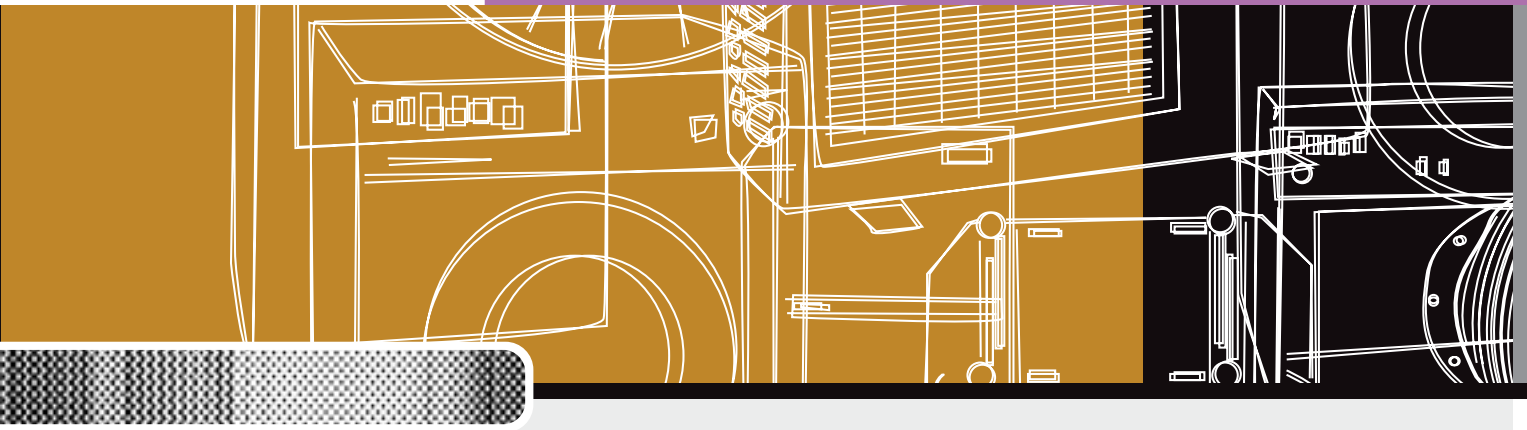


*NATIONAL APPLIANCE AND EQUIPMENT
ENERGY EFFICIENCY PROGRAM*

*APPLIANCE STANDBY POWER CONSUMPTION:
STORE SURVEY 2002 -EXECUTIVE SUMMARY*



June 2002

PREPARED BY ENERGY EFFICIENT
STRATEGIES AND ENERGYCONSULT,
JUNE 2002



APPLIANCE STANDBY POWER CONSUMPTION: STORE SURVEY 2002 – EXECUTIVE SUMMARY

A PROJECT FOR THE NATIONAL APPLIANCE & EQUIPMENT ENERGY EFFICIENCY COMMITTEE

PREPARED BY ENERGY EFFICIENT STRATEGIES AND ENERGYCONSULT, JUNE 2002

OVERVIEW

This report summarises the results of in-store standby measurements for some 635 new household appliances which were undertaken in February 2002. The results are summarised by product group and are compared with readings undertaken in a similar survey in early 2001. These two in-store surveys are the beginning of a longer term benchmarking program and results need to be viewed in this light. It is proposed to undertake similar surveys in future years to assess industry progress in reducing standby consumption of appliances.

BACKGROUND

In 2000 the Australian Greenhouse Office (AGO) and the National Appliance & Equipment Energy Efficiency Committee (NAEEEC) commissioned the report, *Quantification of Residential Standby Power Consumption in Australia* (Harrington and Kleverlaan, 2001). This study provides results of an intrusive survey where measurements on 2,500 appliances were undertaken in 64 houses in Melbourne, Sydney and Brisbane. The report also includes results of measurements on 531 new appliances in retail outlets in Sydney and Brisbane and results of a national telephone survey of 801 households in Australia which documents information on appliance ownership, age and usage patterns. This research revealed that 11.6% of Australia's household electricity consumption is attributed to energy used by appliances and electronic equipment when not performing their primary function (this figure includes some small continuous loads not traditionally classified as "standby"). This "standby" consumption was estimated in 2000 to be costing Australians more than \$500 million per year and generating more than 5 million tonnes of carbon dioxide per annum.

OBJECTIVES OF THIS STUDY

The AGO and the NAEEEC commissioned this survey in 2002 as part of the monitoring of its program to reduce the standby consumption of all electronic appliances to less than 1W. The main objectives of this survey were to:

- Quantify the magnitude of electricity used in standby mode by new appliances offered for sale in the Australian market in early 2002.
- Compare the results from this study with the results of a similar study undertaken in early 2001 in order to track the industry's progress in reducing standby power consumption.

Similar studies are proposed in future years to assess progress towards the 1 Watt target.

RESEARCH METHODS

Two major Melbourne retail stores were approached to take part in the study, in which power measurements on a large range of appliances were undertaken on the shop floor. An accurate metering device was systematically used to measure the power characteristics of display stock across 27 appliances main categories. Power consumption was measured in watts for a range of modes including "in use", "passive and/or active standby" and "off mode", where applicable (only certain modes were measured for each appliance group). Other information recorded included brand, model, power factor, current crest factor and supply voltage. These results were analysed and compared with outcomes from the 2001 in-store survey.

For the purposes of this report, "standby" is a general term which refers to the power consumption of a product or appliance that is

connected to a power source but does not produce any sound or picture, transmit or receive information or is waiting to be switched "on" by a direct or indirect signal from the consumer. This includes the "off" mode, even where there is no remote control. Unqualified use of the term "standby" generally means the lowest power consumption when connected to the mains.

KEY FINDINGS OF THIS STUDY

- Generally there appears to be a slight decrease in standby consumption when comparing the results of the 2002 in-store survey with those from the 2001 survey.

The overall average off mode consumption in 2002 for all products measured (where applicable) was 0.8W in 2002 (393 readings) compared to 1.3W in 2001 (258 readings). Similarly, the overall average passive standby mode consumption in 2002 for all products measured (where applicable) was 4.1W in 2002 (397 readings) compared to 5.8W in 2001 (459 readings). In each case, for off and passive

standby mode, these results represent a statistically significant¹ decrease in standby from 2001 to 2002. However the number and mix of products measured in these surveys were somewhat different so the results need to be taken as indicative and trends within each product need to be examined to fully understand the precise trends.

- A large proportion of appliances were found to have power consumption greater than 1W in both passive standby and off modes.

Only 62% of products measured in 2002 had an off mode. While most units had a power consumption of less than 1 Watt in off mode, 21.6% of models (with an off mode) still had power consumption over 1 Watt in this mode. This ratio was nearly the same in 2001 (23.6%). The power distribution of all products with an off mode is shown in Figure 1.

Most units had a power consumption of over 1 Watt in passive standby mode (84.4%). This ratio was a little worse in 2001 (91.7%). The power distribution of all products with passive standby mode is shown in Figure 2.

¹ Statistically significant at 95%

FIGURE A: DISTRIBUTION OF "OFF MODE" POWER – ALL PR ODUCTS IN 2002 STORE SURVEY

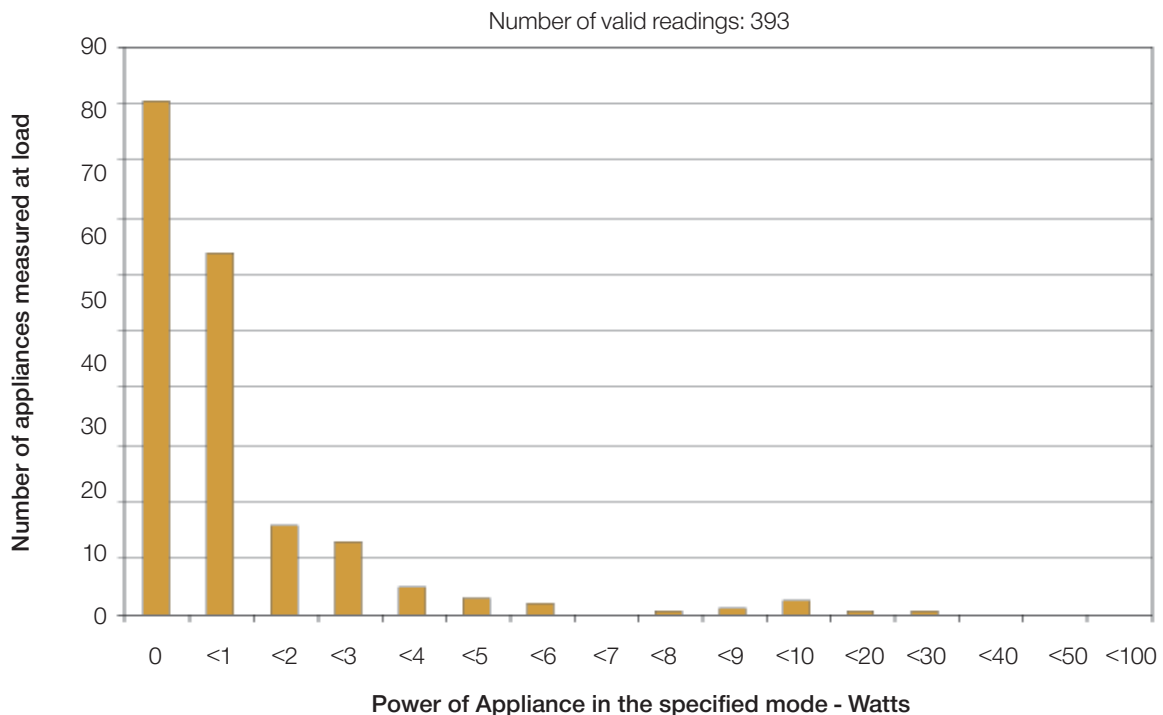
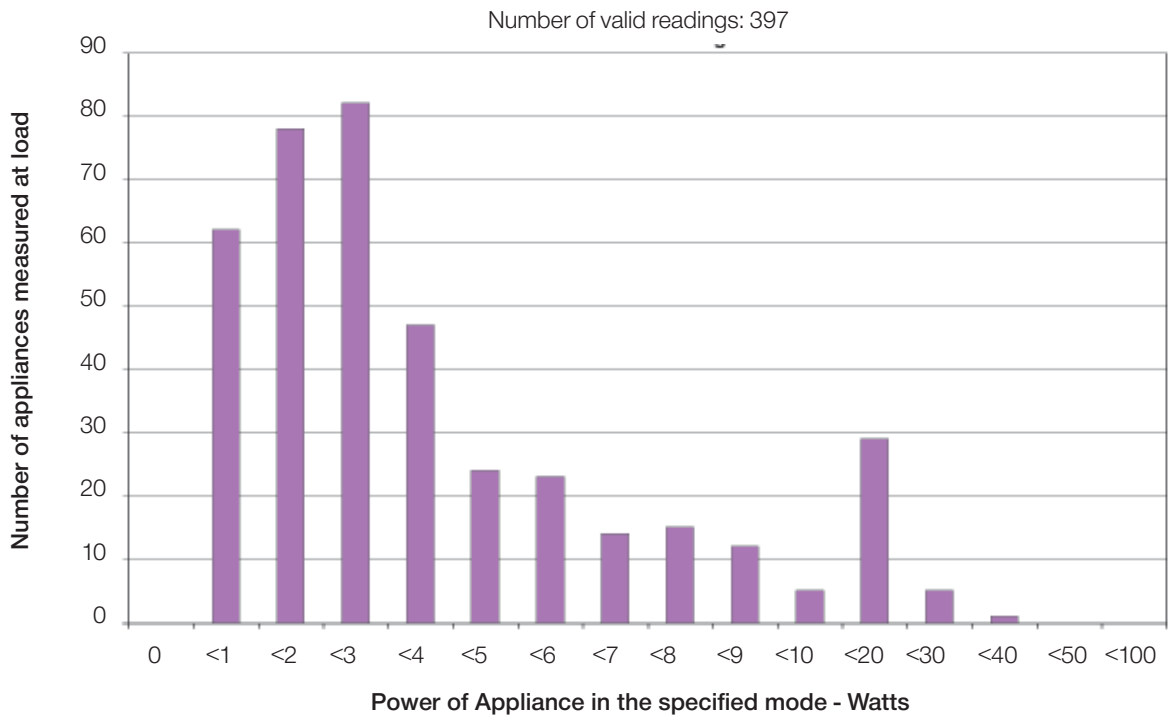


FIGURE B: DISTRIBUTION OF "PASSIVE STANDBY MODE" POWER – ALL PRODUCTS IN 2002 STORE SURVEY



- **It is becoming increasingly common for many products to have no hard "off" switch or to consume significant power in "off mode".**

Many products now have no off switch. Increasingly, even those products with a "power" switch continue to use significant amounts of power in "off mode". While some of this power may be required for some essential functions (eg maintaining clock functions, awaiting remote control signals etc), in many cases the majority would appear due to be poor product design. Of particular concern are certain classes of home entertainment equipment and some computer peripherals, as well as white goods.

- **Results indicate that there is an opportunity for many appliances to improve energy consumption in standby and off modes.**

For the products measured, there was generally a wide variance in power consumption in off mode and passive standby mode within a product type, without any difference in performance or functionality between these products. This tends to suggest that there are substantial opportunities for manufacturers to

reduce standby power consumption, probably at low marginal cost.

- **Trends for different product groups are mixed. While some products appear to be improving, there is still substantial work to be done for some product types. Some products have poor standby power profiles. Ongoing work is required to track current and future trends. Key trends are:**

Major appliances:

- Air conditioners – insufficient data is available (most models are hard wired);
- Clothes dryers – standby decreased from 2001, although sample sizes for both years are probably too small to draw definitive conclusions;
- Dishwashers – possibly increasing standby, trend unclear from lack of data;
- Washing machines – trend appears to be decreasing standby, but 2002 sample appears to be biased towards lower standby models (front loaders over represented), so this trend should be treated with caution.

TABLE A – A SUMMARY OF POWER MEASUREMENTS BY APPLIANCE – 2002 SURVEY

Appliance	Total Number of Appliances	Valid Readings: Off		Average of Off Power (W)		Valid Readings: Passive Standby		Average of Passive Standby Power (W)		Valid Readings: Active Standby		Average of Active Standby Power (W)		Valid Readings: In Use		Average of In Use Power (W)	
		Off	Power (W)	Passive Standby	Power (W)	Active Standby	Power (W)	In Use	Power (W)								
Air Conditioner	20	20	0.4														
Breadmaker	14	14	1.5														
Computers	14	14	3.1														
Dishwasher	42	42	0.8														
Dryer	16	16	0.3														
Dustbuster	9			9	0.9	8	3.3										
DVD Player	44	16	0.1	37	3.0	44	13.0										
Microwave	60			60	2.7												
Monitor	8	8	1.2														
Scanner	6	1	0.8	6	7.5												
Speakers Computer	2	2	2.5														
Stereo – Amplifier	6	5	0.2	4	1.2	4	8.2										
Stereo – CD	17	14	0.1	4	2.9	17	20.4										
Stereo - Integrated	51	3	1.1	50	7.9	51	5.2										
Stereo – Portable	32			32	1.8	32	1.4										
Stereo – Receiver	4	1	0.0	4	1.4												
Stereo - Tape Deck	4	4	1.1			4	6.8										
Stereo – Tuner	2	1	0.0	1	3.8												
TV	98	98	0.0	87	5.1	97	88.4										
TV – LCD	2	2	0.1	2	4.9	2	161.5										
TV – Projection	11	11	0.1	11	2.0	11	153.9										
TV/VCR	2	2	0.2	2	8.5	2	68.6										
VCR	40			40	3.5	39	9.0										
Washer/Dryer	2	2	0.1														
Washing Machine	77	77	1.7														
Printer – Inkjet	20	17	3.0	20	5.5												
Printer – Laser	5	4	0.0	5	6.1												
Surround Sound Amplifier	26	19	0.2	22	2.1	3	47.3										
Stereo – karaoke	1			1	1.8	1	5.6										
Grand Total	635	393	0.8	397	4.1	199	12.4	147	83.4								

Product profiles, summarising key data and significant trends, are included in Table 1 on opposite page. Numbers in brackets indicate the sample size used to determine the average value.

Computers and peripherals:

- Computers – small sample and little trend data, but standby appears to be increasing;
- Monitors – small sample and little trend data, but standby appears to be stable;
- Inkjet printers – no trend data, poor standby profile in off mode;
- Laser printers – no trend data, generally good standby profile in off mode;
- Scanners – no trend data, poor standby profile in passive standby mode (usually no off);

Home entertainment equipment:

- TVs – nearly all models have a low power off mode, 90%+ now have remote controls, slow and ongoing decrease in passive standby mode power;
- VCRs – none have off mode, slow and ongoing decrease in passive standby mode power;
- DVD players – trend is an improvement in off and passive standby mode power;
- CD players – most have off, trend unclear but probably unchanged;
- Integrated stereos – few have off, standby trend is stable but profile is still very poor;
- Portable stereos – none have off, standby trend is improving;

OVERALL RESULTS - SUMMARY

The power consumption of a total of 637 appliances were measured in two large retail stores in February 2002 in Melbourne, Australia. Table 1 provides a summary of the average in-use, active/passive standby and off readings (as applicable) for each of the major appliance groups.

PRODUCT SUMMARIES – HOME ENTERTAINMENT

Televisions

Description: Conventional cathode ray tube (CRT) televisions.

Number of products measured in 2002: 98

Mode = off: average power 0.0W (98).

Mode = passive standby: average power 5.1W (87), maximum 39W.

Mode = in use: average power 88.4W (97).

Trend: There appears to be a reduction in passive standby from 2001 (5.9W).

Notes: In off mode nearly all models were 0.1W or less. In passive standby 20 models used less than 1W in 2002. Most products (around 90%) had remote controls. Average size on display was 62cm.

TVs – LCD

Description: Liquid crystal display (LCD) televisions.

Number of products measured in 2002: 2

Mode = off: average power 0.1W (2).

Mode = passive standby: average power 4.9W (2).

Mode = in use: average power 161.5W (2).

Trend: No data for LCD TVs is available from the 2001 survey.

Notes: In passive standby mode power was 8.6W and 1.1W for the two models measured. Both units were 109cm.

TVs – Projection

Description: Projection large screen televisions (mostly rear projection).

Number of products measured in 2002: 11

Mode = off: average power 0.1W (11).

Mode = passive standby: average power 2.0W (11), maximum 10.8W.

Mode = in use: average power 153.9W (11).

Trend: No data for rear projection TVs is available from the 2001 survey.

Notes: In off mode nearly all models were 0.1W or less. In passive standby 4 models used less than 1W. Sizes ranged from 109cm to 148cm.

VCRs

Description: Conventional VHS video cassette recorders.

Number of products measured in 2002: 40

Mode = passive standby: average power 3.5W (40), maximum 5.6W.

Mode = active standby: average power 9.0W (39).

Trend: There appears to be a slight reduction in passive standby from 2001 (3.8W).

Notes: None of the units measured had an off mode. The minimum power in passive standby was 2.2W. Intermediate sleep mode (down from active standby) and "in use" was not measured in 2002 as this was too time consuming.

DVD Players

Description: Digital Video Disk players (DVD).

Number of products measured in 2002: 44

Mode = off: average power 0.1W (16)

Mode = passive standby: average power 3.0W (37)

Mode = active standby: average power 13W (44)

Trend: There appears to be a reduction in both off mode (from 0.8W) and passive standby mode consumption (from 5.8W) from the 2001 values.

Notes: Only a limited number of models had off mode, but most of these were 0.0W in this mode.

Stereos - CD player

Description: Separate compact disk players (CD).

Number of products measured in 2002: 17

Mode = off: average power 0.1W (14), maximum 1.5W.

Mode = passive standby: average power 2.9W (4).

Mode = active standby: average power 8.2W (17).

Trend: Passive standby mode from the 2001 survey was comparable. It is thought that passive standby mode in 2001 was recorded as off mode, so the standby trend is unclear (probably stable).

Notes: Most models had an off mode and this was mostly 0.0W.

Stereos – Integrated

Description: Integrated stereo systems (usually CD/tape/tuner/amp, non portable).

Number of products measured in 2002: 51

Mode = off: average power 1.1W (3).

Mode = passive standby: average power 7.9W (50), maximum 25W.

Mode = active standby: average power 20.4W (51).

Trend: There appears to be a reduction in passive standby from 2001 (9.3W).

Notes: Only 3 of 51 models had an off mode. In passive standby mode 30% of models used less than 1W (1 model less than 0.1W) and 38% used more than 10W. Generally poor standby profile.

Stereos – Portable

Description: Portable stereo systems (usually CD/tape/tuner/amp, single case).

Number of products measured in 2002: 32

Mode = passive standby: average power 1.8W (32), maximum 3.6W.

Mode = active standby: average power 5.2W (32).

Trend: There appears to be a reduction in passive standby from 2001 (2.8W).

Notes: None of the models measured had an off mode. In passive standby mode in most models used between 1W and 3W (3 models were just below 1W).

Surround Sound Amplifiers

Description: Amplifiers for home theatre audio (usually 4+ speakers).

Number of products measured in 2002: 26

Mode = off: average power 0.2W (19).

Mode = passive standby: average power 2.1W (22), maximum 10.9W.

Trend: No data for surround sound amplifiers is available from the 2001 survey.

Notes: Most models had an off mode and all of these were less than 1W.

PRODUCT SUMMARIES – MAJOR APPLIANCES

Air Conditioners

Description: Fixed (window wall) and portable air conditioners.

Number of products measured in 2002: 20

Mode = off: most 0.0W, average power 0.4W, maximum 1.9W

Trend: No data for air conditioners is available from the 2001 survey. However, limited data from the 2000 intrusive survey suggests this may be increasing.

Notes: Very few of the models measured had remote control operation. The most popular type of air conditioners are split systems (many of these use remote controls) and almost all "hard wired", so in-store measurements were not possible. Lab measurements will be necessary to collect data.

Dishwashers

Description: Domestic dishwashers.

Number of products measured in 2002: 42

Mode = off: average power 0.8W, maximum 11.3W, 25% were 0.0W

Trend: No data for dishwashers is available from the 2001 survey. However, limited data from the 2000 intrusive survey suggests this may be increasing.

Notes: Soft touch controls may increase off mode consumption.

Clothes Dryers

Description: Domestic clothes dryers.

Number of products measured in 2002: 16

Mode = off: average power 0.3W, maximum 2.6W, 50% were 0.0W

Trend: There appears to be a reduction from 2001 value (1.2W).

Notes: Sample size in 2001 was small so care is required when examining trends. Stock values would suggest little change in standby for this appliance.

Washing Machines

Description: Domestic clothes washers (front and top loading).

Number of products measured in 2002: 77

Mode = off: average power 1.7W, maximum 25.9W, 36% were 0.0W

Trend: There appears to be a reduction from 2001 value (3.8W).

Notes: Although some 73% of clothes washers had an off mode consumption of less than 1W, there were a significant number in the range 1-4W and 7-10W. Care is required when examining this trend as the 2002 sample was nearly 50% front loaders which have generally had a low off mode consumption (typically 0.15W) but front loader sales are less than 15% of total sales. A very large selling brand with soft touch controls had a standby of around 9W for all models and this brand was under-represented in terms of display stock versus sales. The very high value was for a machine with a European plug and converter box.

PRODUCT SUMMARIES – COMPUTERS AND PERIPHERALS

Computers

Description: PC/hard drive box with desktop computers.

Number of products measured in 2002: 14

Mode = off: average power 3.1W, maximum 5.2W, none consumed less than 1W.

Trend: No data for computers is available from the 2001 survey, but data from the 2000 intrusive survey suggests most older PCs had no consumption in off mode, indicating a worsening standby trend.

Notes: Off mode consumption may allow hot key start for some models.

Monitors – Computer

Description: Separate monitors for desktop computers.

Number of products measured in 2002: 8

Mode = off: average power 1.2W, maximum 3.6W.

Trend: No data for computer monitors was available from the 2001 survey, but data from the 2000 intrusive survey suggests that this value is stable.

Notes: The reason for any off mode consumption is unclear (possibly EMC filters). LCD displays have an external low voltage DC power supply which will have standby.

Printers - Inkjet

Description: Inkjet printers for personal computers.

Number of products measured in 2002: 20

Mode = off: average power 3.0W, maximum 5.5W, few less than 1.0W.

Trend: No data for inkjet printers was available from the 2001 survey, but data from the 2000 intrusive survey suggests that this value may stable or deteriorating.

Notes: Some models had no off switch (most were soft touch). Often there was often little difference between off and active standby.

Printers - Laser

Description: Laser printers for personal computers.

Number of products measured in 2002: 5

Mode = off: average power 0.0W.

Trend: No data for laser printers was available from the 2001 survey.

Notes: One model had no off switch with a standby consumption of 6.5W. While most laser printers have a low off mode consumption, it appears that some models can have a value in the range 1W to 6W. The 2000 intrusive survey found that many (but not all) laser printers had low off consumption.

Scanners

Description: Scanners for personal computers.

Number of products measured in 2002: 6

Mode = passive standby: average power 7.5W, maximum 12.9W.

Trend: No data for scanners was available from the 2001 survey.

Notes: Only one unit had an off mode. Some of these units may take time to power down into a deep sleep mode after the power is initially connected so the readings for these units may be higher than in normal use.

PRODUCT SUMMARIES – SMALL APPLIANCES

Breadmakers

Description: Domestic electric breadmakers.

Number of products measured in 2002: 14

Mode = off: average power 1.5W, most in the range 1W to 2W

Trend: Little change from 2001 value (1.6W).

Notes: Few models had an off button – those that did had little effect.

Dustbusters

Description: Portable battery operated vacuum cleaners (dustbusters).

Number of products measured in 2002: 9

Mode = passive standby: average power 0.9W (base station only – no battery charge)

Mode = active standby: average power 3.3W (battery charging)

Trend: There appears to little change from 2001 value (1.0W passive standby).

Notes: Passive mode is power supplied to the charging station but appliance removed. Active standby mode is when the appliance is on the charging station and the battery is charging.

Microwaves

Description: Domestic microwave ovens.

Number of products measured in 2002: 60

Mode = passive standby: average power 2.7W, maximum 6.5W

Trend: There appears to be a reduction from 2001 value (3.5W).

Notes: Models with mechanical switches were the only ones consuming less than 1W. Stock values would suggest that there has been a slight reduction of standby power consumption for microwaves in recent years. Models with displays and electronic controls need to be separated from those with mechanical control models for analysis.

COMPARISON WITH 2001 RESULTS

In early 2001 an in-store survey was carried out as part of a broader study into standby power consumption. The results from the 2001 survey are compared with those from this study in Table 2 below. As the sampling approach is reliant on the available retail store floor stock, all the appliance categories were not measured in both years (a significant number of new categories were added in 2002). There are a total of 978 measurements across the 13 appliance categories available for comparison in the 2 surveys. Generally most products measured lower average power consumption in 2002 across all modes. While the figures would appear to indicate a positive overall trend, it needs to be remembered that due to the small numbers of appliances measured in some cases it would be prudent not to treat this result as definitive. Also, the models on display are not necessarily representative of sales volumes. These two in-store surveys are the beginning of a longer term benchmarking program and results need to be viewed in this light.

TABLE 2 – A COMPARISON OF POWER MEASUREMENTS BY APPLIANCE WITH 2001 RESULTS.

Product	No units 2001	No units 2002	Off Mode			Passive Standby			Active Standby / In Use		
			2001	2002	% Change	2001	2002	% Change	2001	2002	% Change
Stereo - Receiver	7	4				6.0	1.4	-94%	37.1	19.3	-48%
Breadmaker	12	14	1.6	1.5	-8.2%						
Stereo - CD	14	17	* 2.2	0.1	-95%		2.9		8.0	8.2	
Dryer	7	16	1.2	0.3	-75%						
Dustbuster	9	9				1.0	0.9	-9.8%	3.6	3.3	-7.2%
DVD Player	31	44	0.8	0.1	-88%	5.8	3.0	-48%	14.9	13.0	-13%
Microwave	60	60				3.5	2.7	-22%			
Stereo – Portable	36	32				2.8	1.8	-37%			
Stereo Unit - Integrated	88	51	3.5	1.1	-69%	9.3	7.9	-15%	19.1	20.4	6.8%
Stereo - Tuner	4	2	0.0	0.0	0.0%	3.7	3.8	4.1%			
TV (all types)	157	113	0.0	0.1	Increase	5.9	4.9	-18%	93.7	95.7	2.2%
VCR	39	40				3.8	3.5	-8.1%	10.9	9.0	-17%
Washing Machine	35	77	3.8	1.7	-55.1%						
Total Number of Units	499	479									
											Active Standby

Notes: Not all products have measurements for all modes. Care is required when comparing data between years when the sample size is small. * Some data recorded as off mode for Stereo – CD in 2001 may be passive standby mode (data records are unclear). Total readings in 2002 were 637 – not all of these product types were measured in 2001 (new product categories were added in 2002).

FURTHER INFORMATION:

Harrington and Kleverlaan, 2001, *Quantification of Residential Standby Power Consumption In Australia:*

Results of Recent Survey Work, prepared by Energy Efficient Strategies and EnergyConsult for NAEEEEC, main report, 29 April 2001. Provides results of an intrusive survey where measurements on 2,500 appliances were undertaken in 64 houses in Melbourne, Sydney and Brisbane. The report also includes results of measurements on 531 new appliances in retail outlets and results of a telephone survey of 801 households in Australia which documents information on appliance ownership, age and usage patterns. Available from www.energyefficient.com.au under documents.

Damnics, Harrington and Kleverlaan, 2002, *Appliance Standby Power Consumption: Store Survey 2002*, prepared by Energy Efficient Strategies and EnergyConsult for NAEEEEC, main report, June 2002. Contains more detailed results of the Australian retail store standby survey undertaken in early 2002 outlined in this executive summary. store Available from www.energyefficient.com.au under documents.