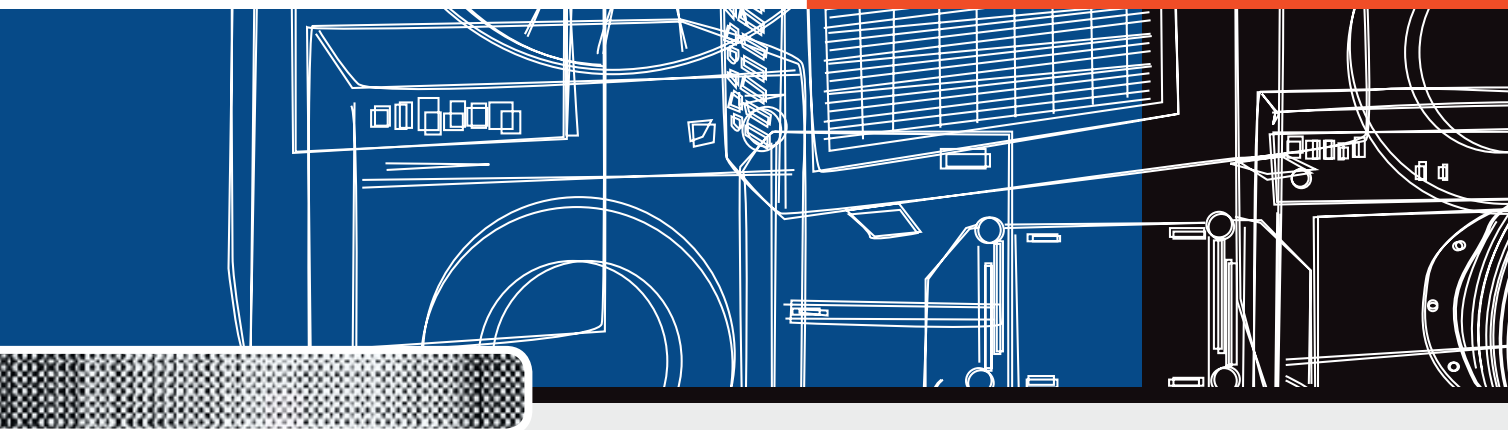


NATIONAL APPLIANCE AND EQUIPMENT
ENERGY EFFICIENCY PROGRAM

GREENING WHITEGOODS



**A THIRD REPORT INTO THE
ENERGY EFFICIENCY TRENDS
OF MAJOR HOUSEHOLD
APPLIANCES IN AUSTRALIA
FROM 1993 TO 2001**

REVISED AND UPDATED WITH 2001 DATA

February 2003

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February 2003

**NATIONAL APPLIANCE AND EQUIPMENT
ENERGY EFFICIENCY PROGRAM**

GREENING WHITEGOODS

**A third report into the energy
efficiency trends of**

**MAJOR HOUSEHOLD
APPLIANCES IN AUSTRALIA
USING DATA FROM
1993 TO 2001 INCLUSIVE**

Report prepared by:

**Energy
Efficient
Strategies**



**With assistance
from
EnergyConsult**



February 2003

Published by

The National Appliance and Equipment Energy Efficiency Committee

Preface



The development and promotion of energy efficient appliances and equipment is a key component of the strategy of all Australian Governments to reduce global warming.

The program is managed by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC), comprising officials from agencies of all Australian governments. Its activities are funded by Commonwealth, State and Territory governments through the Ministerial Council on Energy. This Council of Ministers is committed to supporting the program through *the National Greenhouse Strategy*.

Throughout most of the last decade, the comparative energy efficiency label on major consumer appliances has been the most visible government energy efficiency program. This report measures the effectiveness of that label, which was embraced as a national scheme in 1992, as well as the minimum energy performance standard for domestic refrigerators and freezers that commenced in 1999. Its publication is an important milestone in maintaining consumer confidence in the effectiveness of appliance labelling and energy efficiency standards.

Using available appliance sales data from 1993, the report measures the impact over time of energy labelling of five appliance types (refrigerators, freezers, dishwashers, clothes washers and dryers) as well as the minimum standards for refrigerators and freezers. The results show the real benefits in maintaining energy efficiency programs which deliver both greenhouse gas abatement and economic benefits.

Mandated under various State and Territory Acts, energy efficiency requirements are contained in relevant Australian Standards. This updated report measures the impact of this regulatory program which remains one of the most cost effective government energy efficiency programs. NAEEEC is committed to demonstrating the value of this program to the Australian community.

Dr Tony Marker
Chair
National Appliance and Equipment Energy Efficiency Committee

The lead Commonwealth agency on greenhouse matters

Table of Contents

Executive Summary	7
Overview	7
Background	7
Coverage	8
Key Findings	9
General	9
Refrigerators	9
Freezers	9
Clothes Washers	10
Clothes Dryers	11
Dishwashers	12
Detailed Results	13
Overview	13
Refrigerators and Refrigerator/Freezers	14
Market Trends	14
Energy Efficiency Trends	16
Separate Freezers	19
Market Trends	19
Energy Efficiency Trends	20
Clothes Washers	24
Market Trends	24
Energy Efficiency Trends	25
Clothes Dryers	29
Market Trends	29
Energy Efficiency Trends	29
Dishwashers	32
Market Trends	32
Energy Efficiency Trends	32
Annex A Source data and methodology	35
Source Data	35
Analysis Methodology	37
Acknowledgments	38

List of Tables

Table 1: Changes in Refrigerator Characteristics - 1993 to 2001	16
Table 2: Changes in Freezer Characteristics - 1993 to 2001	21
Table 3: Sales Share by Washer Type - 1993 to 2001	24
Table 4: Changes in Clothes Washer Characteristics - 1993 to 2001	27
Table 5: Changes in Clothes Dryer Characteristics - 1993 to 2001	30
Table 6: Changes in Dishwasher Characteristics - 1993 to 2001	32

List of Figures

Figure 1: Energy Consumption of Refrigerators.....	9
Figure 2: Energy Consumption of Freezers.....	10
Figure 3: Energy Consumption of Clothes Washers.....	11
Figure 4: Energy Consumption of Clothes Dryers.....	12
Figure 5: Energy Consumption of Dishwashers.....	12
Figure 6: Market Share by Refrigerator Group.....	15
Figure 7: Annual Trends in Key Performance Characteristics - Refrigerators	17
Figure 8: Energy Efficiency Trends by Refrigerator Group.....	17
Figure 9: National Sales Distribution by Old Star Rating - Refrigerators	18
Figure 10: National Sales Distribution by New Star Rating - Refrigerators	18
Figure 11: Trends in 1999 MEPS Complying Sales - Refrigerators and Freezers	19
Figure 12: Market Share by Freezer Group	20
Figure 13: Annual Trends in Key Performance Characteristics - Freezers.....	21
Figure 14: Energy Efficiency Trends by Freezer Group	22
Figure 15: National Sales Distribution by Old Star Rating - Freezers	23
Figure 16: National Sales Distribution by New Star Rating - Freezers.....	23
Figure 17: Sales Share by Washer Type - 1993 to 2001	24
Figure 18: Trends in Top and Front Loading Clothes Washer Energy	26
Figure 19: Annual Trends in Key Performance Characteristics - Clothes Washers	27
Figure 20: National Sales Distribution by Old Star Rating - Clothes Washers.....	28
Figure 21: National Sales Distribution by New Star Rating - Clothes Washers.....	28
Figure 22: Annual Trends in Key Performance Characteristics - Clothes Dryers	30
Figure 23: National Sales Distribution by Old Star Rating - Clothes Dryers.....	31
Figure 24: National Sales Distribution by New Star Rating - Clothes Dryers.....	31
Figure 25: Annual Trends in Key Performance Characteristics - Dishwashers.....	33
Figure 26: National Sales Distribution by Old Star Rating - Dishwashers.....	33
Figure 27: National Sales Distribution by New Star Rating - Dishwashers.....	34

APPENDICES

Detailed output tables by appliance, state and year are provided in a separate volume

EXECUTIVE SUMMARY

Overview

The analysis presented in this report demonstrates that there is a clear though gradual improvement in the energy related performance characteristics of appliances sold in Australia under the energy labelling program.

As energy consumption is not generally apparent to the general consumer without information programs like energy labelling, the credit for much of this improvement must be attributed to the National Appliance and Equipment Energy Efficiency Program (NAEEEP). The program increases consumer awareness of energy efficiency and thereby creates demand for energy efficient products. In addition, the introduction of mandatory minimum energy performance standards (MEPS), which in effect bans from sale inefficient refrigerators and freezers, has also made a significant impact on the energy efficiency of those appliances. Revised MEPS levels for those products, scheduled to come into force on 1 January 2005, will have an even more significant impact which could be apparent as early as in next year's data.

Background

This report has been prepared under contract to NAEEEEC¹, a committee of energy efficiency officials which manages the appliance energy labelling and MEPS program. NAEEEEC provides advice and operates under the direction of the Ministerial Council on Energy (MCE²). The Council comprises federal, state and territory government Ministers responsible for energy matters.

In 1995, Energy Efficient Strategies (EES) was first commissioned to undertake an analysis of appliance retail sales data purchased by NAEEEEC from a commercial source, GfK Market Research. This report includes analysis of sales data in Australia for the years 1993 to 2001 inclusive, thus giving nine years of appliance efficiency trends. This is the third public report released by NAEEEEC examining the energy impact of government programs on these appliance types.

This report provides a clear insight with respect to energy consumption and greenhouse gas emissions of the stock of appliances in the residential sector. Once the data series spans 10 years, however, it will have monitored the marketplace for the effective average life of some of these appliances and will give a more complete picture of the total appliance stock of installed in households and businesses.

¹ NAEEEEC is the National Appliance and Equipment Energy Efficiency Committee.

² MCE is the Australian Ministerial Council on Energy.

It may be possible to undertake an even more accurate end use analysis of appliance energy consumption in Australia, when information on new appliances is combined with:

- data on the ownership and penetration of major appliances (and future trends),
- population and household projections,
- appliance use trends (frequency and duration of use), and
- retirement data (scrapping rates for old appliances).

NAEEEC will attempt this analysis when the data for next year is available and will publish that analysis in 2004.

For the first time in the analysis period, GfK have supplied a full data set for each appliance – this will also be available in future years. Prior to 2001, data for approximately 75% to 90% of total sales for each of the appliance groups was provided. However, to preserve continuity in trend analysis, data sets for 2001 were reduced or “cut down” to replicate data in previous years. Where any important trends or new information have emerged in the full data set (compared with the cut down version), these have been noted in the text. In subsequent years, the analysis will include both the full data set and the cut down version, to allow continuity of trends to be examined while providing for data analysis to more fully explore market trends.

Coverage

This report covers five major household electrical appliances:

- Refrigerators;
- Freezers;
- Dishwashers;
- Clothes washers; and
- Clothes dryers.

The report does not cover any other household appliance subject to mandatory energy labelling (in 2003, the only other product is single-phase air conditioners) nor any other product falling within the NAEEEC program (such as gas appliances, electric water heaters or commercial and industrial equipment). Throughout the report there is reference to an average sales weighted “star rating” within each appliance type. The original energy label star rating scale was first introduced in the late 1980’s and was revised in late 2000 to make it more stringent (star ratings for most models decreased on the new scale). This report shows both old and new star rating scales for the appliance types tracked.

All attributes quoted in this report (such as energy, star rating, capacity and so on) are “sales weighted” values (ie in accordance with the sales share of each model recorded).

Key Findings

General

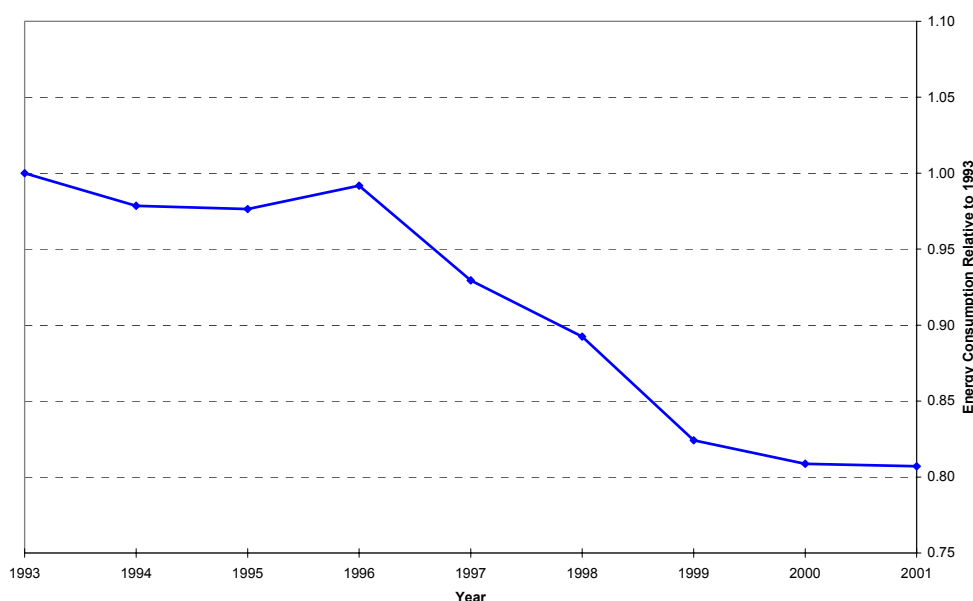
For all appliances covered by the energy labelling program in Australia, the sales weighted energy consumption³ is decreasing.

Refrigerators

Market Trends: Total sales were steady. The share of frost-free models increased markedly from 1993 to 2000 but its market share in 2001 steadied at around 70% of all refrigerator sales. Average fresh food and freezer volumes now appear to be stable after freezer volumes increased during the 1990's. Prices (corrected for changes in sales share by Group) have generally decreased slightly in real terms over the analysis period.

Energy: Energy consumption decreased at an average of 2.6% per annum from 1993 to 2001 (see Figure 1). Energy efficiency (taking account of changes in volume) increased at 3.6% per annum. The average star rating under the old rating system climbed from 3.58 in 1993 to 4.24 in 2001. Under the new star rating system this increased from 1.76 in 1993 to 2.68 in 2001. While there were 0.04% of models sold in 2001 that failed the 1999 MEPS level, it should be noted that these were all obsolete models that were manufactured prior to the MEPS start date.

Figure 1: Energy Consumption of Refrigerators



Freezers

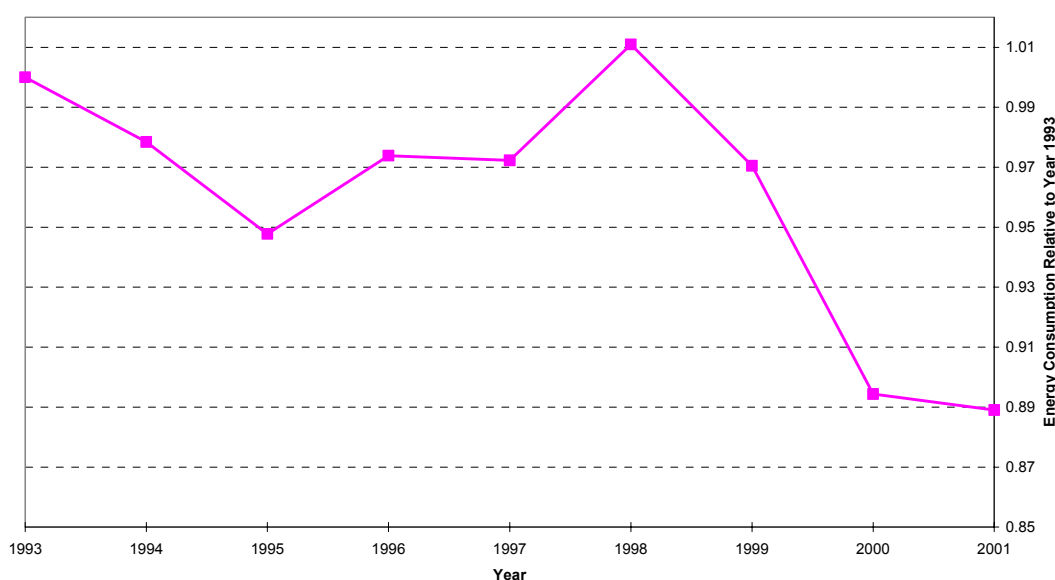
Market Trends: Total sales remain steady. The average volume of freezers also remained fairly static. The share of frost free vertical freezers is continuing to slowly

³ “Sales weighted energy consumption” is based on the energy label consumption (also called the comparative energy consumption) for each model weighted by the proportion of actual sales of each model. This is referred to as just “energy consumption” throughout the report.

increase while manual defrost vertical freezers is decreasing. Chest freezer sales share is static. Prices (corrected for changes in sales share by Group) decreased in real terms over the analysis period.

Energy: Energy consumption decreased at an average of 1.5% per annum from 1993 to 2001, although there was significant variation from year to year (see Figure 2). The CFC phase-out in 1994 appears to have had a dramatic (negative) impact on freezer efficiency, particularly chest freezers. Energy efficiency (taking account of changes in volume) increased at 1.4% per annum. The average star rating under the old rating system climbed from 4.24 in 1993 to 4.72 in 2002. Under the new star rating system this increased from 1.48 in 1993 to 1.97 in 2001. All models identified as sold in 2001 passed the 1999 MEPS level.

Figure 2: Energy Consumption of Freezers



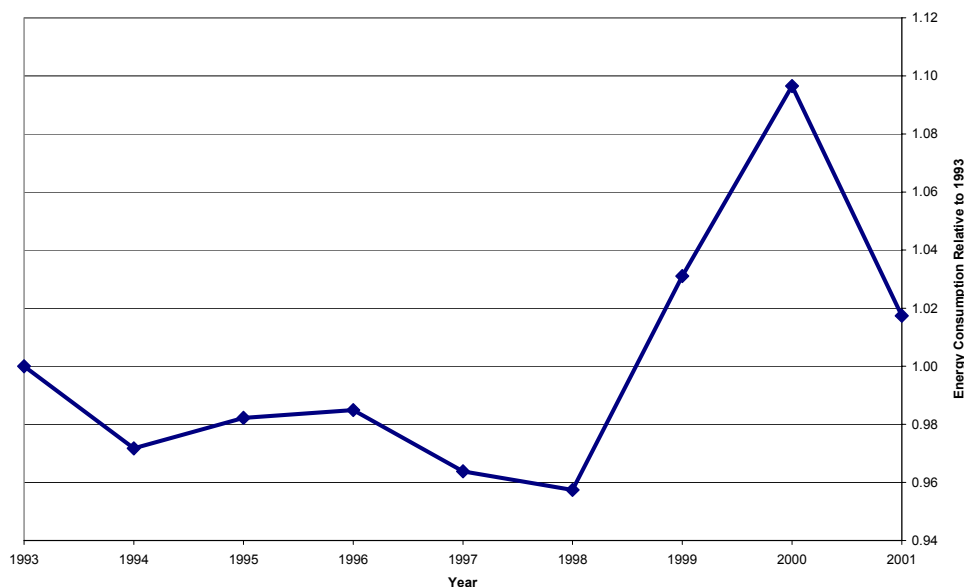
Clothes Washers

Market Trends: Total sales have been static since about 1996. The share of front loading machines was less than 8% until 1996, but increased to nearly 13% in 1997 and has since remained steady at around 13% since (note that the share of front loader sales is understated in the cut down data sets). Average capacity increased at 2.1% per annum with a sharp rise in top loader capacity in 1999. Since 1999 top loader capacity has remained stable. Front loader capacity increased significantly in 2000 and increased again in 2001. Water consumption decreased by 1.0% per annum over the period although there was a slight increase from 1997 to 1999. Front loaders on average use less than 50% of the water of top loaders. Prices have decreased slightly in real terms over the analysis period, although top loader prices decreased slightly and front loader prices increased slightly in nominal terms.

Energy: Energy consumption showed a slight decrease until 1998, but there was a significant increase in energy in 1999 and 2000 (see Figure 3). However, in 2001, energy consumption decreased again. Trends in clothes washer energy consumption are dominated by changes in the top loader market, and this has varied little over the

past 9 years. In contrast, front loader energy has decreased by 39% over the analysis period (a decrease of nearly 6% per annum), noting that actual energy consumption in 2001 is 35% of that for top loaders under the test standard. The average star rating under the old rating system climbed from 3.39 in 1993 (top 3.40, front 4.04) to 3.85 in 2001 (top 3.72, front 5.06). Under the new star rating system this increased from 1.28 in 1993 (top 1.29, front 2.12) to 1.77 in 2001 (top 1.54, front 3.81), noting however that on average both old and new star ratings decreased in the years 1999 and 2000.

Figure 3: Energy Consumption of Clothes Washers

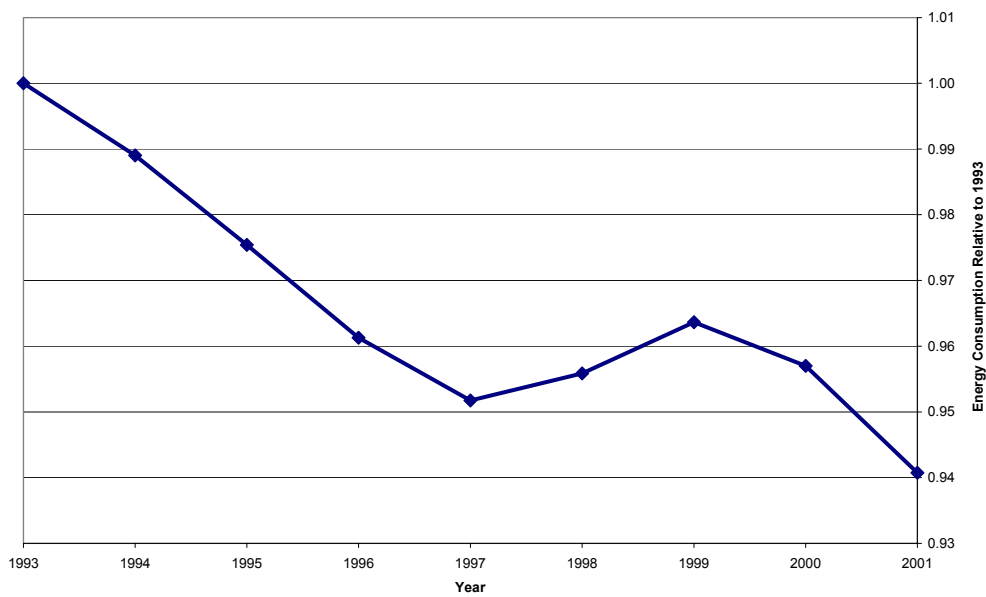


Clothes Dryers

Market Trends: Total sales increased at an average of about 2.7% per annum from 1993 to 2001 but have been reasonably static (but variable) since 1995. The share of auto-sensing dryers has continued to grow significantly and was at 30% in 2001 (full data set). Average load capacity has been static since 1993. Prices for timer dryers were generally steady in real terms over the analysis period while auto-sensing dryers have decreased in real terms over the analysis period.

Energy: Energy consumption decreased at an average of 0.8% per annum from 1993 to 2001 (see Figure 4). The bulk of the overall apparent decrease in energy consumption from 1993 to 2001 is due to the change in market share of timer and auto-sensing dryers. Energy efficiency (corrected for changes in dryer type) was virtually static for the period (auto-sensing dryer energy remained unchanged for the period while timer dryer energy improved very slightly). The average star rating under the old rating system climbed from 2.40 in 1993 to 2.60 in 2001. Under the new star rating system this increased from 1.52 in 1993 to 1.65 in 2001. These increases are primarily due to an increase in market share of auto-sensing dryers. Note that the energy consumption is based on the new energy labelling algorithm of 52 uses per year (introduced in 2000), so care is needed when comparing data in this report to values published in previous years (as this was based on 150 uses per year).

Figure 4: Energy Consumption of Clothes Dryers

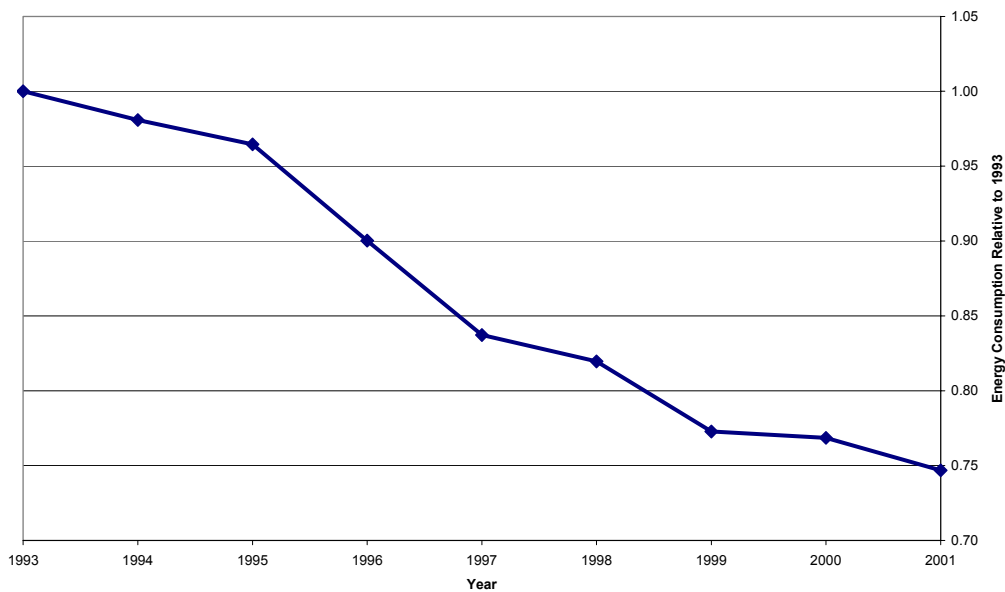


Dishwashers

Market Trends: Total sales continued to increase strongly at 5.4% per annum from 1993 to 2001. Average capacity (place settings) has been stable since 1996 although there was a slight fall in 2001. Water consumption decreased by over 4.3% per annum over the period. Prices fell slightly in real terms over the analysis period.

Energy: Energy consumption decreased at an average of 3.6% per annum from 1993 to 2001 (see Figure 5). The average star rating under the old rating system climbed from 4.07 in 1993 to 5.07 in 2001. Under the new star rating system this increased from 1.88 in 1993 to 2.50 in 2001.

Figure 5: Energy Consumption of Dishwashers



DETAILED RESULTS

Overview

For the nine years analysed, a clear trend for most performance characteristics generally emerged, although, even at the detailed level, there is some variation in the results from year to year. Some caution is required in the interpretation of these results. Shifts in the various parameters from year to year may be due to a combination of actual sales weighted trends in appliances sold together with some effect from the actual mix of models for which GfK have provided sales data. It is hoped these variations will be minimised from 2001 onwards when full data sets are used to track trends. Care needs to be taken interpreting data where there are less than 5 models identified in a particular year and product category.

For the first time in the analysis period, GfK have supplied a full data set for each appliance (excluding “exclusive” models which generally make up less than 1% of total sales for most product types). In past years, data for approximately 75% to 90% of total sales for each of the appliance groups was provided. The data included a list of models with the largest sales in order of decreasing sales.

However, to preserve continuity in trend analysis, data sets for 2001 were reduced or “cut down” to replicate data in previous years. Between 85% and 90% of the full data set was retained for the analysis to align with previous data sets. Models with the largest sales were included for analysis. Where any important trends or new information have emerged in the full data set (compared with the cut down version), these have been noted in the text and tables. Generally, trend data shown in figures uses the cut down data set for 2001 except where otherwise noted. In subsequent years, the detailed analysis will include both the full data set and the cut down version, to allow continuity of trends to be examined while providing for data analysis to more fully explore market trends.

The analysis in this report provides an in depth look at appliance performance trends in Australia. The analysis covers 1.65 million appliances sold in 2001 with a total retail value of AU\$1.5 billion.

The detailed trends by appliance type are discussed in the following sections. Where trends are quoted in terms of change per annum, this usually refers to the eight year period from 1993 to 2001 (based on 9 data points), except where otherwise stated. A positive percentage change is an increase in the attribute while a negative percentage change is a decrease in the attribute. Note that for some characteristics a lower value is an improvement, while for others, a higher value is an improvement.

The data shown in the following sections is based on the EES analysis of the product list provided by GfK. The Star Rating frequency distributions for each appliance have been shown for both the old star rating (the original scale) as well as the new star rating (revised scale introduced in 2000). This has been possible as EES has calculated the old and new star rating index for every product identified by GfK since 1993. Note that the new star rating scale is from 1 to 6 stars in half star increments. While distribution data is available for each half star band under the new star rating system (this data is shown in the tables in the Appendices), figures in the main report generally show distributions in whole star bands for the sake of clarity.

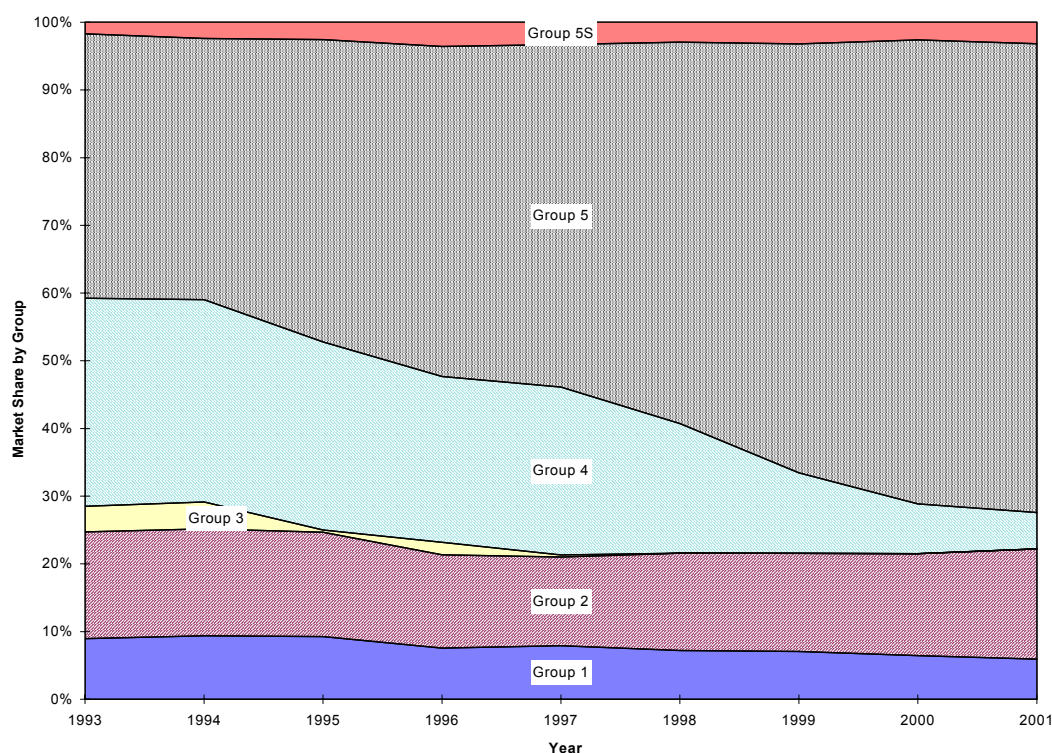
Refrigerators and Refrigerator/Freezers

Market Trends

Total retail refrigerator sales for the period 1993 to 2001 were increasing at an average 0.8% per annum to around 505,000 units per annum in 2001. Since 1996 there has been no distinct increase, although there was some variation year to year. In the full data set, 487 models were identified in 2001 which made up 99.1% of retail sales. In the cut down data set used for trend analysis, 147 models were identified, constituting 88% of retail sales in 2001.

Since 1997 there has been a significant move away from the cyclic 2 door (Group 4) towards the 2 door frost free refrigerator/freezer types (Group 5). In 2001, the cyclic 2 door group had only 5.4% of the refrigerator market share, compared to 24% in 1997. Conversely, the 2 door frost free refrigerator/freezer market share increased from 53% in 1997 to 69% in 2001. As such, Group 5 holds the greatest market share in the refrigerator market in Australia. The sales share of Group 1 (all refrigerator) fell slightly from 1993 to 2001 to about 6% share. Group 2 (refrigerator with an icemaking sub-compartment – mostly small bar fridges, many of which are used in commercial offices) maintained a stable sales share over the period at about 16%. Group 3 (refrigerator with short term freezer) has had no sales identified by GfK since 1998, although 5 models were identified in the 2001 full data set (total sales of 180 units). Group 5S (side by side) remains stable at about 3% share. The market share by Group is shown in Figure 6.

Figure 6: Market Share by Refrigerator Group



A summary of the patterns emerging among the key characteristics of refrigerators and refrigerator/freezers in Australia is as follows:

- Fresh food compartment size:** the average fresh food compartment size for all refrigerators and refrigerator/freezers has remained very stable since 1993. In 2001 the overall average size was 253 litres. Whilst overall the average size has remained stable, within groups there has been some change. Group 1 (all refrigerator) compartment size has increased sharply since 1998, from 308 litres to 368 litres in 2001. Group 4 (cyclic 2 door) has also increased significantly from 232 litres in 1993 to 280 litres in 2001. Group 5 (2 door frost free) has declined slightly so that the average Group 4 and 5 units are now about the same size. Group 5S (side by side) size has remained fairly stable while the average volume of Group 2 (refrigerator with an icemaking sub-compartment) has decreased slightly since 1993.
- Freezer compartment size:** In contrast to the average fresh food compartment size, the average freezer compartment size increased from 1993 to 92 litres in 1996 and has been stable since. Freezer volumes within Groups 4 and Group 5 have been fairly stable from 1993 to 2001 (a small increase and a small decline respectively).
- Purchase Price:** The price of an average refrigerator increased at around 1.5% per annum, which is lower than the inflation rate for the period. The price trends for refrigerators are complicated substantially by the change in sales share by Group. For instance, frost free models (Group 5) are on average slightly larger and more expensive than cyclic models (Group 4) so the increasing share of Group 5 increases the apparent average price of a

refrigerator. Price trends within each Group reveal that Group 4 prices were steady in nominal dollar terms from 1993 to 2001 while frost free models decreased in price at -3% per annum in nominal dollar terms from 1993 to 2001 (i.e. showing significant falls in real terms). Nominal prices of the remaining groups were generally steady over the analysis period, except for Group 1 where there was a +2.2% per annum price increase (roughly constant in real terms) which is a reflection of the size increase from 1998 to 2001.

Energy Efficiency Trends

The energy consumption of refrigerators is now trending downwards at -2.6% per annum over the 8 year period, although there is some variation in this trend from year to year. The most significant falls in energy consumption in recent years are likely to be partly due to increasing pressure from the introduction of MEPS in late 1999.

Encouragingly, while the adjusted volume is still increasing slowly, the total energy efficiency of the refrigerator market is also increasing, at a rate of around +3.1% per annum (i.e. kWh per adjusted litre is trending -3.1%). In 1993, about 37% of refrigerator sales would have failed the MEPS levels (analysis of the 1992 market indicated that 50% of models may have failed). By 2001, there were only seven models (0.04% sales) identified by GfK in their sales list that failed MEPS (see Figure 11). It should be noted that these were all obsolete models that were manufactured prior to the MEPS start date.

Table 1 summarises the key attributes from 1993 to 2001. Also included in the table are the values obtained from analysis using the full set of data in 2001. There appears to be a small difference between the reduced or cut down data set and the full data set in relation to volume and energy. The full data set appears to contain a higher share of models with large volume and the weighted energy consumption is consequently slightly greater. As a result, the figures for the full data set are marginally higher than the cut down data set for fresh food volume (+3%), freezer volume (+7%), energy (+3%) and adjusted volume (+5%). Importantly, the differences in the values between the reduced data set and the full data set for kWh/adjusted litre (inverse of efficiency), old SRI and new SRI are insignificant.

Table 1: Changes in Refrigerator Characteristics - 1993 to 2001

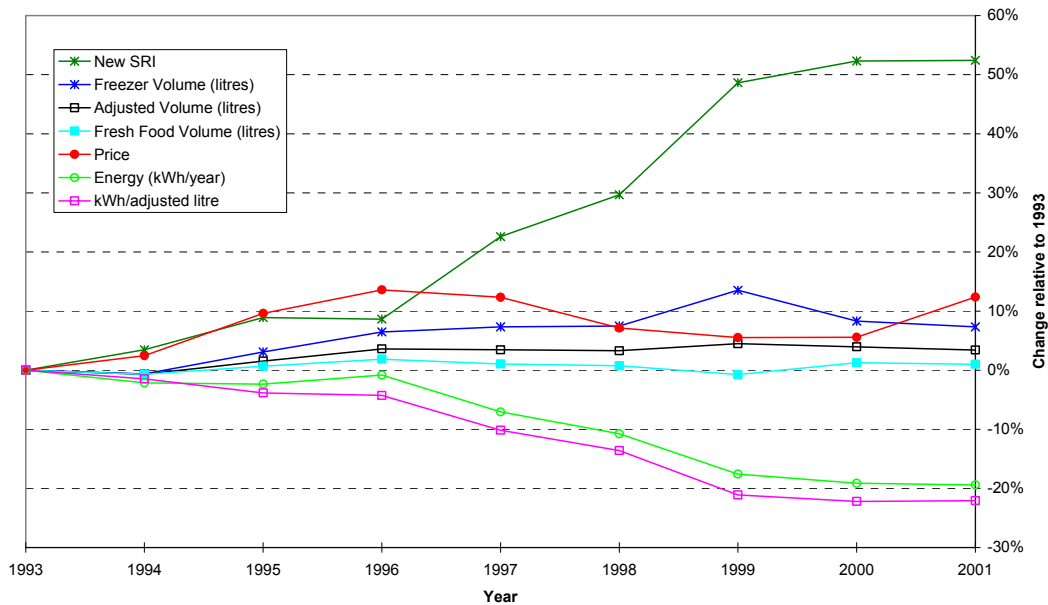
Characteristic	1993 Value	2001 Value	2001 Value *	Change pa #
Fresh Food Volume (litres)	250	252	260	0.1%
Freezer Volume (litres)	85	92	98	0.9%
Energy (kWh/year)	772	622	639	-2.7%
Adjusted Volume (litres)	385	398	417	0.4%
kWh/adjusted litre	2.00	1.56	1.53	-3.1%
Old SRI (star rating)	3.58	4.24	4.31	2.1%
New SRI (star rating)	1.76	2.68	2.68	5.4%
Price	\$911	\$1,023	\$1,023	1.5%

* The values in this column include all data supplied by GfK (99.1 % of retail sales for refrigerators).

Change pa is with 1993 values compared to values obtained in the reduced data set (88% of retail sales for refrigerators).

A year by year breakdown of key performance characteristics is shown in Figure 7.

Figure 7: Annual Trends in Key Performance Characteristics - Refrigerators



Note: 2001 data based on cut down data set.

Figure 8 shows the trend in the inverse of energy efficiency (expressed as kWh per adjusted litre of volume) for each of the main refrigerator Groups. The largest selling Groups (4 & 5) have increased their energy efficiency by +3.8% and +2.9% per annum respectively in the period 1993 to 2001. Because of its dominant market share, Group 5 is now driving overall energy efficiency trends in the refrigerator market.

Figure 8: Energy Efficiency Trends by Refrigerator Group

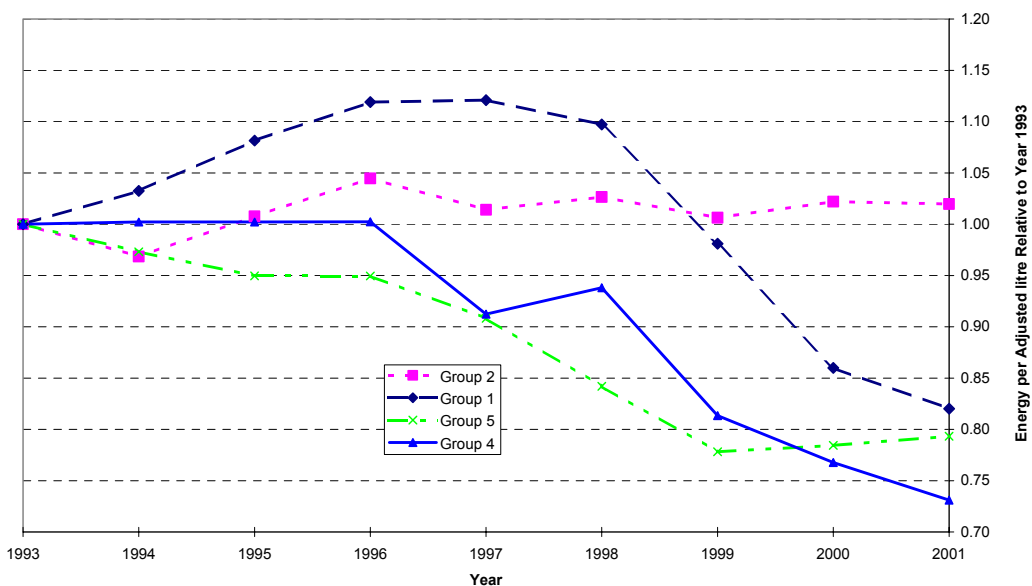


Figure 9 shows the sales distribution of refrigerator old star ratings from 1993 to 2001. The overall market trend is a general reduction in the proportion of 2, 3, and 4 star units sold with a corresponding increase in the proportion of 5 star units sold. This is reflected in a weighted old star rating, which is increasing at 2.1% per annum.

Figure 10 shows the sales distribution of refrigerator new star ratings from 1993 to 2001. The overall market trend is a general reduction in the proportion of 1 star units sold with an increase in those 2 stars and above. The first 4 star units appeared in 1999 and the first 4.5 star units in 2000.

Figure 9: National Sales Distribution by Old Star Rating - Refrigerators

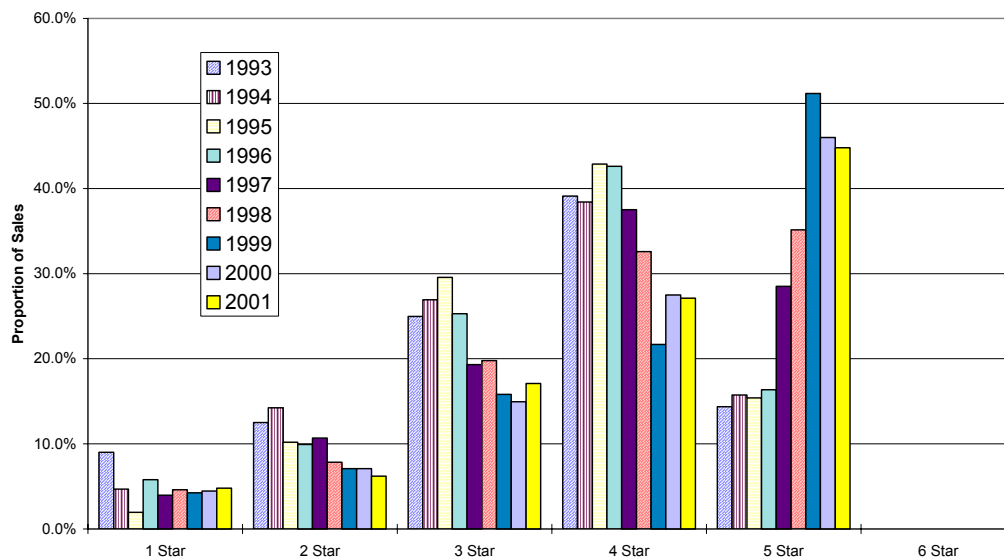


Figure 10: National Sales Distribution by New Star Rating - Refrigerators

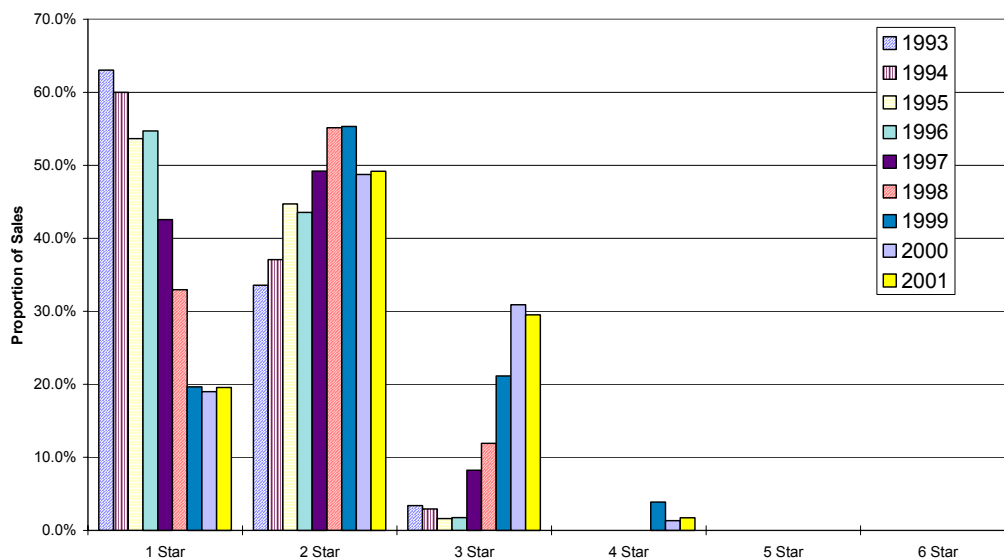
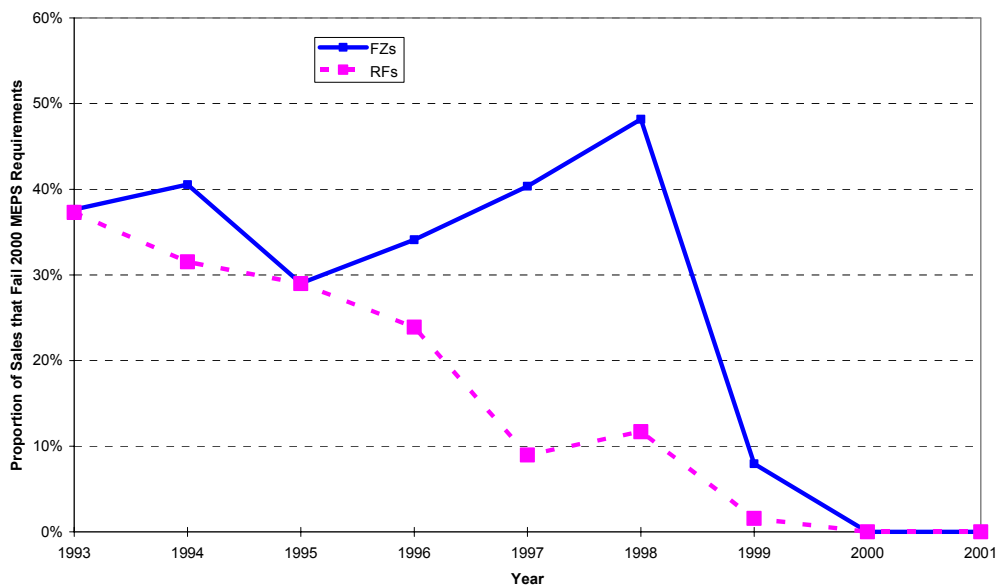


Figure 11: Trends in 1999 MEPS Complying Sales - Refrigerators and Freezers



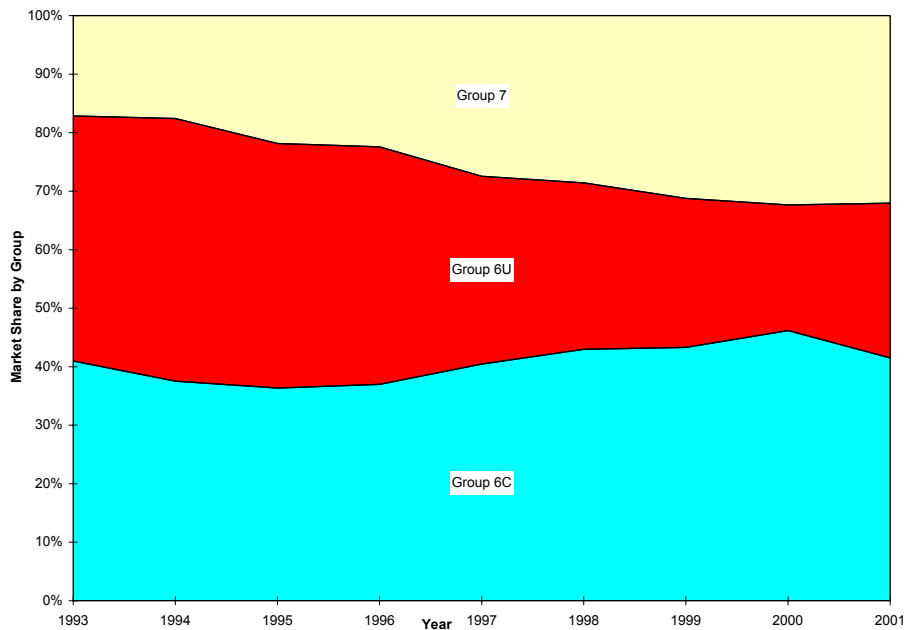
Separate Freezers

Market Trends

Total retail freezer sales for the period 1993 to 2001 were flat at around 80-85,000 units per annum. The 78 models identified in the full data set in 2001 made up around 99.2% of retail sales. 33 models were identified in the reduced data set used for the trend analysis. This represented 86% of retail sales in 2001.

The market share of chest freezers (Group 6C) is around 42%, and this appears to be fairly stable. The balance of separate freezer sales are vertical manual defrost freezers (Group 6U) with about 26% share in 2001 (market share has been fairly stable since 1997) and vertical frost free freezers (Group 7) with about 32% share in 2001 (market share has been increasing over most of the analysis period). Market share by Group is shown in Figure 12.

Figure 12: Market Share by Freezer Group



The average freezer size for all freezers in Australia is 217 litres and this has remained almost static (-0.1% pa) since 1993. However, the average size in each segment is quite different (chest freezers = 185 litres, vertical manual defrost = 150 litres, vertical frost free = 315 litres) and average sizes for all groups are declining very slowly over the analysis period.

The average nominal price of freezers is increasing at around 2.3% per annum, which is roughly equal to the inflation rate (i.e. steady in real terms). However, as for refrigerators, this apparent price rise is mostly due to an increase in sales share of frost free vertical freezers (with an average price of around \$1,000) and a decline in sales share of small vertical freezers (average price of under \$500). The nominal price within each group has been steady over the period.

Energy Efficiency Trends

The energy consumption of freezers is trending downwards at -1.5% per annum, with the most gains in energy efficiency being made since 2000. As the volume is increasing slightly, the total energy efficiency of the freezer market is increasing at a rate of around +1.4% per annum (i.e. kWh per adjusted litre is trending -1.4% pa).

While the overall efficiency of freezers deteriorated from 1995 to 1998, which was most probably associated with the phase out of CFCs in 1994, freezer efficiency improved markedly from 1998 to 2000 but this improvement has slowed into 2001.

In 1993, about 40% of freezer sales would have failed the MEPS levels. In 1999 some 8% of freezer sales still failed the 1999 MEPS levels (all of these being chest freezers). No freezers identified by GfK in 2000 or 2001 failed the 1999 MEPS levels (see Figure 11). Table 2 summarises the key attributes from 1993 to 2001. Also

included in the table are the values obtained from analysis using the full data set. As with refrigerators, there appears to be a small difference between the reduced data set and the full data set in relation to volume and energy. The full data set appears to contain a higher share of models with large volume and the weighted energy consumption is consequently greater. As a result, the figures for the full data set are marginally higher than the cut down data set for freezer volume (+7%), energy (+1.5%) and adjusted volume (+7%). While there is a 5% difference in kWh/adjusted litre, the differences between old SRI, new SRI and price are insignificant.

Table 2: Changes in Freezer Characteristics - 1993 to 2001

Characteristic	1993 Value	2001 Value	2001 Value *	Change pa #
Freezer Volume (litres)	218	217	232	-0.1%
Energy (kWh/year)	619	550	558	-1.5%
Adjusted Volume (litres)	349	347	371	-0.1%
kWh/adjusted litre	1.77	1.58	1.50	-1.4%
Old SRI	4.24	4.72	4.79	1.4%
New SRI	1.48	1.97	1.96	3.6%
Price	\$568	\$681	\$681	2.3%

* The values in this column include all data supplied by GFK (99.2 % of retail sales).

Change pa is with 1993 value compared to value obtained in the reduced data set for 2001 (86% of retail sales).

A year by year breakdown of key performance characteristics is also shown in Figure 13 below.

Figure 13: Annual Trends in Key Performance Characteristics - Freezers

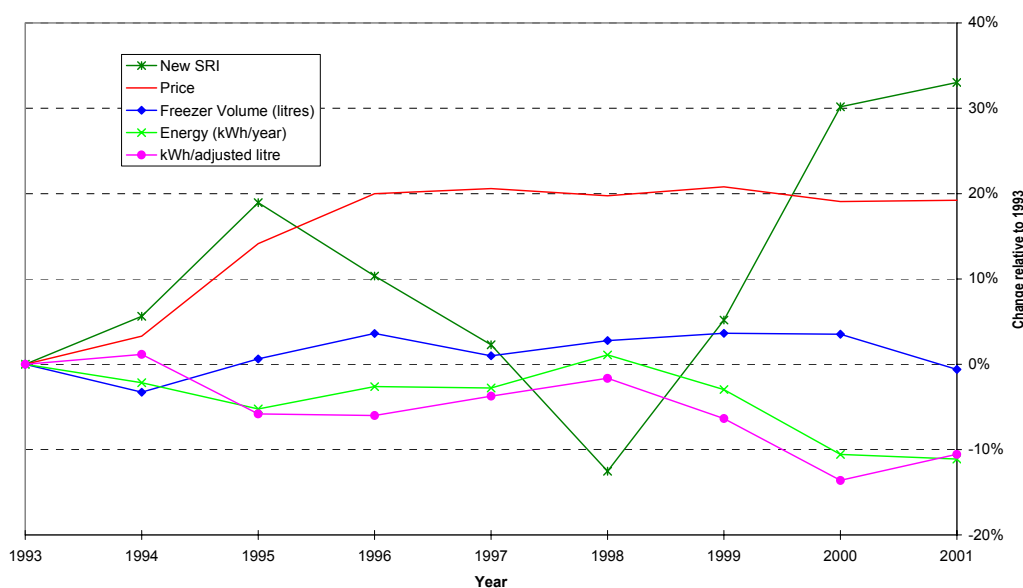


Figure 14 shows the trend in the inverse of energy efficiency (expressed as kWh per adjusted litre of volume) for each of the three freezer Groups. Group 6C (chest freezers) showed an efficiency deterioration from 1995 to 1998 but a subsequent improvement in 1999 and 2000, probably due to MEPS coming into force in 1999. Group 6U (vertical manual defrost freezers) showed no significant improvement in energy efficiency from 1997 to 1999 but improved in 2000 (probably also as a result of MEPS). Group 7 (frost free freezers) showed some improvements over the period 1993 to 2000 (although this was variable). All freezer groups showed a slight deterioration in efficiency from 2000 to 2001.

Figure 14: Energy Efficiency Trends by Freezer Group

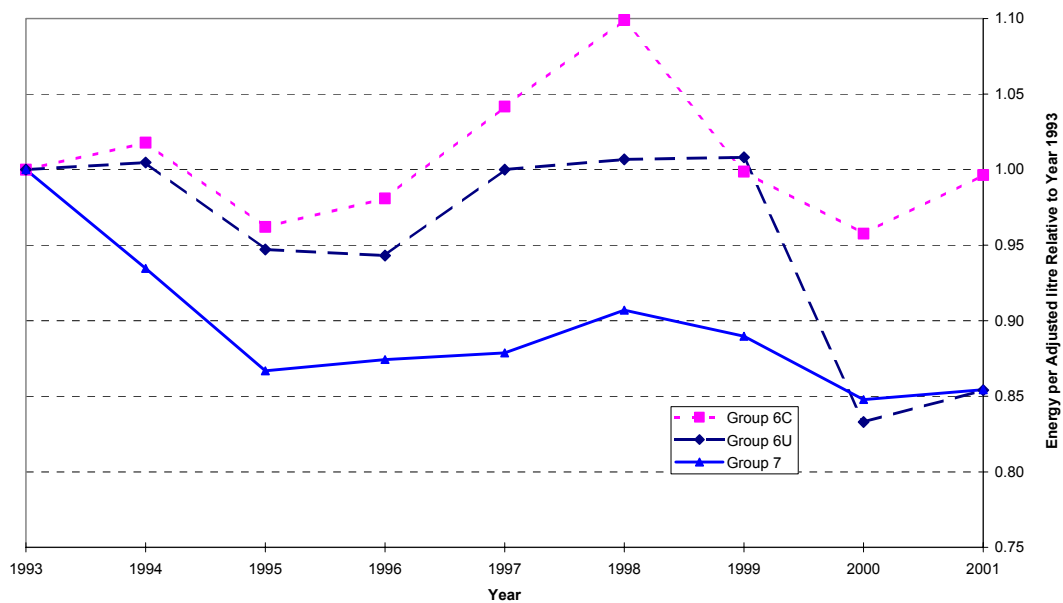


Figure 15 and Figure 16 show the sales distribution of freezer old and new star ratings from 1993 to 2001 respectively. The overall market trend is complex as efficiency decreased during the period 1993-1998 and increased again in 1999 and 2000 and stalled again in 2001. Neither chart shows a clear trend, however, the proportion of higher star rating freezers sold in the market place appears to be increasing in recent years.

Figure 15: National Sales Distribution by Old Star Rating - Freezers

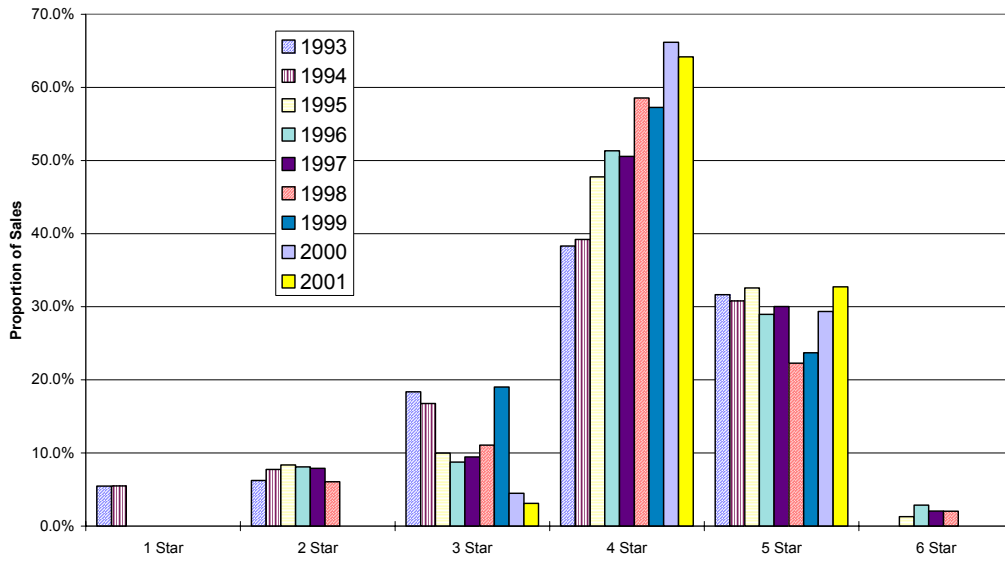
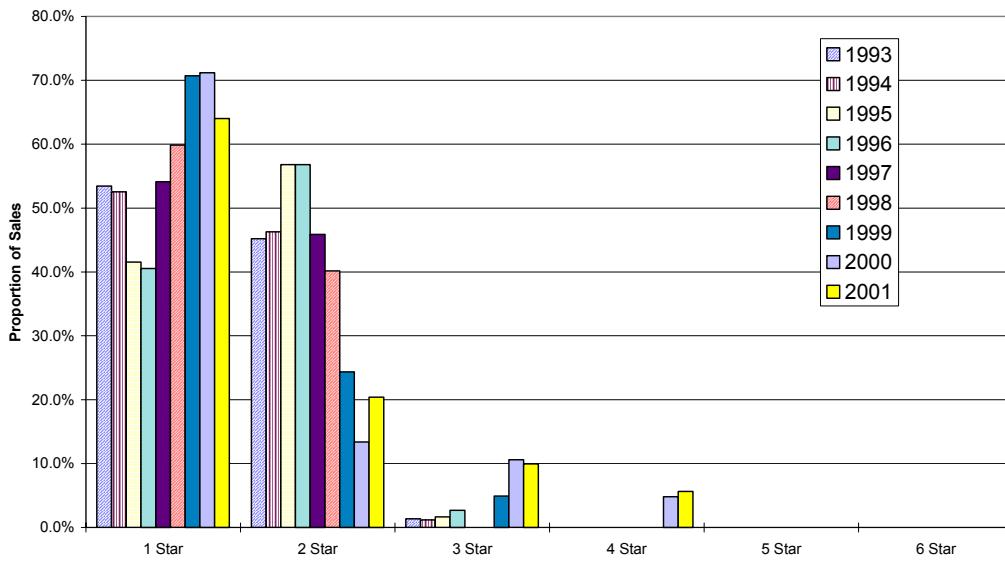


Figure 16: National Sales Distribution by New Star Rating - Freezers



Clothes Washers

Market Trends

Total retail sales for clothes washers for the period 1993 to 2001 increased at 1.3% per annum to about 444,000 units in 2001 (sales varied slightly from year to year but have been static since 1995). The 265 models identified in the full data set in 2001 made up around 98% of retail sales. For the cut down analysis in 2001, 74 models were included, representing 89% of retail sales.

The market share of top loading machines is dominant in Australia at 86% in 2001, which is only slightly down from 88% in 1993. The share of front loading (drum) machines increased from 7.7% in 1995 to 12.6% in 1997 and has been steady since. The market share of twin tubs has declined such that very few (only 0.6% share in 2001) of these units are being sold. Sales share by washer type by year is shown in Table 3 and Figure 17.

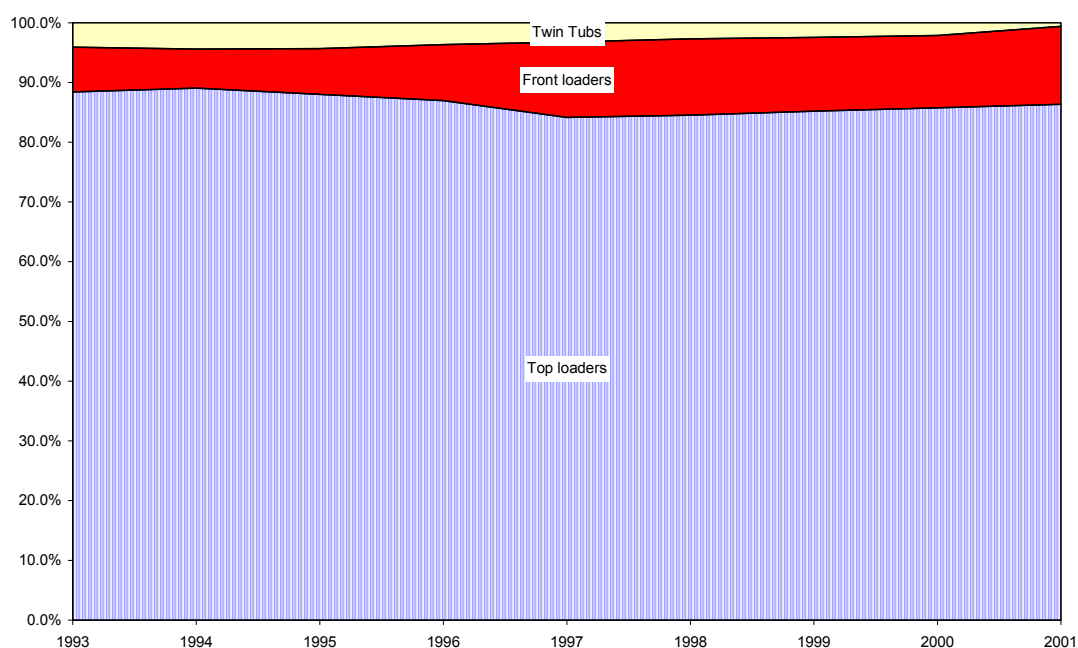
Table 3: Sales Share by Washer Type - 1993 to 2001

Washer Type	1993	1994	1995	1996	1997	1998	1999	2000	2001
Top Loading	88.4%	89.1%	88.0%	87.0%	84.2%	84.5%	85.2%	85.8%	86.3%
Front Loading	7.5%	6.6%	7.7%	9.4%	12.6%	12.8%	12.4%	12.1%	13.0%
Twin Tub	4.1%	4.4%	4.3%	3.6%	3.2%	2.7%	2.4%	2.1%	0.6%

Source: GfK additional data analysis (cross-tabulations) 1993-2000 and full data set for 2001.

Note: Front loading clothes washers are under-represented in GfK hit lists which is used for sales weighted analysis.

Figure 17: Sales Share by Washer Type - 1993 to 2001



The average load capacity for all clothes washers in Australia was 6.2 kg in 2001 and this has been increasing at about 2.1% per annum since 1993. These capacity changes are mostly attributable to the top loading segment due their dominant market share, although both front loaders and twin tubs also increased significantly in capacity over the analysis period. Front loaders in particular increased in capacity from 5.2kg in 1999 to 5.9kg in 2001. The capacity of top loading clothes washers has remained steady at 6.2kg since 1999.

Water consumption of clothes washers generally trended downwards from 1993 to 2001 as the market share of front loaders increased and the top loader water consumption also decreased marginally (although this varied somewhat from year to year). Front loaders have shown a considerable decrease in water consumption since 1997 where water consumption was 91 litres in 1997 compared to 71 litres in 2001. Prior to 1997, the number of front loading models identified by GfK is too small to be certain that it is representative of the segment.

The water consumption of top loaders varied from year to year, with a slight downward trend over the period. In 1999 the water consumption increased with the increase in top loader capacity in that year. However, water consumption declined again in 2000 and was at 143 litres in 2001.

Spin performance of all clothes washers has shown a very gradual improvement since 1993, down from 0.85 to 0.76 in 2001. The average spin performance of top and front loading machines is generally comparable (although there is significant variation in performance within each type).

The price of clothes washers was steady over the period 1993 to 2001 in nominal terms (an increase of +0.1% per annum), which is well below inflation for the period. This is despite the increased market share of front loaders, which are more expensive. Top loader prices decreased in price at -0.9% per annum while front loaders appeared to increase slightly in price in nominal terms. Extra data analysis provided by GfK for 1993 to 2000 showed that the price of front loaders increased at +0.5% per annum to 2001, which is somewhat below inflation.

Energy Efficiency Trends

The energy consumption of clothes washers trended slightly downwards from 1993 to 1998 but increased again in 1999 and 2000. This increase (attributable to top loaders only) coincided with a sharp increase in the capacity of top loaders in 1998 (0.3kg or 5% in 1 year). The energy consumption of top loaders has failed to improve over the analysis period with energy in 2001 at 626 kWh/year, which is 6% above the 1993 value (bearing in mind that capacity has also increased). In contrast, front loader energy consumption has declined consistently over the analysis period from 358 kWh/year in 1993 to 221 kWh/year in 2001, a decrease of 39% over the analysis period (a decrease of nearly 6% per annum). Note that actual energy consumption of front loaders in 2001 is 35% of that for top loaders under the test standard. These energy trends are illustrated in Figure 18.

Despite the apparent lack of improvement in top loader energy consumption over the analysis period, there are other factors that have an important influence on clothes washer energy consumption during actual use in households. Firstly, there has been an ongoing trend towards cold water washing in Australian households. The Australian Bureau of Statistics (see www.abs.gov.au) reported that in 2002 some 68% of households wash in cold water (up from 61% in 1994) (ABS4602.0-2002). This is critical because the energy values analysed for this report are to AS/NZS2040 which specifies a warm wash for the purposes of energy labelling. The energy embodied in warm water for a clothes washer test constitutes typically more than 80% of the total energy consumption of clothes washers. Most top loaders are able to wash in cold water, so the in use energy consumption of top loaders will be considerably lower than stated on the energy label for households that use cold washing frequently. The new energy label now also shows cold water energy for clothes washers – for top loading machines this is an average of 75 kWh/year compared to an average warm CEC of 640 kWh/year for products currently registered.

The other factor that will influence in use energy consumption for clothes washers is frequency of use. The energy label assumes a constant 7 washers per week for all models. Household sizes are continuing to decline while clothes washer capacity in recent years has increased. Presumably the total washing requirement per person is not increasing, so it is reasonable to assume in average households that either there are less loads per week washed or more loads are done at part of rated capacity. In either case, the resulting energy consumption is likely to be less than that stated on the energy label. However, the energy label remains an important comparative tool for consumers.

Figure 18: Trends in Top and Front Loading Clothes Washer Energy

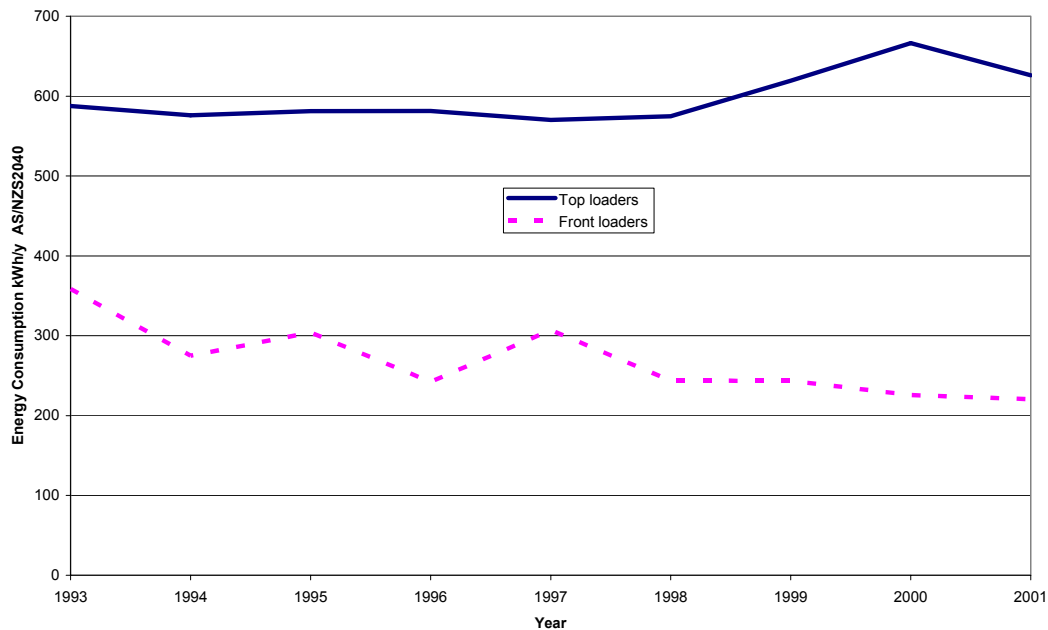


Table 4 summarises the key clothes washer attributes from 1993 to 2001. The table also shows the values obtained from analysis of the full data set (98% of retail sales). The differences between the values in the full data set and the reduced data set are insignificant. A year by year breakdown of key performance characteristics is also shown in Figure 19.

Table 4: Changes in Clothes Washer Characteristics - 1993 to 2001

Characteristic	1993 Value	2001 Value	2001 Value *	Change pa #
Capacity (kg)	5.22	6.17	6.19	2.1%
Water Consumption (litres)	146	134.9	133.6	-1.0%
Spin Performance	0.85	0.76	0.76	-1.4%
Energy (kWh/year)	574	584	576	0.2%
Old SRI	3.39	3.85	3.89	1.6%
New SRI	1.28	1.77	1.83	4.2%
Price	\$802	\$808	\$808	0.1%

* The values in this column include all data supplied by GFK (98% of retail sales).

Change pa is 1993 value compared to value obtained in the reduced data set for 2001 (89% of retail sales).

Figure 19: Annual Trends in Key Performance Characteristics - Clothes Washers

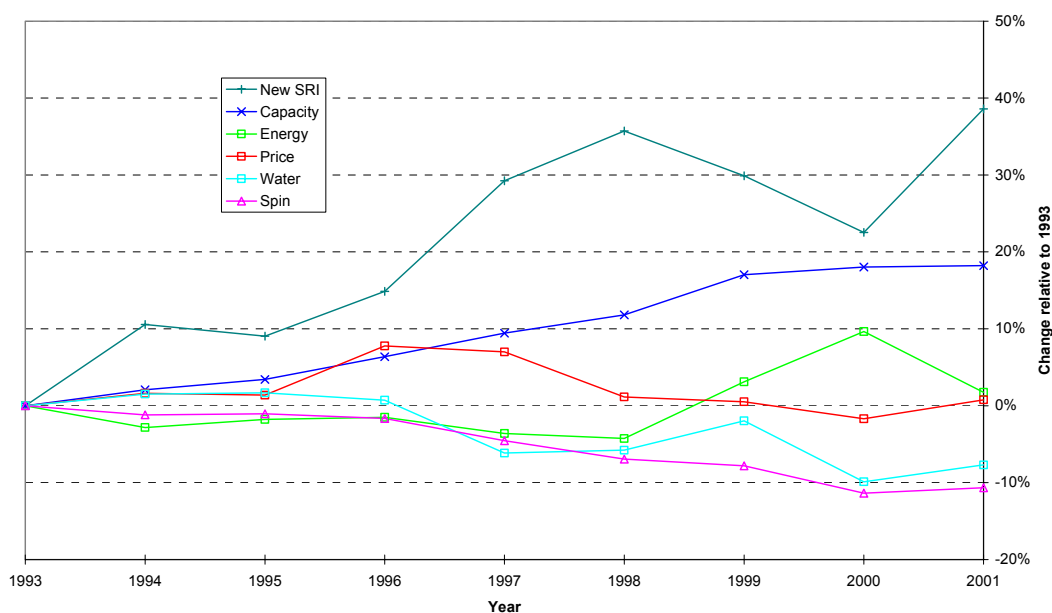


Figure 20 and Figure 21 show the sales distribution of clothes washer old and new star ratings from 1993 to 2001 respectively. The overall market trend is complex as efficiency increased during the period 1993-1998, decreased in 1999 and again in 2000 but then increased in 2001. Generally speaking, under the old star rating, there appears to be a slight increase in the number of 5 star units sold. Under the new star rating system, there is a decrease in 1 star units and an increase in 2 star units being sold.

Figure 20: National Sales Distribution by Old Star Rating - Clothes Washers

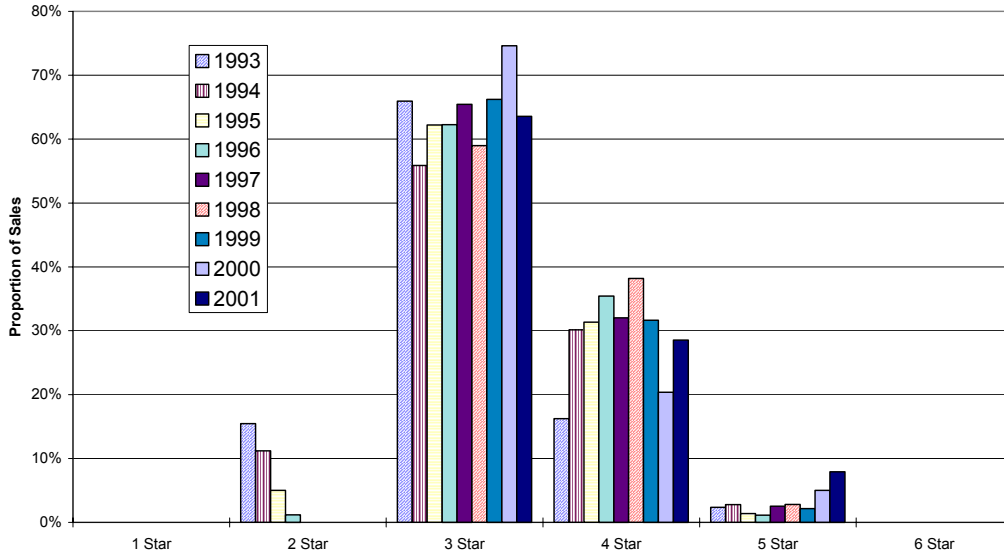
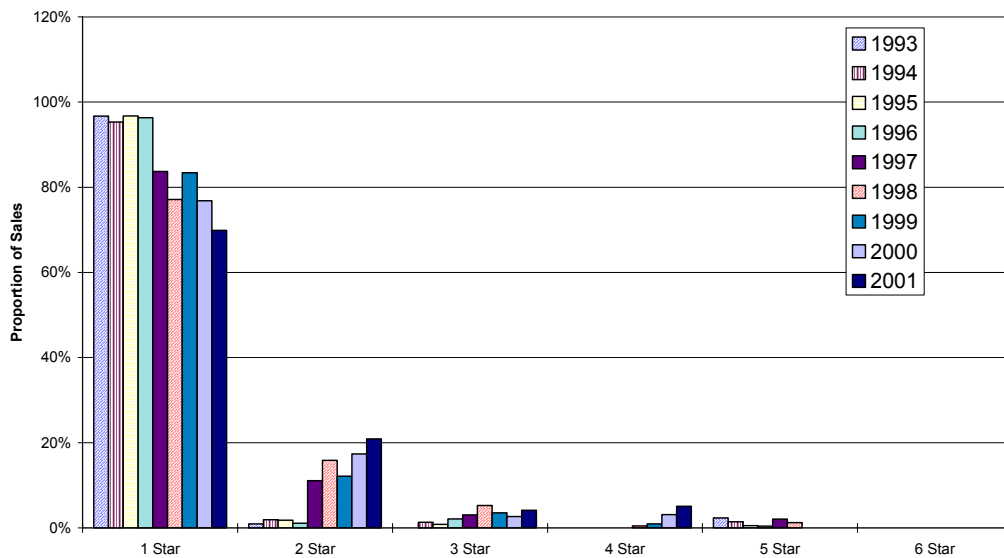


Figure 21: National Sales Distribution by New Star Rating - Clothes Washers



Note: The 5 star units shown in 1993 to 1998 are cold connect machines without a heater which are not required to carry an energy label. However, this is study, that have been allocated a nominal 5 star rating under the new system.

Clothes Dryers

Market Trends

Total retail clothes dryer sales for the period 1993 to 2001 increased at around 2.7% per annum to about 177,000 units in 2001, but sales varied from year to year (sales grew to a peak of nearly 200,000 in 1998 and have declined slightly since). The sales of clothes dryers in Australia are somewhat dependent on weather and the economy, so the annual sales are expected to vary. The 84 models identified in the full data set in 2001 made up nearly 97% of retail sales. The reduced data set used for the analysis identified 18 models which represented 89% of retail sales.

The vast majority of clothes dryers sold in Australia are the vented type – condenser dryers are available but these are fairly unusual. Timer dryers made up about 71.6% sales in 2001. The market share of auto-sensing dryers increased from a 10% in 1993 to about 28.4% in 2001.

The average load capacity for all clothes dryers in Australia was 4.4 kg in 2001 and this has been static over the analysis period. The three main capacities available in 2001 were: 3.5kg (representing 25% of sales), 4.5kg (37% of sales) & 5kg (37% of sales). Other sizes, which range up to 9kg, are available but these have only a negligible market share. Average program time for clothes dryers was around 140 minutes and this has remained constant over the analysis period.

The price of clothes dryers increased at around 2.1% per annum, which was slightly below inflation for the analysis period, despite the increasing market share of auto-sensing models, which were generally more expensive than timer models. The price trend in the timer segment was +1.6% per annum while auto-sensing was +0.3% per annum (both well below inflation).

Energy Efficiency Trends

The energy consumption of clothes dryers trended downwards at around -0.8% per annum. The old and new star ratings for clothes dryers increased at 1.0% per annum. Table 5 summarises the key attributes from 1993 to 2001 and also shows the values obtained from analysis of the full data set. No significant differences between values in the reduced data set and the full data set are apparent. A year by year breakdown of key performance characteristics is shown in Figure 22.

Table 5: Changes in Clothes Dryer Characteristics - 1993 to 2001

Characteristic	1993 Value	2001 Value	2001 Value *	Change pa #
Capacity (kg)	4.42	4.41	4.49	0.0%
Program Time (minutes)	141	139	142	-0.2%
Specific Energy (kWh/kg water removed)	1.10	1.10	1.10	0.0%
Energy (kWh/year)	240	225	229	-0.8%
Old SRI	2.40	2.60	2.57	1.0%
New SRI	1.52	1.65	1.64	1.0%
Price	\$339	\$400	\$400	2.1%

* The values in this column include all data supplied by GFK (97% of retail sales).

Change pa is 1993 value compared to value obtained in the reduced data set for 2001 (89% of retail sales).

Note: The energy trend is affected by the share of timer and auto-sensing. The energy value reported above is based on the new algorithm of 52 uses/year (previously 150 uses/year).

Figure 22: Annual Trends in Key Performance Characteristics - Clothes Dryers

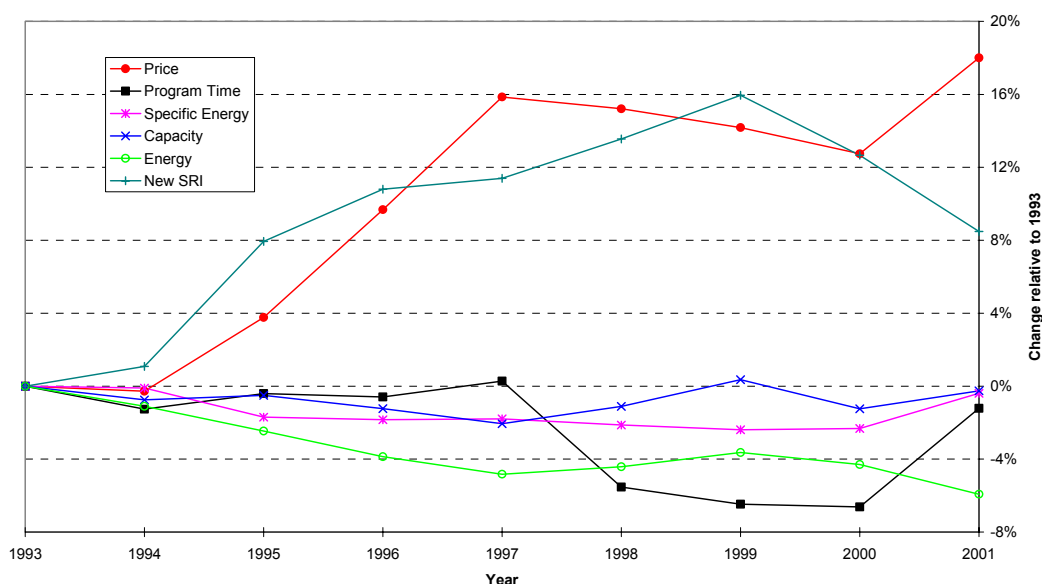


Figure 23 and Figure 24 show the national sales distribution of clothes dryer old and new star ratings from 1993 to 2001. The overall market trend in the old star rating was a reduction in the proportion of 2 star units sold and an increase in the proportion of 3 star units sold. Similarly, the overall market trend in the new star rating was a reduction in the proportion of 1 star units sold and an increase in the proportion of 2 star units sold. 2001 saw a notable increase in the number of one star units sold under the old star rating scheme - these are mostly a small selling low capacity model that was re-registered after 2000 with a lower efficiency than for previous years. Of course this is not visible under the current star rating system as it remains at 1 star before and after re-registration.

Figure 23: National Sales Distribution by Old Star Rating - Clothes Dryers

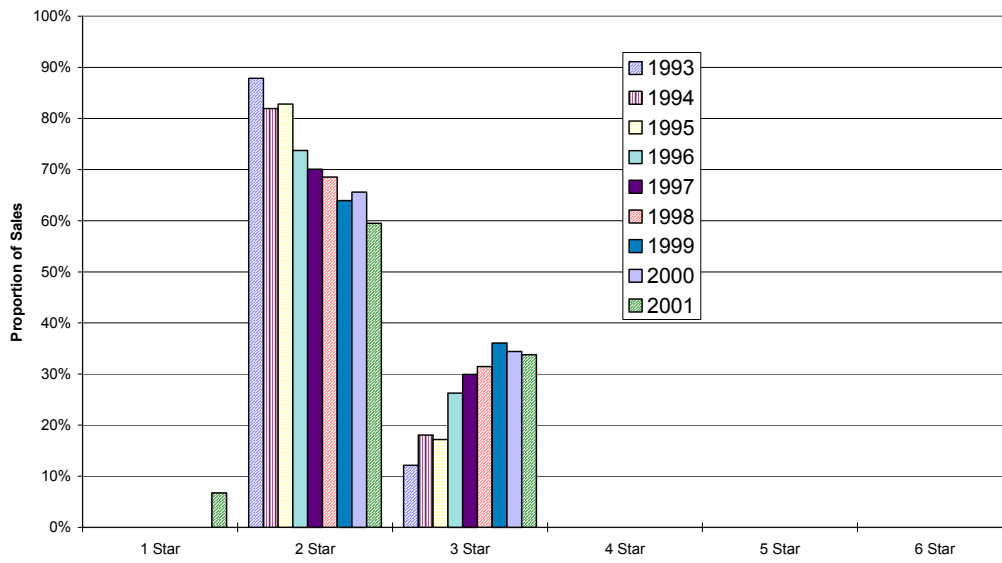
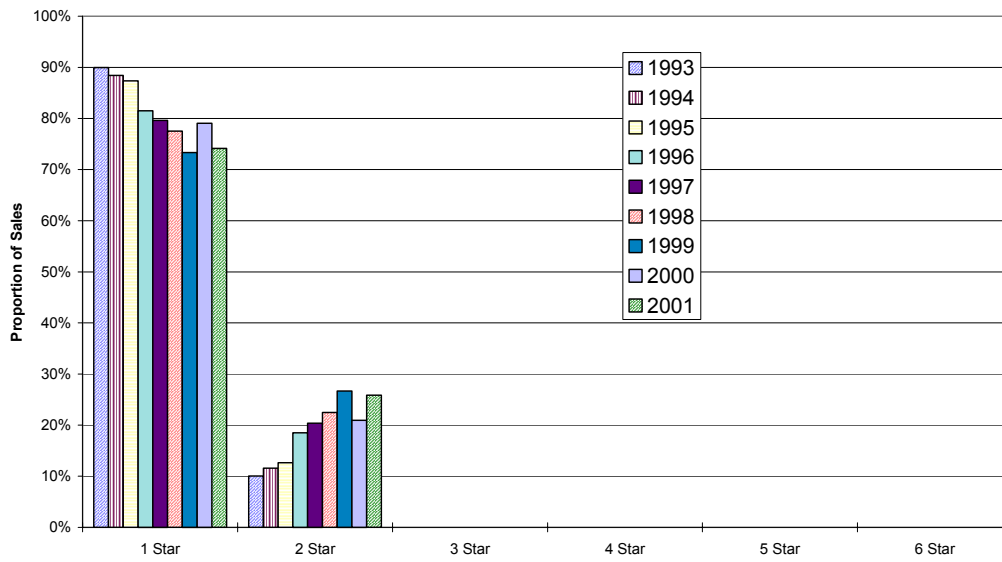


Figure 24: National Sales Distribution by New Star Rating - Clothes Dryers



Dishwashers

Market Trends

Total retail dishwasher sales for the period 1993 to 2001 have continued to grow strongly at 5.4% per annum to about 170,400 units in 2001. The 274 models identified in the full data set in 2001 made up 97% of retail sales. In the reduced data set which was used for this analysis, 77 models were identified, constituting 89% of retail sales. Almost all dishwashers sold in Australia are standard sized 600 mm wide units of 12 or 14 place setting capacity. Smaller units of less than 10 place settings are available but these are fairly unusual.

The average place setting capacity for all dishwashers in Australia was 12.8 which is a slight decline in average capacity of 1.0% per annum since 1993. Program times for dishwashers varied slightly from year to year, but are essentially stable at around 70 minutes. The water consumption of dishwashers trended down at -4.3% per annum to 20.3 litres in 2001. The average water consumption is starting to approach technological limits, therefore water consumption has only fallen by smaller amounts per year since 1997.

The price of dishwashers increased at around 1.2% per annum which was below inflation for the period.

Energy Efficiency Trends

The energy consumption of dishwashers trended downwards at -3.6% per annum from 1993 to 2001. The old star rating for dishwashers increased at 2.8% per annum while the new star rating increased at 3.6% per annum. Table 6 summarises the key attributes from 1993 to 2001 and also includes values obtained from analysis of the full data set. A comparison of the values obtained from the full data set and the reduced data set reveals no significant differences. A year by year breakdown of key performance characteristics is shown in Figure 25.

Table 6: Changes in Dishwasher Characteristics - 1993 to 2001

Characteristic	1993 Value	2001 Value	2001 Value *	Change pa #
Place Settings	13.9	12.8	12.8	-1.0%
Program Time (minutes)	69	73	74	0.7%
Water Consumption (litres)	28.8	20.3	20.2	-4.3%
Energy (kWh/year)	494	369	371	-3.6%
Old SRI	4.07	5.07	5.06	2.8%
New SRI	1.88	2.50	2.48	3.6%
Price	\$927	\$1,016	\$1,016	1.2%

* The values in this column include all data supplied by GFK (97% of retail sales).

Change pa is 1993 value compared to value obtained in the reduced data set for 2001 (89% of retail sales).

Figure 25: Annual Trends in Key Performance Characteristics - Dishwashers

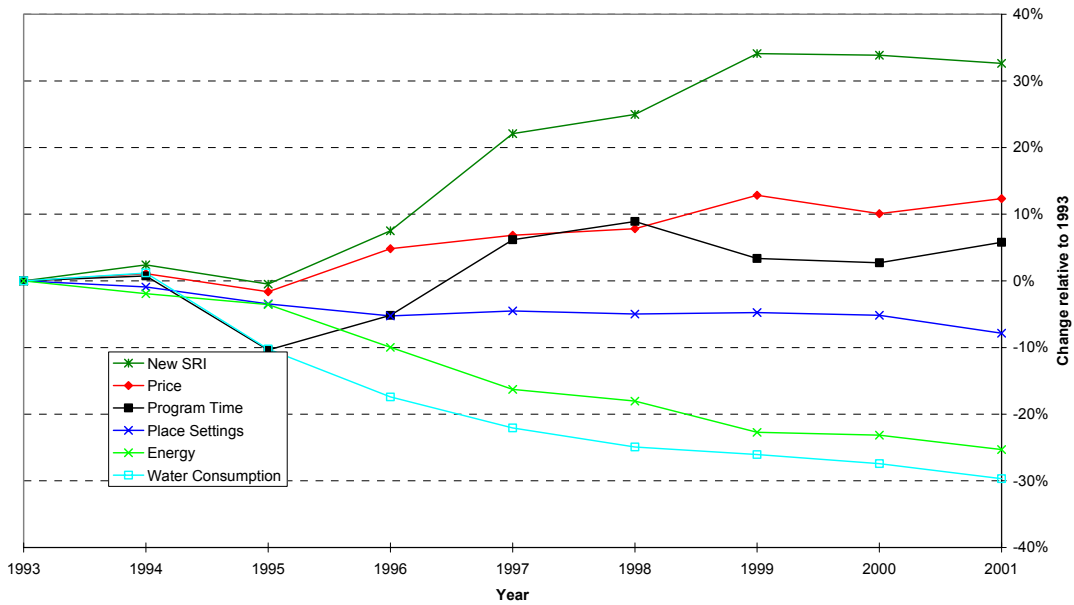


Figure 26 and Figure 27 show the sales distribution of dishwasher old and new star ratings from 1993 to 2001. The overall market trend in the old star rating is a reduction in the proportion of 4 star units sold and an increase in the proportion of 5 and 6 star units sold. The overall market trend in the new star rating is a reduction in the proportion of 1 star units sold and an increase in the proportion of 2 and 3 star units sold.

Figure 26: National Sales Distribution by Old Star Rating - Dishwashers

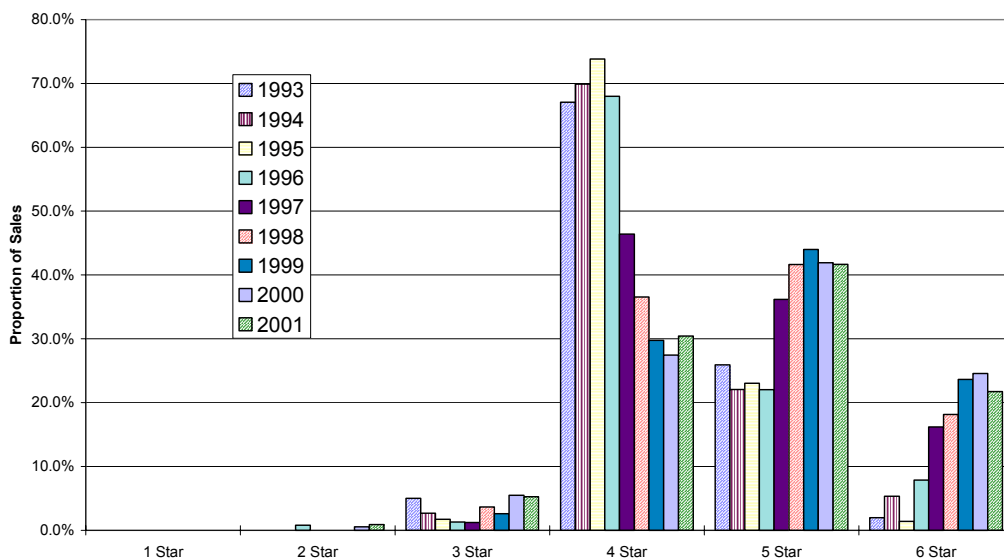
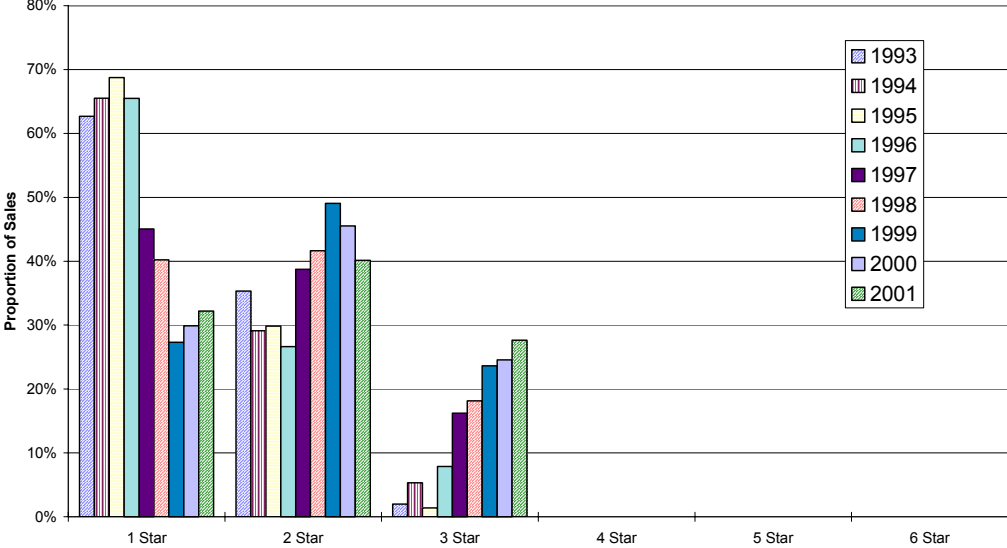


Figure 27: National Sales Distribution by New Star Rating - Dishwashers



ANNEX A

SOURCE DATA AND METHODOLOGY

Source Data

The information provided by GfK was in the form of national sales data plus sales data for five state groupings (NSW+ACT, QLD, WA, SA+NT, VIC+TAS). The appliance lists show the largest selling models for each of the main appliance categories. For 2001 and for subsequent years GfK are providing full sales lists for all models except those tagged as “exclusive”. “Exclusive” models are those that are unique to a single retailer chain – for these models GfK only release the brand (in most cases), price and sales.

For years to 2000 the sum of the state sales for a particular model does not necessarily equal the national sales for that model, as not all models listed at the state level are necessarily listed at the national level and vice versa. However, the total state sales add up to total national sales. From 2001 state and national data is internally consistent.

GfK claim to cover more than 99% of total retail appliance sales in Australia. It is still unclear what proportion of total appliance sales would occur outside the retail system (possibly some large institutional buyers or other large direct wholesale purchases). This is probably most significant for refrigerators. Investigation of any differences will be examined in a separate report.

The appliance sales data is collected by GfK from all major retailers of appliances. GfK estimate that about half of the sales data is from retailers with full census information (via computerised listings), while the model breakdowns in the remaining 50% is estimated on the basis of sampling from selected stores in the various retail chains. It should be noted that the total sales figures (number sold and value) for each appliance type will be accurate - only the market share by model is estimated by GfK by the use of sampling.

For the first time in the analysis period, GfK have supplied a full data set for each appliance. In past years, data for approximately 75% to 90% of total sales for each of the appliance groups was provided. The data included a list of models with the largest sales in order of decreasing sales. However, to preserve continuity in the analysis period, data sets were reduced or cut down to replicate previous years data. Where any important trends or new information have emerged in the full data set, these have been noted in the text. In subsequent years, the analysis will include both the full data set and the cut down version, to enable trends to be examined.

For all appliances covered, GfK provided the following data for each model listed, both at the national and state levels:

- brand
- model number
- energy label consumption (CEC)
- star rating
- unit sales
- average selling price
- maximum price

The GfK data for star ratings in 2000 was not useable as there were a mixture of old and new star ratings recorded. The CEC for clothes dryers was also unusable from 2000 as the rating base change from 150 uses per year to 52 uses per year in 2000.

For refrigerators and freezers, the following additional data was provided for each model:

- nominal total gross volume
- number of external doors
- defrost type (manual, frost free, auto, push button)
- refrigerator type (standard, all refrigerator, upside down, side by side - or chest/upright for freezers)

For clothes washers, the following additional data was provided for each model:

- type - top/front/twin tub
- load capacity

For clothes dryers, the following additional data was provided for each model:

- type - condenser or vented
- load capacity

For dishwashers, the following additional data was provided for each model:

- stand alone or integrated (built in)
- mechanical or electronic control

GfK commenced data collections in February 1993, so no data is available prior to this date. Data is collected in 2 monthly periods, so the closest period which corresponds to a full Calendar year is from February one year to January the next year. These periods have been used as nominal years for this analysis. So far, data has been received and analysed for each of the yearly periods from February 1993 - January 1994 (nominal year 1993) to February 2000 - January 2001 (nominal year 2000). From 1999 GfK collected data monthly and from 2000 true calendar years are available, but these are yet to be analysed.

Analysis Methodology

In earlier years, the first step in the process was to compile all of the state based registers into a single complete listing of all models for each appliance that have ever been registered for labelling. This step has now been superseded as the national registration database has been used as the primary data source for all models. Where data for particular fields was required for the analysis but was missing from an old registration record, this was obtained from related registrations where available, or from labelling brochures where these contained the relevant information. In a few cases, inquiries were made with the state which held the registration and test report for the relevant model, or with the manufacturers themselves. Most current registrations contain complete data.

For each model listed in the GfK hit lists for each period, the correct national database registration number was identified then entered into a separate database together with the GfK data on sales and price for each model (national and state data). From 1999 GfK have supplied electronic lists which made cross matching much faster and more streamlined. The data contained in the energy labelling registration database is much more detailed and accurate than the limited information collected by GfK for each model. The analysis of the 2001 data was slower as the number of models in the full model listing was typically 3 to 4 times larger than the hit lists provided prior to 2001.

A separate sales database has been created for each appliance type and for each year. The appliance attributes which are required for analysis in these yearly sales databases are imported from the master registration database which has been checked for completeness for each record used in the analysis. The yearly sales database then calculates the sales weighted attributes of interest that are tracked in the analysis.

An analysis database imports the relevant sales weighted information from each of the single yearly sales databases and compiles sales weighted information of interest for each year. This data is available at the national and state level. National trend data for all the years analysed is then compiled onto a single listing for further analysis.

From 2001 a cut down version of the year file was also produced to simulate the proportion of sales identified prior to 2001 to allow trends to be examined clearly. Once several years of full data sets are analysed it will become clear if there are issues regarding continuity with the full data set. State and national output sheets that use the full data set from 2001 are noted with a suffix of F and the sales filter is set to 0. For the cut down data set the sales filter is set to be a number that provides an equivalent identified proportion of sales to previous years. For year 1993 to 2000 the sales filter is set to 0 as all available sales records are included in the analysis. However, in these years GfK did not provide the details of the bottom 10% to 15% of sales.

ACKNOWLEDGMENTS

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- NSW Ministry of Energy & Utilities;
- South Australian Office of the Technical Regulator;
- Queensland Department of Industrial Relations; and
- Australian Greenhouse Office.



NAEEEC MEMBER ORGANISATIONS

The Commonwealth, New Zealand, each State and each Territory are represented on NAEEEC and participate in its deliberations. Representatives are drawn from officials within Government departments, agencies and statutory authorities or from persons appointed to represent those bodies. Representatives are usually a senior officer directly responsible for energy efficiency. The membership is currently under review and may expand to include other agencies working in these fields.

The *Australian Greenhouse Office* is the lead Commonwealth agency for greenhouse matters. The Australian Greenhouse Office (AGO) is responsible for monitoring the National Greenhouse Strategy in a cooperative effort with States and Territories and with the input of local Government, industry and the community. An AGO officer is the chair of NAEEEC and others provide support for its activities.

The *NSW Ministry of Energy and Utilities* provides policy advice to the NSW Government and operates a regulatory framework aimed at facilitating environmentally responsible appliance and equipment energy use. The Ministry is represented on the Energy Efficiency and Greenhouse Gas working group through which the appliance and equipment related elements of the National Greenhouse Strategy will be progressed.

The *NSW Sustainable Energy Development Authority* was established in February 1996 with a mission to reduce the level of greenhouse emissions in New South Wales by investing in the commercialisation and use of sustainable energy technologies.

The *Office of the Chief Electrical Inspector* is the Victorian technical regulator responsible for electrical safety and equipment efficiency. Its mission is to ensure the safety of electricity supply and use throughout the State. The corporate vision of the Office is to demonstrate national leadership in electrical safety matters and to improve the superior electrical safety record in Victoria. The Office's strategic focus is to ensure a high level of compliance is sustained by industry with equipment efficiency labelling and associated regulations.

The *Sustainable Energy Authority* was established in 2000 by the Victorian Government to provide a focus for sustainable energy in Victoria. The Authority's objective is to accelerate progress towards a sustainable energy future by bringing together the best available knowledge and expertise to stimulate innovation and provide Victorians with greater choice in how they can take action to significantly improve energy sustainability.

The *Electrical Safety Office, Department of Industrial Relations*, is the Queensland technical regulator responsible for electrical safety and appliance and equipment energy efficiency. The office ensures compliance with electrical safety and efficiency regulations throughout Queensland.

The *Environmental Protection Agency*, a Division of Sustainable Industries, is Queensland's lead agency in the promotion of energy efficiency, renewable power, and other initiatives that reduce greenhouse gas emissions throughout the State. The key aim of the unit is to achieve increased investment in sustainable energy systems, technology and practice.

Energy Safety WA seeks to promote conditions that enable the energy needs of the Western Australian Community to be met safely, efficiently and economically.

The *Western Australian Sustainable Energy Development Office* promotes more efficient energy use and increased use of renewable energy to reduce greenhouse gas emissions while increasing jobs in related industries.

The *Office of the Technical Regulator* seeks to ensure the coordinated development and implementation of policies and regulatory responsibilities for the safe, efficient and responsible provision and use of energy for the benefit of the South Australian community.

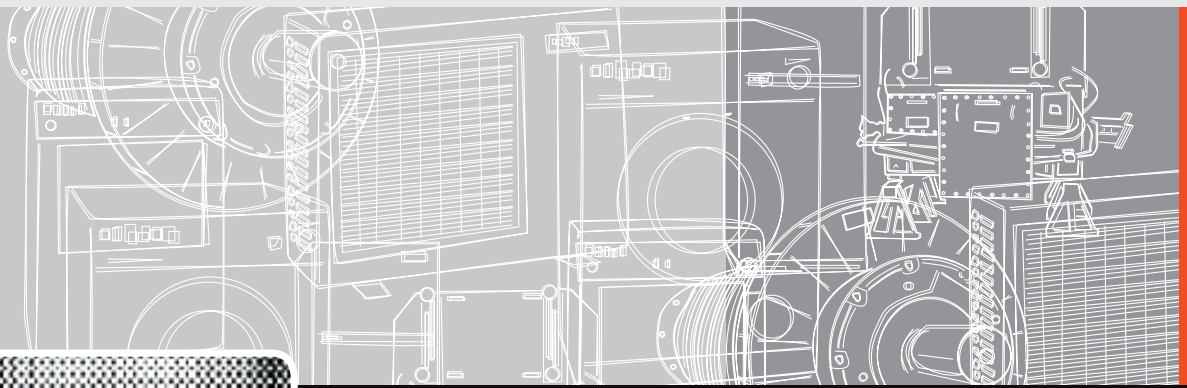
The Tasmanian Government's interest is managed by the *Office of Energy, Planning and Conservation*.

The Australian Capital Territory's interest is managed by the *Energy Policy Unit, Economic Management Branch, ACT Department of Treasury*. (<http://www.treasury.act.gov.au/energypolicy>)

The *Department of Employment, Education and Training* is responsible for the administration of regulations in the Northern Territory regarding various aspects of safety, performance and licensing for goods and services including electrical appliances.

The *Energy Efficiency and Conservation Authority (EECA)* is the principal body responsible for helping to deliver the New Zealand Government's extensive sustainable energy future. EECA's function is to encourage, promote and support energy efficiency, energy conservation and the use of renewable energy sources.

The *Ministry for the Environment (MfE)* is the lead environmental policy agency in New Zealand and is the government policy agency which advises the Minister of Energy on energy efficiency and renewables policy. MfE administers the Energy Efficiency and Conservation Act 2000, and energy efficiency regulations made under the Act.



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or any member organisation working
on the National Appliance and
Equipment
Energy Efficiency Program.