Minimum Energy Performance Standards for Commercial Refrigeration Cabinets

Prepared for:

EECA
Energy Efficiency and Conservation Authority

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CONTENTS

Executive Summary

This report has been commissioned by the Energy Efficiency and Conservation Authority (EECA) to analyse the costs and benefits of introducing mandatory minimum energy performance standards (MEPS) for commercial refrigerated display cabinets used in retail and service businesses in New Zealand. The purpose of this report is to enable the New Zealand Government to reach an informed decision on whether to adopt minimum energy performance standards (MEPS) for these products, and if so, at what level.

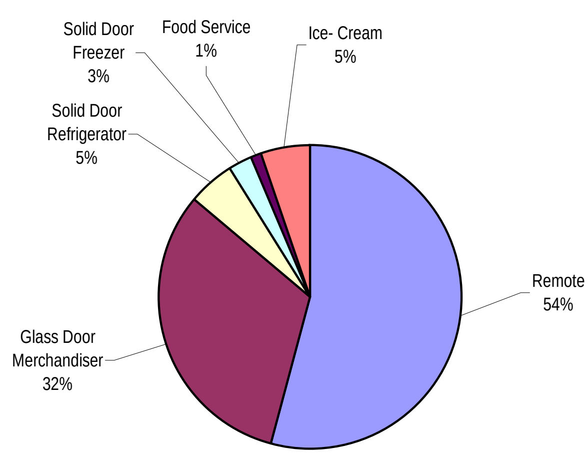
This report describes the key issues relating to MEPS for commercial refrigerated display cabinets in New Zealand. This includes both cabinets which are defined as 'remote' and 'self-contained' but does not cover the following commercial refrigeration technologies or applications:

- Walk-in storage and freezer rooms;
- Processing industries, such as abattoirs and dairies;
- Ice making and Ice storage equipment;
- Refrigerated beverage vending machines;
- Cold water dispensers.

The market for remote cabinets in New Zealand is approximately 1,300 units per annum and the stock is estimated to be between 12,000 and 15,000 units. For self-contained refrigerated cabinets, annual sales are approximately 6,600 units, with a stock of between 70,000 and 85,000 units. While some of the cabinets used in the country are imported, New Zealand is a net exporter of commercial refrigeration cabinets, with Australia being the major destination.

The total energy consumed by refrigerated cabinets in New Zealand in 2002 is estimated to be 780 GWh per annum. Just over half of this is estimated to be used in remote cabinets, while 32% is consumed by self-contained glass door merchandisers.

Figure 1: Distribution of Total Energy Consumption by Refrigerated Cabinets, New Zealand, by Type



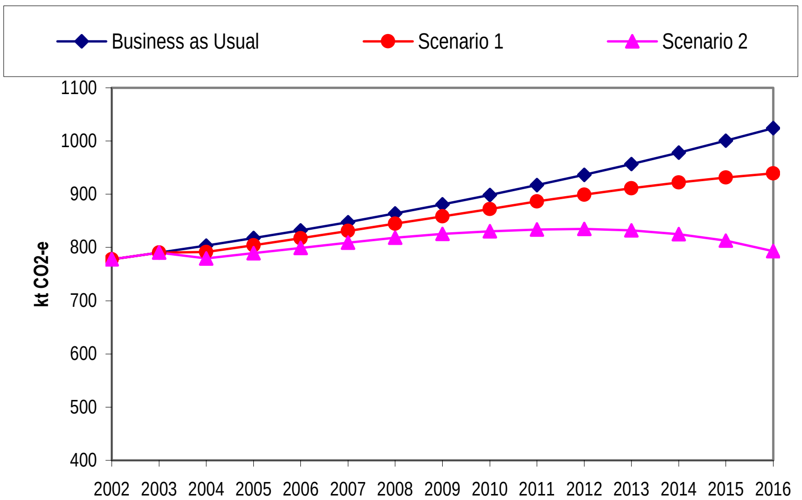
Assuming a greenhouse gas coefficient of 468 kt CO_2-e per GWh electricity, the annual greenhouse emissions in 2002 were approximately 350 kt CO_2–e and it estimated that these will grow to 460 kt CO_2-e by 2016.

In view of the significant contribution to energy consumption due to the use of commercial refrigerated cabinets, most major developed countries have developed programs designed to increase their efficiency, and/or the uptake of more efficient models. These include mandatory MEPS, endorsement labels and the provision of public information.

The development of a MEPS regime for refrigerated cabinets in Australia has been underway since 2000, and the parts of draft Standard (DR03206-03219) have recently been released for public comment, although work is still underway in determining the final MEPS levels to be adopted. This period is now closed and it is intended that the revised AS 1731 comes into effect from 1st April 2004. The test method contained in parts 1 to 13 are based on the draft International Standard, ISO/DIS 23953-2003 E.

Analysis of the technical potential for efficiency improvements, together with the increasingly tough performance levels used as benchmarks for overseas programs, are evidence that significant savings can be made. Based on the levels indicated in the draft Australian standard, it is estimated that the impact of adopting MEPS in New Zealand would result in cumulative energy saving from 2004-2016 of between 450 and 1200 GWh electricity. The impact on greenhouse emissions is shown in the following figure.

Figure 2: Estimated Energy Savings Resulting from Adoption on MEPS



Scenarios 1 and 2 include future increases in the MEPS levels and represent the upper and lower limits of the rate of stock turnover thought to be likely.

Other measures considered, such as labelling, are not likely to be as effective in bringing about energy and greenhouse savings, although targeted information programs and industry agreements may be complementary.

A preliminary cost benefit analysis suggests that there would be a net benefit to New Zealand through the adoption of MEPS at the Australian levels (see Table 1).

Table 1: Results of Cost Benefit Analysis

Scenario 1			**Scenario 2**		
NPV	10%	5%	NPV	10%	5%
Energy Savings	$1,813,062	$2,721,320	Energy Savings	$4,653,402	$7,074,394
Compliance Costs	$1,014,026	$1,484,310	Compliance costs	$2,857,144	$4,132,721
Government Costs	$355,168	$469,679	Government Costs	$355,168	$469,679
Benefit/Cost ratio	**1.32**	**1.39**	**Benefit/Cost ratio**	**1.45**	**1.54**

In view of the similarity of products in Australia and New Zealand there is no indication that the levels adopted in Australia would not be suitable for adoption in New Zealand.

In addition, because of the significant amount of trade between the two countries in commercial refrigeration products, and the benefits of harmonisation of standards between the two countries it is recommended that New Zealand should proceed with the process of adopting MEPS for commercial refrigeration, including:

- Take steps to ensure the new Australian Standard AS1731-2003 is released as a joint standard;
- Undertake further consultation with New Zealand Stakeholders (a list of stakeholders is included in Appendix 1);
- Undertake a full Regulatory Impact Statement on the proposal.

GLOSSARY

Energy Efficiency Ratio (EER):

A ratio of the cooling capacity in Btu/h [W] to the total power input in watts [W] at any given set of rating conditions.

Remote Cabinets:

Cabinets which are fed cooled refrigerant from a system of compressors and condensers located at a distance from the cabinet. Typical application are in supermarkets A remote cabinet usually includes an expansion valve, one or more evaporators and evaporator fans for circulating cold air and/or providing an air curtain in open cases. Many evaporators require periodic defrosting, usually done by an electric resistance heater.

Self-contained Cabinets:

Cabinets which have integral components and are designed to plug into an available electricity supply. They are typically mass produced rather than designed for a specific end-user. This category includes refrigerator vending machines, deli cases, food and beverage merchandisers, ice machines and water coolers.

1. PURPOSE

The Energy Efficiency and Conservation Authority (EECA) has commissioned this report to analyse the costs and benefits of introducing mandatory minimum energy performance standards (MEPS) for commercial refrigerated display cabinets used in retail and service businesses in New Zealand. The purpose of this report is to enable the New Zealand Government to reach an informed decision on whether to adopt MEPS for these products, and if so, at what level.

2. CONTEXT

As a signatory of the Kyoto Protocol, New Zealand is committed to a zero growth in greenhouse gas emissions from 1990 levels. A number of instruments are in place to achieve this, including the Energy Efficiency and Conservation Act 2000, which, in addition to establishing EECA, made provision for the passing of specific legislation (section 36):

> *"(1) The Governor-General may from time to time, by Order in Council made on the recommendation of the Minister, make regulations for all or any of the following purposes:*
>
> > *(a) prescribing minimum energy performance standards for energy-using products and services, including all vehicles:*
> >
> > *(b) prescribing requirements in relation to the labelling of products, including all vehicles, in terms of their energy efficiency or proficiency in conserving energy."*

The Energy Efficiency (Energy Using Products) Regulations 2002 were enacted in February 2002, enabling the introduction of MEPS and mandatory energy performance labelling.

Following analysis of the costs and benefits associated with MEPS and labelling for specific products, the energy performance of the following products are now regulated in New Zealand:

Table 2: Coverage of Existing Energy Efficiency Regulations in New Zealand

Energy Labelling	MEPS
refrigerators and freezers	domestic refrigerators and freezers
dishwashers	domestic electric storage water heaters
clothes dryers	fluorescent tubes
clothes washers	three-phase cage induction motors
household-sized air conditioners	packaged air conditioning units
	fluorescent lighting ballasts

Generally the regulations governing the energy performance of these products are harmonised with Australian legislation, and the Ministerial Council on Energy (MCE) provides a forum for the co-ordination of energy efficiency legislation between New Zealand and Australia.

The Australian Greenhouse Office has been working with Australian industry since 2000 to develop MEPS for commercial refrigeration products. The existing Australian Standard AS 1731 is in the process of being updated and will include mandatory MEPS and voluntary High Efficiency levels. It is due to come into force on 1st April 2004.

It is in this context that EECA wishes to examine whether the revised AS 1731 should become a joint standard.

3. SCOPE

This report describes the key issues relating to MEPS for commercial refrigerated display cabinets in New Zealand. This includes both cabinets which are defined as 'remote' and 'self-contained' (see glossary for a description).

This report does not cover the following commercial refrigeration technologies or applications:

- Walk-in storage and freezer rooms
- Processing industries, such as abattoirs and dairies;

- Ice Making and Ice Storage Equipment
- Refrigerated Beverage Vending Machines
- Cold Water Dispensers

This report examines the current market for these technologies and identifies developments which may have a significant influence on energy consumption and greenhouse emissions. It describes existing energy standards applying to remote commercial refrigeration technologies overseas, together with relevant test methodologies. Significant programs other than regulation, such as labelling, are also identified.

4. PUBLIC POLICY OBJECTIVES

The key public policy objective is to reduce greenhouse emissions in New Zealand from the use of commercial refrigerated display cabinets below the level that they are projected to be, in a manner that is in the community's best interests.

5. METHODOLOGY

This report has been based on previous experience concerning commercial refrigeration and original research specific to New Zealand.

Of particular use in providing background material has been the experience of writing two reports in 2000-2001 for the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) on Commercial Refrigeration in Australia [MEA 2001a, 2001b]. These concerned the introduction of MEPS for remote and self-contained refrigeration products in Australia.

In addition, several interviews have been undertaken with stakeholders in New Zealand, including representatives of cabinet manufacturers, major end-use groups and Government.

Many of the estimates in this report have been made using models constructed for this analysis, based on data provided by industry or sourced in New Zealand.

6. PRODUCT DESCRIPTION

For the purposes of this study, there are two major categories of commercial refrigerated display cabinets: remote and self-contained. Both types may be designed to operate at medium temperature (chilled) or low temperature (freezers).

6.1. Remote Refrigerated Cabinets

By far the largest market for remote cabinets is supermarkets and similar large retail food outlets which operate a number of cabinets. Some large service stations and clubs may also have remote cabinets.

In these instances, compressors supply cooled refrigerant through a pumped system to the cabinets. Most supermarkets have a number of compressors, from 10 to 20, in the 3 hp to 15 hp range (2.2 kW - 11.2 kW) designed to handle part-load conditions efficiently. The system will include one or more condensers, often roof mounted, and a heat recovery heat exchanger, connected to the supermarket's HVAC system. Air-cooled condensers are used in the majority of cases, although some systems use water-cooled or evaporative condensers.

Typically a remote cabinet includes an expansion valve, one or more evaporators and evaporator fans for circulating cold air and/or providing an air curtain in open cases. Many evaporators require periodic defrosting, usually done by an electric resistance heater.

Display cases usually include insulation in exterior panels, between 1.5 - 2 inches thick (37 - 50 mm), and where glass doors are used, these may have two or three layers of glass to reduce heat transfer.

Doors may be fitted with anti-sweat heaters to prevent frozen door seals and glass heaters to reduce condensation. Most cases include lighting, typically fluorescent, to illuminate products on display.

In New Zealand, common types of remote cabinets include:

- Multi-Deck Chilled Cabinets

- Single-Tier Chilled Cabinets
- Glass Door Chilled Cabinets
- Service Chilled Cabinets
- Glass Door Freezer Cabinets
- Wide Island Freezer Cabinets
- Multi-Deck Freezer Cabinets

6.2. Self-Contained Cabinets

Self-contained units include vertical and horizontal cabinets, with glass or solid doors, or are sometimes open. Typical applications include bottle and canned drink merchandisers, ice cream dispensers and prepared food displays.

The major markets for these type of products include corner stores, service stations, take-away food outlets and bottle shops. Self-contained units may also be used in supermarkets to supplement remote refrigerated cabinets, particularly where cabinets are to used in walkways.

Further details on these products are provided below.

6.2.1. Glass Door Merchandisers

These are glass fronted cabinets for displaying and selling goods, primarily packaged beverages. Refrigeration is supplied by a compressor located either at the bottom or top of the unit and powered from a standard power point. Beverage supply companies provide these merchandisers to the vendor. They are therefore designed to maximise sales volume and to present product attractively and at an appropriate temperature. The vendor is responsible for energy running costs.

Units typically comprise of a compressor, two evaporator fans and one condenser fan, and most units have integral lighting for product and logo display. Heat is rejected into the surrounding environment. These units may have a single or double door, which are either triple glazed, or double glazed using a low emissivity coating. Case insulation is approximately 1½ inches thick and provided by blown polyurethane foam.

6.2.2. Solid Door Freezers and Refrigerators

These are freezers and refrigerators commonly used in restaurants and cafés, and other food preparation businesses where the storage of foodstuffs is required. They may be vertical or horizontal ('coffin' type).

Freezers have a compressor, one evaporator fan and one condenser fan. Cases and doors are typically made of stainless steel and contain 2 to 2½ inches of blown polyurethane insulation. Anti-sweat heaters are included in the door surround to prevent condensation and freezing of the seal, and an electric defrost heater is located next to the evaporator coil. Most units have integral lighting in the form of an incandescent lamp switched to operate when the door is open.

Solid door refrigerators are similar in construction to freezers, except that the most common version has two doors. Typically a 1/3 hp compressor is used, and these larger units may have two integral 25W lamps to supply illumination.

6.2.3. Service Chilled Cabinets

Chilled food service cabinets are used in food retail outlets to display and facilitate the serving of foodstuffs. Typically they are used in delis, supermarkets, sandwich bars, and similar outlets for the display of cheeses, meats and prepared dishes.

Most products comprise a metal chest housing the compressor, condenser and fans, with one or more display counters above this and surrounded by a glazing. The glazing protects the foodstuff but allows staff to handle the refrigerated products through an opening on one side, which may be closable by means of a sliding glazed screen. Often the service side of the unit is simply unglazed to allow for easy access. Units typically have integrated lighting to increase the visibility of the food on display.

6.2.4. Ice Cream Displays

These are freezer cabinets for retailing ice cream and other impulse frozen confectionary products, usually with a transparent top lid which can be slid open for access. The large majority are supplied and owned by ice cream suppliers.

Typically these units comprise an insulated box and a 1/3 hp compressor, located at the bottom rear of the chest. Generally no lighting is provided.

7. MARKET PROFILE

The commercial refrigerated cabinet market is dominated by a small number of medium-large scale manufacturers. These are mixture of New Zealand owned, and parts of trans-national companies.

In addition, there are many small companies which manufacture for niche markets and in small volumes.

Most manufacturing in New Zealand includes a significant proportion of imported componentry.

The major companies involved in manufacturing, assembly and import/export activities in this market are shown in Table 3.

Table 3: Major New Zealand Refrigeration Companies

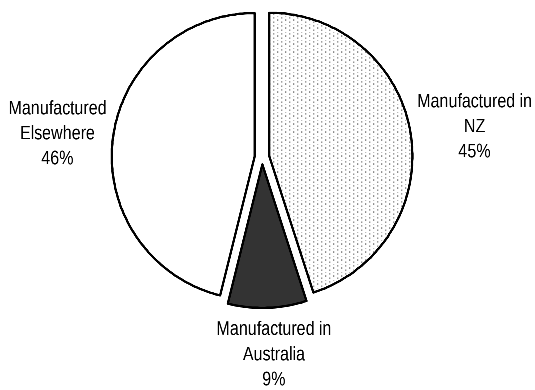
Designation	Remote	Self-Contained
Manufacturers	McAlpine Hussmann	Skope Industries Ltd.
	Future Products Group	Future Products Group
	-	McAlpine Hussmann
	-	White Refrigeration Ltd.
	-	Refrigerated Displays Ltd.
Importers/Exporters	Transcold Industries	Transcold Industries
	Arneg (NZ) Ltd.	Arneg (NZ) Ltd.
	-	Arrow Refrigeration Ltd.
	RSL	RSL
	Cowley Refrigeration	Cowley Refrigeration Ltd.

7.1. Remote Cabinets

7.1.1. Annual Sales

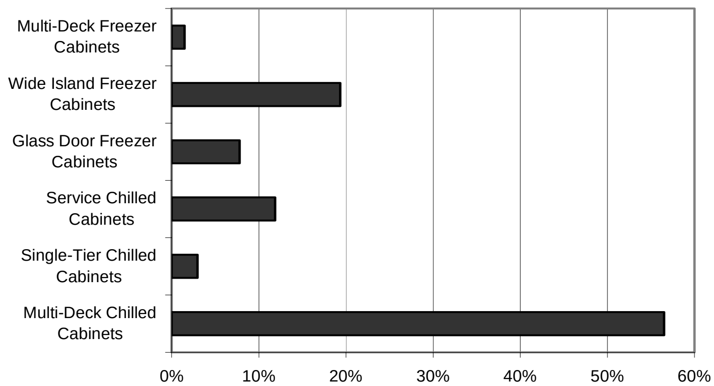
Based on industry figures the market for remote cabinets in New Zealand is approximately 1,300 units per annum, over 95% of which is estimated to go to the supermarket sector. As shown in Figure 3, nearly half of these cabinets are sourced in New Zealand, with the remaining coming from overseas.

Figure 3: Sources of Remote Refrigerated Cabinets



Multi-deck chilled cabinets comprise the largest share of the remote market, as illustrated in Figure 4.

Figure 4: Market Share of Remote Refrigerated Cabinets in New Zealand, by Type



7.1.2. Sales Trends

The forecast is for a steady or declining market in New Zealand, based a contracting supermarket sector, and the increased use of refurbished cabinets. This is despite the tendency for supermarkets to carry more chilled and frozen foodstuffs (e.g. Pre-prepared meals, etc).

7.1.3. Life expectancy

The life expectancy of remote cabinets varies from 7 to 15 years, although the trend is to gain longer service life through refurbishment. This may be minor and involve only a steam clean and painting, or the provision of new panelling, or sometimes a mechanical overhaul including new TX valves, motors and lamps.

7.1.4. Stock

Based on the data presented above, the stock of remote refrigerated cabinets in New Zealand is estimated to be between 12,000 and 15,000 units.

7.2. Self-Contained Cabinets

7.2.1. Annual Sales

Information provided by sources in the New Zealand Refrigeration industry estimate annual sales of self-contained refrigerated cabinets to be approximately 6,600 units per year. These are distributed by type of cabinet according to Table 4.

Table 4: Sales of Self-Contained Refrigerated Cabinets in New Zealand, by Type

Type	Quantity
Glass Door Merchandiser	5,000
Solid-Door Refrigerator	500
Solid-Door Freezer	300
Chilled Food Service	150
Ice-Cream Merchandiser	650

Over half of these are manufactured in New Zealand, with 25% sourced from Australia and a further 325% imported from other overseas sources.

7.2.2. Sales trends

Industry forecasts that the market is growing within New Zealand for some products between 5% and 10% per annum, partly due to the increased number of prepared food outlets, including takeaways, cafés and restaurants. Data from Statistics New Zealand show that the number of such businesses increased by 2-3% from 2001 to 2003.

7.2.3. Life expectancy

The life expectancy of self-contained cabinets varies from 8 to 15 years, depending upon the type.

7.2.4. Stock

Based on the data presented above, the stock of self-contained refrigerated cabinets in New Zealand is estimated to be between 70,000 and 85,000 units. These are distributed by technology as shown in Table 5.

Table 5: Stock of Self-Contained Refrigerated Cabinets in New Zealand, by Type

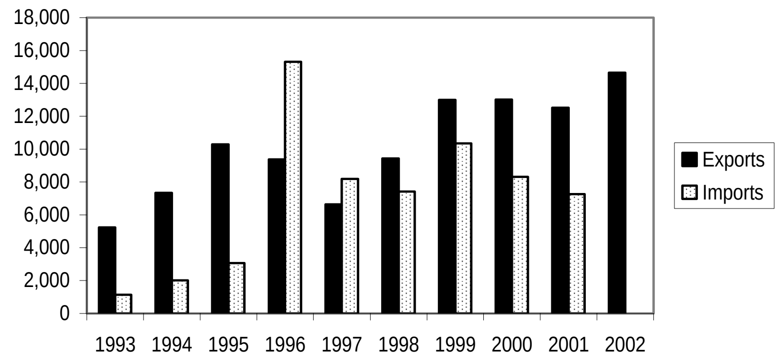
Type	Quantity
Glass Door Merchandiser	55,000
Solid-Door Refrigerator	8,900
Solid-Door Freezer	4,000
Chilled Food Service	2,100
Ice-Cream Merchandiser	8,200

8. IMPORTS, EXPORTS AND OVERSEAS INDUSTRY LINKS

Analysis of import and export data provided by Statistics New Zealand general shows that New Zealand is a nett exporter of commercial refrigeration cabinets, and that there has been a substantial downturn in imports since 1999 (see Figure 5).

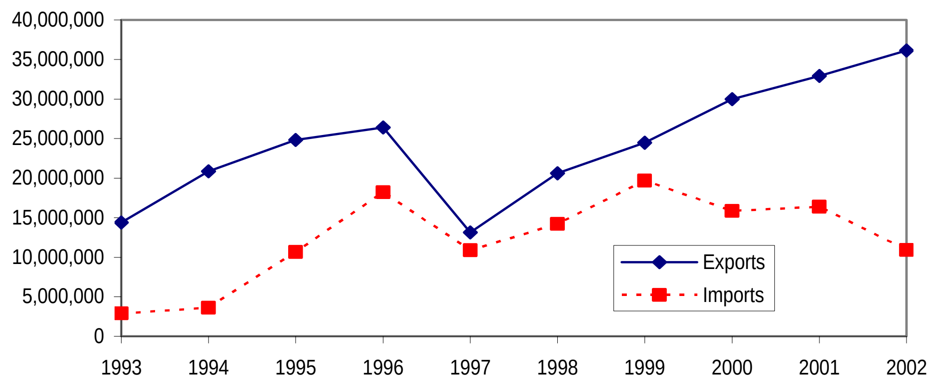
Note that these figures do not include the import of component parts for assembly in New Zealand, and we note that one major refrigeration business, McAlpine Hussmann, import components from their factory in China and cabinets are assembled for the New Zealand market, or exported.

Figure 5: Number Exports and Imports of Refrigerated Cabinets, New Zealand, 1993-2002 [SNZ 2003]



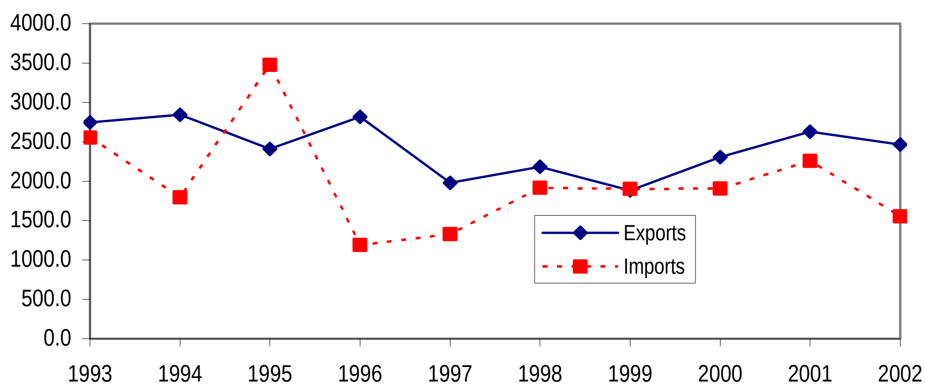
Consistent with the increase in exports, shows that the overseas sales of refrigerated cabinet are now worth approximately NZ$35 million per annum and rising rapidly.

Figure 6: Value of Exports and Imports of Refrigerated Cabinets, New Zealand, 1993-2002 [SNZ 2003]



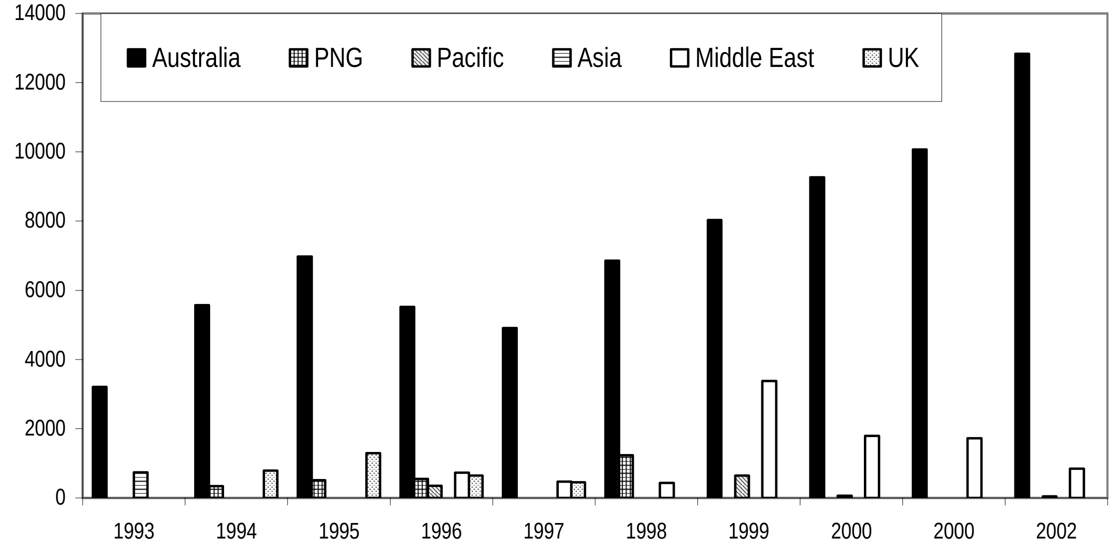
The average value of exported cabinets has been steady or falling slightly since the 1990's. It is likely that this reflects the growing proportion of contained cabinets in the number of products exported, although it may also reflect the value of the New Zealand currency.

Figure 7: Average Value of Refrigerated Cabinet Units, Imports and Exports, New Zealand, 1993-2002 [SNZ 2003]



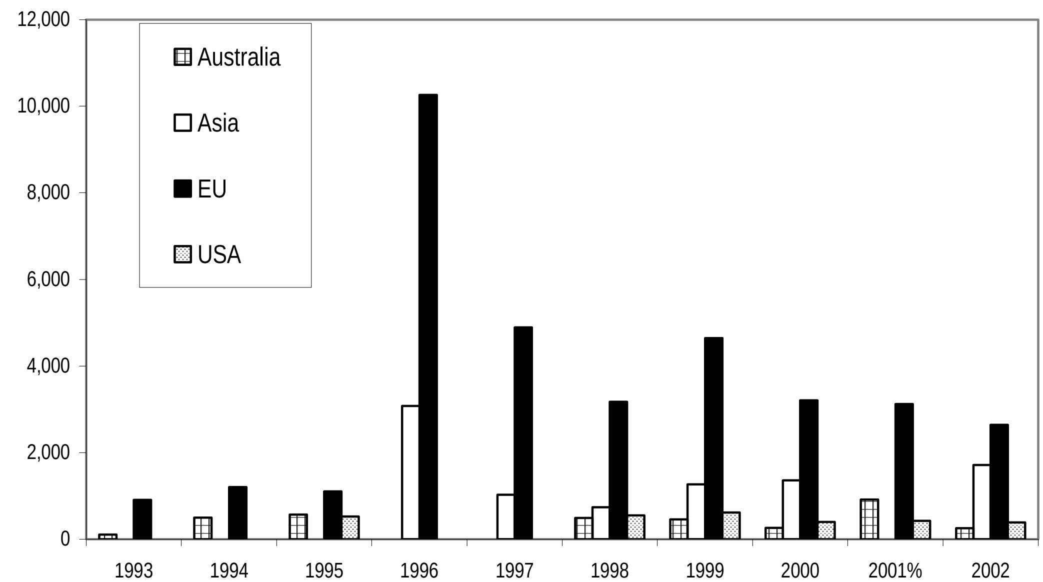
In terms of export destinations, the vast majority of cabinets manufactured or assembled in New Zealand are destined for Australia. In terms of quantities, the export market is nearly twice the size of the indigenous market or refrigerated cabinets.

Figure 8: Destination of Exports from New Zealand, Refrigerated Cabinets, 1993-2002 [SNZ 2003]



With regard to imported cabinets, the major source has been the EU, primarily Italy and Denmark, although recent years has seen a growth in imports from China (see Figure 9).

Figure 9: Origin of Imports to New Zealand, Refrigerated Cabinets, 1993-2002 [SNZ 2003]

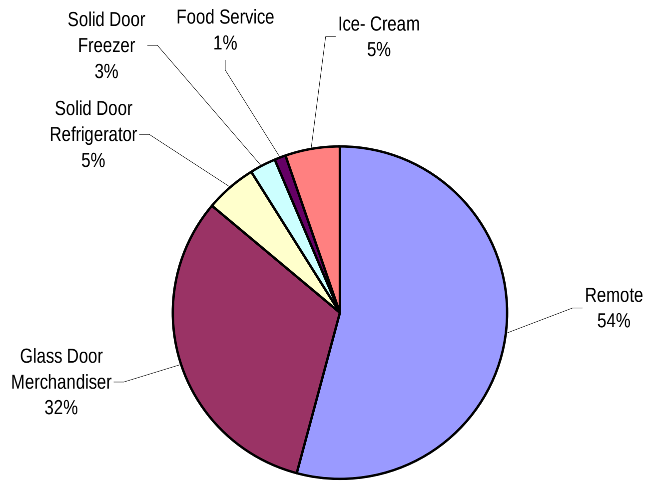


9. ENERGY CONSUMPTION AND POTENTIAL FOR SAVINGS

9.1. Current energy consumption and greenhouse emissions

Based on average energy consumption data per type of cabinet [MEA 2001a,b], the total energy consumed by refrigerated cabinets in New Zealand in 2002 is estimated to be 780 GWh per annum. Just over half of this is estimated to be used in remote cabinets, while 32% is consumed by self-contained glass door merchandisers. A breakdown by cabinet type is shown in Figure 10.

Figure 10: Distribution of Total Energy Consumption by Refrigerated Cabinets, New Zealand, by Type



Assuming a greenhouse gas coefficient of 468 kt CO_2-e per GWh electricity, the annual greenhouse emissions are estimated to 350 kt CO_2–e in 2002.

9.2. Business as usual scenario

Future greenhouse emissions in this sector are a function of the penetration of appliances, and the efficiency of these appliances. These issues are discussed below.

9.2.1. Existing market trends

As noted previously, the market for remote cabinets is expected to be steady or slowly declining in New Zealand, while the market for self-contained cabinets is growing in the region of 5%to10% per annum. Given that emissions are estimated be shared almost equally between these categories, the overall trend is likely to see an increase in stock and a corresponding increase in emissions. Overall emissions growth may be in the region of 5% per year for the foreseeable future.

9.2.2. Likely natural technological development

Suppliers to supermarkets have indicated that some degradation in the sales of more efficient cabinets has occurred in recent years due to competition on first costs (the capital cost of the units). This trend is unlikely to continue, however it suggests that investment in more efficient designs of remote cabinets will not be driven by the local market, and that efficiency levels may remain static.

The situation in self-contained products appears to be the reverse. Growing markets and pressure from one of the most largest clients (Coca Cola Amatil) to achieve significant efficiency improvement, are driving considerable technology improvements in new glass door merchandisers.

9.2.3. Conclusions

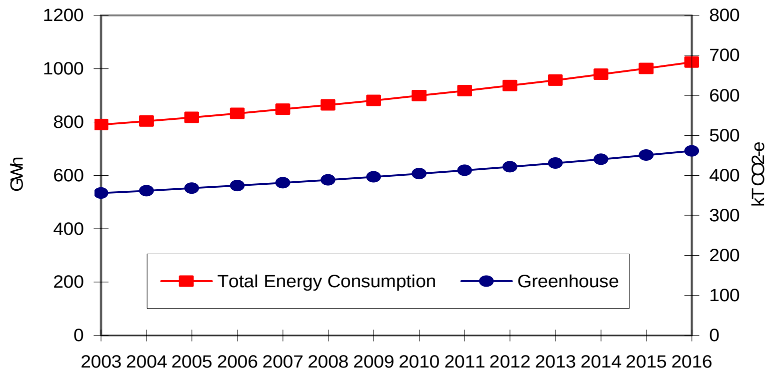
Based on these factors alone, greenhouse emissions from commercial refrigerated cabinets in New Zealand are estimated to grow, from 350 kt CO_2-e in 2002, to 460 kt CO_2-e in 2016. This is illustrated in Figure 11.

It should be noted that although this modelling includes the introduction of progressively more efficient products throughout this period, because of the size of the existing stock and its lifetime, the impact on total energy consumption is small.

The increase in the number of the stock is significant in driving emissions growth and no allowance has been made for saturation of the market, although this may become a relevant factor.

The greenhouse coefficient used has remained constant throughout the period, and we note that discussions are underway to increase the use of fossil fuel electricity generation in New Zealand. This may lead to an increase in the greenhouse intensity of electricity, thereby increasing the total emissions in Figure 11.

Figure 11: Trend in Energy Consumption and Greenhouse Emissions from Refrigerated Cabinets, New Zealand, 2003-2016



9.3. Scope for saving energy and reducing greenhouse emissions

Recent reports produced for NAEEEC on commercial refrigeration equipment [MEA 2001a,b], found that the technical potential for energy savings was between 15% and 40% depending upon the technology.

These include improvements to motors, fan blades, lighting, insulation levels, anti-sweat and defrost facilities.

It should be noted that these estimates assume that the basic design of commercial refrigeration products remain relatively unchanged. Changes in the attitudes of some customers could lead to fundamental changes in the types of products in demand, and this could impact on the potential to save energy. For example, if it became acceptable for supermarkets to have doors on cabinets that are currently open, this would lead to considerable savings, at relatively low cost. Similarly if merchandisers used less illumination, this too would cut energy consumption.

9.4. Market Failure

The typical evidence used to determine whether there is market failure is if consumers (or some other sector of the economy) are observed to be acting in a manner which is not economically rational. Market failure can exist, for example, when a party has insufficient information on which to make a financially reasonable judgement.

In relation to this subject, there are considerable savings in running costs which can be made through the selection of more efficient refrigerated cabinets. In many cases, these savings are sufficient to payback any increased capital costs within a reasonable time. Therefore, selecting higher efficiency refrigerated cabinets would appear to be an economically rational action. 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 in a relatively short time (2-4 years). It is likely that most supermarkets make this decision knowingly, reflecting their priorities at the time. It is not so much evidence of market failure, but more of the low value placed on future savings in running costs, or scepticism in the accuracy of predicted savings.

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 with soft drinks or ice-creams. 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 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 similar situations.

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

Overall, there appears to be some market failure, however there is greater evidence of market imperfection as a result of consumers devaluing future savings. As with other energy efficiency activities, their value to the consumer is currently reduced as a result of the exclusion from the cost of energy of any environmental externalities attributable to energy usage. The inclusion of costs of tackling climate change, for example, would clearly provide a greater financial incentive to save energy and reflect society's concern in the preservation of the environment.

10. OPTIONS FOR ACHIEVING OBJECTIVES

A number of policy options have been considered for the purpose of achieving the desired greenhouse savings. These include both measures which require regulation and those which rely upon voluntary action, and are discussed below.

10.1. Regulatory measures

10.1.1. Mandatory MEPS

The option selected by the Australian Government imposes a mandatory MEPS level on the industry, enshrined in the Australian Standard AS 1731. This Standard includes a test methodology in Parts 1–13, and the energy performance requirements in Part 14.

The development of a MEPS regime for refrigerated cabinets in Australia has been underway since 2000, and the parts of draft Standard (DR03206-03219) have recently been released for public comment. This period is now closed and is intended that the revised AS 1731 comes into effect from 1st April 2004.

Previous versions of AS 1731 have been based on the British Standard BS EN 441, and the revisions have sought to maintain a close relationship with the updated version of the British Standard, now a draft International Standard, ISO/DIS 23953 -2003 E.

Mandatory MEPS are designed to remove the worst performing products from the market, rather than promote the most efficient. As the ability to increase performance increases with new technology or markets, the MEPS levels may be progressively increased, with sufficient lead times to enable manufacturers to adapt.

Consistent with this, the principle used to set Australian MEPS levels has been to relate these to the performance of products current in the marketplace. A number of categories for refrigerated cabinets have been established, for both remote and self-contained types, and 'average' and spread of performances within each category has been analysed. Based on this information, MEPS levels have been set, typically at around 120% of the average performance within each category.

Although AS1731 has been in existence for some time, testing to this standard has not been consistently undertaken on all products. Although some larger clients required performance characteristics to be provided, these had not been consistently applied or based on uniform test conditions. Some performance data used in marketing materials has been based on calculation. As a result the process of collecting accurate performance data has required a number of selected tests to be undertaken to the new standard. The MEPS levels contained in the draft standard are preliminary at this stage, and will be finalised around August 2003, when a Regulatory Impact Statement (RIS) will be produced.

At the behest of Australian Industry, the Australian Government has decided to proceed with an early adoption date for MEPS, on the understanding that the initial levels will not be too onerous. This will allow industry to become used to the regular testing of products. The Government has agreed that more stringent MEPS levels will not be adopted until at least 4 or 5 years following the date of implementation, and that it is likely that the High Efficiency levels will become the benchmark for the new MEPS levels at that time.

Based on current modelling of products in the Australian marketplace, the proposed MEPS levels will prohibit the sale of a number of products, typically the one or two worst performing products in each category. Until the RIS has been undertaken, the impact of this on overall energy consumption is not known, however it is likely to impact on approximately 10%-20% of products. Cabinets with performances close to the MEPS threshold are likely to be improved in order to comply, while products which currently fail by a larger margin will be withdrawn.

After discussions with New Zealand manufacturers it appears that the impact in New Zealand would be similar.

In Australia the introduction of MEPS has been supported by industry on the basis that is applies to all products in the market. This is an important feature of mandatory MEPS in a very competitive industry where customers are not always willing to pay any increased capital costs for improved performance. In this environment, manufacturers with superior products have been disadvantaged. The introduction of MEPS imposes the same costs on all competitors and creates the 'level playing field'.

As mentioned previously, while the industry is dominated by a small number of well established companies, there are a large number of smaller operations, which manufacture in low volumes. Some of these undertake minimal product testing and the requirement for performance testing in a MEPS regime is likely to result in a general improvement to products.

10.1.2. Mandatory Labelling

Energy performance labels are designed to enable consumers to select the more efficient appliances or equipment in any category, and to give more efficient products a marketing advantage. Labels therefore provide manufacturers with an incentive to develop more efficient products.

Labelling works best when there is good differentiation in the market, i.e. a spread of performances, and where customers are reactive to information on the energy performance of products.

For commercial refrigerated cabinets, there appears to be a good spread of performance in most categories however the impact of energy labels may be limited. For remote cabinets, most supermarkets select products on aesthetic and size criteria, and it is unlikely that performance labels will alter purchasing patterns. The larger chains are generally fairly well informed regarding the performance of different cabinets.

The majority of self-contained units are owned by packaged beverage companies, such as Coca Cola Amatil or Cadbury Schweppes and placed in stores. The running costs are the responsibility of the store owner and not the equipment purchaser, and although the store owner may wish for more efficient equipment, they are unable to influence the products purchased. This is also true for most ice cream cabinets.

Energy labels may have some influence on some of the remainder of the market where cabinets are owner operated. However since there is no compunction to purchase higher rated cabinets there is no certainty that purchasing decisions will change.

The new Australian standard does introduce a 'High Efficiency' level for each class of cabinet, although this will not be presented as a label. Products which do not meet this threshold will be prevented from being promoted as high efficiency. The aim of this is to provide a marketing advantage to the best performing products and provide an incentive for manufacturers to develop more efficient models.

10.2. Non-regulatory measures

10.2.1. Voluntary MEPS & Labelling

It is unlikely that voluntary MEPS or Labelling would be taken up to any great extent since there would be no surety that competing companies would incur the same burden of costs e.g. for testing.

10.2.2. Industry Agreements

Bilateral or multilateral agreements between Government and industry associations or larger companies are an alternative method of gaining a commitment to undertake actions. For example a customer may agree to purchase of more efficient cabinets. Typically, the aim of this exercise is to promote 'best practice' and therefore has a different aim to MEPS.

With the commercial refrigerator market dominated by a reasonably small number of purchasers, such as large supermarket chains and the soft drink beverage companies, there is the opportunity to have a manageable process for reaching agreements.

It should be noted that this type of program does not conflict with MEPS. Indeed, the introduction of High Efficiency levels provide a suitable identifier of 'best practice' products which could be called up in any industry agreement. A typical agreement would commit purchasers to buying these 'High Efficiency' products for a specified period of time.

Industry agreements may therefore be considered alongside the introduction of MEPS, however it should be recognised that they are entered into voluntarily and usually are an expression of good intentions. There are few sanctions which can apply and parties may leave the agreement if and when they feel required to do so.

10.2.3. Information Programs

Information programs can include a wide range of activities, such as the dissemination of general leaflets to the production of targeted 'good practice' guides for specific industries. In this instance the latter is likely to be the most effective, and could be considered for audiences which are least knowledgeable. For example, a set of leaflets for corner stores, restaurants and take-way outlets could be produced which gives examples of refrigerator savings and guidelines on the running costs that operators could expect to pay.

The drawback to this type of program is that it is difficult to predict what proportion of the market will act upon this information and it will require extensive follow-up monitoring to assess.

As with industry agreements, it is the type of activity which would complement MEPS rather than be a substitute for regulation.

11. OVERSEAS REGULATORY ACTIVITY AND EXPERIENCE

A number of countries have implemented standards for commercial refrigeration products and these are described below.

11.1. Australian Standard

The development of a MEPS regime for refrigerated cabinets in Australia has been underway since 2000, and the parts of draft Standard (DR03206-03219) have recently been released for public comment. This period is now closed and it is intended that the revised AS 1731 comes into effect from 1st April 2004.

Previous versions of AS 1731 have been based on the British Standard BS EN 441, and the revisions have sought to maintain a close relationship with the updated version of the British Standard, now a draft International Standard, ISO/DIS 23953-2003 E. Table 6 shows the MEPS and High Efficiency levels contained in DR03206-03219 however these will be altered slightly before final publication. Levels for self-contained cabinets are yet to be finalised, but all final levels will be published by mid-late 2003. (The type of categories are explained in Appendix 2)

Table 6: Remote Commercial Refrigerated Cabinets MEPS and High Efficiency Levels

Type	MEPS Maximum energy consumption TEC/TDA (kWh/day/m^2)	High Efficiency Level Maximum energy consumption TEC/TDA (kWh/day/m^2)
RS1 - Unlit Shelves	12.04	8.03
RS1 - Lit Shelves	15.32	10.21
RS2 - Unlit Shelves	13.00	8.91
RS2 - Lit Shelves	15.10	10.07
RS3 - Unlit Shelves	12.75	9.28
RS3 - Lit Shelves	14.84	10.79
RS4 - Glass Doors	9.16	7.49
RS4 – Solid Door	No value	No value
RS5 – Glass Door	No value	No value
RS5 – Solid Door	No value	No value
RS6 - Gravity Coil	10.87	8.89
RS6 - Fan Coil	21.36	12.46
RS7 – Gravity Coil	No value	No value
RS7 - Fan Coil	16.54	11.03
RS8 - Gravity Coil	13.84	8.52
RS8 - Fan Coil	18.61	10.86
RS9 – Gravity Coil	No value	No value
RS9 - Fan Coil	12.51	7.29
RS 10 - High	9.29	8.41
RS 10 - Medium	9.38	8.49
RS 10 - Low	13.19	11.94
RS11	32.14	29.08
RS12	52.81	43.21
RS13 -Solid sided	15.68	12.12
RS13 -Glass sided	16.27	12.57
RS14 -Solid sided	14.52	11.88
RS14 -Glass sided	18.76	12.51
RS15 – Solid Door	No value	No value
RS15 -Glass Doors	32.77	21.85
RS16 – Solid Door	No value	No value
RS16 -Glass Doors	37.11	21.65
RS17 – Glass Door	No value	No value
RS17 – Solid Door	No value	No value
RS18	40.39	33.05
RS19	28.73	23.51

11.2. Canadian Standards

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).

11.2.1. Commercial Refrigerated Display Cabinets and Merchandisers (C657-03)

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].

This standard applies to remote 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 (e.g. cut flowers).

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

C657 sets the maximum Specific Daily Energy Consumption (SDEC), as shown in Table 7, where SDEC is the daily energy consumption associated with, and required for operating, a unit length of a refrigerated display cabinet. The SDEC includes the minimum standard lighting configuration for the cabinet and electric defrost and high efficiency fan options where provided.

$$SDEC = E_C + E_{RRS}. \quad (kW{\circ}h/m)/day)$$

E_C – (kWh/m)/day) - the daily energy consumption of the display cabinet.

E_{RRS} – (kWh/m)/day) - the daily energy consumption of the remote refrigeration system.

The daily energy consumption of the remote refrigeration system (E_{RRS}) shall be calculated in accordance with the following formula:

$$E_{RRS} = (Q/EER) \times (24/1000) \quad (kW{\circ}h/m)/day$$

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/(W◦h) – see Table 8.

Table 7: Maximum SDEC Ratings

Class	Product Temperature °C	SDEC kWh/(m/day) ((kW◦h/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 8: EER Values for R-404a

Evaporating Temperature °C	EER Value Btu/(W◦h)
–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.

11.2.2. Food Service Refrigerators and Freezers (C827-98)

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

C827 sets the maximum annual energy consumption for products, as shown in the following tables.

Table 9: Maximum Annual Energy Consumption: Refrigerators – Solid Doors

Type	**Annual Energy Consumption (AEC_{max}), 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/undercounter	87 V + 780	79 V + 210

Note: V is the refrigerator volume measured in ft^3.
** insufficient product data available*

Table 10: Maximum Annual Energy Consumption: Refrigerators – Glass Doors

Type	**Annual Energy Consumption (AEC_{max}), 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/undercounter	174 V + 1560	158 V + 520

Note: V is the refrigerator volume measured in ft^3.

Table 11: Maximum Annual Energy Consumption: Freezers – Solid Doors

Type	**Annual Energy Consumption (AEC_{max}), 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/undercounter	367 V + 2200	334 V + 400

Note: V is the refrigerator volume measured in ft^3.
** insufficient product data available*

Table 12: Maximum Annual Energy Consumption: Freezers – Glass Doors

Type	**Annual Energy Consumption (AEC_{max}), 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/undercounter	734 V + 4400	668 V + 800

Note: V is the refrigerator volume measured in ft^3.
** insufficient product data available*

Table 13: Maximum Annual Energy Consumption: Refrigerator-Freezers – Solid Doors

Type	**Annual Energy Consumption (AEC_{max}), kWh/y**	
	Standard Efficiency	High Efficiency
Reach-in	92 AV + 1900	84 AV + 1160

** insufficient product data available*

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

11.3. 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.

11.3.1. 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.

11.3.2. Energy Star

The US EPA Energy Star provides an endorsement label for commercial solid door refrigerators, refrigerator-freezers and freezers [US EPA 2003].

Qualifying products must meet the requirements in the following table:

Table 14: Specifications for ENERGY STAR Qualified Commercial Solid Door Refrigerators and Freezers

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

Note: V = Internal volume in ft 3

AV = Adjusted volume = (1.63 x freezer volume in ft 3) + refrigerator volume in ft 3

Products tested to ASHRAE Standard 117-1992

Energy Star also has an endorsement program for refrigerated beverage vending machines.

11.3.3. 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:

- 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 15: Wine Chillers for use by an individual

Appliance (1)	Maximum Annual Energy consumption (kWh)
Wine Chillers with manual defrost	13.7V + 267
Wine Chillers with automatic defrost	17.4V + 344
V= volume in ft^3	

Table 16: Freezers, for products exceeding 30 ft3 and not exceeding 39 ft3, manufactured after 1 March 2003.

Appliance (2)	Maximum Annual Energy consumption (kWh)
Upright Freezers with manual defrost	7.55AV + 258.3
Upright Freezers with automatic defrost	12.43AV + 326.1
Chest freezers	9.88AV + 143.7
AV= adjusted volume in ft^3= 1.73 x freezer volume (ft^3)	

Table 17: 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^3 AV= 1.63 x freezer volume (ft^3)			

* Note: Does not include preparation tables, refrigerated buffet and preparation tables or work tops.

11.4. South Africa

South Africa has a standard applicable to remote and self-contained commercial refrigerated food display cabinets (SABS 1406:1998), 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.

11.5. Europe

11.5.1. EN441 Test Method

EN441 (1995, updated in 1999 and currently being updated further) is the basis for the Australian Standard AS 1731 and provides a comprehensive testing regime for refrigerated display cabinets which is widely used throughout the industry.

The latest version of EN441 (PrEN-441-2001E) has now been issued for consideration as an International Standard ISO/DIS 23953-2.

It should be noted that 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.

11.5.2. EUROVENT Database

A technical methodology to determine energy labels for integral and remote cabinets has been defined, drawing upon data generated by the existing operational EN441 testing standard. This has been proposed as the basis for a Europe-wide labelling scheme. EUROVENT, the industry organisation in Europe, operates a voluntary certification program for remote display cabinets, providing data on key characteristics participating products. Tested according to EN441, energy information provided includes the Refrigeration Electrical Energy Consumption (REC kWh/day) and Direct Electrical Energy Consumption (DEC with 12 hour lighting kWh/day).

The following tables give average figures for the European market. Based on field experience and manufacturing numbers the figures have been collected and averaged.

Table 18: Eurovent Averages: Remote Cabinets [Eurovent 2003]

Cabinet family	Cabinet temperature class	European average TEC/TDA kWh/day.m²
RHC1	3H	6,2
RHC1	3M2	6,7
RHC3, RHC4	3H	5,5
RHC3, RHC4	3M2	5,8
RVC1, RVC2	3H	10,1
RVC1, RVC2	3M2	12,3
RVC1, RVC2	3M1*	13,4
RVC3	3H	13,8
RHF3, RHF4	3L3	13,0
RVF4	3L1	28,5
RYF1	3L3	29,0

(Note that these values are normalised for 2.5m (8ft) cabinet length.)

(This table was determined in 1997 (* = 2001) taking into account cabinets manufactured and sold in Finland, France, Germany, Italy, Sweden and the United Kingdom.)

Table 19: Eurovent Averages: Self-Contained Cabinets [Eurovent 2003]

Cabinet family	Cabinet temperature class	European average TEC/TDA kWh/day.m²
IHC1, IHC2, IHC3, IHC4	3H2	8,2
	3M2	9,6
IVC1, IVC2, (IVC3)	3H2	17,3
	3M2	21,0
IVC4	3M1	13,9
IHF1, IHF3, IHF4	3L3	21,5
	3L1	36,0
IHF5, IHF6	3L1	17,8
IVF4	3L1	30,5
IYF1, IYF2, IYF3, IYF4	3L3	32,3
IYM6	3H2/3L1	25,3

(This table was determined in 2001 taking into account manufactured and sold cabinets in Finland, France, Germany, Italy and Spain.)

11.5.3. Dutch Labelling Scheme

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_2 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.

11.5.4. UK Enhanced Capital Allowance Scheme

In 2001, the UK Government introduced an enhanced capital allowance scheme 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.

11.5.5. UK EPIC Performance Guidelines

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 20: 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 21: Performance Targets for Remote Cabinets [Tait 2000, 2002]

RCV1 & RCV2 for M1	**Minimum Standard Target**	**Best Practice Target**
Year	TEC	TEC
2002	79.14	48.47
2006	59.35	39.57
2010	51.93	29.68
RCV1 & RCV2 for M2	**Minimum Standard Target**	**Best Practice Target**
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
RCV1 & RCV2 for H1	**Minimum Standard Target**	**Best Practice Target**
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
RCV1 & RCV2 for H2	**Minimum Standard Target**	**Best Practice Target**
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 22: Performance Targets for Self-Contained Cabinets [Tait 2000, 2002]

ICV1 & ICV2 for M2	Minimum Standard Target	Best Practice Target
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
ICV1 & ICV2 for H2	**Minimum Standard Target**	**Best Practice Target**
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

11.6. Trade issues

The Australian Government has stated that MEPS level will come into force on 1st April 2004 and following this date all products sold within Australia must meet the required MEPS levels.

However, under the Trans Tasman Mutual Recognition Agreement (TTMRA), which came into force in 1997, products manufactured or imported through New Zealand will be exempt from these regulations, unless Australia seeks an exemption.

If New Zealand decides not to pursue MEPS for commercial refrigerated cabinets, it is likely that Australia will seek an exemption to TTMRA on the grounds that not to do so would have a significant impact on the effectiveness of Australian MEPS. As noted previously, New Zealand manufacturers currently supply a considerable number of cabinets to markets in Australia.

Any decision by the New Zealand Government with respect to MEPS needs to consider the practical and political issues relating to the TTMRA. The New Zealand Energy Efficiency and Conservation Authority and the New Zealand Ministry for the Environment has recognised that the TTMRA is relevant to the development of energy standards, and indeed specifically acknowledged this in their consultation document on the implementation of MEPS:

> *'It is in any case generally desirable under the Trans-Tasman Mutual Recognition Arrangement (TTMRA) for New Zealand and Australian regulations affecting trade to be in broad alignment." EECA (2001), p7.*
>
> *"New Zealand's decisions to apply MEPS and energy labelling regimes along similar lines to those in Australia are expected to facilitate trade. It is hoped that this will prevent the implementation of permanent exemptions to TTMRA. The MEPS and energy labelling implementation regime proposed in this document is consistent with the Government's direction to align our regime with that of Australia." EECA (2001), p10.*

12. COST / BENEFIT ISSUES

12.1. Relationship between Cost and Efficiency

The relationship between cost and efficiency does not appear to be straight-forward. This is due to the fact that there are a number of incremental improvements that can be made to most cabinets at only a small cost. Lighting is a typical example. Where the market demands, and where sales volumes are high, these extra costs appear to be negligible. Coca Cola Amatil has stated that their newest glass door cabinet has a significantly improved performance without costing more than the model it replaced.

On the other hand, major improvements, such as achieved through moving to new types of motors (permanent split capacitor or electronically commutated) or advanced glazing options, have higher costs at the moment. In time when such technologies become more mass produced their costs may fall.

A further consideration is the worldwide trend towards more efficient refrigerated products. As noted in previous section, most developed countries now have programs designed to improve the performance of commercial refrigerators. This will create increased demand for more efficient designs and components which will ultimately lead to lower unit costs.

Based on available information, it seems reasonable to say that steady improvement can be made with only a small cost impact, perhaps in the range of 1%-2%, and that this could be sustained for a number of years. Expecting industry to make rapid and significant improvements without adequate advanced warning is likely to result in substantial cost increases.

12.2. Potential Savings

12.2.1. Energy Savings

In view of the uncertainties concerning the turnover of stock in New Zealand and the final levels adopted by Australia, it is reasonable to estimate two scenarios for potential energy savings.

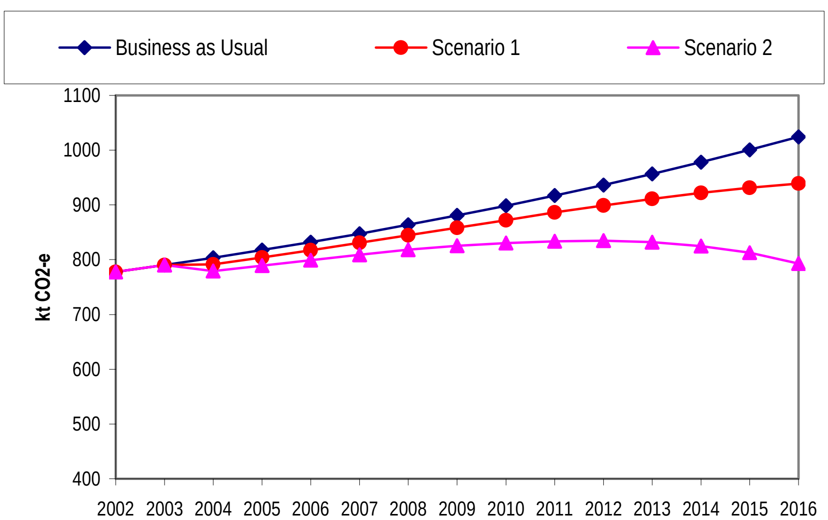
Scenario 1 describes a situation where the turnover of stock is at the lower bound suggested in 7.1.3 and 7.2.3, and the impact of MEPS levels on new New Zealand models is modest. Although MEPS levels are assumed to become increasingly stringent over time, the impact of these are also modest. The overall impact of this scenario is an energy saving of 1.5% in 2004, growing to just over 8% in 2016.

Scenario 2 describes the impact of MEPS levels where the stock turnover is at the upper bound suggested in 7.1.3 and 7.2.3, so influencing the performance of a greater proportion of products. In this case, the overall energy savings grow from 3% in 2004 to nearly 23% in 2016.

These estimates are derived from modelling undertaken in Australia, and taking into account discussion with New Zealand manufacturers. For example Coca Cola Amatil has a global aim of reducing the consumption of their cabinets by 40% over the next ten years.

The results of these scenarios are shown in the following figure, with Scenario 1 yielding cumulative saving during the period of 450 GWh electricity and Scenario 2 yielding a total reduction of 1200 GWh.

Figure 12: Estimated Energy Savings Resulting from Adoption on MEPS



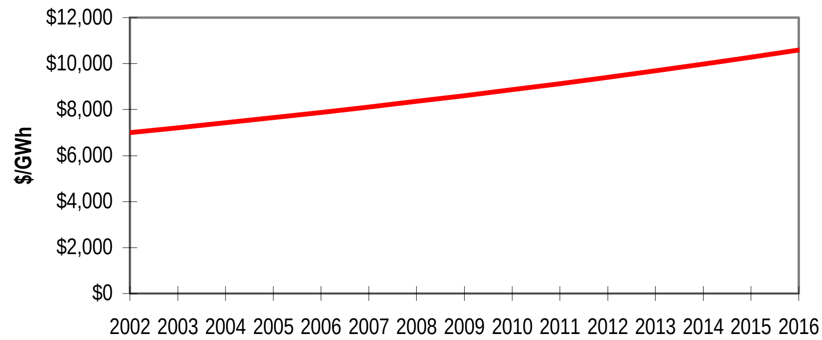
12.2.2. Economic Benefits

The current average price paid by operators of commercial refrigerated cabinets for electricity is assumed to be 7.0 c/kWh. While it is recognised that some major supermarket chains pay less than this at present, many small operators such as corner store owners, pay more.

Given the discussion on electricity supply in New Zealand and the need for new supply options, it is considered likely that the cost of energy will rise gradually to reflect the cost of investing in new generating capacity. The future cost of electricity assumed for this analysis is shown in

Figure 13.

Figure 13: Estimated Price of Electricity



For the two scenarios described, the estimated total annual savings to running costs is between $1 million and 2.5 million in 2016.

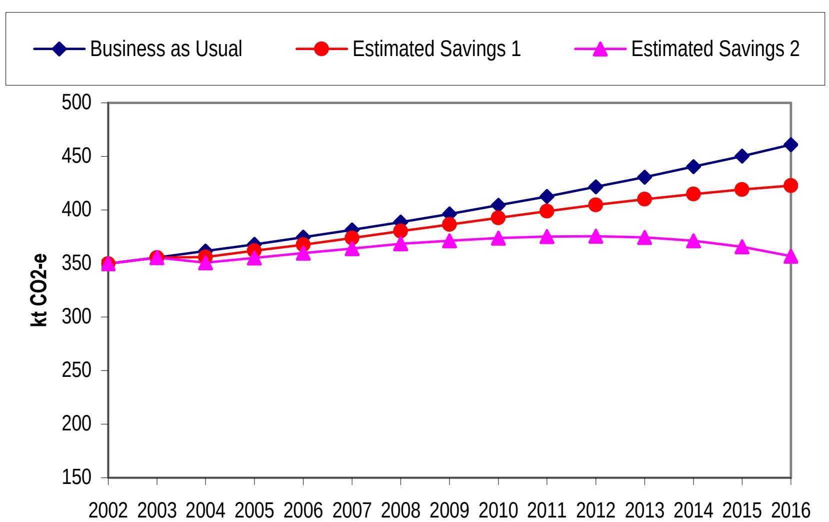
It is likely that some increased sales of 'High Efficiency' models will occur as a result of the introduction of the regulated use of this terminology and associated marketing by manufacturers. Sales of these products will potentially increase earnings for vendors, however due to the uncertainties involved this has not been included in the analysis.

Although the introduction of regulations will result in a reduction in greenhouse gas emissions, no financial gain has been attributed to this environmental benefit in this analysis.

12.2.3. Environmental impact

The estimated cumulative reduction in greenhouse emissions for the two scenarios for the period up to 2016 is between 200 and 530 kt CO_2-e. The annual reduction is shown in Figure 14.

Figure 14: Estimates Reduction in Greenhouse Emissions from Implementation of MEPS



In addition to greenhouse reductions due to more efficient cabinets, some additional savings may flow on from the increased focus on commercial refrigeration and product testing, as a result of a decrease in leakages of refrigerant, which is a potent greenhouse gas. The potential impact of this has not been included in modelling.

12.3. Business compliance costs

The costs associated with the imposition of MEPS regulations are summarised as follows:

- Manufacturing costs – associated with the production of more efficient models;

- Licensing costs – registration in New Zealand;
- Testing costs – the testing of products by manufacturers to ensure compliance;
- Government costs – administration of the scheme, check testing and enforcement costs.

12.3.1. Manufacturing costs

These have been estimated based on modelling undertaken in Australia. It has been assumed that manufacturing costs will be less in scenario 1 than in the more stringent scenario 2.

The on-costs are likely to be modest as a result of the low initial MEPS levels and the long lead times before these are made more stringent, allowing time for manufacturers to adapt production processes.

It has also been assumed that such costs that are incurred will not only be a result of the adoption of MEPS in Zealand but increased demand from other markets for more efficient products. This is particularly the case where such a high proportion of products manufactured in New Zealand are exported. Therefore it is reasonable that not all costs are attributed to the adoption of MEPS by the New Zealand Government.

12.3.2. Licensing Costs

Registration in Zealand is currently free, and it is assumed that this will continue. Registration requires some time input by manufacturers, although it is likely this will be small and readily combined with other administrative functions.

12.3.3. Testing costs

In a MEPS regime, products on the marketplace must be registered with the relevant authority, and manufacturers are required to provide the energy performance level. This may be done for individual cabinet models, or for families of models. For registration of families, only the performance of the worst performing product needs to be provided.

A further means of minimising costs is that for one year after the introduction of MEPS legislation in Australia, manufacturers are allowed to provide calculated energy performance data. Following this, energy performance data must be based on test according to the reference test method.

In considering the costs of testing, it should be noted that a large part of the market already undertakes routine of testing in order to meet customer specifications or food safety requirements. Larger manufacturers have their own test laboratories for these purposes. While it is recognised that companies will need to invest in becoming familiar with the new test methodology and purchase conforming test packs, these costs will reduce over time as the energy testing is integrated in the normal testing regime.

12.4. The distribution of costs

A number of options will enable the costs of regulation to be minimised, including:

- The provision of signalling MEPS levels well in advance of implementation;
- The harmonisation of MEPS levels with other markets;
- The allowance of calculated data to be provided for registration purposes, for a limited period.

However, it should be recognised that smaller manufacturers who have not been used to regularly testing products, and are perhaps less influenced by international trends, may incur a larger proportion of costs, relative to their sales volume. On the other hand, they are likely to be able to adjust designs more easily than larger production lines, and hence their manufacturing costs may be lower.

13. OVERLAPPING COMPLIANCE REQUIREMENTS

Commercial refrigeration products are required to meet regulations relating to Food Safety and Electrical Safety.

The introduction of MEPS regulations in no way overrides these regulations or guidelines.

14. RISK ASSESSMENT

In view of the situation of the commercial refrigeration industry in New Zealand, there appears to be little risk in adopting MEPS regulations at the levels proposed.

There are potential risks in not adopting MEPS regulations as follows:

- The international competitiveness of the New Zealand refrigeration industry may be risked if product development does not keep pace with the demands of overseas markets, and competitive products;
- Future energy prices may rise substantially and disadvantage consumers as the cost of operating refrigeration increases;
- As with other energy saving initiatives, there are risks associated with not reducing greenhouse emissions sufficiently to reduce the potential for climate change or the time before climate change has severe economic impacts.

15. CONCLUSIONS

The use of commercial refrigerated cabinet in New Zealand results in substantial energy use and greenhouse emissions, which would be reduced through the introduction of mandatory MEPS.

Although other measures would complement regulation, no other option examined is likely be as effective in bringing about energy and greenhouse savings.

There has been considerable investment in the development of a test method in Australia, and work is still underway in determining the final MEPS levels to be adopted there. However considering the contributions made to the Australian market by New Zealand products, there is no indication that the selected levels will not be suitable for adoption in New Zealand.

Based on the information presented in this report, a simple cost benefit analysis suggests that there would be a nett benefit through the adoption of MEPS at the Australian levels. Table 23: shows the results of modelling for each Scenario and for a discount rate of 10% and 5%. In all cases, there is a nett benefit.

Table 23: Results of Cost Benefit Analysis

Scenario 1			**Scenario 2**		
NPV	10%	5%	NPV	10%	5%
Energy Savings	$1,813,062	$2,721,320	Energy Savings	$4,653,402	$7,074,394
Compliance Costs	$1,014,026	$1,484,310	Compliance costs	$2,857,144	$4,132,721
Government Costs	$355,168	$469,679	Government Costs	$355,168	$469,679
Benefit/Cost ratio	**1.32**	**1.39**	**Benefit/Cost ratio**	**1.45**	**1.54**

16. SUMMARY OF RECOMMENDATIONS

Based on the findings of this preliminary examination it is recommended that New Zealand should proceed with the process of adopting MEPS for commercial refrigeration, including:

- Take steps to ensure the new Australian Standard AS1731-2003 is released as a joint standard;
- Undertake further consultation with New Zealand Stakeholders (a list of stakeholders is included in Appendix 1);
- Undertake a full Regulatory Impact Statement on the proposal.

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APPENDIX 1: STAKEHOLDERS

This section identifies organisations which are considered stakeholders in commercial refrigeration.

- Supermarket Chains
- Manufacturers
- Hospitality providers
- Installers
- Australasian Soft Drink Association
- Business NZ
- National Assn of Retail Grocers and Supermarkets of NZ (NARGON)
- NZ Ice Cream Manufacturers Association
- Food Standards Australia New Zealand (formerly ANZFA)
- RACCA - Refrigeration & Air Conditioning Companies Association of New Zealand

APPENDIX 2: CLASSIFICATION OF REFRIGERATED CABINETS: AS1731

Classification OF REMOTE refrigerated CABINETS (Medium Temp)

Name	Australian Class	Definition	Subclass		
High Open Multideck	RS 1	Medium temperature multideck, single air curtain, length of air curtain 1.5-1.9m. Cabinet height 2.2-2.5m and depth 0.6-1.2m.	Lit Shelves	Unlit Shelves	
Medium Open multideck	RS 2	Medium temperature multideck, single air curtain, length of air curtain 1.0-1.5m. Cabinet height 1.8-2.19m and depth 0.6-1.2m.	Lit Shelves	Unlit Shelves	
Low Open Multideck	RS 3	Medium temperature multideck, single air curtain, length of air curtain 0.8-1.2m. Cabinet height 0-1.79m and depth 0.6-1.2m.	Lit Shelves	Unlit Shelves	
Self Service & Storage Closed Cabinet	RS 4	*Requires detailed definition*	Solid Door	Glass Door	
Self Service & Storage Closed Cabinet – undercounter	RS 5	*Requires detailed definition*	Solid Door	Glass Door	
Flat Glass Fronted – single deck	RS 6	Medium temperature single tier cabinet with a flat front glass and a sliding door service access to the rear. Cabinet height 1.25-1.4m, depth 0.8-1.2m. Cabinets are dividing into two subclasses on the basis of their evaporator coil arrangements.	Gravity coil	Fan coil.	
Flat Glass Fronted – 2 tier or more	RS 7	Medium temperature two or more tier cabinet with a flat front glass and a sliding door service access to the rear. Cabinet height 1.25-1.4m, depth 0.8-1.2m. Cabinets are dividing into two subclasses on the basis of their evaporator coil arrangements.	Gravity coil	Fan coil.	
Curved Glass Fronted – single deck	RS 8	Medium temperature single tier cabinet with a curved front glass and a sliding door service access to the rear. Cabinet height 1.25-1.4m, depth 0.8-1.2m. Cabinets are dividing into two subclasses on the basis of their evaporator coil arrangement	Gravity coil	Fan coil.	
Curved Glass Fronted – 2 tier or more	RS 9	Medium temperature two or more tier cabinet with a curved front glass and a sliding door service access to the rear. Cabinet height 1.25-1.4m, depth 0.8-1.2m. Cabinets are dividing into two subclasses on the basis of their evaporator coil arrangements.	Gravity coil	Fan coil.	
Island/Walk around merchandiser	RS 10	High, Cabinet height 2.2-2.5m Medium, Cabinet height 1.8-2.19m Low, Cabinet height 1.0-1.79m	High	Medium	Low

Classification of remote refrigerated cabinets (Low Temp)

Name	Australian Class	Definition	Subclass	
Medium Open Multideck	RS 11	Low temperature multideck, length of air curtain 1.0-1.5m. Cabinet height 1.8-2.19m and depth 0.6-1.2m.	*No subclass*	
Low Open Multideck	RS 12	Low temperature multideck, length of air curtain 0.6-1.0m. Cabinet height 1.0-1.79m and depth 0.6-1.2m.	*No subclass*	
Well-type, single width Cabinet	RS 13	Low temperature, well type self service cabinet, open with horizontal air curtain, length of air curtain 0.75-0.85m.	Solid Sided	Glass Sided
Well-type, double width Cabinet	RS 14	Low temperature, well type self service cabinet, open with horizontal air curtain. Length of air curtains 2 x 0.75-0.85m.	Solid Sided	Glass Sided
High Self Service & Storage Closed Cabinet	RS 15	Low Temp, Cabinet height 2.2-2.8m depth 0.6-1.2m	Solid Door	Glass Door
Medium Self Service & Storage Closed Cabinet	RS 16	Low Temp, Cabinet height 1.8-2.19m depth 0.6-1.2m	Solid Door	Glass Door
Low Self Service & Storage Closed Cabinet	RS 17	Low temp, Cabinet height 0-1.79m and depth 0.6-1.2m	Solid Door	Glass Door
Combination glass door over and well under	RS 18	*Requires detailed definition*	*No subclass*	
High Self Service Island Closed Cabinet	RS 19	Low Temp, Cabinet height 2.2-2.8m depth 1.9-2.1m. Glass Door	*No subclass*	
Medium Self Service Island Closed Cabinet	RS 20	Low Temp, Cabinet height 1.8-2.19m depth 1.9-2.1m. Glass Door	*No subclass*	

CLASSIFICATION OF SELF-CONTAINED REFRIGERATED DISPLAY CABINETS

Application	Positive Temp		Negative Temp	
To be used for	**Chilled Foodstuffs**		**Frozen, quick frozen foodstuffs and ice cream**	
Horizontal	Chilled, serve-over counter	HC1	Frozen, serve-over counter	HF1
	Chilled, serve-over counter with integrated storage	HC2		
	Chilled, open top, wall site	HC3	Frozen, open top, wall site	HF3
	Chilled, open top, island	HC4	Frozen, open top, island	HF4
	Chilled, glass top, wall site	HC5	Frozen, glass top, wall site	HF5
	Chilled, glass top, island	HC6	Frozen, glass top, island	HF6
Vertical	Chilled, semi-vertical	VC1	Frozen, semi-vertical	VF1
	Chilled, multi-deck	VC2	Frozen, multi-deck	VF2
	Chilled, roll-in	VC3		
	Chilled, glass door	VC4	Frozen, glass door	VF4
Combined	Chilled, open top, open bottom	YC1	Frozen, open top, open bottom	YF1
	Chilled, open top, closed bottom	YC2	Frozen, open top, closed bottom	YF2
	Chilled, glass door top, open bottom	YC3	Frozen, glass door top, open bottom	YF3
	Chilled, glass door top, closed bottom	YC4	Frozen, glass door top, closed bottom	YF4
	Multi-temperature, open top, open bottom			YM5
	Multi-temperature, open top, closed bottom			YM6
	Multi-temperature, glass door top, open bottom			YM7
	Multi-temperature, glass door top, closed bottom			YM8

Note: Serve-over counters are primarily in assisted service but may be in self service. Chilled multi-deck cabinets are primarily in self service but may be assisted service

Codification:

H = Horizontal
V = Vertical
Y = Combined
C = Chilled
F = Frozen
M = Multi-temperature
A = Assisted Service
S = Self Service
R = Remote Condensing Unit
I = Incorporated Condensing Unit