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OCTOBER 2005

STANDBY ENERGY CONSUMPTION



AUSTRALIAN LOCAL GOVERNMENT BUILDINGS

AUSTRALIA'S STANDBY POWER STRATEGY 2002 - 2012

**AN INITIATIVE OF THE AUSTRALIAN GREENHOUSE
OFFICE AND THE INTERNATIONAL COUNCIL FOR
LOCAL ENVIRONMENTAL INITIATIVES**

**PART OF THE NATIONAL APPLIANCE AND ENERGY
EQUIPMENT EFFICIENCY PROGRAM**

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STANDBY ENERGY CONSUMPTION IN AUSTRALIAN LOCAL GOVERNMENT BUILDINGS

This study was commissioned by the Australian Greenhouse Office and the International Council for Local Environmental Initiatives, with the objective of quantifying the standby energy consumed by electronic equipment in Australian local government premises. The study was conducted between September 2004 and June 2005 and involved 15 councils, 57 premises and 8,691 items of equipment. It focused on a total of 52 types of plug-in, electronic office equipment which were divided into the 10 main categories shown in the figures below.

TYPES OF EQUIPMENT SURVEYED

The majority of office equipment in this study was located in Council head offices, followed by libraries and works depots. Computers and monitors constituted the great majority of all equipment items in the study.

The standby power consumption of 702 items of equipment was individually measured using portable SPAR meters.

Where possible, each standby mode was measured. As expected, standby power levels were generally highest in active standby mode, followed by passive standby mode and off-mode.

After assessing the age of equipment, analysis was made of any changes in the performance of equipment over time. For the majority of equipment items in this study, standby power consumption appears to be decreasing, with the exception of desktop computers, where active and passive mode standby power appears to have increased. This is generally consistent with the increase in penetration of higher specification models with increased functionality.

POWER MANAGEMENT

For equipment which remains switched on for long periods, with only sporadic use (such as computers, monitors, printers and photocopiers), power management is a significant energy conservation measure.

AN INITIATIVE OF THE AUSTRALIAN GREENHOUSE OFFICE AND THE INTERNATIONAL COUNCIL FOR LOCAL ENVIRONMENTAL INITIATIVES

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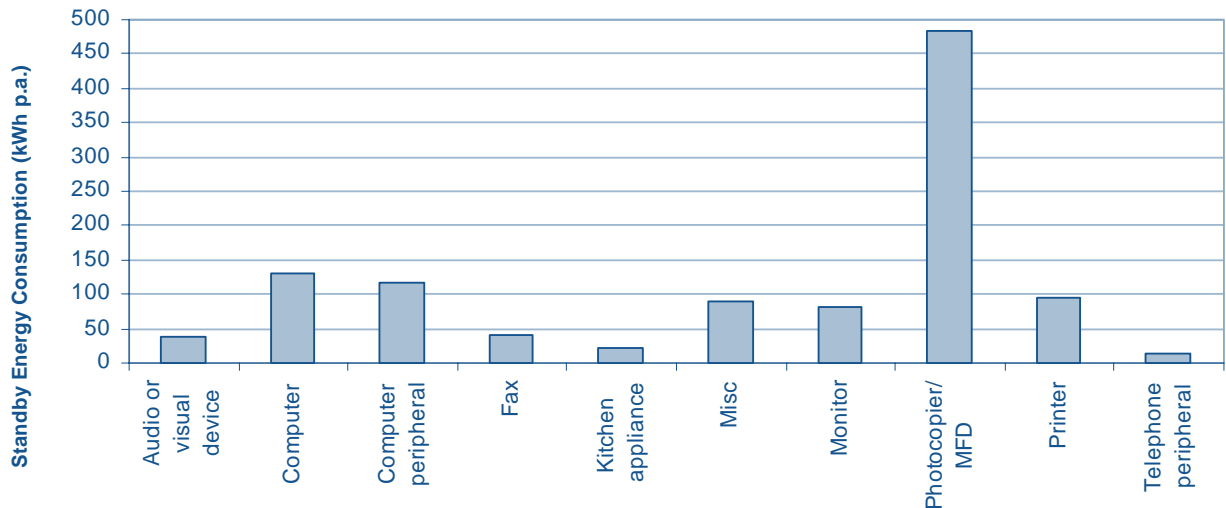
Category	No. Surveyed	No. Measured	Measured/ Surveyed
Computer	3524	83	2.4%
Monitor	3130	112	3.6%
Computer peripheral	360	41	11.4%
Printer	945	156	16.5%
Photocopier/ MFD	158	86	54.4%
Fax	68	47	69.1%
Telephone peripheral	116	16	13.8%
Audio or visual device	104	31	29.8%
Kitchen appliance	136	42	30.9%
Misc	150	88	58.7%
Total	8691	702	8.1%



These equipment types were found to have relatively high enablement rates (70% and above), except for computers (15%) where power management features are often disabled to avoid interfering with network connectivity.

AVERAGE ENERGY CONSUMPTION PER EQUIPMENT TYPE

Estimates were made of the average yearly standby energy consumption of single equipment items, based on actual measurements and information supplied by Councils. The results are shown in the figure below:



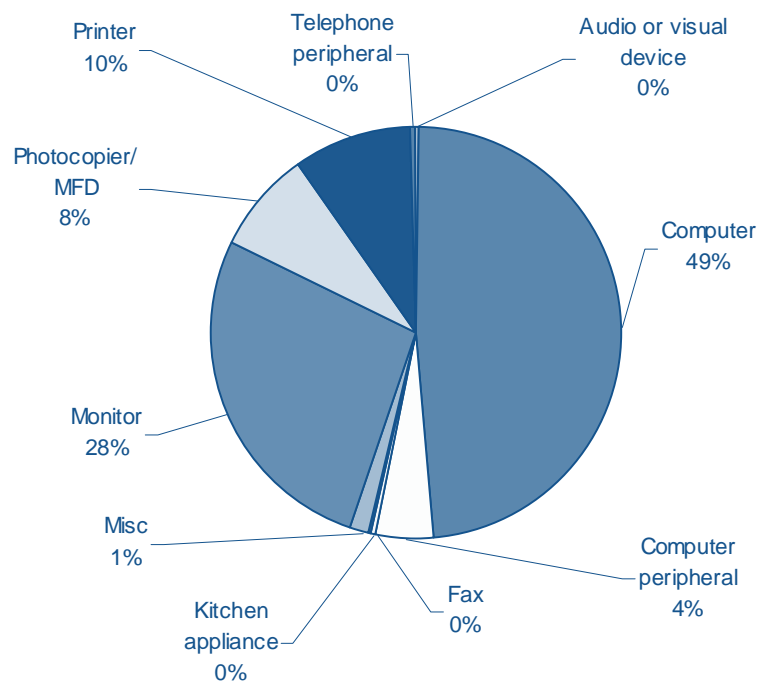
STANDBY AS A PROPORTION OF TOTAL ENERGY CONSUMPTION

For a typical council administration building, the total standby energy was between 4% and 8% of total electricity consumption, and was between 200 and 500 kWh p.a. per employee. For other premises, standby energy was highly variable, and was largely a function of equipment density. The head office is typically the greatest contributor to standby energy consumption for a Council, followed by the library and works depot.

RECOMMENDATIONS

With the aim of reducing standby energy consumption in councils, the following general recommendations were made:

- Ensure that low power modes are enabled for all equipment, where feasible. Note that this can be done for computers without interfering with network connectivity in most cases.
- Set automatic low power mode waiting times to the lowest practical values.
- Ensure that all equipment is switched off overnight, preferably at the power outlet, where feasible.
- Ensure that any redundant equipment is disconnected from the power supply.
- Purchase only the lowest required number of office equipment.
- Purchase office equipment from the Energy Allstars product database (www.energyallstars.gov.au) when product categories appear.
- Purchase only equipment with automatic low power modes.



Contribution to Total Energy Consumption by Equipment Type

Abbreviations

AGO	Australian Greenhouse Office
CCP	Cities for Climate Protection program
ICLEI	International Council for Local Environmental Initiatives
kWh	kilowatt-hour
MEA	Mark Ellis and Associates
NAEEEC	National Appliance and Equipment Energy Efficiency Committee
NSW	New South Wales
w	watts

1 Background

1.1 Introduction

This study was commissioned by the Australian Greenhouse Office (AGO) and the International Council for Local Environmental Initiatives (ICLEI), with the objective of quantifying the standby energy consumed by common electronic equipment in Australian local government offices. ICLEI manage the Cities for Climate Protection (CCP) program, which encourages local government organisations to reduce their greenhouse gas emissions. A number of participating CCP Councils agreed to assist in meeting the objectives of the study.

Standby energy is consumed by electronic equipment when in 'standby' mode, that is when the equipment is either switched off or not performing its primary function. In recent years, the proliferation of electronic equipment has led to a significant increase in the quantity of standby energy consumed. In response, the Australian Government launched the national Standby Power Strategy in 2002 entitled "Money Isn't All You're Saving" (NAEEEC 2002). This strategy is designed to reduce the impact of standby energy consumption over the period 2002 to 2012.

As part of the Standby Power Strategy, key equipment categories are identified for action, and specific performance targets are published for each category. These are contained in individual 'Product Profiles', a number of which have been published to date and are available from www.energyrating.gov.au.

In line with the requirements of the Standby Strategy, the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) has undertaken several in-home and in-store product measurement surveys since 1999 (also available from www.energyrating.gov.au) which focus primarily on equipment used in the residential sector. This study complements these previous surveys by collecting standby power data for commercial office equipment.

Fifteen Councils were selected for the study based on their geographic location and willingness to participate in the project. Five Councils from each of Victoria, New South Wales (NSW) and Queensland were chosen, including three metropolitan, one quasi-metropolitan and one rural Council from each state.

1.2 Definition of Standby Power and Standby Energy

Standby operating modes exist in order to reduce energy consumption for equipment left switched on for long periods of time, while minimizing the impact on functionality. Devices are typically able to be 'woken' from standby mode in a very short period of time. Standby power is the instantaneous power drawn by an item of electronic equipment whilst in standby mode (measured in watts). Standby energy is the total energy consumed over a period of time (measured in kWh). Standby energy equals standby power multiplied by time spent in standby mode.

The various standby operating modes are defined as follows, in order of increasing power consumption:

Off Mode

The item of equipment is connected to the mains electricity supply, but is switched off by a switch or button located on the item, and generally cannot be woken by a remote control or other remote signal. If no off switch or button exists, off mode is generally defined as the lowest possible power state possible for that item.

Passive Standby Mode

The item of equipment is switched on, but is either waiting to be activated by a remote control, or has entered a 'deep sleep' state.

Active Standby Mode

The item of equipment is switched on but is not performing its primary function, such as printing documents, processing significant data, playing sound or video, etc.

On Mode

The item of equipment is performing its primary function, such as printing documents, processing significant data, playing sound or video, etc. This mode is not a standby mode and does not contribute to standby energy consumption, but has been defined here for the sake of completeness.

Appendix 1 describes the operating modes as they apply to the types of equipment included in this study.

1.3 Acknowledgements

This study was undertaken by Mark Ellis and Associates (MEA) for the Australian Greenhouse Office (AGO) and the International Council for Local Environmental Initiatives program (ICLEI). We would particularly like to thank the Councils involved in the study: Botany Bay, Caboolture, Caloundra, Cessnock, Gosford, Manningham, Mosman, Moyne, Redland, Rockhampton, Whitehorse, Canada Bay, Gladstone, Moreland and Whittlesea.

Notwithstanding the many individuals and organizations that have assisted during this project, the content and form of this report, and all of the views, conclusions and recommendations expressed in it, are those of Mark Ellis and Associates.

2 Methodology

The study was conducted between September 2004 and June 2005 and involved the following Councils:

- > New South Wales: Botany Bay, Cessnock, Gosford, Mosman, Canada Bay.
- > Queensland: Caboolture, Caloundra, Gladstone, Redland, Rockhampton.
- > Victoria: Manningham, Moyne, Whitehorse, Moreland, Whittlesea.

Each participating Council nominated a number of their office premises to be included in the study. Premises were categorised as follows:

- > Head office / admin
- > Library
- > Child care centre
- > Community / arts / youth / senior citizens centre
- > Recreation / pool
- > Works depot
- > Other

The premises nominated by Councils for inclusion in the study are listed in Appendix 2.

A total of 57 premises were included in the study from the 15 participating Councils. Councils completed a questionnaire summarising the type, model and number of electronic equipment at each of their premises (a sample questionnaire is included in Appendix 3). Unfortunately Canada Bay, Gladstone, Moreland and Whittlesea Councils were unable to complete the questionnaire. The completed questionnaires were aggregated into a database which totaled 8,691 items of equipment at the 57 sites.

Whilst the primary target of this study is office equipment (computers, photocopiers, printers, fax machines, etc), also covered are other plug-in electronic devices typically used by Councils (eg microwave ovens).

Each Council was visited by staff of Mark Ellis & Associates in order to gather further data and measure the actual standby power consumption of a range of electronic equipment. In total 702 items were measured using portable SPAR meters. All relevant standby modes were measured, where possible.

A mathematical model was constructed using the power measurements, the questionnaire database and the operating hours for each Council to calculate the total standby energy consumption of the premises included in the study.

3 Standby Power Consumption of Equipment

3.1 Types and Locations of Equipment

The study targets plug-in electronic equipment typically used in offices. A total of 52 types of equipment were identified. For purposes of analysis these were categorised as shown in Table 1.

Table 1 - Equipment categories

Equipment Category	Equipment Type	Equipment Category	Equipment Type	
Computer	Desktop	Fax	Fax	
	Laptop	Telephone peripheral	Answering machine	
	Laptop docking station		Mobile phone charger	
Monitor	CRT (small ≤ 15")		Telephone hands-free unit	
	CRT (large > 15")	Audio or visual device	Stereo system / receiver	
	LCD (small ≤ 15")		Radio	
	LCD (large > 15")		Television	
Computer peripheral	CD burner		VCR	
	Floppy disk drive	DVD player		
	Modem	Kitchen appliance	Dishwasher	
	Speakers		Microwave oven	
	Palm pilot dock		Toaster	
	Scanner	Misc	Washing machine	
	Digital camera		Dryer	
	Printer		Laser printer (small)	Battery charger
Laser printer (medium)			Shredder	
Laser printer (large)			Snack vending machine	
Inkjet / bubblejet printer			Calculator (mains powered)	
Drawing plotter			Cash register	
Dotmatrix printer			Binding machine	
Label printer			Folding machine	
Receipt printer			Laminator	
Photocopier/ MFD			Photocopier (small)	Stapler
			Photocopier (large)	Whiteboard
	Multifunction printer + copier (small)		Electric typewriter	
	Multifunction printer + copier (large)			

Participating Councils completed a survey questionnaire detailing the type, model and number of equipment found at each of the premises. MEA staff also visited various premises to measure the standby power consumption of a range of equipment. The quantities of equipment that were surveyed and measured are listed in Table 2.

Table 2 - Equipment surveyed and measured

Category	No. Surveyed	No. Measured	Measured / Surveyed
Computer	3524	83	2.4%
Monitor	3130	112	3.6%
Computer peripheral	360	41	11.4%
Printer	945	156	16.5%
Photocopier/ MFD	158	86	54.4%
Fax	68	47	69.1%
Telephone peripheral	116	16	13.8%
Audio or visual device	104	31	29.8%
Kitchen appliance	136	42	30.9%
Misc	150	88	58.7%
Total	8691	702	8.1%

Higher proportions of equipment were measured where there was found to be wide variation in the make, model and performance of equipment.

Table 3 lists the quantities of equipment surveyed, by their location.

Table 3 - Equipment surveyed and location

Category	Head Office / Admin	Library	Child Care	Community / Arts / Youth / Seniors	Recreation / Pool	Works Depot	Other	Total
Audio or visual device	52	22	1	18	0	11	0	104
Computer	2567	490	3	47	21	318	78	3524
Computer peripheral	233	87	0	13	0	27	0	360
Fax	47	5	1	6	0	7	2	68
Kitchen appliance	81	20	3	8	0	23	1	136
Misc	106	10	2	6	0	23	3	150
Monitor	2215	485	3	46	12	295	74	3130
Photocopier/ MFD	94	28	1	9	1	23	2	158
Printer	578	189	3	21	6	132	15	945
Telephone peripheral	79	12	1	1	0	14	9	116
Total	6052	1348	18	175	40	874	184	8691
Percentage of total	69.6%	15.5%	0.2%	2.0%	0.5%	10.1%	2.1%	

As seen in Table 3, the majority of office equipment in this study is located in Council head offices, followed by libraries and works depots.

3.2 Average Standby Power

For a sample of 702 items of equipment, standby power was measured for each of the three standby modes, where feasible. Table 4 lists the average standby power consumption for the each type of equipment measured.

Table 4 - Average power draw in standby modes

Equipment Category	Equipment Type	Active Standby (w)	Passive Standby (w)	Off Mode (w)
Computer	Desktop (or floor-top)	53.6	20.2	3.2
	Laptop	30.0	13.9	1.6
	Laptop docking station	0.5	N/A	0.2
Monitor	CRT (small <= 15")	58.4	13.0	0.5
	CRT (large > 15")	69.2	6.5	1.8
	LCD (small <= 15")	19.1	3.5	1.5
	LCD (large > 15")	35.0	3.6	1.2
Computer Peripheral	CD burner	3.3	No measurements	0.3
	Speakers	2.5	N/A	2.0
	Palm pilot dock	2.1	0.8	No measurements
	Scanner	26.5	No measurements	2.7
	Digital camera	3.2	No measurements	No measurements
Photocopier/MFD	Photocopier (primary function) (small)	36.2	27.2	1.3
	Photocopier (primary function) (large)	139.0	52.8	10.8
	Multifunction printer + copier (small)	30.6	15.9	1.3
	Multifunction printer + copier (large)	124.4	92.0	16.2
Printer	Laser printer (only) (small)	17.2	12.4	0.2
	Laser printer (only) (medium)	26.8	20.8	0.0
	Laser printer (only) (large)	77.0	46.5	5.9
	Inkjet / bubblejet printer (only)	6.6	No measurements	2.5
	Drawing plotter	40.9	45.6	2.4
	Dotmatrix printer	19.6	No measurements	0.0
	Label printer	6.2	No measurements	1.5
Fax	Fax (primary function)	9.4	6.8	0.1
Telephone Peripheral	Answering machine	3.6	N/A	2.4
	Mobile phone charger	0.9	N/A	0.4
	Hands-free unit	3.1	1.9	No measurements
Audio Visual	Stereo system / receiver	11.9	10.0	2.1
	Radio	3.6	N/A	2.4
	Television	48.1	4.0	0.9
	VCR	13.0	3.1	4.7
	DVD player	10.8	No measurements	5.9
Kitchen appliance	Dishwasher	1.5	No measurements	0.0
	Microwave oven	3.0	N/A	1.6
	Toaster	1.8	N/A	N/A
Misc	Battery charger	2.7	2.1	2.1
	Shredder	4.9	N/A	0.1
	Snack vending machine	89.1	N/A	No measurements
	Calculator (mains powered)	3.5	N/A	2.5
	Cash register	5.8	N/A	No measurements
	Binding machine	4.5	N/A	0.0
	Folding machine	13.4	N/A	0.3
	Laminator	818.1	N/A	0.0
	Stapler	0.8	N/A	1.3
	Whiteboard	9.1	N/A	0.0
Electric typewriter	14.0	N/A	0.0	

Note in Table 4 that "N/A" signifies that the mode does not typically exist on that item of equipment. "No measurements" signifies that measurements were not able to be taken for this mode. As can be seen in Table 4, standby power levels are generally highest in active standby mode, followed by passive standby mode and off-mode, as would be expected.

3.3 Standby Power by Age of Equipment

Assessing the change in standby power performance between models of different ages was complicated by the lack of accurate information relating to the age of each item of equipment. Where possible, items were categorised as being less than 1 year, between 1 and 3 years, or greater than 3 years old. A comparison of the average standby mode power levels was made for each of these age groups. The equipment types for which significant trends were discernable in standby mode power consumption, based on age, are listed in Table 5. “↑” signifies that standby power consumption appears to be increasing in newer equipment, and “↓” means that standby power appears to be decreasing in recent models.

Table 5 - Discernable trends in equipment standby power consumption, based on age

Equipment	Active Standby	Passive Standby	Off Mode
Computer desktop	↑	↑	↓
Computer laptop	none	none	↓
Monitor	↓	↓	none
Multifunction device	↓	none	none
Audio visual : Television	↓	none	none
Audio visual : VCR	↓	none	none

Table 5 suggests that for the majority of equipment in this study, standby power consumption appears to be decreasing. The exception to this is desktop computers, where active and passive mode standby power appears to have increased. This is generally consistent with the increase in penetration of higher specification models with increased functionality. It is interesting to note that this trend does not appear to apply to laptop computers, possibly due to their need to conserve battery life.

3.4 Power Management Enablement

Some types of electronic equipment have inbuilt power management capability. They are able to automatically switch to a lower power mode after a period of inactivity. Typically equipment with these facilities are shipped with this feature enabled. However in most cases end-users are able to alter the power management configuration, either by changing the time taken before the equipment switches to a low power mode, and/or by disabling the power management feature entirely.

Power management is a significant energy conservation measure for several types of equipment, particularly computers, monitors, printers and photocopiers, which remain switched on for long periods during a working day (and sometimes at night) with only sporadic use. It was therefore considered relevant to this study that the ‘rate of enablement’ of power management was recorded.

Of all the equipment measured, for which power management modes were possible and able to be assessed, the percentage that were found to have a low power mode enabled are listed in Table 6.

Table 6 - Power management enablement rates

Device group	% of devices enabled
Computer	15%
Monitor	86%
Fax	71%
Photocopier/MFD	80%
Printer	95%

The proportion of equipment with power management enabled is reasonably typical, although there is still room for improvement. In the case of computers, the rate of enablement has historically been low due to issues regarding network connectivity which has meant that many IT managers are reluctant to allow switching to low power mode.

4 Standby Energy Consumption

4.1 Equipment Hours of Use

The standby energy consumption for an item of equipment was calculated by multiplying its standby power consumption by the time spent in each standby mode. The time spent in each standby mode was derived from Council operating hours for each site. This was then used to estimate the proportion of time spent in each standby mode, for each equipment type. These percentages were estimated rather than measured, as they are highly variable for each individual item of equipment and thus every user would need to be surveyed in order to determine accurate values. The estimates are presented in Table 7.

Table 7 - Estimates of average equipment operating patterns

Equipment	Day				Night			
	% daytime in On Mode	% daytime in Active Standby Mode	% daytime in Passive Standby Mode	% daytime in Off Mode	% nighttime in On Mode	% nighttime in Active Standby Mode	% nighttime in Passive Standby Mode	% nighttime in Off Mode
Computer	25%	60%	5%	10%	0%	10%	2%	88%
Monitor	25%	30%	30%	15%	0%	10%	50%	40%
Computer peripheral	5%	80%	*	15%	0%	50%	*	50%
Printer, Photocopier, MFD, Fax	10%	40%	40%	10%	0%	10%	40%	50%
Telephone peripheral	5%	95%	0%	0%	0%	0%	0%	100%
Audio or visual device	5%	5%	75%	15%	0%	0%	85%	15%
Kitchen appliance	5%	95%	0%	0%	0%	100%	0%	0%
Misc	5%	80%	0%	15%	0%	50%	0%	50%

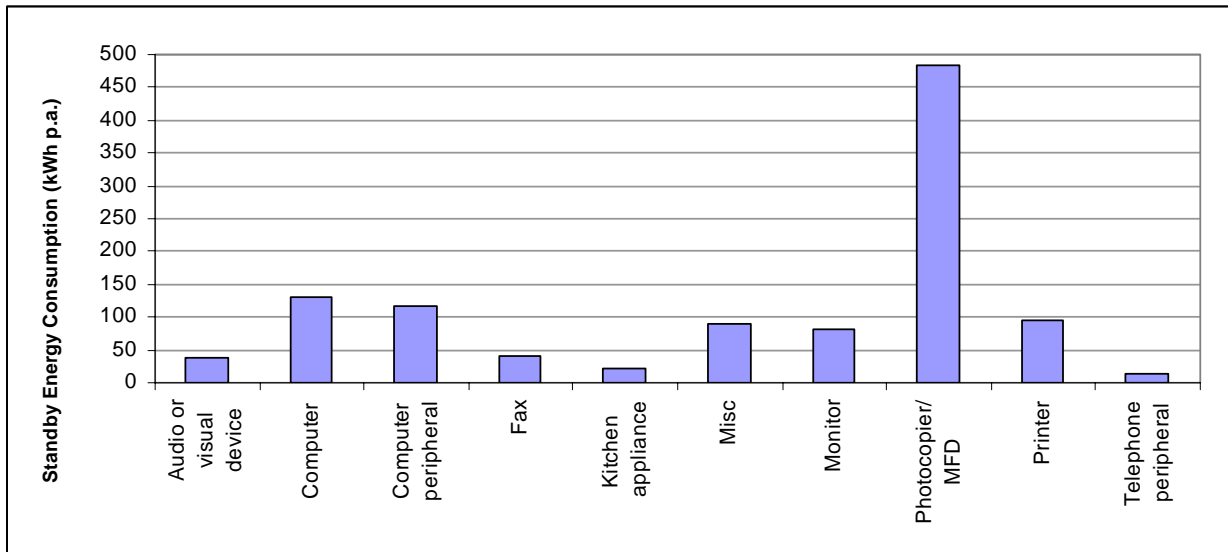
* For computer peripherals, enablement of passive standby mode (where present) varies widely, and hence no percentage figure is given. Note however that the majority of equipment assessed did not feature a passive standby mode.

4.2 Average Standby Energy for Equipment

Details of equipment items were supplied by Councils via a survey questionnaire. Where possible, each equipment item was matched with a recorded standby power measurement for that make and model of equipment. For any models with no existing power measurements, averages across the brand or across the product type were used as default values.

After applying the operating hours described in section 4.1, the average yearly standby energy consumption was calculated for each item of equipment. These values are illustrated in Figure 1. Note that these are the averages for single equipment items, rather than the total for all items of that type.

Figure 1 - Average yearly standby energy consumption, for a single item of equipment

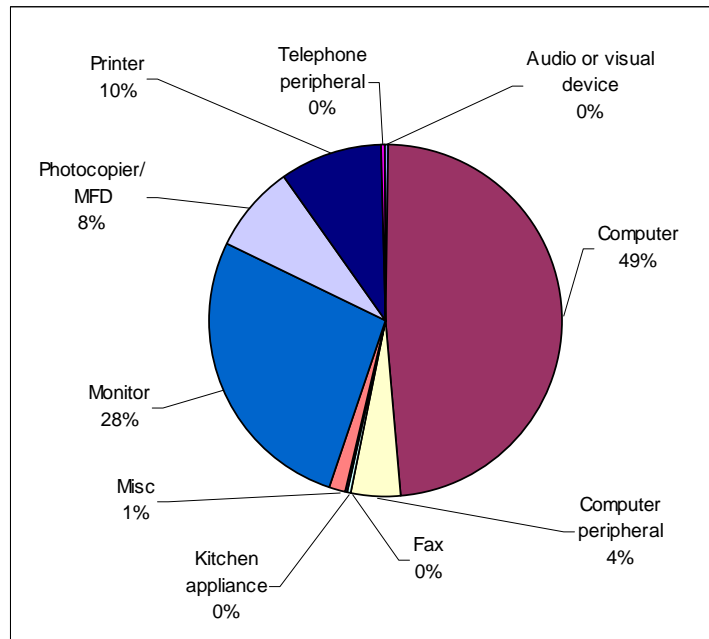


From Figure 1 we can conclude that the standby energy consumption of a photocopier / multifunction device (MFD) is by far the highest of all categories of equipment. The standby energy consumption of a computer is surprisingly low, given their levels of standby power consumption (section 3.2). This is due to the tendency for computers to be switched off at night (section 4.1).

4.3 Total Standby Energy for All Equipment

The total standby energy consumption, for all items of equipment surveyed by Councils, was calculated. Figure 2 illustrates the relative contribution of the equipment categories to the total standby energy of the premises included in this study.

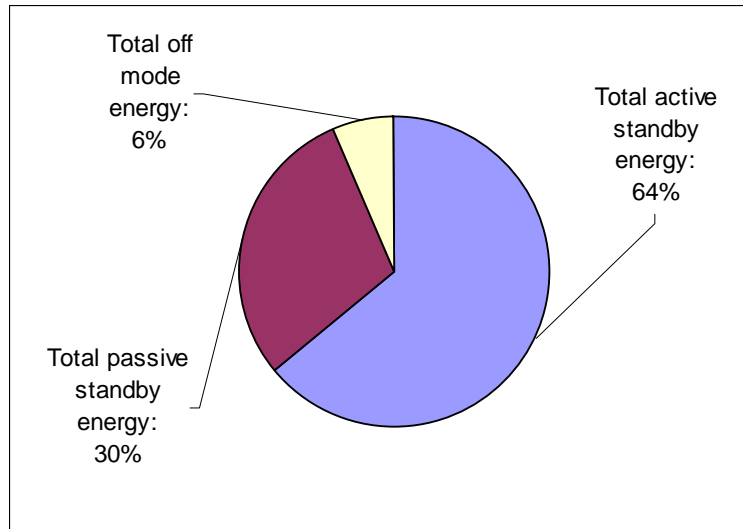
Figure 2 - Contributions to total standby energy consumption, for all premises in the study



From Figure 2 it is evident that standby energy in this study is dominated by computers and monitors, due largely to the high numbers of these devices and the tendency for computers not to have power management features enabled.

Figure 3 illustrates the relative contributions of the three standby modes to total standby energy consumption of equipment in the study.

Figure 3 - Contribution of standby modes to total standby energy consumption of the study

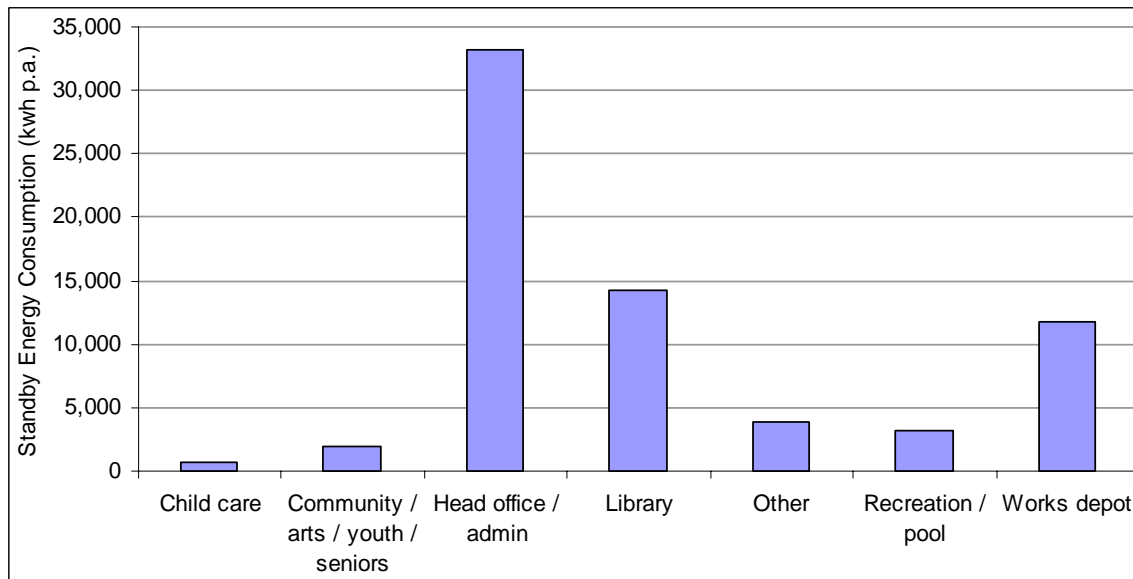


From Figure 3 we can conclude that active standby mode, where equipment is switched on and waiting to be used but has not entered a low power state, is by far the largest contributor to standby energy consumption in an office environment.

4.4 Total Standby Energy for Premises

The total standby energy consumption was calculated for all Council premises, where possible. Figure 4 illustrates the average standby energy consumption by the type of site.

Figure 4 - Average standby energy consumption, single sites



From Figure 4 we can conclude that a head office is typically the greatest contributor to standby energy consumption for a Council, followed by a library and then a works depot. Libraries are significant because of their large numbers of photocopiers and publicly accessible computers.

Appendix 4 lists a breakdown of standby energy consumption for each site included in the study.

5 Potential Indicators for Standby Energy Consumption

For the purpose of comparing the standby energy consumption of various sites, two indicators were used: standby energy consumption as a percentage of total electricity consumption, and standby energy consumption per employee at each site. These are discussed in the following sections.

5.1 Standby Energy versus Total Electricity Consumption

The total electricity consumption of sites was collected from Councils. Table 8 lists standby energy consumption as a percentage of total site electricity consumption for each site, where known.

Table 8 - Standby energy consumption versus total energy consumption

Site type	Council	Site Name	% of total electricity consumption
Child care	Gosford	J.Mitchell Childcare	4.2%
	Mosman	Mosman Occasional Childcare	2.3%
Community / arts / youth / seniors	Whitehorse	Box Hill Community Arts Centre	30.0%
	Rockhampton	Walter Reid Building	23.9%
	Gosford	Ettalong Senior Citizens	2.9%
	Rockhampton	Heritage Village	1.1%
	Mosman	Gallery and Community Centre	0.7%
	Rockhampton	Art Gallery	0.3%
Head office / admin	Moyne	Port Fairy Council Office	13.4%
	Botany Bay	Head Office - ground floor	7.5%
	Cessnock	Council Administration Building	7.3%
	Caboolture	Central Administration Building	7.0%
	Gosford	Head Office	6.9%
	Whitehorse	Civic Centre	6.9%
	Rockhampton	Community Information & Planning	6.8%
	Rockhampton	Head Office	6.3%
	Mosman	Head Office	6.2%
	Redland	Cleveland Administration Building	6.1%
	Caloundra	G&S Economic Development Office	5.1%
	Manningham	Civic Offices	3.8%
Library	Moyne	Mortlake Council Office	0.3%
	Gosford	Erina Library	21.2%
	Redland	Cleveland Library and Offices	7.8%
	Rockhampton	Southside Library	5.5%
	Rockhampton	Northside Library	4.1%
	Caloundra	Caloundra Library Administration	3.8%
	Botany Bay	Pagewood Library	3.6%
	Mosman	Library	3.6%
	Redland	Capalaba Place	3.5%
Caloundra	Caloundra Library	2.0%	
Recreation / pool	Whitehorse	Aqualink Box Hill	0.3%
	Whitehorse	Aqualink Nunawading	0.2%

(... continued over)

(...cont) Table 8 – Standby energy consumption versus total energy consumption

Site type	Council	Site Name	% of total electricity consumption
Works depot	Caboolture	Works Depot	22.2%
	Redland	South Street Depot	8.9%
	Whitehorse	Depot	5.1%
	Rockhampton	Works Depot	4.9%
	Gosford	Erina Depot	4.7%
	Moyne	Koroit Depot	4.7%
	Manningham	Depot	2.6%
Other	Mosman	Works Depot	1.6%
	Manningham	Aged & Disability Support Services	13.0%
	Caboolture	Plant and Fleet	2.0%
	Whitehorse	Box Hill Town Hall	1.1%
	Whitehorse	Whitehorse Centre	0.7%

From Table 8 we can conclude that, for a typical head office / administration building, standby energy consumption represents between 4% and 8% of total electricity consumption. For other sites, standby energy consumption is highly variable and depends largely on the density of office equipment installed. For example, a spacious two-person office might have two computers, a printer, photocopier, fax machine etc. The standby energy consumed by this small number of devices will tend to be small in comparison to the non-standby electricity consumption of the lighting and air conditioning systems.

5.2 Standby Energy versus Council Employment

Councils supplied numbers of full time equivalent staff employed at each site. From this information the standby energy consumption per employee was calculated, and is listed in Table 9.

Table 9 - Standby energy consumption per employee at each site

Site type	Council	Site name	Employees	Standby per employee (kWh p.a.)
Child care	Gosford	J.Mitchell Childcare	10	131
Community / arts / youth / seniors	Moyne	Port Fairy Community Centre	1	1,505
	Rockhampton	Walter Reid Building	3	1,331
	Gosford	Ettalong Senior Citizens	3	1,070
	Mosman	Gallery and Community Centre	6	546
	Moyne	Tourist Information Centre Port Fairy	2	543
	Rockhampton	Art Gallery	5	497
	Mosman	Youth Centre	3	493
	Whitehorse	Box Hill Community Arts Centre	3	300
	Rockhampton	Heritage Village	9	276
	Manningham	Function Centre	4	68

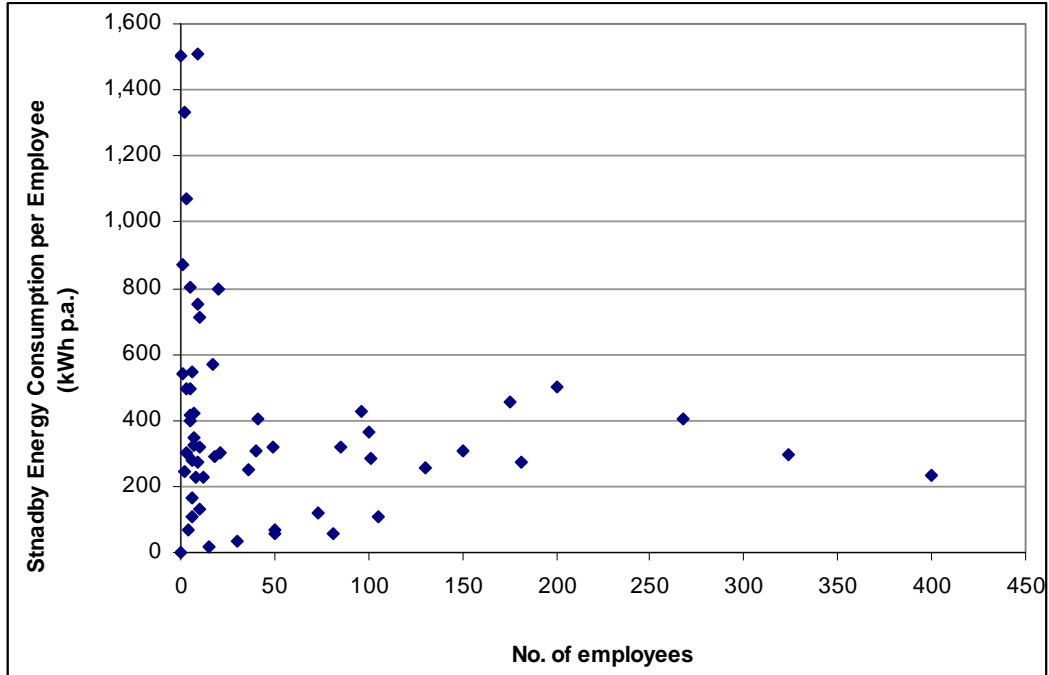
(... continued over)

(...cont) Table 9 – Standby energy consumption per employee at each site

Site type	Council	Site name	Employees	Standby per employee (kWh p.a.)
Head office / admin	Whitehorse	Civic Centre	200	499
	Mosman	Head Office	96	429
	Rockhampton	Community & Cultural Development	7	420
	Rockhampton	Works Depot	41	404
	Redland	Cleveland Administration Building	268	402
	Rockhampton	Airport	5	398
	Mosman	Community Information Centre	7	348
	Rockhampton	Fitzroy River Water	49	319
	Botany Bay	Head Office - ground floor	85	318
	Rockhampton	Head Office	150	309
	Moyne	Port Fairy Council Office	40	305
	Rockhampton	Community Information & Planning	21	304
	Caboolture	Central Administration Building	324	296
	Manningham	Civic Offices	181	276
	Cessnock	Council Administration Building	130	258
	Gosford	Head Office	400	233
	Rockhampton	Botanical Gardens	12	229
	Caloundra	G&S Economic Development Office	6	164
	Moyne	Mortlake Council Office	15	15
	Library	Redland	Capalaba Place	9
Moyne		Port Fairy Library	2	869
Rockhampton		Northside Library	5	805
Mosman		Library	20	797
Rockhampton		Southside Library	10	754
Gosford		Erina Library	10	709
Botany Bay		Pagewood Library	18	567
Redland		Cleveland Library and Offices	175	454
Caloundra		Caloundra Library	10	318
Caloundra		Caloundra Library Administration	6	108
Recreation / pool	Whitehorse	Aqualink Box Hill	50	70
	Whitehorse	Aqualink Nunawading	50	57
Works depot	Moyne	Macarthur Depot	5	418
	Gosford	Erina Depot	100	362
	Caboolture	Works Depot	18	290
	Redland	South Street Depot	101	286
	Mosman	Works Depot	2	245
	Whitehorse	Depot	73	118
	Manningham	Depot	105	107
	Moyne	Koroit Depot	30	35
Other	Caboolture	Plant and Fleet	7	327
	Whitehorse	Whitehorse Centre	6	281
	Caboolture	CabWater	36	249
	Whitehorse	Box Hill Town Hall	8	226
	Manningham	Aged & Disability Support Services	81	55

From Table 9 we can conclude that for head office / administration buildings, standby energy consumption is typically between 200 and 500 kWh p.a. per employee. For other premises, the standby energy consumed by each employee is highly variable, and is affected by the office equipment density as well as the number of employees. For offices with very low numbers of staff, the standby energy consumption per employee tends to be higher, as illustrated in Figure 5.

Figure 5 - Standby energy consumption per employee

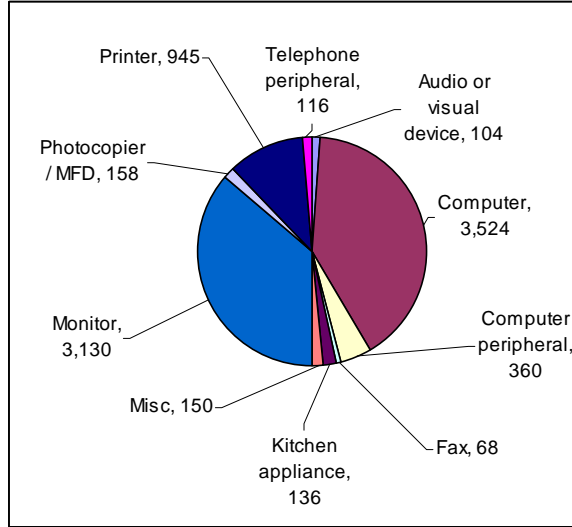


6 Conclusions and Recommendations

6.1 Conclusions

Across the 15 Councils and 57 Council premises included in this study, a total of 8691 items of equipment were assessed. As illustrated in Figure 6, computers and monitors represent the majority of these devices.

Figure 6 - Number of equipment included in study



Of this equipment, the standby power levels of 702 items were measured using a portable SPAR meter. The average standby power measurements for various equipment categories are listed in section 3.2. Generally, the level of standby power decreases as equipment switches from active standby mode, to passive standby mode and (where available) to off mode.

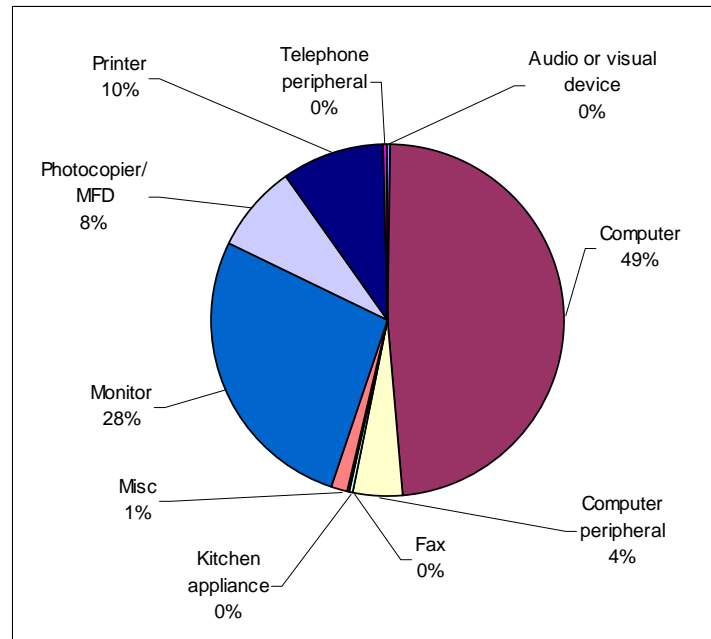
For the majority of equipment in the study, there has been no noticeable change in standby power levels for equipment manufactured over recent years. However, it is encouraging to note that where some change is apparent, standby power consumption generally appears to be decreasing, with the exception of desktop computers.

The majority of computer and photocopying equipment in the study had low power modes enabled, where possible, in order to save energy. The exception to this was again desktop computers, due primarily to the reluctance of IT managers to enable low power modes on PCs.

Calculation showed that the individual standby energy consumption was greatest for photocopiers / multifunction devices (MFDs) and that the average standby energy consumption for a computer was surprisingly low, due primarily to the tendency for computers to be switched off at night.

The proportion of total standby energy consumption, for all items of equipment in the study, is illustrated in Figure 7, which demonstrates that total standby energy is dominated by computers and monitors.

Figure 7 - Contributions to total standby energy consumption, for all premises in the study



Active standby mode, where equipment is switched on and waiting to be used but has not entered a low power state, was found to be the largest contributor to standby energy consumption in an office environment.

The total standby energy consumption was calculated for each Council, where possible (section 4.4). Council head offices were found to be the greatest contributor to standby energy consumption for a Council, followed by libraries and works depots.

For a typical head office / administration building, standby energy consumption represented between 4% and 8% of total electricity consumption. For other sites, standby energy consumption is highly variable and depends largely on the density of office equipment installed.

For head office / administration buildings, standby energy consumption was found to be typically between 200 and 500 kWh p.a. per employee. For other premises, the standby energy consumed by each employee is highly variable, and is affected by the office equipment density as well as the number of employees. For offices with very low numbers of staff, the standby energy consumption per employee tends to be higher.

6.2 Recommendations

With the aim of reducing standby energy consumption in local government buildings, the following general recommendations are made:

> Operating Modes:

1. Ensure that low power modes are enabled for all equipment, where feasible. Note that that this can be done for computers without interfering with network connectivity in most cases.
2. Set automatic low power mode waiting times to the lowest practical values.

> Behavioural:

3. Ensure that all equipment is switched off overnight, preferably at the power outlet, where feasible.
4. Ensure that any redundant equipment is disconnected from the power supply.

> Purchasing:

5. Purchase only the lowest required number of office equipment.

6. Purchase office equipment from the Energy AllStars product database (www.energyallstars.gov.au) when product categories appear.
7. Purchase only equipment with automatic low power modes.

References

NAEEEC 2002 Standby Power Strategy: *Money Isn't All You're Saving*, National Appliance and Equipment Energy Efficiency Committee, 2002.

Appendix 1

Detailed Description of Operating Modes

Equipment Type	On Mode	Active Standby	Passive Standby	Off Mode
Desktop / laptop	Operator typing / mousing	On but not typing / mousing	Auto system standby	Powered down by user
Laptop docking station	Operator typing / mousing	On but not typing / mousing	N/A	Powered down by user
Monitor	Operator typing / mousing	On but not typing / mousing	Auto system standby	Powered down by user
Disk drive / CD burner	Data being read / written	On but no data being read/written	Auto system standby	Powered down by user
Modem	Data being sent / received	On but no data being sent/received	Auto system standby	Powered down by user
Speakers	Sound emitting	On but no sound emitting	Auto system standby	Powered down by user
Palm pilot dock	Charging palm pilot	Palm pilot docked & charged	Palm pilot not docked	Powered down by user
Scanner	Scanning	On but not scanning	Palm pilot not docked	Powered down by user
Digital camera / dock	Camera charging	Camera docked & charged	Camera not docked	Powered down by user
Printer	Printing	On but not printing	Auto system standby	Powered down by user
Photocopier / MFD	Printing / copying	On but not printing / copying	Auto system standby	Powered down by user
Fax	Receiving / sending	On but not receiving / sending	Auto system standby	Powered down by user
Answering machine	Recording message	On and ready to record	On but not set to record	Powered down by user
Mobile phone charger	Charging	Phone connected and charged	N/A	N/A
Telephone hands-free unit	In use - talking	On but not in use	N/A	Powered down by user
Stereo system / receiver	Playing	On but not playing	Awaiting remote control signal to switch on	Powered down by user
Radio	Playing	On but not playing	N/A	Powered down by user
Television	Playing	On but not playing	Awaiting remote control signal to switch on	Powered down by user
VCR	Playing	On but not playing	Awaiting remote control signal to switch on	Powered down by user
DVD player	Playing	On but not playing	Awaiting remote control signal to switch on	Powered down by user
Dishwasher	Washing	On but not washing	N/A	Powered down by user
Microwave oven	Heating	On but not heating	N/A	Powered down by user
Toaster	Toasting	On but not heating	N/A	N/A

(...cont) **Detailed Description of Operating Modes**

Washing machine	Washing	On but not washing	N/A	Powered down by user
Dryer	Drying	On but not drying	N/A	Powered down by user
Battery charger	Charging	Battery connected and charged	N/A	Powered down by user
Shredder	In use	On but not in use	N/A	Powered down by user
Snack vending machine	In use	On but not in use	N/A	Powered down by user
Calculator (mains powered)	In use	On but not in use	N/A	Powered down by user
Cash register	In use	On but not in use	N/A	Powered down by user
Binding machine	In use	On but not in use	N/A	Powered down by user
Folding machine	In use	On but not in use	N/A	Powered down by user
Laminator	In use	On but not in use	N/A	Powered down by user
Stapler	In use	On but not in use	N/A	Powered down by user
Whiteboard	In use	On but not in use	N/A	Powered down by user
Electric typewriter	In use	On but not in use	N/A	Powered down by user

Appendix 2

Council Premises Included in Study

Council	Site Name	Site Type
Botany Bay	Head Office - ground floor	Head office / admin
	Pagewood Library	Library
Caboolture	Works Depot	Works depot
	Plant and Fleet	Other
	CabWater	Other
	Central Administration Building	Head office / admin
Caloundra	Caloundra Administration Building	Head office / admin
	Caloundra Library Administration	Library
	Caloundra Library	Library
	G&S Economic Development Office	Head office / admin
Cessnock	Council Administration Building	Head office / admin
Gosford	Head Office	Head office / admin
	Erina Depot	Works depot
	Erina Library	Library
	J.Mitchell Childcare	Child care
	Ettalong Senior Citizens	Community / arts / youth / seniors
Manningham	Civic Offices	Head office / admin
	Function Centre	Community / arts / youth / seniors
	Depot	Works depot
	Aged & Disability Support Services	Other
Mosman	Head Office	Head office / admin
	Gallery and Community Centre	Community / arts / youth / seniors
	Library	Library
	Works Depot	Works depot
	Community Information Centre	Head office / admin
	Mosman Occasional Childcare	Child care
	Youth Centre	Community / arts / youth / seniors
Moynes	Port Fairy Council Office	Head office / admin
	Mortlake Council Office	Head office / admin
	Koroit Depot	Works depot
	Macarthur Depot	Works depot
	Tourist Information Centre Port Fairy	Community / arts / youth / seniors
	Port Fairy Library	Library
	Port Fairy Community Centre	Community / arts / youth / seniors
Redland	Cleveland Administration Building	Head office / admin
	Cleveland Library and Offices	Library
	Capalaba Place	Library
	South Street Depot	Works depot

(...cont) **Council Premises Included in Study**

Council	Site Name	Site Type
Rockhampton	Head Office	Head office / admin
	Works Depot	Head office / admin
	Walter Reid Building	Community / arts / youth / seniors
	Northside Library	Library
	Southside Library	Library
	Botanical Gardens	Head office / admin
	Community Information & Planning	Head office / admin
	Fitzroy River Water	Head office / admin
	Airport	Head office / admin
	Heritage Village	Community / arts / youth / seniors
	Community & Cultural Development	Head office / admin
	Art Gallery	Community / arts / youth / seniors
	Whitehorse	Civic Centre
Box Hill Town Hall		Other
Whitehorse Centre		Other
Aqualink Nunawading		Recreation / pool
Aqualink Box Hill		Recreation / pool
Box Hill Community Arts Centre		Community / arts / youth / seniors
Depot		Works depot

Appendix 3

Sample Questionnaire

1. Introduction

Background

The Standby Power Survey project aims to quantify the standby energy consumption of office equipment in local government and other office premises.

The objectives of this questionnaire are to describe the types of premises that the Council operates, and to list the office equipment used at **each site**.

This information will be combined with actual equipment measurements and other data held by the consultants, in order to build a comprehensive standby power model for the Council.

Council will receive a free report on the extent of standby energy consumption in its premises, information on how financial and energy savings can be achieved, as well as a free portable power meter.

Instructions

First complete sheet #2 then sheet #3.

Sheet #3 may be completed from Council records, or by undertaking a physical site survey.

The two sheets should be completed electronically, and returned by email to:

steve@beletich.com.au

Please email any questions to the above address or call Steve Beletich on **02 9571 9923** or **0438 660 122**.

Council Total Electricity Consumption

In addition to the equipment survey, it is useful to know the total electricity consumption of the Council's office buildings, in order to estimate standby power consumption as a proportion of total energy consumption.

Please provide these estimates or copies of recent Council electricity bills. Fax to 02 9571 9923 or post to:

Steven Beletich
3 Piper Street
Annandale NSW 2038

2. Premises Details (mandatory)

List **all** council premises, with details of operating hours and staff numbers **for each site**.

There is a 'drop-down' menu provided to allow selection of the site type (ie. library, childcare centre). If none of these are applicable, please type in a more appropriate site type in the adjacent column.

Note that operating hours should reflect staff working hours, not public opening hours.

'No. office staff' should be in terms of average full-time equivalent staffing levels over the year.

Carry a hard copy of this completed sheet whilst completing sheet #3, in order to enter the corresponding 'Site No.' on sheet #3.

Site No.	Site Name	Site type		Operating hours per day							No. office staff (full time equiv.)
		(dropdown menu)	(if 'other', please specify)	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
A	eg. Gosford Library	Community / arts / youth / seniors		8	8	8	8	8	4	4	3.0
B	eg. Molong quarry	Other	Limestone quarry	12	12	12	8	8	0	0	2.0
C											
D											
E											
F											
G											
H											
I											
J											
K											
L											

Appendix 4

Standby Energy Consumption by Site

Site type	Council	Site Name	Standby Energy Consumption (kWh p.a.)
Child care	Gosford	J.Mitchell Childcare	1,312
	Mosman	Mosman Occasional Childcare	176
Community / arts / youth / seniors	Gosford	Ettalong Senior Citizens	3,210
	Manningham	Function Centre	273
	Mosman	Gallery and Community Centre	3,278
	Mosman	Youth Centre	1,480
	Moyne	Port Fairy Community Centre	753
	Moyne	Tourist Information Centre Port Fairy	814
	Rockhampton	Art Gallery	2,486
	Rockhampton	Heritage Village	2,485
	Rockhampton	Walter Reid Building	3,327
	Whitehorse	Box Hill Community Arts Centre	899
	Head office / admin	Botany Bay	Head Office - ground floor
Caboolture		Central Administration Building	95,975
Cessnock		Council Administration Building	33,524
Gosford		Head Office	93,281
Manningham		Civic Offices	49,977
Mosman		Community Information Centre	2,439
Mosman		Head Office	41,206
Moyne		Mortlake Council Office	226
Moyne		Port Fairy Council Office	12,218
Redland		Cleveland Administration Building	107,699
Rockhampton		Botanical Gardens	2,750
Rockhampton		Community & Cultural Development	2,939
Rockhampton		Community Information & Planning	6,385
Rockhampton		Fitzroy River Water	15,652
Rockhampton		Head Office	46,282
Rockhampton		Works Depot	16,580
Whitehorse		Civic Centre	99,741

(...cont) **Standby Energy Consumption by Site**

Site type	Council	Site Name	Standby Energy Consumption (kWh p.a.)
Library	Botany Bay	Pagewood Library	9,919
	Caloundra	Caloundra Library	3,177
	Caloundra	Caloundra Library Administration	646
	Gosford	Erina Library	7,093
	Mosman	Library	15,936
	Moyne	Port Fairy Library	1,303
	Redland	Capalaba Place	13,568
	Redland	Cleveland Library and Offices	79,461
	Rockhampton	Northside Library	4,025
	Rockhampton	Southside Library	7,163
Recreation / pool	Whitehorse	Aqualink Nunawading	2,859
	Whitehorse	Aqualink Box Hill	3,494
Works depot	Caboolture	Works Depot	5,216
	Gosford	Erina Depot	36,248
	Manningham	Depot	11,223
	Mosman	Works Depot	489
	Moyne	Koroit Depot	1,060
	Moyne	Macarthur Depot	2,092
	Redland	South Street Depot	28,847
	Whitehorse	Depot	8,647
Other	Caboolture	CabWater	8,973
	Caboolture	Plant and Fleet	2,287
	Manningham	Aged & Disability Support Services	4,477
	Whitehorse	Box Hill Town Hall	1,808
	Whitehorse	Whitehorse Centre	1,684