



ELECTRICAL DESIGN GROUP

ELECTRICAL COMMUNICATIONS FIRE SYSTEMS DESIGNERS

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PROJECT

**PROJECT
NAME**

DOCUMENT

ELECTRICAL SERVICES BUILDING USERS GUIDE

SITE ADDRESS

**STREET
SUBURB STATE POST CODE**

PROJECT MANAGER

**NAME
ADDRESS
ADDRESS
SUBURB STATE POST CODE**

DESCRIPTION

**REVISION: A
DATE: 1 JUNE 2007**

1.0 INTRODUCTION

1.1 AIM

The aim of this building users guide is to provide guidance material to enable building users to achieve the environmental performance envisaged by the design team, and manage future changes that promote efficiency and environmental quality.

1.2 LIMITATIONS

This component of the Building Users Guide only addresses the Electrical services within the **PROJECT NAME** commercial building at **project address**.

Additional detailed specialist information required by the building managers and maintenance staff/contractors can be found in the building Operations and Maintenance (O&M) manuals.

1.3 SUMMARY

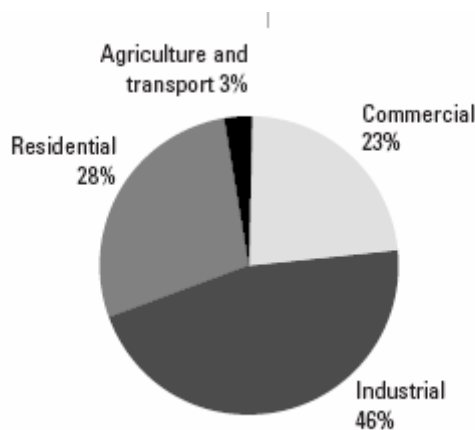
This electrical services Building Users' Guide provides details regarding the everyday operation of the buildings electrical services the building occupants encounter, making it easier for all occupants within that building to understand the electrical services. The aim of this document is to ensure that design features are used efficiently and that changes to the office spaces are managed in the most environmentally appropriate manner.

This document is aimed at management personnel, building occupants and tenant representatives who make facilities management decisions and who monitor internal facility performance against environmental measures, so that they are aware of the environmental impacts of the building and the tenancies.

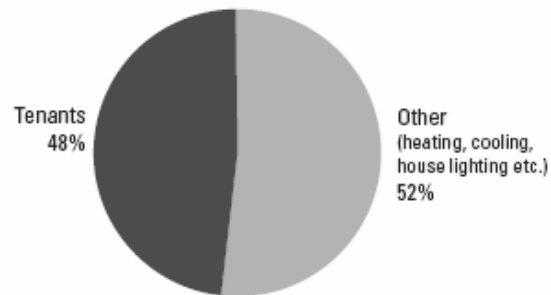
2.0 ENERGY & ENVIROMENTAL STRATEGY

2.1 Energy Use

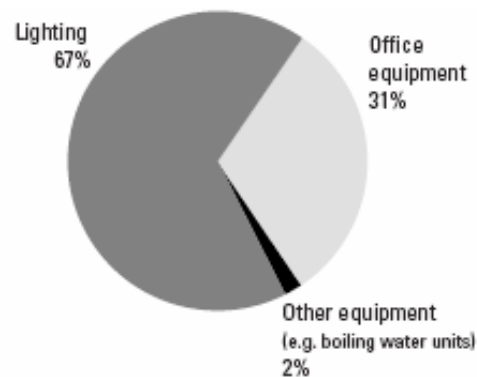
Within Queensland energy is typically consumed as per the following pie chart:



A typical Queensland commercial building uses energy as per the following pie chart:



A typical Queensland commercial building tenancy uses energy as per the following pie chart:



2.2 Energy-Efficient Features and Strategies

The electrical services installation components that consume energy within the **PROJECT NAME** building is limited to the lighting. The lighting installation has been provided with a number of Energy-Efficient Features that include:

- All luminaries are provided with low loss electronic transformers and control gear with discharge fittings provided with high frequency ballasts that operate over 32 kHz.
- The installed maintained lighting levels through out more than 95% of the net lettable area as calculated in accordance with AS1680 are contained between 370 and 430 lux and have a lighting power density that does not have an area weighted average in exceed 2.5 W/m² per 100 Lux.
- The lighting throughout the net lettable area is individually controlled in lighting zones that do not exceed 100m². All individual and enclosed spaces are provided with dedicated individual switches. The switching is logical in its location and configuration and is clearly labelled and easily accessible by the building occupants.
- No light beam is directed beyond the site boundaries or upwards without falling directly on a surface with the explicit purpose of illuminating that surface and the installation complies with AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting.
- The perimeter light fittings are provided with light level sensors to automatically dim the lights and reduce the energy consumption when sufficient natural daylight is available.
- The lighting within the amenities is controlled via movement sensors to reduce the amount of time the amenity lights are on when the amenities are not occupied.

- The commercial tenancy spaces are to be provided with a DALI lighting control system. Each of the luminaries within the commercial tenancy spaces are provided with dimmable individually addressable DALI compatible control gear.
- All common area lighting is automatically controlled.
- The lighting on the commercial levels will be set up with the following philosophy: Each zone on each floor is to be set up individually such that the operator can vary each setting within each zone in the future. The initial setup is common for all zones on all levels as follows:
 - At the end of trading 9.30pm Monday to Friday the BMS is to turn off all of the lighting. A number of lights are not controlled by the BMS and they will remain on permanently.
 - An operator can turn the lights within a zone on after hours for a period of two hours by pressing the push button associated with that zone. The BMS is to turn off the lights within that zone. If the push button for the zone is pressed during the after hours two hour run time the BMS is to reset the two hours.
 - At the commencement of trading 7.30am Monday to Friday the lights within each zone are to remain off until they are turned on by pressing the push button associated with that zone. Following the activation of the lights post the commencement of trading the lights are to remain on until the end of trading as noted above. If the lights within a zone are turned on via the after hours facility within two hours of the commencement of trading the lights in that zone are to remain on upon the commencement of trading.
- Add in any other Energy-Efficient Features systems that form part of the electrical sub contract that are not scheduled above.

Additional advice on how to utilise the Energy-Efficient Features of the lighting installation are provided in the fitout guide in section 4.0 Lighting.

The electrical services installation includes the following energy meters that are all monitored by the building management system (BMS) with the results displayed on the buildings touch screen system.

- The supply authority service is bulk metered.
- Each commercial tenancy quarter power private meter.
- Each commercial tenancy quarter lighting private meter.
- Each commercial floor airconditioning power private meter.
- Each commercial floor common area (lobby amenities) power and lighting private meter.
- Each retail tenancy power and lighting private meter.
- The common area (carpark and external) light and power private meter.
- Each major component (fans and pumps) within the airconditioning and ventilation system power private meter.
- Each lift power private meter.
- The fire pump power private meter.

Additional advice on how to utilise the Energy-Efficient Features of the installation are provided in the fitout guide in section 6.0 Expansion / Re-fit Considerations. For further information on the BMS and the building touch screen system, refer to the BMS and touch screen building users guide.

2.3 POTENTIAL SAVINGS

2.3.1 ECONOMIC

The difference in energy costs between a building with a good energy performance and a poor energy performance can exceed \$10/m per annum.

Improving energy efficiency will:

- Reduce your energy bills, by as much as 60%, year after year, with savings going directly to your bottom line (several case studies in the handbook show even greater reductions);
- Reduce greenhouse gas emissions

- and enable you to report this improved environmental performance – to employees, customers, shareholders and the community. Energy efficiency in your offices can also help your budget indirectly. It can:
 - Reduce maintenance costs by installing longer-life energy efficient technologies;
 - Increase product output by using the latest high-quality equipment;
 - Extend the useful working life of equipment by controlling running hours and using equipment more wisely;
 - Increase staff productivity, morale and loyalty by creating a comfortable working environment and demonstrating your willingness to take action on an issue of wide community concern;
 - Gain market recognition for the improved environmental performance of your premises. This can give your business a competitive advantage and improve government and other corporate relationships.

2.3.2 ENVIRONMENTAL

Most scientists agree that global warming caused by excessive greenhouse gas emissions – the ‘enhanced greenhouse effect’ - is one of the most serious environmental problems facing the world today. Increasing levels of greenhouse gases in the atmosphere as a result of human activity – mostly from burning fossil fuels for energy – are likely to have a serious impact on the global climate.

These impacts include increases in temperature, and in the incidence and severity of extreme weather events. Although Australia contributes just over 1% of total greenhouse gas emissions, our per capita emissions are amongst the highest in the world. Reducing the consumption of fossil fuel based energy is critical to reducing our greenhouse gas emissions.

Approximately 90% of Australia’s electricity is generated by burning coal, a major source of greenhouse gas emissions and pollution. CO₂ emissions from electricity supplied from a Queensland coal fired power station are approximately 1.02 kg/kWh or 1.02 tonnes/MWh.

Converting energy savings to cars off the road.

As a ‘rule of thumb’, annual energy savings have been converted throughout the handbook to a number of cars being taken off the road. This is based on a car traveling on average 15,000 km per year producing on average 4.5 tonnes of carbon dioxide (CO₂). So saving 12 MWh of electricity in a year, which saves 11 tonnes of CO₂ in NSW (12 x 0.92), equates to taking 2.5 cars off the road (11 divided by 4.5).

* Source: Australian Greenhouse Office (1997). The Greenhouse Challenge Workbook Refer to Glossary section 5.5 for further technical terms.

Commercial office buildings are big energy users:

- More than two-thirds of the energy used by commercial office buildings is in the form of electricity – our most greenhouse-intensive energy source. Commercial office buildings account for almost a quarter of the electricity consumed in Australia.
- Operational energy use in the commercial sector generates more than 35 million tonnes of CO₂, and costs business around \$4 billion each year.
- Energy use is growing faster in the commercial sector than in any other sector. If growth continues at the same rate, energy-related greenhouse gas emissions from commercial buildings would double to 62 million tonnes by 2010.
- Tenants directly account for almost half the electricity consumption in commercial buildings.

2.4 USER STRATEGIES

In addition to the strategies implemented in the buildings design, following are a number of strategies that can be implemented by the users:

- Turn off all computers, monitors and other office machines when not in use (especially overnight and on weekends).
- Activate the energy-saving function 'Energy Star' that is installed on most new computers. A step-by-step guide is provided at <http://www.energystar.gov.au/consumers/stepbystep.html>. If your computer doesn't have energy-saving software installed you can save energy by simply switching off the monitor when not in use. Monitors can consume three times the energy used by your PC.
- Re-set photocopiers and printers to default to double-sided printing.
- Always choose the low water consumption feature on dishwashers (ie. the short-wash option often called "Economy"). Display a sign to this effect for all users, including cleaners.

3.0 MONITORING & TARGETING

You first need to establish whether you are using too much energy in providing the services you require, and whether you are getting good value for the money you spend on energy. A simple 'walk-through' inspection of your office by an engineer experienced in office energy efficiency can help identify obvious opportunities for improvement. Organisations which consume a lot of energy may need to conduct a more comprehensive energy audit periodically, to identify where energy is being wasted.

You can also get a sense of the patterns of energy consumption in your office by analysing your bills and checking your meter yourself.

Step 1

Collect your energy bills for at least a year, preferably two:

- Graph energy consumption over time (monthly). Look for patterns and unexplained upward movements.
- Calculate annual consumption per square meter of floor area (floor area should be stated on your lease, or you could estimate it, perhaps by counting ceiling tiles). Compare your energy use with that of a typical office (135 kWh/m² + wide variation) and an energy-efficient one (45 kWh/m²).
- Look at the tariff or contract details to see what components of your energy consumption are most costly (e.g. peak electricity).

Step 2

Use your electricity meters to analyse the pattern of consumption during the day; The energy meter data is available on the buildings touch screens.

- Over a period of time (say, a week), record the readings at set times each day: start of working hours (say 8 am), start and end of lunchtime (say 12.30 and 2.00 pm), and end of working day (say 6 pm).
- Then calculate the average power use per square meter (in watts/m²) during working hours, at lunchtime and outside working hours.

Use the formula:

Power use (watts) per square metre = (kWh x 1000)/
(time interval in hours x floor area)

For example, if consumption is 7.5 kWh over a 1.5 hour lunch period for a 200 m² office:

Power use per square metre = (7.5 x 1000)/(1.5 x 200) = 25 watts/m²

Power use should be somewhat lower at lunchtime and much lower outside working hours than during office hours. If this is not the case, a lot of equipment or lighting is being left on and there is large potential for savings through better equipment management.

Step 3

The information from your energy bills can be used to do a Building Greenhouse Rating self-assessment, so you can find out where you stand in terms of greenhouse gas emissions.

After reviewing your current office energy use, the next step is to determine the most appropriate energy saving program, products or systems for your workplace. Investigate options and implement your program

4.0 LIGHTING

Typically tenants lighting accounts for more than 60% of the average tenant's energy costs. The lighting installation provided as part of the base building has been provided with a number of Energy-Efficient Features that include:

- All luminaries are provided with low loss electronic transformers and control gear with discharge fittings provided with high frequency ballasts that operate over 32 kHz.
- The installed maintained lighting levels through out more than 95% of the net lettable area as calculated in accordance with AS1680 are contained between 370 and 430 lux and have a lighting power density that does not have an area weighted average in exceed 2.5 W/m² per 100 Lux.
- The lighting throughout the net lettable area is individually controlled in lighting zones that do not exceed 100m². All individual and enclosed spaces are provided with dedicated individual switches. The switching is logical in its location and configuration and is clearly labelled and easily accessible by the building occupants.
- The commercial tenancy spaces are to be provided with a DALI lighting control system. Each of the luminaries within the commercial tenancy spaces are provided with dimmable individually addressable DALI compatible control gear.
- The perimeter light fittings are provided with light level sensors to automatically dim the lights and reduce the energy consumption when sufficient natural daylight is available.
- The lighting on the commercial levels will be set up with the following philosophy: Each zone on each floor is to be set up individually such that the operator can vary each setting within each zone in the future. The initial setup is common for all zones on all levels as follows:
 - At the end of trading 9.30pm Monday to Friday the BMS is to turn off all of the lighting. A number of lights are not controlled by the BMS and they will remain on permanently.
 - An operator can turn the lights within a zone on after hours for a period of two hours by pressing the push button associated with that zone. The BMS is to turn off the lights within that zone. If the push button for the zone is pressed during the after hours two hour run time the BMS is to reset the two hours.
 - At the commencement of trading 7.30am Monday to Friday the lights within each zone are to remain off until they are tuned on by pressing the push button associated with that zone. Following the activation of the lights post the commencement of trading the lights are to remain on until the end of trading as noted above. If the lights within a zone are tuned on via the after hours facility within two hours of the commencement of trading the lights in that zone are to remain on upon the commencement of trading.

Efficient lighting management has the potential to significantly reduce costs associated with lighting:

- Control systems regularly checked and maintained
- Signs for employees and cleaners to turn off lights after use
- Lights cleaned periodically to remove dust build-up

Efficient lighting design and installation has the potential to significantly reduce costs associated with lighting:

- Older style electromagnetic ballasts consume more energy, cause perceptible light flicker that can cause headaches and nausea as well as generating an audible hum. Modern electromagnetic ballasts with electronic ballasts which are not only more energy efficient but operate at a higher frequency and produce virtually no detectable flicker or noise.
- Install intelligent lighting controls including motion detectors, separate zone switching and after-hours timers and photo sensors to automatically turn off bays of lights when natural light is ample.
- Design your office layout to maximise use of natural light.

Using less energy for lighting doesn't mean compromising on performance. More efficient lamps and fittings can deliver the same or better lighting levels as conventional systems. And better lighting control can increase the potential for saving even more. You could reduce your lighting bill by 40-80%!

As well as the benefits of lower costs and greenhouse gas emissions, an efficient lighting system can have a number of other advantages:

- Better-quality light can increase staff performance and morale by providing a healthy and pleasant working environment.
- Airconditioning energy costs can be reduced as more efficient lamps emit less heat.
- Maintenance costs are reduced because longer-life lamps need replacing less frequently.

Paint your office walls and ceilings a light colour to minimise lighting demand. Use efficient fluorescent lights with specular reflectors and electronic ballasts for general office lighting. Use compact fluorescent or light emitting diode (LED) lighting for special purpose lighting. These are up to ten times more efficient than low voltage dichroic, halogen or incandescent lights. 'Low voltage' does not mean 'low energy'—it's the wattage that's important. Control lights with motion-based sensors. Light sensors are useful near windows.

A T5 fluorescent triphosphor lamp is about 8% more efficient than the commonly used T8 halophosphor fluorescent lamps and lasts approximately twice as long. Tenant Energy Management Handbook, NSW Department of Energy, Utilities and Sustainability.

How much light do you need?

Different tasks need different amounts of light – called 'illuminance'.

A lighting technician can check that your lighting meets the levels specified in the standard. Otherwise you can buy a light meter and do regular checks yourself. It's also important to get staff input on any lighting changes to make sure they feel that their individual lighting requirements are being met.

The following table details the recommended lighting levels suggested by Australian Standards for interior lighting (AS1680.2.2-1994)

Activity	Type	Recommended Illuminance (lux)
Typing, Reading, Writing	Background	160
	Task	320
Computer work	Keyboard	160
	Reference Material	240-600 (depending on print quality)
	Background	160
Drawing	Drawing Board	600
	Reference Material	320-600 (depending on print quality)
	Background	240
Meeting Rooms, Training Rooms, Boardrooms		240-320
Photocopy Rooms	General	160
	Collating	240

The following table details the core components of a lighting installation and how they effect the efficiency of the installation:

LAMPS

T8 and T5 refer to the diameter of the tube, based on the U.S system a T8 is 8/8ths of an inch wide. A T5 is 5/8ths of an inch wide and noticeably narrower

Standard Practice	More efficient practice	Best practice
<p>Fluorescent halophosphor T8 (36 watts)</p> <p>Most commercial lighting systems incorporate two standard T8 36W halophosphor fluorescent tubes with a standard magnetic ballast running each tube (see below)</p> <p>Life = 6000hrs</p>	<p>Fluorescent triphosphor T8 (36 watts)</p> <p>20% greater light output than a standard T8 lamp of the same wattage. The greater light output means fewer lamps are required, resulting in a lower capital cost and lower energy consumption. To maximise these savings, appropriate lighting design is important</p> <p>Life = 13 000hrs (magnetic ballast) Life = 16 000hrs (electronic ballast)</p>	<p>Fluorescent triphosphor T5 (28 watts)</p> <p>23% more efficient than triphosphor T8 lamp and 38% more efficient than standard T8 lamp i.e. less energy is needed to produce the same amount of light. T5 lamps are most economical when installing new light fixtures, as they require different fittings to T8 lamps. Operate specifically with an electronic T5 ballast. T5 lamps are smaller, therefore fewer resources (such as glass, phosphor and mercury) are used. Shorter than a T8 and so ideally suited to standard 1200mm ceiling tiles.</p> <p>Life = 16 000hrs</p>
<p>Incandescent</p> <p>These are the most common lamps used for general lighting. They're the least efficient - less than 5% of electricity consumed is actually converted into useful light</p> <p>Life = 1000hrs</p>	<p>Compact fluorescent lamps (CFLs)</p> <p>Last 10 to 13 times longer than incandescent lamps and consume about 75% less energy e.g. 60W incandescent light can be replaced with an 11W CFL. Can provide the same warm coloured light as incandescent lamps. Can be dimmed to 10% of maximum light output (4-pin lamps only). Can usually fit into existing light fittings. Light output is directional-mainly from the sides of the tube, so appropriate fittings and/or reflectors are important for effective lighting.</p> <p>Life = 10 000 - 13 000hrs</p>	

BALLASTS

Devices used to control the voltage in fluorescent lamps

Standard Practice	More efficient practice	Best practice
<p>Magnetic (9W)</p> <p>Consumes about 10-20% of the input energy to the lamp. Cannot be dimmed. Due to rising minimum standards, magnetic ballasts are to be progressively withdrawn from the market</p>	<p>Low-loss magnetic (6W)</p> <p>Consumes less energy than standard magnetic ballasts. Can simply replace existing magnetic ballasts. Cannot be dimmed</p>	<p>Electronic (4W)</p> <p>20% more efficient than magnetic ballasts. Can simply replace existing magnetic ballasts. Have a 50% longer service life than magnetic ballasts. Eliminates flickering. Can be dimmed. Cause the lamp to draw less energy. Improves power factor, thereby reducing peak demand charges.</p>

REFLECTORS

Sit behind lamps in fittings

Standard Practice	More efficient practice
Standard	Specular (mirror) reflector
Usually white, flat or curved	Usually white, flat or curved. Directs more light downward from the fitting. When Retrofitted into existing fitting with a single triphosphor lamp and electronic ballast, energy costs can be cut by up to 50%. Available as a metal fitting and as an adhesive film. The adhesive film requires a little more time to install but is cheaper than the metal reflector.

DOWNLIGHTS

Small lights used for display lighting and areas where direct lighting is needed. Require a transformer and are not generally an efficient option for general lighting purposes, especially when used with a magnetic transformer (see below)

Standard Practice	More efficient practice
50-watt low voltage downlights	35-watt low-voltage downlights
Also known as 'dichroic' lamp Life = 4000hrs	New design delivers the same output as a 50-watt lamp but uses only 35 watts. Use internal heat reflection to generate high light output Light quality as good as a 50 watt lamp A straight replacement for a 50 watt lamp Life = 6000hrs

TRANSFORMERS

Convert electricity from 240 volts to a lower voltage

Standard Practice	More efficient practice
Magnetic (15-22W)	Electronic (2-3W)
Standard practice for low-voltage downlights Long, narrow and metal	Becoming more widely used since good quality and reliable transformers, made in Australia, are now available Transformers to which 3 lamps can be connected are also now available. Users report that lamps last longer using electronic transformer. Relatively simple retrofit for an electrician. Curved, rounded and plastic.

Lighting Controls

Technology	Where can I use it?
Localised switches	In separate work areas e.g individual offices
Timer Controls	

<p>A Manual ON control switch and an Automatic OFF control that allows lights to be turned off after a set period of time Simple to install</p>	<p>In areas which are used for fixed duration activities, e.g lunchtimes and at the end of the day A local manual switch should be provided for every 100m² of office space and also for each separate room</p>
<p>Occupancy Sensor controls Infrared and/or ultrasonic sensors which detect heat or movement, automatically activate lights when some-one enters a room and turn them off after a specified period of time While infrared sensors are the most common, ultrasonic sensors prove to be more popular as they provide higher savings</p>	<p>Best used in low-occupancy areas including meeting rooms, conference rooms, tearooms, bathrooms and storerooms. Sensor must be aligned correctly</p>
<p>Daylight-linked dimming system on fluorescent lamps</p>	
<p>Photocell dimming controls sense levels of natural light and turn lights down or off when sufficient daylight is available. Dimming also extends life of the lamps. Electronic ballasts must be used to enable dimming</p>	<p>Best used near windows to optimise energy savings from natural light</p>
<p>Reduced voltage system Fluorescent lights require 240-volt supply from the lights to strike (i.e light up). Thereafter the operating voltage can be reduced with imperceptible effect on lighting level. A reduced voltage system reduces the voltage after startup to a lower level, resulting in energy savings without noticeable difference in lighting levels. Reduced high voltage systems can often be more cost-effective than installing reflectors and lighting upgrades, especially in short-term tenancies</p>	<p>On any system of fluorescent lamps in commercial buildings, carpark, etc.</p>

5.0 MATERIALS & WASTE POLICY

5.1 CONSUMERABLE COMPONENTS

What we commonly call 'waste' can be a valuable resource and a cost-saving opportunity. Waste management costs are passed on directly or indirectly to tenants. A comprehensive waste minimisation and recycling service can generate significant savings. Landfill costs are increasing significantly in comparison to recycling costs and this trend is expected to accelerate. Saves on building owner's landfill fees, which may be passed on to you Responds to employee concern about pollution and waste Demonstrates leadership to shareholders, stakeholders and the community

The consumerable components of the electrical installation are limited to lamps. Fluorescent and HID lamps contain mercury which is toxic to the human nervous system. Generally the higher the power usage the more mercury is required in the operation of the lamp. Mercury containing lamps include: high pressure discharge (HID) lamps such as mercury vapour lamps, which typically contain about 30 milligrams (mg) of mercury, as used for street and road lighting linear fluorescent tubes, which are required by an Australian standard to contain less than 15 mg, as used in most commercial and public buildings, and compact fluorescent lamps (CFLs), which will be required to contain less than 5 mg of mercury under a new Australian standard to be introduced in 2009, mostly used in homes.

One way to dispose of lamps that contain mercury is to have them recycled by specialty recyclers. Recycling can safely recover and reuse the mercury, glass, phosphor and aluminium. The recovered mercury is commonly sold to the dental industry, where it is used in amalgam for fillings. Most lamp recyclers will collect large quantities of lamps from capital cities and selected regional areas. By recycling fluorescent and HID lamps, up to 99.9% of the recovered mercury can be reused.

You should NOT place CFLs in your kerbside recycling collection because they can break during transport and contaminate recyclable items.

Mercury based fluorescent and HID lamps can be recycled by the following private organizations:

CMA Ecocycle

- <http://www.cmaecocycle.net/index.html>
- Phone: (07) 3890 8443

Lamp Recyclers

- <http://www.lamprecyclers.com.au/default.asp>
- Phone: 1300 789 917

What to do if a fluorescent or HID lamp is broken?

Although the mercury content of CFLs is small, and scientific investigations into the potential risks of mercury exposure from an accidentally broken CFL report that for the average person poisoning is very unlikely, lighting companies typically recommend that if a CFL breaks, people should:

- Open nearby windows and doors to ventilate the room.
- Use a brush to carefully sweep up the pieces and then use a paper towel, preferably moist, to wipe up any remaining glass fragments and phosphor powders.
- Use disposable rubber gloves.
- DO NOT use a vacuum cleaner because this can spread the contents of the bulb and contaminate the cleaner.
- Place all of the pieces of the light bulb and clean-up materials into a sealed plastic bag for disposal in your waste bin or in accordance with the advice of your local waste disposal authority.

Other than changing of lamps and cleaning of the light fittings the electrical installation does not include any other components that can be services or replaced by the building user. Electricity is inherently dangerous and a licensed electrician must be used to undertake any work on the electrical installation.

5.2 OFFICE EQUIPMENT

5.2.1 GENERAL

After lighting, efficient office equipment is the next biggest opportunity to reduce ongoing energy costs at no additional upfront cost.



Office equipment that displays the ENERGY STAR logo must meet continually updated energy efficiency standards. ENERGY STAR features an ability to power down or sleep during periods of inactivity and wake when needed. Since between 0–80% of the energy is used when office activated but doing nothing useful**, it is extremely important to choose that has efficient sleep and hibernation modes as well as operating

Paper-efficient office equipment can significantly reduce paper costs and office waste. Energy-efficient office equipment can use half as much energy as standard equipment. It also generates less heat, which keeps your office more comfortable and can reduce air conditioning costs by up to 30%.* All of this can be gained at no extra upfront cost.

Consider leasing arrangements with companies who commit to recycling or reuse of equipment at the end of its lease period. Check that the equipment is ENERGY STAR compliant and make sure this function is enabled (see 'Managing office equipment'). Office equipment spends much of its time in low power modes, and there can be a wide variation in efficiency even amongst ENERGY STAR compliant equipment. Compare the energy use of all the different power modes (e.g. active, standby, sleep, deep sleep). Multi-function equipment (for example a combined fax/printer) can be a good idea if it saves you more energy than having separate machines—check the specifications. Seek out manufacturers that take back nonrecyclable product packaging for reuse.

5.2.2 PURCHASING OFFICE EQUIPMENT

Office equipment accounts for % of the average tenancy's energy use. Computers and monitors should be a focus, as they account for about 85–95% of office equipment energy costs.* The savings don't stop at energy—the biggest ongoing cost saving is probably the reduction in paper use made possible by choosing equipment that allows double-sided printing and print size reductions. Flat screens and efficient multi-function devices take up less office space too. Reduces energy, paper and toner costs—savings can be significant for no extra upfront cost! Reduces heat load from equipment and improves workspace comfort levels Reduces tenancy greenhouse emissions and paper waste.

Following is a checklist that can be considered when purchasing electronic office equipment:

- Energy-efficient computers (particularly laptops) and LCD monitors
- Energy-efficient photocopiers that allow efficient use of paper and toner
- Energy-efficient printers that allow efficient use of paper and toner
- Paperless faxing capacity
- Energy-efficient faxes that allow efficient use of paper and toner
- Energy-efficient scanners
- Energy-efficient audio-visual equipment
- Video-conferencing and tele-conferencing capacity

Computers and monitors

Of all office equipment, computers and monitors represent the biggest opportunity to save money on energy bills, as they account for about 85–95% of office equipment energy costs.* Energy-efficient models cost around the same as standard options. Monitors can consume more than twice the energy used by the computer. Choose efficient LCD flatscreen monitors that are ENERGY STAR compliant.

Laptop computers are by far the most energy efficient option, and when efficiently operated can use up to 98% less energy than a desktop computer.* They also allow more flexible working arrangements (work from home or other locations), which is becoming increasingly important to employees, especially younger employees. It's a popular misconception that screen savers save energy. Not only do they use as much energy as the regular screen display, but many require considerable processing energy as well. Choose 'none' or 'blank' as a screensaver option.

Photocopiers

Cost savings can be achieved by choosing models that reduce demand for paper and consumables. Over a year, the cost of paper and toner is about 5 times the electricity cost of running a photocopier. Although photocopiers and printers account for only –6% of office equipment energy costs, it still makes sense to choose energy-efficient models, particularly as they don't usually cost more upfront. A photocopier that meets the criteria below can save you up to 80% on electricity used for photocopying and cut your toner and paper bills in half.

Following is a checklist that can be considered when purchasing photocopiers:

- Low energy use compared to other models in range (for all power modes). ENERGY STAR compliant.
- 'Energy save' button (users can select low power mode as soon as they finish copying). Programmable power management features.
- Rapid wake-up from energy-saving mode.
- Automatic duplex (double-sided) printing.
- Print reduction capability.
- Uses reused and recycled components.
- Uses remanufactured or refillable consumables (e.g. cartridges).
- Warranty allows use of paper with high recycled content.
- Product take-back and recycle at end of life (including easy disassembly of components for recycling).
- Seven day timer (auto switch-off on weeknights and weekends).
- Ask manufacturers to demonstrate the power management features to staff upon installation.
- Note that accessories such as document feeders or collators may consume a lot of energy if they don't power down with the rest of the machine.
- Ensure the quoted power rating in low power mode includes any power used by the accessories.

* Commonwealth of Australia (00) *Green Office Guide*, Sustainable Solutions Pty Ltd. Note: computer efficiency calculations are based on an efficiently operated laptop versus an inefficient desktop computer left on continuously.

A local Council in Sydney with 400 PCs, 7 printers and 10 faxes saved around \$7,800 a year and 10 tonnes of greenhouse gas just by enabling ENERGY STAR on all equipment. Tenant Energy Management Handbook, NSW Department of Energy, Utilities and Sustainability.

Printers

Printers that meet the criteria below should save you at least \$40 in energy per unit per year, and save you much more in reduced paper and toner costs. They will also reduce waste management costs, because more than half of office waste tends to be paper.

Following is a checklist that can be considered when purchasing printers:

- Low energy use compared to other models in range (for all power modes).
- ENERGY STAR compliant.
- Has duplex (double-sided) printing and print reduction (e.g. two-to-a-page) capacity.
- Toner/ink saving mode available.
- Trays for both double-sided and reused paper (single-sided) printing.
- Long-life consumables available.
- Uses recycled or remanufactured consumables.
- Product take-back and recycle at end of life.

Fax machines

Faxes spend most of their time doing nothing, as actual use is on average less than an hour a day. For this reason, it's important to ensure the model you select has low energy use in all modes, particularly standby and sleep. Also, make sure your office has paperless fax capability (staff able to send and receive faxes by computer) to save time, paper and toner.

Following is a checklist that can be considered when purchasing fax machines:

- Low energy use compared to other models in range (all power modes, particularly standby and sleep).
- ENERGY STAR compliant.
- Plain paper fax, warranty allows reused paper to be used.
- Toner/ink saving mode available.
- Able to scan double-sided pages
- Long-life consumables available.
- Uses recycled or remanufactured consumables.
- Product take-back and recycle at end of life.

5.2.3 MANAGING OFFICE EQUIPMENT

Simply ensuring the energy saving settings are enabled on all equipment can halve the electricity consumption of your office equipment. Further reductions can be achieved by turning equipment off when it's not in use. Reduces energy, paper and toner costs significantly reduces heat load from equipment and improves workspace comfort levels as well as reducing tenancy greenhouse emissions and paper waste.

Overseeing the efficient management of office electronics should be part of the job description of relevant staff, for example your IT manager or your office administrator. To make sure this is well implemented it should also be included in staff training and induction. Reminder signs on equipment can also help. Simply ensuring the energy efficiency settings are enabled on all equipment can halve the electricity consumption of your office equipment. Further reductions can be achieved by turning equipment off when it's not in use. On delivery of equipment, ask the supplier to enable ENERGY STAR and demonstrate the power management settings on equipment. The power management settings usually allow you to select the time lapse after which the equipment moves to low power, sleep and off modes (set to as low as is practical). The default settings are often conservative and can lead to unnecessarily high energy bills.

Some photocopiers require the lid to be closed to enable ENERGY STAR to function—check with your manufacturer and if this is the case use signage to remind staff to close the lid after use.

Following is a management checklist to ensure you have optimised the office equipment energy efficiency:

- Enable ENERGY STAR on all equipment (set lowest practical time spans to move to low power modes).
- Ensure staff switch off their computers and monitors overnight and when away from workstations for significant periods of time.
- Encourage use of ink and toner saving settings where appropriate.
- Encourage automatic duplex (double-sided) printing.
- Reuse any single-sided paper (in printers, photocopiers, for notepaper).
- Make sure staff know how to use paperless fax option.
- Use timers to switch off photocopiers overnight and on weekends.
- Switch off equipment at the power point over holiday periods.
- Checks are in place to make sure energy-efficient settings are enabled on all equipment
- Equipment is switched off at the power point over holiday periods
- Information or reminders for staff on saving energy and paper (e.g. signs)

6.0 EXPANSION / RE-FIT CONSIDERATIONS

To ensure that design features are used efficiently and that changes to the office spaces are managed in the most environmentally appropriate manner, following is a number of items that should be considered during expansion, renovation and fitout:

- Lighting design (refer to section 4.0 of this document for additional guidance on lighting design)
- Lighting control (refer to section 4.0 of this document for additional guidance on lighting control)
- Energy metering and monitoring
- Office equipment (refer to section 5.2 of this document for additional guidance on office equipment)

7.0 REFERENCES & FURTHER INFORMATION

Links to relevant information including websites, publications, and organizations pertaining to energy conservation, efficient building operation, indoor air quality / sick building syndrome, environmentally friendly design features, etc. A list of such links can be obtained from the EDG web site <http://www.edg.net.au/Links/Environment.htm>.

Alternative Technology Association	www.ata.org.au
Australian Building Codes	www.abcb.gov.au
Australian Conservation Foundation	www.acfonline.org.au
Australian Greenhouse Office	www.greenhouse.gov.au
BP	www.bpsolar.com.au
Clean Up Australia	www.cleanup.com.au
Clean Up the World	www.cleanuptheworld.org
Conservation Volunteers Australia	www.conservationvolunteers.com.au
Corporate responsibility Index	www.corporate-responsibility.com.au
Department of Energy, Utilities and Sustainability	www.energysmart.com.au
Department of Housing Smart Housing Related Sites	www.housing.qld.gov.au
Eco Recycle Victoria	www.ecorecycle.vic.gov.au
Ecotourism Australia	www.ecotourism.org.au

Energy Rating Labels	www.energyrating.gov.au
Energy SA	www.sustainable.energy.sa.gov.au
Energy Smart	www.energysmart.com.au
Energy Star	www.energystar.gov.au
Environment Business Australia	www.environmentbusiness.com.au
Fair Trade Association	www.fta.org.au
Fatal Light Awareness Program (U.S)	www.flap.org
Friends of the Earth	www.foe.org.au
Good Environmental Choice	www.aela.org.au
Green Building Council of Australia	www.gbcaus.org
Green Electricity Watch	www.greenelectricitywatch.org.au
Greenhouse Friendly	www.greenhouse.gov.au
Greenhouse Gases	www.greenhousegases.gov.au
Greenpeace	www.greenpeace.org.au
Green Power	www.greenpower.gov.au
Green Print Procurement Guide	www.srd.org.au
Green Vehicle Guide	www.greenvehicleguide.com.au
Illuminating Engineering Society of North America	www.iesna.org
International Dark-Sky Association	www.darksky.org
International Electrotechnical Commission (IEC)	www.iec.ch
Keep Australia Beautiful	www.kab.org.au
National Greenhouse Strategy	www.greenhouse.gov.au
Nature Conservation Council of NSW	www.nccnsw.org.au
NSW Ministry of Energy and Utilities	www.energy.nsw.gov.au
Origin Energy	www.originenergy.com.au
Planet Ark	www.planetark.org
Power Partners	www.power-partners.com.au
Property Council of Australia	www.proertyoz.com.au
Qld Department of Public Works	www.build.qld.gov.au
Qld Government Office of Sustainable Energy	www.energy.qld.gov.au
Sharp	www.sharp.net.au
Solar Shop	www.solarshop.com.au

Standards	www.standards.com.au
Sustainable Energy Authority	www.seav.vic.gov.au
Sustainable Energy Development Authority	www.seda.nsw.gov.au
Sustainable Energy Development Office (WA)	www.sedo.energy.wa.gov.au
Sustainable Energy Queensland	www.sustainableenergyqld.com
Sustainable Industries Division, EPA, QLD	www.epa.qld.gov.au
The Association for the Conservation of Energy	www.ukace.org
The Healthy Home Project	www.healthyhomeproject.com
Tenant Energy Management Handbook	www.deus.nsw.gov.au
The Urban Wildlands Group (U.S)	www.urbanwildlands.org
The Wilderness Society	www.wilderness.org.au
Total Environment Centre	www.tec.org.au
Your Home Guide	www.greenhouse.gov.au
The Urban Wildlands Group (U.S)	www.urbanwildlands.org
Whitegoods Profiler	www.helphouse.com.au
WWF Australia	www.wwf.org.au
Australian Co-ops	www.australia.coop.com.au
Biome - Homewares and Beauty Products	www.biome.com.au
Ewood	www.closetheLoop.com.au
Earth Basics - Plastics	www.earthbasics.com.au
Eco Buy	www.ecobuy.org.au
Fair Trade Association	www.fta.org.au
Green Electricity Watch	www.greenelectricitywatch.org.au
Green Pages Directory	www.greenpagesaustralia.com.au
Neco	www.neco.com.au
Painted House - Paint & Wood Finishes	www.house-paint.com.au
Rechargeable Batteries	www.eneloop.com.au
Say No to Plastic Bags	www.noplasticbags.org.au
Sustainable Energy Queensland	www.sustainableenergyqld.com
Sustainable Living Directory	www.slf.org.au
World Nomads - Carbon Neutral travel Insurance	www.worldnomads.com
Australian Building Greenhouse Rating	www.abgr.com.au
Australian Conservation Foundation	www.acfonline.org.au

Building Energy Software Tools Directory	www.eere.energy.gov
Carbon Planet	www.carbonplanet.com.au
Carbon Neutral	www.carbonneutral.com.au
Climate Friendly	www.climatefriendly.com
Department of Environment Purchasing Checklist	www.environment.gov.au
Easy Being Green	www.easybeinggreen.com.au
Eco Office	www.ecooffice.com.au
Ecological Footprint	www.ecofoot.org
Emissions Calculator	www.elementree.com.au
Greenhouse Calculator	www.epa.vic.gov.au
Neco	www.neco.com.au
Origin Energy	www.originenergy.com.au
Safe Climate Calculator	www.safeclimate.net/calculator
The Carbon Reduction Institute	www.noco2.com.au
Carbon Planet	www.carbonplanet.com.au
Carbon Neutral	www.carbonneutral.com.au
Easy Being Green	www.easybeinggreen.com.au
Elementree	www.elementree.com.au
Green Fleet	www.greenfleet.com.au
Trees for Life	www.treesforlife.org.au
Australian Computer Society	www.iss.net.au
Business to Community Recyclers	www.b2recyclers.com.au
Computer Angels	www.computerangels.org.au
Dell Recycling (Any Brand)	www.dell.com.au
Department of Environment	www.oilrecycling.gov.au
Mobile Muster	www.mobilemuster.com.au
Mobile Phone Recycling	www.mobilephonerecycling.com.au
Recycling Near You	www.recyclingnearyou.com.au
Southern Cross Metal Recyclers (Office Equipment/Computers)	www.southerncrossmetalrecyclers.com.au
Visy Recycling	www.visy.com.au
Dept. of Environment Building and Construction Industry Sustainability	www.environment.gov.au
Eco Specifier	www.ecospecifier.org

Green Directory	www.thegreendirectory.com.au
Green Pages	www.greenpagesaustralia.com.au
Green Plumbers	www.greenplumbers.com.au
Sustainable Earth Technologies	www.sustainable.com.au

REPORTS / BOOKS

The Dollars and Sense of Green Buildings sets out a comprehensive business case for green office buildings, including a section specifically focused on drivers for tenants. The report can be downloaded from the Green Building Council of Australia's website: www.gbcaus.org.

Colliers International's report *Lifeblood* examines the relationship between the workplace and drivers for Australian businesses. It provides a valuable summary of the benefits of green buildings from a tenant perspective. The report can be purchased from Colliers International: www.colliers.com/Markets/Australia/KnowledgeCentre/LifeBlood.

Green Building A to Z Understanding the Language of Green Building by Jerry Yudelson provides an easy point of entry to learn about environmentally sustainable buildings and technology, without any technical or business training by the reader. www.newsociety.com