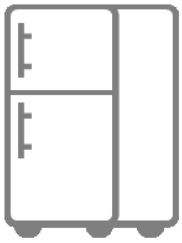


Country:	Australia
Technology:	Domestic Cold Appliances
Sub Category:	Freezers and Refrigerator/ Freezers Combinations

Introduction

The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. Doing this ensures that comparison between the participating countries is done against a specific and consistent set of products.

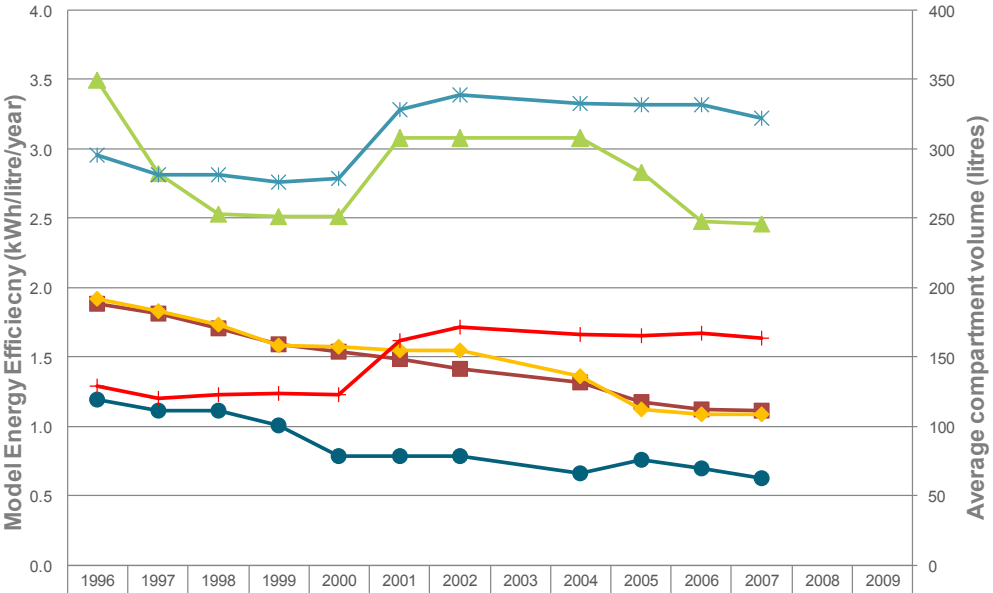
The summary definition for this product is:

Under Counter/ upright Refrigerators (Single Grouping – collect data only, i.e. NOT PRESENTED HERE)	Refrigerator with freezer (ice) compartment (Single grouping – collect data only, i.e. NOT PRESENTED HERE)	Side-by-Side and Freezer top/ Refrigerator bottom and Refrigerator top/ Freezer bottom (Collect data on proportion of each type of unit in the market)	Chest/Under Counter/Upright Freezer (Collect data on proportion of each type of unit in the market)
Where units are: • From all climate classes (but collect data on specific climate class that may be useful for later analysis) • Have freezer compartments with rated temperatures below -12 (all temperature ratings to refrigerator with freezer (ice) compartment) • Differentiated (if possible) between units with peripheral water coolers and ice makers			
Do not differentiate between • Defrost Cycles including Manual/Cyclical/Automatic (although collect data in case normalisation is required) • Controls mechanisms including manual, automatic and cyclical • Built in and stand-alone units (but where differentiated in market, collect data to enable normalisation) • Volume (but collect data on gross volumes as base metric) • Climate class (but collect data on climate class in case future analysis required, plus data on related local test conditions for climate classes)			

The detailed product definitions can be found at the Annex website:

http://mappingandbenchmarking.iea-4e.org/

Energy Efficiency of New Fridge Freezers Australia

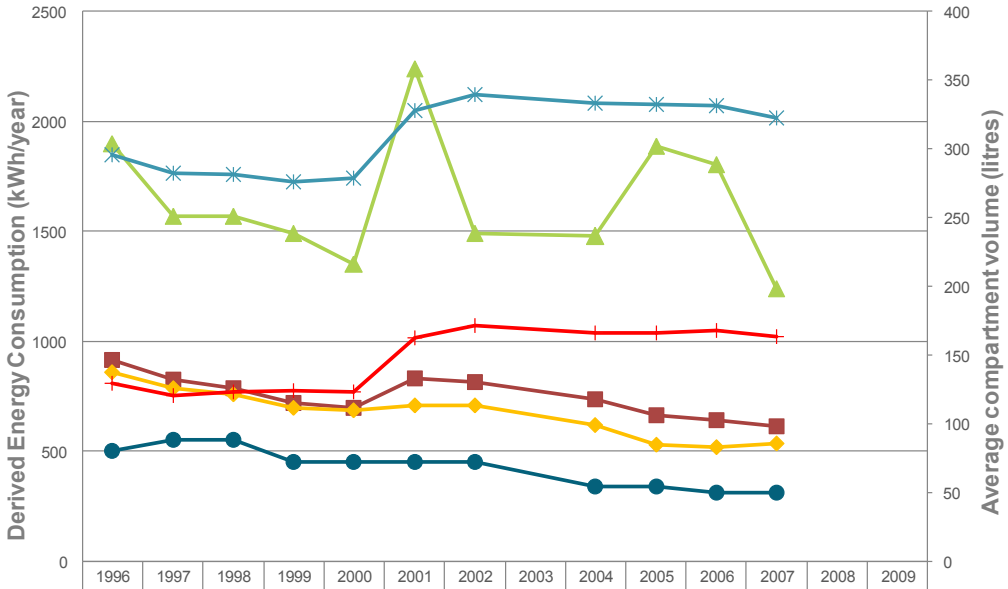


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Worst product	3.50	2.82	2.53	2.51	2.51	3.08	3.08		3.08	2.83	2.48	2.46		
Product Weighted Average	1.88	1.81	1.71	1.59	1.54	1.48	1.41		1.31	1.17	1.12	1.11		
Sales Weighted Average	1.92	1.83	1.74	1.58	1.57	1.55	1.55		1.36	1.12	1.09	1.09		
Best Product	1.19	1.12	1.12	1.01	0.78	0.78	0.78		0.66	0.76	0.70	0.62		
Ave Fridge Volume	296	282	282	276	279	328	339		333	332	332	323		
Ave Freezer Volume	129	120	123	124	123	162	172		166	166	168	163		

Key notes on Graph (see notes section 1)

- Data points before 2000 are calculated using only a partial data set as some products have been excluded due to incomplete model data (e.g. volumes of compartments)
- Energy consumption and efficiency figures are based on performance under local test conditions and are adjusted to a “standardised” refrigerator equivalence volume (based on standard local factor). Model compartment volumes are unadjusted and based on local regulations.
- Only products classified in Groups 4 and 5 in the Australian data labels are assessed.
- All volumes shown are product weighted averages.

Energy Consumption of New Fridge Freezers Australia



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Worst Product	1900	1570	1570	1493	1352	2240	1493		1478	1890	1803	1240		
Product Weighted Average	917	824	787	719	696	829	815		736	662	640	612		
Sales Weighted Average	857	787	757	695	686	706	708		619	530	519	532		
Best Product	500	550	550	452	452	452	452		338	338	312	312		
Ave Fridge Volume	296	282	282	276	279	328	339		333	332	332	323		
Ave Freezer Volume	129	120	123	124	123	162	172		166	166	168	163		

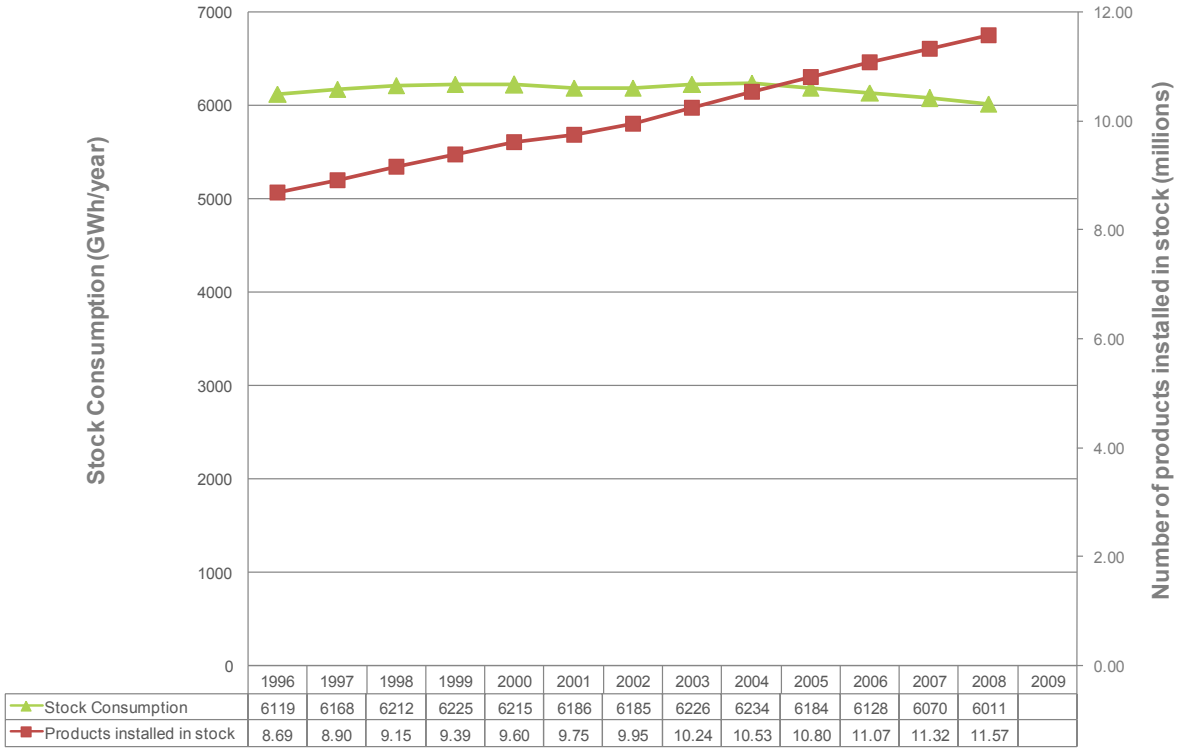
Key notes on Graph (See notes section 2)

- Data points before 2000 are calculated using only a partial data set as some products have been excluded due to incomplete model data (e.g. volumes of compartments)
- Energy consumption and efficiency figures are based on performance under local test conditions and are adjusted to a “standardised” refrigerator equivalence volume (based on standard local factor). Model compartment volumes are unadjusted and based on local regulations.
- Only products classified in Groups 4 and 5 in the Australian data labels are assessed.
- All volumes shown are product weighted averages.

Energy Efficiency in the Installed Fridge Freezer Stock Australia

Insufficient data available for analysis.

Energy Consumption in the Installed Refrigerator Stock Australia



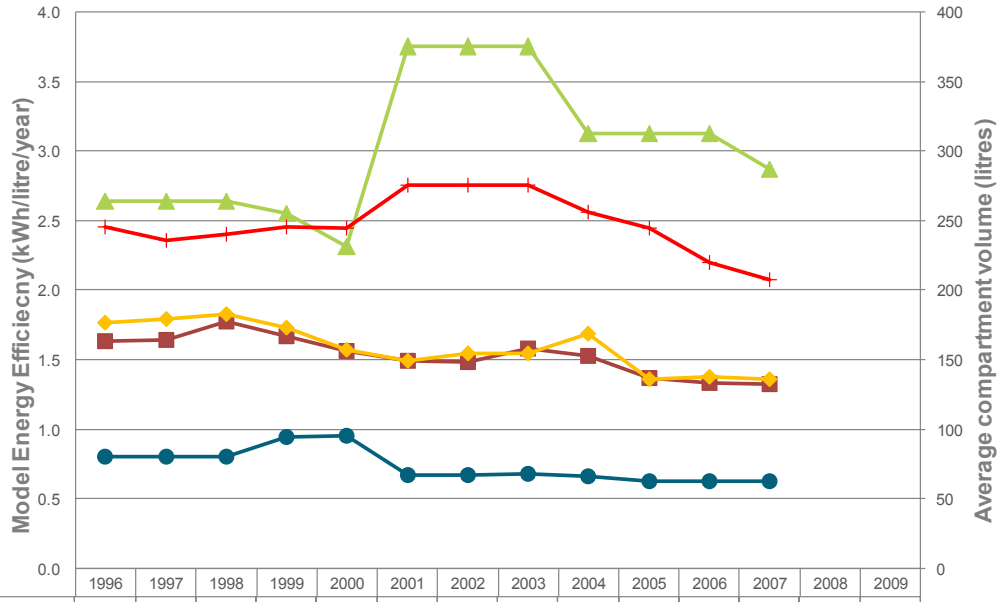
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Stock Consumption	6119	6168	6212	6225	6215	6186	6185	6226	6234	6184	6128	6070	6011	
Products installed in stock	8.69	8.90	9.15	9.39	9.60	9.75	9.95	10.24	10.53	10.80	11.07	11.32	11.57	

Key notes on Graph (see Notes Section 4)

- THIS GRAPH SHOWS RESULTS FOR ALL REFRIGERATORS BECAUSE THE MODEL USED TO PROVIDE THE DATA DOES NOT ANALYSE REFRIGERATOR AND REFRIGERATOR FREEZER COMBINATIONS SEPARATELY. AS A RULE OF THUMB, REFRIGERATORS REPRESENT APPROXIMATELY 20% OF THE ENERGY CONSUMPTION SHOWN.

- Stock consumption figures are based on a 2008 Australian Government model which uses direct market survey or sales data.

Energy Efficiency of New Freezers Australia

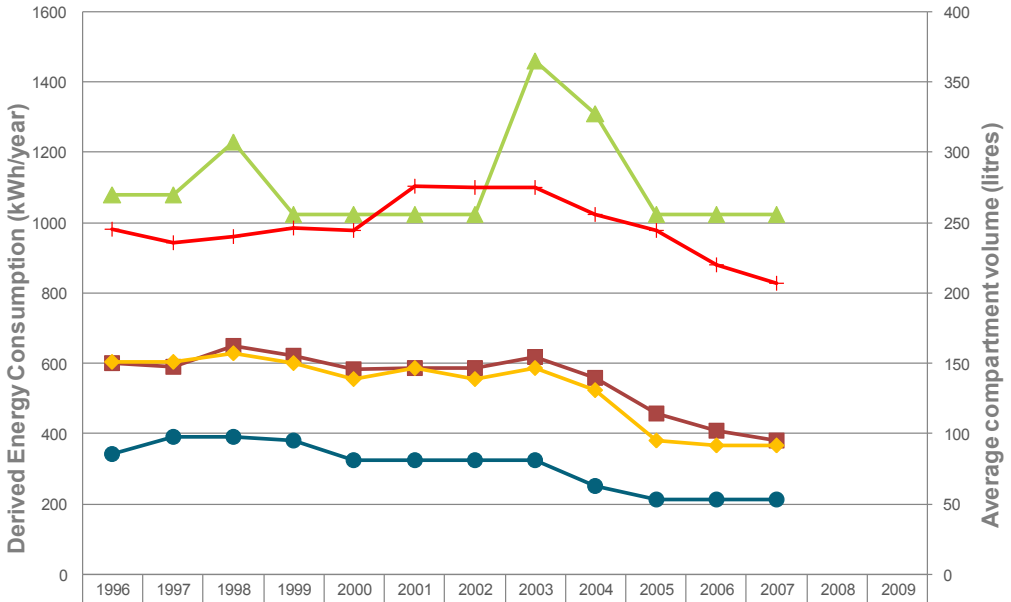


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Worst product	2.64	2.64	2.64	2.55	2.32	3.75	3.75	3.75	3.13	3.13	3.13	2.87		
Product Weighted Average	1.63	1.64	1.77	1.67	1.56	1.49	1.48	1.58	1.53	1.37	1.33	1.32		
Sales Weighted Average	1.77	1.79	1.82	1.73	1.57	1.49	1.55	1.54	1.69	1.35	1.38	1.35		
Best Product	0.80	0.80	0.80	0.95	0.95	0.67	0.67	0.67	0.66	0.62	0.62	0.62		
Ave Freezer Volume	245	235	240	246	244	276	275	275	256	244	220	207		

Key notes on Graph (see notes section 1)

- Data points before 2000 are calculated using only a partial data set as some products have been excluded due to incomplete model data (e.g. volumes of compartments)
- Energy consumption and efficiency figures are based on performance under local test conditions and are adjusted to a “standardised” refrigerator equivalence volume (based on standard local factor). Model compartment volumes are unadjusted and based on local regulations.
- Only products classified in Groups 6 and 7 in the Australian data labels are assessed.
- All volumes shown are product weighted averages.

Energy Consumption of New Freezers Australia

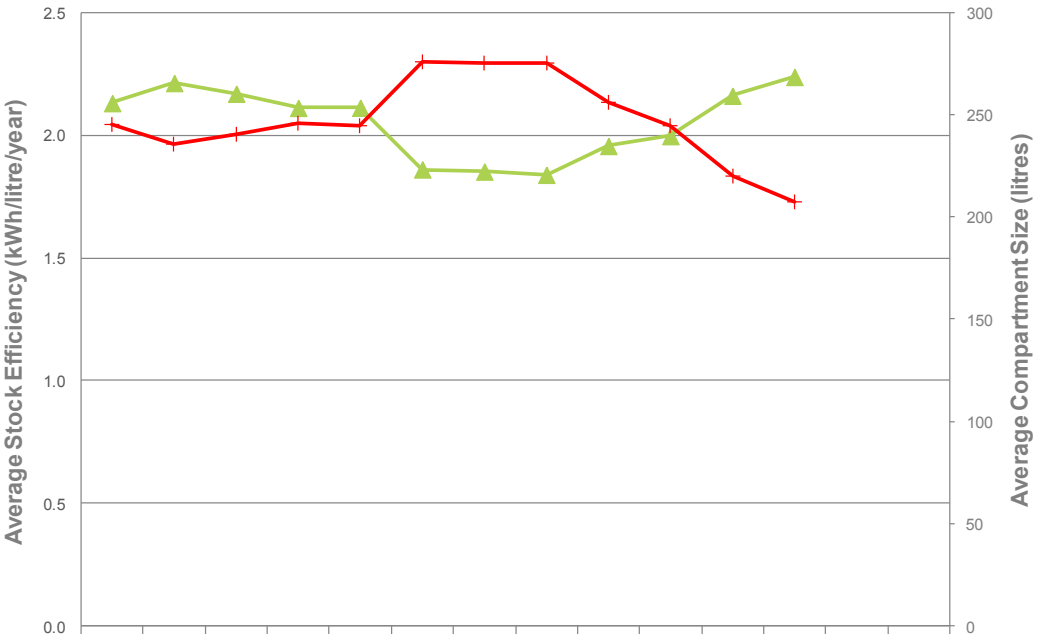


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Worst Product	1080	1080	1230	1024	1024	1024	1024	1460	1310	1024	1024	1024		
Product Weighted Average	601	590	649	622	582	587	587	617	558	455	409	380		
Sales Weighted Average	603	602	626	601	554	587	553	587	521	378	366	365		
Best Product	340	390	390	380	323	323	323	323	249	210	210	210		
Ave Freezer Volume	245	235	240	246	244	276	275	275	256	244	220	207		

Key notes on Graph (See notes section 2)

- Data points before 2000 are calculated using only a partial data set as some products have been excluded due to incomplete model data (e.g. volumes of compartments)
- Energy consumption and efficiency figures are based on performance under local test conditions and are adjusted to a “standardised” refrigerator equivalence volume (based on standard local factor). Model compartment volumes are unadjusted and based on local regulations.
- Only products classified in Groups 6 and 7 in the Australian data labels are assessed.
- All volumes shown are product weighted averages.

Energy Efficiency in the Installed Freezer Stock Australia



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Stock Efficiency	2.13	2.21	2.17	2.11	2.11	1.86	1.85	1.84	1.95	1.99	2.16	2.24		
Ave Freezer Volume	245	235	240	246	244	276	275	275	256	244	220	207		

Key notes on Graph (See Notes Section 3)

- Stock consumption figures are based on a 2008 Australian Government model rather than direct market survey or sales data.
- Average volumes are based on sales data for that year rather than average volume in the stock because stock data is not available. Hence Stock efficiency figures may be somewhat misleading.

Energy Consumption of the Installed Freezer Stock Australia

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Stock Consumption	1660	1645	1635	1621	1608	1586	1570	1583	1590	1568	1539	1508	1477	
Products installed in stock	3.18	3.16	3.14	3.12	3.12	3.09	3.08	3.13	3.18	3.22	3.24	3.26	3.27	

Key notes on Graph (see Notes Section 4)

- Stock consumption figures are based on a 2008 Australian Government model which uses direct market survey or sales data.
- Graph axes do not start at zero.

Major Policy Interventions (See notes Section 5)

Energy Labels

- **December 1986:** Mandatory energy labels introduced in the State of New South Wales.
- **February 1987:** Mandatory energy labels introduced in the State of Victoria.
- **1991 to 1994:** Mandatory energy labels progressively introduced in all other Australian States.
- **1991:** First extensive review of the energy labelling programme in Australia was conducted (GWA 1991). It reviewed the technical basis for all labelled appliances and marked the start of a coherent national energy labelling program in Australia, especially with regard to test procedures.
- **1996:** The first cost benefit evaluation of the labelling program was undertaken (GWA 1996).
- **1997:** Further review of the technical basis of the energy efficiency labelling programme commenced, which included within its scope revision of the energy efficiency labelling algorithms for all labelled appliances as well as the energy label design itself.
- **1998:** NAEEEC recommended the introduction of new energy labelling algorithms (equations used to calculate the 'star' rating) to provide expanded scope for improvements in energy efficiency (5+ star rated units were regraded to become 3 – 3.5 star units).
- **2000:** Energy labelling algorithm revised and it became compulsory for all display stock to carry these labels from 1 October 2000.

Minimum energy performance standards

- **1992 to 1993:** A study conducted into the feasibility of minimum energy performance standards (GWA 1993).
- **October 1999:** MEPS for refrigerators and freezers first introduced
- **1 January 2005:** New stringent MEPS levels (based on US 2001 levels) introduced.

Cultural Issues (See Notes Section 6)

Ownership for refrigerators and refrigerator-freezers has been increasing very slowly (about 1.4 per house), but a 2% p.a. increase in household numbers is increasing the stock of appliances. The relatively fast increase in household numbers is driven by population growth (about 0.7%), immigration (about 1%) and ongoing declines in average household size.

Very few houses in Australia have central heating or air conditioning, so refrigeration appliances are often subjected to a wide range of ambient temperatures, particularly overnight and in unconditioned parts of the house (eg freezers are sometimes located in laundries or garages). Given that ambient temperature is a primary driver of in-use energy consumption, the extremely wide variation in climates across Australia will result in substantial differences in end use energy consumption by state.

There has been an increase in the share of side by side models – these make up 15% of new refrigerators in 2007 (up from a negligible share in 1993). Bottom freezer models have been fairly constant at about 13%. Manual defrost refrigerator-freezers have more or less disappeared from the Australian market (were 30% in 1993, disappeared by 2004). Refrigerator-freezers have made up about 80% of all refrigerator sales (excluding separate freezers) – this has been fairly constant since 1993.

The average size of refrigeration appliances has not changed very much in the past 15 years. Average fresh food volumes are fairly steady at about 260 litres (very small increase), while freezer volumes have increased slightly (80 litres in 1993 to 105 litres in 2007, partly due to an increase in the share of side by side models). However, given decreases in average household size, the litres per consumer is increasing.

Australian's tend to do large shopping trips once or twice a week and therefore need larger refrigerators (than say in Europe, for example). Fresh foods such as fruit and vegetables are usually stored in the refrigerator.

Data on the average age of refrigerators and freezers in Australia is poor. No studies have systematically documented the age of products leaving the stock. Data on sales and ownership suggest an average operating life for a refrigerator is about 17 years and for freezers over 20 years.

Notes on data

Section 1: Notes on Product Efficiency

1.1 Test methodologies, Performance Standards and Labelling Requirements

1.1.1 Current Test Methodology

Standard	AS/NZS 4474.1:2007, 'Performance of household electrical appliances - Refrigerating appliances - Energy consumption and performance' (available from www.saiglobal.com)
Equivalence	Unknown at present
Scope	Standard specifies the method for determining the performance characteristics of electric refrigerating appliances intended for household and similar use. Appliances covered by this Standard include refrigerators, refrigerator/freezers and freezers. Appliances such as multi-fuel refrigerating appliances, extra low voltage units (including d.c.) and mobile or portable units are not included in the scope of this Standard.
Historical Information	• First published in Australia as AS B116-1956. • Second edition 1967. • Revised and redesignated AS 1430-1973. • Second edition 1976. • Third edition 1986. • AS 2575.2 first published 1986. • Second edition 1989. • First published in New Zealand as NZS 6205:1982. • Revised and redesignated in part as NZS 6205.2:1988. • Second edition 1989. • AS 1430-1986, part of AS 2575.2-1989 and part of NZS 6205.2:1989 jointly revised, amalgamated and redesignated AS/NZS 4474.1:1997. • Second edition 2007.
Impact of incremental changes	Unknown at present

1.1.1 Current Performance Standards and Labelling Requirements

Standard	AS/NZS 4474.2:2009, 'Performance of household electrical appliances - Refrigerating appliances - Energy labelling and minimum energy performance standard requirements' (Available from www.saiglobal.com)
Equivalence	Unknown at present
Scope	This Standard specifies the energy labelling and minimum energy performance standard (MEPS) requirements for vapour compression refrigerating appliances that can be connected to mains power and which are within the scope of AS/NZS 4474.1:2007. Such refrigerating appliances that are used in the commercial sector are included within the scope. Separate stand alone wine storage cabinets are not specifically within the scope of this Standard. In particular, this Standard specifies the following: a) Projected annual energy consumption (PAEC). b) Adjusted volume. (c) Comparative energy consumption (CEC). c) Star rating. d) Performance criteria for energy label validity. e) Some of the requirements for energy label validity. f) Minimum energy performance standards (MEPS) for refrigerating appliances for MEPS 2010 requirements. g) Test report format and printing requirements for refrigerating appliance energy labels.
Historical Information	• First published in Australia as AS 2575-1982. • AS 2575.2 first published 1986. • Second edition 1989. • AS 2575-1982 revised and redesignated as AS 2575.1-1989. • First published in New Zealand as NZS 6205:1982. • NZS 6205:1982 revised and redesignated as NZS 6205.1:1989 and NZS 6205.2:1989. • AS 2575.1-1989 and NZS 6205.1:1989 and parts of AS 2575.2-1989 and NZS 6205.2:1989 jointly revised, amalgamated and redesignated as AS/NZS 4474.2:1997. • Second edition 2000. • Third edition 2001. • Fourth edition 2009.
Impact of incremental changes	Unknown at present

1.2 Product Classifications

(Source: AS/NZS 4474.1:2007)

Group	Description
Group 1	Single door, all refrigerator, no internal frozen space
Group 2	Single door, all refrigerator, with an internal ice making sub-compartment
Group 3	Single door, all refrigerator, with short-term internal frozen food sub-compartment
Group 4	Two door, cyclic defrost refrigerator, with separate freezer section/compartment
Group 5T	Two door, vertical refrigerator, frost free, with freezer compartment at top
Group 5B	Two door, vertical refrigerator, frost free, with freezer compartment at bottom
Group 5S	Two door, vertical refrigerator, frost free, with freezer compartment at side
Group 6C	All freezer - chest type
Group 6U	All freezer - vertical cabinet type manual defrost
Group 7	All freezer - vertical cabinet type frost free

1.3 Product Efficiency Graphic

Source: various Australian Government databases.

Derived Total Model Volume: based on net volume (as defined in local regulations) with freezer compartment volume multiplied by a correction factor (in Australia - 1.63) to get equivalent fridge volume. Add this volume to the net fridge volume to establish the net total volume normalised to a refrigerator equivalent. This volume is the Derived Total Volume.

Derived Model Energy Consumption: based on total annual energy consumption under local test conditions, reducing consumption by 5% if the unit has an ice maker. This energy consumption is the Derived Unit Energy Consumption.

Derived Model Energy Efficiency: Equals Derived Model Energy Consumption divided by Derived Total Model Volume

Sales Weighted Energy Efficiency of New Models: (Sum of (Derived Model Energy Efficiency multiplied by sales volume of Model in year) for all Models) divided by (Sum of sales volume of all Models in year)

Model Weighted Energy Efficiency of New Models (used where no sales data is available): (Sum of Derived Model Energy Efficiency for all models sold in year) divided by (Number of Models sold in year).

Some of the data in the database was not used due to the omission of information necessary to undertake the analysis. The proportion of the total data sets used were as follows:

Fridge Freezers:

Coverage	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sales units analysed	314,807	347,561	360,675	348,237	358,772	396,766	382,769	0	471,000	671,696	740,694	713,160
Sales units removed	0	0	0	0	0	0	0	751899	0	0	0	1
Products analysed	77	98	78	79	92	408	536	0	688	801	883	843
Products removed	17	12	21	11	0	0	0	600	0	0	0	1
% of data set analysed	82%	89%	79%	88%	100%	100%	100%	0%	100%	100%	100%	100%
% of market covered by dataset	77%	76%	76%	75%	75%	74%	74%	73%	73%	95%	95%	95%
Approx % of market analysed	63%	68%	59%	66%	75%	74%	74%	0%	73%	95%	95%	95%

Freezers:

Coverage	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sales units analysed	67,527	68,007	72,036	70,123	74,495	44,627	92,870	134,983	131,044	198,256	230,298	215,696
Sales units removed	0	0	0	135	0	0	0	0	0	0	0	0
Products analysed	22	26	22	23	24	79	97	70	83	102	134	152
Products removed	5	3	7	5	3	0	0	0	0	0	0	0
% of data set analysed	79%	77%	76%	74%	72%	70%	68%	66%	66%	95%	95%	95%
% of market covered by dataset	77%	76%	76%	75%	75%	74%	74%	73%	73%	95%	95%	95%
Approx % of market analysed	61%	59%	57%	55%	53%	52%	50%	48%	48%	90%	90%	90%

Section 2: Notes on Product Consumption

2.1 Test methodologies, Performance Standards and Labelling Requirements

Refer to section 1.1

2.2 Product Classifications

Refer to section 1.2

2.3 Consumption Graphic

Refer to section 1.3

Section 3: Notes on Efficiency of Stock

Source: Australian Government database (2008)

Refrigerator Freezers:

None

Freezers:

Model provides average annual consumption of Freezers in stock in kWh/year. This figure is divided by the average new freezer volume (product weighted) to calculate average Stock efficiency numbers shown. Average volumes based on sales data for that year rather than average volume in the stock because stock data is not available. Hence Stock efficiency figures may be somewhat misleading.

Section 4: Notes on Consumption of Stock

Source: Australian Government database (2008)

Refrigerator Freezers:

Model provides total annual consumption of Freezers in stock in GWh/year as shown. However, this graph shows results for all refrigerators because the model does not analyse refrigerator freezers separately and options for estimating the consumption of fridge freezers alone from the data provided were not considered to be robust.

Freezers:

Model provides total annual consumption of Freezers in stock in GWh/year as shown.

Section 5: Notes on Policy Interventions

5.1 Energy Labels

(Source: National Appliance and Equipment Energy Efficiency Committee Report 2004/05, '*Energy Label Transition – The Australian Experience: Main Report*', July 2004)

5.2 Minimum Energy Performance Standards

(Sources: National Appliance and Equipment Energy Efficiency Committee Report 2004/05, 'Energy Label Transition – The Australian Experience: Main Report', July 2004; Paper 6.290, 'Energy consumption of whitegoods - what is improving and what is not: analysis of 13 years of data in Australia', March 2007)