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EQUIPMENT ENERGY EFFICIENCY

Equipment Energy Efficiency Committee

Regulatory Impact Statement

Consultation Draft

Minimum Energy Performance Standards and Alternative Strategies for Refrigerated Beverage Vending Machines

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

SEPTEMBER 2008

Prepared by Niskin Enterprises Pty Ltd

This regulatory impact statement was prepared by Niskin Enterprises Pty Ltd for the Equipment Energy Efficiency Committee. This Committee reports to the Ministerial Council on Energy, comprising energy Ministers of the Australian federal, state and territory governments, and of the New Zealand Government.

Comment is invited on any relevant matter. However, the final appendix of this document lists a number of specific matters on which the Equipment Energy Efficiency Committee seeks comment.

Please address your written submissions by close of business on 28 October to:

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Glossary and Abbreviations

ABS	Australian Bureau of Statistics
ARI	Air-Conditioning and Refrigeration Institute
ASERCOM	Association of European Refrigeration Compressor and Controls Manufacturers
AS/NZS	Australian Standards and New Zealand Standards
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BAU	Business-as-usual
BCR	Benefit-cost Ratio
CBA	Cost Benefit Analysis
CEC	California Energy Commission
CO_2-e	Carbon dioxide equivalent units
COAG	Council of Australian Governments
CPRS	Carbon Pollution Reduction Scheme (formally known as the Emissions Trading Scheme)
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
ECCA	Energy Efficiency and Conservation Authority – New Zealand
EEEP	Equipment Energy Efficiency Program (formerly NAEEEP)
EPA	Environment Protection Agency (USA)
ETS	Emission Trading Scheme (NZ Scheme)
EU	European Union
EUORVENT	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
GWh	Giga Watt hour – 1 million Watt hours
IEA	IEA International Energy Agency
IEC	International Energy Commission
Kt	Kilo Tonnes – 1 thousand Tonnes
kWh	Kilo Watt hour – 1 thousand watt hours
MCE	Ministerial Council for Energy
MEPS	Minimum Energy Performance Standards
MRET	Mandatory Renewable Energy Target
NAEEEC	National Appliance Equipment and Energy Efficiency Committee (now E3)
NAEEEP	NAEEEP National Appliance Equipment and Energy Efficiency Program (now EEEP)
NFEE	NFEE National Framework on Energy Efficiency
NGS	National Greenhouse Strategy
NPV	Net Present Value
NZ	New Zealand
RBVM	Refrigerated Beverage Vending Machine
RIS	Regulatory Impact Statement
TTMRA	Trans Tasman Mutual Recognition Arrangement
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

This is a Consultation Regulatory Impact Statement (RIS) proposing the introduction of Minimum Energy Performance Standards (MEPS) for Refrigerated Beverage Vending Machines (RBVMs) in Australia and New Zealand.

This Consultation RIS has been prepared following the 2005 publicly released report on *"Analysis of the Potential for Minimum Energy Performance Standards for Refrigerated Beverage Vending Machines."*

This report found that RBVMs were the most energy intensive of refrigerated vending machines (RVMs) and represented 75% of total RVM energy consumption. Given that several U.S manufacturers had introduced energy efficient RBVMS into the U.S market at a small incremental cost, the report recommended the introduction of MEPS to enable the transfer of the U.S energy efficiencies into Australia and New Zealand.

The Problem

At the time of the 2005 report, the Business As Usual (BAU) energy consumption and greenhouse gas emission levels were expected to continue to increase over time. On this analysis, RBVMs were estimated to generate 534 GWh per annum in 2008 climbing to 576 GWh by 2020. However, since the 2005 report, several U.S RBVM manufacturers started to supply the Australian and New Zealand markets with ENERGY STAR ® compliant products. The proposed MEPS prescribed in AS/NZ 4864 are identical to the ENERGY STAR ® specification. As these manufacturers control about 80% of the Australian and New Zealand market, the BAU energy consumption and greenhouse gas emission levels have been adjusted accordingly.

The revised BAU shows the annual electricity consumption of RBVMs for 2008 to be estimated at 520 GWh per annum for Australia and 104 GWh per annum for New Zealand. However, given the introduction of ENERGY STAR ® compliant product into the Australian and New Zealand marketplace, energy consumption is projected to decline to 514 GWh in Australia and 103 GWh in New Zealand by 2020.

Electricity related greenhouse gas emissions (GHG) are projected to decline from 538 kt CO_2-e in 2008 to 456 kt CO_2-e by 2020 for the Australian market. A similar decline is projected for the New Zealand market; from 73 kt CO_2-e in 2008 to 72 kt CO_2-e by 2020.

Despite the unforeseen early introduction of ENERGY STAR ® compliant product into the Australian and New Zealand markets, 20% of RBVM annual sales currently are not ENERGY STAR ® registered. These products are imported from Europe and also manufactured locally.

The significant energy efficiency improvements that have been developed since 2005 by large RBVM manufacturers in the U.S.A and the resultant 50% reduction in energy consumption, would suggest that other manufacturers and users would demand similar efficiencies and cost savings. The energy efficient technology/components are accessible to all manufacturers and do not impose a significant incremental cost. However, only the major RBVM manufacturers would appear to have made the energy efficiency improvements.

An analysis of the RBVM market reveals split incentives is the key problem for the limited uptake of energy efficiency improvements by smaller manufacturers. The split-incentive problem is where the owner of the energy consuming appliance has no incentive to provide energy efficient appliances as the user pays for the energy costs.

In the RBVM market, major brand-name companies own the vending machines and the user of the vending machine pays the electricity bill. Similarly, small business vending operators own the vending machines and the site owners such as offices, factories, warehouses etc (users) pay for the electricity bill. Hence, there is no financial incentive for manufacturers and owners of the vending machines to make energy efficiency improvements. Notwithstanding this, a small number of major manufacturers and brand-name companies responded to the voluntary adoption of the U.S ENERGY STAR ® specification for RBVMs. These U.S RBVM manufacturers have about 80% market-share in Australia and New Zealand. However, the other 20% of annual sales are dispersed amongst small importers/suppliers and many small business vending operators who own the RBVMs. Hence, the sheer numbers involved in the independent vending sector makes it difficult to over-come the split incentives between small business vending operators (RBVM owners) and site owners (users).

The Objective

The objective of the proposed strategies for RBVMs is to reduce Australia's and New Zealand's greenhouse gas emissions below what they are otherwise projected to be (i.e the "business-as-usual" case), that provides a net benefit to the community.

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, it must also provide a broad positive financial benefit to end consumers, without compromising appliance quality or functionality.

The Proposal

The proposed strategy involves the introduction of mandatory MEPS for RBVMs from October 2009.

Split-incentives can cause market failure that requires government intervention. Given that some of the market has responded to the voluntary U.S ENERGY STAR ® specification for RBVMs, it would be inappropriate to consider split-incentives have caused a market failure. However, split-incentives exist in the independent vending sector of the RBVM market; between small business vending operators (RBVM owners) and site-owners (users) who pay the energy costs.

MEPS ensure all site-owners have installed RBVMs meet minimum energy efficiency requirements. MEPS address imperfect information and split incentive market failures. MEPS are needed to introduce into the market cost-effective technology that is invariably available but market barriers prevent its actual implementation. A key market barrier is energy costs account for only 1.6% of total commercial expenditure.[1]

Other market barriers include capital constraints and organisational barriers that impact on the adoption of energy efficiency improvements. Economic literature such as *DeCanio and Watkins (1998)* show larger firms that have the financial, technical and human resources are more likely to adopt energy efficiency improvements.

Hence, small business is likely to be prevented by market barriers to adopt energy efficient RBVMs in the independent vending sector. MEPS remove the market barriers and the research transaction costs as all RBVMs are required to meet minimum energy performance requirements.

The proposed MEPS are consistent with the regulations and voluntary labeling standards that have been developed and introduced in the U.S and Canada over the past ten years. The proposed MEPS and test method for RBVMs are described in AS/NZS 4864.

Assessment

Australia

The following table summarises the analysis for Australia over the period 2006 to 2020. The data presented is based upon the Net Present Value (NPV) calculations at a discount rate of 7.5%.

Summary Data for BAU Sales Australia – 7.5% Discount Rate

Energy Saved (cumulative)	120GWh
GHG Emission Reduction (cumulative)	112.5 kt
Total Benefit	$9.56 M
Total Cost	$2.35M
Benefit Cost Ratio	4.07

Australia's GHG is estimated to decline from 521 kt to 444kt CO2-e from 2009 to 2020 with a cumulative GHG reduction of 112 kt CO_2-e.

[1] Productivity Commission (2005), The Private Cost Effectiveness of Improving Energy Efficiency", Australian Government.

New Zealand

The following table summarises the analysis for New Zealand over the period 2006 to 2020. The data presented is based upon the Net Present Value calculations at a discount rate of 5%.

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

Energy Saved (cumulative)	25GWh
GHG Emission Reduction (cumulative)	17.5 kt
Total Benefit	$3.1 M
Total Investment	$0.75 M
Benefit Cost Ratio	4.1

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

New Zealand's annual GHG is estimated to decline from 73 kt p.a in 2009 to 70 kt p.a by 2020 with a cumulative reduction of 18 kt.

At the user level, the following table shows the large benefit cost ratio with the purchase of a MEPS compliant RBVM.

Present Value Costs and Savings – RBVM

	Incremental Price Increase	Estimated Annual Energy Savings (kWh/pa)	Energy Costs Savings/year	Present Value Cost Savings (10years)1	Benefit Cost Ratio
Australia	$200	2701	$432	$2,765	13.8
New Zealand	$200	2701	$432	$3,136	15.7

1. The cost savings are based on an Australian and New Zealand average tariff of 16.0c/kWh. Cost savings are discounted at 7.5% for Australia and 5% for New Zealand.

Alternative Options

The other options considered for meeting the objective were:

- Voluntary efficiency standards;
- Levies and emissions trading;
- Certification;
- Dis-endorsement labeling; and
- Mandatory energy labeling.

Voluntary efficiency standards have been adopted by the larger manufacturers in the U.S. However, voluntary adoption of the proposed MEPS is unlikely with the other players in the market given that there are many independent vending operators that are focused primarily on their investment return.

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

The Australian Government has announced that a domestic emission trading scheme to be known as the Carbon Pollution Reduction Scheme (CPRS) will be implemented no later than 2012. This could eventually lead to the full cost of GHG emission impacts being reflected in energy prices, but it is unlikely that CPRS alone and the energy price rises that might flow from it in the future would quickly lead to site users of RBVMs seeking energy efficient products. This is due in part to the split incentive problem.

A voluntary certification program is 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 to participate who have products that vary from efficient to less efficient, so any program is likely to cover only a proportion of the RBVMs available.

A dis-endorsement labeling scheme and the mandatory energy rating labelling scheme are unlikely to be effective as RBVMs are sold to commercial businesses rather than to retail customers.

Recommendations (draft)

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

1. To implement mandatory energy performance standards for RBVMs.

2. That products covered by this RIS include all RBVMs except refrigerated machines that vend both beverages and snacks, combination machines that vend both hot and cold beverages and combination machines that vend hot and cold beverages and chilled snacks.

3. To use the test method described in AS/NZS 4864.1.2008

4. That RBVMs must meet or surpass the minimum energy performance requirements that are proposed in this document and set down in AS/NZS 4864.2.2008

5. To have all jurisdictions take the necessary administrative actions to ensure that the suite of regulations can take effect from not earlier than 1 October 2009.

Key Consultation Issues

The analysis uses data and information from Australian, New Zealand and international studies, including estimates and calculations of variables. The methodology, data and assumptions for the analysis are described in APPENDIX 5.

During the consultation phase, feedback, comments and more accurate data, if it exists, is sought on the following estimates and calculated values:

- An average incremental cost of $200 for the utilisation of efficient compressors, T8 fluorescent tubes (required by other MEPS) and compressor/evaporator fans will add about 5% to 10% to the cost of existing vending machines.
- The estimated compliance costs listed in Table 9; and
- The number of annual RBVM sales subject to the proposed MEPS requirements as prescribed in AS/NZ 4864. A figure of 389 units or 20% of 1,946 annual RBVM sales is estimated.

In the event of disagreement with this base data, details of stakeholders' assumptions and costs would be appreciated to increase the accuracy of the analysis.

Stakeholders are also invited to provide comments on the viability of the other options, including views on costs, benefits, expected participation by importers and suppliers and the proposed transition period prior to implementation of the proposed MEPS.

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 Guide* (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 following the *"Analysis of the Potential for Minimum Energy Performance Standards for Refrigerated Beverage Vending Machines."*

This chapter provides the background to Australia and New Zealand policy responses to global warming, the role and contribution of the equipment energy efficiency program to these policy responses and the reasons for the selection of refrigerated beverage vending machines (RBVMs).

1.2 Australian and New Zealand Policy Responses to Global Warming

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. 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 household appliances. Purchase of energy-efficient products can have a large impact on aggregated*

emissions over time, and reduce the impact on household budgets of any rise in carbon prices". (DPMC, 2007, pp 135).

Similarly, in July 2007, the Prime Minister released *Australia's Climate Change Policy – our economy, our environment, out future* (ACCP, 2007). The report 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." (DPMC, 2007, 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 2008-2012 to 108 percent 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/report/nzeecs-07.pdf.

The 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 labeling for household appliances continues to form part of New Zealand's climate change strategy, as part of implementing the NZEECS.

Ministerial Council on Energy

In October 2006, the Ministerial Council on Energy (MCE) comprising 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 bi-partisan agreement demonstrates the on-going commitment of all participating jurisdictions to using regulatory measures that deliver effective, measurable abatement.

International Energy Agency

Australian and New Zealand policy is in accord with the International Energy Agency's position on the need for energy efficiency improvements to address climate change.

"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)

Furthermore, recent IEA research has shown that since 1990 energy consumption has outstripped energy efficiency improvements and the rate of energy efficiency improvement has been 50% lower than previous decades amongst IEA countries. IEA projections show that the current rate of improvement in energy efficiency will need to be at least double to contribute effectively to addressing climate change[2].

[2] International Energy Agency, *"Energy Use in the New Millennium – Trends In IEA Countries"* 2007.

Australia has lagged behind the IEA average since 1973. From 1973 to 1990, Australian energy efficiency improved by 0.6% per annum compared with improvements of 2% for the IEA average. Similarly, Australian energy efficiency improved by 0.3% per annum from 1990 to 1998 compared with improvements of 0.7% for the IEA average[3].

Equipment Energy Efficiency Program

In Australia, regulatory intervention in the market for energy-using products was first introduced with mandatory appliance energy labeling by the New South Wales 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 labeling 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 increasing energy efficiency standards, which address market deficiencies relating to lifetime energy cost information for appliances and equipment.

The proposal to address RBVMs 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 (NEECS). It is organised as follows:

- Implementation of the E3 program is the direct responsibility of the Equipment Energy Efficiency Committee (referred to as 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 the 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 labeling requirements and MEPS. New requirements are

[3] The Allen Consulting Group, *"The Energy Efficiency Gap – Market failures and Policy Options"* November 2004.

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.

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 emission 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.

The broad policy mandate of E3 has been regularly reviewed over the last decade and was most recently refreshed in December 2007. Not only is any energy-using equipment type potentially included in resulting work plans for possible regulation but RBVMs were specifically nominated for regulatory impact assessment.

E3 provides stakeholders with opportunities to comment on specific measures as they are developed by issuing reports (including fact sheets, technical reports, cost benefit analyses and regulatory impact statements) and by holding meetings.

1.3 Refrigerated Beverage Vending Machines

Reason for focus on RBVMs in Australia

An analysis of the potential for minimum energy performance standards for RBVMs was undertaken in 2005 found that RBVMs were the most energy intensive of the refrigerated vending machines. As can be seen from Table 1, RBVMs were the most prolific type of vending machine with the highest daily energy use and represented 75% of total energy consumption.

Table 1: Estimated Energy Consumption by Vendor Type in Australia

Vendor Type	Estimated installed Australian stocks	Daily energy use kWh	Annual energy use GWh pa	Percentage of total energy consumption
Refrigerated beverage	110,000	13.0	522.0	75%
Chilled Snack	27,500	12.3	123.5	18%
Refrigerated combination Beverage/snack	5,000	7.5	14.6	2%
Refrigerated food (includes Hot foods stored cold/frozen)	6,000	14.3	31.3	5%
TOTAL			**691.4 GWh pa**	

Further, the 2005 report found that major U.S manufacturers of RBVMs had introduced technologies that improved energy efficiencies capable of reducing energy consumption by nearly 50%. However, at the time of the report, these models had not been introduced into Australia and the report recommended the introduction of MEPS as a matter of priority to enable similar energy consumption and greenhouse gas emission reductions.

Product Description

There are two major types of beverage vendor:

1. the closed RBVM; and,
2. the glass fronted RBVM.

The most common beverage vending machine is the closed front machine, used to vend cans and/or bottles. With closed front machines, the product cannot be seen and the machine either has signage or a backlit panel on the front advertising the contents. The unit machine (signage only) is typical of machines placed in an external location. Depending on the model, these machines can contain up to 800 cans and up to 12 different varieties of beverages.

The other major type of beverage vendor is the glass fronted machine. This design allows the consumer to see the products inside the machine, with some models displaying as many as 45 different varieties of drinks. Product packaging is not limited to cans and bottles, and may also include cartons, tetra packs and non-standard bottle shapes. Glass fronted machines are typically placed inside a building or sheltered location. With the increasing market for non-carbonated soft drinks such as energy drinks, fruit juices and water (which come in a variety of packaging types and sizes) these machines provide much wider choice for the consumer.

1.4 RBVM Market

The RBVM market is comprised of three key segments:

- manufacturers/importers/distributors of vending machines;
- owners of vending machines (brand companies & independent operators); and
- site owners.

Vending in Australia is comprised of brand-name companies and independent operators. The brand companies particularly Coca-Cola Amatil and to a lesser extent, PepsiCo, Cadbury Schweppes and Smiths Snack Vend, dominate the vending market. Invariably, these brand companies purchase and own the vending machines and provide installation, restocking and servicing.

The independent operator sector comprises small companies that purchase small fleets (on average ten vending machines) for on-site rental. Similarly, these small companies usually provide installation, restocking and servicing.

Site owners provide the location for the brand-name companies and the independent operators to install their vending machine. Site owners include airports, railway stations, offices, factories, warehouses, supermarkets, schools etc.

Current Installed Base

The number of installed stocks of RBVMs was estimated at between 100,000 to 120,000 in Australia in 2005.[4] The current installed stocks is probably still within the estimated range as new sales comprise a fair amount of replacement of existing stock based on confidential advice from RBVM suppliers. In New Zealand, the number of installed stocks is estimated at 20,000 in 2005.

Sales Trends

RBVM annual sales was estimated between 1500 and 2,000 in Australia in 2005.[5] Consultation with large and small importers/distributors confirms the range although there was a preference for the bottom of the range. According to importers/distributors, the annual sales can fluctuate from year to year, and this is dependent on Coca-Cola Amatil's purchasing plans as it accounts for about 50% of total annual sales. Annual sales in New Zealand is estimated at 300, and similar to Australia, annual sales are dependent on Coca-Cola Amatil.

1.5 Australian and New Zealand Market Players

The majority of RBVMs are imported; mostly from the U.S.A and to a lesser extent Europe, with minimal imports from Asia.

Royal Vendors, Vendo Sanden and Dixie Narco (U.S manufacturers) dominate the sales of RBVMs in Australia and are estimated to have about 80% market share. Several European manufacturers distributing to Australia include Azkoyen and FAS.

The major importers and distributors of imported machines servicing the national market include: Automatic Vending Specialists, Brivend, Coinco, Professional Vending Services, R.P Vending & Quirks Refrigeration. There are about a further 12 smaller vending suppliers servicing local markets. The major importers and suppliers in New Zealand include Provender, Valley Vendors, Vending Direct and Snackmate.

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[4] Collins. R & Ellis. M, *"Analysis of the Potential for Minimum Energy Performance Standards for Refrigerated Beverage Vending Machines"* prepared for the Australian Greenhouse Office and NAEEEC, Draft Report, March 2005.

[5] Ibid.

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% of 2000 levels by 2050.

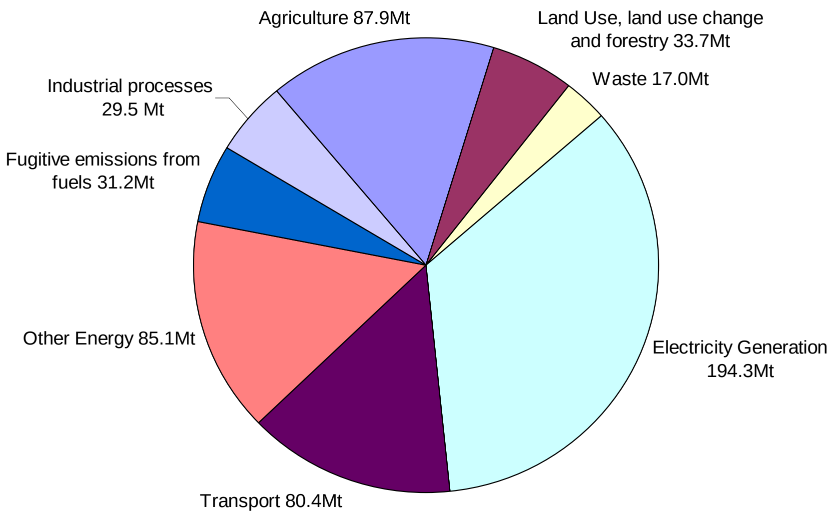
New Zealand ratified the Kyoto Protocol on 19 December 2002, and has committed to reducing its greenhouse gas emissions back to 1990 levels, on average, over the period 2008 to 2012 or to take responsibility for any emissions above this level if it cannot meet this target. The introduction of minimum 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

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 as illustrated in Figure 1.

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

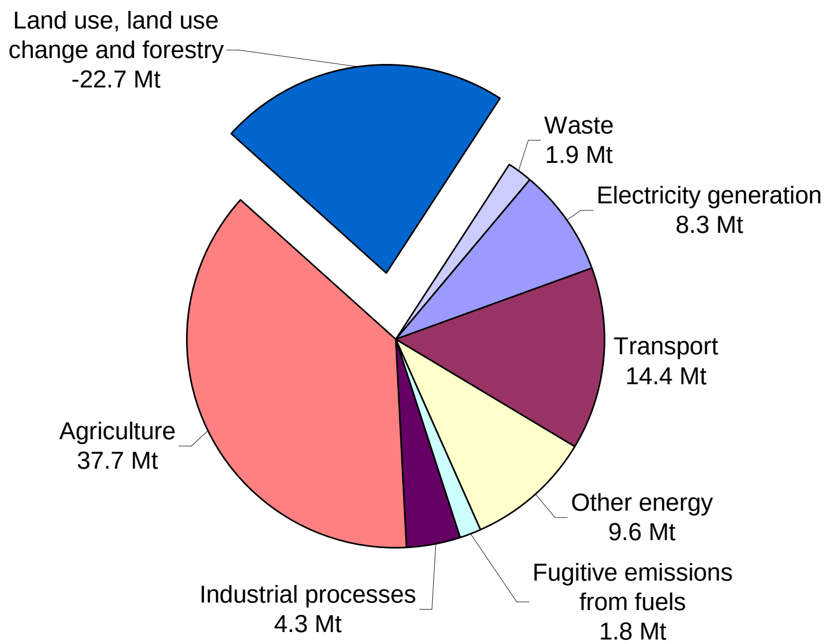
Figure 1: Australian Greenhouse Gas Emissions by Sector 2005 (NGGI 2007)



The Australian Bureau of Agricultural and Resource Economics projects total electricity use to increase by an average of 2.2% per annum between 2004/05 and 2010/11 (ABARE 2006). Electricity use in the residential sector is projected to account for around 23% 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% of CO_2-e emissions from the energy sector in 2006 (MFE NZ 2008). In 2005, emissions from this source increased significantly by 35.2% 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% 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% 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 RBVMs to Energy Use and Emissions

Energy efficiency improvements for appliances and equipment can play a significant contributing role as demonstrated by the National Framework for Energy Efficiency (NFEE) research into potential energy efficiency improvements. The NFEE estimated from 2005 to 2014 net technical energy efficiency improvements of up to 40% for the commercial sector[6].

As part of the commercial sector, greenhouse gas emissions from the installed stock of RBVMs were estimated to be 0.50 Mt CO_2-e in 2004 based on an average energy consumption of 13kWh per day and was forecast to reach slightly below 0.70 Mt CO_2-e by 2020 based on an assumption of a 2% annual sales growth.

However, since 2006 Royal Vendors, Vendo Sanden and Dixie Narco have supplied the Australian and New Zealand markets with ENERGY STAR ® approved vending machines that are consistent with the proposed AS/NZS 4864.

In addition, the assumption of an average 2% annual sales growth may be correct but from a lower annual sales base of 1,500 units based on wide industry advice rather than 2,000 units used as the baseline for the 2004 estimations.

[6] The Allen Consulting Group, *"The Energy Efficiency Gap – Market failures and Policy Options"* November 2004.

Given these factors, the BAU from the 2005 report has been revised to generate 534 GWh per annum in 2008 climbing to 576 GWh by 2020.

In view of the earlier than anticipated introduction of ENERGY STAR ® compliant product into the Australian and New Zealand markets, the revised BAU presented in Table 2 shows the annual electricity consumption of RBVMs for 2008 to be estimated at 520 GWh per annum for Australia and 104 GWh per annum for New Zealand. Energy consumption is projected to decline to 514 GWh in Australia and 103 GWh in New Zealand by 2020.

Electricity related greenhouse gas emissions (GHG) are projected to decline from 538 kt CO_2-e in 2008 to 456 kt CO_2-e by 2020 for the Australian market. A similar decline is projected for the New Zealand market; 73 kt CO_2-e in 2008 to 72 kt CO_2-e by 2020. (Table 3)

Table 2: Net Annual BAU energy consumption (GWh)

Year	NSW/ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2000	172	5	101	46	10	122	51	**507**	**102**
2001	175	5	103	46	10	124	52	**516**	**103**
2002	176	5	103	47	10	124	52	**518**	**103**
2003	177	5	104	47	10	125	52	**520**	**104**
2004	177	5	104	47	10	125	52	**522**	**104**
2005	177	5	104	47	10	125	52	**521**	**104**
2006	177	5	104	47	10	125	52	**521**	**104**
2007	177	5	104	47	10	125	52	**521**	**104**
2008	177	5	104	47	10	125	52	**520**	**104**
2009	177	5	104	47	10	125	52	**520**	**104**
2010	176	5	104	47	10	125	52	**519**	**104**
2011	176	5	104	47	10	125	52	**519**	**104**
2012	176	5	104	47	10	124	52	**518**	**104**
2013	176	5	104	47	10	124	52	**518**	**104**
2014	176	5	103	47	10	124	52	**517**	**104**
2015	176	5	103	46	10	124	52	**517**	**103**
2016	175	5	103	46	10	124	52	**516**	**103**
2017	175	5	103	46	10	124	52	**516**	**103**
2018	175	5	103	46	10	124	51	**515**	**103**
2019	175	5	103	46	10	124	51	**515**	**103**
2020	175	5	103	46	10	123	51	**514**	**103**

Figure 3 shows the decline in BAU energy consumption in Australia from 2005 to 2020 with the introduction of U.S ENERGY STAR ® compliant RBVMs. Figure 5 shows a similar trend line for BAU energy consumption in New Zealand. However, a significant decline is delayed until 2014 due to the smaller stock of RBVMs in the New Zealand market.

Figure 3: Net Annual BAU Energy Consumption - Australia

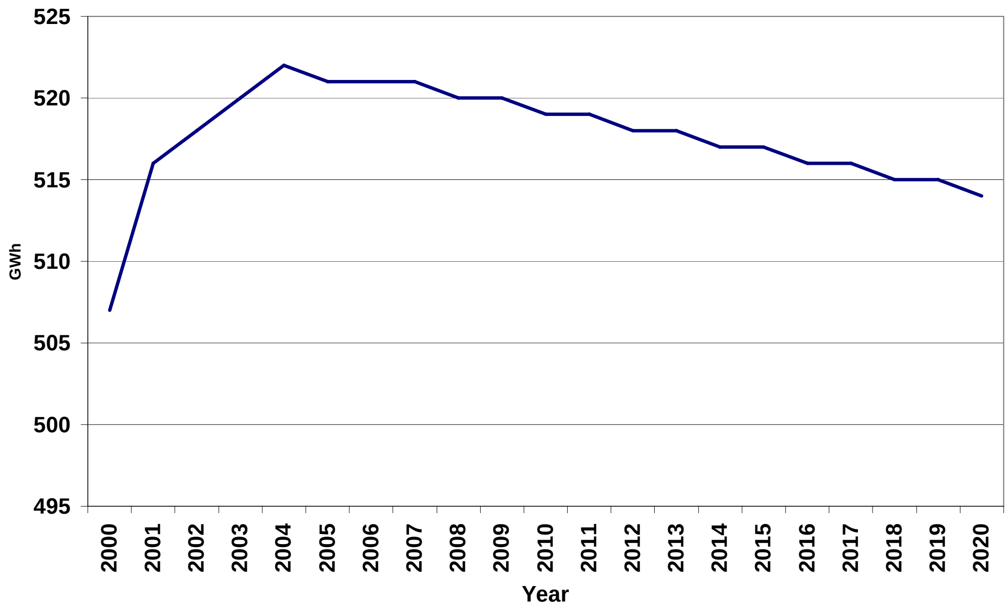


Table 3: Annual BAU GHG emissions (kt CO_2-e)

Year	NSW/ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2000	164	0.04	107	47	7	120	53	**497**	**71**
2001	167	0.04	109	47	7	122	54	**505**	**72**
2002	169	0.04	107	47	7	123	52	**505**	**72**
2003	180	4	106	54	9	140	54	**547**	**73**
2004	182	4	103	55	8	141	54	**548**	**73**
2005	181	4	106	52	8	138	47	**537**	**73**
2006	183	4	104	53	9	140	46	**538**	**73**
2007	184	4	106	54	10	141	45	**546**	**73**
2008	180	4	102	54	11	141	46	**538**	**73**
2009	175	4	97	52	11	137	46	**521**	**73**
2010	172	4	97	51	10	134	46	**515**	**73**
2011	170	4	96	51	10	135	43	**510**	**73**
2012	170	4	97	52	10	137	43	**513**	**73**
2013	166	4	93	50	10	135	43	**502**	**73**
2014	169	4	96	51	10	138	43	**511**	**73**
2015	162	4	94	47	10	130	44	**491**	**72**
2016	161	4	93	46	10	127	44	**485**	**72**
2017	155	4	92	46	10	123	42	**472**	**72**
2018	155	4	90	45	10	123	41	**469**	**72**
2019	154	4	89	46	10	119	42	**464**	**72**
2020	151	4	89	44	10	115	42	**456**	**72**

Figures 4 & 6 show a continual decline in annual BAU greenhouse gas emissions for Australia and New Zealand respectively. As mentioned in the previous figures, this is due to the introduction of U.S ENERGY STAR ® compliant RBVMs in 2005.

Figure 4: Annual BAU GHG Emissions - Australia

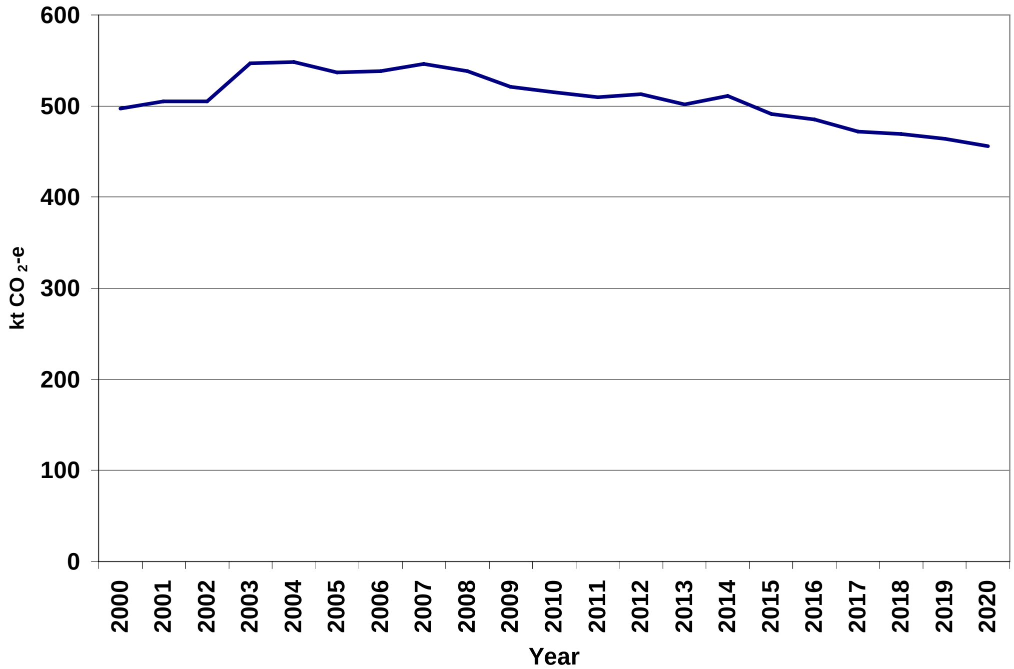


Figure 5: Net Annual BAU Energy Consumption - New Zealand

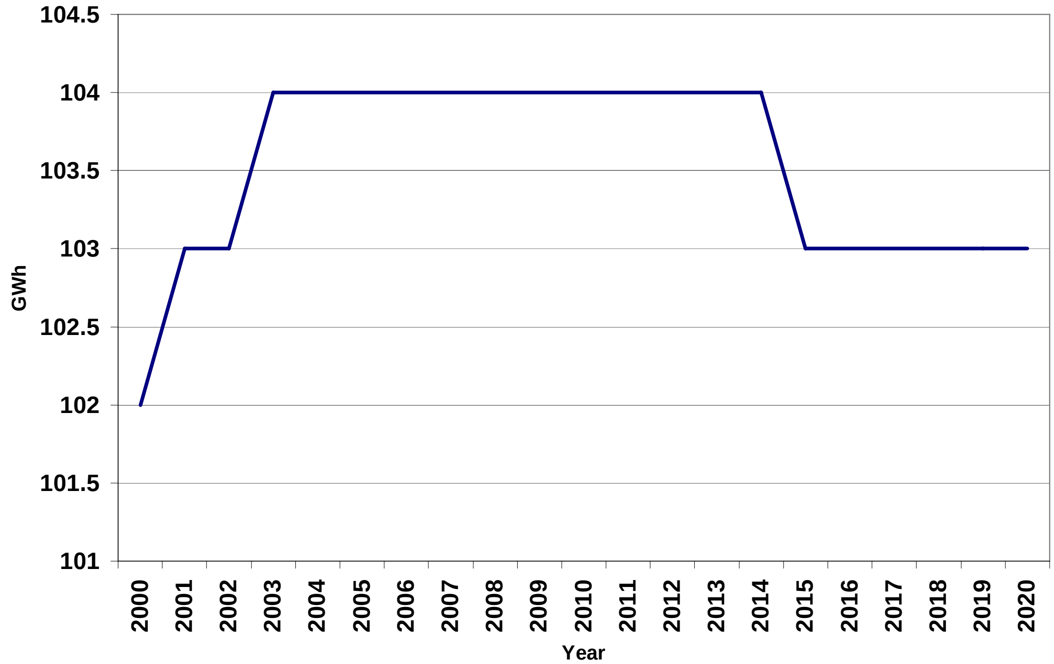
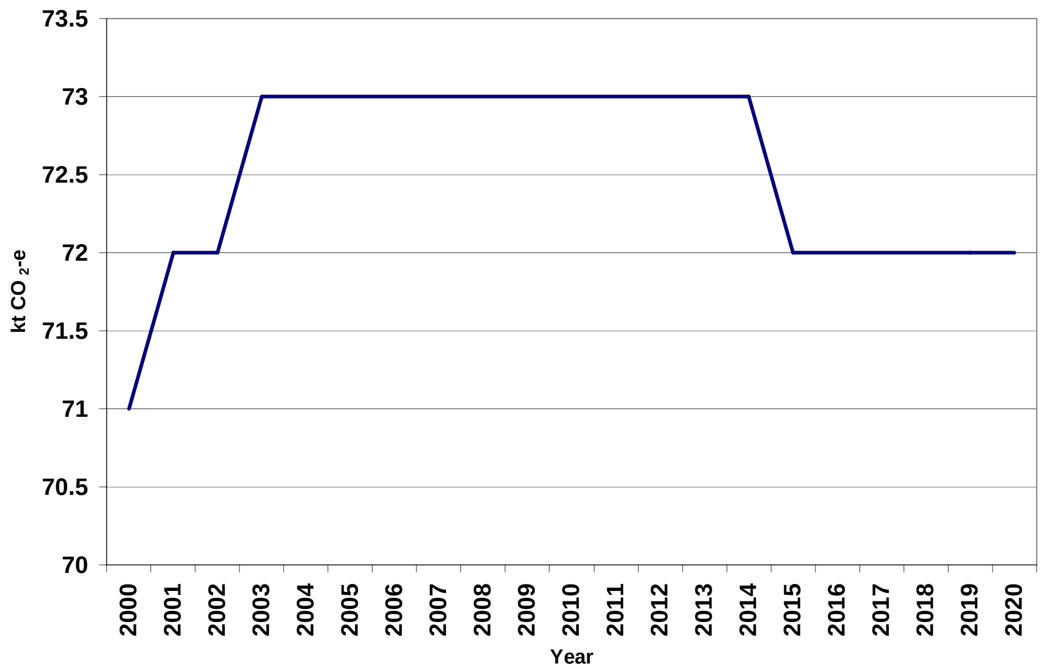


Figure 6: Annual BAU GHG Emissions - New Zealand



Currently the overall electricity used by RBVMs accounts for almost 1% of total commercial electricity usage in Australia (EMET 2004). For Australia the share of RBVMs of overall electricity-related GHG emissions is about 0.25%.

In New Zealand, the overall electricity used by RBVMs accounts for about 2.5% of total commercial sector electricity usage in 2002 (ECCA 2007). The share of total electricity-related GHG emissions in New Zealand from RBVMs is about 0.9%.

2.3 RBVM Technologies & Energy Efficiencies

This section explores the voluntary uptake by some parts of the market of energy efficiency improvements, if there is cost and efficiency trade-offs to explain non-adoption of other parts of the market and whether the market will ultimately prevail in full adoption of energy efficiency improvements or needs the assistance of regulation.

Comparison of U.S & Australian Energy Efficiency in 2005

As reported in March 2005, RBVMs were being sold in Australia and New Zealand that generated lower energy efficiency than the U.S.A and Canada.[7]

Comparison of energy consumption at this time for the same model machines[8] from the U.S and Australia revealed significant differences as can be seen from Tables 4 & 5.

Table 4: Energy Consumption for selected models 2005 sold in Australia and New Zealand

Type	Model	Can Capacity	Lighting Types	Daily energy (kWh)
Closed door –backlit	DN501E	444	T8 electronic ballast 95 LPW	11.87
Glass front	DN5500	405	T8 – electronic ballast 84 LPW	13.92
Glass front	DN5000	405	T8 – electronic ballast 41 LPW	16.00

Table 5: Energy Consumption for selected models 2005 sold in the U.S

Type	Model	Can Capacity	Temperature	Daily energy (kWh)
Closed door –backlit	DN501E	444	32.2+1 C_	4.9
Glass front	DN5500V	405	23.9+1 C	6.4
Glass front	DN5000V	405	23.9+1 C	5.4

[7] Collins. R & Ellis. M, *"Analysis of the Potential for Minimum Energy Performance Standards for Refrigerated Beverage Vending Machines"* prepared for the Australian Greenhouse Office and NAEEEC, Draft Report, March 2005.
[8] Note: DN5500V is an updated model of the DN5500 and similarly, the DN5000V is an updated model of the DN5000.

Comparison of U.S & Australian Energy Efficiency in 2008

Since 2006, the major U.S RBVM manufacturers have supplied the Australian and New Zealand markets with U.S ENERGY STAR ® compliant beverage vending machines. In addition, since 2008 these manufacturers have made further energy efficiency improvements as required by Tier 2 requirements under U.S ENERGY STAR ® that imposes further stringent requirements. Table 6 shows a comparison of several of the models tested in 2005 and the continued energy efficiency improvements.

Table 6: Comparison of Energy Consumption for selected models in 2005 & 2006

Type	Model	Can Capacity	2004 Daily energy (kWh	2006 Daily energy (kWh)
Glass front	DN5500V	405	6.4	3.97
Glass front	DN5000V	405	5.4	4.95

As of late March 2008, there are 53 models that are qualified to carry the ENERGY STAR ® endorsement; 14 indoor models and 39 outdoor models.

Royal Vendors has 26 models; Sanden Vendo, 13 models; Dixie Narco, 12 models; Seaga Manufacturing, 1 model and The Wittern Group, 1 model.

Daily energy ratings for these qualified ENERGY STAR ® models range from 3.97 kWh to 5.75 kWh for indoor models and from 4.22 kWh to 6.92 kWh for outdoor models.

Most of these models are imported into Australia and New Zealand markets and account for 80% of annual sales.

It is not clear whether major European manufacturers such as FAS and Azkoyen as well as several small Australian manufacturers would meet the U.S ENERGY STAR ® standard.

Cost versus Efficiency

Sometimes barriers to access new technologies and/or higher costs for more energy efficient components can prevent other RBVM manufacturers, particularly small to medium sized manufacturers from making energy efficiency improvements to their products.

Table 7 and Figure 7 provide an approximate guide of the key components in a RBVM and the contribution to energy consumption.

Table 7: Energy consumption data by component

Component	% Energy consumption
Compressor	43%
Lighting (T12 fluorescent tube)	35%
Compressor fan and evaporator fan	20%
Electronics	2%

Figure 7: Energy Consumption Data by Component

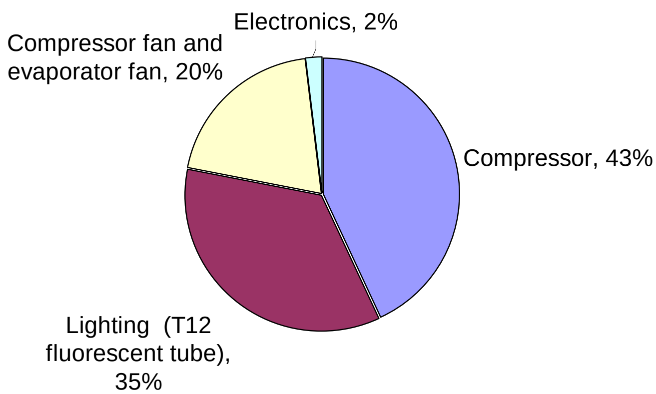


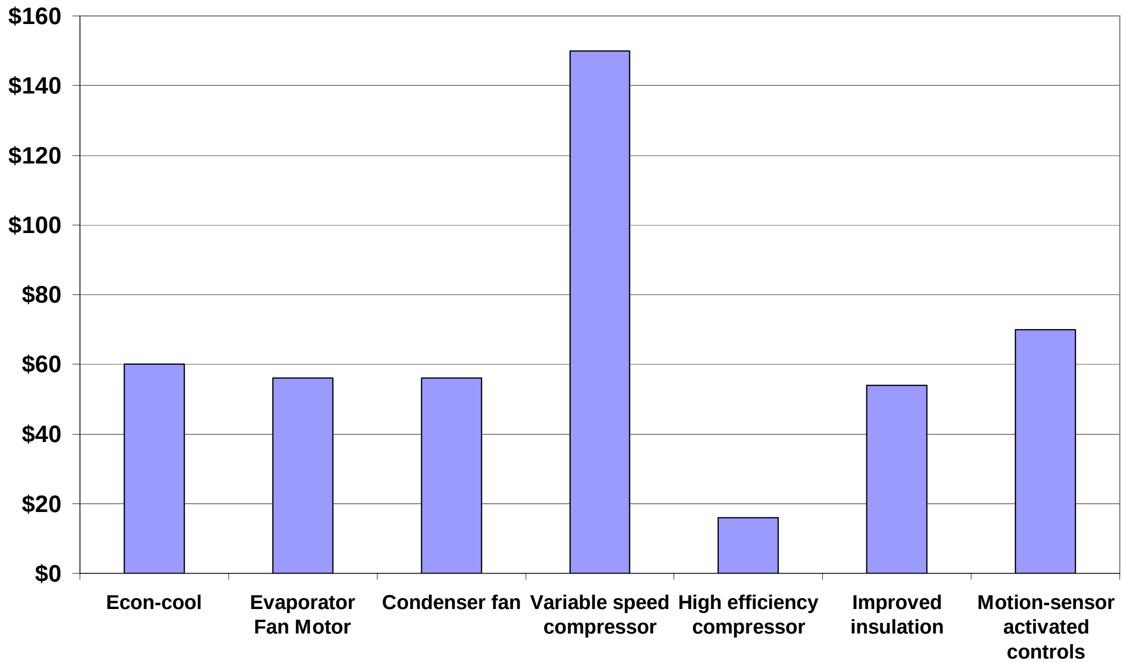
Table 8 and Figure 8 provides analysis of the incremental retail cost in $US for various energy efficiency measures to meet energy efficiency improvement in 2004.[9]

Table 8: Incremental Cost for a Range of Energy Efficiency Measures

Measure	Incremental Retail Cost
Econ-cool	$60
Evaporator Fan Motor	$56
Condenser fan	$56
Variable speed compressor	$150
High efficiency compressor	$16
Improved insulation	$54
Motion-sensor activated controls	$70

[9] Davis Energy Group, "Analysis of Standards Options for Refrigerated Beverage Vending Machines, Pacific Gas and Electric Company, 5 May, 2004

Figure 8: Incremental Cost for a Range of Energy Efficiency Measures



It should be noted that these costs are not cumulative but provide a range of energy efficiency measure options that manufacturers could select from to obtain energy efficiency improvements. However, motion-sensor activated controls are disabled during energy performance testing.

In 2005, it was estimated by Royal Vendors, a major U.S RBVM manufacturer that the total incremental cost to use energy efficient components and meet the U.S ENERGY STAR ® Tier 1 requirements was $139.69 per unit. [10]

Based on previous recent estimates, it is assumed that the incremental cost would be no more than $200 to obtain substantial energy efficiency improvements. Most vending machines cost between $2,000 and $4,000. The $200 incremental cost for the utilization of efficient compressors, T8 fluorescent tubes (required by other MEPS) and compressor/evaporator fans would add about 5% to 10% to the cost of existing vending machines.

Given the relatively low incremental cost of utilizing energy efficient components and the common availability of energy efficient components, higher costs and access barriers to technologies cannot explain the incomplete adoption of energy efficient components by the RVBM manufacturing industry.

[10] Collins. R & Ellis. M, *"Analysis of the Potential for Minimum Energy Performance Standards for Refrigerated Beverage Vending Machines"* prepared for the Australian Greenhouse Office and NAEEEC, Draft Report, March 2005.

Is technology or regulation driving energy efficiency improvements?

In the mid 1990s, estimations of 1000kWh annual energy savings per vending machine were identified in the U.S with the adoption of more efficient and low cost refrigeration and lighting technologies that had been proven successful in other applications.[11]

Given the split-incentive problem discussed in section 2.4 below, there was limited if little market adoption of more efficient and accessible technologies to improve the energy efficiency of RBVMs. As the RBVM manufacturer, bottlers and distributors (owners of the machines) did not pay the electricity bill they had no incentive to adopt more energy efficient technologies.

The Canadian Standards Association introduced a performance standard based on minimum energy consumption for RBVMs that became a minimum energy performance requirement in 1996.

In response to these potential energy savings, the U.S National Resource Defense Council organised a coalition of interested parties; the Energy Efficient Machine Working Group comprising the EPA, Department of Energy, American Council for an Energy Efficient Economy, California Energy Commission and the Consortium for Energy Efficiency.[12]

This followed in the development of the U.S EPA ENERGY STAR ® performance based specification for RBVMs. That is, manufacturers could use any technology provided they met the performance standard. The ENERGY STAR ® specification comprised phase one (Tier 1) and was 25% more stringent than the Canadian Standard Association specification. A second phase (Tier 2) was also developed in response to rapid advances in lighting and refrigeration technologies. Tier 1 was introduced in 2006 and Tier 2 in 2008.

Of note, the U.S RBVM market was controlled by three manufacturers with about 85% market share. This is similar to the Australian and New Zealand markets. According to U.S government officials, *"the vending machine manufacturers were very willing to work with our group to share test data and appreciated the opportunity to provide input on the ENERGY STAR ® specification. They recognized the marketing value of the ENERGY STAR ® label"*.[13]

It would appear that despite the availability of more efficient low cost refrigeration and lighting to the RBVM manufacturers, they still required government intervention to finally adopt these technologies.

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[11] Little, Arthur D," Energy Savings Potential for Commercial Refrigeration Equipment" 1996.
[12] Horowitz, N D; Dolin, J; Suozzo, M & LaFrance, M, "A Roadmap for Simultaneously Developing the Supply and Demand for Energy Efficient Beverage Vending Machines" ACEEE, 1998.
[13] Ibid

However, since the introduction of the U.S ENERGY STAR ® specification, Seaga Manufacturing Inc has introduced L.E.D lighting to replace T8 electronic ballast fluorescent tubes. The reliability and energy efficiency of L.E.D lighting can last up to 50,000 hours and are considered superior to T8 fluorescent tubes. The purported benefits of the L.E.D lighting is a brighter back-lit glass fronted beverage machine that apparently improves product turnover and also reduces maintenance costs with fewer service calls in response to failed lighting. Seaga Manufacturing Inc has its vending machine on the U.S ENERGY STAR ® list of qualified vending machines.

Coca-Cola has also recently introduced on a trial basis a limited number of HFC free RBVMs that provide further greenhouse gas reductions compared with most HFC vending machines.

Notwithstanding the commitment and adoption of the ENERGY STAR ® by the three largest manufacturers, smaller U.S manufacturers that represent the remaining 15% of the market have not officially adopted the ENERGY STAR ® specification.

This is not to infer that these smaller U.S manufacturers have not adopted more efficient low cost technologies similar to the three largest vending machine manufacturers. The smaller manufacturers may not be ENERGY STAR ® compliant as they may consider the cost of qualification with the ENERGY STAR ® program is outweighed by their limited sales turnover and/or their servicing of regional niche markets rather than national markets and customers.

It is possible that some or most of these smaller U.S manufacturers could be meeting the ENERGY STAR ® specification as most refrigeration compressor manufacturers are making more energy efficient compressors than ten years ago and are under pressure to meet the needs of their customer's regulatory obligations. For example, the Association of European Refrigeration Compressor and Controls Manufacturers (ASERCOM) provides a performance certification service for refrigeration compressors based on European Standard EN 12900 and has a common refrigerant database to enable refrigeration manufacturers to select the most appropriate compressor with the highest co-efficient performance. The ASERCOM database comprises 8 major compressor manufacturers: Bock, Bitzer, Copeland, Danfoss, Dorin, Embraco, Frascold and Tecumseh. These companies have collectively 467 certified compressors (not all appropriate for vending machines) and can be found on the ASERCOM database.

A study on the contribution of market adoption of technology versus regulation to generate energy efficiency improvements in central air-conditioners, room air – conditioners and gas heaters was undertaken in the 1990s. The study found both technology, regulation and other factors such as energy price movements all played a role in energy-saving innovations.

"Our analysis indicates that there is a substantial component of energy efficiency improvement that can be attributed to the overall rate of innovation in the products, which appears to be independent of energy prices and regulation, although we find

systematic differences in this overall rate across products and over time. There is also a significant component of energy-saving innovation that is clearly sensitive to relevant prices (in this case, energy prices) and to energy efficiency regulations.

We found that if energy prices had been held constant at their low 1973 levels through 1993, a substantial portion of the observed improvements in the mean energy efficiency of the menu of products on the market would not have occurred. We also found that Federal product labeling standards and minimum energy efficiency regulations likewise played significant roles in advancing the average energy efficiency of these three products".[14]

In the case of RBVM manufacturing, the successful voluntary adoption of the ENERGY STAR ® specification can be attributed to the influence of government and a small number of large manufacturers and bottling companies working together to improve the energy efficiency of RBVMs.

However, similar to the U.S, the Australian and New Zealand markets have about 20% of the market that is being supplied with RBVMs where the status of the energy efficiency of the vending machines remains uncertain as to whether they have adopted improved technologies over the past five years.

While it appears Australia and New Zealand have benefited from the efficiency improvements obtained from U.S energy efficiency standards, it still remains unclear as to whether RBVM manufacturers outside of the U.S have been influenced from these standards and adopted similar energy efficiencies. This Consultation RIS provides the opportunity for Australian and New Zealand suppliers representing European and local manufacturers to advise on the energy efficiency of their RBVMs using the test method from AS/NZ 4864.1.2008.

In the event that non ENERGY STAR ® or AS/NZ 4864 RBVMs have not adopted similar energy efficiencies, each RBVM could be consuming excess energy of 3,467 kWh per annum. The total excess energy consumption of the 389 or 20% of 1,946 RBVMs sold in Australia and New Zealand would total 1.3 GWh per annum.[15]

Testing Standards for RBVMs

There is currently no Australian Standard for measuring the efficiency of RBVMs. AS/NZS 4864 is currently under development and is based on U.S ENERGY STAR ® for RBVMs together with the ANSI/ASHRAE Standard 32.1-1997R, Methods of Testing for Rating Vending Machines for Bottled, Canned and Other Sealed Beverages. AS/NZS 4864 is to be published by September 2008.

[14] Newell, R, Jaffe, A, Stavins, R "The Induced Innovation Hypothesis and Energy Saving Technological Change", Quarterly Journal of Economics, Vol 114, No 3, Aug 1999.
[15] The excess energy of 3,467 kWh per annum is based on the 389 or 20% of RBVMs consuming an average of 14kWh per day compared to 4.5kWh per day for ENERGY STAR ® compliant RBVMs.

2.4 Assessment of Market Deficiencies and Failures

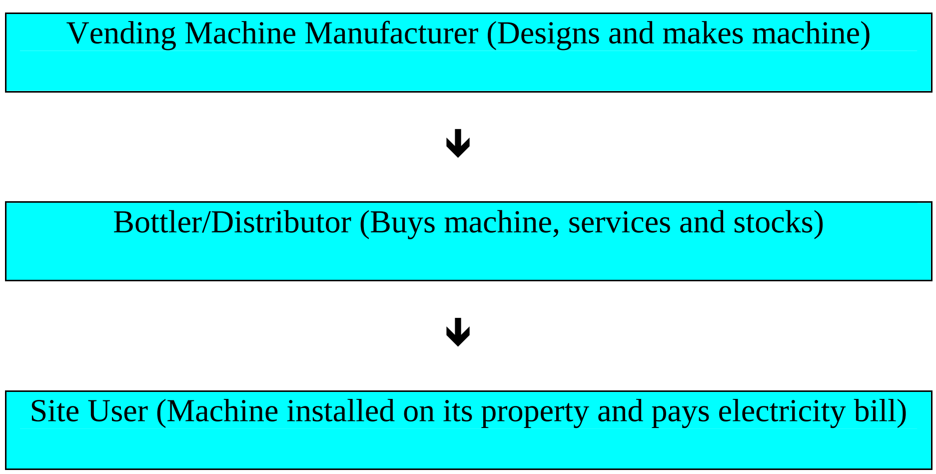
The significant energy efficiency improvements that have been developed since 2005 by large RBVM manufacturers in the U.S.A and the resultant 50% reduction in energy consumption, would suggest that other manufacturers and users would demand similar efficiencies and cost savings. The aforementioned discussion revealed that the energy efficient technology/components are accessible to all manufacturers and do not impose a significant incremental cost. However, only the major RBVM manufacturers would appear to have made the energy efficiency improvements.

The split incentive problem may provide a plausible explanation for the limited uptake of energy efficiency improvements by smaller manufacturers.

The split-incentive problem is where the owner of the energy consuming appliance has no incentive to provide energy efficient appliances as the user pays for the energy costs. In this case, the bottling company invariably owns the vending machine and the users who provide space for the installation of the vending machine such as offices, factories or schools pay for the energy consumption. Clearly, the split-incentive problem was overcome in the U.S and also the Australian and New Zealand markets due to the small number of large RBVM manufacturers and major bottling companies who agreed to make energy efficiency improvements even though they did not receive any direct benefit from reduced energy bills.

Figure 9 shows the supply chain of the vending market for large manufacturers and customers.

Figure 9: RBVM Supply Chain for Large Manufacturers & Bottling Companies

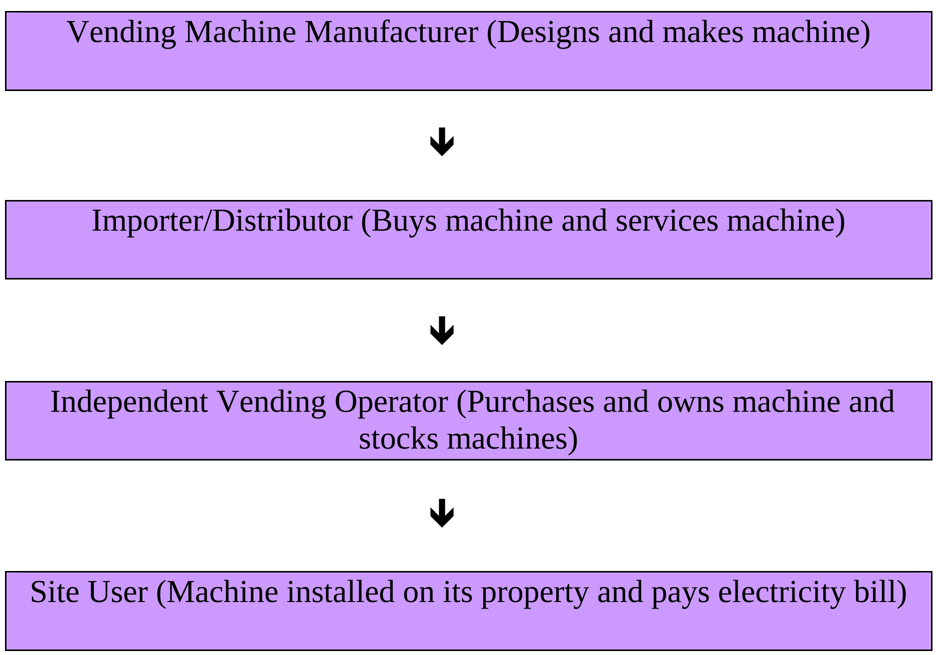


However, the independent vending sector is involved in importing, distributing, manufacturing/assembly but its business model is to find people interested in creating a business of purchasing their vending machines by helping them to find suitable locations such as offices, factories, warehouses etc. Hence, the independent sector is slightly more complex in terms of the players involved: independent vending company that supplies machines; investors that purchase these machines and maintain at various locations and the location of the site that ultimately pays for the energy bills.

Generally, the arrangement is that an investor purchases the vending machines and locates at an office (the vending machine supplier may assist with identifying and negotiating a location) and maintains the machine by replenishing stock. The investor makes a profit margin on the stock and generally does not charge the owner of the site for the vending machine. The owner of the site provides a vending machine for the convenience of their workers or clients and only pays for the energy consumption of the vending machine. Although sites with large turnover of vending stock such as airports, railway stations are known to demand a commission on turnover from the vending operator.

In these situations, offices, factories and warehouses are clearly making an investment that may save their staff (and hence improve productivity) if they can provide refreshments on-site at minimal cost other than the energy bill of the vending machine. Figure 10 shows the longer supply chain of the independent vending sector.

Figure 10: RBVM Supply Chain for Independent Vending Sector



The independent vending sector is comprised mostly of distributors who supply non-ENERGY STAR ® RBVMs from Europe such as Azkoyen and FAS International brands and also some locally manufactured RBVMs. However, some of them also supply ENERGY STAR ® product.

To ascertain whether the split-incentive problem would actually exist with the other 20% of the market not dominated by the major U.S manufacturers and also whether this would continue under an emissions trading scheme with increased electricity prices, it is useful to review the market behaviour of RBVM manufacturers in Europe where electricity prices are substantially higher than in Australia and New Zealand[16]. The three largest U.S RBVM manufacturers with ENERGY STAR ® compliant RBVMs supply the European market in competition with European RBVM manufacturers. Given that electricity prices are higher than Australia, New Zealand and also the U.S, it is reasonable to assume that the U.S manufacturers would market their ENERGY STAR ® status and if energy efficiency was a primary driver for a RBVM customers' purchasing decision, European manufacturers would respond by promoting in their brochures and other material the energy efficiency of their RBVM products.

A review of the technical information and brochures provided by manufacturers and suppliers reveals that the major U.S RBVM manufacturers promote that their products are ENERGY STAR ® but do not disclose and promote the actual kWh energy consumption. This prevents purchasers/site users to identify energy efficient RBVMs although the kWh energy consumption for ENERGY STAR ® qualified products are provided on the U.S EPA website. However, European RBVM manufacturers such as Azkoyen and FAS International make no mention of the energy efficiency of their RBVMs.

Table 9: Voluntary Disclosure of energy efficiency information by U.S and European RBVM manufacturers

Name of Manufacturer	Disclosure of Energy Star or energy efficiency brand on manufacturer's website	Disclosure of Daily kWh consumption in technical brochures on manufacturer's website
Royal Vendors (U.S)	Yes	No
Sanden Vendo (U.S)	No	No
Dixie Narco (U.S)	Yes	No
Seaga Manufacturing (U.S)	Yes	No
Wittern Group (U.S)	No	No
Azkoyen (Spain)	No	No
FAS International (Italy)	No	No

Source: Manufacturer's websites [17]

The absence energy efficiency information particularly the kWh energy consumption in the technical literature and brochures for both U.S and European manufacturers would suggest that even with higher electricity prices, purchasers and site owners are not

[16] Productivity Commission (2005), The Private Cost Effectiveness of Improving Energy Efficiency", Australian Government.

[17] Website addresses: www.royalvendors.com; www.vendoco.com; www.dixienarco.com; www.seagamfg.com; www.wittern.com; www.industrial.azkoyen.com; and www.fas.it

demanding relevant information such as kWh energy consumption so that they can make comparisons on the energy efficiency of RBVMs.

This lack of demand for energy efficiency information from RBVM purchasers and site-owners is possibly explained by energy expenditure representing a small proportion of most business costs; so that even with significant electricity price increases, most businesses do not respond as the cost would still represent a small proportion of their total costs.

While it is difficult to make decisive international comparisons, the European comparison provides some insight as to how Australian and New Zealand RBVM suppliers, purchasers and site-owners, particularly in the independent vending sector, might behave in relation to higher electricity prices and energy efficiency.

Based on the European comparison, it is reasonable to assume that the split-incentive problem in the Australian and New Zealand independent vending sector could continue even with higher electricity prices.

Other factors that need to be taken into account are also the rationale of site-owners for installing RBVMs. Several independent RBVM suppliers advised that the primary reason for site owners with factories, warehouses and offices located in business estates or a away from retail centres was to reduce the lost time from employees leaving the business premises to obtain refreshments. Clearly, in these cases, the primary objective and benefit of the RBVM is to improve employee productivity and would outweigh the cost savings of purchasing an energy efficient RBVM.

3. Objectives of Strategies

3.1 Objective

The objective of the proposed RBVM strategies 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, it must also provide a broad positive financial benefit to end consumers, without compromising appliance quality or functionality.

3.2 Assessment criteria

Abatement measures that do not increase the life-cycle cost of appliances are considered to be cost-effective. This means that the value of the energy savings to the user is not less than the incremental purchase price of a more efficient appliance and the 'no regrets' criterion is satisfied. The contribution to abatement is implicitly valued at zero.

MCE has determined that it will also consider greenhouse abatement measures that have a net financial cost to Australians and New Zealanders, provided the net cost (per tonne of CO_2-e) is not higher than the cost of abatement achieved by other programs. This recognises that regulatory proposals can deliver a net benefit to the community despite an increase in financial costs, and implicitly puts a positive value on the contribution to abatement.

Several secondary assessment criteria are also applied:

1. Does the option address market failures?
2. Does the option minimise negative impacts on product quality and function?
3. Does the option minimise negative impacts on manufacturers and suppliers? For example, the measures need to be clear and comprehensive, minimising the potential for confusion or ambiguity for users and suppliers.

4. Proposed Strategies

A range of potential strategies have been considered to meet the objective of reducing greenhouse gas emissions of RBVMs. The potential strategies are:

- Status Quo or business as usual;
- Voluntary efficiency standards;
- Voluntary certification program;
- Levies and emission trading;
- Dis-endorsement labelling;
- Mandatory energy labelling; and,
- Mandatory energy performance standards.

These options are discussed below.

4.1 Status Quo (BAU)

Since 2006, the three largest suppliers of RBVMs who hold about 80% of market-share in Australia and New Zealand have introduced RBVMs that comply with the U.S ENERGY STAR ® standard. Accordingly, about 80% of RBVMs supplied into the Australian and New Zealand markets have been meeting the proposed MEPS proposal over the past two years. Consequently, the BAU scenario shows a decline rather than an increase in energy consumption and greenhouse gas emissions.

Accordingly, net energy consumption from all types of RBVMs in Australia is estimated to be approximately 520 GWh per annum, equivalent to annual greenhouse emissions of 538 kt CO_2-e in 2008. Net energy consumption declines to 514 GWh and 456 kt CO_2-e in 2020. The net energy consumption from all types of RBVMs in New Zealand have been estimated to be approximately 104GWh per annum, equivalent to annual greenhouse gas emissions of 73kt CO_2-e in 2008. Similarly, net energy consumption declines to 103 GWh and 72 CO_2-e in 2020.

Given this, the BAU will be measured against the proposed MEPS.

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 where there are a relatively small number of suppliers with highly similar products and 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 a large number 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.

In the case of the U.S, there are several large manufacturers of refrigerated vending machines that have voluntarily adopted the U.S ENERGY STAR ® standard. This has been also assisted by the fact that a significant percentage of the output is purchased by several large corporations: Coca-Cola and Pepsi Co.

The Australia and the New Zealand market is similar to the U.S market in that the same RBVM manufacturers supply most of the market and Coca-Cola and Pepsi Co are the major customers.

Hence, the Australian and New Zealand markets have benefited over the past two years from the voluntary adoption by the major vending machine manufacturers of the U.S ENERGY STAR ®.

However, there are 18 importers some of whom undertake local manufacturing of RBVMs.

It is unlikely that all importers and local manufacturers would necessarily agree to voluntary adoption of a minimum energy efficiency standard unless the cost was reasonable and unlikely to impact sales. Several local importers and manufacturers consulted were not aware whether imported European or locally manufactured products would meet the proposed MEPS. However, some indicated that they use 5 star rated Fisher and Paykel compressors in their RBVMs and that they might meet the proposed MEPS.

The Office of Best Practice Regulation Handbook (2006) notes that the likelihood of self-regulatory industry schemes being successful is increased if there is:

- “adequate achievable coverage of industry concerned;
- a viable industry association;
- a cohesive industry with like-minded/motivated participants committed to achieving the goals;
- evidence that voluntary participation can work – effective sanctions and incentives can be applied, with low scope for the benefits being shared by non-participants; and a
- cost advantage from tailor-made solutions and less formal mechanisms, such as access to quick complaints handling and redress mechanisms or the need to make regulatory adjustments quickly to meet developing market circumstances”

The vending machine industry would appear to meet the first two points. The Australian Vending Association (AVA) has been established since 1967 and has wide industry coverage with a total membership of 44 full members. Not all of these members are specifically involved in RBVMs.

The AVA has a code of ethics and a customer charter but does not appear to have been responsible for any self-regulatory scheme. The AVA does not have formal powers to sanction members and informal discussions with AVA executive suggests that the third point is currently difficult to achieve. Given the absence of formal sanction powers and a cohesive industry vision on energy efficiency, a voluntary scheme would not address the split-incentive problem.

4.3 Voluntary Certification Program

A voluntary energy performance certification program would involve manufacturers submitting their products for independent third-party testing. Certification involves testing and rating a product. If the products perform satisfactorily, then the products can be labelled as ‘certified’ to fulfill 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 customers to purchase more efficient products and motivates suppliers to improve the efficiency of their products.

The purpose of these rating or “certification programmes” is to create a common set of criteria for rating products rather than require products meet minimum energy efficiency performance. 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.

Several organizations such as the U.S Air-conditioning and Refrigeration Institute (ARI) and EUROVENT currently do not include RBVMs in their certification process. As previously mentioned in section 2.3, ASERCOM provides an energy performance certification system for refrigeration compressor manufacturers. While the compressor utilizes the most energy consumption of all the components in a RBVM, the ASERCOM certification system is voluntary and currently covers eight large compressor manufacturers.

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 to participate who have products that vary from efficient to less efficient, so any program is likely to cover only a proportion of the RBVMs available.

Given this, a voluntary certification program would not address the split-incentives between small business independent vending operators and site owners.

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 are expected to strongly oppose the introduction of such a scheme.

A mandatory dis-endorsement label is unlikely to be effective for RBVMs as they are not sold at the retail level. Consequently, the label would not be seen by the end-user who pays for the energy consumption until the machine was installed at their site. Therefore, the dis-endorsement label is likely to have a minimal positive impact.

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 RBVMs is to increase the purchase cost or operating costs of the inefficient products from the business' perspective. This can be done by raising the price of the RBVM via a levy or raising the price of the energy the product consumes. Both options are discussed below.

Equipment Levy

The equipment levy involves imposing upon inefficient models a levy which would raise the prices of the RBVM. The funds raised could be used to fund programs which would reduce the greenhouse impact of using RBVMs. The revenue raised from the levy could be diverted to greenhouse-reduction strategies unrelated to the efficiency improvement of RBVMs or used to subsidise the costs of more efficient models of RBVMs in order to reduce any cost differentials between these and inefficient models. However, an equipment levy would not raise sufficient revenue (unless there was a significant levy) given that 80% of annual sales are energy efficient, and even if it did, it would be inequitable for Australian and European manufacturers to be cross-subsidising U.S manufacturers for sunk and marginal incremental costs for the introduction of energy efficient components that were implemented several years ago.

There are significant issues surrounding the measurement of RBVMs, 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, electricity prices are sufficiently low that energy efficiency has not been a critical issue in the design of RBVMs. The imposition of a government levy on electricity prices or the introduction of emissions trading would raise the site owner's consideration of the energy efficiency of RBVMs and might encourage the uptake of more efficient machines. As 80% of annual sales comprise AS/NZ 4864 energy efficient machines, the electricity levy would have a greater impact on inefficient stock purchased more than two and a half years ago. Hence, the electricity levy would have an uneven impact on site owners with RBVMs.

A low level electricity levy is currently 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 RBVMs.

Carbon Pollution Reduction Scheme – Australia

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.

The nature of the Australian CPRS and the impact on the costs and benefits of the proposed policy approach for RBVMs cannot be determined until the operational details of the CPRS have been decided and until modeling of future electricity prices is available. The impact of a CPRS on the RIS analysis is discussed in Section 5.6 and Appendix 6.

However, it is unclear if a CPRS would impact on the energy efficiency of RBVMs. The energy price rises that might flow from the introduction of a CPRS are unlikely to lead to purchasers and installers of RBVMs being concerned about energy efficiency given the split incentive problem. However, the increased cost of energy could stir some site owners to demand energy efficient RBVMs. Although, some of the sites with large vending turnover share a percentage of the turnover with the independent vending operator, and it is doubtful, whether the increased energy prices would impact on these site owners.[18] However, energy prices would encourage over time investment in energy efficiency actions by site owners, particularly at the time when a brand name company or an independent vending operator is replacing the RBVM.

Hence, it is concluded that even if CPRS were to significantly increase energy prices, the split incentive problem where the site- owner rather than the owner of the machine pays for the electricity bill, would not create any immediate motivation for manufacturers/vending operators/site owners to purchase more efficient RBVMs.

New Zealand Emissions Trading Scheme

In September 2007, the New Zealand Government announced an in-principle decision to use an Emissions Trading Scheme as its core price-based measure to reduce greenhouse gas emissions and enhance forest carbon sinks.

The Government proposes to implement the scheme from 2008, with various sectors phased in over the years to 2013. It is 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. New Zealand units are expected to be the primary domestic unit of trade and the scheme would allow purchase from, and sale to, international trading markets.

Feedback from stakeholders and Maori will inform subsequent decisions on the design of the scheme and the ultimate form of legislation required to implement the scheme.

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[18] Based on confidential advice provided by RBVM suppliers.

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

The scheme is intended to shift New Zealand's economy towards investing in and consuming goods and services with lower greenhouse gas emissions (e.g investment in energy efficiency and renewable energy generation). This will be achieved by making the price of greenhouse gas emissions a factor in the decisions of both producers and consumers.

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 a CPRS is Australian Government policy, but it is unlikely the CPRS alone will impact on the energy efficiency of the products to be covered by the proposed MEPS.

4.6 Mandatory Energy Labelling

Mandatory energy labeling 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 model to another model within a product category such as refrigerators. Energy labeling requires the establishment of relative energy levels and a rating system.

RBVMs are not sold to consumers but are a business product purchased by major food manufacturers such as Coca-Cola and Pepsi, and also independent vending suppliers who on-sell the vending machines to small businesses that enter into contractual arrangements to locate their vending machines at airports, railway stations, offices, factories, warehouses, universities and schools.

Some large corporations such as supermarket chains and government departments have the financial and personnel resources to obtain energy efficiency data from suppliers and can make informed purchasing decisions and would not receive any incremental benefits from an energy labeling rating system. Most independent vending suppliers sell to small businesses that purchase about ten vending machines who in turn locate these machines with the assistance of the independent vending supplier at offices, factories etc. These small business vending operators are interested in the return on their investment and as they do not pay for the electricity bill, energy consumption at a site-owner's premises has no impact on the small business vending operator's investment return. Accordingly, a comparative labeling system would not play a major factor in their purchasing decision of an RBVM.

Given this, a mandatory comparative energy labeling system would not address the split incentive problem associated with the smaller part of the RBVM market.

4.7 Mandatory Minimum Energy Performance Standards

Minimum Energy Performance Standards (MEPS) aim to remove the worst performing products from the marketplace. MEPS are a blunt, but efficient regulatory tool in removing the need for smaller businesses and consumers to calculate the energy efficiency and life-cycle costs of appliances, or where split-incentives exist, ensure the appliance owner provides the user with an energy efficient appliance.

Split-incentives can cause market failure that requires government intervention. Given that some of the market has responded to the voluntary U.S ENERGY STAR ® specification for RBVMs, it would be inappropriate to consider split-incentives have caused a market failure. However, split-incentives exist in the independent vending sector of the RBVM market; between small business vending operators (RBVM owners) and site-owners (users) who pay the energy costs.

MEPS provide a feasible alternative strategy that ensures all site-owners have installed RBVMs that meet minimum energy efficiency requirements. MEPS address imperfect information and split incentive market failures. MEPS are needed to introduce into the market cost-effective technology that is invariably available but market barriers prevent its actual implementation. A key market barrier is energy costs account for only 1.6% of total commercial expenditure.[19]

Other market barriers include capital constraints and organisational barriers that impact on the adoption of energy efficiency improvements. Economic literature such as *DeCanio and Watkins (1998)* show larger firms that have the financial, technical and human resources are more likely to adopt energy efficiency improvements.

Hence, small business is likely to be prevented by market barriers to adopt energy efficient RBVMs in the independent vending sector. MEPS remove the market barriers and the research transaction costs as all RBVMs are required to meet minimum energy performance requirements.

MEPS are performance based and not technology prescriptive regulations. Hence, MEPS provide manufacturers with the flexibility as to how to comply and meet the minimum energy performance standard.

[19] Productivity Commission (2005), The Private Cost Effectiveness of Improving Energy Efficiency", Australian Government.

On the supply-side, MEPS can potentially reduce competition if the standard is set too high for most suppliers or barriers exist to some suppliers to access technologies to meet the standard. Minimum energy performance standards can also reduce the incentive for energy efficiency improvements. Hence, MEPS need to be carefully designed and considered in terms of the impacts on the community.

In Australia and New Zealand, MEPS have been introduced for a range of appliances. This is achieved by including the energy performance criteria within an Australian/New Zealand Standard which is incorporated by reference in legislation.

The proposed MEPS are consistent with the MEPS and voluntary labeling standards that have been developed and introduced in the U.S and Canada over the past ten years.

Canada and California introduced MEPS for RBVMs in 1996 and 2004 respectively and the U.S EPA introduced voluntary labelling under its ENERGY STAR ® program based upon the Canadian Standards Association: CAN/CSA C804-96 in 2006.

By and large, the Canadian, Californian and U.S EPA standards are identical with small feature differences. The detail of these standards can be found in Appendix 3.
The proposed MEPS are performance based and not technology specific. The proposed MEPS sets a maximum 24 hour energy consumption level based on continuous machine operation and includes energy consumed vs. machine capacity equation. (Refer to Appendix 3 for the MEPS equations)

For the purposes of verification of the energy performance of a model, at least one unit of the nominated model should be tested in accordance AS/NZS 4864.1.2008 The key requirements of the verification process comprise testing a fully loaded RBVM and recording for 24 consecutive hours the ambient temperature, relative humidity, temperature of each of the standard test packages, energy consumption in kWh, input voltage and duration of test.

The Australian and New Zealand MEPS levels ensure our products matches world best regulatory practice. The E3 Committee's operating instructions under the National Framework for Energy Efficiency are that Australia/New Zealand will set MEPS at stringency levels *"to match world's best regulatory practice, but with a suitable time-lag to allow local industry to adapt"* or to *"lead the world with regulatory standards - where there is no significant manufacturing base and is supported by industry"* (AGO 2007). In the case of RBVMs, the MEPS seek to match the stringency of world's best practice.

4.8 Conclusions

The voluntary options presented in this section are not practical otherwise full adoption of low cost and accessible energy efficient components would have been incorporated into all RBVMs. The proposed options regarding equipment and electricity levies, as well as the emissions trading scheme, all seek to increase energy costs. However, the split incentive problem, particularly in the independent sector, makes these options impractical and ineffective in the short-term. Mandatory labeling is an inappropriate option as the vending machines are owned by businesses rather than consumers. The most effective way to reduce the remaining greenhouse gas emissions caused by RBVMs is to consider the introduction of MEPS. This option is assessed in the next section.

5. Cost Benefit and Other Impacts

This section presents the costs, benefits and impacts of the proposed MEPS for RBVMs. Most of the assumptions from 2009- 2020 that apply to Australia also apply to New Zealand as the products 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.

5.1 Costs to the Taxpayer

The proposed E3 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 annum;
- Check testing, research and other costs underpinning the program: $75,000 per annum, 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 annum.

Hence, total Australian government program costs are estimated to be $150,000 per annum. In addition, New Zealand government costs are estimated to be 25% or $37,500 of the total Australian government costs.

These costs have been included in the national cost-benefit analyses in later sections for Australia and New Zealand.

5.2 Business Compliance Costs

Responsibility for compliance with the proposed MEPS resides 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 to calculate the costs for compliance with the proposed MEPS. The costs of compliance were identified as follows:

- Education – which involves maintaining awareness of legislation band regulations, and the costs of keeping abreast of changes to regulatory details;

- Permission –which involve 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 costs and benefits analysis as increased purchase costs to the customer.

The categories, tasks and cost inputs are presented in Table 10.

Table 10: Business Cost Calculations 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	Rating to AS4864	$500 per model supplied	Based on international sources
Permission	Complete MEPS registration	8 hours per model	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 $55/hr	ABS Average Weekly Earnings

About 70 models are estimated to be supplied from about 18 importers/suppliers. The Business Cost Calculator was used to determine the cost on a “per model” basis for the cost benefit analysis. Given the significant skew of models to three particular brands of RBVM, an average cost to business would be misleading for most importers/suppliers. The cost on a per business and per model basis are presented in Table 11.

Table 11: Business Compliance Costs for RBVM MEPS (AUD)

Category	Task	Cost/business	Costs/model
Education	Train staff, keep up-to-date with regulations	$4,400	$1,100
Permission	Rating to AS4864	$2,000	$500
Permission	Complete MEPS registration	$1,760	$440
Record Keeping	Maintain documents for 5 years	$440	$110
Total		$8,600	$2,150

These costs amount to about $155,000 to Australian suppliers in the first year of the MEPS based on 18 importers/suppliers and about $1,860,000 of undiscounted costs from 2009 to 2020. The cost benefit analysis assumes new models are introduced to the market each year and hence are required to be registered. As about 80% of models already are rated to AS4864, the permission cost is likely to be significantly lower than the $2,000 estimation. Importers/distributors supplying Energy Star compliant RBVMs that are identical to the proposed MEPS prescribed in AS/NZ 4864 must provide testing reports that were used to support Energy Star compliance. However, the importers and manufacturers will also be required to register/list products and provide statistical sales data, as per the standard, along with bearing the costs of registration in Australian States and Territories plus education and record-keeping costs.

5.3 Industry, Competition and Trade Issues

Industry Issues

This section reviews the impacts of the proposal on suppliers. There is estimated to be approximately 18 importers/suppliers; several represent multi-national manufacturers with the remainder suppliers of local product.

Given that the proposed MEPS is adopting the U.S ENERGY STAR ® specification, several U.S manufacturers have qualified against this standard and are not anticipated to incur any incremental costs due to the proposed MEPS requirements.

There are several European manufacturers and some local suppliers that prima facie may not meet the proposed MEPS. The wide accessibility of efficient compressors as demonstrated by the ASERCOM database would probably suggest that the larger European RBVM manufacturers may be in fact meeting the ENERGY STAR ® specification and the proposed MEPS requirements.

Given that most vending machines cost between $2,000 and $4,000, utilization of efficient compressors, T8 fluorescent tubes (required by other MEPS) and compressor/evaporator fans would cost about $200 and represent about 5% to 10% of the vending machine. This does not take into account the cost impact on gross profit margins per RBVM.

Competition

The proposed MEPS are performance based and not technology specific, so it allows manufacturers to select from a range of efficiency measures to meet the minimum energy performance standard.

The incremental cost for design changes and the adoption of energy efficiency measures assumed that manufacturers would need to make systemic changes with the introduction of the proposed MEPS. However, industry feedback from some of the smaller manufacturers in Australia would suggest that they are already utilizing energy efficient compressors similar to the U.S manufacturers and are also required by law to install T8 fluorescent tubes. Given the large number of ASERCOM certified compressors available in the market, it is more than likely that most manufacturers are already incorporating these compressors in their RBVMs.

Coca-Cola is the single largest customer of the RBVM market in Australia and New Zealand. Coca-Cola purchases almost 50% of RBVMs per annum. Coca-Cola has had a long-standing relationship with two U.S vending machines manufacturers; Royal Vendors and Sanden Vendo. Coca-Cola purchases their RBVMs from both of these manufacturers. Other major brand companies including Pepsi Co purchase from Royal Vendors, Sanden Vendo and Dixie Narco.

There are about 18 importers/suppliers independent vending machine suppliers in Australia and general industry feedback was that while they are distributors of U.S and European manufacturers that build RBVMs, they sell very few of these machines compared with other types of vending machines such as combined vending machines and coffee vending machines etc.

Hence, the incremental price increase is unlikely to inhibit local importers and suppliers from gaining access to the larger brand name outlets for RBVMs as these companies tend to have global contracts with the large vending machine manufacturers.

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 costs savings from a more energy efficient product, while the costs include the estimated incremental price due to suppliers meeting the proposed MEPS requirements.

Consumer Perspective

The undiscounted benefits peak at $2.4 million for Australia and NZ$500,000 for New Zealand in 2020 while the highest costs are estimated in 2020 at $387,000 for Australia and $77,000 for New Zealand.

The benefits continue to grow from 2009 to 2020 as result of the replacement of existing stock with more energy efficient product while there is a negligible rise in the incremental cost. This is more a reflection of increased sales over time.

Given that 80% of current annual sales are already compliant with the proposed MEPS requirements, consumer benefits although small, begin to flow prior to the implementation from 2009 and the undiscounted benefits outweigh the costs from 2009 through to 2020. The total consumer benefits and costs for Australia and New Zealand are shown in Figures 11 and 12 respectively.

Figure 11: Consumer Cost Benefits of MEPS - Australia

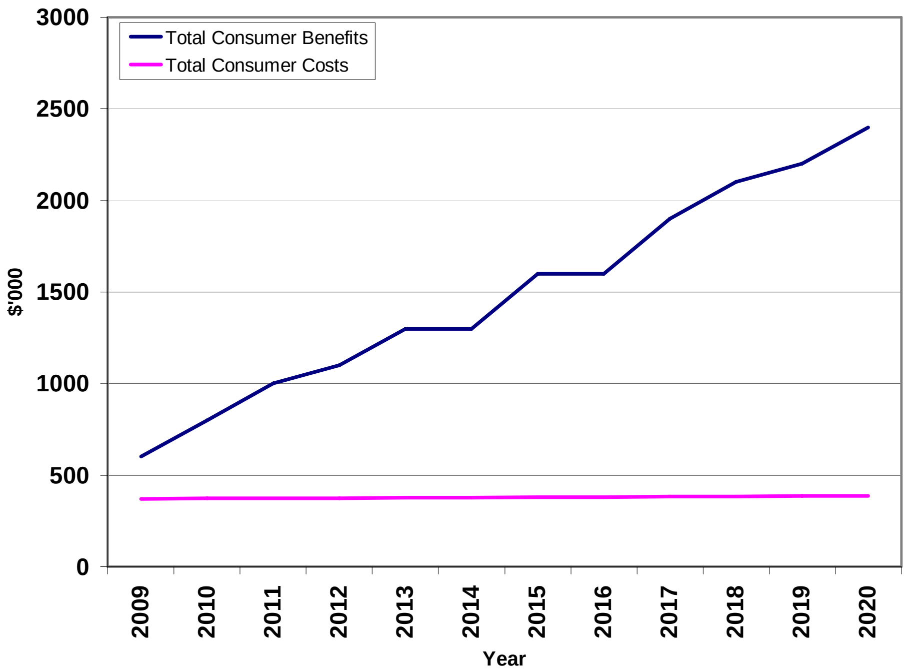
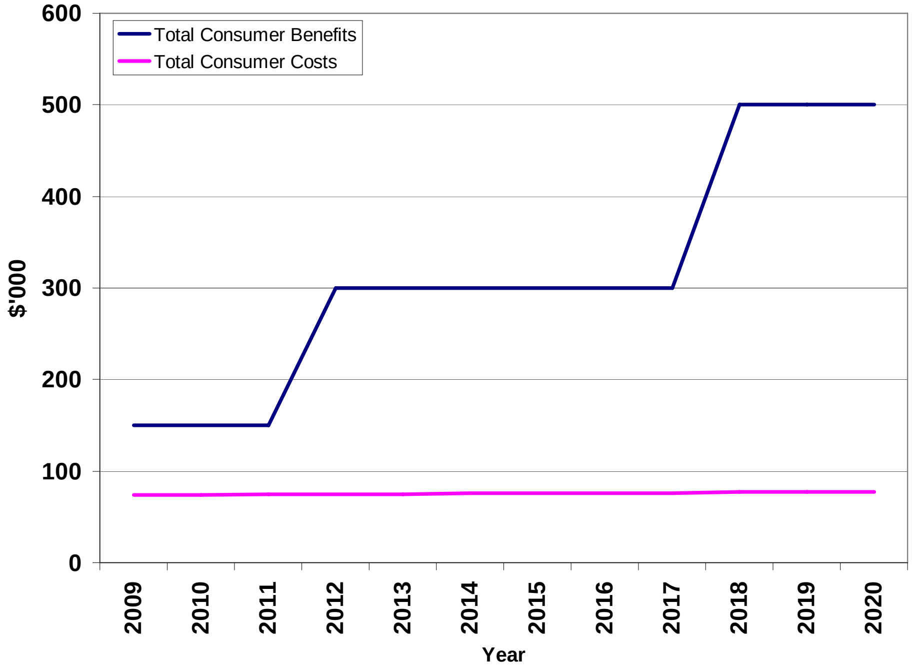


Figure 12: Consumer Cost Benefits of MEPS - New Zealand



The individual costs and benefits of the MEPS in 2008 are presented in Table 12. Note, the present value of the benefits is discounted over the ten year service life of the products.

Table 12: Present Value Costs and Savings – RBVM

	Incremental Price Increase	Estimated Annual Energy Savings (kWh/pa)	Energy Costs Savings/year	Present Value Cost Savings (10years)1	Benefit Cost Ratio
Australia	$200	2701	$432	$2,765	13.8
New Zealand	$200	2701	$432	$3,136	15.7

1. The cost savings are based on an Australian and New Zealand average tariff of 16.0c/kWh. Cost savings are discounted at 7.5% for Australia and 5% for New Zealand.

Many small businesses located in offices, factories and warehouses stand to make substantial energy savings given that it is the site owner rather than the owner of the vending machine that pays for the electricity bill.

The discounted and annualised lifecycle costs of the average RBVM in terms of energy consumption are presented in Table 13. Note the lifecycle cost is discounted over the ten year life of the products.

Table 13: Present value and Annualised Lifecycle Cost – RBVM

	Purchase Price	Annual Energy Consumption (kWh/pa)	Energy Costs Over 10 years	Lifecycle Costs (Purchase Price & Energy Costs)	Present Value Lifecycle Cost (10 years)1	Present Value Annualised Lifecycle Cost
Australia	$3,000	2,555	$4,090	$7,090	$5,807	$581
New Zealand	$3,000	2,555	$4,090	$7,090	$6,158	$616

1. The cost savings are based on an Australian and New Zealand average tariff of 16.0c/kWh. Cost savings are discounted at 7.5% for Australia and 5% for New Zealand.

Cost of Foregoing Product Features

The measures that make improvements to the energy efficiency of RBVMs invariably require compressors that are smaller than inefficient compressors and more efficient fluorescent tubes. In the case of the efficient compressor, this reduces the space utilized by the vending machine and hence provides for further innovative features to be developed in the future.

Distributional Impact

Given that the products need to be kept cold, RBVMs invariably operate 24 hours 365 days of the year. The proposed MEPS provides for a low power mode when the RBVM is not being used, generally in the evening.

Hence, usage is not a major issue with regard to RBVMs compared with some other appliances that may have significant variance in the patterns of usage.

5.5 Impact on Energy Use and Greenhouse Gas Emissions

The proposed MEPS impact is based on an implementation date of October 2009. The energy and greenhouse impacts are modeled to occur from 2009 to 2020. Table 14 shows that Australia's energy consumption is estimated to decline from 520 GWh in 2009 to 499 GWh by 2020 with an equivalent reduction in GHG from 521 kt to 444kt CO_2-e. Similarly, New Zealand's energy consumption is estimated to decline from 104 GWh in 2009 to 100 GWh by 2020 with an equivalent reduction in GHG from 73 kt in 2009 to 70 kt by 2020.

Australia has cumulative GHG reductions of 112 kt CO_2-e and New Zealand has 18 kt CO_2-e reductions from 2009 to 2020.

Table 14: Energy and Greenhouse Impacts – Australia & New Zealand

	Australia				New Zealand			
Year	BAU Energy Use GWh	BAU GHG	Energy Use MEPS GWh	MEPS GHG	BAU Energy Use GWh	BAU GHG	Energy Use MEPS GWh	MEPS GHG
2009	520	521	516	517	104	73	103	72
2010	519	515	514	509	104	73	103	72
2011	519	510	513	503	104	73	103	72
2012	518	513	511	506	104	73	102	71
2013	518	502	510	494	104	73	102	71
2014	517	511	509	503	104	73	102	71
2015	517	491	507	482	103	72	101	70
2016	516	485	506	476	103	72	101	70
2017	516	472	504	461	103	72	101	70
2018	515	469	502	457	103	72	100	70
2019	515	464	501	451	103	72	100	70
2020	514	456	499	444	103	72	100	70

Figures 13and 14 shows the downward trend in net annual energy and greenhouse gas emissions in Australia.

Figure 13: Net Annual Energy - BAU & MEPS - Australia

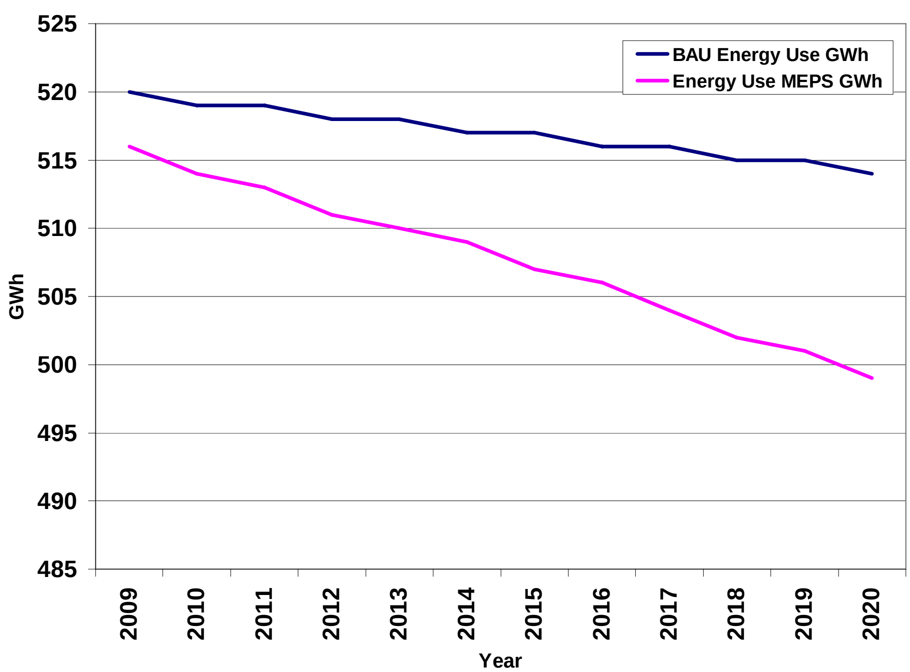
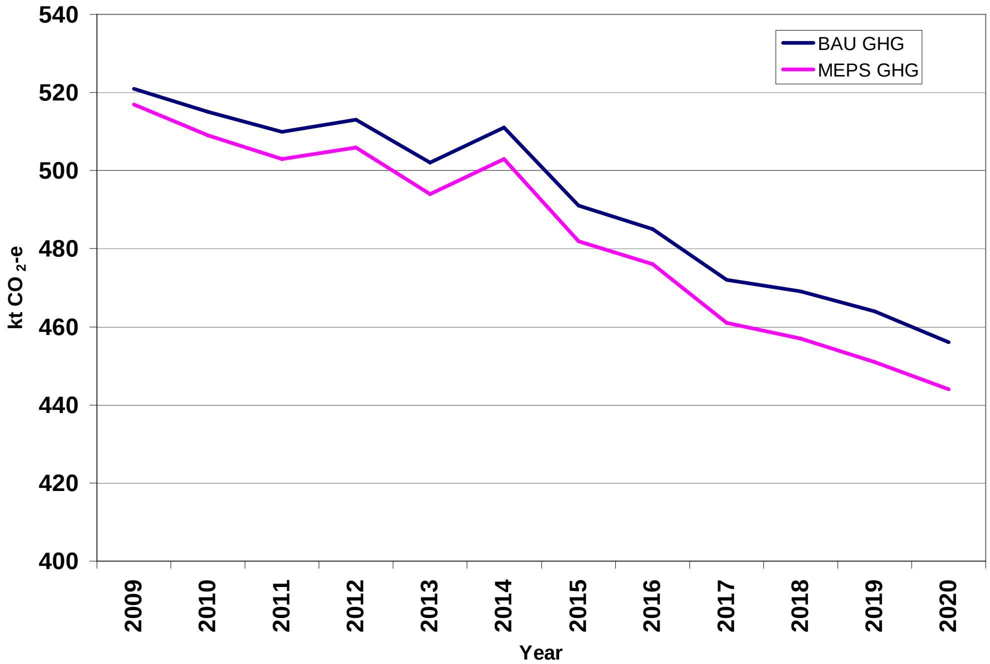


Figure 14: GHG Emissions - BAU & MEPS - Australia



Similarly, figures 15 and 16 shows the downward trend in net annual energy and greenhouse gas emissions in New Zealand.

Figure 15: Net Annual Energy - BAU & MEPS - New Zealand

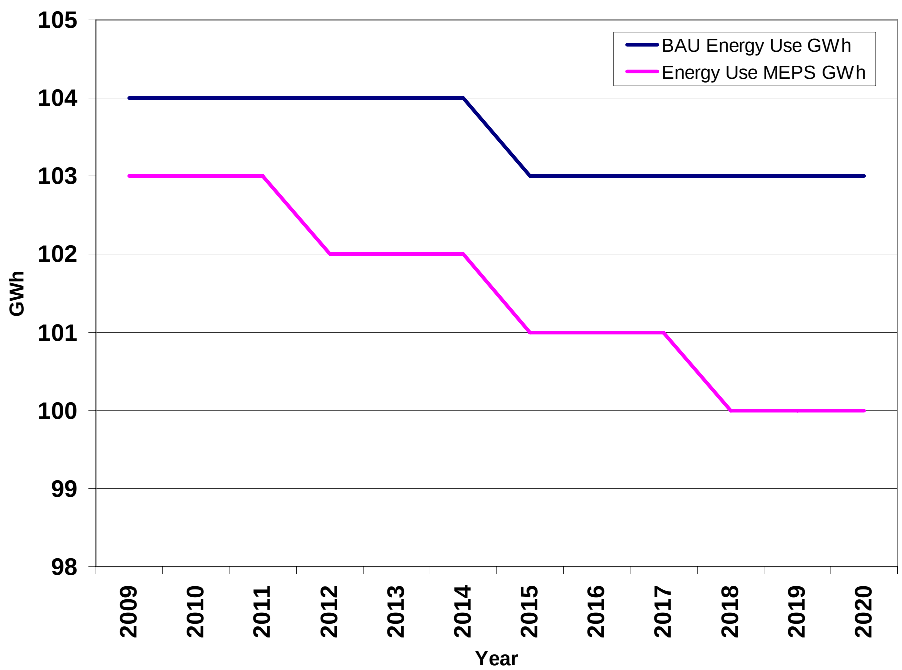
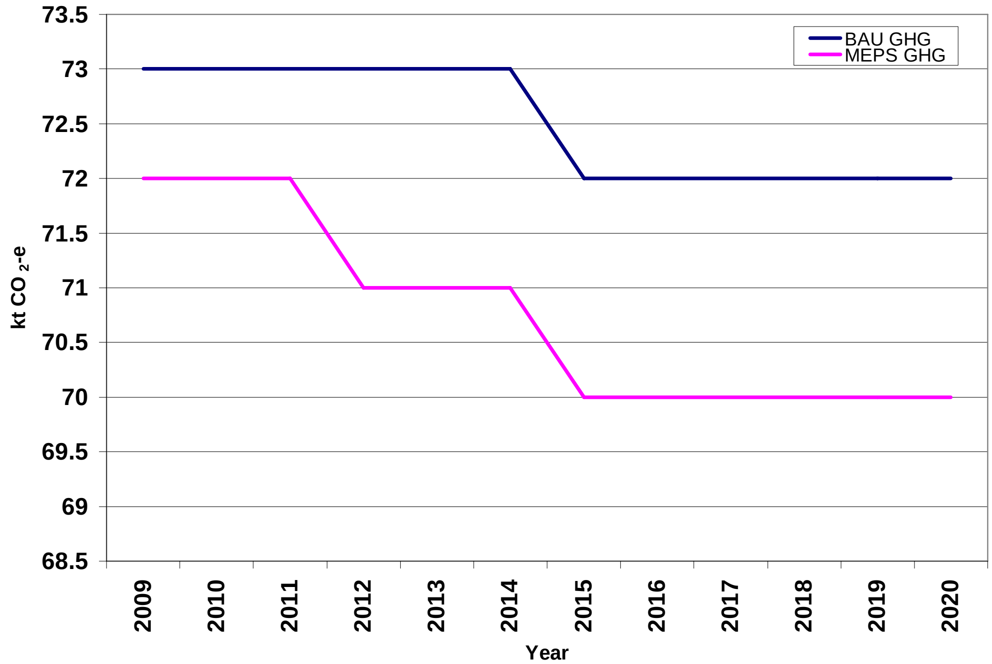


Figure 16: GHG Emissions - BAU & MEPS - New Zealand



5.6 National and State Costs and Benefits

National and State Analysis – Australia

Table 15 presents the Net Present Value and Benefit Cost Ratios for Australia using a range of real discount rates. The national perspective includes:

Costs

- To the consumer due to the incremental price increases of the RBVM
- To the State and Federal government for implementing and administering the E3 program;
- To the RBVM suppliers for complying with the requirements of the proposed MEPS program i.e testing, administration, training, record-keeping etc

Benefits

- To the community 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 much more difficult to assess from a resource perspective.

Table 15 shows the Net Present Value and Benefit Cost Ratios and that a benefit cost ratio of more than 4 is achieved under the highest discount rate.

Table 15: 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	$4,545,000	$2,893,000	$2,350,000	$1,930,542
Total Benefits	$19,200,000	$11,892,440	$9,565,477	$7,800,000
Net Benefits	$14,655,000	$8,999,440	$7,215,477	$5,869,458
Benefit Cost Ratio	4.2	4.1	4.07	4.04

The benefit cost ratios for all Australian states are shown in Table 16.

Table 16: 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	4.53	4.43	4.39	4.37
NT	0	0	0	0
QLD	3.96	3.8	3.75	3.69
SA	4.3	4.35	4.38	4.39
TAS	0	0	0	0
VIC	4.8	4.69	4.64	4.61
WA	4.32	4.08	3.97	3.86

Analysis – New Zealand

The analysis of costs and benefits to New Zealand uses the same approach as for Australia. The New Zealand Government has announced an in-principle decision to use an Emissions Trading Scheme (ETS) as its core price-based measure to reduce greenhouse gas emissions. No account of this has been used in this analysis, as the New Zealand Government has yet to establish the details of how an ETS will operate. Once known, this information will help determine the best approach to including the emissions abatement benefits under the ETS in the RIS.

Table 17 shows the Net Present Value and Benefit Cost Ratios for New Zealand using a range of discount rates. All data tables are based on the incremental real price increase for products for MEPS compliant products. In addition, part of the program costs is apportioned to NZ in relation to the proportion of NZ sales of RBVMs to Australian sales. All values are expressed in NZ dollars, converted at 1.2 NZD to 1 AUD.

Table 17: Financial Analysis – NZ Base Sales Growth for a Range of Discount Rates

	NPV Nil (0%)	NPV Low (5%)	NPV Med (7.5%)	NPV High (10%)
Total Costs	$1,089,600	$764,400	$651,232	$560,038
Total Benefits	$4,680,000	$3,144,000	$2,625,246	$2,216,400
Net Benefits	$3,590,400	$2,379,600	$1,974,014	$1,656,362
Benefit Cost Ratio	4.3	4.1	4.03	3.96

Summary Data

Table 18: Summary Data for BAU Sales Australia – 7.5% Discount Rate

Energy Saved (cumulative)	120GWh
GHG Emission Reduction (cumulative)	112.5 kt
Total Benefit	$9.56M
Total Cost	$2.35M
Benefit Cost Ratio	4.07

Table 19: Summary Data for BAU Sales New Zealand – 5% Discount Rate

Energy Saved (cumulative)	25GWh
GHG Emission Reduction (cumulative)	17.5 kt
Total Benefit	$3.1 M
Total Cost	$0.75 M
Benefit Cost Ratio	4.1

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

6. Consultations and Comments

The proposed MEPS have been made with the following organizations being represented on the Standards Australia/New Zealand Committee to develop AS4864:

- Australian Food and Grocery Council
- Australian Greenhouse Office, now part of The Department of the Environment, Water, Heritage and The Arts
- Australian Industry Group
- Australian Institute of Refrigeration Air Conditioning and Heating (Inc)
- Australian Retailers Association
- Electrical Compliance Testing Association
- Energy Efficiency and Conservation Authority of New Zealand
- Engineers Australia
- Food Science Australia
- Food Standards of Australia New Zealand
- NSW Health Department
- National Association of Retail Grocers of Australia
- Refrigeration Air Conditioning Companies Association

7. Evaluation and Recommendations

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.

Based on the modeling 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 product from the market, the MEPS will most effectively address the split incentive 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 RBVMs 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 the 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 2005 and the Australian/New Zealand Standard will be published in 2008, the program could be implemented in October 2009.

Recommendations (draft)

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

- To implement mandatory energy performance standards for RBVMs.
- That products covered by this RIS include all RBVMs except refrigerated machines that vend both beverages and snacks, combination machines that vend both hot and cold beverages and combination machines that vend hot and cold beverages and chilled snacks.
- To use the test method described in AS/NZS 4864.1.2008
- That RBVMs must meet or surpass the minimum energy performance requirements that are proposed in this document and set down in AS/NZS 4864.2008
- To have all jurisdictions take the necessary administrative actions to ensure that the suite of regulations can take effect from not earlier than 1 October 2009.

8. Implementation and Review

The RBVM MEPS would be implemented under the same State and Territory and New Zealand regulations as appliance labelling and MEPS, and therefore will be subject to the same sunset provisions, if any. Victoria and South Australia have general sunset provisions applying to their labelling/MEPS regulations as a whole, while NSW has sunset provisions applying to the inclusion of some (but not all) items scheduled.

Once the States, Territories and New Zealand agree to mandatory requirements, their removal in any one jurisdiction would undermine the effect in all other jurisdictions, because of the relevant Mutual Recognition agreements. Under the co-operative arrangements for the management of the Equipment Energy Efficiency (E3) Program, States and Territories advise and consult when the sunset of any of the provisions is impending. This gives the opportunity for revised cost-benefit analyses to be undertaken.

Australian/New Zealand Standards called up in State, Territory and New Zealand labelling and MEPS regulations are also subject to regular review. The arrangements between the Commonwealth, State and Territory and New Zealand Governments and Australia/ New Zealand Standards agencies provide that the revision of any Standards called up in energy labelling and MEPS regulations are subject to the approval of the governments. E3 has adopted the principles that there should be a MEPS ‘stability period’, and that 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 the date of implementation. If they are implemented in October 2009, the earliest possible revision would be in October 2012.

Appendix 1: References

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Appendix 2: Australia's 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 regret", 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 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% of its 1990 emissions. This is a 30% 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 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 former Prime Minister announced in June 2007 that Australia will introduce a world-class domestic emissions trading system by 2012. Emissions trading under the Carbon Pollution Reduction Scheme (CPRS) 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 & Proposed MEPS

This section provides information on the approaches used in the U.S, Canada, California and Europe, the proposed approach in Australia and New Zealand, and a short analysis of the international differences.

Canada

In 1996, the Canadian Standards Association issued a Standard incorporating energy performance standards and test methods for RBVMs: CAN/CSA C804-96. This standard specifies that maximum energy consumption determined by:

ED = (ET / tT) x (24 / 1000)

Where

ED = rated energy consumption per day (kWh)
ET = energy consumed during the test
tT = duration of the test (hours)
24 = hours per day
1000 = conversion from Watts to kilowatts

The test specifies that the internal temperature control be set to 1±1°C and that ambient temperature is controlled at 32.2±1°C

The baseline energy consumption is determined by:

Y = 8.66 + (0.009 x C)

Where

Y = total daily energy consumption (kWh)
C = the vending capacity of 355mL cans

In October 2004, Canada's Office of Energy Efficiency (under NRCan – Natural Resources Canada) decided to amend their energy efficiency regulations to match the USA's ENERGY STAR ® Tier 1 levels (described below) - with the exception that a low power mode would not be mandatory (as also proposed by the California Energy Commission). Test methodology will be based on ANSI/ASHRAE 32.1 – 1997 Methods of Testing for Rating Bottled and Canned Beverage Vending machines. The new standards come into effect in Canada on 1st January 2006.

United States

ENERGY STAR ®

The US Environment Protection Agency (EPA) established eligibility criteria for voluntary labelling of vending machines under its ENERGY STAR ® program, based upon the Canadian Standards Association standard: CAN/CSA C804-96. These efficiency criteria are as follows:

Energy Consumption: Qualifying models shall consume equal to or less energy in a 24-hr period than the values obtained from the equations, shown below:

Tier I: *effective 1st April 2004 to 31st December 2006*

$Y = 0.55 [8.66 + (0.009 \times C)]$

Tier II: *effective 1st January 2007*

$Y = 0.45 [8.66 + (0.009 \times C)]$

<u>Where</u>

Y = 24 hr energy consumption (kWh/day) after the machine's internal temperature has stabilized at the set point

C = vending capacity of 355 mL cans

Testing methods are as per ANSI/ASHRAE Standard 32.1 1997R (Note the 2004 version is acceptance of 1997R)

The EPA differentiates test ambient temperatures and relative humidity for indoor and outdoor machines, as follows:

- Indoor machines are tested at an ambient temperature of 75°F and 45% relative humidity.
- Outdoor machines are tested at 90°F and 65% relative humidity.

California

The California Public Utilities Commission commissioned Pacific Gas and Electric to prepare a report (PG&E 2004) analysing standards and legislative options for RBVMs.

The report recommended that the California Energy Commission introduce a Minimum Energy Performance Standard in line with ENERGY STAR ®'s Tier 1 target, to be implemented in 2006.
In December 2004, the Californian Energy Commission approved new regulations for MEPS based upon the Tier 1 targets in the US ENERGY STAR ® guidelines and NSI/ASHRAE test specifications (1997R/2004 version), as follows:

Y = 4.76 + (0.005 x C)

(Note – this provides the same result as the ENERGY STAR ® formula Y = 0.55 [8.66 + (0.009 x C)])

<u>Where</u>

Y = 24 hr energy consumption (kWh/day) after the machine's internal temperature has stabilized at the set point

C = vending capacity of 355 mL cans

This new regulation applies to refrigerated canned and bottled beverage vending machines manufactured on or after 1st January 2006 and will be legislated by the State of California in the near future.

The PG&E report also recommended that vending machines were shipped from the manufacturer with the following default low power mode settings:

7 am - 11:59 pm: lights on and temperature set to 37°F (2.8°C)
12 am - 6:59 am: lights off and temperature set to 50°F (10°C)

The Californian Energy Commission regulations specify machine control requirements such that machines shall be equipped with hard-wired controls or software capable of automatically placing the machine into each of the following low power mode states (and of automatically returning the machine to its normal operating conditions at the conclusion of the low power mode):

a) Lighting low power state – lights off for an extended period; (Note - Actual times not specified)
b) Refrigeration low power state – the average beverage temperature is allowed to rise above 40°F (4.4°C) for an extended period of time;
c) Whole machine low power state – the lights are off and the refrigeration operates in its low power state;
d) The low power mode related controls/software shall be capable of on-site adjustments by the vending operator or machine owner.
Note. Communication with CEC to clarify low power mode during testing has confirmed that all low power mode options are to be disabled during testing.

Test Methods for Beverage Vending Machines – ANSI/ASHRAE

ASHRAE standards are prepared by a committee established by the American Society of Heating, Refrigeration and Air-conditioning Engineers Inc (ASHRAE). The committee must include members of ASHRAE, but may also include non-ASHRAE members subject to them being technically qualified inthe subject.

Currently there are three versions of the ANSI/ASHRAE 32.1 "X dated" test standard referenced by US and Canadian organisations.

The latest and current standard, ANSI/ASHRAE 32.1 2004, was approved by the ASHRAE Board in June 2004 and later approved by American National Standards Institute (ANSI) in December 2004

ANSI/ASHRAE 32.1 - 2004 is the approved version of ASHRAE 32.1 - 1997R. ASHRAE 32.1 –1997R was an interim modified version of the original 1997 test methods to cater for a lower ambient temperature to reflect indoor conditions for machines designed for indoor use only.

ASHRAE 32.1 – 1997 was based upon Canada's Standard CAN/CSA-C804-96 *Energy Performance of Vending Machines*, which was published in 1996.

References by the various organisations to the different versions appears to be based upon which Standard was current at the time of drafting regulations and standards.
A recent review of current documents on NRCan's, CEC's and US ENERGY STAR ® web sites shows

- CEC refers to the 2004 Standard.
- US ENERGY STAR ® refers to the 1997R Standard
- NRCan refers to the 1997 Standard and is dated October 2004.

ENERGY STAR ® and NRCan have adopted the latest standard.

ANSI/ASHRAE 32.1 – 1997 and ANSI/ASHRAE 32.1 – 1997R

ANSI/ASHRAE 32.1 – 1997 only tests machines at an ambient temperature of 32.2 ±1ºC and 65% relative humidity, which is deemed to be outdoor (external use) conditions.

The revised version: ANSI/ASHRAE 32.1 - 1997R, included another category for indoor machines, which uses an ambient temperature of 23.9±1ºC and 45% relative humidity. This test temperature for indoor machines has been adopted by the US ENERGY STAR ® program and their web site refers to ASHRAE 32.1 - 1997R.

ANSI/ASHRAE 32.1 – 2004

ANSI/ASHRAE standards are reviewed every 5 years and in 2004 a revised draft of 32.1 – 1997 was completed. This review of ANSI/ASHRAE 32.1 – 1997 was quite timely, given the increasing use of the relatively recent introduction of a new class of machines - glass fronted/multi-package machines designed mainly for indoor use only.

The original 1997 test method only allowed for testing at an ambient temperature of 32.2ºC. This caused consternation in the US industry because 1997 test rationale was for traditional closed front stacked models and based upon total beverage can capacity and an external use temperature of 32.2±1 ºC. Glass front machines are principally designed for use in internal locations and like any other machine, consume more power if tested outside their design parameters. i.e. at an external (ambient) temperature of 32.2ºC.

Manufacturers doubted that they could meet the CEC's proposed MEPS if tested at 32.2ºC and requested that a lower temperature consumption test for glass fronted machines, in line with the lower ambient temperature option adopted by ENERGY STAR ®. South California Edison also questioned the test regimes for these machine types for similar reasons [SCE 2004].

Ultimately, ANSI/ASHRAE 32.1 – 2004 also included:

- Testing at 23.9±1ºC and 45% relative humidity for designated indoor machines, which covers both glass front machines and traditional closed front machines for internal use;
- Changing the condition that all ratings be based on 12 oz (US) cans such that machines which are not capable of vending cans are to be loaded to maximum capacity with the standard product specified by the manufacturer;
- The machine is to be operated at normal lighting and control settings, using only the pre-set energy management controls that cannot be changed by an operator.

Europe

The European Vending Association (EVA) has developed a voluntary protocol to measure the energy consumption of vending machines in 2006.

The EVA EMP (Energy Measurement Protocol) is based on two existing standards:

Canada's CAN/CSA –C804-96 and the ASHRAE 32.1

At this stage, the EU has not introduced any energy efficiency regulation such as labeling or MEPS specific to RBVMs.

Proposed MEPS for Australia and New Zealand

The proposed MEPS and test method for RBVMs are described in AS/NZS 4864. This standard is divided into two parts:

4864.1 Part 1: Test Methods – Energy performance
4864.2 Part 2: Minimum energy performance standard (MEPS) requirements

The energy consumption of a RBVM shall be less than or equal to the value calculated from the equation shown below:

Minimum energy performance requirements

Y= 0.55 [8.66 + (0.009 x C)
<u>Where</u> Y = 24 hr energy consumption (kWh/day) after the machine's internal temperature has stabilized at the set point. C = vending machine capacity

In addition the standard prescribes a "high efficiency" designation for RBVMs where the energy consumption is less than or equal to the value calculated from the equation shown below:

High Efficiency Level

Y= 0.45 [8.66 + (0.009 x C)
<u>Where</u> Y = 24 hr energy consumption (kWh/day) after the machine's internal temperature has stabilized at the set point. C = vending machine capacity

The minimum energy performance requirement and the high efficiency level is the same as U.S ENERGY STAR ® Tier 1 and Tier 2 respectively.

Summary of International Approaches and Impact on Australian/New Zealand Approach

The U.S EPA's ENERGY STAR ® specifications are the most stringent requirements and have been subsequently adopted by the Californian Energy Commission. The U.S

EPA, California and Canada have different formulas. However, the calculations are the same using different formulas. Unlike Canada, the U.S ENERGY STAR ®/CEC specifications include a low power mode for when the RBVM is not being used by a customer and also make a distinction between indoor and outdoor RBVMs by applying different tests for ambient temperature and humidity.

The proposed MEPS for Australia and New Zealand is the same as the U.S ENERGY STAR ® specifications including the low power mode and the different tests for ambient temperature and humidity that apply to indoor and outdoor RBVMs. Accordingly, the proposed MEPS stringency levels match world's best regulatory practice.

Appendix 4: Energy Prices and Factors

Table 20: Marginal Commercial Electricity Tariffs 2006-2007

Jurisdiction	Cents/kWh commercial
New South Wales	17
Victoria	17
Queensland	15
South Australia	16
Western Australia	14
Tasmania	16
Northern Territory	15
Australian Capital Territory	19
Australia (weighted)	16
New Zealand	16

Appendix 5: Calculation Methodology

Cost-Benefits Analysis

The NPV benefits are calculated for each State using the avoided costs of electricity as shown in Appendix 4: Energy Prices and Factors multiplied by the energy savings calculated earlier. The incremental costs are based upon industry information and discussed in section 5.3. 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.

NPV is calculated using real discount rates of 0%, 5%, 7.5% and 10%.

Given that 80% of annual sales already meet the proposed MEPS, the incremental cost is applied to the remaining 20% of annual sales.

As the RBVM market is a mature market, sensitivity analysis of high growth sales scenario was considered unwarranted.

Appendix 6: CPRS Provisional Benefits to be Included in Future

The potential impact of an Australian carbon pollution reduction (CPRS) on the benefit-cost ratio is assessed in this appendix. On 3 June 2007, the former 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. Prime Minister Rudd has endorsed the introduction of the CPRS. However, the nature of the CPRS and the timing of its introduction could be changed. Whatever the nature of any CPRS, it has the potential to increase the national benefits from RBVM MEPS due to the cost the CRPS will impose 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 trialed 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 modeling 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 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 CBA 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 CO2-e from 2012 and Table 20 reports the effect of this on the CBA.

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 21: Carbon Permit Sensitivity Analysis – Australia Base Sales Growth

$0/t CO2-e Carbon Permit Price				
	NPV Nil (0%)	**NPV Low (5%)**	**NPV Med (7.5%)**	**NPV High (10%)**
Total Costs	$4,545,000	$2,893,000	$2,350,000	$1,930,542
Total Benefits	$19,200,000	$11,892,440	$9,565,477	$7,800,000
Net Benefits	$14,655,000	$8,999,440	$7,215,477	$5,869,458
Benefit Cost Ratio	4.2	4.1	4.07	4.04
Cumulative kt C02-e Abatement (2012-2020) 89.5 kt				
Potential Carbon Permit Avoided Costs				
Additional Avoided Carbon Costs @ $10/t CO2-e from 2012	$895,000	$532,525	$417,070	$329,360
Additional Avoided Carbon Costs @ $20/t CO2-e from 2012	$1,790,000	$1,065,050	$834,140	$658,720
Changes to Benefit Cost Ratio				
BCR with @$10/t CO2-e from 2012	4.42	4.29	4.25	4.21
BCR with @$20/t CO2-e from 2012	4.62	4.48	4.42	4.38

As the table shows, a potential carbon permit price of $10/t CO2-e would increase the BCR from 4.07 to 4.25; likewise the permit price of $20/t CO2-e would increase the BCR to 4.42, at a discount rate of 7.5%.

The New Zealand Government has announced an in-principle decision to use an Emissions Trading Scheme (ETS) as its core price-based measure to reduce greenhouse gas emissions. No account of this has been used in this RIS, as the New Zealand Government has yet to establish the details of how an ETS will operate. Once known, this information will help determine the best approach to including the emissions abatement benefits under the ETS in the RIS.

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 RBVMs in Australia or New Zealand. However, very few sales are made compared to the larger manufacturers. Where a local supplier does provide RBVMs, this supplier can either test the unit to the relevant Australian/New Zealand Standard or a recognised international equivalent test and provide the details.

GATT issues

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

These are addressed below.

As almost all of the products addressed in the study are currently imported, MEPS would not favour local supplies against imports. It is a particular concern of the GTBT that where technical regulations are required and relevant international standards exist or their completion is imminent, members should use them, or the relevant parts of them, as a basis for their technical regulations. The energy consumption standard and the energy test procedure adopted by the Australian/New Zealand Standard replicates the U.S ENERGY STAR ® specification and the ASHRAE test respectively.

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 fulfill the objectives of their own regulations.

The design of the compliance program for the MEPS allows for the acceptance of the ASHRAE testing results.

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

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

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

Appendix 8: Detailed Sales and Stock – Base Scenario

Table 22: Total Annual Sales of Refrigerated Beverage Vending Machines for Australia and New Zealand

Year	NSW/ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2004	510	15	300	135	30	360	150	1,500	300
2005	520	15	306	138	31	367	153	1,530	306
2006	530	16	312	140	31	375	156	1,560	312
2007	541	16	318	143	32	381	159	1,590	318
2008	553	16	324	146	32	389	162	1,622	324
2009	563	16	331	149	33	397	165	1,654	330
2010	574	16	337	152	34	405	169	1,687	337
2011	585	17	344	155	34	413	172	1,720	344
2012	597	17	351	158	35	421	175	1,754	351
2013	608	18	358	161	36	429	179	1,789	358
2014	621	18	365	164	36	438	183	1,825	365
2015	633	19	372	167	37	447	186	1,861	372
2016	645	19	380	171	38	455	190	1,898	379
2017	658	19	387	174	39	465	194	1,936	387
2018	671	20	395	178	39	474	197	1,974	395
2019	684	20	403	182	40	483	201	2,013	403
2020	698	20	411	185	41	493	205	2,053	411

Table 23: Total Stock of Refrigerated Beverage Vending Machines for Australia and New Zealand

Year	NSW/ACT	NT	QLD	SA	TAS	VIC	WA	AUST	NZ
2004	37,400	1,100	22,000	9,900	2,200	26,400	11,000	110,000	22,000
2005	37,609	1,106	22,122	9,955	2,212	26,547	11,061	110,612	22,122
2006	37,820	1,112	22,247	10,011	2,225	26,697	11,124	111,236	22,247
2007	38,038	1,119	22,374	10,068	2,237	26,849	11,187	111,872	22,374
2008	38,257	1,126	22,504	10,127	2,250	27,005	11,252	112,521	22,504
2009	38,482	1,132	22,636	10,186	2,264	27,164	11,318	113,182	22,636
2010	38,711	1,139	22,771	10,247	2,277	27,326	11,386	113,857	22,771
2011	38,945	1,145	22,909	10,309	2,291	27,491	11,455	114,545	22,909
2012	39,184	1,152	23,049	10,372	2,305	27,659	11,525	115,246	23,049
2013	39,427	1,160	23,192	10,437	2,319	27,831	11,596	115,962	23,192
2014	39,676	1,167	23,338	10,502	2,334	28,006	11,669	116,692	23,338
2015	39,928	1,174	23,487	10,569	2,349	28,185	11,744	117,436	23,487
2016	40,186	1,182	23,639	10,637	2,364	28,367	11,820	118,195	23,639
2017	40,449	1,190	23,794	10,707	2,379	28,553	11,897	118,969	23,794
2018	40,718	1,198	23,952	10,778	2,395	28,742	11,976	119,759	23,952
2019	40,993	1,206	24,114	10,851	2,411	28,936	12,057	120,568	24,113
2020	41,272	1,214	24,278	10,925	2,428	29,133	12,139	121,389	24,277

Appendix 9: Greenhouse Gas Emission Factors

Table 24: Projected marginal emissions-intensity of electricity supply by State

Region	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NSW/ACT	1.021	1.031	1.039	1.018	0.987	0.975	0.963	0.965	0.945	0.961	0.919	0.91	0.883	0.888	0.881	0.866
VIC	1.106	1.117	1.13	1.13	1.094	1.075	1.086	1.105	1.085	1.112	1.048	1.023	0.992	0.995	0.965	0.936
QLD	1.02	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	1.112	1.123	1.153	1.161	1.113	1.093	1.099	1.12	1.078	1.093	1.014	0.993	0.986	0.979	1.00	0.955
WA	0.906	0.884	0.868	0.885	0.89	0.894	0.83	0.826	0.823	0.838	0.845	0.855	0.817	0.804	0.808	0.81
NT	0.76	0.76	0.764	0.77	0.769	0.775	0.779	0.727	0.732	0.735	0.739	0.743	0.747	0.75	0.752	0.754
TAS	0.769	0.902	1.007	1.024	1.033	0.998	0.993	1.00	1.016	1.005	1.038	0.984	0.965	0.954	0.966	0.976
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

Source:www.greenhouse.gov.au/ggap/round3/emission-factors.html

Appendix 10: Population and Household Numbers

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NSW	HH('000)	2605	2643	2682	2720	2758	2797	2836	2875	2914	2952	2991	3030	3068	3105	3143	3180
	Persons	6811	6889	6924	6978	7032	7087	7141	7192	7243	7294	7345	7396	7444	7492	7541	7589
VIC	HH('000)	1946	1976	2006	2036	2066	2096	2127	2157	2187	2218	2248	2279	2309	2339	2368	2398
	Persons	5018	5071	5112	5154	5195	5237	5278	5317	5355	5394	5432	5471	5508	5544	5581	5618
QLD	HH('000)	1544	1583	1623	1663	1704	1745	1787	1829	1872	1914	1958	2001	2045	2088	2132	2175
	Persons	3925	4000	4067	4134	4202	4269	4337	4403	4469	4535	4601	4667	4732	4798	4863	4928
SA	HH('000)	642	649	656	663	670	677	684	690	697	704	710	717	723	729	735	741
	Persons	1537	1544	1548	1552	1556	1560	1565	1568	1571	1574	1577	1580	1583	1585	1587	1590
WA	HH('000)	789	806	824	841	858	876	894	912	930	948	966	984	1001	1019	1037	1055
	Persons	2006	2033	2059	2084	2110	2136	2162	2187	2212	2237	2262	2287	2311	2335	2359	2384
TAS	HH('000)	201	203	205	207	209	211	213	215	217	219	221	223	225	226	228	229
	Persons	476	477	477	477	477	478	478	478	478	478	478	477	477	476	476	475
NT	HH('000)	66	67	68	70	71	72	73	75	76	77	78	80	81	82	83	84
	Persons	204	205	208	210	212	215	217	219	222	224	226	229	231	233	236	238
ACT	HH('000)	128	130	132	134	136	138	140	142	144	146	148	150	151	153	155	157
	Persons	330	333	335	337	340	342	344	346	349	351	353	355	357	359	361	363
AUST	HH('000)	7920	8057	8195	8333	8472	8612	8754	8895	9036	9177	9320	9461	9602	9741	9880	10019
	Persons	20307	20531	20729	20927	21125	21323	21522	21710	21898	22085	22273	22461	22642	22823	23004	23185
	Persons/HH	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)	1526	1548	1566	1585	1603	1622	1641	1659	1677	1696	1714	1733	1750	1767	1784	1801
	Persons	4062	4109	4136	4164	4192	4220	4248	4274	4300	4326	4353	4379	4404	4429	4455	4480
	Persons/HH	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)	9446	9605	9761	9918	10075	10234	10395	10554	10713	10873	11034	11194	11352	11508	11664	11820
	Persons	24369	24640	24865	25091	25317	25543	25770	25983	26197	26412	26626	26840	27046	27252	27459	27665
	Persons/HH	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

Appendix 11: Annual Cost Inputs for RIS model

STB Category	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cost to Government															
Establishment (once-off)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance/Yr	$0	$0	$0	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50
Administration of Program	$0	$0	$0	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Random Check/Testing	$0	$0	$0	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Consumer Information	$0	$0	$0	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
RIS/Market Research	$0	$0	$0	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Subtotal Government	$0	$0	$0	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150
Costs to Industry	$0	$0	$0												
Testing	$0	$0	$0	$77	$77	$77	$77	$77	$77	$77	$77	$77	$77	$77	$77
Registration	$0	$0	$0	$78	$78	$78	$78	$78	$78	$78	$78	$78	$78	$78	$78
Subtotal Business	$0	$0	$0	$155	$155	$155	$155	$155	$155	$155	$155	$155	$155	$155	$155
Cost to Consumers	$0	$0	$0												
Incremental Price Increase	$0	$0	$0	$66	$67	$69	$70	$71	$73	$74	$76	$77	$79	$81	$82
Total	$0	$0	$0	$371	$372	$374	$375	$376	$378	$379	$381	$$382	$384	$386	$387

Annual non-discounted costs in thousands of dollars ($'000)

Appendix 12: Annual Consumer Energy, Benefits and Costs Data

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

Year	Units	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Australia																		
BAU Energy Use	GWh/yr	522	521	521	521	520	520	519	519	518	518	517	517	516	516	515	515	514
With program energy use	GWh/yr	522	521	519	518	517	516	514	513	511	510	509	507	506	504	502	501	499
Energy Savings	GWh/yr	0	0	2	3	3	4	5	6	7	8	8	10	10	12	13	14	15
Value of Energy Saved	$M	0	0	.30	.50	.50	.60	.80	1.0	1.1	1.3	1.3	1.6	1.6	1.9	2.1	2.2	2.4
Emissions saved (marginal)	ktCO_2-e	0	0	1	2	3	4	6	7	7	8	8	9	9	11	12	13.5	12
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	371	372	374	375	376	378	379	381	382	384	386	387

Year	Units	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NSW&ACT																		
BAU Energy Use	GWh/yr	177	177	177	177	177	177	176	176	176	176	176	176	175	175	175	175	175
With program energy use	GWh/yr	177	177	176	176	176	175	175	174	174	173	173	172	172	171	171	170	170
Energy Savings	GWh/yr	0	0	1	1	1	2	1	2	2	3	3	4	3	4	4	5	5
Value of Energy Saved	$M	0	0	.17	.17	.17	.34	.17	.34	.34	.50	.50	.70	.50	.70	.70	.85	.85
Emissions saved (marginal)	ktCO_2-e	0	0	1.03	1.04	1.02	1.97	.97	1.93	1.93	2.8	2.9	3.7	2.7	3.5	3.5	4.4	4.3
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	126	126	127	127	128	129	129	130	130	131	131	132

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
NT																		
BAU Energy Use	GWh/yr	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
With program energy use	GWh/yr	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Energy Savings	GWh/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Value of Energy Saved	$M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emissions saved (marginal)	ktCO_2-e	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	4	4	4	4	4	4	4	4	4	4	4	4

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
QLD																		
BAU Energy Use	GWh/yr	104	104	104	104	104	104	104	104	104	104	103	103	103	103	103	103	103
With program energy use	GWh/yr	104	104	104	104	103	103	103	103	102	102	102	101	101	101	100	100	100
Energy Savings	GWh/yr	0	0	0	0	1	1	1	1	2	2	1	2	2	2	3	3	3
Value of Energy Saved	$M	0	0	0	0	.15	.15	.15	.15	.30	.30	.15	.30	.30	.30	.45	.45	.45
Emissions saved (marginal)	ktCO_2-e	0	0	0	0	1	1	1	1	1.8	1.8	1	1.8	1.8	1.8	2.6	2.6	2.6
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	74	74	75	75	75	76	76	76	76	77	77	77

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
SA																		
BAU Energy Use	GWh/yr	47	47	47	47	47	47	47	47	47	47	47	47	46	46	46	46	46
With program energy use	GWh/yr	47	47	47	47	47	46	46	46	46	46	46	46	46	45	45	45	45
Energy Savings	GWh/yr	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1
Value of Energy Saved	$M	0	0	0	0	0	.16	.16	.16	.16	.16	.16	.16	0	.16	.16	.16	.16
Emissions saved (marginal)	$ktCO_2$-e	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1
Additional appliance cost	$’000	0.0	0.0	0.0	0.0	0.0	33	33	34	34	34	34	34	34	34	35	35	35

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
TAS																		
BAU Energy Use	GWh/yr	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
With program energy use	GWh/yr	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Energy Savings	GWh/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Value of Energy Saved	$M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emissions saved (marginal)	$ktCO_2$-e	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional appliance cost	$’000	0.0	0.0	0.0	0.0	0.0	7	7	7	7	7	7	7	8	8	8	8	8

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
VIC																		
BAU Energy Use	GWh/yr	125	125	125	125	125	125	125	125	124	124	124	124	124	124	124	124	123
With program energy use	GWh/yr	125	125	125	124	124	124	123	123	123	122	122	122	121	121	120	120	120
Energy Savings	GWh/yr	0	0	0	1	1	1	2	2	1	2	2	2	3	3	4	4	3
Value of Energy Saved	$M	0	0	0	.17	.17	.17	.34	.34	.17	.34	.34	.34	.50	.50	.68	.68	.50
Emissions saved (marginal)	ktCO_2-e	0	0	0	1	1	1	2.1	2.2	1	2.1	2.2	2.1	3	3	4	3.9	2.8
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	89	89	90	90	91	91	91	92	92	92	93	93

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
WA																		
BAU Energy Use	GWh/yr	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	51
With program energy use	GWh/yr	52	52	52	52	52	52	51	51	51	51	51	51	51	50	50	50	50
Energy Savings	GWh/yr	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	1
Value of Energy Saved	$M	0	0	0	0	0	0	.14	.14	.14	.14	.14	.14	.14	.28	.28	.28	.14
Emissions saved (marginal)	ktCO_2-e	0	0	0	0	0	0	1	1	1	1	1	1	1	1.6	1.6	1.6	1
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	37	37	37	37	38	38	38	38	38	38	39	39

Year	Units	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
NZ																		
BAU Energy Use	GWh/yr	104	104	104	104	104	104	104	104	104	104	104	103	103	103	103	103	103
With program energy use	GWh/yr	104	104	104	104	103	103	103	103	102	102	102	101	101	101	100	100	100
Energy Savings	GWh/yr	0	0	0	0	1	1	1	1	2	2	2	2	2	2	3	3	3
Value of Energy Saved	$M	0	0	0	0	.15	.15	.15	.15	.30	.30	.30	.30	.30	.30	.50	.50	.50
Emissions saved (marginal)	$ktCO_2$-e	0	0	0	0	0.7	0.7	0.7	0.7	1.40	1.40	1.40	1.40	1.40	1.40	2.1	2.1	2.1
Additional appliance cost	$'000	0.0	0.0	0.0	0.0	0.0	74	74	75	75	75	76	76	76	76	77	77	77