

DRAFT FOR PUBLIC COMMENT

**REGULATORY IMPACT STATEMENT:  
Minimum Energy Performance Standards and  
Alternative Strategies for  
COMMERCIAL REFRIGERATION CABINETS  
in Australia and New Zealand**

Prepared for the Australian Greenhouse Office

by

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## **GLOSSARY and ABBREVIATIONS**

<b>BaU</b>	Business as usual
<b>CO<sub>2</sub>e</b>	Carbon dioxide equivalent units
<b>E2G2</b>	Working Group for Energy Efficiency and Greenhouse Gas
<b>kWh</b>	Unit of measurement of energy, equivalent to 1,000 watts of power flowing for one hour
<b>MCE</b>	Ministerial Council on Energy
<b>MEPS</b>	Minimum energy performance standards
<b>Mt</b>	Mega-tonne (metric) = 1,000 tonnes
<b>NAEEEP</b>	National Appliance and Equipment Energy Efficiency Program
<b>NZ</b>	New Zealand
<b>RIS</b>	Regulatory impact statement
<b>t</b>	tonne (metric)
<b>TDA</b>	Total display of a refrigerator in m <sup>2</sup>
<b>TEC</b>	Total energy consumption of a refrigerator in kWh/day
<b>TEC / TDA</b>	Total energy consumption of a refrigerator per unit of display area in kWh/day/m <sup>2</sup>
<b>TMRA</b>	Trans-Tasman Mutual Recognition Agreement
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>Watt (w)</b>	Unit of measurement of power (in this context electrical power)

# Executive Summary

This is the regulatory impact statement for the introduction of Minimum Energy Performance Standards (MEPS) for all remote and self-contained refrigerated display and storage cabinets and their internal components within the scope of the Australian Standard AS 1731, as typically manufactured, imported and sold in Australia and New Zealand.

## The problem

Commercial refrigeration in Australia currently consumes an estimated 7,000 GWh of electricity per annum and consequently around 6.7 million tonnes CO<sub>2</sub> equivalent greenhouse gases each year, representing 1.3% of Australia's total greenhouse gas emissions. Due to market failures within the Australian and New Zealand commercial refrigeration market, the level of energy efficiency of these products is lower than what is economically optimal.

## The objective

The primary objective of the proposed regulation is to bring about a reduction in greenhouse gas emissions from the use of commercial refrigerators, to below the levels they are otherwise projected to reach under a business as usual scenario, through improving their energy efficiency.

## The proposal

The proposed measure involves introducing mandatory MEPS for commercial refrigerators in late 2004 that would stipulate in government legislation the minimum level of energy efficiency these products would need to meet in order to be sold on the Australian and New Zealand market. The proposal will either lead manufacturers of commercial refrigerators to upgrade those products that currently do not meet these standards or remove them from sale.

## Assessment

The proposed measure is projected to achieve greenhouse gas abatement of between 1.5 and 2.4 Megatonnes of CO<sub>2</sub> equivalent from 2005 to 2020 inclusive. The cost benefit analysis indicates that over the period 2005 to 2020 the proposed regulation will also deliver cumulative energy saving benefits (ignoring the benefits of abatement) of between \$129 million and \$250 million in net present value terms using a 5% discount rate. The investment required is expected to range between \$88 million and \$98 million in net present value terms over the same period, with a benefit to cost ratio of between 1.5 and 2.6 .

The balance of benefits and costs will fall unevenly between users depending on whether they are the purchaser of the unit or have it supplied to them, and the size of the unit they use. However analysis indicates that in most cases users will benefit from the proposed regulation.

## Other Options

The other options considered for achieving the objective for this regulation were: voluntary MEPS; levies on electricity or equipment, together with financial assistance for abatement activities; an equipment certification program; and mandatory product labelling. Levies, subsidies, certification and mandatory product labelling have the advantage that they would not restrict choice of refrigerator cabinet. However certification and mandatory product labelling are considered unlikely to deliver the kind of benefits that could be expected from mandatory MEPS, due to entrenched market structures such as separation of cabinet ownership and use. Equipment subsidies are likely to require significant amounts of money due to the large number of inefficient cabinets being sold and it could be argued are an inefficient use of taxpayers money to encourage a market to do what ultimately is in its own financial interests. Levies present substantial difficulties to implement as they are not current government policy. Voluntary MEPS, while possibly costing less to administer, would overall impose similar costs upon the economy as mandatory MEPS but without the same degree of confidence in the delivery of an outcome that achieved the stated objective.

## **Recommendations (draft)**

It is recommended that:

- > States and Territories implement mandatory minimum energy performance standards for commercial refrigeration cabinets as outlined in Australian Standard 1731.
- > The mode of implementation be through amendment of the existing regulations governing appliance energy labelling and MEPS in each State and Territory, to add commercial refrigeration to the schedule of products for which minimum energy performance standards are required.
- > The regulations refer to Australian Standard 1731.
- > The amendments take effect on 1 October 2004.
- > State and Territory governments should require registration of commercial refrigeration models, so invoking Part 14 of the Standard.
- > Governments re-examine, no later than 2008, the costs and benefits of revising the MEPS levels and other options for further increasing the energy efficiency of commercial refrigeration.

# 1 THE PROBLEM

## 1.1 Energy-Related Greenhouse Gas Emissions

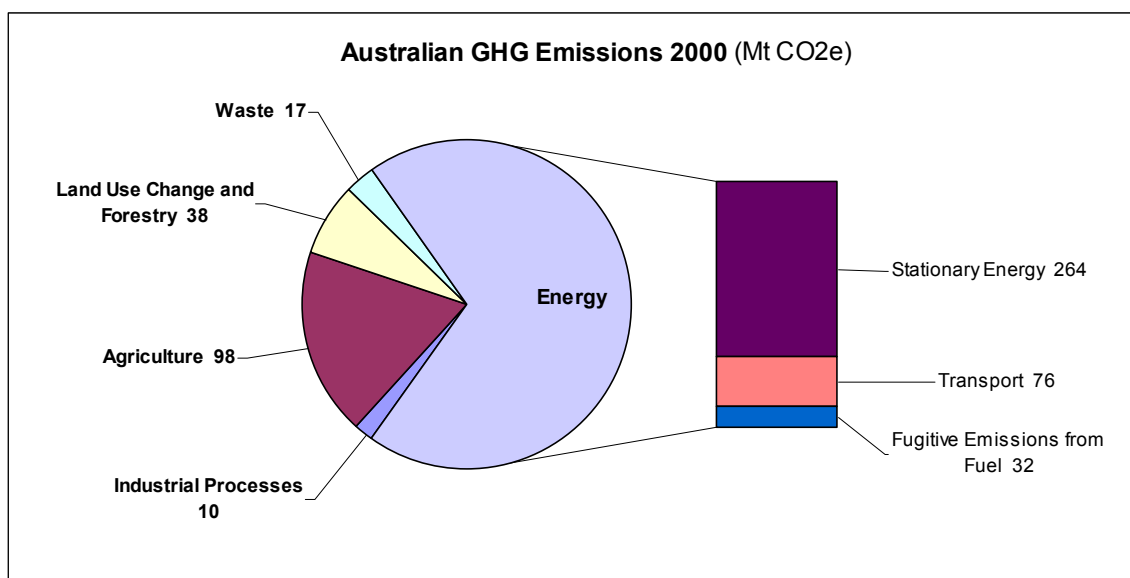
In recognition of the risks and costs of climate change, Australia accepts its fair share of the global task to reduce greenhouse gas emissions below what they would otherwise be in the 'business as usual' (BaU) scenario. The Australian Commonwealth, State and Territory governments adopted a National Greenhouse Strategy to give effect to this objective (NGS 1998).

The United Nations Framework Convention on Climate Change (UNFCCC) was agreed in 1992 and came into force in 1994. It places much of the responsibility for taking action to limit greenhouse gas emissions on the developed countries, including Australia, which are collectively referred to as Annex 1 countries. 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, but has not been ratified by the required number of its signatories to bring it in to force. The Australian Government has announced its reasons for not ratifying the Kyoto protocol though it is committed to meeting the greenhouse reduction target for 2008 – 2012 (Kemp 2003).

Figure 1 shows estimated Australian greenhouse gas emissions by sector for 2000. The estimated total greenhouse gas emissions for 2000 is 535 million tonnes of CO<sub>2</sub>-e (NGGI 2000). Emissions have increased by 2.1% from 1999 to 2000 and by 6.3% from 1990 to 2000 (NGGI 2000). The stationary energy sector represents the greatest contribution to Australia's greenhouse gas emissions, as illustrated in Figure 1.

Figure 1: Australian Greenhouse Gas Emissions by Sector 2000 (Source: NGGI 2000)



ABARE 2003 projects total electricity use to increase by an average of 2.2% p.a. between 2001 and 2020. Energy use in the commercial and services sector is projected to increase by 2.5% p.a. and by 2.2% in the manufacturing sector. Slowing, and ultimately reversing, the growth in electricity-related emissions is thus a high priority in Australia's greenhouse gas reduction strategy.

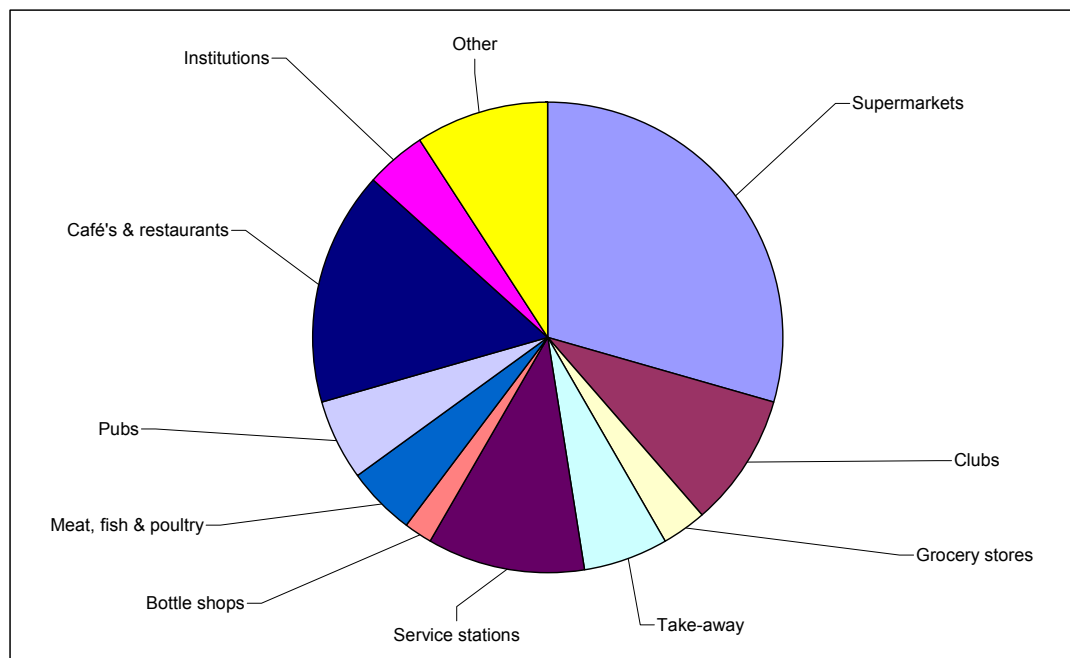
## 1.2 Contribution of Commercial Refrigeration to Emissions

Commercial Refrigeration in Australia currently consumes an estimated 7,000 GWh of electricity per annum and is responsible for the emission of around 6.7 million tonnes CO<sub>2</sub>-e each year (MEA 2000a+b). This represents around 1.3% of Australia's total greenhouse gas emissions, or around 2.5% of the emissions due to stationary energy consumption. In New

Zealand, commercial refrigeration consumes an estimated 780 GWh per annum, resulting in the emission of around 350 ktonnes p.a. (MEA 2003).

Figure 2 illustrates the estimated proportional contribution to greenhouse gas emissions of each of the commercial refrigeration end uses. Note that this excludes refrigerated transport and industrial refrigeration such as that used in food processing, abattoirs and dairies.

Figure 2: Sectoral contribution to greenhouse gas emissions



Source: MEA 2000a+b

Given these estimations, it is reasonable to conclude that commercial refrigeration is worthy of efforts to improve their overall efficiency.

### 1.3 NAEERP Abatement Strategy

Regulation of commercial refrigeration is an element of the National Appliance and Equipment Energy Efficiency Program (NAEEEP). NAEERP is part of the National Greenhouse Strategy, which targets the energy efficiency of consumer appliances as well as industrial and commercial equipment. The primary tools of the Program are mandatory energy efficiency labelling and minimum energy performance standards (MEPS), as well as voluntary measures including endorsement labelling, training and promotion of efficient products.

NAEEEP's governance structure is as follows:

- > The Program is the direct responsibility of the National Appliance and Equipment Energy Efficiency Committee (NAEEEC), which comprises officials from the Commonwealth, State and Territory government agencies, together with representatives from New Zealand, responsible for implementing product energy efficiency initiatives in those jurisdictions.
- > NAEEEC reports through the Working Group for Energy Efficiency and Greenhouse Gas (E2G2) to the Ministerial Council on Energy (MCE), which is made up of the Ministers with portfolio responsibility for implementation of the National Greenhouse Strategy in this field.
- > MCE has charged E2G2 to manage overall policy and budget of the national program.

NAEEEP relies on State and Territory legislation to give it legal effect. This use of state and territory laws involves using the relevant Australian Standard for the specific product type, which is called up as mandatory by State and Territory legislation.

Any type of consumer appliance, industrial or commercial equipment is eligible for inclusion in NAEEEP, provided it is identified as a likely contributor to growth in energy demand or greenhouse gas emissions. The selection criteria include potential for greenhouse or energy savings, environmental impact of the fuel type, opportunity to influence purchase, market barriers, access to testing facilities, and administrative complexity. Commercial refrigeration meets many of these criteria and hence occupies a key position in NAEEEP.

Table 1 lists the appliances and equipment for which NAEEEP is currently implementing MEPS, along with the estimated greenhouse gas abatement and financial benefits for the period 2003-2018. This data is contained in the NAEEEP report "Projected impacts 2000-2020" (NAEEEP 2003). Table 2 provides the same information regarding planned NAEEEP programs, excluding commercial refrigeration.

Table 1: Projected Impacts of current NAEEEP MEPS and Labelling programs

Appliance / Equipment		Date Implemented	Estimated Total Greenhouse Gas Abatement to 2003-2018 (Mt CO <sub>2</sub> e)	Estimated Total Net Benefit to 2018 (\$M NPV at 5%)	Benefit/Cost
P1 Apps	Mandatory Labels for refrigerators, freezers, dishwashers, single phase air conditioners, clothes washers, clothes dryers	1986; revised label 2000	25.0	1,091	2.1
	MEPS for refrigerators, freezers, electric storage water heaters	1999			
P8	MEPS for 3 phase air conditioners	2001	7.7	720	27.1
P10	MEPS for Electric motors	2001	4.2	267	3.1
P12	MEPS for fluorescent lamp ballasts	2003	5.1	394	7.3

Table 2: Projected Impacts of planned NAEEEP MEPS and Labelling programs

Appliance / Equipment		Date Implemented	Estimated Total Greenhouse Gas Abatement to 2003-2018 (Mt CO <sub>2</sub> e)	Estimated Total Net Benefit to 2018 (\$M NPV at 5%)	Benefit/Cost
P2	Revision of MEPS for refrigerators & freezers	2005	7.7	346	2.3
P3	MEPS for single-phase air conditioners	2004	1.2	41	1.7
P4	Revision of MEPS for small electric storage water heaters	2005	4.5	282	5.1
P5	Optional labelling for small electric water storage heaters	2006	1.4	42	1.5
P6	Revision of MEPS for large electric storage water heaters	2005	1.8	55	1.4
P7	MEPS for miscellaneous electric water heaters	2005	1.4	97	3.0
P9	Revision of MEPS for 3-phase and single-phase air conditioners	2007	2.9	218	3.2
P11	Revision of MEPS for Electric Motors	2006	2.6	172	3.4
P13	MEPS for linear fluorescent lamps	2004	11.6	730	3.7
P14	MEPS for electricity distribution transformers	2004	13.8	124	1.4
P16	One Watt standby program for office equipment and home entertainment products	2004	32.0	1685	3.0

## 1.4 Commercial Refrigeration Technology and Energy Efficiency

### 1.4.1 Commercial Refrigeration Technology

Commercial refrigeration equipment is commonplace throughout the retail and hospitality industries. There are many different designs, however commercial refrigerators usually comprise the following components:

- > insulated display cabinet
- > compressor
- > evaporator with fan(s)
- > condenser with fan(s)
- > expansion valve.

Some units are also equipped with lights, anti-sweat heaters, electric defrost systems, solid or glass doors or tops, etc.

There are two major categories of commercial refrigeration cabinets: 'remote' and 'self-contained'. Australian Standard 1731.14—2003 *Refrigerated Display Cabinets Part 14: Minimum Energy Performance Standard Requirements* defines remote refrigerated cabinets as units that have compressors and condensing units located separately from the cabinet. Self-contained refrigerated cabinets are defined as units that have the compressors and condensers built into the cabinet.

Refrigerated cabinets are often also classified as open (without doors) or closed (with glass or solid doors), and by product temperature, ie medium temperature (chilled) or low temperature (frozen).

There is a wide range of cabinet designs available in the Australian and New Zealand marketplace to meet specific applications, and there is no agreed international system for classification. AS1731 includes definitions of all the major types and detailed description of products and their respective MEPS levels.

This RIS covers all products within the scope of AS1731, that is remote and self-contained refrigerated display or storage cabinets and their internal components, as typically manufactured, imported and sold in Australia and New Zealand. Individual components used in remote refrigeration systems or in custom-made cool rooms are not covered, nor are ice making machines, vending machines and cold water dispensers.

### 1.4.2 Energy Efficiency Levels

Energy consumption may be expressed in several different ways. For example as a total annual energy consumption, daily energy consumption, energy consumption per unit length or per unit of display area or volume. AS1731 provides the methodology to calculate the daily energy consumption per square meter of display area, measured in kWh/day/m<sup>2</sup>. The energy consumption includes all components such as lights, anti-sweat heaters, defrost mechanisms, etc. Figure 3 shows the test data for a number of Australian remote cabinets tested in accordance with AS1731.

Figure 3: Test data for Australian remote cabinets

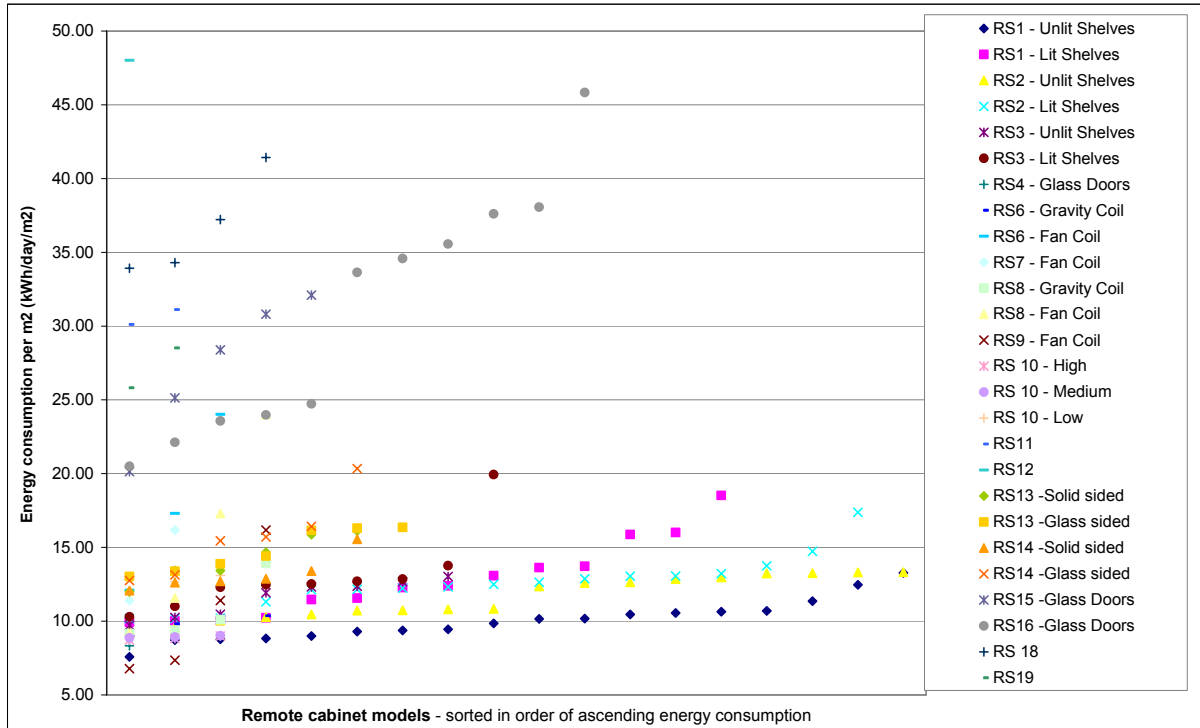
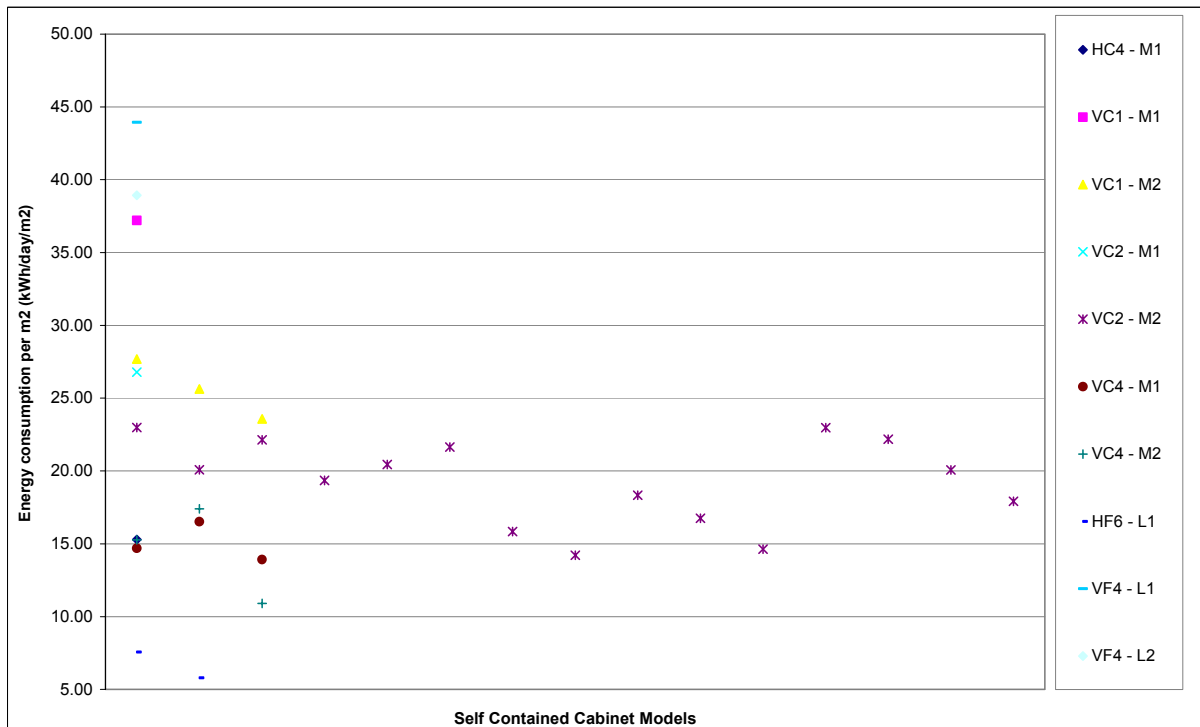


Figure 4 graphs the test data for a number of Australian, and some European, self-contained cabinets available in Australia tested in accordance with AS1731.

Figure 4: Test data for Australian and European self-contained cabinets



From Figure 3 and Figure 4 it can be seen that there is some variation in efficiency levels within each category. Discussions with manufacturers also reveal that there are likely to be a number of budget cabinets that consume more energy than the units illustrated in Figure 3 and Figure 4.

### 1.4.3 Commercial Refrigeration Testing and Other Requirements

The Australian Standard 1731 series covers general mechanical and physical requirements, test conditions, installation and maintenance, including a user's guide, for refrigerated display cabinets for the sale and/or display of food products. The Standard does not cover refrigerated vending machines, cabinets intended for use in catering and similar non-retail applications. The various elements of the standard are as follows:

- 1) Part 1 - Terms and definitions
- 2) Part 2 - General mechanical and physical requirements
- 3) Part 3 - Linear dimensions, areas and volumes
- 4) Part 4 - General test conditions
- 5) Part 5 - Temperature test
- 6) Part 6 - Classification according to temperatures
- 7) Part 7 - Defrosting test
- 8) Part 8 - Water vapour condensation test
- 9) Part 9 - Electrical energy consumption test
- 10) Part 10 - Test for absence of odour and taste
- 11) Part 11 - Installation, maintenance and user guide
- 12) Part 12 - Measurement of the heat extraction rate of the cabinets when the condensing unit is remote from the cabinet
- 13) Part 13 - Test report
- 14) Part 14 - Minimum energy performance standard (MEPS) requirements

Part 14 of the standard specifies the requirements for remote and self-contained cabinets that fall within the Scope of AS1731. It should be read in conjunction with the full AS1731 series. The objective of part 14 is to provide detailed information on:

- (a) The performance requirements for a refrigerated display cabinet to meet minimum energy performance standard requirements.
- (b) The performance requirements for a refrigerated display cabinet to be designated as 'high efficiency'.
- (c) The reporting format for refrigerated display cabinet applications for registration or notification.
- (d) The mandatory labelling requirements for self contained display cabinets designed to operate in climate Classes 4 to 7 inclusive.

## 1.5 The Commercial Refrigeration Market

### 1.5.1 Product Supply

A large proportion of remote refrigeration cabinets are currently manufactured in Australia or New Zealand by the following manufacturers:

- o Austral
- o Frigrite
- o McAlpine Hussmann
- o Williams

Importers and overseas manufacturers

- o Barkers (Bonnet Neve)
- o Arneg
- o Linde

The majority of self-contained cabinets are manufactured and imported by the following companies:

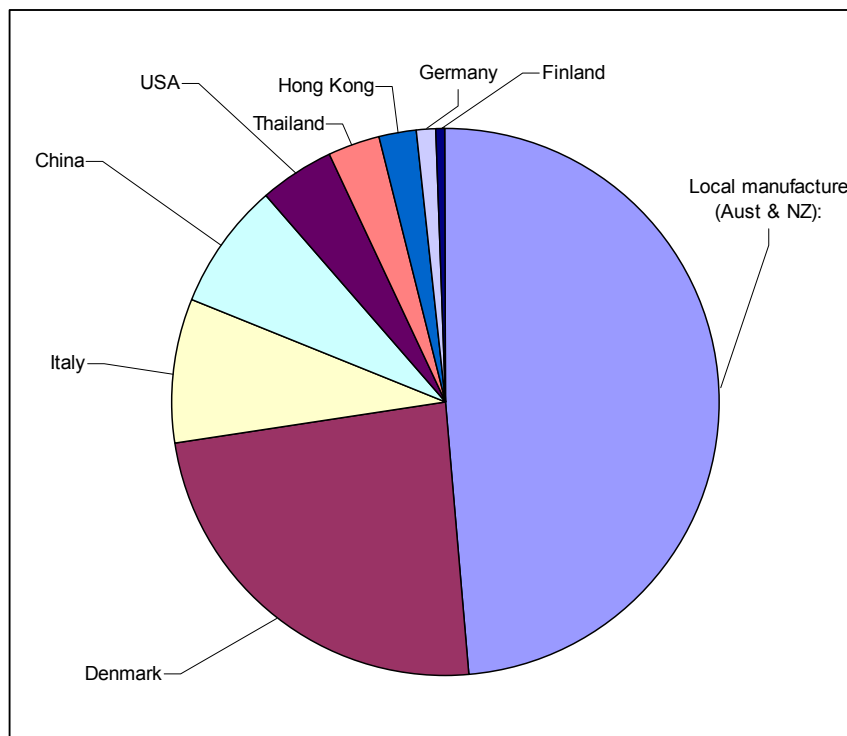
- > Manufacturers:
  - o Skope (New Zealand)
  - o Orford
  - o Williams
  - o Austral

- Frigrite
- McAlpine Hussmann
- > Importers:
  - Kingloc (Italy)
  - Arcus (WA)
  - Bakers (WA).

Figure 5 illustrates approximate proportions of imported and locally manufactured commercial refrigeration for Australia and New Zealand combined. Note that, for the purposes of this RIS, cross-Tasman trade in cabinets is included as 'local manufacture'. Note also that cross-Tasman trade is significant, estimated at around 3,500 cabinets per annum, which is one reason to support the view that Australia and New Zealand should adopt identical MEPS levels.

Data for Figure 5 was sourced from MEA 2000a+b and MEA 2003, which is in turn based on 1999 data from the Australian Bureau of Statistics (ABS) and from a survey of New Zealand refrigerated cabinet manufacturers. The estimates in Figure 5 should be treated as approximate only, due to the difficulty in identifying intended equipment use within ABS product categories (i.e. commercial, domestic, industrial) and the age of some data (1999).

Figure 5: Estimated imports and local manufacture of commercial refrigeration cabinets for Australia & New Zealand



The stock and sales of remote and self-contained cabinets are discussed in detail in section 3.1.

### 1.5.2 Equipment Selection

#### Cost-Benefit Analysis of Efficient Equipment

Within the commercial refrigeration market there are two types of end user:

- > The end user who does not own the equipment as it is provided by the supplier of merchandise, for example cabinets which are provided by soft drink or ice cream companies.
- > The end user who owns the equipment, for example supermarket food displays.

The first group is not concerned with the capital cost of equipment but will benefit from efficiency gains because they pay the recurrent cost of energy consumed by the cabinet. In this case however the cabinet provider (e.g. soft drink or ice cream company) will bear any additional capital cost for increased efficiency, with little financial return.

One major cabinet provider has suggested that they experience fewer complaints when they supply high performance cabinets, which may indicate a perceived value. There is also some evidence to suggest that some of the larger beverage companies are demanding improved efficiencies to enhance their corporate image. However, any direct financial incentive resulting from these factors is considered less than the additional cost to the cabinet provider of supplying high performance cabinets.

In relation to the second group, in the perfect market this group would compare the additional cost of more efficient equipment to the lifetime benefit of reduced energy costs and make economically rational decisions based on these data. Evidence from industry suggests that this is not occurring and that purchase decisions are often based purely on capital cost. This phenomenon is discussed in detail below.

Furthermore, it is not possible to generalise that improved efficiency will result in increased capital cost. Some efficiency gains can be incorporated for negligible cost (discussed in section 5.1.1). However, assuming that improved efficiency does cost more, an analysis of the costs and benefits of improvements to the efficiency of commercial refrigeration amongst three typical end-users has been undertaken. The aim of this is to examine whether these benefits and costs are distributed equitably.

The three examples analysed are as follows:

- > Table 3: a small end-user such as a small corner store or similar retail outlet, which sells refrigerated soft drinks, ice cream and some frozen convenience foodstuff. In this case, four of the cabinets are not owned by the operator, and therefore any additional capital cost to improve efficiency is absorbed by the beverage and ice cream distributor.
- > Table 4: a medium-sized end-user such as a service station, small independent supermarket or large delicatessen. In this instance half of the glass door merchandisers are assumed to be owned by the operator and half by the beverage distributor. The ice cream cabinets are owned by the distributor.
- > Table 5: a large supermarket. All cabinets are assumed to be owned by the operator.

In each table, the ratio of benefits to costs is determined for a range of discount rates, from 5% to 10% over the lifetime of the cabinet which is assumed to be 8 years. Average energy use for each type of cabinet is taken from previous reports (MEA 2000a, MEA2000b). Based on data collected for this report, cost-benefit calculations for MEPS assume an additional capital cost of approximately 7.5% of the retail price of the cabinet which achieves an 11% energy saving. Further assumptions used in this analysis are shown in Table 6.

Table 3: Costs and benefits of refrigerator efficiency improvements for small users

Corner Store	Glass Door Merchandisers	Ice Cream cabinet	Chest Freezer	Multideck Refrigerator	Total
	2	2	1	0	5
Annual energy consumption (kWh/y)	9,000	4,000	5,200	0	18,200
Annual electricity cost (\$)	\$1,338	\$595	\$773	\$0	\$2,706
Additional capital costs	\$0	\$0	\$325	\$0	\$325
New annual energy consumption (kWh/y)	8,010	3,560	4,628	0	16,198
New annual electricity cost (\$)	\$1,191	\$529	\$688	\$0	\$2,408
Total annual electricity costs saved (\$)			\$298		
Simple payback period (yrs)	1.1				
	5% discount rate		7% discount rate		10% discount rate
NPV lifetime cost savings (\$)	\$2,221		\$2,075		\$1,886
Benefit/Cost	6.8		6.4		5.8

Note that even if the owner in Table 3 was to pay the full capital costs, the ratio of benefits to costs would still exceed one (1.4-1.7).

Table 4: Costs and benefits of refrigerator efficiency improvements for medium-sized users

Service Station	Glass Door Merchandisers	Ice Cream cabinet	Chest Freezer	Multideck Refrigerator	Total
	8	4	2	3	14
Annual energy consumption (kWh/y)	36,000	8,000	10,400	57,000	111,400
Annual electricity Cost (\$)	\$4,866	\$1,081	\$1,406	\$7,704	\$15,057
Additional capital costs	\$1,200	\$0	\$650	\$1,350	\$3,200
New annual energy consumption (kWh/y)	32,040	7,120	9,256	50,730	99,146
New annual electricity cost (\$)	\$4,330	\$962	\$1,251	\$6,857	\$13,400
Total annual electricity costs saved (\$)	\$1,656				
Simple payback period (yrs)	1.9				
	5% discount rate		7% discount rate		10% discount rate
NPV lifetime cost savings (\$)	\$12,361		\$11,546		\$10,492
Benefit/Cost	3.9		3.6		3.3

Table 5: Costs and benefits of refrigerator efficiency improvements for large users

Supermarket	Glass Door Merchandisers	Ice Cream cabinet	Chest Freezer	Multideck Refrigerator	Total
	8	4	15	30	27
Annual energy consumption (kWh/y)	36,000	8,000	78,000	570,000	692,000
Annual electricity Cost (\$)	\$4,136	\$919	\$8,961	\$65,484	\$79,500
Additional capital costs	\$2,400	\$800	\$4,875	\$13,500	\$21,575
New annual energy consumption (kWh/y)	32,040	7,120	69,420	507,300	615,880
New annual electricity cost (\$)	\$3,681	\$818	\$7,975	\$58,281	\$70,755
Total annual electricity costs saved (\$)	\$8,745				
Simple payback period (yrs)	2.5				
	5% discount rate		7% discount rate		10% discount rate
NPV lifetime cost savings (\$)	\$65,266		\$60,964		\$55,399
Benefit/Cost	3.0		2.8		2.6

Table 6: Modelling assumption for cost/benefit analysis

	Cabinet Type			
	Glass Door Merchandisers	Ice Cream cabinet	Chest Freezer	Multideck
Annual Energy Consumption – Unimproved (kWh/y)	4500	2000	5200	19000
Average additional capital cost to make increase efficiency (\$)	\$300	\$200	\$325	\$450
Cabinet lifetime	8 years			

	Small User	Medium User	Large User
Tariff (c/kWh)	14.87	13.52	11.49

This analysis demonstrates that although the distribution of costs and benefits is not equal amongst these examples, all end-users experience a net benefit.

## Market Failure

There are various reasons why market forces may not lead to socially efficient outcomes. For example, purchasers may not have enough information, or the right type of information, about the range of goods and services on offer to them (for example, on whole-of-life costs).

In relation to commercial refrigeration, as demonstrated above there are considerable savings in running costs which can be made through the selection of more efficient cabinets. In most cases, these savings are sufficient to payback any increased capital costs within a reasonable time. Therefore, selecting more efficient refrigerated cabinets would appear to be an economically rational action in many circumstances. However, in the commercial refrigeration market, there are a range of purchasers and operators which display different behaviour, and this is discussed below.

Industry sources suggest that supermarkets are increasingly purchasing on the basis of low capital costs, despite the fact that there are products available which would pay for any additional cost within a relatively short time frame (2-4 years). These supermarkets usually have access to good technical advice but due to the low relative importance of electricity costs upon their overall operations, they focus resources on other, more critical concerns.

There is clearly the potential for market failure in the situation where dedicated cabinets are provided by one party, but operated by another, such as within the soft drink and ice cream markets. Since end-users pay for the electricity consumed, there is little or no cost incentive for the purchasers to source more energy efficient units. Most end-users have little market power and little awareness or information of the savings potential available.

However, discussions with major soft-drink manufacturers suggest that they are playing a significant role in improving the performance of cabinets, even though there is no direct financial incentive for them to do so. This may not maximise benefits or apply to all situations.

The remainder of the market comprises a wide range of small or medium-sized operators who own and use refrigerated cabinets. These typically have little understanding of the technology and the possibility of selecting more efficient products in order to realise cost savings.

Overall, it would appear that a lack of information on whole-of-life costs has some impact on the energy consumed by commercial refrigeration cabinets. However another form of market failure – where market transactions impose costs or confer benefits on third parties – also contributes to the scale of the problem.

In Australia, as in many other countries, electricity prices do not always reflect the costs of pollution created when energy is produced and/or used. If electricity prices reflected these costs, then purchasers of commercial refrigeration cabinets may place a greater emphasis on energy consumption in their purchasing decisions

## 2 OBJECTIVES OF THE REGULATION

COAG Guidelines:

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

### 2.1 Objective

The primary objective of the proposed regulation is to bring about a reduction in greenhouse gas emissions from the use of commercial refrigerators below the level that they are otherwise projected to be in the business as usual case.

### 2.2 Assessment Criteria

The primary assessment criterion is the extent to which an option meets the primary objective. In addition, the following secondary assessment criteria have been adopted:

1. Does the option address market failures, so that the average lifetime costs of commercial refrigeration are reduced, when both capital and energy costs are taken into account?
2. Does the option address information failures, so that buyers have ready access to product descriptions that are consistent and accurate with regard to energy efficiency?
3. Does the option minimise the risk of negative impacts on product quality and function?
4. Does the option minimise the risk of negative impacts on manufacturers and suppliers?
5. In light of any potential restriction in competition, do the benefits outweigh the likely costs?
6. Is the restriction in competition no more restrictive than necessary in the public interest?

It should be noted that to the extent an option is shown to restrict competition, this option must satisfy criteria 5 and 6.

### 3 PROPOSED REGULATION AND ALTERNATIVES

COAG Guidelines:

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

The following options for achieving the regulatory objectives were considered for the purposes of this commercial refrigeration regulatory impact statement:

1. Status quo (termed business as usual, or BaU).
2. Voluntary MEPS.
3. Levies on electricity or equipment together with financial assistance for abatement activities.
4. Equipment certification program.
5. Mandatory product labelling.
6. The proposed regulation (mandatory MEPS).

The following sections describe the options in more detail, and assess the non-MEPS options. The mandatory MEPS option has been subject to detailed cost-benefit analysis, which is reported in section 5.

#### 3.1 Status Quo (BaU)

From MEA 2000a and estimates from industry sources, the Australian and New Zealand stock of refrigerated cabinets that will be subject to MEPS is around 400,000 units. From data included in MEA 2000a the weighted average lifetime of a cabinet is estimated to be 8 years.

Most industry sources confirm that sales have grown substantially over the past 5-10 years and consider it likely this trend will continue. In addition, there is considerable agreement on the factors that are currently causing increases in sales. The relative impact of these factors varies for each product type, and in some cases there are geographical or other issues which play a role. In general, the drivers for increased sales include:

- > Growth in the overall volume of refrigerated food sales.
- > An increase in the choice of refrigerated foods (product lines) available on the market. A specific example is the advent of the flavoured milk market.

- > An increase in the number of producers of refrigerated foods.
- > An increased focus on health issues in food retail, including an increase in policing of existing regulations regarding the temperature for storage and display of foodstuffs.

Further issues which may have a future impact on refrigeration consumption include developments by foodstuff product manufacturers to:

- > Expand the number of frozen products generally available.
- > Supply chilled bottled drinks in supermarkets.

Industry sources suggest that these factors will continue to drive increases in sales for some commercial refrigeration products by at least 10% per annum, while others are approaching saturation. In New Zealand, there is evidence of an increase in refurbishment of larger units used in supermarkets and very little growth in this sector. As a result we have used a range of scenarios to reflect industry views.

The full set of inputs used to model the BaU case for cabinets that will be subject to MEPS are listed in Table 7. This BaU scenario is referred to as the 'B1 Middle' scenario.

Table 7 – Variables for B1 middle BaU scenario

Quantity	Value	Source
Initial stock (Australia + New Zealand)	400,000	MEA 2000a+b & discussions with industry
Product lifetime	8 years	MEA 2000a+b
Stock growth rate 2001-2009	8%	MEA 2000a+b
Stock growth rate 2010-2020	5%	MEA 2000a+b
Marginal electricity tariff	\$135 / MWh	Discussed in section 5.1.3
Weighted average purchase price	\$5,000	Estimations from industry
Weighted average energy consumption	24.32 kWh / day	From test data

In order to account for the full range of variables over forthcoming years, a range of BaU scenarios were modelled. These scenarios are described as follows:

- > B1 – middle scenario, based on average test data, the most popular views from industry and reasonable assumptions (Table 7).
- > B2 – low scenario, likely to result in low level of benefits when MEPS are applied.
- > B3 – high scenario, likely to result in high level of benefits when MEPS are applied.

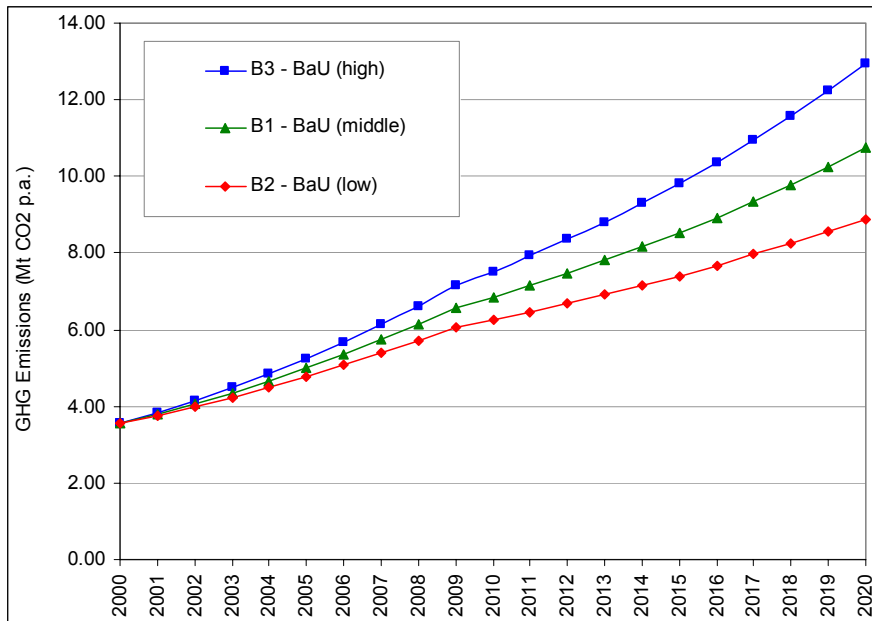
The variables used for all BaU scenarios are listed in Table 8.

Table 8 – Variables for BaU scenarios

Quantity	B1 (Middle)	B2 (Low)	B3 (High)
Initial stock (Australia + New Zealand)	400,000		
Lifetime	8 years		
Stock growth rate 2001-2009	8%	7%	9%
Stock growth rate 2010-2020	5%	4%	6%
Margin electricity tariff	\$135 / MWh	\$122 / MWh (90% of B1)	\$149 / MWh (110% of B1)
Weighted average purchase price	\$5,000		
Weighted average energy consumption	24.32 kWh / day		

Figure 6 illustrates the greenhouse gas emissions (p.a.) of the three BaU scenarios.

Figure 6 - GHG Emissions from BaU Scenarios



The above projections for refrigerated cabinets form the baseline for quantitative analysis of the impacts of the various options. The status quo option would, by definition, fail to meet the primary objective of the regulation. That is, there would be no reduction in Australia's greenhouse gas emissions below the BAU case.

In addition, there would be no correction of the identified market failures or information failures that currently lead to the lifetime costs of commercial refrigeration not being optimised. On the other hand, there would be no negative impact on product quality or function, no negative impacts on manufacturers and suppliers, and no restrictions placed on market participants.

### 3.2 Voluntary MEPS

Success of this option relies on equipment suppliers being effectively encouraged to meet certain minimum energy efficiency levels voluntarily, i.e. in the absence of regulation. This would require suppliers to decrease their model ranges to eliminate less efficient models, or to upgrade these models to meet MEPS. As there are few commercial incentives for doing so, it is unlikely that suppliers would willingly make these changes without significant government incentives. Indeed, several manufacturers who have tried to introduce high efficiency products in the past have reported that they have subsequently withdrawn these products from the market, due to competition from low-cost and less efficient products marketed by other manufacturers or importers.

### 3.3 Levies & Financial Assistance

#### Equipment Levy

Another option involves a levy imposed upon inefficient appliances to fund programs which would redress the greenhouse impact of equipment energy use. Two variations of this option are worthy of consideration:

- a) The proceeds from the levy are diverted to greenhouse-reduction strategies unrelated to commercial refrigeration efficiency.
- b) The proceeds are used to subsidise the costs of more efficient refrigerators so that any cost differentials between these and inefficient models are narrowed or eliminated.

## **Electricity/Carbon Levy**

At present, the electricity prices faced by consumers reflect – however imperfectly - the cost of the capital invested in the electricity generation and transmission systems, operating and maintenance costs, fuel and taxes. They may also reflect the costs of controlling pollutants such as oxides of nitrogen and sulphur (NO<sub>x</sub> and SO<sub>x</sub>), for which emissions standards are currently in force in some areas. They do not reflect the value of greenhouse gas emissions, or rather they implicitly assign a value of zero to such emissions. In other words, greenhouse costs are not internalised in the electricity price.

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

This would be a broad based economy-wide measure affecting all consumers of electricity, not just those that sell, buy and operate commercial refrigeration units.

## **Financial Assistance**

Financial assistance can be used in an attempt to increase the uptake of efficient refrigeration equipment. Two such methods are tax breaks and direct subsidies. Tax breaks, such as the UK Government's 'Enhanced Capital Allowance Scheme' (discussed in Appendix A: Overseas Programs) allow end-users who invest in eligible efficient technologies to claim an increased portion of expenditure against tax. Direct subsidies, such as the Dutch Government's STIMECK scheme (discussed in Appendix A: Overseas Programs) provide capital cost subsidies for equipment which achieves a minimum performance rating

## **Conclusions**

None of the proposed financial options are currently government policy, hence they would require extensive consultation at the highest levels of government to address an issue (commercial refrigeration) for which there is already a highly specific and effective mechanism for intervention. The concept of incorporating a cost for greenhouse emissions into electricity would have far reaching implications across the entire Australian economy that would go far beyond the issue under consideration and may not actually address the market failure associated with commercial refrigeration. The financial assistance options would incur considerable government expense (or loss of tax revenue) due to the currently significant levels of sales of efficient cabinets. Additionally, the efficacy and sustainability of financial assistance programs in the commercial sector is difficult to demonstrate.

Hence these options are not worthy of consideration until such time as government policy and demonstrable results change to favour financial schemes in the commercial sector.

## **3.4 Certification Program**

In Europe, EUROVENT operate a third party certification scheme for commercial refrigeration products, with the test results publicly available to enable product comparison). Manufacturers voluntarily supply products for certification in order to gain a listing on the website (see Appendix A). A similar program could be implemented in Australia.

The EUROVENT program has been in existence for several years (at least since 1999), and there has been some growth in the products listed. However, there has been no analysis made available of the impact of this program in terms of sales of higher performance products.

As with other voluntary information-type programs, there is a tendency for only the better performing products to participate in an attempt to gain a marketing advantage over

cheaper, and poorer performing, products. This type of program can work in a buoyant market where consumers are looking for efficient products. However in a cost sensitive market and with the additional costs of participation borne by only a part of the market, voluntary information programs usually struggle to have an impact.

As a result, we conclude that the impact of this option in Australia and New Zealand would be negligible in comparison to the BaU cases.

### **3.5 Mandatory Labelling**

A mandatory labelling scheme would involve improving information flow to the end user, relating to the efficiency of commercial refrigeration units. Similar to the appliance star rating scheme, an energy label would simplify information by way of an easily recognised and well understood symbol. Initially, labelling should be supported by informational programs to educate consumers of the meaning of the labels, and their impact on running costs, etc.

Unlike the voluntary information program described above, the costs of this option would be shared amongst all manufacturers.

However, a labelling scheme would be subject to the following:

- > Commercial refrigeration cabinets are typically not purchased from a showroom like consumer products such as domestic fridges or dishwashers. Therefore this option would need to be coupled with some means of information dissemination in order to publicise the choice of products available. A public access website may be one method to accomplish this. However, as discussed above, in a cost sensitive market there is little evidence to suggest that information provision alone will lead to increased uptake of efficient products.
- > Large end-users (for example supermarket chains and soft drink manufacturers) are currently very knowledgeable with regard to the performance of their refrigerated cabinets. Indeed many have their own technical departments. Hence a labelling scheme is unlikely to improve their knowledge base and overcome barriers to investment in energy efficiency.
- > End-users, who do not own equipment which is provided by soft drink or ice cream companies, are unable to influence equipment choice, and therefore would not benefit from increased information.

It should be noted that supermarkets, and end-users who do not own equipment are amongst the largest clients groups for commercial refrigeration. It is estimated that between 40%-50% of sales by volume of commercial refrigerated cabinets are targeted towards these sectors (MEA2000a & MEA2000b). As a result mandatory labelling would at best have an impact on 60% of the market, and then only if the information provided by the label was acted upon. While the imposition of a mandatory labelling option would mean that all products were labelled, it would not ensure that all consumers noticed and then acted upon this information.

Labelling programs such as the comparative energy label which has been in operation for domestic appliances in Australia for more than 10 years has now achieved good consumer recognition. While consumer research shows that 80%-90% of consumers recall the label, 40%-50% say that they intend to use this information when making a purchase. While this result is excellent in comparison with other labeling programs, it should be noted that this is the result of sustained promotion over a decade. Clearly, a new label for commercial refrigeration products would take a considerable period before it could begin to have this degree of impact.

Assuming that 60% of the market would benefit from better information, and that 50% of these over time might act on this information, at most the program would influence 30% of the market. Initially the uptake would be expected to be far lower.

### 3.6 Mandatory MEPS

Australian Government agencies propose to introduce mandatory MEPS for commercial refrigeration in October 2004. This forms part of the Governments's strategy for reducing greenhouse gas emissions and follows the successful implementation of regulatory efficiency standards for other products (see Table 1). Experience has shown the substantial benefits that minimum energy performance standards bring by eliminating the worst performing products from the market. NAEEEP estimates the cost effectiveness of its activities is minus \$28/tonne CO<sub>2</sub> (in other words a gain of \$28 per tonne CO<sub>2</sub>) (NAEEEP 2003). Analysis of the commercial refrigeration market and discussions with Australian industry suggest that voluntary mechanisms will not provide the necessary conditions for investment in energy efficiency. By applying to all products sold in Australia, MEPS maintains a level playing field for all product suppliers, and provides the necessary security for the development of more efficient refrigerated cabinets.

The MEPS levels are based on the levels set out in Australian Standard 1731.14—2003 *Refrigerated Display Cabinets Part 14: Minimum Energy Performance Standard requirements*. MEPs levels from 1731.14 are listed in Table 9 and Table 10.

Table 9: MEPS levels for remote refrigeration

Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )	Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )
RS1 - Lit	17.76	RS10 - High	no value
RS1 - Unlit	12.55	RS10 - Medium	no value
RS2 - Lit	16.98	RS10 - Low	18.67
RS2 - Unlit	12.73	RS 11	38.13
RS3 - Lit	18.39	RS 12	66.33
RS3 - Unlit	14.84	RS13 - Solid sided	19.48
RS4 - Solid door	no value	RS13 - Glass sided	19.58
RS4 - Glass door	9.73	RS14 - Solid sided	15.49
RS5 - Solid door	no value	RS14 - Glass sided	37.08
RS5 - Glass door	no value	RS15 - Solid door	no value
RS6 - Gravity coil	14.21	RS15 - Glass door	37.08
RS6 - Fan coil	14.16	RS16 - Solid door	no value
RS7 - Gravity coil	no value	RS16 - Glass door	40.56
RS7 - Fan coil	14.79	RS17 - Solid door	no value
RS8 - Gravity coil	12.25	RS17 - Glass door	no value
RS8 - Fan coil	13.19	RS 18	48.58
RS9 - Gravity coil	no value	RS 19	36.15
RS9 - Fan coil	12.09	RS 20	no value

Table 10: MEPS levels for self-contained refrigeration

Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )	Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )	Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )
HC1 - M1	11.5	VC3 - M2	no value	HF5 - L2	no value
HC1 - M2	11.5	VC4 - M1	17	HF6 - L1	8
HC2 - M1	no value	VC4 - M2	17.5	HF6 - L2	8
HC2 - M2	no value	YC1 - M1	no value	VF1 - L1	no value
HC3 - M1	no value	YC1 - M2	no value	VF1 - L2	no value
HC3 - M2	no value	YC2 - M1	no value	VF2 - L1	no value

Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )
HC4 - M1	15.5
HC4 - M2	15.5
HC5 - M1	no value
HC5 - M2	no value
HC6 - M1	no value
HC6 - M2	no value
VC1 - M1	37.5
VC1 - M2	28
VC2 - M1	27
VC2 - M2	25.5
VC3 - M1	no value

Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )
YC2 - M2	no value
YC3 - M1	no value
YC3 - M2	no value
YC4 - M1	no value
YC4 - M2	no value
HF1 - L1	no value
HF1 - L2	no value
HF3 - L1	no value
HF3 - L2	no value
HF4 - L1	26.5
HF4 - L2	26.5
HF5 - L1	no value

Type	MEPS TEC/TDA ( kWh / day / m <sup>2</sup> )
VF2 - L2	no value
VF4 - L1	44
VF4 - L2	39
YF1 - L1	no value
YF1 - L2	no value
YF2 - L1	no value
YF2 - L2	no value
YF3 - L1	no value
YF3 - L2	no value
YF4 - L1	no value
YF4 - L2	no value

Note: TEC = total energy consumption of a refrigerator in kWh/day  
TDA = total display of a refrigerator in m2

Figure 7 and Figure 8 show the proposed Australian MEPS levels and performance data for remote units tested. Machines with their data point above the MEPS line do not meet the proposed MEPS level.

Figure 7: Test data and MEPS levels for remote refrigeration categories RS1 – RS3 lit

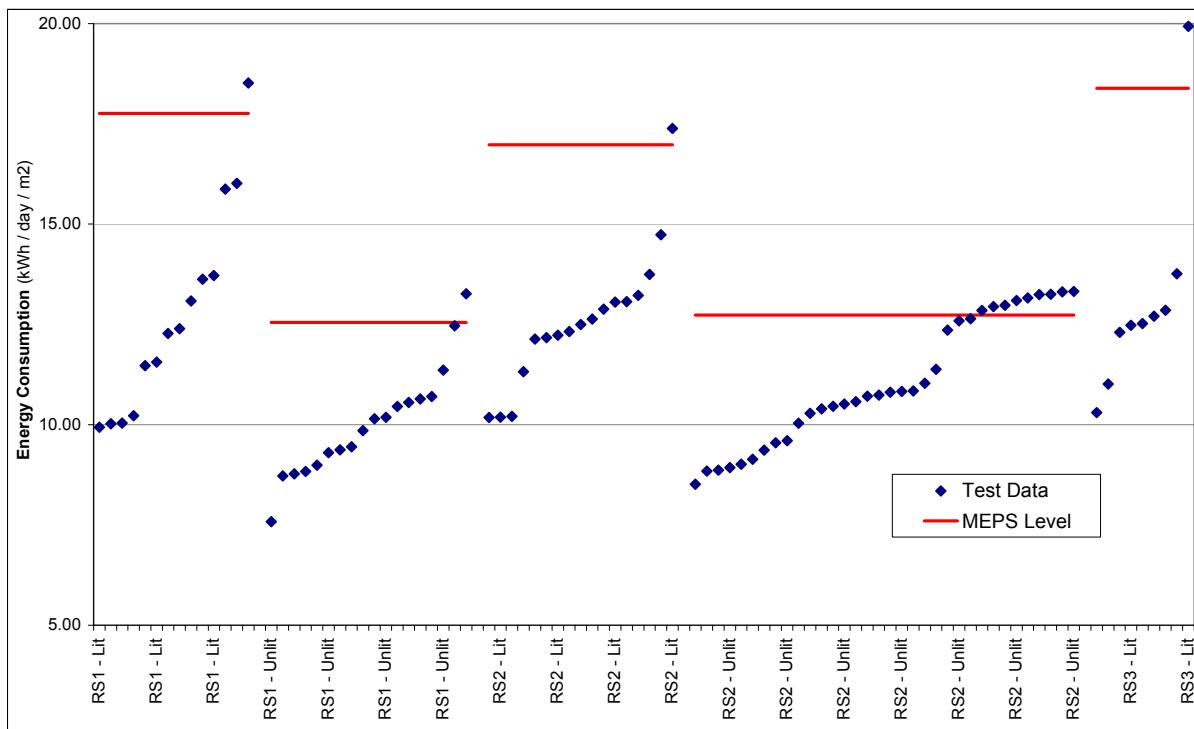


Figure 8: Test data and MEPS levels for remote refrigeration categories RS3 unlit – RS19

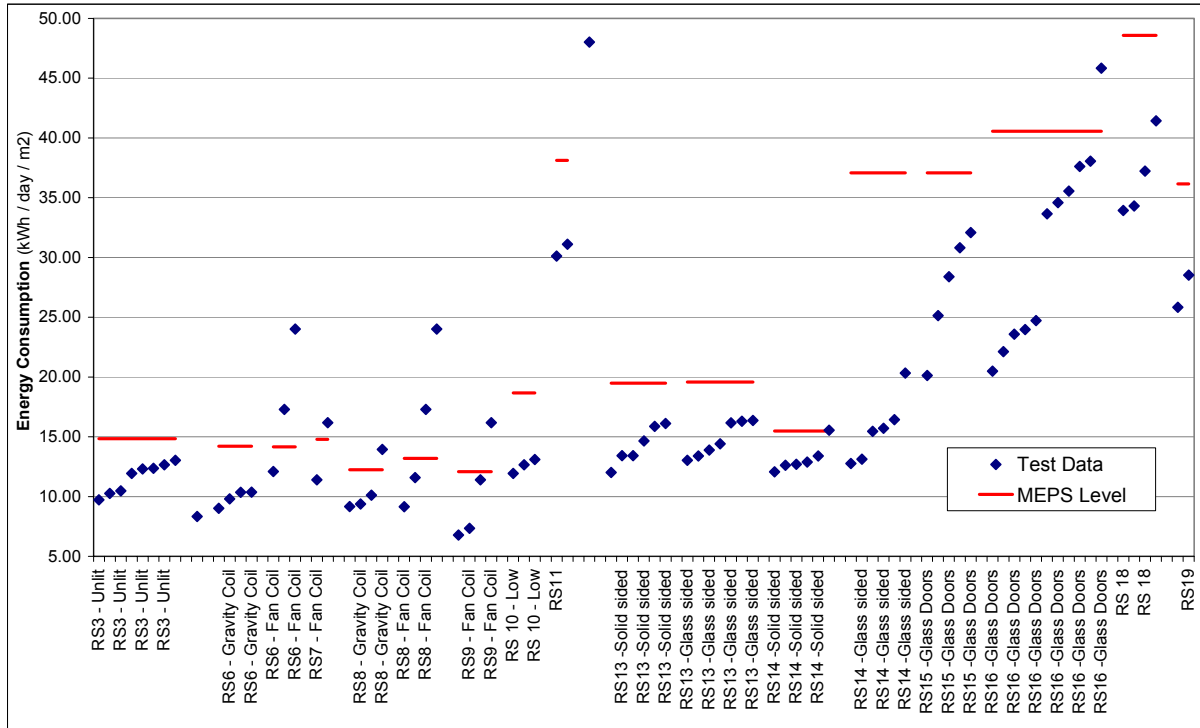
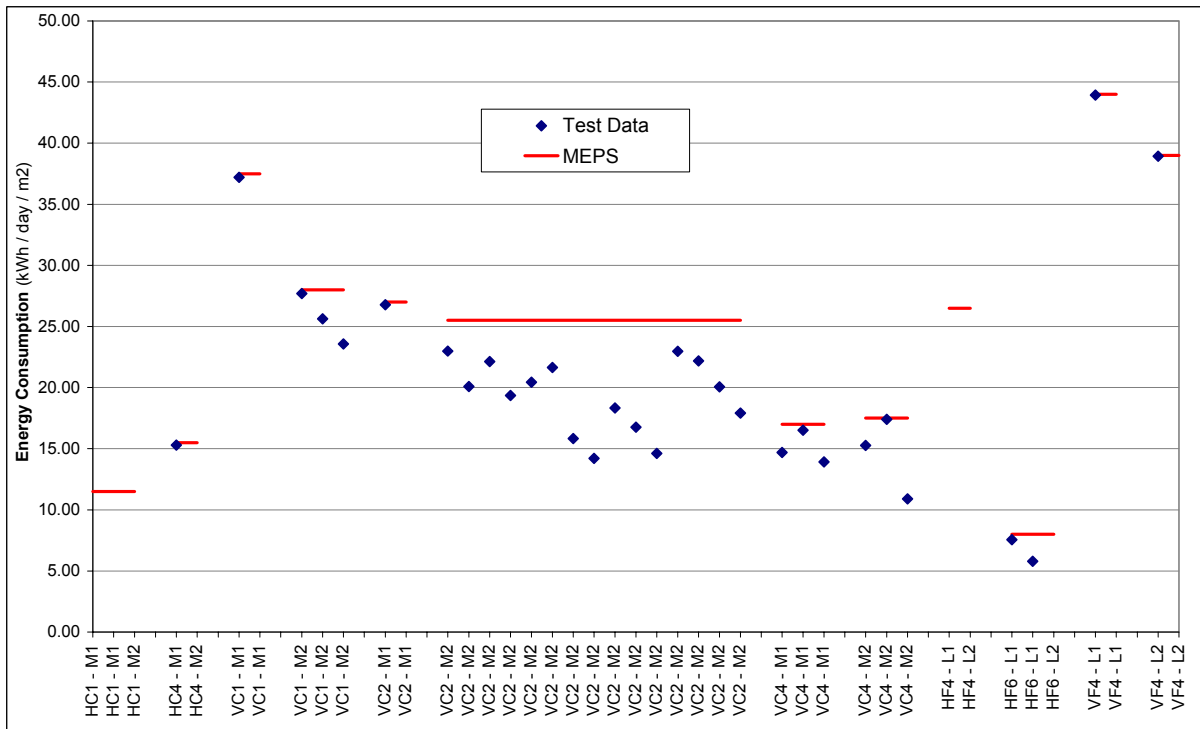


Figure 9 show the proposed Australian MEPS levels and performance data for self-contained machines tested. Again, machines with their data point above the MEPS line do not meet the proposed MEPS level.

Figure 9: Test data and MEPS levels for self-contained refrigeration (all categories)



The data for units available in Australia is sourced from tests undertaken during the process of establishing MEPS levels. It should be noted that this does not cover the full range of products available as priority was given to assessing the performance of cabinets with high volume

sales, and those which are likely to be close to the MEPS threshold. This is why in Figure 9 all the self-contained machines tested meet the proposed MEPS levels. However, as discussed in detail in section 5.1.1, there are a substantial number of cabinets that will be influenced by the proposed MEPS.

## 4 PROGRAMS TO PROMOTE EFFICIENT COMMERCIAL REFRIGERATION IN OTHER COUNTRIES

### 4.1 Program Summary

Several major economies have implemented mandatory or voluntary programs designed to improve the efficiency of, and reduce greenhouse emissions from, commercial refrigeration. Table 11 provides a summary of regulatory standards (MEPS) or voluntary benchmarks and labelling programs by country. These are more fully described in Appendix A: Overseas Programs.

Table 11 - Summary of energy efficiency programs for commercial refrigeration

Country	Name	Program Type	Scope	Date Implemented
Canada	C657-95	Mandatory MEPS	Refrigerated Display Cabinets and Merchandisers	2000 Currently being updated
	C827-98	Mandatory MEPS	Food Service Refrigerators and Freezers	2000 Currently being updated
Japan	JRA 4032-1993	No further information available		1993
Europe	EUROVENT	Information	Self-contained and Remote	Approx 1999
	STIMECK	Information and Financial Assistance	Remote	1998
South Africa	SANS 1406:1999	Mandatory MEPS	Food display cabinets	1999
United Kingdom	EPIC	Information	Self-contained and Remote	2003
	Enhanced Capital Allowance Program	Financial Assistance	Prescribed equipment	Pre-Sept 2003, Post-Sept 2003
United States	EPA Energy Star	Endorsement Label	Solid door	2001
	Californian State	Mandatory MEPS	Solid and glass door	March 2003, August 2004

### 4.2 Program Selection

The type of program used by each country tends to vary according to local preferences and political support, and reflect what type of program infrastructure is already in place. These pre-existing conventions determine the practicalities of program implementation and consequently strongly influence decisions on the type of intervention a government selects. As a result there is often little detailed analysis undertaken of the alternative options and their effectiveness. Although it is now common for countries to require more detailed assessments of the costs and benefits of new legislation, this requirement may not have existed at the time when these measures were implemented. The requirements for voluntary measures are generally less rigorous. The particular issues with respect to program selection for each country are discussed below.

#### Canada

Canada's two regulatory standards are currently in the process of being updated and not currently enforced nationally and therefore have not been subjected to cost benefit analysis. It is understood that they have been enacted in Ontario however regulators have no record of any assessment made as part of the implementation process. There is also no known information on the impact in Ontario of these standards.

Canada has a track record of regulating for efficiency, under the Energy Efficiency Act (1992). Since the Energy Efficiency Regulations came into effect in February 1995 a wide range of products have been included and it is understood that there is an intention to enforce the Commercial Refrigeration standards nationwide.

### **Japan**

The Japanese use a wide variety of mechanisms to promote efficiency, including voluntary and regulatory mechanisms. Due to a scarcity of materials on these programs available in English, it has not been possible to examine this standard or the processes involved in its enactment.

### **Europe**

The use of regulations for efficiency across the whole of Europe is rare due to the complex political processes required and therefore voluntary mechanisms tend to be favoured. Regulations by individual member countries are also increasingly unusual due to their potential to act as barriers to free internal trade, and most efficiency regulations were enacted prior to these concerns.

The Stimeck and Eurovent listings are voluntary programs, run by TNO-MEP (a research agency in the Netherlands) and EUROVENT-CECOMAF, the European Committee of Air Handling and Refrigerating Equipment Manufacturers. These are intended to overcome information barriers, and in the case of Stimeck, is allied with a financial assistance package provided by the Dutch Government. The financial assistance package is part of a broad program of financial incentives run by the Dutch Government.

It is extremely difficult to assess the impact of information programs, since there is no guarantee of uptake. All available assessments of the Dutch financial assistance scheme cover a wide range of products and end-uses and it has not been possible to evaluate the success of the program for commercial refrigeration. However, it is noted that the scheme continues to be supported by Government and industry.

### **South Africa**

Historically South Africa has not regulated for energy efficiency, however this situation is beginning to change. The regulation SANS 1406 is still available from Standards South Africa (Stansa) but is not included in the list of performance standards promoted by the South African Institute of Refrigeration & Air Conditioning. An evaluation of the performance levels indicated by this standard has not been possible due to the different test conditions prescribed and unclear guidelines. It has not been possible to access further information on this standard and is presumed not to be enforced.

### **United Kingdom**

As with other European countries, although some products and application may have been traditionally regulated, new efficiency regulations are not common. Both the UK EPIC voluntary information program and the Enhanced Capital Allowance scheme have been instigated since 2000 to address perceived market barriers to a broad range of products. Discussions with the program organisers indicate that no evaluation of the impact of the measures on commercial refrigeration have been made (only a general assessment of the potential), and that to date the uptake of financial assistance for these products has been minimal (Tait 2002).

### **United States**

The EPA's Energy Star program is a well-established voluntary information program which covers both residential and commercial products. Some mainly domestic products are regulated by the Department of Energy, however the processes required to establish new regulations require broad political support which has not been forthcoming in recent years. As a voluntary program, the EPA is not required to produce detailed analysis of the impact of the individual program, although it has undertaken general assessment of the potential (eg. Cadmus 1999, Cadmus 2000).

At the time that the program was launched, the EPA estimated that an Energy Star compliant reach-in refrigerator would save 1,968 kWh/year per unit, with total estimated savings in 2003 of 47 GWh. The savings estimate for Energy Star compliant reach-in freezers is 1,382 kWh/year/unit, with a total estimated saving in 2003 of 30 GWh. The incremental cost to the consumer for Energy Star qualified reach-in refrigerators and freezers were \$179 and \$139, respectively. However, the EPA reports there are some market indicators that suggest that this differential is becoming narrower (EPA 2004).

The Californian Energy Commission has a record of introducing a wide range of progressive measures to promote energy efficiency, and this has been enhanced in recent years as a result of the energy supply problems experienced in parts of that State. The regulation for commercial refrigeration is part of the CEC's legislative program introduced in 2002 (Title 20 and 24) covering both the upgrading of existing regulations and the introduction of new regulations.

The CEC is required to examine the impact of new legislation, although not to examine the potential of other program types. Table 12 and Table 13 show the results of this analysis from a consumer and from a statewide point of view, respectively.

The major assumptions include:

- > 3% real after-tax discount rate;
- > no change in maintenance costs.

Table 12: Californian Standards - cost effectiveness for individual customers

Appliance	Added first cost (US\$/unit)	Lifetime (years)	Financial savings (US\$/unit)	Simple payback (years)	Gross US\$ savings over lifetime *	Net US\$ savings over lifetime *
Commercial refrigerator & freezers with transparent door	\$382	9	\$173	2.2	\$976.10	\$594.10
Commercial refrigerator & freezers with solid door	\$382	9	\$237	1.6	\$1,339.54	\$957.54

(\* note: these represent net present values)

Table 13: Californian Standards - cost effectiveness statewide

Appliance	Number of units sold per year	Added first cost (US M\$)	Financial savings per year (US M\$)	Gross US M\$ savings over lifetime *	Net US M\$ savings over lifetime *
Commercial refrigerator & freezers with transparent door	33,750	\$12.9	\$5.8	\$32.9	\$20.1
Commercial refrigerator & freezers with solid door	11,250	\$4.3	\$2.7	\$15.1	\$10.8

(\* note: these represent net present values)

### 4.3 Comparison of proposed Australian MEPS levels with overseas programs

In order to see how the proposed Australian MEPS levels compare with overseas programs, analysis has been undertaken where feasible. Due to the differences explained below, these comparisons should be considered as approximate only.

It should be noted that there is no universal classification for the many hundreds of designs for commercial refrigeration cabinets, except of the most generic type. In part this is due to the fact that there is considerable regional variation in the range of cabinets used. Some products common in North America are not used in Europe, and Australia too has its own product range. While use of broad product classification may assist in making international comparisons, it does not assist with setting MEPS levels at an optimum level since under this system there is the potential for a wide range of performances within any one class. This is particularly the case with remote cabinets. The choice of a classification system for remote cabinets which is currently uniquely Australian is designed to enable the most appropriate MEPS levels for similar types of cabinets with similar performance attributes.

For self-contained cabinets, the European system of classification has been used, which is considered appropriate for the range of products used in Australia.

There are currently two major test standards which form the basis for most programs, as follows:

- North American tests are based on ANSI/ASHRAE 117(1992) or 72 (1998); and
- European Tests are based on En441. The Australian Standard, the AS1731 series, is a technical clone of En441.

Both sets of test standards are in the process of review and updating, however they differ considerably and produce results which are hard to compare, for example because ambient temperatures are different.

### 4.3.1 Comparison with United Kingdom

Figure 10 shows the Australian MEPS levels for categories of medium temperature remote cabinets compared to the thresholds current used by the UK Enhanced Capital Allowance Scheme (ECA) to determine eligibility. These thresholds vary for cabinets delivering different product temperatures (M0, M1 & M2), but are the same for all cabinet designs. Therefore direct comparison is not possible, however it is evident from the figure that the levels are similar. Also shown are the Australian 'High Efficiency' limits, which are generally more stringent than the UK levels.

Figure 10: Australian MEPS levels compared to UK program levels – Remote Medium Temperature Cabinets

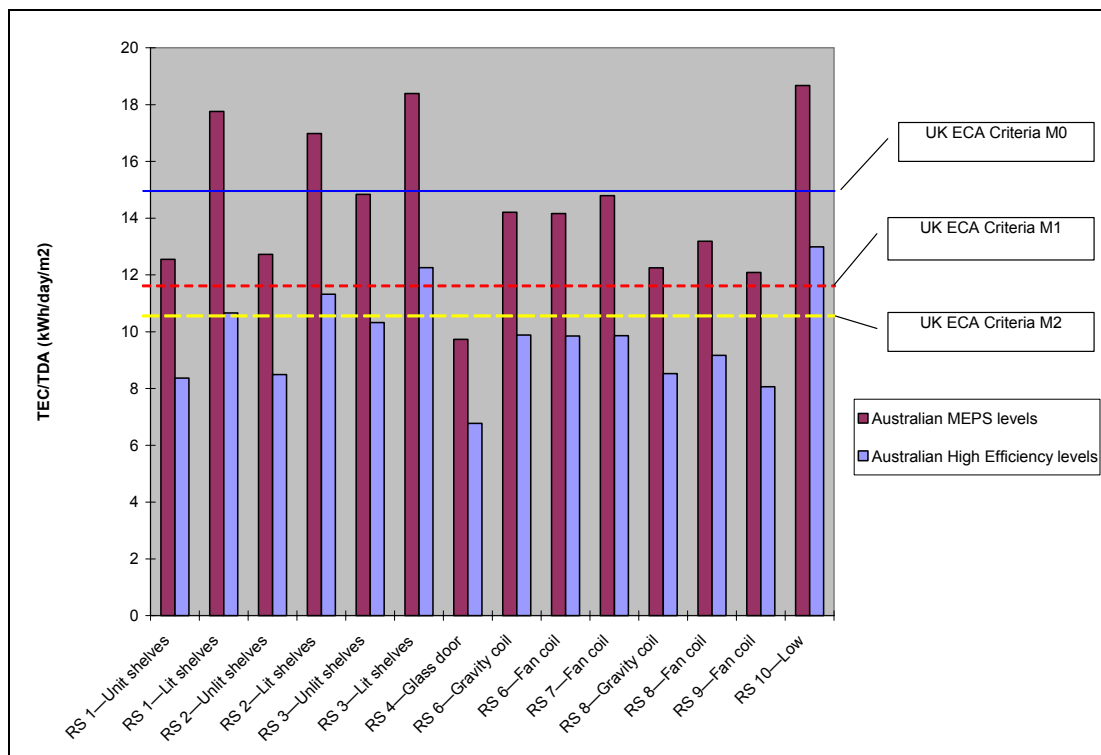
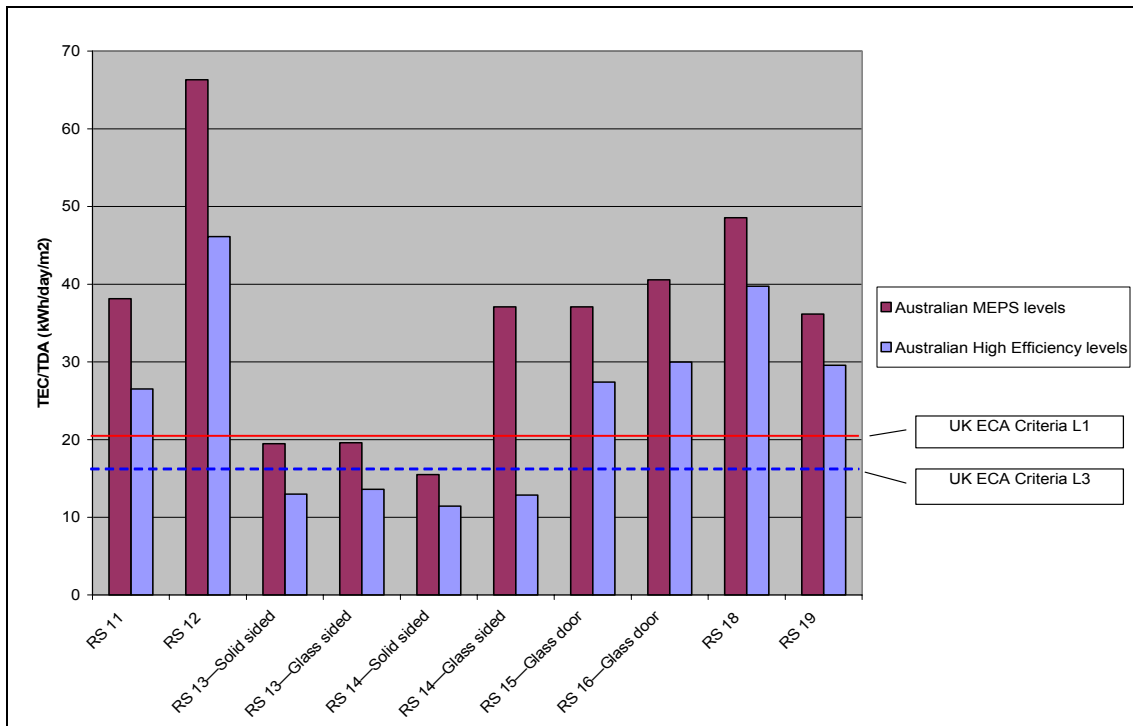


Figure 11 shows the Australian MEPS levels for categories of low temperature remote cabinets compared to the thresholds current used by the UK Enhanced Capital Allowance Scheme. In this instance, the ECA thresholds are more similar to Australian 'High Efficiency' levels than to the MEPS levels. This may be because there are products in use in Australia which are not used so extensively in the UK.

Figure 11: Australian MEPS levels compared to UK program levels – Remote Low Temperature Cabinets



The following two figures cover self-contained refrigerated cabinets, open or with glass doors. In Figure 12 and Figure 13, Australian MEPS levels are shown to be generally less stringent than the ECA threshold for medium and low temperature cabinets respectively, while the 'High Efficiency' levels are more similar.

Figure 12: Australian MEPS levels compared to UK program levels – Self-contained Medium Temperature Cabinets

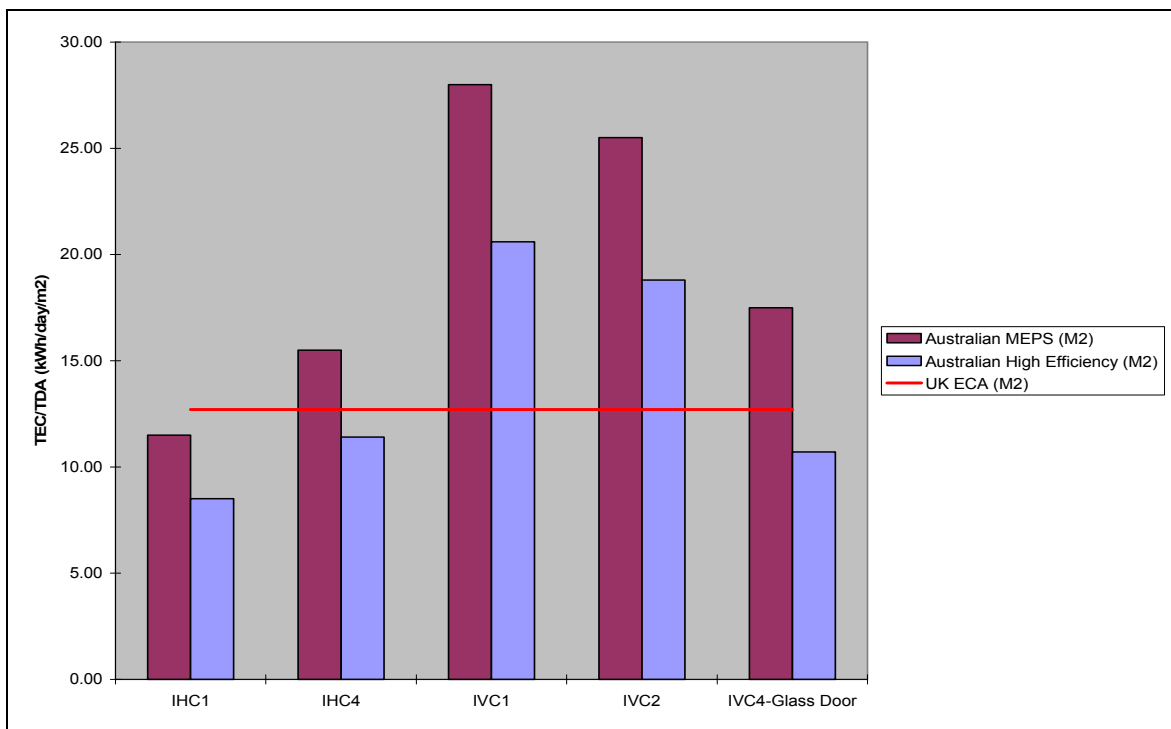
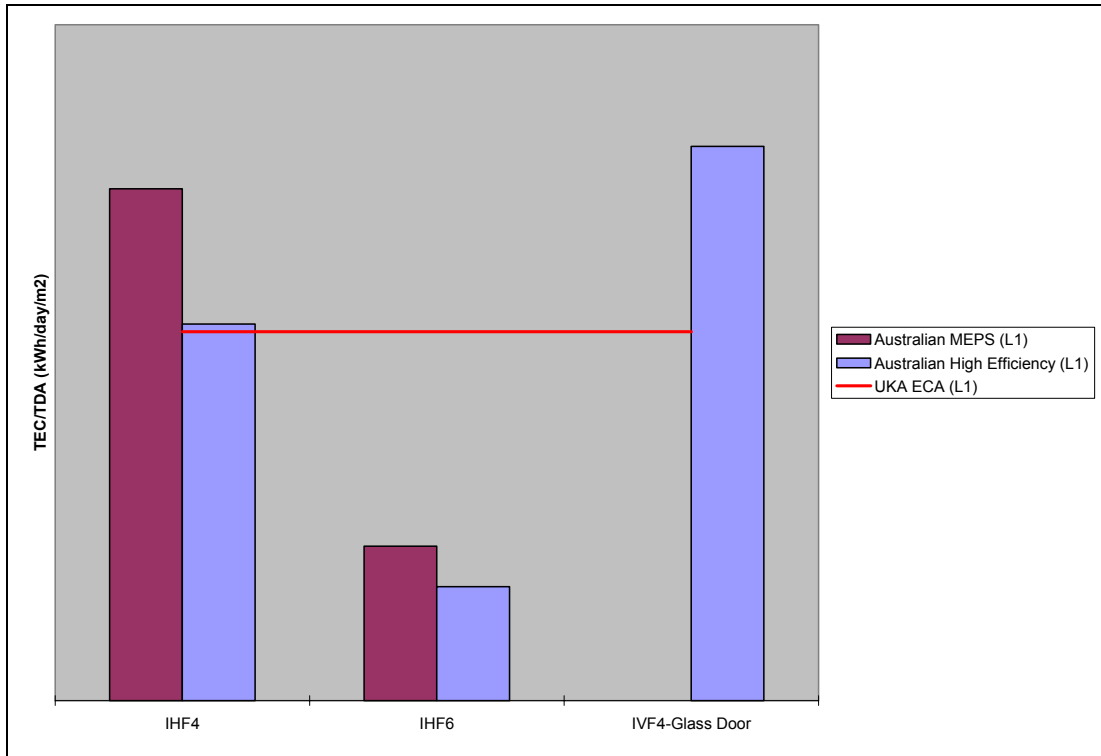


Figure 13: Australian MEPS levels compared to UK program levels – Self-contained Low Temperature Cabinets



The following two figures cover only solid door cabinets - Figure 14 refers to single-door cabinets while

Figure 15 refers to those with double-doors.

Figure 14: Australian MEPS levels compared to UK program levels – Self-contained Single Solid-Door Medium Temperature Cabinets

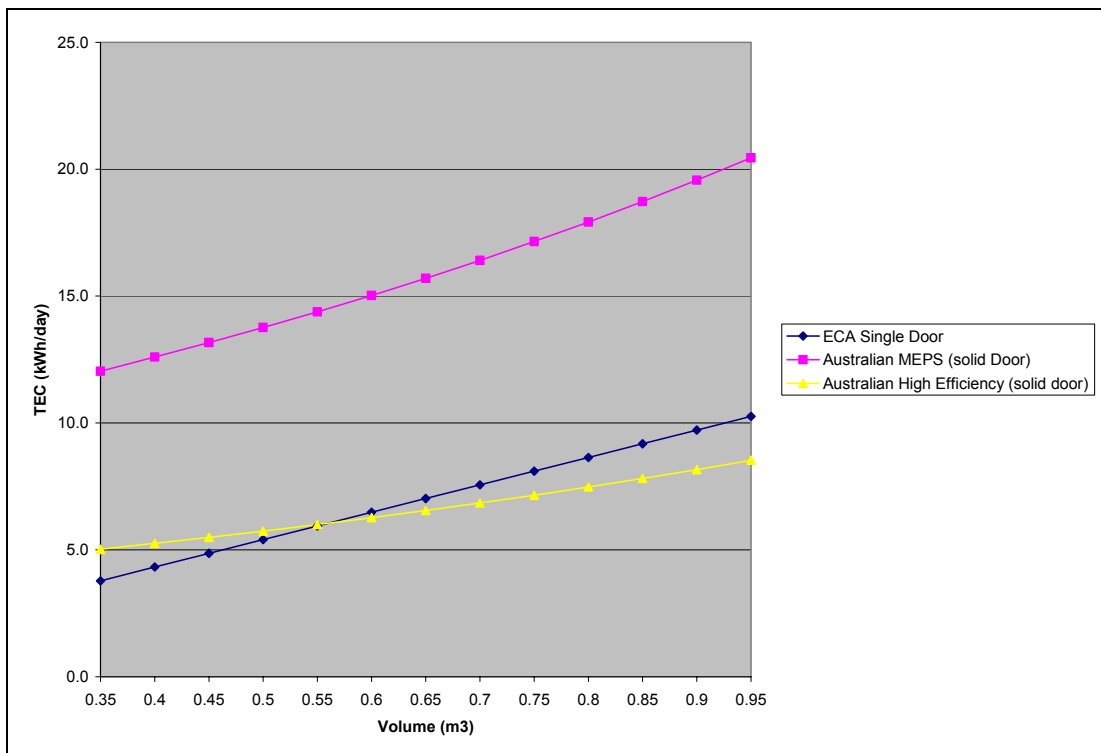
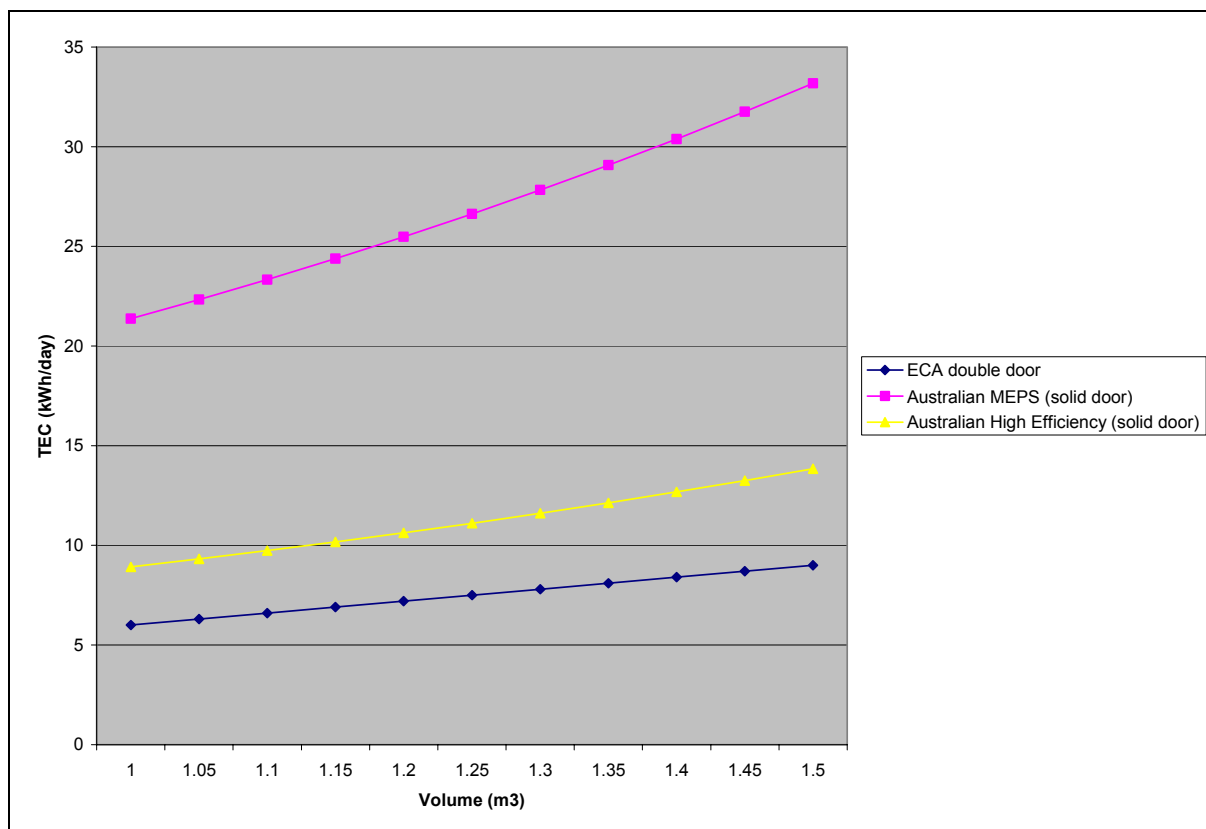


Figure 15: Australian MEPS levels compared to UK program levels – Self-contained Double Solid-Door Medium Temperature Cabinets



In both these figures, Australian MEPS levels are considerably less stringent than in the UK. This is thought to be partly due to different products in each country but mainly because the Australian levels are generally the same as those for open or glass door cabinets. This is due to the lack of tested data available when these MEPS levels were being devised.

#### 4.3.2 Comparison with North America

Table 14 shows the coverage of the Canadian and Californian MEPS for self-contained cabinets, and the Energy Star endorsement label.

Table 14: Coverage of North American programs for self-contained commercial refrigeration cabinets

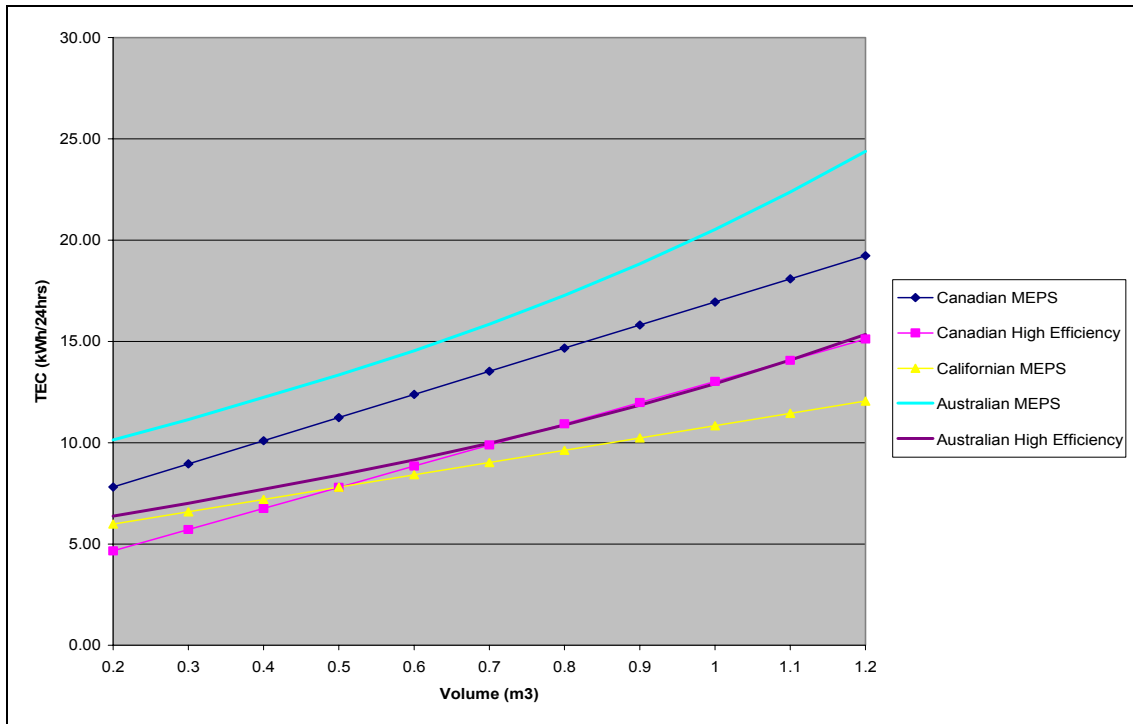
	Canadian Standard (C827-98)		Californian Standard (C827-98)		Energy Star
	Standard Efficiency	High Efficiency	Mar-03	Aug-04	
Glass Door Refrigerator	X	X	X	X	
Solid Door Refrigerator	X	X	X	X	X
Glass Door Freezer	X	X	X	X	
Solid Door Freezer	X	X	X	X	X

The performance levels for glass-door cabinets relating to these programs are shown in Figure 16. All of these performance levels are based on tests to the ANSI/ASHRAE standards. These are compared to the Australian proposals for MEPS and 'High Efficiency' thresholds. It should be noted that because of the differences in the test standards, direct comparison is complex and the representation of the Australian limits are only intended as an approximate guide.

For self-contained glass door cabinets, the Australian MEPS level is slightly less stringent than both the Canadian and Californian MEPS levels. The Australian 'High Efficiency' level is

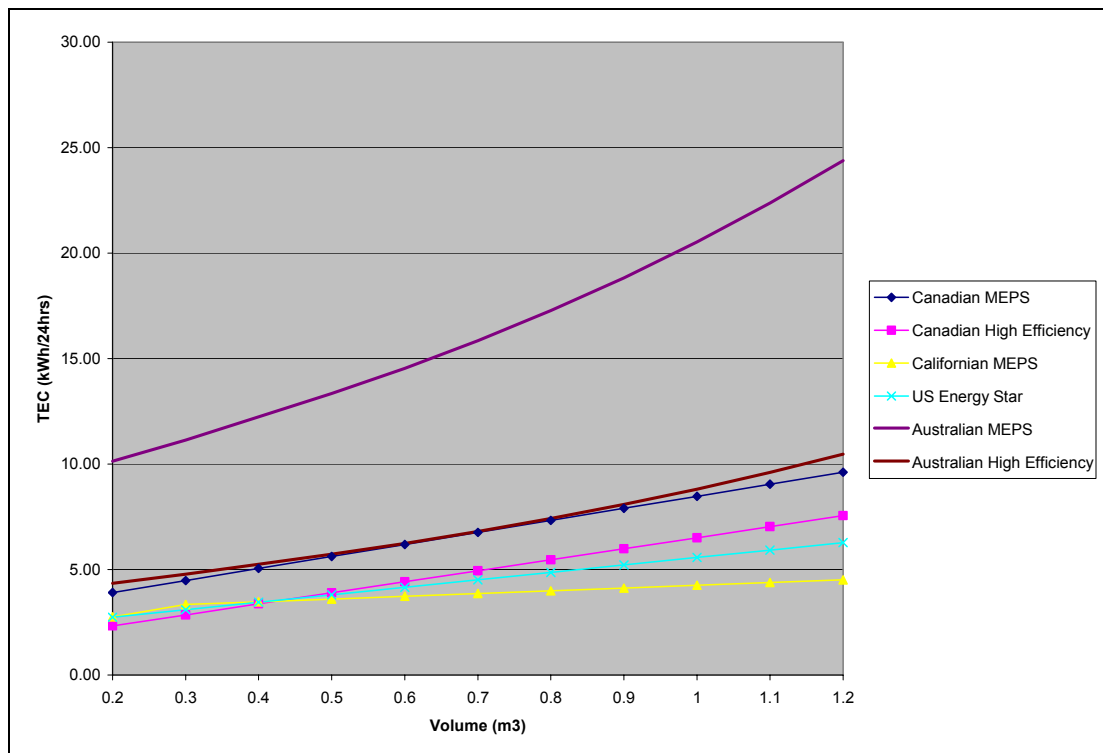
approximately equivalent to the Canadian high efficiency threshold, but less stringent than the Californian MEPS level.

Figure 16 – Australian MEPS compared to North American MEPS levels – Self-contained medium temperature glass-door cabinets



For self-contained solid-door cabinets, the Australian MEPS level is less stringent than both the Canadian and Californian MEPS levels. The Australian 'High Efficiency' level is approximately equivalent to the Canadian MEPS, but less stringent than the Californian MEPS level and Energy Star.

Figure 17: Australian MEPS compared to North American MEPS levels – Self-contained medium temperature solid-door cabinets



As noted in the UK comparison, the major reason why Australian MEPS levels for solid-door cabinet are less stringent than their overseas counterparts, is that that in Australia these products are required to meet the same performance levels as open or glass door cabinets.

#### **4.4 Conclusion**

As noted elsewhere in this report, there are considerable differences in the product range in Australia compared to the European or North American markets. However, the operation of the markets in each of these regions is similar and therefore general assessments of the potential for energy savings in commercial refrigeration and the barriers to uptake appear highly consistent with the findings in Australia.

The range of approaches used by countries to promote energy efficient commercial refrigeration include the use of information programs, financial mechanism and regulation. The selection of which approach is most suitable appears to be dictated primarily by whichever type of program energy agencies already have in operation, rather than an analysis of all the options. No documentation of analysis undertaken into the alternative programs and their effectiveness has been found. There is no record of regulatory programs for commercial refrigeration products being considered but discarded for other program types.

A comparison of the proposed Australian MEPS levels for remote cabinets suggest these are equivalent to levels for similar products covered in the UK ECA Scheme, which is the only readily comparable benchmark. Generally the Australian MEPS levels for self-contained cabinets are less stringent than other overseas regulations, although the 'High Efficiency' levels are similar. As demonstrated in the following sections, the average savings predicted as a result of the Australian MEPS are therefore considerably lower (in the order of 11%) than the 30%-40% savings predicted by the Californian and Energy Star measures. This situation is an intentional strategy to minimise the impact on the Australian industry in the short-term.

### **5 COSTS, BENEFITS AND OTHER IMPACTS**

COAG Guidelines:

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

#### **5.1 Benefits and Costs of Mandatory MEPS**

##### **5.1.1 Machine Characteristics**

From available test data and market weightings provided by industry, the weighted average energy consumption of commercial refrigeration cabinets (restricted to the categories to be subject to MEPS) was calculated to be 24.32 kWh/day.

In modeling the cost of MEPS, assumptions have been made with respect to the operation of the market in response to inefficient products which are effected due to MEPS.

The options include:

- > A manufacturers upgrades its product to comply with MEPS;
- > A manufacturer withdraws its product from the market altogether and the sales are replaced by another product.

While this may have differing effects on manufacturers and importers, for the purposes of modeling the result is the same, ie. a less efficient model is replaced by one which passes MEPS. It is then a question of whether the failed products are replaced by models which just pass MEPS or which exceed the MEPS threshold. Both of these scenarios are possible and depend upon the investment decisions of individual manufacturers. For example, a

manufacturer may choose to re-design a cabinet so that it meets an expected future MEPS level or the High Efficiency threshold, thereby avoiding the need for further investment in the next few years. Since there is currently no indication on how the market will respond, we have assumed that:

- > 50% of failed products are replaced by products which just comply with MEPS, and
- > 50% of failed products are replaced by products which meet the average energy consumption for their category.

For remote cabinets, the introduction of MEPS will result in the need to upgrade or phase out 22 of the 175 models tested. When market penetration weightings are applied, the net result is that 15% of remote cabinets currently being sold would fail MEPS. Applying the 50/50 ratio above with regard to failed product substitution, we find that the average required efficiency improvement is 11%. The effect that this has on the market is that the weighted average efficiency of all new remote cabinets being sold will improve by 1.65%.

For self-contained cabinets, there is a limited amount of test data available, and the proposed MEPS levels would not affect any of the models tested (as noted in section 3.6). This is not surprising since the models tested were selected to just pass the proposed MEPS levels. However from discussions with manufacturers, it is considered that there are significant numbers of self-contained cabinets currently being sold that are inefficient and would be affected by the proposed MEPS levels. For this reason, and due to the similarities of the technologies and markets, it was considered reasonable to assume that MEPS would have similar effects on both self-contained and remote cabinets. These effects are described in the previous paragraph, and the assumptions are subjected to sensitivity (scenario) analyses in section 5.1.2.

From data provided by the refrigeration industry in Australia, it was estimated that the weighted average price for a commercial refrigeration cabinet is \$5,000. It was also estimated that the improvement to 'failed' models (15% of currently available cabinets) as described above results in a price increase of 7.5% for each failed model (i.e. an average increase of \$375).

A 7.5% price increase is considered to be reasonable for the following reasons:

- > as with many technologies, the cost of efficiency improvements is non-linear, reflecting the fact that moderate increases in efficiency may be made at low-cost, or indeed zero-cost. However major re-design or new technology is often required to make substantial improvements in performance.
- > Discussions with industry technical representatives suggest that the additional capital cost required to for a 'failed' unit to achieve the improvement required to pass MEPS is between \$150 and \$400.
- > In the analysis undertaken in California in 2001 (CEC 2001), an average additional cost of US\$382 per unit was assumed (see Section 4.2). Based on the exchange rate in 2001 this is equivalent to approximately A\$726, although only A\$500 at the 2004 exchange rate. It should be noted that CEC assessment of costs was based on achieving average energy savings of between 35% and 40% per unit, which is considerably more than the average 11% improvement envisaged by the Australian MEPS.

In line with the data collected for the Californian analysis which is consistent with advice from the Australian industry, meeting MEPS is assumed to have no impact on servicing costs.

The sensitivity of the results to this assumption has been tested. Note that in the cost-benefit modelling, a range of scenarios are modelled in order to take account of the assumptions discussed above. These are outlined in section 5.1.2.

### **5.1.2 Scenarios**

A range of BaU scenarios were modelled for all machines, in order to account for any inaccuracies in assumptions or data. The scenarios are as follows:

- > M1 – middle scenario, based on collected data and reasonable assumptions.
- > M2 – low scenario, likely to result in low level of net benefits when MEPS are applied.
- > M3 – high scenario, likely to result in high level of net benefits when MEPS are applied.

The variables used for all BaU and MEPS scenarios are listed in Table 15.

Table 15: Variables for MEPS scenarios

Quantity	Middle		Low		High	
	BaU (B1)	MEPS (M1)	BaU (B2)	MEPS (M2)	BaU (B3)	MEPS (M3)
Initial stock (Australia + New Zealand)	400,000					
Lifetime	8 years					
Stock growth rate 2001-2009	8%		7%		9%	
Stock growth rate 2010-2020	5%		4%		6%	
Cost of electricity	\$135 / MWh		\$122 / MWh (90% of middle scenario)		\$149 / MWh (110% of middle scenario)	
Average increase in price of 'failed' machine due to MEPS	N/A	\$375	N/A	\$412 (110% of M1)	N/A	\$338 (90% of M1)
Weighted average efficiency improvement of new cabinets, due to MEPS	N/A	1.65%	N/A	1.49% (90% of M1)	N/A	1.82% (110% of M1)
Weighted average energy consumption of new cabinets	24.32 kWh/day	23.59 kWh/day	24.32 kWh/day	23.67 kWh/day	24.32 kWh/day	23.52 kWh/day

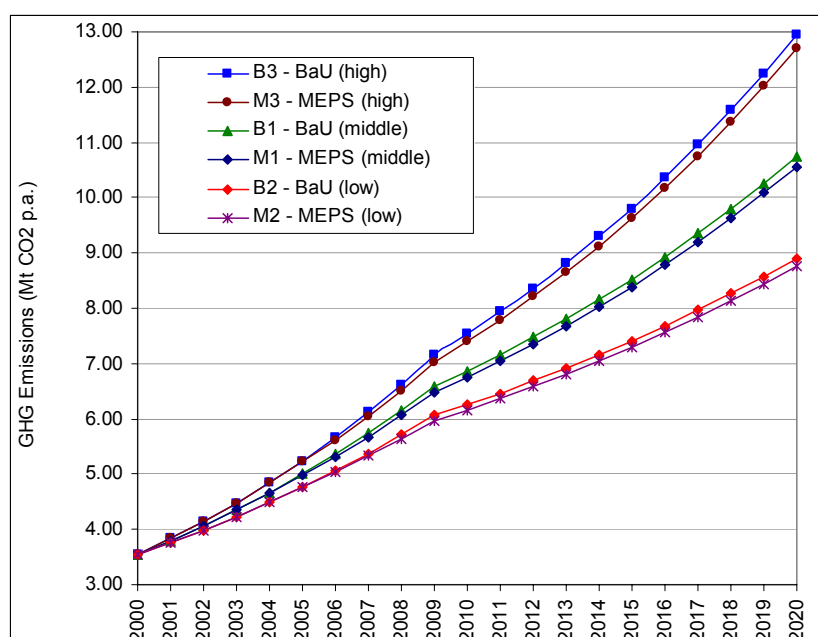
Application of variables in Table 15 will result in middle, low and high levels of net benefits when MEPS are applied. As the low and high cases represent the application of a number of variables specifically altered to produce low and high results respectively, the resultant cases are likely to be extremes.

### 5.1.3 National Benefits And Costs

#### Greenhouse Gas Emissions

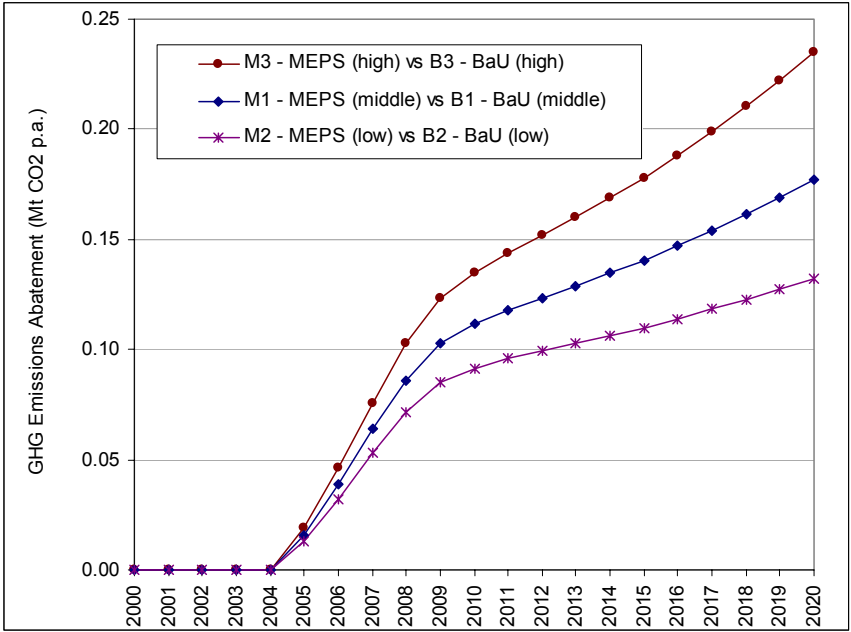
The greenhouse gas emissions (per annum) of all BaU and MEPS scenarios is illustrated in Figure 18.

Figure 18: Greenhouse gas emissions (per annum) of BaU and MEPS options



To calculate greenhouse gas emissions and net benefits, each MEPS scenario is compared to the corresponding BaU scenario, which has the same set of assumptions (apart from the implementation of MEPS). i.e. M1 is compared to B1, M2 is compared to B2, etc. This comparison is illustrated in Figure 19 which graphs the greenhouse gas abatement (per annum) of the three MEPS options.

Figure 19: Greenhouse gas abatement (per annum) of MEPS options



From Figure 19 it can be seen that each of the three mandatory MEPS scenarios modelled results in greenhouse gas emissions reductions. It is estimated that mandatory MEPS will result in total cumulative greenhouse gas abatement of between 1.5 and 2.4 Mtonnes CO<sub>2</sub>e abatement from 2005 to 2020 inclusive.

**Compliance and Program Costs**

This RIS assumes that any increases in cabinet design and construction costs will be passed on to customers through higher capital costs. Conformity with mandatory MEPS will also require manufacturers to register each model or family of models with the appropriate government authority. The cost of compliance with this requirement is assumed to be borne by the manufacturers. Unlike other regulated products, under this MEPS regime physical testing of commercial refrigeration products is not mandatory, although manufacturers are required to provide estimates of performance. Since most models are already tested to meet food safety standards and to meet client specifications, it is considered that there will be minimal need for further tests. Hence total manufacturer compliance costs are estimated to be \$250,000 per annum, which mainly comprises the time required for registration (equivalent to one person engaged full time across the industry), plus an allowance for some testing.

The mandatory MEPS program would also 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 NAEDEC 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, RIS, etc.

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

- > Salary and overheads for officials administering the program: \$50,000 per year;

- > Check testing, research and other costs underpinning the program: \$75,000 per year, half of it borne by the Commonwealth and the other half by other jurisdictions in proportion to their population, in accordance with long-standing cost-sharing arrangements for NAEEEC activities; and
- > Printing and promotional activities at \$25,000 per year.

Hence total government program costs are estimated to be \$150,000 per annum.

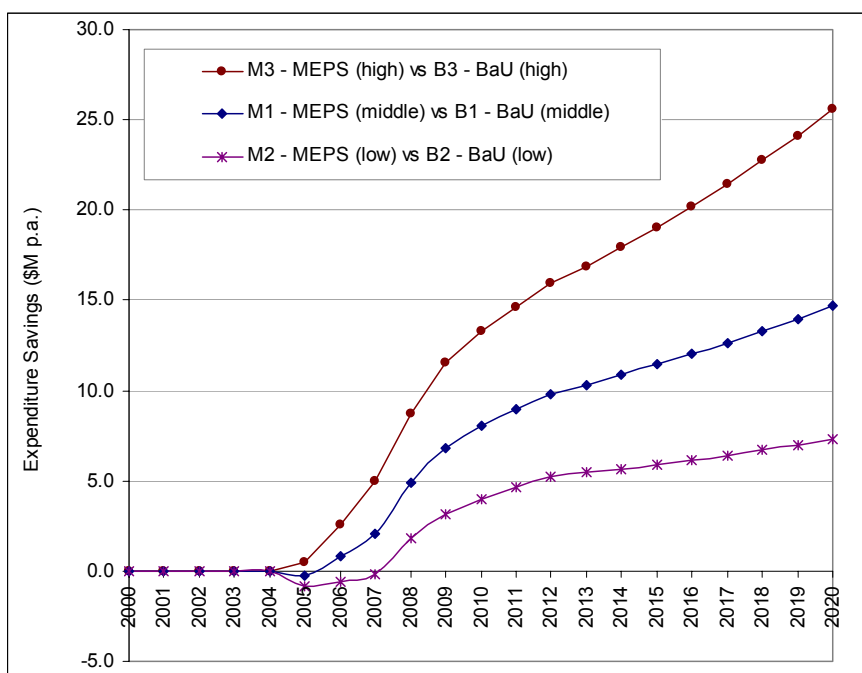
The total cost of compliance and program administration is therefore estimated at \$400,000 per year. These costs have been included in the national cost-benefit analyses throughout section 5.

### Financial Costs and Benefits

The national average costs of electricity are calculated using marginal electricity prices from each state (from GWA 2003) and state energy consumption weightings from GWA 2001. The cost-benefit model used in this RIS does not accurately replicate the end user perspective, but calculates costs and benefits directly at the national level from national average values.

Figure 20 illustrates the total net direct economic benefits of the three MEPS options, when compared to each corresponding BaU option. The net benefit is calculated from differences in capital costs, energy costs and program costs between the MEPS and BaU scenarios.

Figure 20 – Net benefits of MEPS options (per annum)



Based on the assumptions in the RIS, and using a discount rate of 5 per cent, the cost of MEPS between 2005 and 2020 for the different scenarios range between \$88 million and \$98 million. This includes all additional equipment, compliance and administration costs. The corresponding total net cumulative benefits are estimated to be \$129 million and \$250 million.

Table 16 presents the estimated NPV of costs and benefits of the MEPS scenarios analysed.

Table 16: Costs and benefits of proposed MEPS for commercial refrigeration cabinets

Scenario	NPV Costs (\$M)	NPV Benefits (\$M)
M2 - MEPS (low) vs B2 - BaU (low)	88	129
M1 - MEPS (middle) vs B1 - BaU (middle)	93	182
M3 - MEPS (high) vs B3 - BaU (high)	98	250

## 5.2 Industry, Competition And Trade Issues

### Industry Issues

The previous section examines the costs and benefits of MEPS from the perspective of refrigeration equipment buyers and users. It was assumed that all manufacturing costs incurred by suppliers are eventually passed on to buyers in the normal course of business, with the exception of registration costs (\$250,000 p.a. across all suppliers).

The MEPS requirements may have a detrimental effect on the industry if they:

- > are applied unequally to part of the market.
- > are overly stringent, thereby reducing the range of products which conformed.
- > place onerous requirements on manufacturers to demonstrate that standards were met.
- > are introduced with little notice.

The following paragraphs outline the findings in respect of these issues.

MEPS will apply to all products sold or imported into Australia and New Zealand and to this extent it is non-discriminatory. Some smaller manufacturers which are unused to testing the performance of products may initially experience a greater learning curve than the larger manufacturers however, this will be short-lived.

The proposed MEPS levels have been carefully set following extensive industry consultation so as to ensure that the full product range is maintained. To this extent some potential energy and greenhouse savings have been sacrificed to minimise the impact on the industry.

The registration requirements have also been kept to a minimum so as not to disadvantage the smaller manufacturers who are not used to undertaking regular product testing. Unlike other regulated products, for commercial refrigeration there is no mandatory requirement for products to be tested prior to registration. It should be noted that this much of the industry is already required to meet manufacturing and performance standards (relating to food safety) and the introduction of MEPS at the level proposed is not expected to be any more onerous than these existing requirements.

Proposals to introduce MEPS were launched to the Industry by the Australian Greenhouse Office in 2000, and the proposals have been advanced since then via a stakeholder committee comprising representatives from industry and major consumers. During the subsequent period the AGO has initiated numerous mailouts of information, publicity in the trade press and trade events and other communication with the industry. In the formulation of the standard AS1731, Standards Australia has held several meetings of the committee ME-008 and undertaken a consultation process prior to publication. This demonstrates that considerable effort has been taken to provide advance notice to the industry over the 4.5 years prior to the introduction of MEPS.

While we consider that the likelihood of any detrimental impact on the industry to be minimal, there may be some benefits for manufacturers due to increased profit derived from the transition to higher priced, more efficient cabinets.

### Competition

Implementation of the MEPS thresholds proposed are unlikely to effect the competitiveness of one supplier over another, most of which have a wide range of products. Indeed there has been considerable effort spent on product testing and consultation to ensure that the MEPS levels are such that their impact is distributed fairly. However as discussed above, some smaller local manufacturers may find the registration requirements more onerous than their larger competitors.

There may be some product importers which select not to register products for the relatively small Australian market, however the majority currently imported European products meet the proposed MEPS levels.

Also the proposed regulation will restrict the ability for suppliers to compete based upon products with low capital cost where this has been achieved through the use of inferior materials and technology that result in poor energy efficiency below the MEPS threshold. But this will be of genuine benefit to users of commercial refrigeration units, who at present are making sub-optimal financial choices. Furthermore it still leaves suppliers to compete on a wide variety of product attributes including capital cost, total cost of ownership, after-sales service, relative energy efficiency (above the MEPS threshold), degree of customization, durability and a number of other attributes of genuine lasting benefit to buyers and users of these products. Experience from the introduction of MEPS levels upon other products in Australia, of which domestic refrigeration is perhaps the most relevant, is that the number of products available and their functionality remains the same or actually increases.

## **Trade**

### *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.

It is a particular concern of the GTBT that where technical regulations are required and relevant international standards exist or their completion is imminent, members should use them, or the relevant parts of them, as a basis for their technical regulations. The energy test procedures and conditions in Australian Standard 1731 are fully consistent with En441, the widely used European Standard. The majority of imported products are sourced from Europe, where testing is regularly undertaken to gain EUROVENT and it will be possible for importers from Europe to use results from pre-existing test data.

The other widely used technical standards: ANSI/ASHRAE 72 and 117, are not currently technically equivalent to En441 and AS1731, although these US standards are currently being redrafted to make them similar to the European standard. However, it should be noted that since test results are not required for registration under the proposed Australian MEPS regime for commercial refrigeration products, this does not raise a particular trade barrier.

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.

There would be scope for accepting the results of cabinet tests conducted in other countries under comparable standards. However, there is no scope for accepting a cabinet that may comply with MEPS in its country of origin (eg in the EU) unless it also complies with Australian MEPS levels. The GATT does not prevent countries from setting MEPS levels according to their own requirements, costs and benefits.

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

### *Trans-Tasman Mutual Recognition Agreement*

Another trade issue is the Trans-Tasman Mutual Recognition Agreement (TTMRA). This 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. This RIS covers MEPS for Australia and New Zealand, both of whom would implement the same MEPS levels. Thus the TTMRA will not present the problem of suppliers importing sub-MEPS products from one country to another.

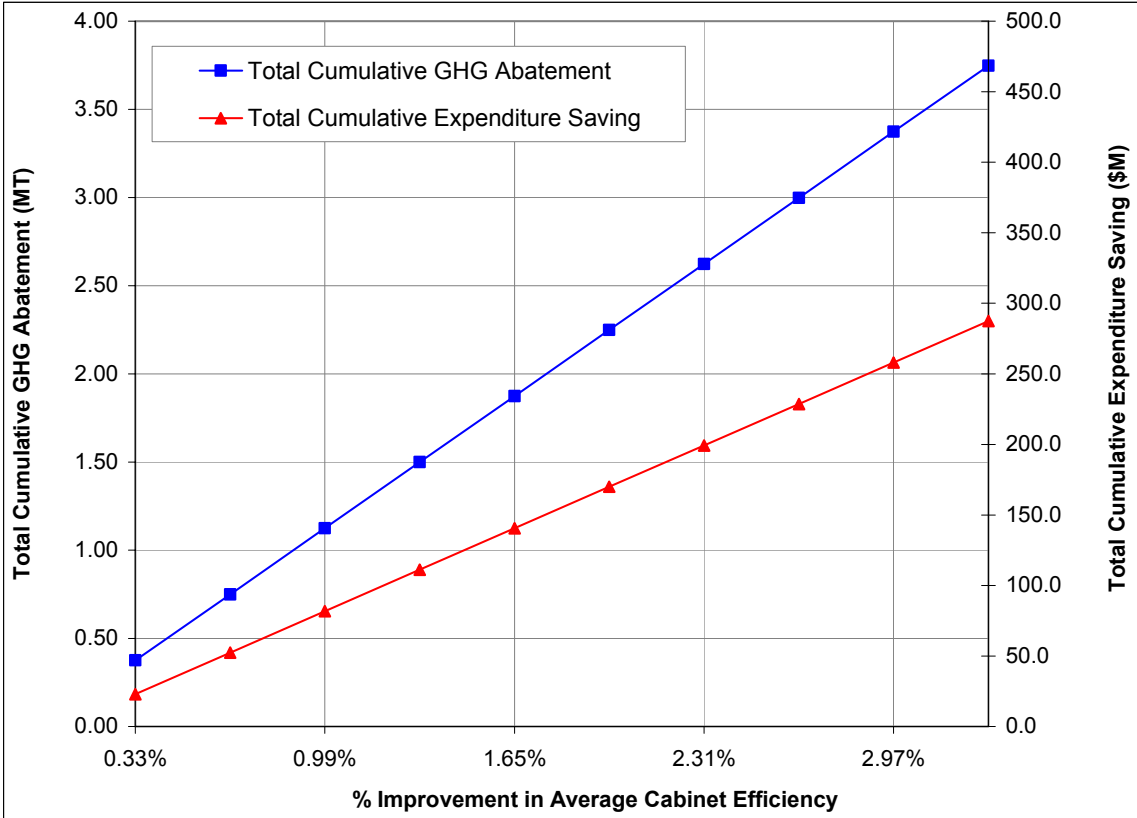
## **5.3 Benefits and Costs of Other Options**

The options put forward (voluntary MEPS, levies and financial incentives, certification, mandatory labelling and mandatory MEPS) all seek to decrease the penetration of inefficient

refrigeration cabinets. The numbers and efficiency of cabinets constitute the key variables in reducing greenhouse gas emissions and creating economic benefits.

In other words, for the options put forward in this RIS, the extent to which an option can increase the average efficiency of commercial refrigeration cabinets will determine the level of financial benefits and greenhouse abatement achieved. This is illustrated in Figure 21, which graphs the total cumulative greenhouse abatement and total net financial benefits of improving the average cabinet efficiency by between 0.33% and 3%.

Figure 21 – Effect of average performance improvement on abatement and financial benefits



From Figure 21 it is evident that the effect of improved average performance on abatement and financial benefit is linear. In other words, the greater the improvement, the greater the benefit. Note that Figure 21 is centered on the M1 (middle) MEPS case (1.65% efficiency increase) and that the average increase in capital cost of cabinets is assumed to be proportional to the increase in efficiency. This is a simplification since, as explained in section 5.1.1, efficiency improvements and costs are seldom related linearly but more typically follow a step function. Therefore while a direct relationship is likely to be true for initial efficiency gains, as efficiency gains are taken up the incremental cost of efficiency improvements is likely to rise, and the benefits are likely to level off.

In sections 3.2 to 3.6 the ability of these programs to improve the efficiency of new cabinets has been discussed. Of these mandatory MEPS is the only option that would ensure the sale of more efficient cabinets. The other options all rely on voluntary means of increasing sales of efficient cabinets (including mandatory labelling, which requires a mandatory label but does not remove the voluntary choice of cabinet from the consumer).

Experience with voluntary programs worldwide shows that it is unlikely that any voluntary program could totally eliminate the sale of inefficient cabinets, given a realistic program budget. It should be noted that mandatory labelling was estimated to usefully act on 30% of the market, and then only after a considerable period. The mandatory MEPS option will therefore maximise energy, greenhouse and financial savings.

However, other options may be more cost-effective if there are considerable differences between the program costs of each program type. It is assumed that the costs of capital improvements to increase efficiency are the same whatever the mechanism used to stimulate these. These are estimated to reach \$12 million per year by 2020. Table 17 shows the estimated program costs for each option considered.

Table 17 – Estimated Program Costs

Option	Industry Costs p.a.	Government Costs p.a.			Total Costs p.a.
		Salaries & Overheads	Check Testing	Printing & Promotional	
<b>Status Quo</b>	\$0	\$0	\$0	\$0	<b>\$0</b>
<b>Voluntary MEPS</b>	\$0	\$150k	\$25k	\$100k	<b>\$225k</b>
<b>Levies &amp; Financial Assistance</b>					
Equipment levy	\$250k	\$250k	\$75k	\$150k	<b>\$725k</b>
Electricity levy	\$0	\$250k	\$0	\$150k	<b>\$400k</b>
Financial assistance	\$100k	\$250k	\$25k	\$150k	<b>\$525k</b>
<b>Certification</b>	\$250k	\$50k	\$75k	\$50k	<b>\$425k</b>
<b>Mandatory Labelling</b>	\$800k-1000k	\$150k	\$75k	\$250k	<b>\$1275k-1475k</b>
<b>Mandatory MEPS</b>	\$250k	\$50k	\$75k	\$25k	<b>\$400k</b>

Mandatory MEPS requires an annual expenditure of \$400,000 by Government and Industry. In comparison, only voluntary MEPS is cheaper to administer while the electricity levy is estimated to cost a similar amount to the proposed MEPS regulation.

The provision of financial assistance and certification programs is slightly more expensive however an equipment levy and mandatory labelling both cost considerably more. Mandatory labelling would require all products to be tested, which would involve considerable expense at least for an initial period.

Since mandatory MEPS has the greatest impact, only programs with a lower cost can be more cost-effective. As a result the two cheapest alternative programs are discussed further below.

### **Voluntary MEPS**

Legislating new regulations and changing existing regulations is often an extensive and time consuming process that can be difficult to alter once enacted. Consequently there is a view that voluntary, non-legislative regulatory schemes managed by industry are a superior option to legislated schemes. It is thought that these voluntary schemes can often be implemented sooner, and achieve results equivalent to those associated with mandatory regulations with less cost and greater flexibility to adapt to changing circumstances. However evidence on the efficacy of self-regulated schemes is mixed at best, and there is certainly no guarantee that the desired result will be achieved in the Australian commercial refrigeration market. The fact that several manufacturers who have tried to introduce high efficiency products in the past have reported that they subsequently withdrew these products due to arguably unfair competition from lower cost, less efficient products, suggests that a voluntary MEPS scheme is unlikely to be as effective as the proposed mandatory approach. Also a voluntary approach is likely to require considerable effort and time on the part of government and industry officials to get a critical mass of manufacturers involved and also to get them all to agree. This is especially difficult once it is considered that cabinets sold in Australia come from over 9 different countries, with the majority being imported.

Also whether the scheme is voluntary or mandatory makes relatively little difference to the overall costs of the schemes (if we assume the same MEPS levels) – the difference in program administration costs of \$175,000 per annum is dwarfed by the energy savings of \$27 million per annum by 2020 – which are more likely to be delivered through the mandatory approach.

## **Electricity Levy**

Incorporating a cost of greenhouse emissions into electricity prices through some kind of levy has the primary advantage over mandatory MEPS that it does not restrict choice of refrigeration cabinet yet hopefully should create a stronger incentive for purchasing a more efficient cabinet. This is an advantage because it is imaginable that there may be circumstances where the amount of electricity consumed by a commercial refrigeration cabinet may be so small (cabinet is used infrequently or is of small capacity) that any savings from improved efficiency cannot offset the increased capital cost of a more efficient cabinet. However the cost benefit analysis contained in this document indicates that in the vast number of cases the improved efficiency of the cabinets resulting from MEPS will offset the increased capital costs and the overall net dollar result is very positive.

Of course another advantage of the electricity levy is that as a broad based measure it should lead to greenhouse reductions across the entire economy rather than just commercial refrigeration cabinets. But at the same time the levy would also impose costs across the entire economy, and in the end may not actually overcome the market failures specific to commercial refrigeration cabinets - which is the entire reason for why regulation is being considered! A levy such as this is of such importance that it would require support from the highest levels of government, and would take a considerable amount of time to properly implement. To date a decision to proceed with a nation-wide scheme has not been made and could not be justified on the basis of commercial refrigeration inefficiency. Consequently, for the narrow purposes under consideration (reducing greenhouse emissions due to market failure in commercial refrigeration products), an electricity levy is not preferable.

## **Conclusion**

The alternatives presented here, except voluntary MEPS, involve program costs greater or equal to mandatory MEPS, and would not remove inefficient cabinets from the market as quickly as mandatory MEPS. Hence mandatory MEPS is considered to be the most effective option for achieving this aim, and for achieving the primary objective of the proposed regulation, that is to bring about a reduction in greenhouse gas emissions from the use of commercial refrigeration cabinets.

## 6 CONSULTATION

### 6.1 Consultations

The following summarises the stakeholder consultation undertaken by the AGO in drafting the MEPS regulations.

Date	Event		
<b>November 1999</b>	<b>Engagement of Consultant</b>		
<b>Nov 1999 – Oct 2000</b>	<b>Preparation of Draft Scoping Study</b>		
	Kingloc	RMIT	Kirby Refrigeration
	Streets	Commercial Refrigeration Manufacturers Assoc	Orford Refrigeration
	Franklins	Australian Supermarket Inst	Woolworths
	Coca Cola Amatil	Australian Retailers Assoc	Yarra Valley Refrigeration
	Mackenzie Deane	Australian Assoc of Convenience Stores	Seitze van der Sluis, Inst. Of Environmental Science, The Netherlands
	Skope	National Assoc of Retail Grocers of Australia	Canadian Standards Assoc & NRCAN
	McAlpine Hussman	Standards Australia	US EPA & US DOE
	ETSU (UK)	ARI (US)	
<b>August 2000</b>	<b>1<sup>st</sup> Steering Committee Meeting</b>		
	All steering committee members		
<b>February 2001</b>	<b>2<sup>nd</sup> Steering Committee Meeting (combined)</b>		
	All steering committee members		
<b>March 2001</b>	<b>Production of Final Draft Scoping Study</b>		
	<i>Comments:</i>	RB Brown	Kirby Refrigeration
	NIDA Group	McAlpine Hussman	Kyser Warren
	Skope	Yarra Valley Refrigeration	
<b>October 2001</b>	<b>Working Group for Remote Products</b>		
	Frigrite	Coles	Skope
	McAlpine Hussman	Woolworths	UNSW
<b>October 2001</b>	<b>Working Group for Self-Contained Products</b>		
	Skope	McAlpine Hussman	Orford
	Frigrite	UNSW	
<b>December 2001</b>	<b>Working Group for Remote Products</b>		
	Frigrite	Coles	Skope
	McAlpine Hussman	Woolworths	UNSW
	Austral		
<b>14 Feb 2002</b>	<b>Steering Committee for Self Contained Products</b>		
	McDonalds Australia	Sanden International (Australia) Pty. Ltd	Channon Refrigeration
	Cadbury Schweppes	Skope	McAlpine Hussman Ltd
	Heatcraft Australia	Coca-Cola South Pacific	Airefrig Australia Pty Ltd
	Orford Pty Ltd	Coca-Cola Amatil	Pepsico Beverages
	York International		
<b>13 Feb 2002</b>	<b>Steering Committee for Remote Products</b>		
	Bitzer Australia	Heatcraft Australia Technology Group	Frigrite
	Austral	Airefrig Australia Pty Ltd	McAlpine Hussman
	Woolworths	McGregor & Associates	

<b>22 August 2002</b>	<b>Working Group for Remote Products</b>		
	Frigrite	Linde	Austral
	McAlpine Hussman	Standards Australia	
<b>22 August 2002</b>	<b>Steering Committee for Self Contained Products</b>		
	Com Ref Mfg Assn		
	Frigrite	Orford Refrigeration	Standards Australia
	CSIRO Energy Technology	Coca-Cola Amatil	McAlpine Hussmann Ltd
	Austral Refrigeration	Skope Refrigeration	Baker Refrigeration & A/c
	Unilever (Streets)	Coca-Cola Australia	CSIRO Food Science
	Williams Refrigeration		
<b>1 July 2003</b>	<b>Steering Committee for Remote Products</b>		
	McGregor & Associates	Heatcraft Australia	Frigrite
	Austral	Airefrig Australia Pty Ltd	McAlpine Hussman
	Woolworths		
<b>22 July 2003</b>	<b>Steering Committee for Self Contained Products</b>		
	Sanden International (Australia)	Orford Refrigeration	Skope
	Heatcraft	MECHLAB	Coca-Cola South Pacific
	Frigrite	Sanden International	Kingloc
	Williams Refrigeration	Cadbury Schweppes	

In addition, Standards Australia has convened the following meetings of ME-008, the committee responsible for Commercial Refrigeration Cabinets.

- o 28 & 29 November 2002
- o 17 December 2002
- o 13 & 14 March 2003
- o 2 July 2003

## 6.2 Comment on this Regulatory Impact Statement

The AGO will send out letters to known interested parties informing them of this regulatory impact statement and solicit their comments on the proposed regulation. The AGO will also advertise in national daily newspapers seeking comments on the proposed regulation.

Written comments on this proposal will be received until **23 March 2004**. NAECC will determine its response to these comments and revise the final RIS as appropriate as well as informing the Ministerial Council on Energy on the substance of these comments.

Written submissions should be addressed to:

Mr Tristan Edis  
 Equipment, Appliances and Transport Team  
 Australian Greenhouse Office  
 GPO Box 621  
 CANBERRA ACT 2601  
 Phone: (02) 6274 1293  
 Fax: (02) 6274 1884  
 Email: [energy.rating@greenhouse.gov.au](mailto:energy.rating@greenhouse.gov.au)

## 7 EVALUATION AND RECOMMENDATIONS

COAG Guidelines:

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

### 7.1 Assessment

This section contains a summary assessment of the alternatives considered in this RIS against the objectives of the mandatory MEPS option.

#### **Reduce Greenhouse Gas Emissions Below Business as Usual**

As discussed in section 5.3, the mandatory MEPS option, due to its ability to prohibit rather than encourage the sale of efficiency equipment, will reduce greenhouse gas emissions below business as usual levels to a greater extent than other options considered.

#### **Address Market Failures**

By requiring the removal of inefficient cabinets from the market, mandatory MEPS will most effectively address market failures, so that the average lifetime costs of commercial refrigeration cabinets are reduced. All other options rely on voluntary mechanisms and therefore cannot as effectively require that average lifetime costs are taken into account (i.e. by mandating cabinets with lowest lifetime costs).

#### **Address Information Failures**

Mandatory MEPS will not effectively provide buyers with improved access to product performance information, nor will any of the other options, with the exception of labelling. By removing the worst performing products from the market, mandatory MEPS removes the need to identify these products. Further, by including a definition of 'High Efficiency' products within the standard AS1731, consumers will be able to identify the best performing products in the market, and be assured of the accuracy of manufacturer's claims.

#### **Minimise the Risk of Negative Impact on Product Quality and Function**

Industry sources generally acknowledge that efficient cabinets are of higher quality than inefficient models. Hence, as all of the options seek to increase the sale of efficient cabinets, none of the options is likely to have a negative impact on product quality. Furthermore, product function is unlikely to be affected, as evidenced by the fact that there are numerous examples of fully-functional, efficient models on the market. Furthermore, the introduction of MEPS in no way negates or removes the requirements on all relevant products to meet existing food safety requirements.

#### **Minimise the Risk of Negative Impacts on Suppliers**

As discussed in section 5.2, halting the sale of inefficient cabinets is unlikely to have any significant impacts on suppliers. Hence, as all options aim to halt the sale of inefficient cabinets, none of the options are likely to have any impacts on suppliers.

#### **Benefits Versus Costs, in Light of any Potential Restriction in Competition**

As discussed in section 5.2, the proposal stipulates the energy efficiency of products that can be supplied in the market and it therefore restricts competition. However the proposal demonstrates substantial financial benefits and greenhouse gas abatement which would not be realised through other means.

There is unlikely to be a reduction in the range of products available.

#### **Restriction of Competition no More than Necessary in the Public Interest**

The degree to which competition is restricted is considered minimal as a result of the design of the proposed MEPS levels. The proposal enables suppliers to compete on a wide variety of product attributes including capital cost, total cost of ownership, after-sales service, relative

energy efficiency (above the MEPS threshold), degree of customization, durability and a number of other attributes of genuine lasting benefit to buyers and users of these products.

## Conclusions

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

- > The mandatory MEPS option is likely to be effective in meeting all the stated objectives.
- > None of the non-MEPS alternatives examined appear as effective in meeting all objectives. Some would be completely ineffective with regard to some objectives and some appear to be considerably more difficult or costly to implement.
- > Given that the proposal for MEPS has been in the public domain in draft form since March 2000, and in final form since October 2003, and it has been accepted as an Australian Standard, the program could be implemented as early as 1 October 2004..

## 7.2 Recommendations

It is recommended that:

- > States and Territories implement mandatory minimum energy performance standards for commercial refrigeration cabinets as outlined in Australian Standard 1731.
- > The mode of implementation be through amendment of the existing regulations governing appliance energy labelling and MEPS in each State and Territory, to add commercial refrigeration to the schedule of products for which minimum energy performance standards are required.
- > The regulations refer to Australian Standard 1731.
- > The amendments take effect on 1 October 2004.
- > State and Territory governments should require registration of commercial refrigeration models, so invoking Part 14 of the Standard.
- > Governments re-examine, no later than 2008, the costs and benefits of revising the MEPS levels and other options for further increasing the energy efficiency of commercial refrigeration.

## 8 REVIEW

Commercial refrigeration MEPS would be implemented under the same State and Territory regulations as household appliance labelling and MEPS, and so subject to the same sunset provisions, if any. Victoria and 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 and Territories agree to mandatory requirements, their removal in any one jurisdiction would undermine the effect in all other jurisdictions, because of the Mutual Recognition agreements between the States and Territories. Under the co-operative arrangements for the management of the National Appliance and Equipment Energy Efficiency Program, States advise and consult when the sunset of any of the provisions is impending. This gives the opportunity for revised cost-benefit analyses to be undertaken.

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

Therefore any proposal to make commercial refrigeration MEPS in an Australian standard either more or less stringent would need the cooperation of both the standards bodies and of the regulators.

NAEEEC has adopted the principles that there should be a MEPS 'stability period' of at least 4 years, and that a cost-benefit analysis would be undertaken before any revisions are proposed. The earliest possible timing of any change to the MEPS regulations discussed in this RIS would therefore depend on date of their implementation. If they are implemented in 2004, the earliest possible revision would be 2008. However, it would be necessary to carry out a study well in advance of that time, so that adequate notice could be given to industry in the event that a change was justified.

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## APPENDIX A: OVERSEAS PROGRAMS

Several major economies have implemented mandatory or voluntary programs designed to reduce greenhouse emissions from commercial refrigeration. The type of program used tends to vary according to local circumstances, and reflect what type of program infrastructure is already in place. For example, Energy Star has a strong image and long history in the US, whereas in Canada, they have developed a preference for regulations.

Clearly there may also be some local variations in the types of refrigerators and local conditions; however the development of international standards has gone a long way in enabling comparisons to be made.

There are currently two major test standards used: North American tests are based on ANSI/ASHRAE 117(1992) or 72 (1998), and European Tests are based on En441. The Australian Standard, the AS1731 series, is a technical clone of En441. Both sets of test standards are in the process of review and updating.

Table 18 provides a summary of regulatory standards (MEPS) or voluntary benchmarks and labelling programs by country, and these are outlined further in the section below.

Table 18 - Summary of overseas efficiency programs for commercial refrigeration

Country	Name	Program Type	Scope	Date Implemented
Canada	C657-95	Mandatory MEPS	Refrigerated Display Cabinets and Merchandisers	2000 Currently being updated
	C827-98	Mandatory MEPS	Food Service Refrigerators and Freezers	2000 Currently being updated
Japan	JRA 4032-1993	No further information available		1993
Europe	EUROVENT	Information	Self-contained and Remote	Approx 1999
	STIMECK	Information and Financial Assistance	Remote	1998
South Africa	SANS 1406:1999	Mandatory MEPS		1999
UK	EPIC	Information	Self-contained and Remote	2003
	Enhanced Capital Allowance Scheme	Financial Assistance	Prescribed equipment	Pre-Sept 2003, Post-Sept 2003
United States	EPA Energy Star	Endorsement Label	Solid door	2001
	Californian State	Mandatory MEPS		March 2003, August 2004

### Canada

Canada has two current standards applicable to the following products:

- > Energy Performance Standard for Commercial Refrigerated Display Cabinets and Merchandisers C657-03
- > Energy Performance Standard for Food Service Refrigerators and Freezers C827-98

These prescribe a minimum energy performance standard and test methodology, with reference to ASHRAE testing methods (ANSI/ASHRAE Standard 72 for open cabinets and ANSI/ASHRAE Standard 117).

#### Commercial Refrigerated Display Cabinets and Merchandisers (C657-03)

This standard applies to open and closed refrigerated display cabinets that are intended for displaying and merchandising food products including canned and bottled beverages, ice (intended for human consumption), and other perishable merchandise (eg. cut flowers).

This standard does not apply to self-contained cabinets as covered by C827.

The standard C657 is being updated from the 1995 version and the following is a summary of the latest version (Draft 10, 15 February 2003) (Loggia 2003).

C657 sets the maximum Specific Daily Energy Consumption (SDEC), as shown in Table 19, where SDEC is the daily energy consumption associated with, and required for operating, a unit length of a refrigerated display cabinet. Testing is undertaken to ASHRAE 72 or 117.

The SDEC includes the minimum standard lighting configuration for the cabinet and electric defrost and high efficiency fan options where provided.

$$SDEC = E_C + E_{RRS}. \text{ (kWh/m)/day}$$

**E<sub>C</sub>** – (kWh/m)/day) - the daily energy consumption of the display cabinet.

**E<sub>RRS</sub>** – (kWh/m)/day) - the daily energy consumption of the remote refrigeration system.

The daily energy consumption of the remote refrigeration system (E<sub>RRS</sub>) shall be calculated in accordance with the following formula:

$$E_{RRS} = (Q/EER) \times (24/1000) \text{ (kWh/m)/day}$$

Where: Q = total refrigeration load per unit length of refrigerated display cabinet (a value obtained by the tests), (Btu/h)/m ((Btu/h)/ft)

EER = energy efficiency ratio Btu/(Wh) – see Table 20.

Table 19 - Maximum SDEC ratings

Class	Product Temperature °C	SDEC kWh/(m/day) ((kWh/ft)/day)
1	5.0	13.1
2	5.0	9.5
3	5.0	5.4
4a	-17.8	30.8
5a	-17.8	15.1
6a	5.0	7.5
6b	-17.8	20.0
7a (fan)	5.0	8.7
7b (gravity)	5.0	3.3

Table 20: EER values for R-404a

Evaporating Temperature °C	EER Value Btu/(W <sup>h</sup> )
-40.0	5.2
-35.0	5.9
-30.0	6.7
-25.0	7.6
-20.0	8.7
-15.0	9.9
-10.0	11.4
-5.0	13.3
0	15.6

**Note:** For evaporating temperatures not indicated, the appropriate EER values should be calculated by interpolation.

## Food Service Refrigerators and Freezers (C827-98)

This Standard applies to close self-contained commercial refrigerator, refrigerator-freezer, and freezer cabinets that are intended for storage or holding food products and other perishable merchandise.

Products must meet the energy performance standards ("Standard Efficiency"). The second performance level "High Efficiency", defines products which can claim to be high efficiency units. All products are required to be clearly labelled with the average energy consumption of the unit achieved under specified test conditions, and whether it claims to be a standard or high efficiency unit.

Table 21: Maximum annual energy consumption: refrigerators (solid doors)

Type	Annual Energy Consumption (AEC <sub>max</sub> ) (kWh/y)	
	Standard Efficiency	High Efficiency
Reach-in	59 V + 1010	54 V + 470
Reach-in Wine Cooler	51 V + 300	47 V + 10
Milk or beverage type	31 V + 450	28 V + 260
Worktop table / under counter	87 V + 780	79 V + 210

Note: V is the refrigerator volume measured in ft<sup>3</sup>.

Table 22: Maximum annual energy consumption: refrigerators (glass doors)

Type	Annual Energy Consumption (AEC <sub>max</sub> ) (kWh/y)	
	Standard Efficiency	High Efficiency
Reach-in	118 V + 2020	108 V + 940
Reach-in Wine Cooler	102 V + 600	94 V + 20
Milk or beverage type	62 V + 900	56 V + 520
Worktop table / under counter	174 V + 1560	158 V + 520

Note: V is the refrigerator volume measured in ft<sup>3</sup>.

Table 23: Maximum annual energy consumption: freezers (solid doors)

Type	Annual Energy Consumption (AEC <sub>max</sub> ) (kWh/y)	
	Standard Efficiency	High Efficiency
Reach-in	172 V + 930	156 V + 1270
Ice-cream cabinet	86 V + 1270	78 V + 755
Worktop table / under counter	367 V + 2200	334 V + 400

Note: V is the refrigerator volume measured in ft<sup>3</sup>.

Table 24: Maximum Annual Energy Consumption: Freezers – Glass Doors

Type	Annual Energy Consumption (AEC <sub>max</sub> ) (kWh/y)	
	Standard Efficiency	High Efficiency
Reach-in	334 V + 1860	312 V + 2540
Ice-cream cabinet	172 V + 2540	156 V + 1510
Worktop table / under counter	734 V + 4400	668 V + 800

Note: V is the refrigerator volume measured in ft<sup>3</sup>.

Table 25: Maximum Annual Energy Consumption: Refrigerator-Freezers – Solid Doors

Type	Annual Energy Consumption (AEC <sub>max</sub> ) (kWh/y)	
	Standard Efficiency	High Efficiency
Reach-in	92 AV + 1900	84 AV + 1160

Note: Adjusted volume (AV) is equal to the refrigerator volume plus 1.63 times the freezer volume. Volume is measured in ft<sup>3</sup>.

## Europe

Although there is currently no EC-wide program for commercial refrigeration, the EC has indicated that commercial refrigeration equipment will be the subject of minimum energy performance standards or negotiated agreements for energy efficiency (CEC, 2000). No details are currently available on which of these approaches will be adopted but there is a commitment to proceed with standards if voluntary programs are not agreed with the industry. There are number of information programs in Europe, described below and under the United Kingdom.

### EUROVENT Certification

The EUROVENT Certification Program is run by the European Association of Air Handling and Refrigerating Equipment Manufacturers and aims to create a common set of criteria for rating products.

The program covers remote and self contained cabinets and independent testing is undertaken in accordance with EN441. The performance of all cabinets tested are available from EUROVENT's free website, to enable comparison

### European Labelling & Financial Incentive Programs

The Dutch Government has an operational subsidy scheme for retail refrigeration called STIMECK, which gives subsidies towards cabinets achieving A or B ratings according to the assessment method described above (Van Der Sluis, 1999).

The Dutch subsidy scheme covers supermarket refrigeration, including the cooling plant and cabinets. The scheme was set up by three electricity distribution companies, together with NOVEM (the Dutch Energy Agency).

The distributors to subsidise energy saving by DFL 150 (A\$ 207) per ton of CO<sub>2</sub> saved (one year basis), which amounts to about DFL 0.08 (A\$ 0.11) per kWh.

The whole scheme is now regionally administered. Requests for subsidy must be made by supermarkets to the energy distribution companies. Each energy distribution company will select the ten best requests in their region (with the help of TNO), and subsidise these. Each distribution company has set aside a budget of about DFL 150.000 (A\$ 206,850) for this pilot phase.

## South Africa

South Africa has a standard applicable to remote and self-contained commercial refrigerated food display cabinets (SANS 1406:1999), including frozen food storage (Type A), fresh food and liquids (Type B) and ice-cream storage (Type C). The standard sets a test methodology and a minimum energy performance standard, based on the gross capacity of the cabinet. The same energy performance standard applies to all cabinet types.

## United Kingdom

### UK Enhanced Capital Allowance Scheme

The UK Government launched an enhanced capital allowance scheme (ECA) in 2001, for application to a range of energy efficiency improvements including commercial

refrigeration. Under the scheme, companies investing in eligible energy efficiency technologies are able to claim 100% of expenditure against tax in the first year of investment.

Eligible refrigeration technologies include:

- Refrigerated Display Cabinets, remote and self-contained; and
- Refrigerated Commercial service (or storage) cabinets, being a solid door vertical self-contained cabinet.

The thresholds for these technologies are shown in the following tables. All tests are according to En441.

Table 26: ECA Thresholds for Self-Contained Refrigerated Display Cabinets

Temperature Class	Performance Threshold TEC/TDA (kWh/day/m <sup>2</sup> )
L1	<= 19.10
M0	<= 14.70
M2	<= 12.70
H2	<= 9.2

Table 27: ECA Thresholds for Remote Refrigerated Display Cabinets

Temperature Class	Performance Threshold TEC/TDA (kWh/day/m <sup>2</sup> )
L1	<= 23.50
L3	<= 21.00
M0	<= 11.75
M1	<= 11.75
M2	<= 10.85
H1	<= 8.00
H2	<= 9.20

Table 28: ECA Thresholds for Refrigerated Commercial Service Cabinets

Type	Gross Internal Volume	Energy Efficiency Index Threshold I (kWh/48hrs/m <sup>3</sup> )	
		Temperature Class M1	Temperature Class L1
Single Door	400 and 600 nominal	I <= 21.60	I <= 40.00
Double Door	1,300 (+/- 15%)	I <= 12.00	I <= 36.00

## UK EPIC

The UK EPIC program is designed to provide easy public access to information on the performance of a range of appliances and equipment. Information is provided to purchasers on the UKEPIC website and published buyers guides. Information is provided voluntarily by manufacturers or suppliers according to guidelines established by the program. UKEPIC provides two sets of energy performance guidelines for buyers – “Minimum Standard” and “Best Practice”.

In January 2002, guidelines for Commercial Refrigerated Retail Display Cabinets and Refrigeration Compressors were announced. These levels have been set in relation to the mean TEC of a dataset of products provided by manufacturers. The relationship of each target to the mean of the dataset is provided in the following table.

Table 29: UK EPIC, method for calculating targets (Tait 2000, 2002)

Year	Multiplier of the 2001 mean consumption to derive Indicative Minimum Standard	Multiplier of the 2001 mean consumption to derive Indicative Best Practice
2002	160%	98%
2006	120%	80%
2010	105%	60%

These values have been set such that the majority of products in the dataset meet the initial minimum standard (although not the all products in the marketplace). The initial best practice level is achieved by approx. 40% of products in the dataset.

The following targets for remote and self-contained products are set according to the test methodology in prEn 441.

Table 30: Performance targets for remote cabinets (Tait 2000, 2002)

<b>RCV1 &amp; RCV2 for M1</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	79.14	48.47
2006	59.35	39.57
2010	51.93	29.68
<b>RCV1 &amp; RCV2 for M2</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	13.00 x TDA + 19.74	7.97 x TDA + 12.09
2006	9.75 x TDA + 14.80	6.5 x TDA + 9.87
2010	8.53 x TDA + 12.95	4.88 x TDA + 19.74
<b>RCV1 &amp; RCV2 for H1</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	10.19 x TDA + 23.61	6.24 x TDA + 14.46
2006	7.65 x TDA + 17.7	5.10 x TDA + 11.80
2010	6.69 x TDA + 15.49	3.82 x TDA + 8.85
<b>RCV1 &amp; RCV2 for H2</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	7.34 x TDA + 35.08	4.50 x TDA + 21.49
2006	5.51 x TDA + 26.31	3.67 x TDA + 17.54
2010	4.82 x TDA + 23.02	2.75 x TDA + 13.16

Notes: Cabinet classification is according to prEn 441 and EUROVENT.  
Note that these values are normalised for 2.5m (8ft) cabinet length.

Table 31: Performance Targets for Self-Contained Cabinets (Tait 2000, 2002)

<b>ICV1 &amp; ICV2 for M2</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	24.50 x TDA + 6.04	15.01 x TDA + 3.70
2006	18.38 x TDA + 4.53	12.25 x TDA + 3.02
2010	16.08 x TDA + 3.97	9.19 x TDA + 2.27
<b>ICV1 &amp; ICV2 for H2</b>	<b>Minimum Standard Target</b>	<b>Best Practice Target</b>
Year	TEC	TEC
2002	15.30 x TDA + 15.41	9.37 x TDA + 9.44
2006	11.48 x TDA + 11.56	7.65 x TDA + 7.71
2010	10.04 x TDA + 10.11	5.74 x TDA + 5.78

## United States

Although the United States does not currently have national minimum energy performance standards, there are a number of national standards applicable to commercial refrigeration technologies, which provide energy consumption test methodologies. These have been developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) and the American National Standards Institute (ANSI), and cover open and closed refrigerated cabinets and beverage vending machines, and are referenced by many other standards:

- > ANSI/ASHRAE Standard 72 for open cabinets, and
- > ANSI/ASHRAE Standard 117 for closed cabinets.

In addition there are two information programs, Energy Star and FEMP, and MEPS in the State of California.

### Air Conditioning & refrigeration Institute (ARI)

In 2002 ARI issued a new test standard (1200-2002), which is a refinement of the two ANSI/ASHRAE standards.

Alongside the issuing of the standard, ARI stated that the Commercial Refrigerator Manufacturers Division (CRMD) will develop a certification program to provide end users with performance information calculated according to ARI 1200-2002.

### Energy Star

Energy Star is a voluntary program between the US EPA, DOE and product manufactures, aimed at achieving market transformation. It encourages the manufacture, promotion and use of efficient products, using the Energy Star endorsement label to identify conforming products in the marketplace.

Energy Star criteria for self-contained solid door commercial refrigerators and freezers were launched in 2000/01, effective from September 2001. Tests are undertaken to ASHRAE Standard 117-1992, "Method of Testing Closed Refrigerators," and the criteria are expressed as maximum daily energy consumption per unit volume (US EPA 2003).

Qualifying products must meet the requirements in the following table:

Table 32: Specifications for ENERGY STAR Qualified Commercial Solid Door Refrigerators and Freezers

Product Type	Energy Consumption Under Test Conditions
Refrigerators	$< 0.10V + 2.04 \text{ kW-hours/day}$
Freezers	$< 0.40V + 1.38 \text{ kW-hours/day}$
Refrigerator-Freezers	$< 0.27AV - 0.71 \text{ kW-hours/day}$
Ice Cream Freezers	$< 0.39V + 0.82 \text{ kW-hours/day}$

Note: V = Internal volume in ft<sup>3</sup>

AV = Adjusted volume = (1.63 x freezer volume in ft<sup>3</sup>) + refrigerator volume in ft<sup>3</sup>

### Federal Energy Management Program (FEMP)

Federal buyers are directed by FAR Part 23 and Executive Orders 13123 and 13221 to purchase products that are ENERGY STAR® labelled or products that are designated to be in the upper 25% of energy efficiency in their class as well as products with low standby power. FEMP's Buying Energy Efficient Products program helps Federal purchasers identify these types of highly efficient products.

The FEMP criteria listed cover the same products as, and are technically equal to Energy Star.

## California

In 2002, California passed a new Code of Regulations (Title 20 Division 2, Chapter 4 Article 4, Sections 1601-1608) which prescribes minimum energy performance levels for commercial refrigeration products in the State.

The requirements came into force on March 1, 2003 and are as follows:

- > Criteria are expressed in terms of maximum daily consumption per unit volume, with new limits applying from August 1, 2004 (see Table 33);
- > Testing to ASHRAE Standard 117-1992, "Method of Testing Closed Refrigerators";
- > Internal illumination of appliances manufactured after 1 March 2003 shall be only T8 fluorescent lamps with electronic ballasts, or a lighting system that has no fewer lumens per watt than a system using only T-8 fluorescent lamps with electronic ballasts.

Table 33: Reach in Refrigerators and Freezers

Appliance (3)		Maximum Daily Energy consumption (kWh)	
		March 1, 2003	August 1, 2004
Reach-in cabinets, pass-through cabinets, and roll-in or roll through cabinets that are refrigerators; and wine chillers that are not consumer products	Solid	0.125V + 4.22	0.125V + 2.76
	Transparent	0.172V + 5.78	0.172V + 4.77
Reach-in cabinets, pass-through cabinets, and roll-in or roll through cabinets that are freezers	Solid	0.398V + 2.83	0.398V + 2.28
	Transparent	0.940V + 510	0.940V + 510
Reach-in cabinets that are refrigerator-freezers	Solid	0.273AV + 2.63	0.273AV + 1.65
V= volume in ft <sup>3</sup> AV= 1.63 x freezer volume (ft <sup>3</sup> )			

## References for Appendices

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