# Electrical

In selecting electrical and electronic equipment, Zero Waste SA sought to maximise energy efficiency (using star ratings) and to minimise waste.

## Source of power

Zero Waste SA has chosen to use Green Power to meet all electrical energy needs of the office. Green Power is produced from renewable sources, including wind, sun, and methane from landfills, which benefit the environment and reduce greenhouse gas emissions.

As the physical limitations of the office space and building as a whole preclude the use of other sustainable energy sources (of photovoltaic cells, for instance), Green Power (supplied by Origin Energy) is the most sustainable option available; its choice also supports the renewable energy industry.

*South Australia's State Strategic Plan* under 'Objective 3: Attaining Sustainability' sets a target of reducing energy consumption in Government buildings by 25% within 10 years and lead Australia in wind and solar power generation within 10 years.

## Lighting

### Maximising natural light

Daylight enters the office space through glass on its eastern and northern perimeters. During the fitout, clear glass was used to maximise the extent to which that natural light infiltrates through the office. It also, of course, permits the passage of artificial light, or 'borrowed light'. Clear glass has been used in the:

- north-facing walls of all enclosed rooms
- top of partitions between these rooms
- top of workstation partitions
- doors.

The increase natural light has reduced artificial lighting requirements, which will generate energy savings. It is also likely to generate productivity gains by improving the environmental quality of the office space.

### The artificial lighting system

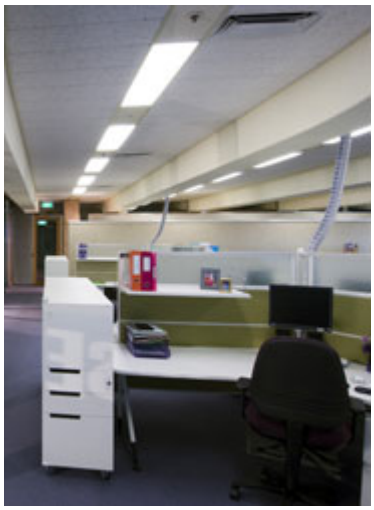
The simplest ways of minimising energy consumption from lighting are to consider:

- energy efficient fluorescent tubes

(T5 or T8 depending on sitting and use of light)

- use of natural light
- use of electronic ballasts (7% more efficient)
- user controls.

(Source: ESD Design Guide for Government Buildings)



The building manager replaced the office lighting system before the main refit was undertaken. Unfortunately, Zero Waste SA was not aware of this before most work was contracted and the system was chosen to work with the existing lighting fixtures, which were recessed – most modern efficient fixtures, by contrast, are exposed. Sustainability criteria were, however, part of the selection process, as the building manager knew of Zero Waste SA's aim to meet Green Star requirements.

**The system chosen**

Each luminare consists of two 28-watt, T5 fluorescent tubes using an electronic ballast, installed in a standard 'white box' housing with a K19 prismatic diffuser over each fitting. While the performance of this combination of reflector and diffuser is inferior to that of other available systems (see below), the system chosen does have a number of positive features.

**Sustainability features**

Compared with T8 tubes, T5 tubes:

- are smaller and so use less resources (eg glass, phosphor and mercury)
- have twice the life expectancy of standard T8 tubes
- have lower maintenance requirements.

The T8 fluorescent tubes that were replaced in the refurbishment were returned to the building manager for reuse in other areas of the building.

Electronic ballasts:

- have a 50% longer service life than standard magnetic ballasts
- are approximately 20% more energy efficient and cause lamps to draw less energy
- eliminate flickering, giving better quality lighting, which improves the office environment for staff.

Other positives:

- The entire lighting system emits less waste heat than a standard system, reducing air-conditioning loads and associated energy costs.
- The system has independently switchable lighting zones so that when the level of natural light in a particular area is high, the lighting there can be turned off. In addition, occupancy sensors mean that when certain areas of the office (eg quiet rooms) have not been used for a specified period, their lighting switches off.

**A more sustainable alternative**

In order to provide the greatest light output for a given source while meeting relevant lighting quality standards, most highly efficient luminares now use a diffuser that is not recessed or covered. A preferred lighting system would comprise two 28-watt, T5 fluorescent tubes, surface mounted in an ultra-low-brightness diffuser, using a dimmable electronic ballast.

Advantages to be gained:

- The luminare recommended would achieve more efficient light generation and significant energy savings. In addition, the number of light fittings could be reduced by one to two rows (or 14% to 28%), with no reduction in lighting quality.
- Less material is needed to manufacture this system.
- Dimmable ballasts save energy and waste in a number of ways:
    - Australian Standard–based computer modelling techniques can overestimate light level requirements; by reducing lighting levels to minimum requirements, dimmable ballasts improve baseline energy efficiency.
    - Near windows, photosensor-controlled dimming in response to natural light reduces energy use.
    - Dimming extends the life of lamps and thereby reduces waste.

**Building further sustainability**

A straightforward lighting survey can be undertaken: if lighting levels are found to be too high, some fluorescent tubes can be removed to reduce energy use (and such a change can also impact positively on staff amenity and productivity). Any action should be undertaken in consultation with the building manager, or the tubes may simply be replaced!

## Energy Star facilities

Where possible, the equipment chosen by Zero Waste SA has an activated ENERGY STAR facility, so that it enters a low power mode after a specified period of inactivity. Sustainability benefits of such facilities include:

- less energy is consumed (on compliant equipment, these facilities can reduce greenhouse gas emissions by over 50%)
- less office noise is generated
- the appliance's lifespan is extended and maintenance costs are reduced
- less heat is generated, which helps to reduce air-conditioning requirements.

## Office equipment

Much of the office equipment used in Zero Waste SA's previous office was shifted to Statewide House to avoid unnecessary wastage; some items could not be shifted, however, so new equipment was selected.

### Multifunctional device

Zero Waste SA purchased a new multifunctional device, a Lanier LD124c, to use for photocopying, printing, faxing and scanning which has resulted in multiple sustainability gains:

- The decision to purchase one device, rather than four, minimises materials and associated waste at end-of-life.
- Only one device, rather than four, will be consuming standby power, which accounts for a significant proportion of energy consumed by office equipment.
- Lanier has a detailed environmental management program, in accordance with ISO14001, aimed at mitigating the environmental impact of their products. The program covers various stages in the life-cycle, including manufacture and end-of-life: the device can be returned to the company for disassembly and recycling of some materials.
- The device has ENERGY STAR facilities (an 'energy saver mode' and an 'auto off timer'). In the case of printing and copying equipment, such facilities can reduce annual electricity use by over 60%.

- Double-sided printing, which is the default option, results in the use of less paper and, both directly and indirectly, less energy. It takes 10 times more energy to manufacture a piece of paper than to copy an image onto it.

### LCD computer screens

Zero Waste SA transferred its computers to the new office, but chose to replace the cathode ray tube (CRT) screens previously used with LCD screens. The CRT screens will be reused by others, however, to reduce material wastage.

Crystal clear advantages: Compared with CRT screens, LCD screens:

- consume significantly less energy (less than half)
- require less material for construction, so produce less waste at the end of their life. In addition, a significant proportion of material from LCD screens can be recycled
- generate weaker electromagnetic fields, which staff are exposed to on an ongoing basis
- generate less heat and a smaller load on air-conditioning systems, thus saving energy/cost.

## Wireless technologies

Wireless technologies are being used for some computer networking. The wireless approach has the following waste-related benefits:

- Less material is used at the fitout stage, resulting in less waste during future office restructuring or relocation.
- Office mobility and flexibility are enhanced, which facilitates office restructuring or relocation.

On the other hand, wireless technologies increase the energy used for networking; and the lack of information on the safety of prolonged exposure to the electromagnetic radiation associated with wireless technologies prevents a full assessment of this option.

## Kitchen equipment

### Refrigerator

As the small ‘bar fridge’ used in the previous office wouldn’t meet Zero Waste SA’s needs at Statewide House, it was offered to another Department, and a new Westinghouse RP432V refrigerator, which is manufactured in Australia, was selected. This five-star product has an expected annual energy consumption of 390 kWh. Compared with the average performance of 460 kWh (for fridges of similar size), the fridge selected uses 15% less energy. Its more efficient operation will result in less heat generation, which will reduce the load on the air-conditioning system, producing further significant savings. The fridge selected has no freezer, as this was considered surplus to Zero Waste SA’s needs and would consume energy unnecessarily.

### Dishwasher

Zero Waste SA chose a Fisher and Paykel, Double DishDrawer DD603 dishwasher, which is manufactured in New Zealand. It is rated at three stars and has an expected annual energy consumption of 275 kWh and water consumption of 16.88 litres per full wash. Two separate dish compartments make it possible to wash a half-sized load with as little as 7.5 litres of water, and to achieve significant water and energy savings.

Compared with an average performance of approximately 366kWh (for dishwashers with similar cycle specifications), the unit selected uses 25% less energy. Again, more efficient operation will reduce the load on the air-conditioning system and generate further savings.


Zero Waste SA's kitchen.

## Building Management System (BMS)

Statewide House has an active building management system (BMS), which controls lighting and air conditioning systems. These systems can also, however, incorporate controls for energy management: various parameters, such as temperature, humidity, energy use and occupancy patterns are monitored, and services such as air conditioning, ventilation and heating, lift services, hot water systems and lighting are controlled to minimise energy use while optimising comfort and functionality.

The BMS at Statewide House is being upgraded to provide more comprehensive energy management features.

### Building further sustainability

Following the upgrade, an investigation into the operation and performance of the BMS could be undertaken by the Statewide House building manager in order to check whether:

- existing controls are working properly
- all desirable controls are being used
- the system has been upgraded to maximise flexibility and energy efficiency.

## Heating, ventilation and air conditioning (HVAC)

Statewide House has a centralised plant that services the whole building. Information on the system was obtained from building management and, while little improvement could be achieved in the short-term, it is expected that improvements will be made (especially in relation to cooling) during the life-span of the fitout.

For cooling the plant uses two relatively old chillers, which are considered inefficient by modern standards. The building manager is likely to upgrade this plant within five years, using one of the many highly efficient technologies locally available, and will install more temperature sensors in each office space, to improve the accuracy and controllability of the system.

For heating the plant uses a series of gas-fired boilers, which have a life expectancy of approximately 10 years and have recently had control systems upgraded. It is thought they are operating effectively and there is little room for improvement, other than by replacing the entire system, which would represent significant wastage, given its life expectancy.

Within the constraints of the existing HVAC system, Statewide House's management plans to investigate the potential for any efficiency improvements; they are likely to be control-based and limited in scope.

Zero Waste SA’s selection of energy-efficient appliances means that less heat is being generated, which reduces the air-conditioning load and associated energy consumption (and overall HVAC energy consumption over the year).

The seating of staff at a distance from windows is likely to facilitate energy reductions when new, more finely controlled HVAC systems are installed in the future.

**Building further sustainability**

Working with the building manager, Zero Waste SA could:

- investigate the performance of the existing system and use the control systems to maximise energy efficiency, eg by using 'night purging' and economy cycles
- investigate methods for reducing waste associated with eventual replacement of the existing HVAC system, such as by using existing infrastructure, where this would not compromise the performance of the new system.

## Water heating

The building has a centralised water heating system, which is expected to require replacement within six years. Given that, in many cases, hot water is now travelling long distances from the tank to the outlet, and a large volume of water then remains in the pipework, there is considerable potential for heat loss.

Zero Waste SA may seek to have showering facilities incorporated into the office space, for the benefit of employees who cycle to work; existing plumbing will be used to minimise waste and avoid unnecessary resource consumption.

**Building further sustainability**

Improved efficiency could be achieved by installing localised water heating facilities, such as on-demand, tankless systems, to reduce heat loss and energy inefficiencies associated with the long runs of pipework. This strategy could also reduce pipework and insulation requirements at the end of the life of existing pipework, and reduce accessibility-based maintenance difficulties.

Furthermore, a building-wide education campaign, aimed at reducing or avoiding hot water consumption wherever possible, could be introduced. Other options for consideration include working with building management to:

- investigate the performance of the existing system and use the control systems to maximise energy efficiency
- investigate increased insulation of the system and associated pipework
- investigate methods for reducing waste associated with replacement of the existing system.