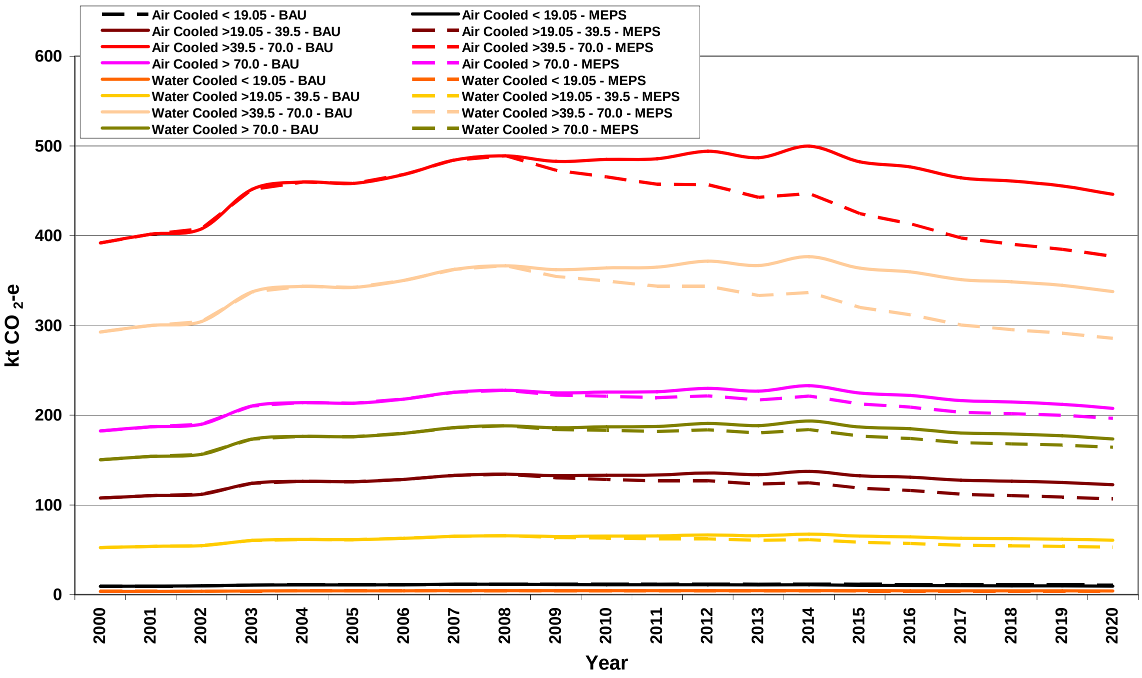
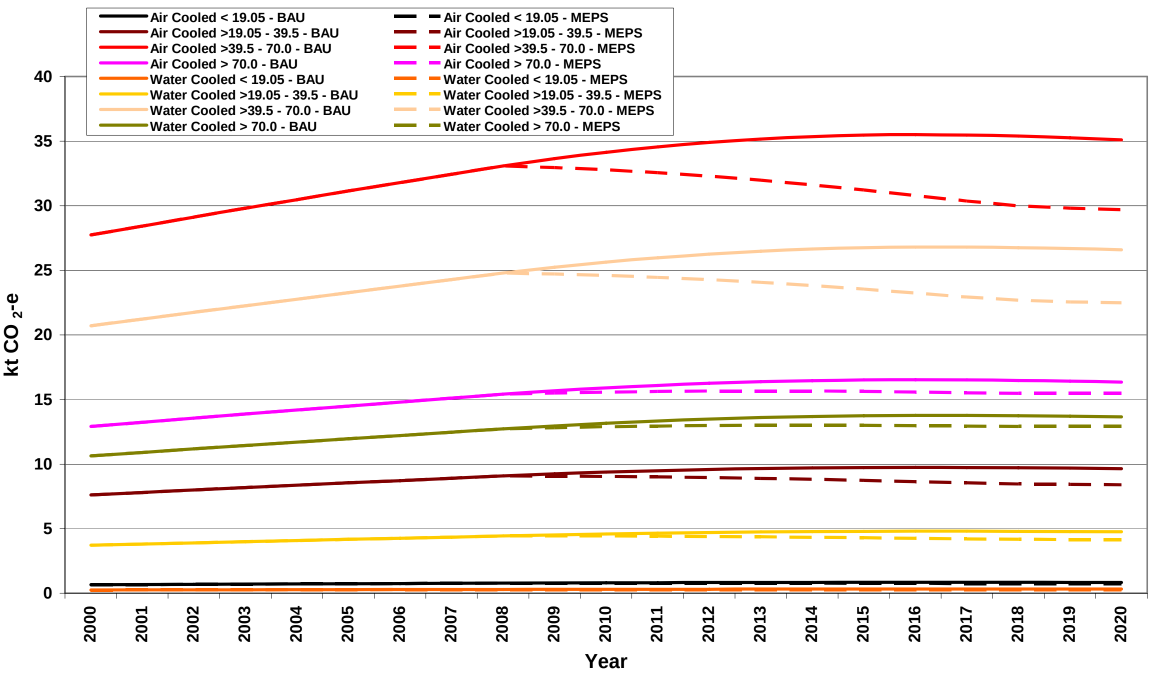


Figure 21: GHG Emissions - BAU and MEPS: NZ Low Sales Scenario



5.6 National and State Costs and Benefits

National and State Analysis

Table 9 shows the Net Present Value and Benefit Cost Ratios (BCR) for Australia for a range of discount rates. The national perspective includes:

- **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, training, etc
- **Benefits:**
    - to the nation due to the avoided electricity generation, distribution and transmission costs.

In terms of an approach for the cost-benefit analysis, it is necessary to do this from either a consumer or societal perspective, although the ratio between retail and resource costs will be much the same for both electricity prices and any incremental costs associated with the efficiency increase due to MEPS, so the cost/benefit outcomes will be similar.

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.

Analysis from societal or resource perspective, involves assessing the cost to the economy of manufacturing more efficient products using the marginal cost of resources diverted from other activities. Only the extra costs involved in the manufacturing and distribution process (i.e., extra materials, handling, storage costs) are counted and any benefits are valued at the marginal cost of electricity production rather than the retail price. Price components not related to costs, such as retail mark-ups and taxes are not included.

The dollar value of both costs and benefits will be lower from the resource perspective than from the consumer perspective, although if they both fall in the same proportion then the cost/benefits ratios will be much the same. Carrying out a separate cost/benefit analysis from the resource perspective is only necessary if the ratios of private to public costs are significantly different for costs and benefits.

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 recommended for the development of RISs associated with the E3 programme (NAEEEP 2005). The impact of varying discount rates is very much more difficult to assess from a resource perspective.

Table 9 shows the Net Present Value and Benefit Cost Ratios (BCR) for Australia for a range of discount rates. All data tables are based on the incremental real price increase for CCAC as per Table 7 for MEPS compliant product, the State and Federal program costs in Section 5.1 and business compliance costs in Section 5.2.

The provisional benefits under a CPRS are discussed in Appendix 8. However, they are not included in the main analysis, as the Australian Government has yet to establish the details of how a CPRS will operate or to undertake modelling of future electricity prices under emissions trading. This information will help determine the best approach to including the emissions abatement benefits under the CPRS in the RIS.

Table 9: Financial Analysis – Australia Base Sales Growth for a Range of Discount Rates

	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
Total Costs	$51,782,480	$35,249,360	$29,581,071	$25,079,386
Total Benefits	$461,629,121	$248,510,559	$188,076,992	$144,972,874
Net Benefits	$409,846,641	$213,261,199	$158,495,921	$119,893,489
Benefit Cost Ratio	8.9	7.1	6.4	5.8

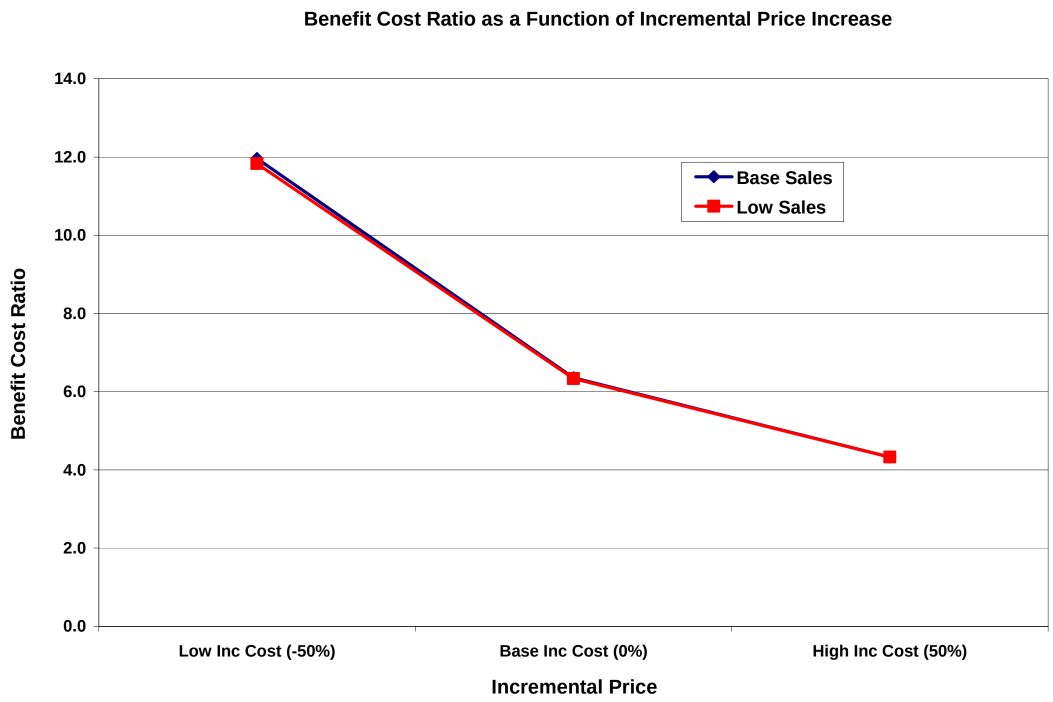
Table 10 presents the NPV benefits and costs of the proposed MEPS for the Low Sales scenario. The net benefits are lower while the BCR is only marginally lower then the Base Sales scenario.

Table 10: Financial Analysis – Australia Low Sales Growth for a Range of Discount Rates

	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
Total Costs	$44,957,184	$31,019,259	$26,195,439	$22,341,548
Total Benefits	$399,514,515	$217,969,388	$165,982,858	$128,685,817
Net Benefits	$354,557,332	$186,950,128	$139,787,420	$106,344,270
Benefit Cost Ratio	8.9	7.0	6.3	5.8

To assess the potential sensitivity of the benefit-cost ratio to the estimated incremental price increase for CCAC due to the MEPS, a number of options were modelled. The incremental price increase of CCAC was increased by 50 per cent and decreased by 50 per cent. Figure 22 shows the change in the national BCR if the price of MEPS-compliant product is up to 50 per cent higher than the price increase estimated in Table 7. As the figure demonstrates, the net present benefits are still significantly higher than the costs under these conditions.

Figure 22: Benefit Cost Ratio as a Function of Incremental Price Increase (Australia)



The benefit-cost ratios for all the Australian states are shown in Table 11 under the Base Sales scenario. In all states the BCR is well above 1. 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 11: Benefit Cost Ratio for States by Discount Rate: Base Sales Scenario

State	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
NSW & ACT	9.5	7.5	6.8	6.1
NT	9.5	7.5	6.8	6.1
QLD	8.4	6.6	6.0	5.4
SA	8.9	7.0	6.4	5.8
TAS	7.8	6.2	5.6	5.1
VIC	8.9	7.0	6.4	5.8
WA	8.4	6.6	6.0	5.4

The benefit cost ratios for all the Australian states and territories are shown in Table 12 under the Low Sales scenario. Again, in all states the BCR is well above 5 and also shows very little sensitivity to changes in sales growth.

Table 12: Benefit Cost Ratio for States by Discount Rate: Low Sales Scenario

State	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
NSW & ACT	9.4	7.5	6.7	6.1
NT	9.4	7.5	6.7	6.1
QLD	8.3	6.6	5.9	5.4
SA	8.9	7.0	6.3	5.8
TAS	7.8	6.1	5.5	5.0
VIC	8.9	7.0	6.3	5.8
WA	8.3	6.6	5.9	5.4

Figure 23 shows the forecast net benefit by state/territory over the period 2000 to 2020 at a discount rate of 7.5 per cent for the Base Sales scenario. There are small negative benefits in 2007 and 2008 which reflect the government costs associated with the establishment of the MEPS program and systems before the implementation date of 2008, however these are minor in the figure due to their size (less than $500,000 for all states). The negative net benefits in 2009 are largely due to the incremental cost increases of MEPS compliant product, which are greater than the energy cost savings in the first year.

Figure 23: Annual Net Benefit $M: Base Sales Growth Scenario

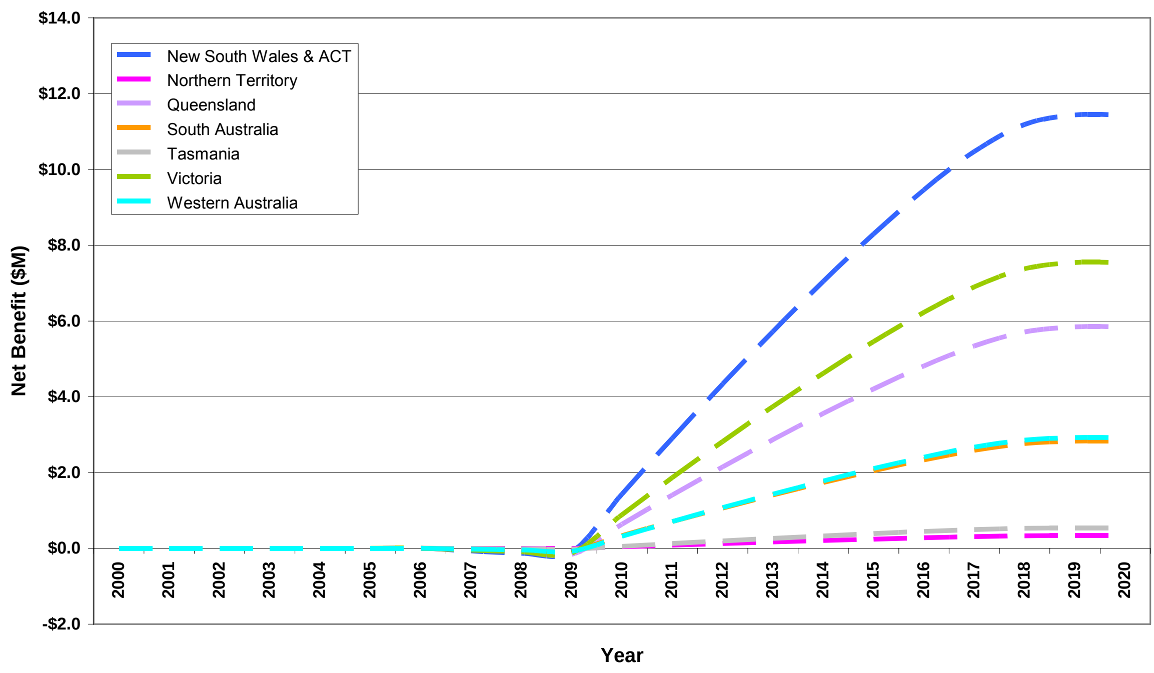
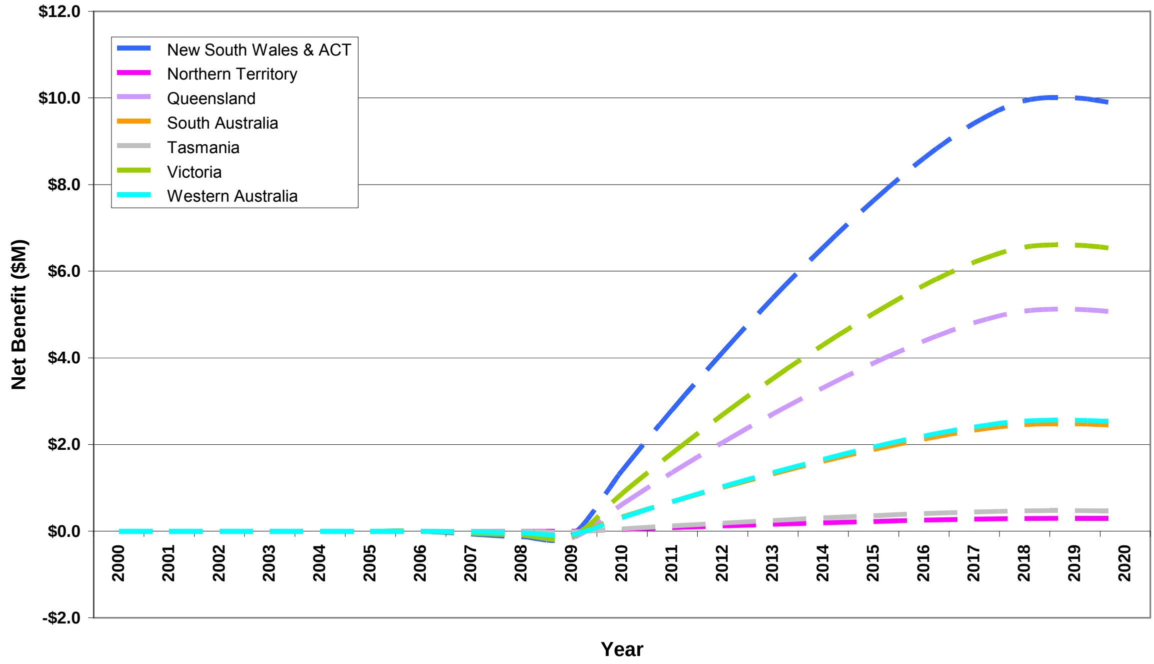


Figure 24 shows the forecast net benefit by State over the period 2000 to 2020 at a discount rate of 7.5 per cent for the Low Sales scenario.

Figure 24: Annual Net Benefit $M: Low Sales Growth Scenario



Analysis – New Zealand

Table 13 shows the Net Present Value and Benefit Cost Ratios for New Zealand for a range of discount rates under Base Sales scenario. All data tables are based on the incremental real price increase for products as per Table 7 for MEPS compliant products. In addition, part of the program costs is apportioned to New Zealand in relation to the proportion of New Zealand sales of CCAC to Australian sales. All values are expressed in New Zealand dollars, converted at 1.1NZD to 1 AUD.

Table 13: Financial Analysis – NZ Base Sales Scenario for a Range of Discount Rates

	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
Total Costs	$5,688,373	$3,870,096	$3,246,755	$2,751,732
Total Benefits	$46,134,078	$24,835,534	$18,795,952	$14,488,232
Net Benefits	$40,445,705	$20,965,437	$15,549,197	$11,736,500
Benefit Cost Ratio	8.1	6.4	5.8	5.3

Table 14 presents the NPV benefits and costs of the proposed MEPS for the Low Sales scenario for New Zealand.

Table 14: Financial Analysis – NZ Low Sales Scenario for a Range of Discount Rates

	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
Total Costs	$4,937,590	$3,404,785	$2,874,335	$2,450,570
Total Benefits	$39,926,497	$21,783,324	$16,587,918	$12,860,544
Net Benefits	$34,988,907	$18,378,539	$13,713,583	$10,409,974
Benefit Cost Ratio	8.1	6.4	5.8	5.2

The benefit cost ratio under the Low Sales scenario is the only slightly lower than the Base Sales scenario.

Summary Data for Alternative BAU Sales Scenarios

The impact of changes to the forecast sales of CCAC is shown for the two scenarios in Table 15 for Australia and in Table 16 for New Zealand.

Table 15 Summary Data for Alternative BAU Sales Australia – 7.5% Discount Rate

Scenario	Base Sales	Low Sales
Energy Saved (cumulative)	1,748 GWh	1,569 GWh
GHG Emission Reduction (cumulative)	1.6 Mt CO_2-e	1.5 Mt CO_2-e
Total Benefit	$188M	$166M
Total Cost	$30M	$26M
Benefit Cost Ratio	6.4	6.3

Table 16 Summary Data for Alternative BAU Sales New Zealand – 5% Discount Rate

Scenario	Base Sales	Low Sales
Energy Saved (cumulative)	175 GWh	157 GWh
GHG Emission Reduction (cumulative)	122 kt CO_2-e	109 kt CO_2-e
Total Benefit	$24.8M	$21.8M
Total Cost	$3.9M	$3.4M
Benefit Cost Ratio	6.4	6.4

Note that NZ Govt requires analysis of alternative proposals with 5% discount rate.

6 Consultations and Comments

The following consultations have been undertaken in relation to the policy development for CCAC:

- ***Launch of MEPS Proposal – Close control air conditioners: October 2004.*** Almost 100 participants attended the Energy Efficiency Forum in October 2004 representing industry, regulators, Commonwealth and state government agencies, testing authorities, academia and consultants. The proposal provided details of the product description, efficiency and characteristics of new products, ownership trends, relevant Australian Standards, Australian and international policies for this product, potential MEPS levels, energy consumption, greenhouse emissions and potential savings. Detailed comments where sought from industry and one formal submission was received. The timeline for development of this policy option was explained and subsequently an Australian Standards working group was established to develop the technical requirements for both the testing standard and the MEPS for CCAC.

- ***Industry meeting – Close Control AC: November 2004.*** The proposed MEPS was explained. This presentation was made available to all that attended and requests for comment noted. Comments were submitted, as follows:
    - The proposed MEPS levels were very stringent, especially considering Australian conditions and the efficiency of current equipment.
    - Suppliers support a MEPS if the test method used for determining the efficiency performance is tailored to the specific conditions that CCAC operate in and the MEPS levels are realistic.
    - Industry were not convinced of the need for an upper limit and indicated they would most likely recommend a change to 'no maximum size'.
    - Industry proposed that AGO consider lowering the MEPS level as Australian units are not technically capable of reaching these performance levels.
    - Work cooperatively to provide test data from either their own labs and UNSW lab on the most highly efficient "off-the-self" models at various test conditions available at present and set the MEPS levels at those levels.
    - The AGO noted that if the proposal for lower MEPS was accepted, the timeframe should be brought forward from 2007 to October 2006.
    - The proposal might set the next MEPS level 3 years hence (October 2009) at which time the Australian scheme could match the USA levels.

- ***AGO Response to industry comment – August 2005:*** In response to the concerns of the Australian suppliers to the proposed MEPS, the AGO provided the following commitments:

  - Agreed that the design criteria for close control units are different than "standard" air conditioning. For this reason the ASHRAE Standard 127-2001 "Method of Testing for Rating Computer Room Unitary Air-Conditioners" should be chosen for Close Control Units.
  - Agreed to work towards a software simulation approach to the measurement of energy efficiency of close control units for the registration requirements for MEPS
  - Agreed to widen the scope of the MEPS to water cooled units and work cooperatively to determine the appropriate MEPS levels for Australia.

- ***Annual National Air Conditioning & Energy Forum: September 2005***. The close control air conditioner MEPS proposal was discussed in detail at the National Air Conditioning forum in Sydney. During the forum, it was also decided to delay the implementation date of the MEPS from October 2007. Testing issues were also addressed at the conference and a broad cross-section of the industry was invited to participate in a Steering Committee to be established following the forum.

- ***AGO Letter to Stakeholders – January 2006:*** The AGO notified industry that the ASHRAE Standard 127-2001 is under revision and a draft will be published in early 2006, hence cooperative testing of Australian close control units will be postponed and the new ASHRAE Standard will be investigated for use in Australia.

- ***MEPS Steering Committee: February 2006 - onwards.*** Further consultation between the close control air conditioning industry and government was conducted in a series of meetings during 2006 and 2007. Agreements were sought on the test methods for suppliers to comply with the MEPS and the MEPS levels were refined to reflect the market conditions in Australia. Several meetings were held as follows:
  - 14 March 2006 – Sydney
  - 13 September 2006 – Sydney
  - 18 October 2006 – Sydney

  In these meetings, many topics were covered, including the MEPS levels by type/size of unit, testing methods, rating and compliance pathways, sales data for product by size/type, data on efficiency of product sold in Australia and the potential costs of implementation. Representatives from all the major suppliers in Australia were present at many of the meetings and all received the meeting notes. There was total support for the implementation of the MEPS under the terms agreed to within the meetings. The suppliers represented at these meetings and provided information on the market characteristics included:
  - Emerson Network Power
  - Hirotec
  - Stulz
  - Uniflair

- ***National Air Conditioning & Energy Workshop: November 2006***. The close control air conditioner revised MEPS proposal developed with the Industry MEPS Steering Committee was discussed in detail at the workshop in Canberra. The proposed testing standard and potential MEPS levels were presented.

- ***Australian Standards working Group of Committee EL15/16.: Oct 2006 - onwards.*** To progress the development of the testing method and MEPS for CCAC, a new working group of Standards Australia committee EL15/16 was established in the second half of 2006. This working group was tasked to develop the measurement and rating system for CCAC, which was based on the revised ASHRAE Standard 127-2007 Several meetings were held in Sydney as follows:
  - 18 October 2006
  - 20 December 2006
  - 13 February 2007
  - 10 September 2007

  The draft standards developed by this committee are now published for public comment. These documents are now published and expected to be finalised by mid 2008.

In addition, the key policy/technical documents were also available on the public website, www.energyrating.gov.au and public comments invited.

6.1 Summary of Comments

To be added after release of the draft for consultation.

6.2 Responses to Comments

To be added after release of the draft for consultation.

7 Evaluation and Recommendations

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 greenhouse emissions. This is supported by the industry who state that voluntary targets in this market would not provide sufficient incentive for acceptable levels of compliance, and overseas experience supports this view.

Based on the modelling of the MEPS, significant greenhouse gas emission reductions are possible.

Due to its non-voluntary nature, the MEPS option has the highest probability of reducing greenhouse gas emissions below business-as-usual with high benefit cost ratios for end consumers.

Addressing Market Failures

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

MEPS will not effectively provide buyers with improved access to product performance information, nor will any of the other options, with the exception of mandatory labelling, which would not be effective in this market.

The MEPS option would clearly require importers and suppliers of CCAC to provide complying equipment. This is not thought to involve negative impacts on suppliers as the volume of sales would not be substantially affected and compliance costs are low.

Conclusions

After consideration of the policy options it is concluded that:

- The MEPS option is likely to be effective in meeting all the stated objectives.
- None of the non-MEPS alternatives examined appear as effective in meeting all objectives. Some would be completely ineffective with regard to some objectives and some do not have industry support.
- Given that the proposal for MEPS has been in the public domain since October 2004 and the Australian Standard will be published in 2007, the program could be implemented in 2008.

7.2 Recommendations (Draft)

It is recommended that the Ministerial Council on Energy (MCE) agree:

1. To implement mandatory energy performance standards for CCAC in regulation.
2. That products covered by this RIS include all those defined as CCAC in the scope of the new Australian/New Zealand Standard, Performance CCAC (AS/NZS 4965, Part 1.1).
3. To use the test method of the new Australian/New Zealand Standard, Performance CCAC (AS/NZS 4965, Part 1.1), which specifies methods of testing of CCAC to verify the capacity, power and efficiency requirements at a specific set of conditions.
4. That CCAC must meet or surpass the energy performance requirements that are proposed in this document and will be set down in Australian and New Zealand Standard AS/NZS 4965, Part 2: Minimum Energy Performance Standard (MEPS) Requirements.
5. That the amendments take effect not earlier than 1 July 2009 in Australia and New Zealand.
6. To have all jurisdictions take the necessary administrative actions to ensure that the suite of regulations can take effect from the proposed implementation dates.

8 Implementation and Review

General administrative arrangements

Australia has a national scheme for mandatory energy labelling and performance standards that relies on State and Territory legislation to give it legal effect. The jurisdictions have also agreed to a set of administrative guidelines. While not legally binding, they aim to promote a uniform approach, consistent outcomes and to minimise compliance costs. The E3 program released the latest guidelines in May 2005 (NAEEEC 2005). The key administrative arrangements are:

1. The technical details of the MEPS and labelling requirements are contained in Australia or Australian and New Zealand Standards that are incorporated by reference into the State and Territory legislation. These standards do not vary between states and territories and are subject to unanimous approval by State and Territory regulatory bodies.

2. Changes to the technical detail in Standards are subject to transition periods that are negotiated between industry and government. State and Territory regulatory agencies and stakeholders have agreed that this type of transition arrangement minimises the cost of compliance and the confusion surrounding both the old and the new standards.

3. To minimise trade barriers, State and Territory regulatory agencies support a policy of adopting international standards wherever appropriate. E3 and Standards Australia actively support the development of international standards.

4. Where a product is not regulated for energy efficiency prior to the implementation of MEPS for the first time, products that were manufactured in Australia or imported before the MEPS implementation date may be sold without the need for any registration. Products that are manufactured in Australia or imported after the MEPS implementation date must hold a valid registration at the time of sale, which indicates compliance with the relevant MEPS requirements.

5. Grandfathering arrangements are adopted such that stocks of non-complying products that were imported or manufactured in Australia prior to the effective date of legislation affecting them can be sold for an indefinite period (i.e. products made in Australia or imported prior to the relevant MEPS date may be sold at any time into the future).

6. All states and territories accept the registration of an appliance undertaken in another State or Territory. Where a regulatory agency has refused to register a model for energy efficiency labelling or MEPS, it will immediately inform all other states and territories of the circumstances surrounding the refusal.

7. State and Territory regulatory agencies have set target time periods within which they aim to process applications.

8. Proposed changes in administrative and operating practice are subject to consultation between states.

Product-specific compliance and enforcement activities

The E3 program organises its compliance and enforcement activities as follows:

1. A check testing program is administered by the Department of Environment, Water, Heritage and the Arts.

2. Checktesting is conducted in National Association of Testing Authorities (NATA) accredited laboratories.

3. Equipment is selected for check testing on the basis of risk factors rather than randomly. The risk factors are as follows:
    - history of success and failure in check tests;
    - age of models, with newer models given greater attention, reflecting the prospect of longer life in the market;
    - high volume sales;
    - claims of high efficiency;
    - complaints.

4. In the event of failure to comply, there are several sanctions that may be utilised.
    - There is a 'shaming' option involving publication of failed brands or models in reports by agencies and/or the relevant Ministers.
    - Deregistration by the state and territory authorities, subject to show cause procedures. Subsequent sale of deregistered appliances would be a criminal offence. Re-registration of models that are subject to MEPS is subject to new registration tests.
    - Legal action by the ACCC.

5. Standard statistical criteria are applied to deal with normal variation in the performance of equipment selected for check testing. A sample of only one is selected initially, with a further sample of 3 selected if the first fails.

6. Laboratories that produce misleading tests results may also be denied further registration business.

7. Applicants that use laboratories for registration testing, whose products subsequently fail Checktesting, may be asked to ensure that future testing conducted in relation to their products is undertaken by a NATA accredited

laboratory or a laboratory accredited by a body with a mutual recognition agreement with NATA.

General monitoring and benchmarking of impacts and effectiveness

In the past the E3 program has periodically commissioned an omnibus evaluation of its impacts. The last of these was published in April 2005 (NAEEEC 2005b), titled W*hen you keep measuring it, you know even more about it: Projected impacts 2050-2020.* The general aims of such an exercise are to document expected impacts, estimate costs and benefits, and compare outcomes with earlier projections. It commits E3 to examine the appliance register and store survey data, and comparative review of trends in appliance efficiency. The program has since advised industry that the 2003 exercise was the last of the omnibus reviews and will be replaced by ad-hoc reviews. The first of these evaluated the impacts of MEPS and labelling of refrigerators and freezers (EnergyConsult 2006).

Over the past seven years, E3 has produced an annual "Achievements" report, the most recent reporting the 2006 position. These reports provide summary information such as achievements in the year, current and projected economic benefits, current and projected greenhouse gas reductions, compliance/enforcement issues, procedures and outcomes and Standards information. The bi-annual standby store survey provides the E3 program with trend data and information on the energy consumption of products that are being sold in the market. This survey specifically targets set-top boxes and other consumer electronics, and will be used to monitor the general effectiveness of the MEPS over time

E3 holds an annual consultation forum and invites stakeholders to raise concerns about its operation and impacts. In addition, E3 also holds industry/stakeholder forums and conferences to discuss future directions for currently regulated products and products being considered for regulation.

Less frequently, E3 reviews program fundamentals. The most recent exercise of this kind was a major research-based review and scoping of future directions for a wide range of appliance efficiency labels in Australia and NZ (Winton 2003).

The program also takes occasional opportunities to benchmark its activities with programs in other countries.

Regulatory review

Review functions are not centralised: each state and territory has its own arrangements for review. The 'subordinate legislation' acts in several states provide for the automatic revoking of regulations after 10 years. These states are Victoria, SA, Queensland and Tasmania. NSW requires that all regulations contain sunset clauses. The remaining jurisdictions have no general requirement but may include sunset clauses on a case-by-case basis.

All jurisdictions have some Parliamentary machinery for the systematic review of regulations, such as a 'Legislation Review Committee'. Arrangements for agency or inter-agency review are more variable. Only Victoria has a specific body charged with regulatory oversight; the Victorian Competition and Efficiency Commission. This work is undertaken by an inter-departmental committee in the NT. Otherwise, the review process uses a parliamentary secretariat to raise issues and solicit public comment.

Once the states and territories agree to mandatory requirements, their removal in any one jurisdiction would undermine the effect in all other jurisdictions, because of the Mutual Recognition agreements between the states and territories. Under the co-operative arrangements for the management of the Equipment Energy Efficiency Program, states 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.

Information Specific to Close Control Air Conditioner Requirements

Close Control Air Conditioner MEPS would be implemented under the same state and territory regulations as household appliance labelling and MEPS, and so subject to the same sunset provisions, if any.

As with the E3 adopted principles there should be a MEPS 'stability period', and a cost-benefit analysis would be undertaken before any revisions are proposed. The earliest possible timing of any change to the MEPS regulations discussed in this RIS would therefore depend on date of their implementation. If implemented in July 2009, the earliest possible revision would be July 2012.

In respect of revisions, it would be necessary to carry out a study well in advance of that time, so that adequate notice could be given to industry in the event that a change was justified. The study would typically be undertaken 18 - 24 months before a revision was proposed. The study would review and compare local and international trends in efficiency levels, international programs and harmonisation initiatives, possibly proposing more stringent MEPS, if sufficient evidence indicated such change was achievable and beneficial. Equally, the study could indicate that continuation of MEPS, with registration, may not be the most cost effective outcome for the community at large and hence recommend alternative options, including the removal of mandatory measures.

Therefore considering the E3 Committee principles and the state sunset requirements:

- the earliest a review would be undertaken would be 2011 (if changes were to be considered for implementation in July 2012).
- the latest a review to be undertaken would be in 2017, one year before the State sunset provisions.

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Appendix 1: References

ABARE, 2006, *Australian energy national and state projections to 2029-30*, Australian Bureau of Agricultural and Resource Economics. ABARE research report 06.26, December 2006

AGO, 2007, *Equipment Energy Efficiency Programme: Achievements 2006*, Report No: 2007/01, Australian Greenhouse Office, Department of the Environment and Water Resources, Canberra, Australia, May 2007

ASHRAE 90.1 – 2001. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) *Standard 90.1 – 2001 Energy Standard for Buildings Except Low-Rise Residential Buildings*. AHREA 2004

ASHREA *Standard 127-2001 -- Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners (ANSI Approved).*

CEC, 2002, California Energy Commission: Appliance Efficiency Regulations, 27/11/2002.

CEN, 2002, Draft pr EN 14511-2, *Air conditioners, liquid chilling packages and heat pumps with electrically drive compressors for space heating and cooling – Part 2: Test conditions*. June 2002.

COAG, 2007, *Best Practice Regulation: A Guide for Ministerial Councils and Standard-Setting Bodies*, Council of Australian Governments, October 2007.

DOE, 2000, Proposed Rules (48830). 10 CFR Part 431: *Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards for Commercial Air Conditioners and Heat Pumps, Commercial Packaged Boilers, Commercial Water Heaters, Hot Water Supply Boilers and Unfired Hot Water Storage Tanks*; Federal Register / Vol. 65, No. 154 / Wednesday, August 9, 2000

EECA, 2007, Energy End Use Database, http://www.eeca.govt.nz/enduse/index.aspx

EnergyConsult, 2004, *Analysis of the Potential Policy Option: Close Control Air Conditioners*. EnergyConsult for NAEEEC & AGO, Canberra, Australia, Oct 2004

EnergyConsult, 2006, *Retrospective Analysis of the Impacts of Energy Labelling and MEPS: Refrigerators and Freezers*, Australian Greenhouse Office for NAEEEC, October, 2006.

Energy Strategies, 2005, *Climate Control Heating Ventilation, Air-Conditioning and Efficiency, A Discussion Paper,* for the National Appliance & Equipment Energy Efficiency Committee, Canberra, Australia, Sep 2005.

EMET, 2004, *Energy Efficiency Improvement in the Commercial Sub-sectors*. For Sustainable Energy Authority of Victoria, by EMET Consultants Pty Ltd, Feb 2004

EUROVENT, 2007, EUROVENT Certification Programme database and programme guidelines, (www.eurovent-certification.com)

G. Groppenbacher, 2006, *Presentation to Air Conditioner Industry Forum* Canberra, 29 November 2006. Available from http://www.energyrating.gov.au/forums-2006-ac-workshop.html

Informark, 2004, *AC industry sales data produced by Informark for AGO from Data Supplied by Wholesalers.* May 2004

MED NZ, 2006, *Revised New Zealand Energy Greenhouse Gas Emissions 1990 - 2005*, Ministry of Economic Development, Wellington, New Zealand, December 2006

MED NZ, 2006b, *Future Energy Directions Workshop - New Zealand's Energy Outlook to 2030: Base Case.* Ministry of Economic Development, Wellington, New Zealand, 23 Aug 2006.

MFE NZ, 2008, *New Zealand's Greenhouse Gas Inventory 1990–2006 An Overview.* Ministry for the Environment, Wellington, New Zealand, April 2008.

NAEEEC, 2005, *Administrative guidelines for the National Appliance and Equipment Energy Efficiency Program of mandatory labelling and minimum energy performance standards*, May 2005

NAEEEC, 2005b, *When you can measure it, you know even more about it: Projected impacts 2000-2020*, April 2005

NAEEEP, 2005, *Guide to Preparing Regulatory Impact Statements for the National Appliance and Equipment Energy Efficiency Program (NAEEEP)*, prepared by George Wilkenfeld and Associates Pty Ltd, for Australian Greenhouse Office, Report No 2005/19, Canberra, Australia, May 2005

NGGI, 2007, *National Greenhouse Gas Inventory 2005*, Australian Greenhouse Office, Department of the Environment and Water Resources, Canberra, Australia, March 2007.

OBPR, 2006, Business Cost Calculator, Version Current at: 26 October 2006, www.industry.gov.au/businesscostcalculator, Office of Best Practice Regulation

Syneca Consulting, 2003, *Minimum Energy Performance Standards for Airconditioners Regulatory Impact Statement*, prepared for the Australian Greenhouse Office, Canberra Australia, Report No 2003/08, August 25, 2003

Syneca Consulting, 2006, *The Proposal to include standby power in the energy ratings of clothes washers & dishwashers, Consultation Regulatory Impact Statement,* 19th May 2006, for Australian Greenhouse Office, by Syneca Consulting.

Winton L, 2003 *A major research-based review and scoping of future directions for appliance efficiency labels in Australia and New Zealand*, Report to the Australian Greenhouse Office

Appendix 2: Australian Energy Efficiency Policy Background

The Australian Government's initial response to concerns about the environmental, economic and social impacts of global warming was set out in the Prime Minister's statement of 20 November 1997, *Safeguarding the Future: Australia's Response to Climate Change*. The Prime Minister noted that the Government was seeking *"…realistic, cost-effective reductions in key sectors where emissions are high or growing strongly, while also fairly spreading the burden of action across the economy."* He also stated that the Government is "*…prepared to ask industry to do more than they would otherwise be prepared to do, that is, go beyond a 'no regrets'*[6]*, minimum cost approach where this is sensible in order to achieve effective and meaningful outcomes."* This "no regrets" test was a key part of the guidelines adopted by the Council of Australian Governments (COAG) in 1997 that any initiative proposed by the MCE, including standards and labelling measures under the Equipment Energy Efficiency Program, must meet.

In 1998 the Australian Government released *The National Greenhouse Strategy* (NGS) that was endorsed by the Australian Government and state and territory governments and committed them to an effective national greenhouse response. Progress under the NGS was reported to the Council of Australian Governments (COAG). Many key elements of the NGS were implemented successfully, but, over time, the Australian Government identified a range of emerging climate change priorities that required attention at the federal government level. Similarly, there was acknowledgment that state and territory jurisdictional boundaries necessitated state/territory level climate change action plans and these were developed.

In 2004, the Australian Government released a new climate change strategy as articulated through its Energy White Paper, *Securing Australia's Future*, and the 2004-05 Environment Portfolio Budget. Some elements of the earlier NGS were included in the new strategy. As a critical element of the Australian Government's climate change strategy, the new energy policy represented the refinement of strategic themes pursued in relation to energy under the NGS, including energy market reform, the development of low-emissions and renewable technologies, and improvements to end-use energy efficiency.

Since that time, COAG has remained the primary forum for progressing Australian, state and territory government collaboration on climate change issues requiring inter-jurisdictional attention. Significant progress has been made under the COAG climate change agenda since COAG's agreement in June 2005 to establish a new Senior Officials

[6] The Productivity Commission has defined "No regrets" policy options as measures that … *have net benefits (or at least no net cost) in addition to addressing the enhanced greenhouse effect. A more intuitive interpretation of 'no regrets' measures could be that they are actions which would still be considered worthwhile even in the absence of concerns about the potential adverse impact of global warming.* (PC 1997: page vii). This may involve imposing additional business costs on suppliers if the resulting more efficient products deliver a net benefit to the wider community.

Group to consider ways to further improve investment certainty for business, encourage renewable energy and enhance cooperation in areas such as technology development, energy efficiency and adaptation. This work culminated in the January 2006 COAG climate change action plan. In addition, climate change issues requiring national coordination have been managed through a number of inter-governmental ministerial councils including the Ministerial Council on Energy.

The Australian Government's climate change strategy is the mechanism through which Australia will meet its international commitments as a party to the United Nations Framework Convention on Climate Change (UNFCCC). The Government has an overall target of limiting Australia's emissions in 2008-2012 to 108 per cent of its 1990 emissions. This is a 30 per cent reduction on the projected "business as usual" (BAU) outcomes in the absence of interventions.

Over 2006, the national policy debate over introducing a carbon price in Australia continued with the state and territory governments proposing an emissions trading scheme, and the Australian Government holding a nuclear energy enquiry and announcing its own emissions trading inquiry by the *Task Group on Emissions Trading*.

In 2007, emissions trading became a major new plank in the Australian Government's response to climate change. The Prime Minister, the Hon John Howard MP, announced in June 2007 that Australia will introduce a world-class domestic emissions trading system by 2012. Emissions trading will be the primary mechanism for achieving the long term emissions reduction goal, which will be set in 2008. It will have a strong economic foundation and take account of global developments while preserving the competitiveness of our trade exposed emissions intensive industries. Through emissions trading, the market will help Australia develop the most cost effective technologies for cutting greenhouse emissions.

Emissions trading will complement existing Government actions to reduce greenhouse gases. These include:

- improving end-use energy efficiency;
- investing in the new low emissions technologies Australia and the world will need in the future, including renewable energy technologies and clean coal;
- supporting world-class scientific research to continue to build our understanding of climate change and its potential impacts, particularly on our region; and
- assisting regions and industries to adapt to the impacts of climate change.

An emissions trading scheme will build on the success of past and ongoing measures. These measures include the *2004 Energy White Paper*, *2004-05 Climate Change Strategy*, earlier measures such as *Measures for a Better Environment* and *Safeguarding the Future*, as well as new programs announced in 2006-07.

Appendix 3: Review of International Approaches

USA

The regulatory framework for the US programs consists of the National Energy Policy and Conservation Act (NEPCA) of 1978 (and subsequent amendments), which requires comparative labelling for household appliances and packaging disclosure panels for certain classes of lighting; the National Appliance Energy Conservation Act (NAECA) of 1987 (and subsequent amendments), which requires MEPS for a range of household appliances; and the Energy Policy and Conservation Act (EPCAct) of 1992, which extended MEPS and labelling to certain classes of non-household products. This legislation requires the US Department of Energy (DOE) to set MEPS for a wide range of named products, plus any other products that consume more than a specified amount of energy.

While the USA has equipment based MEPS for many products under the Energy Policy Act of 1992, the efficiency of close control air conditioning is not at present regulated.

ASHRAE – 90.1 Standard

The American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) publish standards and tests methods for many USA jurisdictions. Of greatest importance is the ASHRAE Standard 90.1 – 1999 (Energy Standard for Buildings Except for Low Rise Residential Buildings), now up to revision SI 90.1 – 2001, which provides the minimum requirements for energy-efficiency design of non-residential buildings.

The ASHRAE Standard 90.1 specifies the test standards and MEPS levels for chillers and non-residential building air conditioning and this standard then forms the technical basis for all State building codes. However, close control air conditioning is not included in the USA building codes.

In the 1999 revision the standard was widened to include space that is conditioned for use by computer rooms and other specialised purposes. Previously, computer rooms were exempt from the 1989 standard, however now they are required to meet the various sections of the standard, except for explicit exceptions (such as time controls). However, a minimum requirement for the efficiency of the mechanical cooling equipment was NOT specified in the 1999 revision. The efficiency of computer room air conditioners is not explicitly stated in the standard, as for other categories of HVAC equipment. (ASHRAE 2001).

More recently, a revision of the testing standard ASHRAE 127-2001 has brought the testing standard into alignment with the ASHRAE Thermal Guidelines for Data Processing Environments.

DOE – EPCA

The US has specified the minimum efficiency requirements of various categories of equipment under the power of the Energy Policy Conservation Act (EPCA). In the most recent examination of the coverage of this Act of computer room air conditioners, the DOE have assessed computer room air conditioners as not being a "covered" product under EPCA (DOE 2000). They have dedicated two pages of discussion on this mater in the *Proposed Rule: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards for Commercial Air Conditioners and Heat Pumps, August 9, 2000.*

If the ASHRAE Standard 90.1 is modified to explicitly include this equipment, a test method and MEPS levels to cover it, then the DOE states they will reconsider their inclusion.

CEC – Appliance Standards

The California Energy Commission (CEC) regulates the sale of new appliances (and equipment) under the Title 20: Appliance Efficiency Regulations. In general, the CEC utilises the minimum requirements for efficiency specified under the US DOE EPCA, however where they consider greater stringency is required or the equipment is not covered by EPCA, the CEC specifies the minimum efficiency and testing standard. The new Appliance Standards became effective on 27 November 2002 and include amendments that specifically state the new MEPS and test standards for computer room air conditioners (CEC 2002). These standards have been retained in the 2006 revision of the Standards. These standards are shown in Table 17 and converted to EERs and size in w/w and kW in Table 18.

Table 17: CEC MEPS: Minimum EER (Btu/h/w) for Air Cooled Units by Size

Effective Date Btu/h output -	1/01/1998	1/03/2003	1/01/2004	1/01/2006
<65000	8.3	9.3	10.7	11
<=65000 <135000	7.7	8.3	10.4	10.4
<=135000 <240000		7.9	10.2	10.2

Table 18: CEC MEPS: Minimum EER (w/w) for Air Cooled Units by Size

Effective Date kW output	1/01/1998	1/03/2003	1/01/2004	1/01/2006
<19.05	2.43	2.73	3.14	3.22
<=19.05 <39.5	2.26	2.43	3.05	3.05
<=39.5 <70.3	-	2.32	2.99	2.99

Testing Standard: ANSI/ASHRAE 127-2001

The MEPS prescribed by the CEC are based on tests to the ASHRAE 127-2001, which has different test conditions to the conditions specified for commercial air conditioning equipment (ARI Standard 210/240-1994). The conditions in ARI 210/240 are close to the ISO T1 conditions for "Point A" of the test, which is commonly reported in the manufacturer data and used for determining the EER. The indoor air test conditions for ASHRAE 127-2001 are 72°F (~22°C) dry bulb and 60°F (~16°C) wet bulb, compared to the ISO T1 conditions of 27°C and 19°C respectively. Other differences between the test standards do exist including:

- ARI 210/240 limits indoor-side air quantity to 37.5 scfm per 1000 Btu/h, while the ASHRAE 127-2001 does not
- ASHRAE 127-2001 and ARI 210/240 prescribe different external static pressures.

According to the US DOE (DOE 2000), the dominating effect is the difference in specified indoor dry bulb temperatures which result in the EERs from the ASHRAE standard having lower EERs compared to a test from the ARI standard.

Hawaii – Model Energy Code

The Hawaii Model Energy Code provides explicit exemptions for computer room air conditioned space.

There are no state–specific MEPS for computer room air conditioners, only those prescribed federally by the DOE.

Oregon – Non-Residential Energy Code

The Oregon Office of Energy administers the Non-Residential code, which recently changed the scope of the code limit exemptions. Previously all computer rooms were exempt, however in line with changes to the ASHRAE 90.1 – 1999, exemptions were changed to specific areas, such as economizer requirements, VAV requirements, and restrictions against simultaneous heating and cooling (OOE 2002).

Europe

UK – Market Transformation Programme (MTP)

The UK implements a number of programmes to encourage efficiency, including the Climate Change Levy and associated tax concessions. As part of these programmes, suppliers list products and their characteristics according to various tests. The UK MTP has explicitly exempted CCAC form these programmes. (UK MTP 2002)

No MEPS is in place for CCAC in the UK.

Eurovent – Certification Programme (EU)

The purpose of the Eurovent Certification Programmes is to create a common set of criteria for rating products. Through specification of certified products, the engineer's tasks are made easier, since there is no need for carrying out detailed comparison and performance qualification testing.

The Eurovent programme has a specific programme for certification of CCAC and specifies the test conditions. The test conditions for CCAC are close to the ASHRAE conditions used by the CEC with their MEPS, with indoor air at 24 ^{o}C dry bulb and 17^{o}C wet bulb (compared to ~22^{o}C wb and ~16^{o}C db in ASHRAE 127-2001) (EUROVENT 2003).

Testing Standard CEN: prEN 14511-2

A draft standard is being prepared by the CEN for European use. The draft standard is called prEN 14511, Air conditioners, Liquid Chilling Packages and Heat Pumps with Electrically Driven Compressors for Space Heating and Cooling. Part 2: Test Conditions is of most interest. The standard is still in draft stage, however, the test conditions for CCAC are the same as those of EUROVENT (outdoor 35^{o}C dry bulb and 24^{o}C wet bulb and indoor air at 24 ^{o}C dry bulb and 17^{o}C wet bulb) (CEN 2002).

Summary

Internationally, the Californian Energy Commission (CEC) is the only jurisdiction that regulates the efficiency of CCAC. The US Department of Energy have assessed computer room air conditioners as not being a "covered" product under Energy Policy and Conservation Act (EPCA), primarily due to their exclusion from the defacto USA building code – ASHREA Standard 90.1. However, ASHRAE have developed a specific test standard for computer room air conditioners under Standard 127-2001. This standard was revised and has now been published as Standard 127-2007. In addition ASHRAE have specifically included computer rooms under the general requirements for 90.1-1999, but ASHRAE have not set minimum efficiency levels for computer room air conditioners.

The MEPS for computer room air conditioners specified by the CEC have been in place since 1998 and increased until 2006. The CEC MEPS for computer room air conditioners has been effectively as stringent, or more stringent, than the USA MEPS applied to commercial unitary air conditioners from 2004.

The test conditions specified internationally for rating CCAC are typically different to comfort air conditioners. The inside conditions specified by the ASHREA Standard 127-2001 and the draft European standard are 22°Cdb/16°Cwb and 24°Cdb/17°Cwb respectively. The revised ASHRAE standard 127-2007 specifies indoor conditions as 22°CDB/50% RH. These rating points will cause different results for EER. The standard ISO conditions for comfort air conditioners are generally 27°Cdb/19°Cwb.

A summary of the situation in each of these jurisdictions is shown below:

Region		MEPS	Certification/ Other Compliance
USA – All		**Yes, Some States**	
	California	Yes from 1998	Yes – ANSI/ASHRAE 127-2001 for equipment / ASHRAE 90.1 –1999
	Hawaii	No	No/ Model Building Code provides exemption to Computer Room Air Conditioners
	Oregon	No	No/ All commercial must comply with ASHRAE 90.1-1999
Europe		**No**	
	UK	No	MTP does not apply to Computer Room Air Conditioners
	EU - All	No	Yes to EUROVENT, with CEN developing a common Standard for Close Control Air Conditioners

Appendix 4: Stock and Sales

Close Control Air conditioners – Sales Trends

Sales by Category

The sales of air and water cooled CCAC is a function of economic growth and more specifically the result of business activity in the telecommunications and data centre sectors of the economy. Industry sources have suggested that historically the sales of all types of CCACs have increased steadily at an annual growth rate of around 3 per cent. There have been small changes in proportion of technology and size in the annual sales. For example, there has been an upward trend towards higher capacities which in turn has led to a marginally rising share of water cooled units.

Annual sales by category of product are forecast from estimated values, as provided by industry sources, for the year 2006 by applying an annual growth rate of 3 per cent. The historical and forecast sales figures developed for the RIS take into account the mix of two technologies and size categories. Using the 2006 estimates as a reference point the historical and forecast values have been estimated. In doing so, assumptions have been made to account for growing sales of water cooled units at the expense of air cooled counterparts. RIS analysis is required to use year 2000 as the starting year. Consequently year 2000 is used as reference year in this document.

The year 2000 estimates provide that of all new CCACs sold 60 per cent were air cooled and remaining 40 per cent were water cooled. The proportional shares by capacities within each technology have been estimated to have also changed proportionally with an increasing share of larger capacities. Hence a large proportion of air cooled CCACs is skewed towards smaller capacities, while the reverse is applicable for water cooled units. Table 19 provides the market shares by technology and by cooling capacity in year 2000.

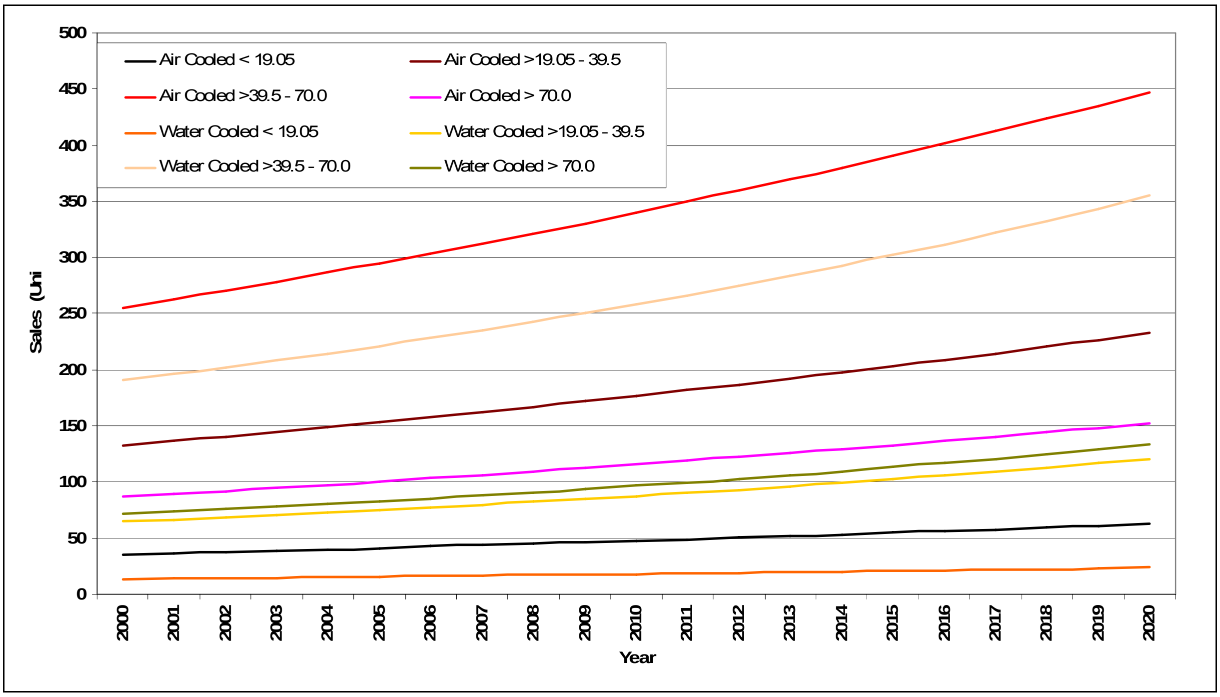
Table 19: Market Shares by technology and cooling capacities (2000)

Cooling Capacity (kW)	Market Share (Stock)			Market Share (Sales)		
	% Air	% Water	All	% Air	% Water	All
< 19.05	8%	5%	**7%**	7%	4%	**6%**
>19.05 - 39.5	27%	20%	**24%**	26%	19%	**23%**
>39.5 - 70.0	49%	55%	**51%**	50%	56%	**52%**
> 70.0	16%	20%	**17%**	17%	21%	**19%**
All	**61%**	**39%**	**100%**	**60%**	**40%**	**100%**

In order to allow for shift in preference for larger water cooled technology offset was applied to general annual sales growth rate of 3 per cent for all CCACs. In case of water cooled CCACs a +0.5 per cent offset was applied to general 3 per cent sales growth. In contrast a -0.5 per cent offset was applied to general 3 per cent annual sales growth rate of water cooled CCACs.

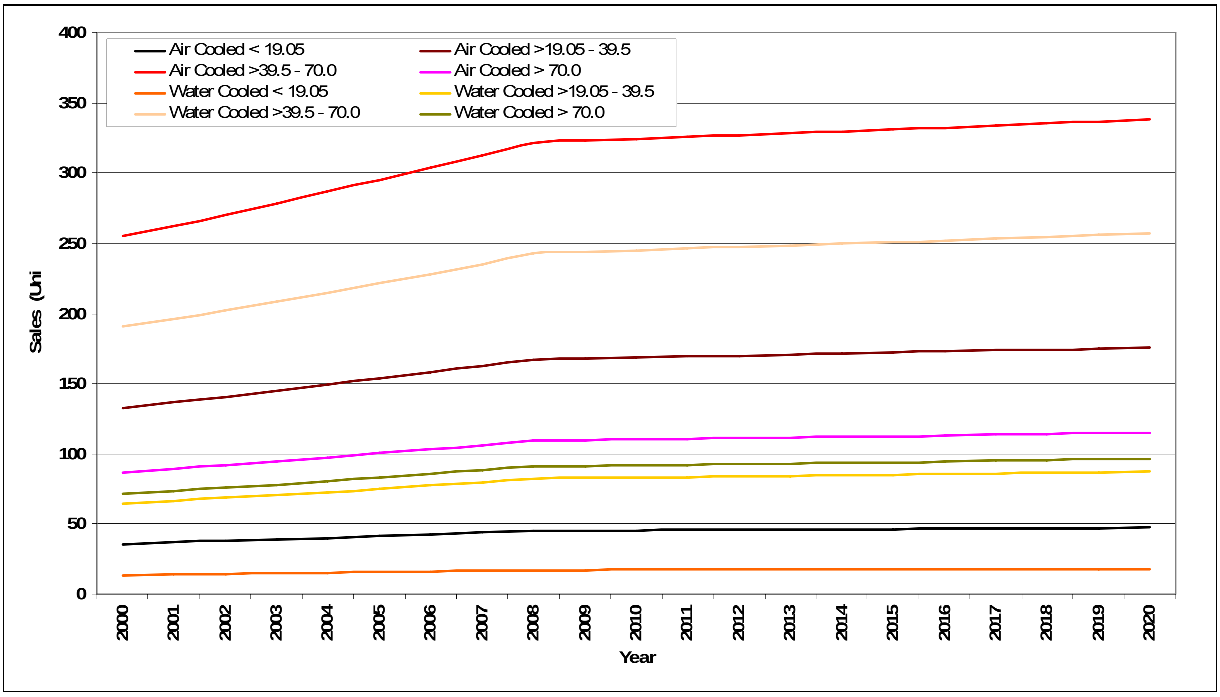
Figure 25 shows the resulting forecast sales of CCACs to 2020 in Australia by category for the base sales scenario.

Figure 25: Forecast Sales of CCACs - Base Sales Scenario Australia



The current trends indicate that Base Sales scenario is more likely however many factors can influence these projections. The competing Low sales scenario is shown in Figure 26. Please note that in both cases forecast values start from 2008.

Figure 26: Forecast Sales of CCACs - Low Sales Scenario Australia



Similar forecasts and sales estimates were also made for the New Zealand market, based on the assumption that New Zealand market, both in terms of stock and sales, is about 10 per cent of Australian market. Figure 27 and Figure 28 show the forecast sales of CCACs to 2020 by category in New Zealand for the base and low sales scenarios respectively.

Figure 27: Forecast Sales of CCACs - Base Sales Scenario New Zealand

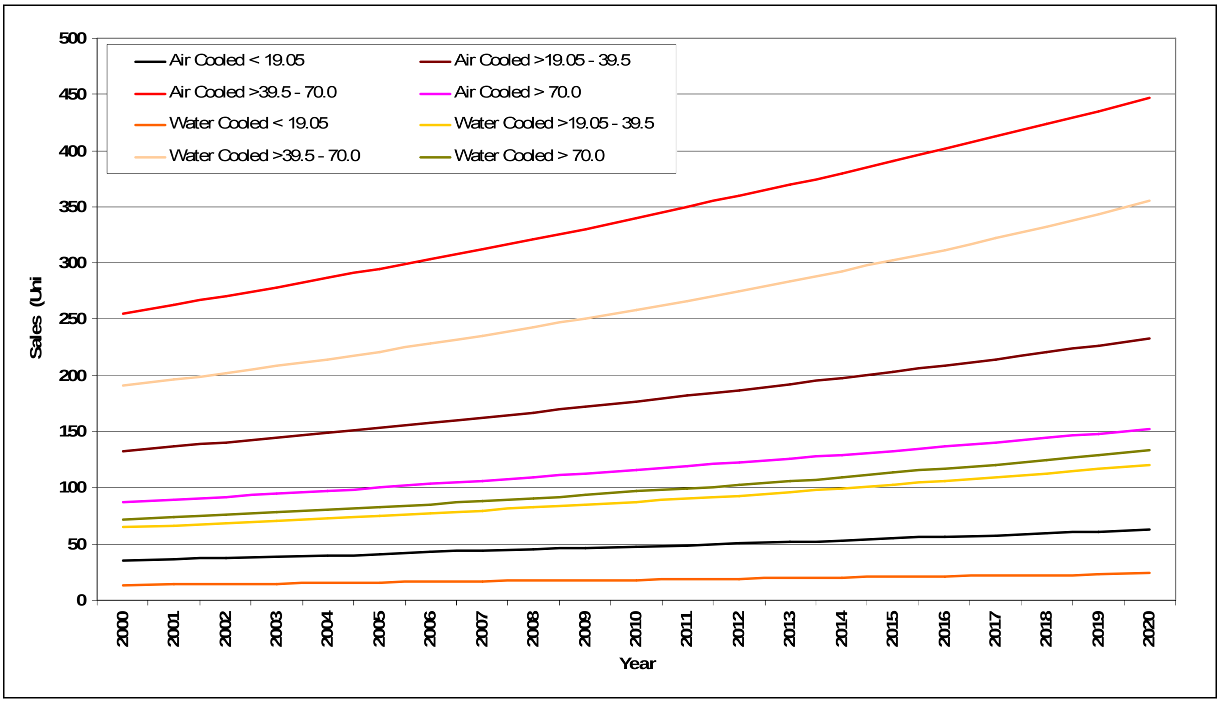
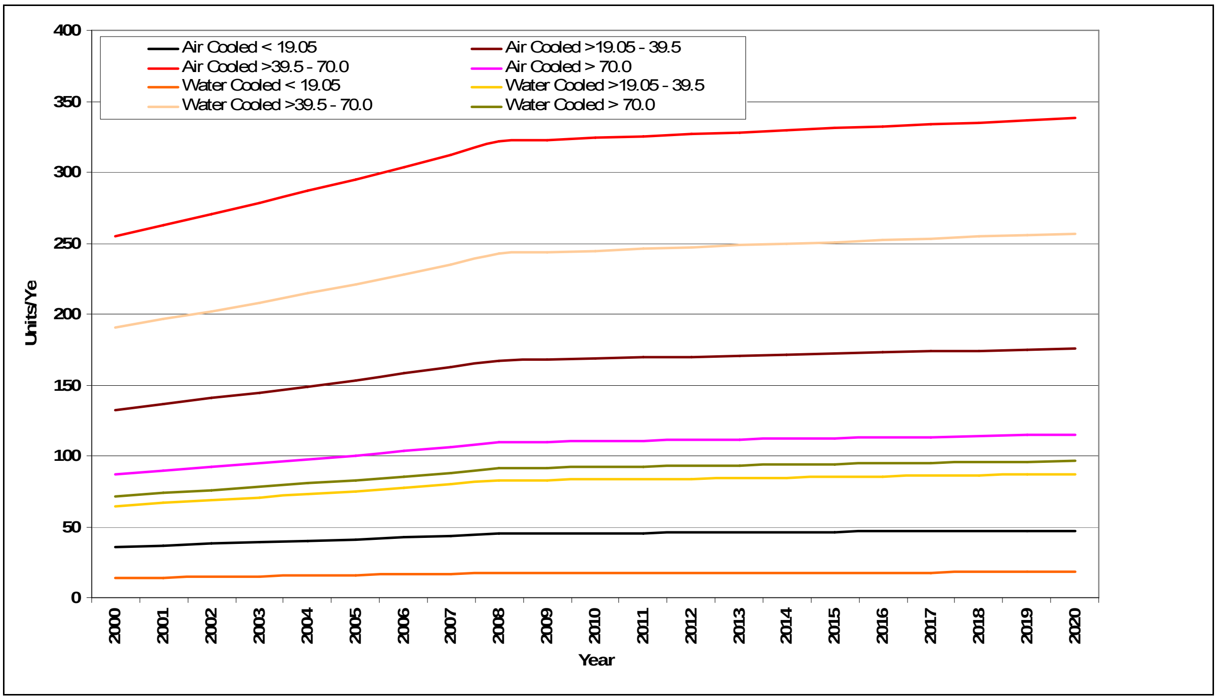


Figure 28: Forecast Sales of CCACs - Low Sales Scenario New Zealand



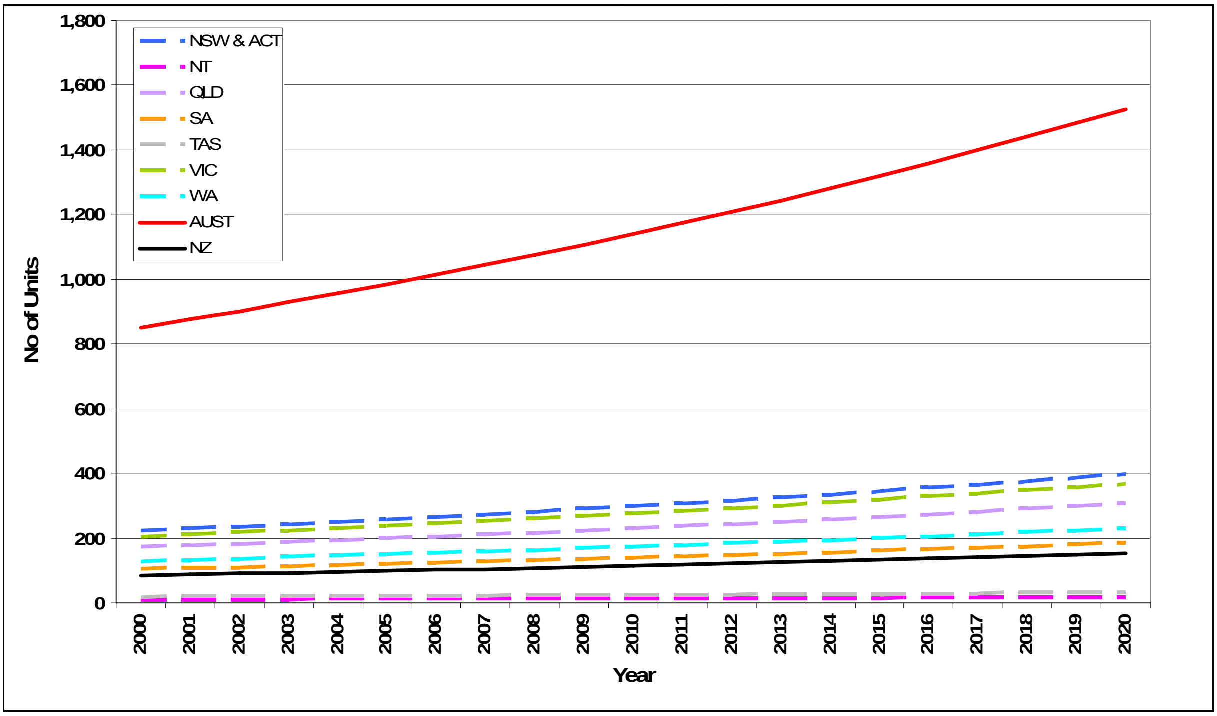
Sales by States and New Zealand

Based on the earlier forecasts of sales, the share of CCACs sales by State for the period 2000 – 2020 are shown in Table 20 while Figure 29 graphically illustrates the sales trends. New Zealand sales are the total sales for New Zealand, where the Australian states based on estimates provided by industry sources.

Table 20: Total annual sales of CCAC 2000-2020, by States, Australia as a whole and New Zealand – Base sales scenario

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2000	221	9	170	102	17	204	128	**850**	**85**
2001	228	9	175	105	18	210	131	**875**	**88**
2002	234	9	180	108	18	216	135	**902**	**90**
2003	241	9	186	111	19	223	139	**929**	**93**
2004	249	10	191	115	19	230	143	**956**	**96**
2005	256	10	197	118	20	236	148	**985**	**98**
2006	264	10	203	122	20	243	152	**1,014**	**101**
2007	272	10	209	125	21	251	157	**1,044**	**104**
2008	280	11	215	129	22	258	161	**1,076**	**108**
2009	288	11	221	133	22	266	166	**1,107**	**111**
2010	296	11	228	137	23	274	171	**1,140**	**114**
2011	305	12	235	141	23	282	176	**1,174**	**117**
2012	314	12	242	145	24	290	181	**1,209**	**121**
2013	324	12	249	149	25	299	187	**1,245**	**124**
2014	333	13	256	154	26	308	192	**1,282**	**128**
2015	343	13	264	158	26	317	198	**1,320**	**132**
2016	353	14	272	163	27	326	204	**1,359**	**136**
2017	364	14	280	168	28	336	210	**1,399**	**140**
2018	374	14	288	173	29	346	216	**1,440**	**144**
2019	385	15	297	178	30	356	222	**1,483**	**148**
2020	397	15	305	183	31	366	229	**1,526**	**153**

Figure 29: Annual sales of CCACs by State, Australia and NZ – Base sales scenario



Close Control Air conditioners – Stock Trends

Stock by Category

CCACs are often required to operate continuously. As a result they tend to have shorter lifespan as compared with chillers. Typically CCACs have a life span of between 8 and 12 years. Water cooled CCACs are known to have only marginally longer life span than the air cooled types. The long life of CCACs makes it complicated to estimate the number of CCACs by their technology, cooling capacity, and age. Identifying the CCACs by these three attributes is important from the point of view of having reliable estimates of energy consumption and GHG emissions, as older CCACs are considered to be less efficient than new units.

Once again to estimate historic and forecast stock, the values for the year 2000 were used as reference. The estimated stock in 2000 and its breakdown by technology and cooling capacity were calculated from estimates provided by the industry sources for 2006. It was estimated that in year 2000 around 9,700 CCACs were operating in Australia. Of all the operating CCACs, 39 per cent were estimated to be water cooled and remaining were the air cooled types. An estimated breakdown of air and water cooled CCAC stock in 2000 has been shown in Table 19. The resulting breakdown was subjected to backwards distribution across 8 to 12 years on the basis of annual sales estimates and a survival function that reflects the life span of water and air cooled CCACs. Consequently the year 2000 stock was broken down, first by technology and cooling capacity based on values in

Table 19, followed by each category broken down into estimated number of units over the past several years up to the maximum life of technology (12 years for both technology types). The resulting breakdown was subjected to appropriate "survival functions" to re-estimate the year 2000 stock. Please note the CCACs stock re-estimated as above, now provides another level of breakdown i.e. the age of CCACs, which when applied with relevant energy performance values, was used to estimate more reliable energy and GHG emission estimates.

Because of similar operating behaviour and life spans, similar survival functions were used for both technology types. The survival functions shown in Figure 30 and Figure 31 provide a graphical view of the percentage of CCACs (Rt) in useful service over the life in years from purchase (t).

Figure 30: Survival Function of water cooled CCACs for Australia and New Zealand

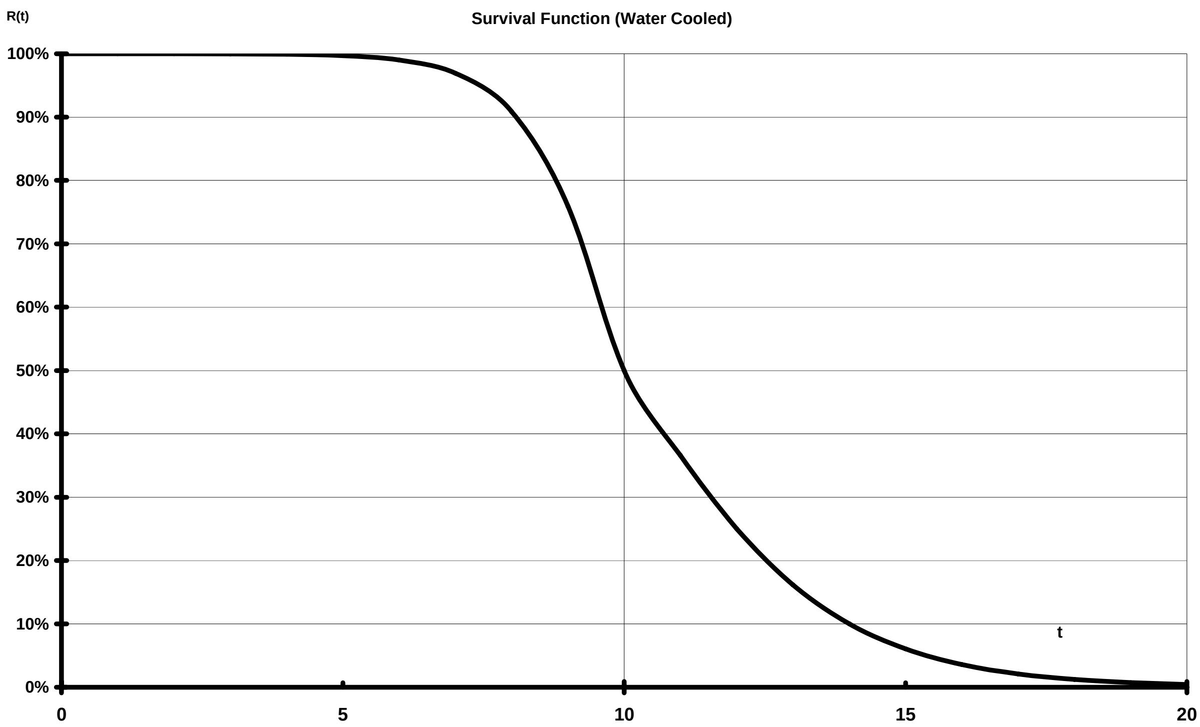
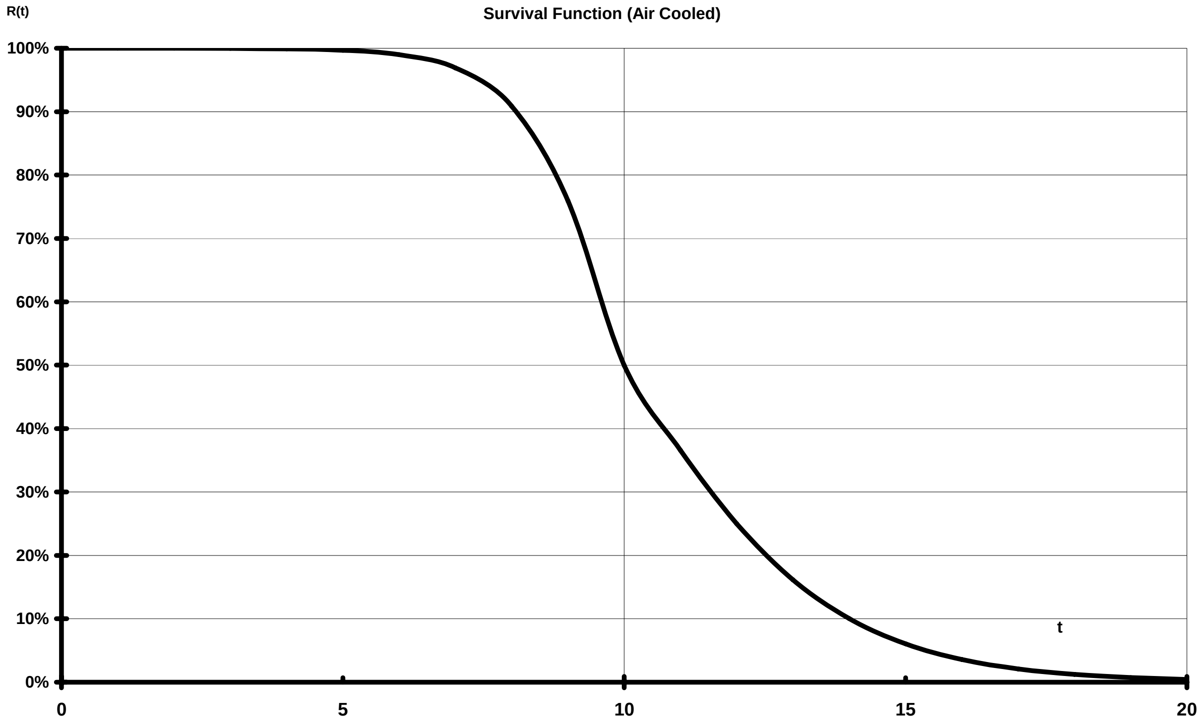


Figure 31: Survival Function of air cooled CCACs for Australia and New Zealand



The resulting estimated stock of CCACs by category for Australia over the period 2000 – 2020 is shown in Figure 32 for the base sales scenario and Figure 33 for the low sales scenario.

Figure 32: Forecast Stock of CCACs - Base Sales Scenario Australia

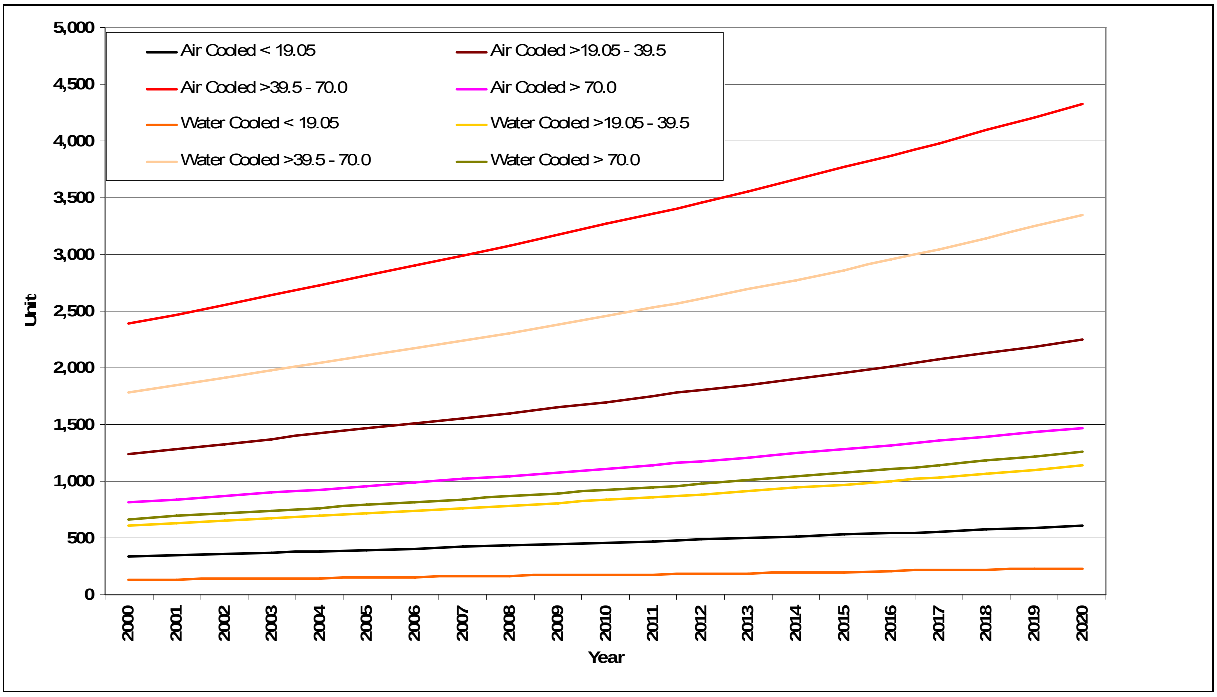
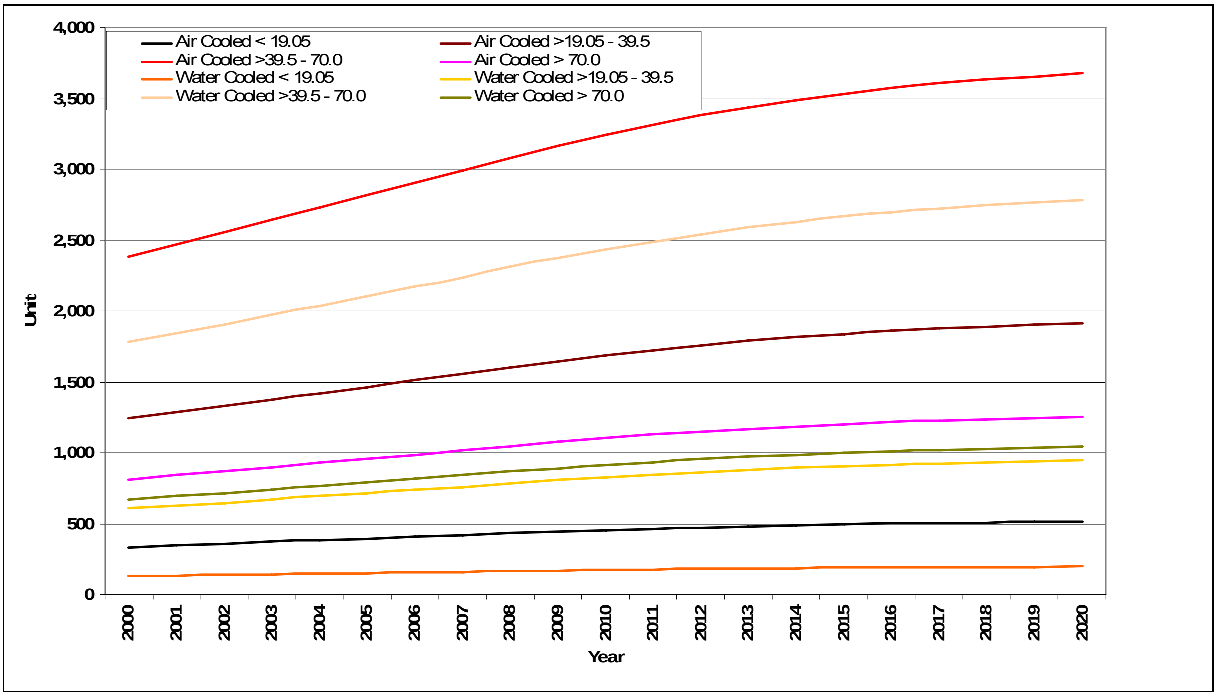


Figure 33: Forecast Stock of CCACs - Low Sales Scenario Australia



Similarly in NZ, the stock of CCACs by category for the period 2000 – 2020, for the base sales scenario is shown in Figure 34 and Figure 35 for the low sales scenario.

Figure 34: Forecast Stock of CCACs - Base Sales Scenario New Zealand

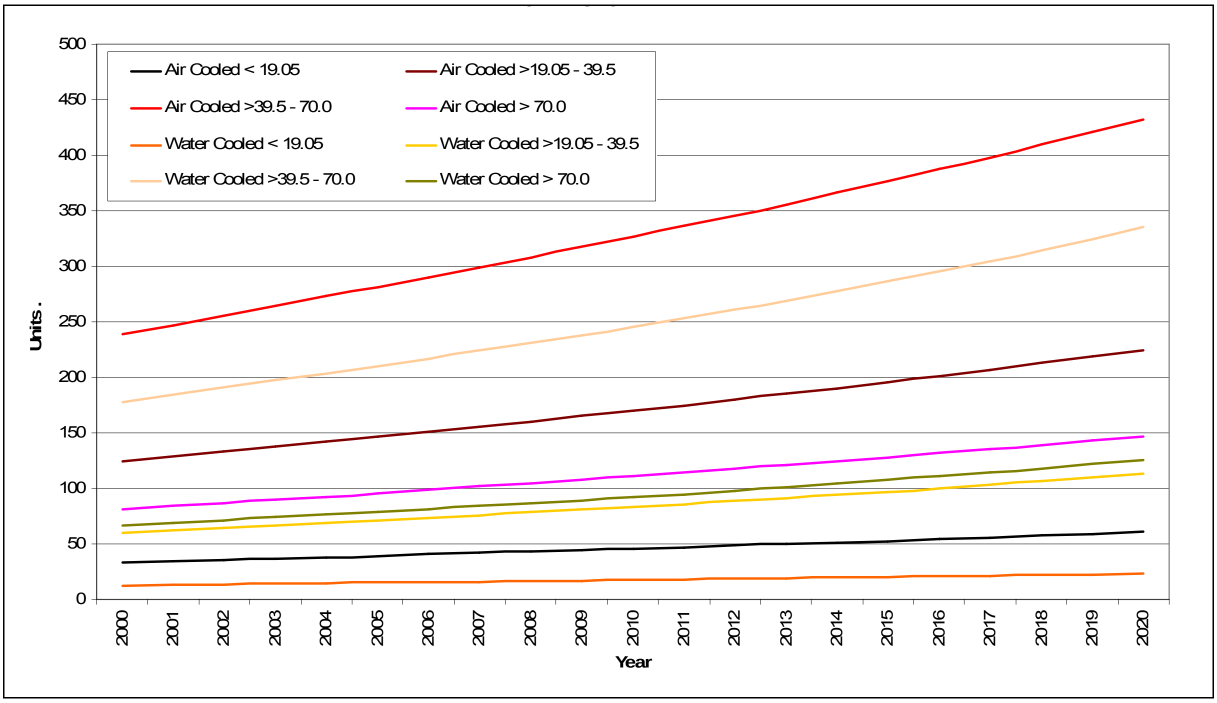
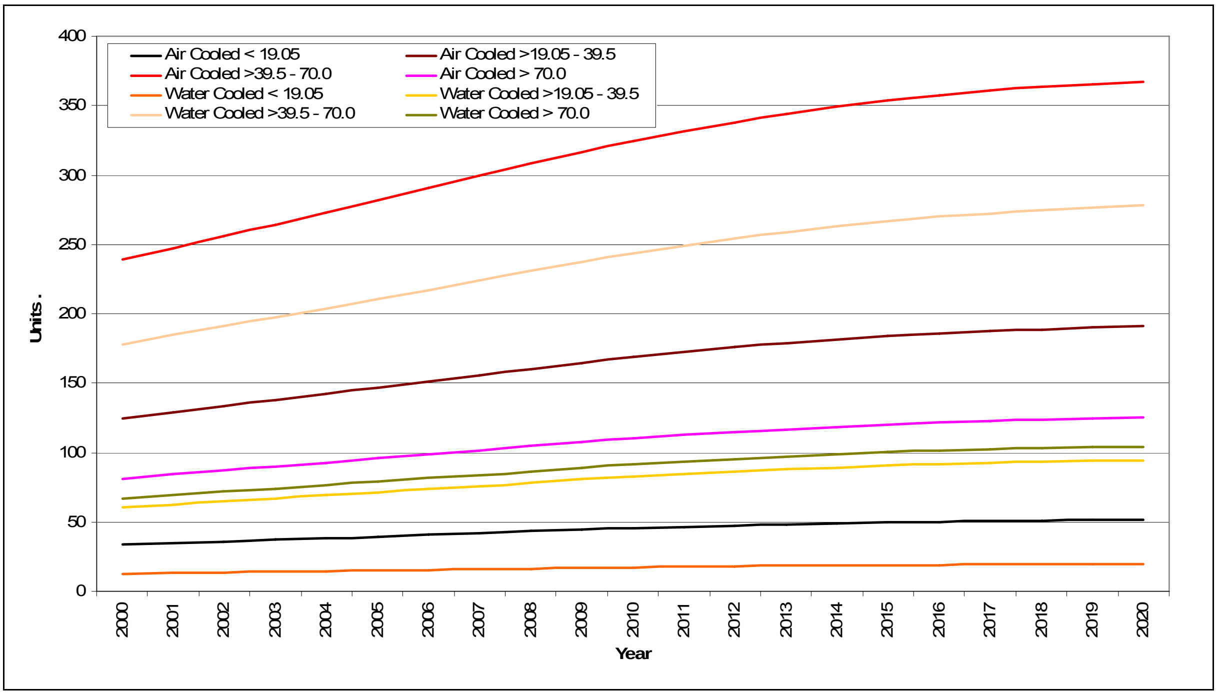


Figure 35: Forecast Stock of CCACs - Low Sales Scenario New Zealand



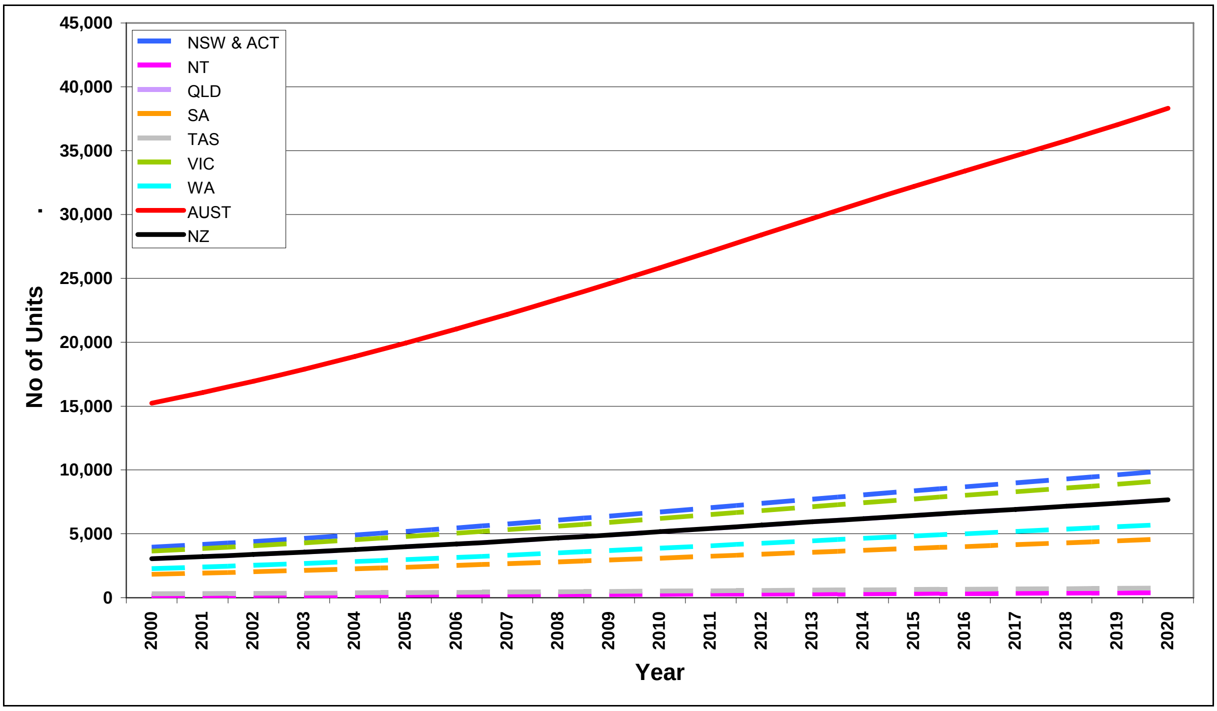
Stock by States and New Zealand

The estimates of CCACs stock for the period between 2000 and 2020 by states, Australia as a whole and New Zealand are provided in Table 21 while Figure 36 shows the corresponding trend.

Table 21: Stock of CCAC 2000-2020, by States, Australia as a whole and New Zealand (base sales scenario)

YEAR	NSW & ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2000	2,069	80	1,591	955	159	1,909	1,193	**7,956**	**796**
2001	2,142	82	1,647	988	165	1,977	1,235	**8,237**	**824**
2002	2,215	85	1,704	1,022	170	2,045	1,278	**8,520**	**852**
2003	2,290	88	1,761	1,057	176	2,114	1,321	**8,806**	**881**
2004	2,365	91	1,819	1,091	182	2,183	1,364	**9,095**	**910**
2005	2,441	94	1,877	1,126	188	2,253	1,408	**9,387**	**939**
2006	2,517	97	1,936	1,162	194	2,324	1,452	**9,682**	**968**
2007	2,595	100	1,996	1,198	200	2,395	1,497	**9,981**	**998**
2008	2,674	103	2,057	1,234	206	2,469	1,543	**10,285**	**1,029**
2009	2,755	106	2,119	1,272	212	2,543	1,589	**10,597**	**1,060**
2010	2,838	109	2,183	1,310	218	2,620	1,637	**10,915**	**1,092**
2011	2,923	112	2,248	1,349	225	2,698	1,686	**11,242**	**1,124**
2012	3,010	116	2,316	1,389	232	2,779	1,737	**11,578**	**1,158**
2013	3,100	119	2,385	1,431	238	2,861	1,788	**11,923**	**1,192**
2014	3,192	123	2,455	1,473	246	2,947	1,842	**12,277**	**1,228**
2015	3,287	126	2,528	1,517	253	3,034	1,896	**12,642**	**1,264**
2016	3,385	130	2,604	1,562	260	3,124	1,953	**13,018**	**1,302**
2017	3,485	134	2,681	1,608	268	3,217	2,011	**13,404**	**1,340**
2018	3,588	138	2,760	1,656	276	3,312	2,070	**13,801**	**1,380**
2019	3,694	142	2,842	1,705	284	3,410	2,131	**14,210**	**1,421**
2020	3,804	146	2,926	1,756	293	3,511	2,195	**14,630**	**1,463**

Figure 36: Trend - Stock of CCACs 2000 – 2020 by States, Australia as a whole and New Zealand (base sales scenario)



Appendix 5: Energy Prices and Factors

Table 22: Marginal Commercial Electricity Tariffs 2006-07

State	c/kWh Commercial
NSW	17
Victoria	17
Queensland	15
SA	16
WA	14
Tasmania	16
NT	15
ACT	19.0
Australia (weighted)	**16.0**
New Zealand	**16**

Source: Estimates from published electricity tariffs and *Guide to Preparing Regulation Impact Statements for the Appliance and Equipment Energy Efficiency Program* (NAEEEP 2005). All values include GST

Appendix 6: Calculation Methodology

The following Appendix describes the assumptions, data sources and calculation steps and methodology for this RIS.

This methodology and the assumptions made are the basis of the Costs, Benefits and Impacts of the proposal. As such, careful scrutiny and feedback is sought from stakeholders in this consultative phase.

Power and Usage

Energy used by CCACs 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 generation mix by type of technology.

The number of operating units is a function of existing stock, replacements and new sales. Estimates of stock and sales were made for all Australia and New Zealand as detailed in Appendix 4: Stock and Sales. Combination of running stock and new sales were subjected to a "survival function" that reflected the life span of typical CCACs. These sales, in combination with the survival function, were multiplied by BAU and MEPS average power input figures and corresponding average number of hours of operation for each category.

It is worth noting that CCACs are known to operate at almost their full capacity throughout a year. Therefore, the energy performance of CCACs is often measured at full-load.

The input power to a CCAC is a function of the commonly used Energy Efficiency Ratio (EER) of the CCAC. The EER and cooling capacity in kW are the commonly used technical attributes of CCACs. The input power in kW can be calculated as:

$$\text{Inpout Power (kW)} = \frac{\text{Cooling Capacity (kW)}}{EER}$$

Since CCACs normally operate at constant load, only the EER at full-load operation is used to estimate the input power.

The BAU and MEPS average cooling capacities, EERs and input power for 100 per cent loading for each category of CCACs are shown in Appendix 11: To determine the total energy consumption, these values were multiplied by their respective usage characteristics as applicable to different states and New Zealand.

It is worth noting that industry consultations have revealed that while CCACs operate almost continuously at full-load when operating, the operating times of units are rotated so some units are always on standby in case a unit fails. Such industry sources have estimated that on an average roughly 65 per cent of all installed units operate at any given time while the others stay idle as standby units. In order to incorporate this behaviour to the entire installed stock, it is considered that any given unit operates for 65 per cent of the time (i.e. 65 per cent of 8760 hours in a year) at its full-load capacity while it is in OFF state for the remaining time.

Since the CCACs either operate at 100 per cent load or do not operate at all, simulation of different usage levels scenarios was not conducted for CCACs.

Energy and Greenhouse

Generally the sum of direct and indirect energy consumption is used to provide the net energy consumption used for all subsequent calculations. However, operation of CCACs does not significantly affect energy usage by other appliances, for example, other heating or cooling appliances. Consequently the indirect energy resulting due to the operation of CCACs is either none or negligible. The GHG emissions were estimated by using the State energy calculations combined with the Greenhouse Gas Emissions Factors in Appendix 9.

Cost-Benefits

The NPV benefits are calculated for each state using the commercial tariffs as shown in Appendix 5: Energy Prices and Factors multiplied by the energy savings calculated earlier. The incremental costs are based upon industry information and shown in Table 7. 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 2020 of cohorts of product installed up till 2020 under the MEPS scenario are included in the net benefits, as per the Guide to Preparing Regulatory Impact Statements (NAEEEP 2005).

Sensitivity Scenarios

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

- two sales scenarios were modelled; Base and Low Growth: and
- three incremental cost scenarios were modelled as shown in Figure 22.

Appendix 7: 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, e.g. by affecting one group of suppliers more than another.

There are local manufacturers of close control air conditioner products in Australia. However, the industry has been working closely with Standards Australia to ensure that testing of product is undertaken using the most applicable international standards and the newly developed testing standard will reflect Australia and New Zealand conditions. The test method developed by the industry is designed to minimise testing costs and produce accurate, repeatable and representative results. The industry representatives have also reported that they currently have units available that meet the required MEPS.

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 internationally traded or manufactured from imported components and hence the MEPS would not favour local suppliers 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 Standard replicates the new ASHRAE 127-2007 test with modifications to test only the indoor unit.

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.

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

TTMRA

The Trans-Tasman Mutual Recognition Agreement (TTMRA) states that any product that can be lawfully manufactured in or imported into either Australia or New Zealand may be lawfully sold in the other jurisdiction. If the two countries have different regulatory requirements 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 may 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 TTMRA is an issue that may arise if New Zealand or Australia does not implement the MEPS requirements, in accordance with the Standard, at the same time. However, the Australian and New Zealand regulators are working together within the E3 Committee and hence this is not envisaged as an issue.

Appendix 8: Australian CPRS Indicative Benefits

The potential impact of an Australian CPRS on the benefit-cost ratio is assessed in this appendix. On 3 June 2007, the Prime Minister announced that Australia will implement a domestic emissions trading system beginning no later than 2012, and that the Government will set a national emissions target in 2008. The CPRS has the potential to increase the national benefits as a cost is imposed on greenhouse gas (GHG) emissions. Hence the RIS should take into account the increased benefits due to the avoided cost of carbon permits for electricity generators, which will result from the proposed MEPS reducing the consumption and generation of electricity at the margin.

These valuations are included as a trial in this RIS and will be included within the main analysis once the Australian Government has set out parameters for how the emissions trading scheme will operate and this RIS methodology has been trialled and reviewed.

A number of possible methodologies could be used to value the GHG emissions abatement, such as using a separate carbon price or using retail electricity tariffs that include the effects of the CPRS. The most appropriate approach can be determined once the Government has made decisions on how the CPRS will operate (which will clarify how a new MEPS and the CPRS interact) and once modelling of future electricity prices under emissions trading is available.

In the interim, the MCE E3 Committee plans to use the valuation methodology discussed below, and to revisit the choice of methodology once more information is available. The approach essentially involves sensitivity testing of a range of plausible carbon prices.

The methodology values abatement at the shadow price of the carbon permit price on the basis that by introducing emissions trading the Government has placed a carbon constraint on the economy and created a market value for emission reductions (i.e., “commoditised” emissions). Abatement is also shown in tonnes of greenhouse gases for information. With a CPRS operating in the economy, any new MEPS should have its abatement valued in terms of the counter-factual cost of achieving the same abatement through other measures in the CPRS.

As this RIS is a partial equilibrium analysis, it values the costs and benefits of the proposed measure at the prevailing prices in the economy, assuming the impact of the measure has negligible impact on those prices. As already noted in Section 5.6, the MEPS will reduce the consumption of electricity at the margin and this reduction is valued at the avoided cost of electricity generation and transmission for the economy – hence it provides the basis of the national benefits.

Similarly, a partial equilibrium analysis takes the CPRS cap as given, assuming any new individual MEPS will have negligible impact on the carbon market and cap. Therefore the GHG emissions reduction is valued at the expected prevailing carbon permit price. This implicitly recognises that the emissions avoided through the MEPS will obviate the need for an equivalent amount of abatement elsewhere in the economy. Using the same approach as for the avoided cost of electricity generation and transmission, the avoided cost of carbon permits is added to the national benefits.

The carbon prices for sensitivity analysis are shown at $0, $10 and $20/t CO_2-e from 2012 and Table 23 reports the effect of this on the RIS.

Although the future carbon price under the CPRS is uncertain at present, emissions trading will mean the estimated benefits will always be higher than without emissions trading (i.e., the benefits will always be higher when the carbon price is above zero).

Table 23: Carbon Permit Sensitivity Analysis – Australia Base Sales Growth

$0/t CO_2-e Carbon Permit Price				
	NPV Nil (0%)	**NPV Low (5%)**	**NPV Med (7.5%)**	**NPV High (10%)**
Total Costs	$51,782,480	$35,249,360	$29,581,071	$25,079,386
Total Benefits	$461,629,121	$248,510,559	$188,076,992	$144,972,874
Net Benefits	$409,846,641	$213,261,199	$158,495,921	$119,893,489
Benefit Cost Ratio	8.9	7.1	6.4	5.8
Cumulative Mt CO_2-e Abatement (2012 -2020)	1.5			
Potential Carbon Permit Avoided Costs				
Additional Avoided Carbon Costs @ $10/t CO2-e from 2012	$14,804,987	$8,932,660	$7,037,609	$5,593,520
Additional Avoided Carbon Costs @ $20/t CO2-e from 2012	$29,609,974	$17,865,321	$14,075,219	$11,187,041
Changes to Benefit Cost Ratio				
BCR with @ $10/t CO_2-e from 2012	9.2	7.3	6.6	6.0
BCR with @ $20/t CO_2-e from 2012	9.5	7.6	6.8	6.2

As the table shows, a potential carbon permit price of $10/t CO_2-e would increase the BCR from 6.4 to 6.6; likewise the permit price of $20/t CO_2-e would increase the BCR to 6.8, at a discount rate of 7.5%.

Appendix 9: Greenhouse Gas Emissions Factors

Table 24: Projected Marginal Emissions Factors: Electricity by State 2000-2020

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NSW+ ACT	0.950	0.950	0.958	1.018	1.027	1.021	1.031	1.039	1.018	0.987	0.975	0.963	0.965	0.945	0.961	0.919	0.910	0.883	0.888	0.881	0.866
VIC	0.008	0.008	0.008	0.754	0.757	0.760	0.760	0.764	0.770	0.769	0.775	0.779	0.727	0.732	0.735	0.739	0.743	0.747	0.750	0.752	0.754
Qld	1.053	1.053	1.035	1.021	0.991	1.020	0.994	1.022	0.979	0.935	0.935	0.929	0.932	0.901	0.929	0.912	0.901	0.894	0.874	0.864	0.869
SA	1.020	1.020	1.003	1.163	1.167	1.112	1.123	1.153	1.161	1.113	1.093	1.099	1.120	1.078	1.093	1.014	0.993	0.986	0.979	1.000	0.955
WA	0.651	0.651	0.663	0.840	0.769	0.769	0.902	1.007	1.024	1.033	0.998	0.993	1.000	1.016	1.005	1.038	0.984	0.965	0.954	0.966	0.976
NT	0.988	0.988	0.992	1.122	1.128	1.106	1.117	1.130	1.130	1.094	1.075	1.086	1.105	1.085	1.112	1.048	1.023	0.992	0.995	0.965	0.936
Tas	1.040	1.040	0.996	1.038	1.029	0.906	0.884	0.868	0.885	0.890	0.894	0.830	0.826	0.823	0.838	0.845	0.855	0.817	0.804	0.808	0.810
New Zealand	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698	0.698

Source: www.greenhouse.gov.au/ggap/round3/emission-factors.html: see separate emissions factor file for each State. Regional weightings by GWA All values state-wide average kg CO_2-e per kWh delivered, taking into account transmission and distribution losses (combustion emissions only). NZ Emissions updated in Oct 2007

Appendix 10: 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
NZ	HH ('000)	1441	1462	1483	1504	1526	1548	1566	1585	1603	1622	1641	1659	1677	1696	1714	1733	1750	1767	1784	1801
	Persons	3880	3925	3970	4016	4062	4109	4136	4164	4192	4220	4248	4274	4300	4326	4353	4379	4404	4429	4455	4480
	Persons/HH	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5
ANZ	HH ('000)	8826	8980	9139	9301	9446	9605	9761	9918	10075	10234	10395	10554	10713	10873	11034	11194	11352	11508	11664	11820
	Persons	23291	23559	23829	24098	24369	24640	24865	25091	25317	25543	25770	25983	26197	26412	26626	26840	27046	27252	27459	27665
	Persons/HH	2.6	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	2.4	2.3

Source: ABS 3236 Series III, Statistics New Zealand

Appendix 11: Average Cooling Capacity, and BAU & MEPS EERs and Power Inputs by Category

CCAC Category	Load Interval	Average Cooling Capacity (kW)	BAU EER	BAU Power Input (kW)	MEPS EER	MEPS Power Input (kW)
Air Cooled < 19.05	100%	10	2.31	4.34	2.75	3.64
Air Cooled >19.05 - 39.5	100%	30	2.21	13.55	2.75	10.91
Air Cooled >39.5 - 70.0	100%	55	2.14	25.67	2.75	19.99
Air Cooled > 70.0	100%	85	2.42	35.16	2.75	30.90
Water Cooled < 19.05	100%	10	2.31	4.34	2.75	3.64
Water Cooled >19.05 - 39.5	100%	30	2.21	13.55	2.75	10.91
Water Cooled >39.5 - 70.0	100%	55	2.14	25.67	2.75	19.99
Water Cooled > 70.0	100%	85	2.42	35.16	2.75	30.90

Appendix 12: Annual Cost Inputs for RIS Model

Category	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Costs to Government														
Establishment (Once Off)	$70,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance/Yr	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Administration of Program	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$30,000	$35,000	$40,000	$45,000	$50,000
Random Check/Testing/	$0	$20,000	$20,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$24,000	$23,000	$22,000	$21,000	$20,000
Consumer Information/Education/	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$24,000	$23,000	$22,000	$21,000	$20,000
Misc (RIS, Market Research)r	$25,000	$20,000	$20,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Subtotal Government	$195,000	$140,000	$140,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$153,000	$156,000	$159,000	$162,000	$165,000
Costs to Industry														
Total Cost of Testing	$0	$205,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000	$41,000
Total Cost of Registration	$0	$43,840	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768	$8,768
Subtotal Business	$0	$248,840	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768	$49,768
Costs to Consumers														
Costs of Incremental Price Increase	$0	$0	$4,576,287	$4,476,487	$4,378,753	$4,283,049	$4,189,344	$4,097,601	$4,007,790	$3,919,878	$3,833,831	$3,749,619	$3,667,210	$3,586,574
Total	$195,000	$345,000	$4,766,055	$4,676,255	$4,578,521	$4,482,817	$4,389,112	$4,297,369	$4,207,558	$4,122,646	$4,039,599	$3,958,387	$3,878,978	$3,801,342

Appendix 13: Annual Benefit and Cost Data

Table 25: Annual Consumer Energy, Benefits and Costs by State for Australia & New Zealand: Base Sales Scenario

Year	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Australia																						
BAU Energy use	GWh/yr	1,207	1,237	1,267	1,297	1,326	1,355	1,384	1,413	1,441	1,470	1,500	1,529	1,559	1,590	1,621	1,653	1,685	1,718	1,752	1,786	1,821
With-program energy use	GWh/yr	1,207	1,237	1,267	1,297	1,326	1,355	1,384	1,413	1,441	1,444	1,447	1,452	1,458	1,465	1,474	1,485	1,497	1,513	1,535	1,565	1,601
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	26	52	77	101	125	147	168	188	205	217	221	220
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.24	$8.36	$12.37	$16.24	$19.98	$23.55	$26.95	$30.09	$32.80	$34.70	$35.34	$35.25
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.5	51.8	76.0	100.5	120.9	145.5	160.0	176.1	187.3	197.4	199.0	195.3
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.58	$4.48	$4.38	$4.28	$4.19	$4.10	$4.01	$3.92	$3.83	$3.75	$3.67	$3.59
NSW&ACT																						
BAU Energy use	GWh/yr	410	421	431	441	451	461	471	480	490	500	510	520	530	541	551	562	573	584	596	607	619
With-program energy use	GWh/yr	410	421	431	441	451	461	471	480	490	491	492	494	496	498	501	505	509	515	522	532	544
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	9	18	26	34	42	50	57	64	70	74	75	75
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.53	$3.02	$4.46	$5.86	$7.21	$8.50	$9.73	$10.86	$11.84	$12.53	$12.76	$12.73
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	17.3	25.3	33.3	40.1	48.1	52.6	58.1	61.5	65.4	66.1	64.8
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.56	$1.52	$1.49	$1.46	$1.42	$1.39	$1.36	$1.33	$1.30	$1.27	$1.25	$1.22
NT																						
BAU Energy use	GWh/yr	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	17	17	17	18	18	18
With-program energy use	GWh/yr	12	12	13	13	13	14	14	14	14	14	14	15	15	15	15	15	15	15	15	16	16
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.04	$0.09	$0.13	$0.17	$0.21	$0.25	$0.29	$0.32	$0.35	$0.37	$0.38	$0.37
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.7	0.9	1.1	1.2	1.4	1.5	1.6	1.7	1.7
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.05	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
QLD																						
BAU Energy use	GWh/yr	241	247	253	259	265	271	277	283	288	294	300	306	312	318	324	331	337	344	350	357	364
With-program energy use	GWh/yr	241	247	253	259	265	271	277	283	288	289	289	290	292	293	295	297	299	303	307	313	320
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	5	10	15	20	25	29	34	38	41	43	44	44
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.79	$1.57	$2.32	$3.04	$3.74	$4.41	$5.05	$5.64	$6.15	$6.50	$6.62	$6.61
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	9.8	14.4	18.9	22.5	27.3	30.7	33.9	36.6	37.9	38.1	38.3
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.92	$0.90	$0.88	$0.86	$0.84	$0.82	$0.80	$0.78	$0.77	$0.75	$0.73	$0.72

Year	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
SA																						
BAU Energy use	GWh/yr	109	111	114	117	119	122	125	127	130	132	135	138	140	143	146	149	152	155	158	161	164
With-program energy use	GWh/yr	109	111	114	117	119	122	125	127	130	130	130	131	131	132	133	134	135	136	138	141	144
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	2	5	7	9	11	13	15	17	18	20	20	20
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.38	$0.75	$1.11	$1.46	$1.80	$2.12	$2.42	$2.71	$2.95	$3.12	$3.18	$3.17
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	5.1	7.6	10.2	12.1	14.5	15.4	16.8	18.2	19.1	19.9	18.9
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.41	$0.40	$0.39	$0.39	$0.38	$0.37	$0.36	$0.35	$0.35	$0.34	$0.33	$0.32
TAS																						
BAU Energy use	GWh/yr	24	25	25	26	27	27	28	28	29	29	30	31	31	32	32	33	34	34	35	36	36
With-program energy use	GWh/yr	24	25	25	26	27	27	28	28	29	29	29	29	29	29	29	30	30	30	31	31	32
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	1	1	2	2	2	3	3	4	4	4	4	4
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.07	$0.15	$0.22	$0.28	$0.35	$0.41	$0.47	$0.53	$0.57	$0.61	$0.62	$0.62
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.7	4.0	4.1	4.3	4.3
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.09	$0.09	$0.09	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08	$0.07	$0.07	$0.07
VIC																						
BAU Energy use	GWh/yr	290	297	304	311	318	325	332	339	346	353	360	367	374	382	389	397	404	412	420	429	437
With-program energy use	GWh/yr	290	297	304	311	318	325	332	339	346	347	347	348	350	352	354	356	359	363	368	376	384
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	6	13	19	24	30	35	40	45	49	52	53	53
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.02	$2.01	$2.97	$3.90	$4.79	$5.65	$6.46	$7.22	$7.87	$8.32	$8.48	$8.46
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	13.5	20.1	26.9	32.5	39.3	42.3	46.1	48.8	51.8	51.1	49.5
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.10	$1.07	$1.05	$1.03	$1.01	$0.98	$0.96	$0.94	$0.92	$0.90	$0.88	$0.86
WA																						
BAU Energy use	GWh/yr	121	124	127	130	133	136	138	141	144	147	150	153	156	159	162	165	169	172	175	179	182
With-program energy use	GWh/yr	121	124	127	130	133	136	138	141	144	144	145	145	146	147	147	148	150	151	154	157	160
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	3	5	8	10	12	15	17	19	20	22	22	22
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.40	$0.78	$1.16	$1.52	$1.87	$2.21	$2.52	$2.82	$3.07	$3.25	$3.31	$3.30
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.7	6.4	8.4	10.3	12.3	14.2	16.1	16.7	17.4	17.8	17.8
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.46	$0.45	$0.44	$0.43	$0.42	$0.41	$0.40	$0.39	$0.38	$0.37	$0.37	$0.36
NZ																						
BAU Energy use	GWh/yr	121	124	127	130	133	136	138	141	144	147	150	153	156	159	162	165	169	172	175	179	182
With-program energy use	GWh/yr	121	124	127	130	133	136	138	141	144	144	145	145	146	147	147	148	150	151	154	157	160
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	3	5	8	10	12	15	17	19	20	22	22	22
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.42	$0.84	$1.24	$1.62	$2.00	$2.35	$2.69	$3.01	$3.28	$3.47	$3.53	$3.52
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.6	5.4	7.1	8.7	10.3	11.7	13.1	14.3	15.1	15.4	15.4
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.50	$0.49	$0.48	$0.47	$0.46	$0.45	$0.44	$0.43	$0.42	$0.41	$0.40	$0.39

Table 26: Annual Consumer Energy, Benefits and Costs by State for Australia & New Zealand: Low Sales Scenario

Year	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Australia																						
BAU Energy use	GWh/yr	1,207	1,237	1,267	1,297	1,326	1,355	1,384	1,413	1,441	1,467	1,489	1,507	1,523	1,535	1,544	1,549	1,552	1,551	1,548	1,543	1,536
With-program energy use	GWh/yr	1,207	1,237	1,267	1,297	1,326	1,355	1,384	1,413	1,441	1,441	1,438	1,434	1,427	1,419	1,409	1,396	1,383	1,369	1,357	1,352	1,349
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	26	50	74	95	116	135	153	169	182	190	191	187
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.13	$8.06	$11.77	$15.28	$18.58	$21.66	$24.51	$27.06	$29.17	$30.47	$30.54	$29.96
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.9	49.9	72.3	94.5	112.4	133.8	145.5	158.4	166.6	173.3	172.0	166.0
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.46	$4.26	$4.06	$3.88	$3.70	$3.53	$3.37	$3.22	$3.07	$2.93	$2.79	$2.67
NSW&ACT																						
BAU Energy use	GWh/yr	410	421	431	441	451	461	471	480	490	499	506	513	518	522	525	527	528	527	526	525	522
With-program energy use	GWh/yr	410	421	431	441	451	461	471	480	490	490	489	488	485	482	479	475	470	465	462	460	459
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	9	17	25	32	39	46	52	57	62	65	65	64
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.49	$2.91	$4.25	$5.52	$6.71	$7.82	$8.85	$9.77	$10.53	$11.00	$11.03	$10.82
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	16.7	24.1	31.3	37.3	44.2	47.8	52.3	54.7	57.5	57.1	55.1
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.52	$1.45	$1.38	$1.32	$1.26	$1.20	$1.15	$1.09	$1.04	$1.00	$0.95	$0.91
NT																						
BAU Energy use	GWh/yr	12	12	13	13	13	14	14	14	14	15	15	15	15	15	15	15	16	16	15	15	15
With-program energy use	GWh/yr	12	12	13	13	13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	13
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.04	$0.09	$0.13	$0.16	$0.20	$0.23	$0.26	$0.29	$0.31	$0.32	$0.32	$0.32
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.7	0.8	1.0	1.1	1.3	1.4	1.4	1.4	1.4
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03
QLD																						
BAU Energy use	GWh/yr	241	247	253	259	265	271	277	283	288	293	298	301	305	307	309	310	310	310	310	309	307
With-program energy use	GWh/yr	241	247	253	259	265	271	277	283	288	288	288	287	285	284	282	279	277	274	271	270	270
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	5	10	15	19	23	27	31	34	36	38	38	37
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.77	$1.51	$2.21	$2.86	$3.48	$4.06	$4.59	$5.07	$5.47	$5.71	$5.72	$5.61
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	9.4	13.7	17.8	20.9	25.1	27.9	30.5	32.6	33.3	33.0	32.5
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.89	$0.85	$0.81	$0.78	$0.74	$0.71	$0.67	$0.64	$0.61	$0.59	$0.56	$0.53

Year	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
SA																						
BAU Energy use	GWh/yr	109	111	114	117	119	122	125	127	130	132	134	136	137	138	139	139	140	140	139	139	138
With-program energy use	GWh/yr	109	111	114	117	119	122	125	127	130	130	129	129	128	128	127	126	124	123	122	122	121
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	2	5	7	9	10	12	14	15	16	17	17	17
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.37	$0.72	$1.06	$1.37	$1.67	$1.95	$2.20	$2.43	$2.62	$2.74	$2.75	$2.69
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	5.0	7.3	9.6	11.3	13.3	14.0	15.1	16.2	16.8	17.2	16.1
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.40	$0.38	$0.37	$0.35	$0.33	$0.32	$0.30	$0.29	$0.28	$0.26	$0.25	$0.24
TAS																						
BAU Energy use	GWh/yr	24	25	25	26	27	27	28	28	29	29	30	30	30	31	31	31	31	31	31	31	31
With-program energy use	GWh/yr	24	25	25	26	27	27	28	28	29	29	29	29	29	28	28	28	28	27	27	27	27
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	1	1	1	2	2	3	3	3	4	4	4	4
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.07	$0.14	$0.21	$0.27	$0.32	$0.38	$0.43	$0.47	$0.51	$0.53	$0.53	$0.52
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	1.9	2.4	2.7	3.2	3.3	3.5	3.6	3.7	3.7
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.09	$0.09	$0.08	$0.08	$0.07	$0.07	$0.07	$0.06	$0.06	$0.06	$0.06	$0.05
VIC																						
BAU Energy use	GWh/yr	290	297	304	311	318	325	332	339	346	352	357	362	365	368	371	372	372	372	371	370	369
With-program energy use	GWh/yr	290	297	304	311	318	325	332	339	346	346	345	344	343	341	338	335	332	329	326	324	324
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	6	12	18	23	28	32	37	41	44	46	46	45
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.99	$1.93	$2.82	$3.67	$4.46	$5.20	$5.88	$6.49	$7.00	$7.31	$7.32	$7.19
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	13.0	19.2	25.3	30.2	36.1	38.5	41.5	43.4	45.4	44.2	42.0
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.07	$1.02	$0.98	$0.93	$0.89	$0.85	$0.81	$0.77	$0.74	$0.70	$0.67	$0.64
WA																						
BAU Energy use	GWh/yr	121	124	127	130	133	136	138	141	144	147	149	151	152	153	154	155	155	155	155	154	154
With-program energy use	GWh/yr	121	124	127	130	133	136	138	141	144	144	144	143	143	142	141	140	138	137	136	135	135
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	3	5	7	10	12	14	15	17	18	19	19	19
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.39	$0.76	$1.10	$1.43	$1.74	$2.03	$2.30	$2.54	$2.73	$2.85	$2.86	$2.81
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	4.5	6.1	7.9	9.6	11.3	12.9	14.5	14.9	15.3	15.4	15.2
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.45	$0.43	$0.41	$0.39	$0.37	$0.35	$0.34	$0.32	$0.31	$0.29	$0.28	$0.27
NZ																						
BAU Energy use	GWh/yr	121	124	127	130	133	136	138	141	144	147	149	151	152	153	154	155	155	155	155	154	154
With-program energy use	GWh/yr	121	124	127	130	133	136	138	141	144	144	144	143	143	142	141	140	138	137	136	135	135
Energy savings	GWh/yr	0	0	0	0	0	0	0	0	0	3	5	7	10	12	14	15	17	18	19	19	19
Value of energy saved	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.41	$0.81	$1.18	$1.53	$1.86	$2.16	$2.45	$2.70	$2.91	$3.04	$3.05	$2.99
Emissions saved (marginal)	ktCO2-e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.5	5.1	6.7	8.1	9.4	10.7	11.8	12.7	13.3	13.3	13.1
Additional appliance cost	$M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.49	$0.47	$0.45	$0.43	$0.41	$0.39	$0.37	$0.35	$0.34	$0.32	$0.31	$0.29