Mapping Document

Country:	Australia
Technology:	Domestic refrigerated appliances
Sub Category:	Refrigerators, refrigerator-freezers and freezers

Introduction

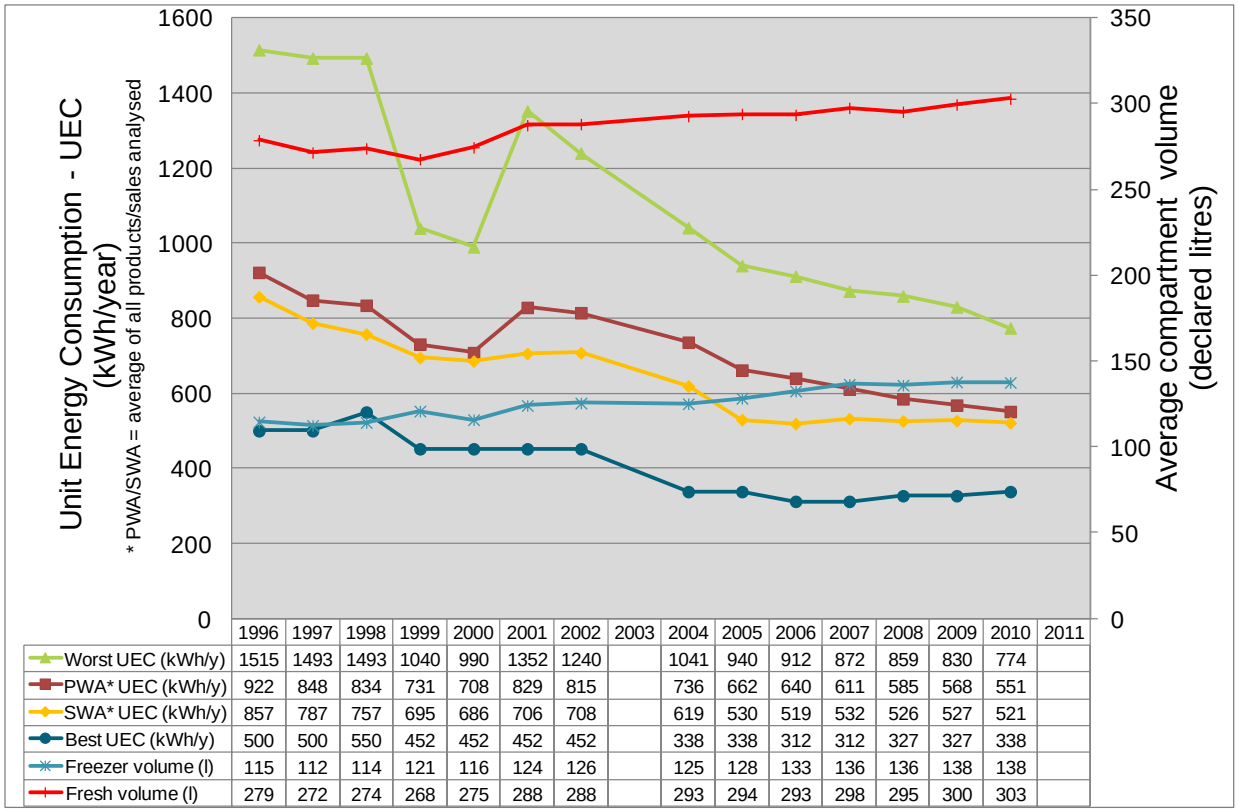
The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. This ensures that comparison between the participating countries is done against a specific and consistent set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

The summary definition for this product is:

M&B Category	Description
Refrigerator only and refrigerators with freezer compartments	The primary compartment is for fresh storage in the temperature range 5°C >= T> 0°C *and* • The unit has no freezer compartment, *or* • The unit has a freezer compartment of any temperature rating but a volume of less than 14 litres, *or* • The unit has a frozen food compartment of any volume that is rated as 0°C >= T > -15°C
Refrigerator/Freezer	The primary compartment for fresh storage in the temperature range 5°C >= T> 0°C *and* the primary frozen food compartment is greater than 14 litres and has a rated temperature T <= -15°C
Freezer only	A unit where *all* compartments have a temperature rating T <= -15°C

The detailed product definition can be found at the Annex website:
http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=13

Unit Energy Consumption of new refrigerator freezers in Australia

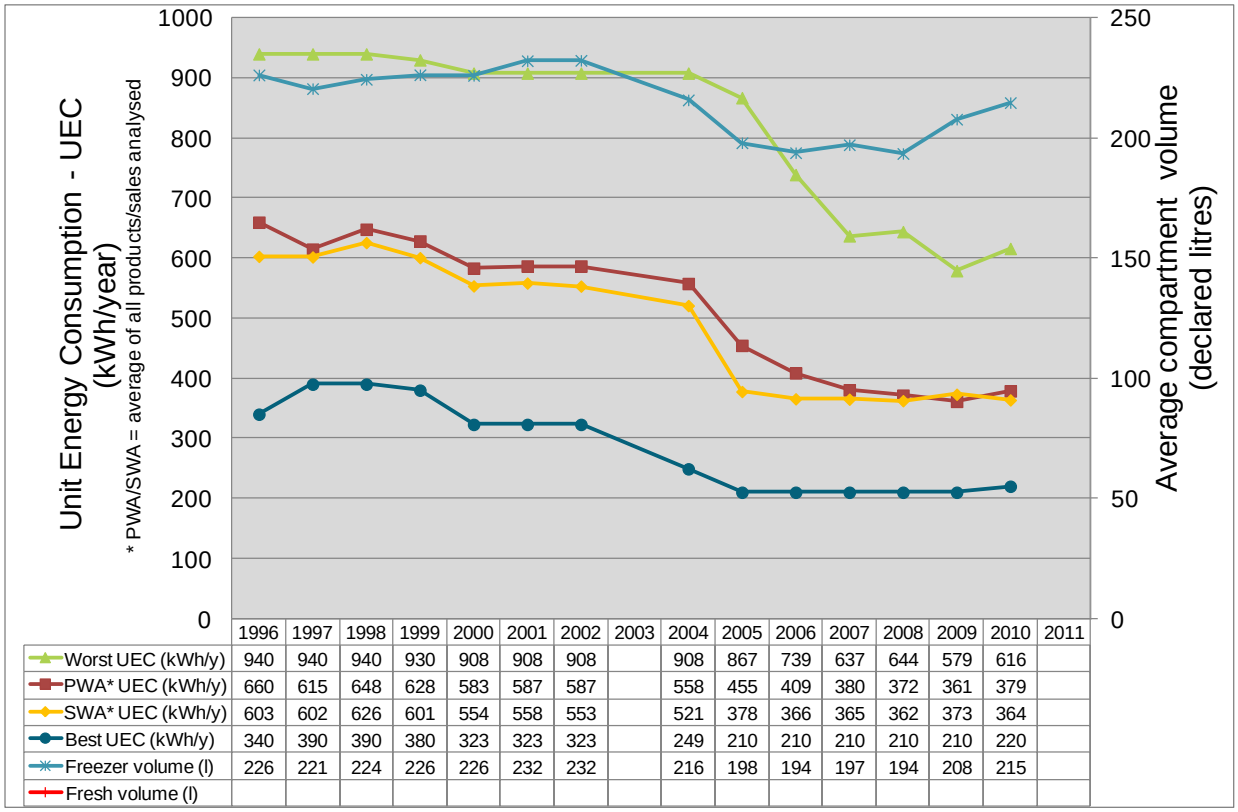


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEC (kWh/y)	1515	1493	1493	1040	990	1352	1240		1041	940	912	872	859	830	774	
PWA* UEC (kWh/y)	922	848	834	731	708	829	815		736	662	640	611	585	568	551	
SWA* UEC (kWh/y)	857	787	757	695	686	706	708		619	530	519	532	526	527	521	
Best UEC (kWh/y)	500	500	550	452	452	452	452		338	338	312	312	327	327	338	
Freezer volume (l)	115	112	114	121	116	124	126		125	128	133	136	136	138	138	
Fresh volume (l)	279	272	274	268	275	288	288		293	294	293	298	295	300	303	

Key notes on Graph (see notes section 1)

- Data points from 2001 onward are based on full market data. Prior to this, data represents the majority of products sold, but only a limited sample of all products on the market.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

Unit Energy Consumption of new freezers in Australia

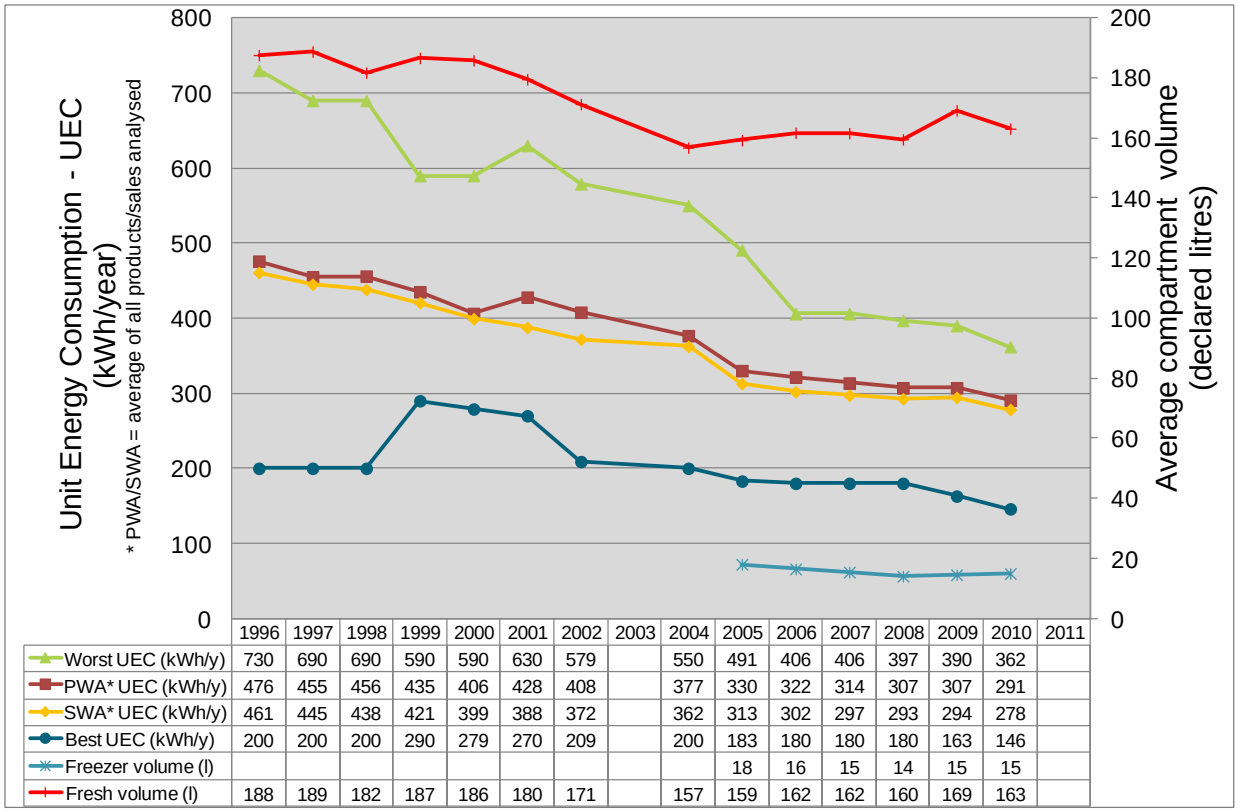


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEC (kWh/y)	940	940	940	930	908	908	908		908	867	739	637	644	579	616	
PWA* UEC (kWh/y)	660	615	648	628	583	587	587		558	455	409	380	372	361	379	
SWA* UEC (kWh/y)	603	602	626	601	554	558	553		521	378	366	365	362	373	364	
Best UEC (kWh/y)	340	390	390	380	323	323	323		249	210	210	210	210	210	220	
Freezer volume (l)	226	221	224	226	226	232	232		216	198	194	197	194	208	215	
Fresh volume (l)																

Key notes on Graph (see notes section 1)

- Data points from 2001 onward are based on full market data. Prior to this, data represents the majority of products sold, but only a limited sample of all products on the market.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

Unit Energy Consumption of new refrigerators and refrigerators with freezer compartments in Australia

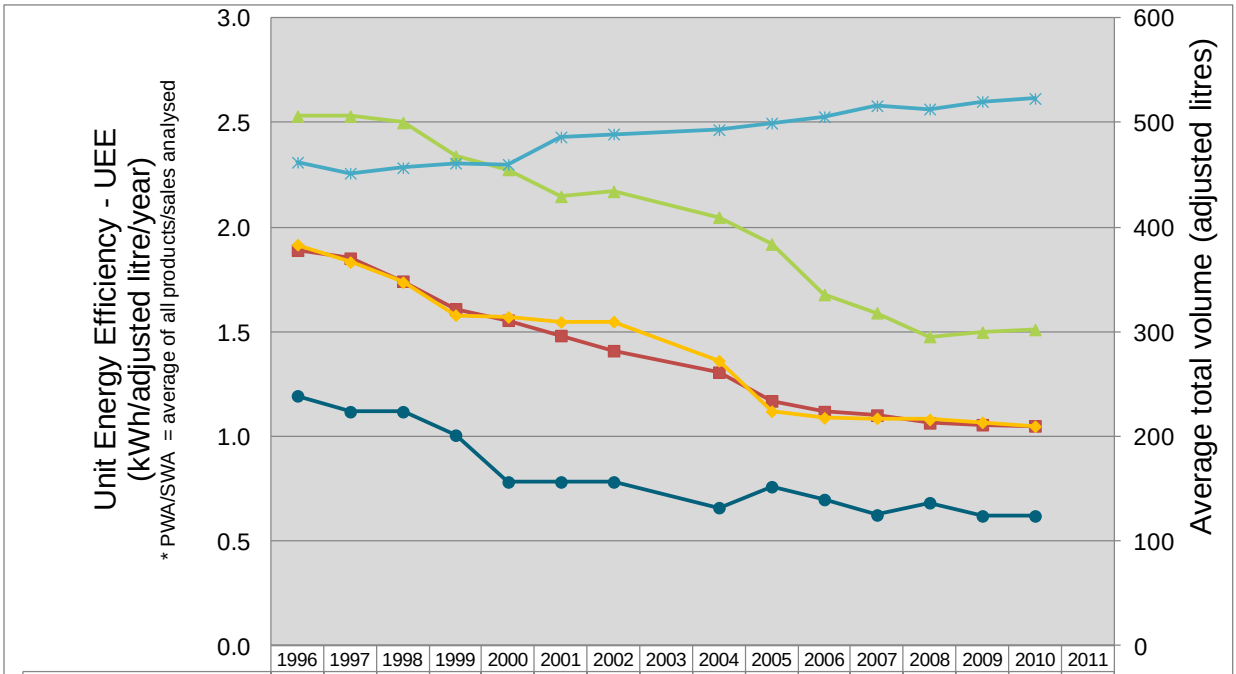


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEC (kWh/y)	730	690	690	590	590	630	579		550	491	406	406	397	390	362	
PWA* UEC (kWh/y)	476	455	456	435	406	428	408		377	330	322	314	307	307	291	
SWA* UEC (kWh/y)	461	445	438	421	399	388	372		362	313	302	297	293	294	278	
Best UEC (kWh/y)	200	200	200	290	279	270	209		200	183	180	180	180	163	146	
Freezer volume (l)										18	16	15	14	15	15	
Fresh volume (l)	188	189	182	187	186	180	171		157	159	162	162	160	169	163	

Key notes on Graph (see notes section 1)

- Data points from 2001 onward are based on full market data. Prior to this, data represents the majority of products sold, but only a limited sample of all products on the market.
- All volumes shown are sales weighted averages.
- The 'Worst UEC' is the UEC of the product at the 'worst 5%' point of a ranked list of products in the dataset.

Unit Energy Efficiency of new refrigerator freezers in Australia

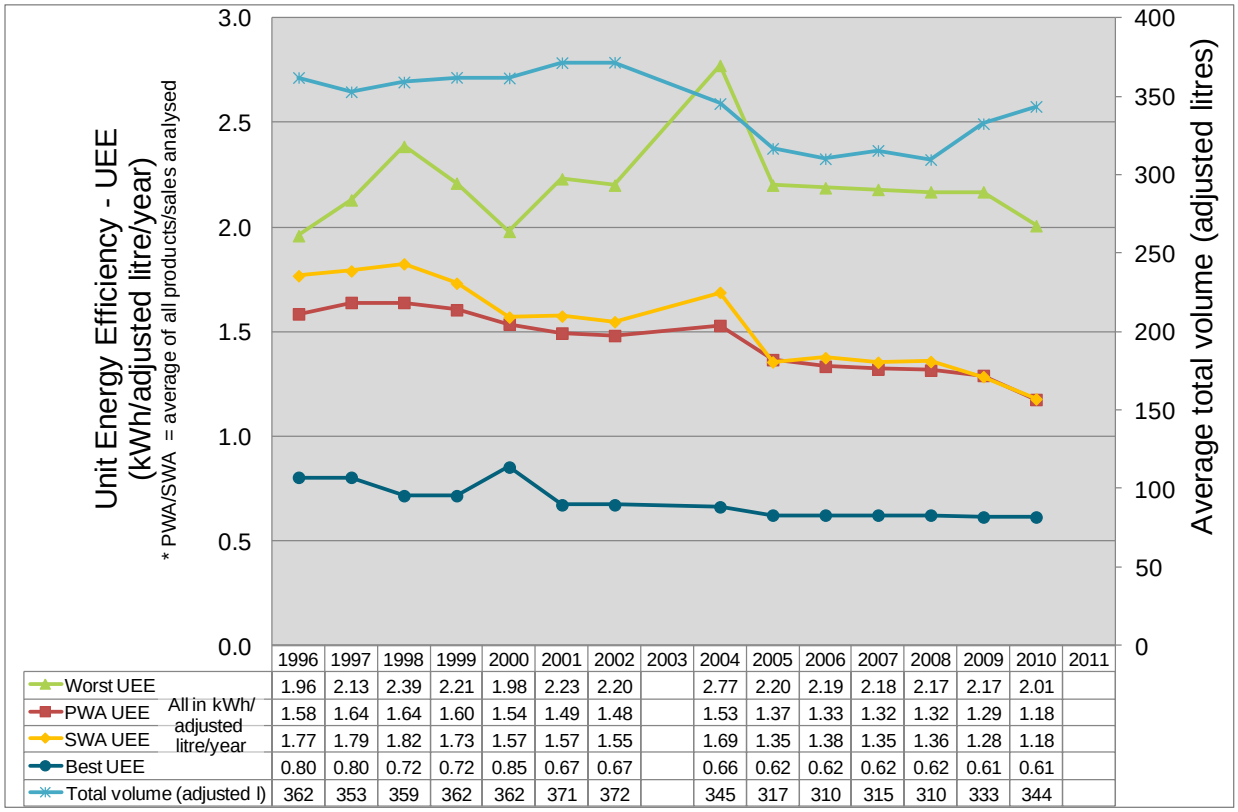


	All in kWh/ adjusted litre/year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEE		2.53	2.53	2.50	2.34	2.28	2.15	2.17		2.05	1.92	1.68	1.59	1.48	1.50	1.51	
PWA UEE		1.89	1.85	1.74	1.61	1.55	1.48	1.41		1.31	1.17	1.12	1.10	1.06	1.06	1.05	
SWA UEE		1.92	1.83	1.74	1.58	1.57	1.55	1.55		1.36	1.12	1.09	1.09	1.08	1.07	1.05	
Best UEE		1.19	1.12	1.12	1.01	0.78	0.78	0.78		0.66	0.76	0.70	0.62	0.68	0.62	0.62	
Total volume (adjusted l)		462	452	457	461	460	486	489		493	499	506	516	513	520	523	

Key notes on Graph (see notes section 1)

- The average total volumes shown (adjusted litres) are calculated using the temperatures and methods defined in the local test methodology/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
- Data points from 2001 onward are based on full market data. Prior to this, data represents the majority of products sold, but only a limited sample of all products on the market.
- All volumes shown are sales weighted averages.
- The 'Worst UEE' is the UEE of the product at the 'worst 5%' point of a ranked list of products in the dataset.

Unit Energy Efficiency of new freezers in Australia



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEE	1.96	2.13	2.39	2.21	1.98	2.23	2.20		2.77	2.20	2.19	2.18	2.17	2.17	2.01	
PWA UEE	1.58	1.64	1.64	1.60	1.54	1.49	1.48		1.53	1.37	1.33	1.32	1.32	1.29	1.18	
SWA UEE	1.77	1.79	1.82	1.73	1.57	1.57	1.55		1.69	1.35	1.38	1.35	1.36	1.28	1.18	
Best UEE	0.80	0.80	0.72	0.72	0.85	0.67	0.67		0.66	0.62	0.62	0.62	0.62	0.61	0.61	
Total volume (adjusted l)	362	353	359	362	362	371	372		345	317	310	315	310	333	344	

All in kWh/ adjusted litre/year

Key notes on Graph (see notes section 1)

- The average total volumes shown (adjusted litres) are calculated using the temperatures and methods defined in the local test methodology/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
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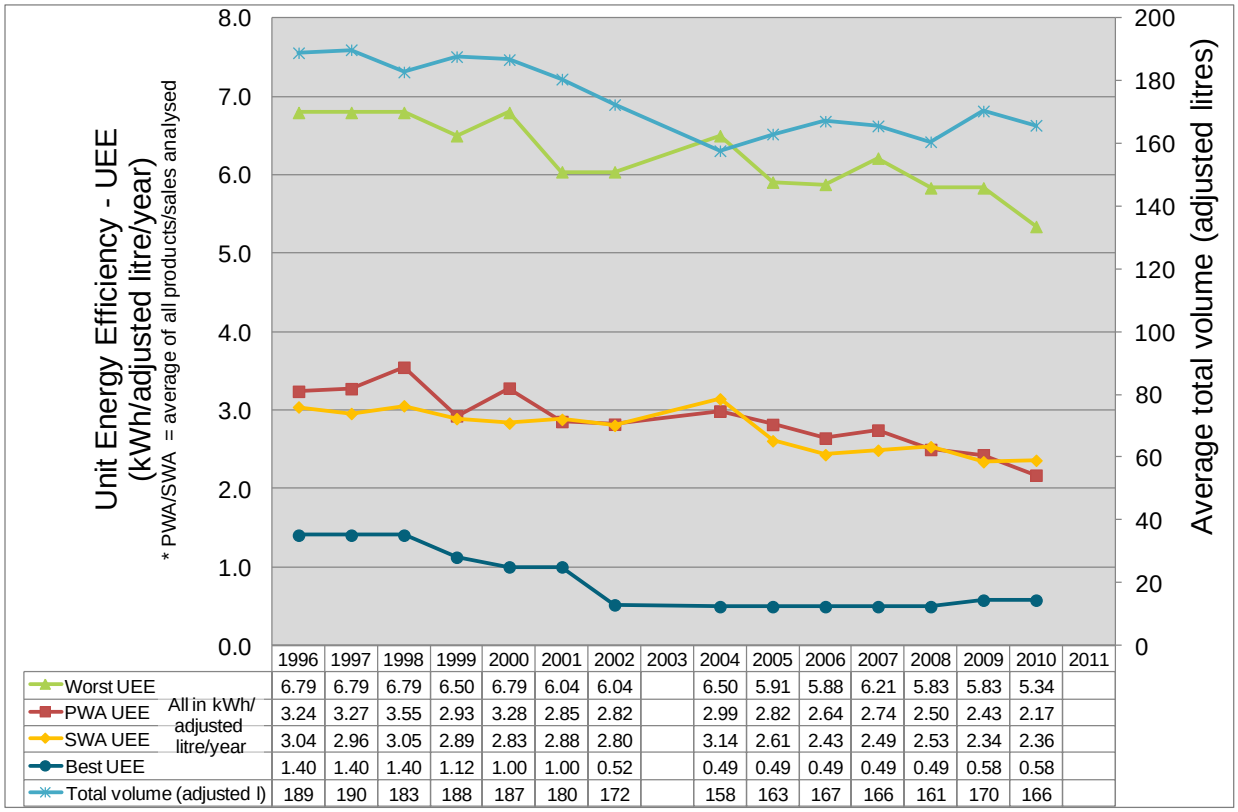
Unit Energy Efficiency of new refrigerators and refrigerators with freezer compartments in Australia



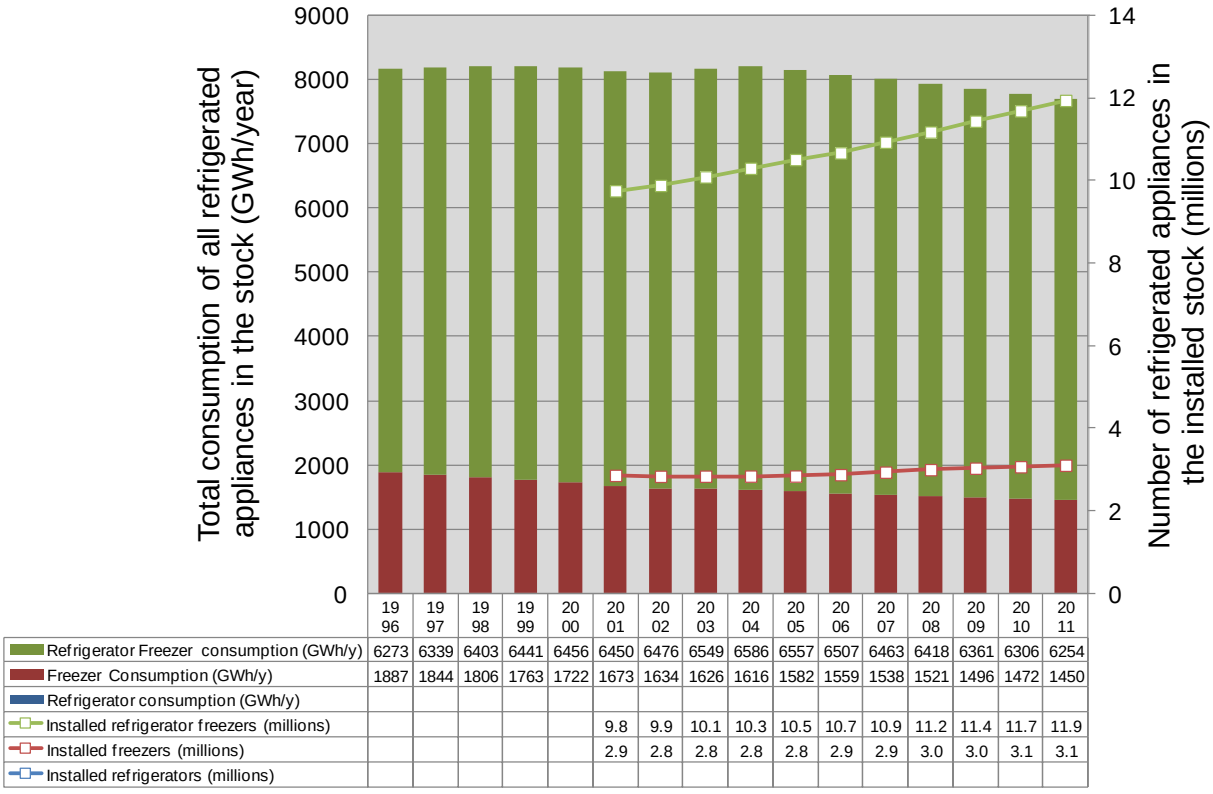
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Worst UEE	6.79	6.79	6.79	6.50	6.79	6.04	6.04		6.50	5.91	5.88	6.21	5.83	5.83	5.34	
PWA UEE	3.24	3.27	3.55	2.93	3.28	2.85	2.82		2.99	2.82	2.64	2.74	2.50	2.43	2.17	
SWA UEE	3.04	2.96	3.05	2.89	2.83	2.88	2.80		3.14	2.61	2.43	2.49	2.53	2.34	2.36	
Best UEE	1.40	1.40	1.40	1.12	1.00	1.00	0.52		0.49	0.49	0.49	0.49	0.49	0.58	0.58	
Total volume (adjusted l)	189	190	183	188	187	180	172		158	163	167	166	161	170	166	

All in kWh/ adjusted litre/year

Key notes on Graph (see notes section 1)

- The average total volumes shown (adjusted litres) are calculated using the temperatures and methods defined in the local test methodology/regulations. The average unit energy efficiency (UEE) is then calculated using these total adjusted volumes.
- Data points from 2001 onward are based on full market data. Prior to this, data represents the majority of products sold, but only a limited sample of all products on the market.
- All volumes shown are sales weighted averages.
- The 'Worst UEE' is the UEE of the product at the 'worst 5%' point of a ranked list of products in the dataset.

Energy Consumption of the installed stock of refrigerated appliances in Australia



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Refrigerator Freezer consumption (GWh/y)	6273	6339	6403	6441	6456	6450	6476	6549	6586	6557	6507	6463	6418	6361	6306	6254
Freezer Consumption (GWh/y)	1887	1844	1806	1763	1722	1673	1634	1626	1616	1582	1559	1538	1521	1496	1472	1450
Refrigerator consumption (GWh/y)																
Installed refrigerator freezers (millions)						9.8	9.9	10.1	10.3	10.5	10.7	10.9	11.2	11.4	11.7	11.9
Installed freezers (millions)						2.9	2.8	2.8	2.8	2.8	2.9	2.9	3.0	3.0	3.1	3.1
Installed refrigerators (millions)																

Key notes on Graph (see notes section 2)

- The refrigerator freezer data shown includes refrigerators and refrigerators with freezer compartments as it was supplied in combination. Refrigerator freezers are the most common products in the.stock and currently represent approximately 75% of all sales.

Major Policy Interventions (*see notes section 3)*

IMPORTANT NOTE: Consultation is ongoing regarding Australian adoption of the revised IEC 15502 test procedure (currently at the committee stage of the IEC). This would also require the revision of the Australian performance standards and labelling algorithms. However, at the time of preparation, the test methodologies and performance standards (4474.1 and 4474.2) detailed below are still in force.

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 4)*

The ABS Energy Efficiency in Australian Homes report[1] gives useful information on the penetration and age of refrigerated appliances:

"Almost all homes in Australia had a refrigerator, with one-third having two or more in use. The age of a refrigerator affects the energy efficiency of the unit. Close to six in ten homes (57%) had refrigerators aged 5 years or more, while 30% had refrigerators aged ten years or more. For those homes with more than one refrigerator, more than half (51%) reported their secondary refrigerator was 10 years or older. Over one third (37%) of homes had at least one separate freezer". Very few houses in Australia have central heating, 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.

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.

[1] http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4614.0.55.002Main+Features5Apr+2010

Section 1. Unit Energy Consumption and Unit Energy Efficiency Graphics

1.1 Test methodologies, Performance Standards and Labelling Requirements

IMPORTANT NOTE: Currently consultations are ongoing regarding Australian adoption of the revised IEC 15502 test procedure (currently at the committee stage of the IEC). This would also require the revision of the Australian performance standards. However, at the time of preparation, the test methodologies and performance standards (4474.1 and 4474.2) detailed below are still in force.

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	Standard is generally aligned with ISO 15502:2005 in some areas it follows the ANSI/AHAM approach. A summary of differences between the Standard and ISO 15502 and the ANSI/AHAM standard is included in the Foreword.
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.

1.1.2 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 Data sources and limitations

Australian data is sourced directly from the Department of Climate Change and Energy Efficiency. It is a mix of the Government's product registration database and GfK sales data and consequently is a very robust representation of the whole Australian market. However, data prior to 2001 is based primarily on data from product sales rather than the comprehensive listing of all products registered. Therefore, product weighted data prior to 2001 should be treated with caution.

The number of models and sales analysed by product category are presented in the tables below.

Refrigerator freezers:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	94	110	99	90	112	408	536	0	688	801	883	844	822	799	548	0
Products analysed	94	110	99	90	112	408	536	0	688	801	883	844	822	799	548	0
% products included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%
Sales in dataset	314,807	347,561	360,675	348,237	358,772	396,766	382,769	-	471,000	671,696	740,694	713,161	726,288	750,188	710,214	-
Sales analysed	314,807	347,561	360,675	348,237	358,772	396,766	382,769	-	471,000	671,696	740,694	713,161	726,288	750,188	710,214	-
% Sales included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%

Freezers:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	27	29	29	28	27	79	97	70	83	102	134	152	174	185	123	0
Products analysed	27	29	29	28	27	79	97	0	83	102	134	152	174	185	123	0
% products included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%
Sales in dataset	67,527	68,007	72,036	70,123	74,495	82,861	92,870	134,983	131,044	198,256	230,298	215,696	232,550	194,536	161,878	-
Sales analysed	67,527	68,007	72,036	70,123	74,495	82,861	92,870	-	131,044	198,256	230,298	215,696	232,550	194,536	161,878	-
% Sales included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%

Refrigerators and refrigerators with freezer compartments:

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Products in dataset	31	34	26	28	30	80	91	0	125	124	144	160	156	172	121	0
Products analysed	31	34	26	28	30	80	91	0	125	124	144	160	156	172	121	0
% products included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%
Sales in dataset	95,040	88,853	99,241	95,614	98,316	104,795	108,468	-	154,293	212,688	221,530	214,097	226,386	188,750	160,810	-
Sales analysed	95,040	88,853	99,241	95,614	98,316	104,795	108,468	-	154,293	212,688	221,530	214,097	226,386	188,750	160,810	-
% Sales included	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	0%

1.4 Data manipulations and specific limitations

1.4.1 Overview of the mapping and benchmarking process

There are essentially 4 stages to the mapping and benchmarking process for domestic refrigerated appliances as detailed below:

Stage:	Description
1. Data Cleaning and Pre-processing	• Removal of duplicate entries • Pre-processing to align all terminology and reported test values to be consistent between countries • Assigning of local, mapping and benchmarking and EU categories • Etc
2. Production of mapping outputs	• Production of mapping outputs based on local test methodologies
3. Normalisation of test data	• Calculation of adjusted volumes • Assignment Unit Energy Consumption to individual compartments • Normalisation for test temperature differentials
4. Production of Benchmarking outputs	• Post processing of benchmarking results • Production of benchmarking report

The details of this process are described in three supporting documents that accompany this mapping report:

1. The **product definition** describes the exact characteristics of the product being analysed; the energy metrics that will be calculated; the technological, usage and other characteristics that will be considered; and any other policy or cultural information that will be collected
2. The **summary of approach** provides an overview of the mapping and benchmarking process for analyzing domestic refrigerated appliances for all countries and regions.
3. The **actions and assumptions** report details the specific steps that were necessary to allow the data submitted from a specific country or region to be included in the mapping and benchmarking process as described in the product definition and summary of approach.

All these documents can be found at the annex website:

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

by clicking on the "X" in the matrix table that aligns with *Australia* and *Domestic refrigerated appliances 2012*.

1.4.2 Specific cautions for this data

Please refer to the actions and assumptions document described in Section 1.4.1.

Section 2. Energy Consumption of the installed stock of refrigerated appliances graphic

2.1 Data sources and limitations

Australian stock data is based on outputs from a model developed directly for the Department of Climate Change and Energy Efficiency. The model uses input data from direct market survey, sales data and data from the Australian Bureau of Statistics. The full report detailing data sources and derivations can be found in *"Evaluation of Energy Efficiency Policy Measures for Household Refrigeration in Australia"*[2].

[2] http://www.energyrating.gov.au/resources/program-publications/?viewPublicationID=2150

Section 3. Major Policy Interventions

No additional notes.

Section 4. Cultural Issues

No additional notes.