



**Government  
of South Australia**

**Zero Waste SA**

**CASE STUDY DOCUMENTATION OF  
ZERO WASTE SA GREEN FIT-OUT**

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# CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

## Executive summary

The aim of this report is to document and analyse Zero Waste SA's green fit-out at Statewide House, 99 Gawler Place, Adelaide. The report:

- reviews the relevant literature on green building and design
- documents how the fit-out was designed using wherever possible materials, fixtures, appliances and furniture that support the implementation of Greening of Government Operations Priority Areas and Green Star Rating criteria
- documents how the fit-out incorporates adequate provision for recycling receptacles (wheelie bins; toner cartridge recycling box; fluoro tube recycling boxes; soft plastics recycling box; worm farm), highlighting Zero Waste SA's existing recycling efforts
- analyses the up-front cost impact of undertaking a green fit-out compared with traditional 'non-green' approaches
- describes the organisational processes and HR aspects involved in planning and implementing the relocation and fit-out project
- makes recommendations for future green fit-outs based on the case study.

Zero Waste SA commissioned researchers from the Hawke Research Institute and the Institute for Sustainable Systems and Technologies (University of South Australia) to write the report. Research was gathered through interviews and meetings with the senior management at Zero Waste SA and the fit-out architect, through email questionnaires with staff and an analysis of the fit-out plans and documentation.

It is intended that this report will be used to inform the activities of government bodies and others, during the process of future office fit-outs, to increase the sustainability of such activities from an initial and ongoing operational perspective.

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## 1 Introduction

Zero Waste SA is a statutory authority created by the South Australian Government in 2003. Its objective to promote waste management practices that, as far as possible, eliminate waste or its consignment to landfill, advance the development of resource recovery and recycling, and base themselves on an integrated strategy for the State.

As part of its corporate identity, Zero Waste SA wishes to be seen as visibly sustainable, projecting an image of leading the way in a sustainable working environment, in which efficient new technologies are employed, including LCD computer screens, sensor-controlled lighting and wireless technologies. Within the corporate objectives of the organisation, Zero Waste SA aims to be a model of efficiency and is the lead agency for waste management within the eight priority areas of the Greening of Government Operations (GoGO) framework.

GoGO projects will 'green' the South Australian Government's operations, demonstrating a commitment to sustainability and eco-efficiency on a whole of government basis. The framework is essentially a tool for prescribing policy-making and management practices that will incorporate sustainability into all aspects of government decision-making.<sup>1</sup>

Six principles of sustainable environmental management underpin the program:

- integrating economic, environmental, social and human considerations in decision making
- efficient and effective use of human and material resource
- recognising the value of traditional knowledge and intergenerational equity
- minimising waste and using environmentally, socially and economically viable substitutes for scarce resources
- preventing adverse impacts on the economy, environment social and human health
- conserving natural resources.

The GoGO framework is intended to improve the efficiency and significantly reduce the environmental impact of government operations while positioning South Australia as a leading state in this regard. The framework intends to ensure: the delivery of greater environmental benefits as part of each government agency's core business; economies of scale created as part of a change process; best practice environmental management in the delivery of government products and services; and avoiding duplication of effort in the process. The GoGO framework is also committed to human resource policies that assist in the delivery of environmental targets.<sup>2</sup>

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<sup>1</sup> Greening of Government Operations Framework, Office of Sustainability fact sheet, [www.greening.sa.gov.au/docs/GoGO%20Fact%20Sheet.pdf](http://www.greening.sa.gov.au/docs/GoGO%20Fact%20Sheet.pdf)

<sup>2</sup> Greening of Government Operations (GoGO) Framework: A Green Framework for South Australian Government, [www.environment.sa.gov.au/sustainability/gogo.html](http://www.environment.sa.gov.au/sustainability/gogo.html)

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The Department for Administrative and Information Services (DAIS) is responsible for three of the eight priority areas within the GoGO framework, including building and procurement. As such, DAIS is the lead government agency responsible for promoting 'green building'. There is a general perception by government agencies that green building practices are more expensive to implement than standard building practices, but this was accepted at the start of the Zero Waste SA office fit-out. DAIS will incur this increased cost, and will also receive any associated savings, achieved through energy efficiency improvements made during this process on an ongoing basis.

Zero Waste SA specified that the fit-out was to be designed using, wherever possible, materials, fixtures, appliances and furniture that:

- support the implementation of GoGO 'priority areas' and achieve Green Star Rating by sourcing products and services that contribute to energy and water conservation and efficiency
- are designed for disassembly, resource recovery and diversion of materials from landfill at the end of the product's useful life
- stimulate market demand for products with recycled content (as one aspect that defines 'green' products).

Furthermore, as the lifecycle of the fit-out is expected to be 10 years, potential fit-out elements must demonstrate characteristic longevity.

As part of the fit-out brief, and according to Green Star criteria, it was specified that the new office space should incorporate adequate provision for recycling receptacles such as:

- three 240 L 'wheelie bins'
- one toner cartridge recycling box
- one fluorescent tube recycling box
- one soft plastics recycling box
- at least one worm farm.

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In this report, attributes of energy used in the manufacture and, where relevant, operation of elements of the office fit-out, are analysed and compared to existing similar alternatives, where time and resources permit. Energy used in manufacture (embodied energy) is often difficult to quantify; however, where this information is readily available, it is included in this report. Energy efficiency of elements chosen for the existing fit-out are compared to identified superior products. Where relevant, water consumed during the operation of equipment used for the fit-out is analysed and discussed. The characteristics of waste relating to the reusability and recyclability of office elements, and the ease with which such elements can be disassembled, are also analysed and discussed.

The use of certain elements with sustainable features in the office fit-out could have an impact on their associated market. Where practicable, this report assesses how elements of the Zero Waste SA office fit-out could stimulate market demand for products with recycled content. The report lastly describes and analyses the human resource processes deployed by management during the fit-out process and response to these processes from staff.

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## 2 Literature review of green building and design

Through various literature search mechanisms it became evident that very little information relating to local sustainability based activities in South Australian State Government was available. The primary reason for this is a lack of coherent documentation. Much available literature tended to relate to newly constructed buildings and data pertaining to costs of the fit-out component of projects is very limited, making associated comparisons between the Zero Waste SA fit-out and others difficult. The majority of relevant literature located was internet-based, due to the short timeframes in which information relating to sustainability, in the green building and design sector, remains relevant and up to date.

### 2.1 Costings

A small amount of information relating to estimated office fit-out costs for State Government activities was obtained through DAIS from Rider Hunt Adelaide Pty Ltd. This information details South Australian State Government office fit-out benchmarking figures, which represent estimates of future office fit-out costs, based on an area of 1000 m<sup>2</sup>. Such figures are used to predict the cost of future office fit-outs with areas of this sort of magnitude. Benchmarking figures relating to a conventional, 'non-green' approach to office fit-outs are given in Table 1.

**Table 1: SA State Government conventional office fit-out costs**

Type of government office space (1000 m <sup>2</sup> )	Fit-out benchmark figure (April 2005)
Non public floor	\$985/m <sup>2</sup>
Public floor	\$1,138/m <sup>2</sup>

These figures were revised in an attempt to reflect the impact of recently imposed government requirements relating to the GoGO. Further benchmarking figures were therefore obtained, which relate to a less conventional, green approach, and include an allowance for Green Star Rating and ecologically sustainable development initiatives. These benchmarking figures, which are expected to relate to a fit-out with a Green Star Rating of five, are given in Table 2.

**Table 2: SA State Government green office fit-out costs**

Type of government office space (1000 m <sup>2</sup> )	Green office fit-out benchmark figure (April 2005)
Non public floor	\$1,151/m <sup>2</sup>
Public floor	\$1,289/m <sup>2</sup>

In comparison to a conventional approach, a green approach incurs a significant 17% increase in expected cost for non-public office space.

As discussed in a later section, it was estimated that the Zero Waste SA office fit-out will cost approximately \$1350/m<sup>2</sup>.

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The Zero Waste SA office space represents a non-public floor, therefore the estimated cost of the green fit-out is:

- 37% higher than the equivalent government benchmarking figure of \$985/m<sup>2</sup> for a conventional office fit-out (Table 1)
- 17% higher than the equivalent government benchmarking figure of \$1151/m<sup>2</sup> for a green office fit-out (Table 2).

This suggests that, in comparison to current government green fit-out activities, the Zero Waste SA fit-out was executed at an above average overall cost. It should be noted, however, that the Zero Waste SA office space is significantly smaller than the 1000 m<sup>2</sup> spaces on which the benchmarking figures are based. This factor is significant, given that considerable economies of scale are achieved with larger fit-outs, on a per square metre basis, in comparison to the approximately 400 m<sup>2</sup> Zero Waste SA fit-out. This is based on the fact that the extent and associated cost of many fit-out design based activities is relatively independent of floor area (i.e. a linear relationship does not exist).

According to a Sustainable Energy Authority survey,<sup>3</sup> the cost of a standard office fit-out is estimated to be approximately \$1100/m<sup>2</sup>. This figure is similar to the State Government benchmark figures, obtained through DAIS, suggesting that these are relatively accurate. In comparison to this figure, the Zero Waste SA 'green fit-out' is likely to cost approximately 23% more than a conventional fit-out. Architectural consultants estimated that the cost of a green office fit-out can range from \$1200 to \$2500 per square metre, therefore the Zero Waste SA fit-out falls in the lower end of this spectrum for a 'green fit-out'; however, this is not supported by the government benchmarking figures.

A recently designed State Government building project, which incorporates a green fit-out, is the City Central Tower in the Adelaide CBD, adjacent to the Advertiser building site. This project, which is still under construction, is currently on track to achieve a Green Star Rating of 5. This building will include 11,000m<sup>2</sup> of office space, when completed, and it is estimated that the fit-out will cost approximately \$1050/m<sup>2</sup>. This figure is significantly lower than that estimated for the Zero Waste SA fit-out, but again this relates to the much larger floor area in the City Central Tower building, than the approximately 400m<sup>2</sup> Zero Waste SA office space. This significant cost difference also relates to further cost savings achieved through incorporation of green initiatives into the City Central Tower building design at the construction phase, rather than being retrofitted; the necessity for adaptation can generate considerable additional costs. For these reasons, it is therefore problematic to compare the cost of the Zero Waste SA office fit-out with that of other larger projects. It appears important that the information gained through the Zero Waste SA fit-out should be incorporated into the currently existing minimal body of knowledge, relating to such small scale projects, to inform future activities.

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<sup>3</sup> Sustainable Energy Authority Victoria, Case Study 01: Automotive Centre of Excellence – Kangaroo Island TAFE, [www.kangan.edu.au/ace/environment/seav\\_casestudy.pdf](http://www.kangan.edu.au/ace/environment/seav_casestudy.pdf)

### 2.2 National activity

A significant body of knowledge relating to sustainability exists nationally, and a number of sustainability based projects and programs have been identified through the literature review. One example of an existing program, designed to encourage green office fit-outs, is a collaboration between The Sustainable Energy Authority Victoria (now integrated into Sustainability Victoria) and the Property Council of Australia, known as the Commercial Office Building Energy Innovation Initiative (COBEII). It is supported through the Victorian Greenhouse Strategy and assists developers, property owners and tenants to demonstrate innovation in the design and application of sustainable energy in: major refurbishment; tenancy fit outs; building services upgrades; and new building construction.<sup>4</sup>

The COBEII strategy has established a well documented process for implementation of sustainability initiatives throughout all processes involved in commercial office building works. This program has led to the implementation of sustainable design strategies and technologies in a number of buildings throughout Victoria, including: VicUrban; Metropolitan Fire Brigade; Australian Super Developments; Monash University; Bendigo Bank; Bordo International Pty Ltd; Spotlight; and Kangan Batman TAFE. Innovative design strategies and technologies investigated through COBEII partnerships include: chilled beams; underfloor ventilation; BATISO (concrete slab conductive cooling); mixed mode ventilation; solar water heating; use of hydrocarbon refrigerants; night sky cooling; and night purging.<sup>5</sup>

#### **Kangan Batman TAFE Automotive Centre of Excellence**

The Kangan Batman TAFE Automotive Centre of Excellence, part of the aforementioned COBEII strategy, was the first stage of a new facility built in Melbourne's Docklands. The building was designed to achieve a 5-star Green Star Rating with an energy performance well in excess of Australian Building Greenhouse Rating 5 star. Sustainable technologies utilised in the building include: use of BATISO as the primary cooling source for airconditioning of the two lower levels; use of active chilled beams with some assistance from the BATISO in the floor slab for the upper level; use of a 100% outside air system to provide ventilation; and use of a water spray system that uses a night sky radiative cooling system to produce passive chilled water, which is intended to deliver the bulk of the cooling required through a year.<sup>6</sup>

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<sup>4</sup> Sustainable Energy Authority Victoria, Commercial Office Building Energy Innovation Initiative, [www.seav.sustainability.vic.gov.au/buildings/COBEII/index.asp](http://www.seav.sustainability.vic.gov.au/buildings/COBEII/index.asp)

<sup>5</sup> Centre for Design, COBEII case studies, [www.cfd.rmit.edu.au/programs/sustainable\\_buildings/cobeii\\_case\\_studies](http://www.cfd.rmit.edu.au/programs/sustainable_buildings/cobeii_case_studies)

<sup>6</sup> Sustainable Energy Authority Victoria, Case Study 01: Automotive Centre of Excellence – Kangan Batman TAFE

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### Council House 2

One of the best examples of sustainable office space design found in Australia through the literature review is the City of Melbourne's 'Council House 2' (CH2). CH2 is a 10-storey office building, as yet unoccupied, that represents world leadership in office building design. It was awarded 6 Green Stars by the Green Building Council of Australia, the first in Australia to achieve this rating.

CH2 has sustainable technologies incorporated throughout its 10 storeys: a water-mining plant in the basement; phase-change materials for cooling; automatic night-purge windows; vaulted concrete ceilings that will improve air circulation, cooling and natural light harvesting; and a façade of louvres (powered by photovoltaic cells) that track the sun. CH2 is thought to be the best example of comprehensive use and integration of existing sustainable technologies in an office space.<sup>7</sup>

A study and outreach program has been created in association with the CH2 building construction. This program represents a coordinated effort to consolidate the various opportunities for study, research, documentation and promotion relating to CH2. The program aims to generate much greater understanding of sustainable design and its benefits, significantly influence the building and related industries, and generally raise awareness of sustainable design opportunities. The study and outreach program will involve: documentation of the design, development and construction of CH2; research of the green technologies in CH2 and encouragement of industry adoption; identification and development of productivity measures to guide implementation of ecologically sustainable design in future commercial development; and extensive evaluation of building performance and associated workplace practices, following occupancy in early 2006.<sup>8</sup> It is expected that the future outcomes of the study and outreach program could be used to enhance the body of knowledge relating to office fit-outs and other building projects, available in South Australia.

### CSIRO Energy Centre

A nationally recognised building, incorporating many examples of sustainable technology, is the CSIRO Energy Centre. This building showcases energy efficiency technology and integrates onsite generation of power to match the building's demands. The centre incorporates leading-edge and commercially practical techniques and technologies, including: optimum orientation to maximise natural daylight and minimum use of artificial light; dedicated automatic lighting controls; thermal mass for heat retention and cold reduction; energy efficient airconditioning complemented with opening windows for natural ventilation; a Building Management System that operates, controls and monitors energy consumption and implements energy management programs and water saving devices on hydraulic fittings and fixtures. Energy is

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<sup>7</sup> City of Melbourne, 2005, Melbourne's Council House 2 rated world's greenest office building', [www.melbourne.vic.gov.au/info.cfm?top=228&pg=715&st=329](http://www.melbourne.vic.gov.au/info.cfm?top=228&pg=715&st=329)

<sup>8</sup> City of Melbourne, CH2, Setting a new standard in green building design, [www.melbourne.vic.gov.au/info.cfm?top=171&pg=2021](http://www.melbourne.vic.gov.au/info.cfm?top=171&pg=2021)

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generated on-site from integrated renewable systems and other sources, including photovoltaic arrays (solar panels) and a gas-fired microturbine cogeneration plant.<sup>9</sup>

### University of South Australia research

Recent research into sustainable characteristics, relating to building design elements, was conducted by the University of South Australia. The aim of this research was to identify the best practice sustainable attributes of various different types of building spaces and to utilise these in the design of a building to showcase sustainable design and technologies. Although not specifically an office space, many of the proposed features in the building that was subsequently designed are relevant to office spaces.

Sustainable features incorporated into the design of this building include: design for deconstruction; design to minimise material use e.g. through modular design and dimensions; avoidance of composite materials; avoidance of materials requiring harmful extraction or manufacturing processes; use of materials which require fewer resources such as water and virgin materials; use of predominantly local materials; use of materials which do not cause illness; use of materials with low embodied energy; design to reduce maintenance; use of salvaged materials; use of materials with recycled content; use of reusable or recyclable material; and site waste minimisation during construction. The details of the aforementioned report are confidential, but features of the design mentioned, which were identified as key desirable sustainable building practices, are similar to those expressed in the Zero Waste SA brief. This highlights the appropriateness of the aims expressed for the Zero Waste SA green office fit-out, with regard to sustainability.

### Local government sector in South Australia

A recent report has identified a number of green building activities that have been implemented by the local government sector in South Australia.<sup>10</sup> This report details local government sustainable initiatives, where building and project managers of new and renovated council buildings have incorporated best practice energy efficiency, low embodied energy equipment and renewable power sources. Such projects include the City of West Torrens Hamra Centre library redevelopment, which incorporates a 7.5 kW photovoltaic system, solar water heating, double glazing and sun-shading, energy efficient airconditioning using an economy cycle, energy efficient T5 fluorescent lighting utilising photosensors and an automated BMS.

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<sup>9</sup> CSIRO Energy Technology, CSIRO Energy Centre, [www.det.csiro.au/energycentre/](http://www.det.csiro.au/energycentre/)

<sup>10</sup> ICLEI Local Governments for Sustainability, 2004, *Local Greenhouse Action: South Australian councils participating in the Cities for Climate Protection Campaign*, ICLEI, Office of Sustainability, Capital City Committee, Adelaide City Council, [www.iclei.org/fileadmin/user\\_upload/documents/ANZ/WhatWeDo/Previous/LocalGreenhouseActionRpt.pdf](http://www.iclei.org/fileadmin/user_upload/documents/ANZ/WhatWeDo/Previous/LocalGreenhouseActionRpt.pdf)

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Another similarly focused, ongoing project is the Adelaide City Council's staged upgrade of the Colonel Light Centre. This upgrade, although not yet complete, is on track to achieve a 5-star rating in accordance with the Australian Building Greenhouse Rating Scheme, through the incorporation of: active chilled beam airconditioning systems enabling the retention of the majority of the existing airconditioning system infrastructure (and thus substantial capital and energy cost savings); and a lighting system with dimmable low energy T5 luminaires.<sup>11</sup>

Other council examples of sustainability improvements include: City of Mitcham Civic Centre; City of Prospect Civic Centre; City of Playford Elizabeth Centre; City of Marion Cultural Centre; City of Norwood Payneham and St Peters Library; and City of Burnside Library. These projects have also generated significant information and educational elements.

Most recently, in the area of building energy efficiency, SA local governments have begun to negotiate and procure energy performance contracting (EPC) services. A partnership between Energy SA and the Australasian Energy Performance Contracting Association, has generated three locally based trained and accredited EPC facilitators. At least six councils have engaged a facilitator and begun the tendering process for an EPC. Councils have apparently found that because of the variety of staff involved, the EPC process has helped embed energy efficiency awareness into their organisations. One such project is identifying opportunities that generate at least a 20% return on investment. It is thought that this activity helps stimulate the energy efficiency products and services the market in South Australia and demonstrates the economic benefits of environmental guardianship.<sup>12</sup>

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<sup>11</sup> Bassett, Projects: Colonel Light Centre, Adelaide, [www.bassett.com.au/projects/\\_bassett-projects\\_bassett-applied-research-1.asp](http://www.bassett.com.au/projects/_bassett-projects_bassett-applied-research-1.asp)

<sup>12</sup> ICLEI Local Governments for Sustainability, Project Adelaide: Partnerships towards a sustainable region, [www.iclei.org/index.php?id=1268&0=](http://www.iclei.org/index.php?id=1268&0=)

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Five South Australian councils also took part in an ICLEI-A/NZ Green Purchasing Pilot Project during 2002–03, which has stimulated a group of South Australian councils to form a green purchasing network with a mission to "to engage and advocate for local government to acknowledge their responsibilities to lead the way in adopting sustainable purchasing practices, into their standard purchasing systems".<sup>13</sup>

It is highly likely that Adelaide will soon be taking part in the international Solar Cities program, which among other things has the aim of reducing energy consumption and increasing the sustainability of the urban built environment. It is expected that there will be significant possibilities for State Government agencies to collaborate with Solar Cities project managers to benefit from economies of scale generated through large scale adoption of sustainable initiatives. Such benefits could relate to the large purchasing power already existent within State Government networks, and could see unexpected improvements to the outcomes of the program for both public and private sector participants.

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<sup>13</sup> ICLEI Local Governments for Sustainability, Project Adelaide: Partnerships towards a sustainable region, [www.iclei.org/index.php?id=1268&0=](http://www.iclei.org/index.php?id=1268&0=)

### 3 Background to fit-out elements

Initially, tenders were invited to bid for the design and implementation of the 'green fit-out', based on numerous criteria. Such criteria included a requirement that the project be executed and documented according to the Green Star Rating system, and that it be performed in the most sustainable manner achievable within physical and economic constraints. The Green Star Rating system was used to ensure that sustainable practices and materials were used, as intended. The successful consultant was architecture and interior design firm JackmanParkenEvans (JPE). JPE was chosen, in part based on its perceived ability to meet the aforementioned criteria, having successfully completed projects with similar sustainable aspects and using the Green Star Rating system.

JPE initially subcontracted EcoSpecifier to conduct a one-day workshop with key project stakeholders, in order to identify elements that would contribute to the achievement of project objectives and to help familiarise stakeholders with some processes necessary for the success of the project (see Appendix A for workshop summary).

EcoSpecifier aims to help "architects, designers, builders and specifiers simplify the process of sourcing sustainable materials, to facilitate the creation of a more sustainable physical environment by increasing the use of environmentally preferable and healthy products, materials and design processes".<sup>14</sup> Through the workshop process, a number of elements were identified as being preferred for the fit-out, though not all of them were selected in the end, for various reasons. Following the workshop a project team, with representatives from Zero Waste SA, DAIS, Bestec and JPE, was established and became the primary driver of the project.

Based on the requirements of the Zero Waste SA brief JPE selected most elements of the fit-out, including furniture, fixtures and building materials. Zero Waste SA was responsible for selecting all new electrical equipment. A number of apparent compromises in the selection process of certain fit-out elements will be identified. The selection of a component that meets all of the various specifications for the fit-out is an infinitely complex process, given that in most cases at least two specifications can conflict. For example, the brief specified that locally made products be preferred but in some categories world's best practice sustainable products were not manufactured in Australia and would have to be imported.

One trade-off commonly made is based on embodied energy, which increases with distance travelled for delivery. To further complicate the process, information on embodied energy for an array of products with similar specifications is rarely available. The selection process has therefore been driven by the availability and comparability of information relating to the sustainability of a component. Where an objective comparison has not been possible, an educated guess has been required, based on available quantitative and qualitative information and past experience. There is much

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<sup>14</sup> EcoSpecifier, [www.ecospecifier.org/](http://www.ecospecifier.org/)

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potential for error here; however this was rarely used for the purposes of the Zero Waste SA office fit-out.

JPE believed that, based on the relatively small size of the fit-out, there was limited time available to research and source energy-efficient elements to be used and furthermore that the associated environmental benefits of certain sustainable technologies would be minimal, based on the scope of the works. This is a practical necessity, based on the economic constraints faced by the consultant. However, there is a degree of conflict between this perception and specifications for the fit-out.

JPE aimed to educate all contractors on-site about the requirements of the fit-out from the perspective of waste management. It was a requirement of the fit-out that waste generated through the process was recorded and documented – one of the many challenges faced by JPE. The success of this process will be assessed following completion of the fit-out.

The organisation responsible for leasing and building management of Statewide House is Colliers International. A significant proportion of Colliers business in Adelaide is associated with SA State Government-based tenants. Colliers has demonstrated an interest in achieving Green Star Ratings of its office spaces in previous projects and, based on the objectives of the GoGO framework, this has now effectively become a mandatory requirement associated with all future government tenancies. It is therefore fortuitous that the Zero Waste SA office space is managed by a company that apparently has both an internally and externally driven interest in sustainability.

Colliers has stated that it aims to increase the Green Star Rating for Statewide House and recently conducted a program of power factor correction throughout the building, thereby eliminating associated inefficiencies for the foreseeable future. Although this action is likely to have been undertaken for the sole benefit of building management, it demonstrates that Colliers is attentive to energy efficiency opportunities available in Statewide House and supports its aim to improve the Green Star Rating.

The Statewide House office space is leased under a gross lease contract, whereby the landlord, namely Colliers International, pays for all expenses normally associated with ownership, such as utilities. Building managers charge the tenant, namely DAIS on behalf of Zero Waste SA, a set rental amount. Based on the leasing arrangements, it is beneficial to the building managers if the tenant saves energy. Therefore, in the case of the Zero Waste SA office fit-out, both parties have a similar sustainability-based objective.

### 4 Fit-out elements

JPE was responsible for selecting most elements for the Zero Waste SA office fit-out. As part of the process of ensuring that the elements chosen met the specifications of the brief, JPE required that product manufacturers have undergone sustainability auditing of their production processes. Furthermore, associated documentation was required to substantiate manufacturers' claims in relation to specific products, based on auditing. This information has been retained by JPE for future reference.

#### 4.1 Electrical appliances

Zero Waste SA have chosen to use Green Power to supply all the electrical energy needs of the office. Green Power schemes allow electricity consumers to support sustainable energy generation by purchasing some or all of their electricity requirements with power supplied to the grid by accredited Green Power providers. This energy is generated from various sources including the wind, the sun and gas from landfills.<sup>15</sup>

It is expected that the building management system will be used to monitor power consumption of the office space and thus calculate the amount of Green Power required. Green Power is the most sustainable available power source, given the physical limitations that exist within the chosen office space and building. Furthermore, this supports the renewable energy industry, which is an industry that supports many of the objectives of the Zero Waste SA office fit-out and associated GoGO framework.

A range of electrical equipment will service the Zero Waste SA office space in Statewide House. The equipment discussed in this report is: lighting equipment; computer equipment; kitchen appliances; control systems; heating, ventilation and airconditioning (HVAC) systems; and water heating systems.

Electrical and electronic equipment used in the fit-out were specified to be selected based on high energy efficiency and, where possible, waste minimisation. Energy efficiency was proposed to be determined using the existing star rating systems, where possible, in which appliances receive a rating of up to 6 stars based on their level of efficiency in comparison to a standard model.<sup>16</sup> It was also expected that all equipment, where possible, would have an activated ENERGY STAR facility.

The ENERGY STAR facility simply causes equipment to enter a low power mode following a specified period of inactivity, thus reducing the energy consumption of the equipment. Further benefits of ENERGY STAR enabled equipment include a reduction in office noise level as the equipment powers down when not in use and decreased maintenance costs due to extended appliance life. Furthermore, in an office space with

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<sup>15</sup> Environment Protection Authority (SA), Air quality, [www.environment.sa.gov.au/epa/greenhouse.html](http://www.environment.sa.gov.au/epa/greenhouse.html)

<sup>16</sup> Australian Greenhouse Office, [www.energyrating.gov.au](http://www.energyrating.gov.au): Australia's leading guide to choosing an energy efficient appliance, Government of Australia, [www.energyrating.gov.au/](http://www.energyrating.gov.au/)

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such energy-efficient appliances, less heat is generated, contributing to a cooler and more comfortable workspace and a reduction in airconditioning costs.<sup>17</sup>

### Lighting equipment

It is a standard policy of the building management organisation responsible for Statewide House, and many similar organisations, that a tenancy such as the Zero Waste SA office space must start with identical conditions to those at the start of the previous tenancy. Before the office fit-out began, the office lighting system was replaced. Neither Zero Waste SA nor JPE was aware of this before a large proportion of this type of work had been contracted for the building; therefore these works took place outside the Zero Waste SA tender specifications. This process also occurred with the flooring, as will be discussed in a later section of this report.

Those responsible for building management were aware that the new tenant desired a lighting system with energy-efficient features that met the requirements of the Green Star Rating system and, although this was achieved, the system chosen is in the low end of the performance spectrum, in comparison to other more superior lighting systems on the market. Specifically, the luminaire consists of two 28 watt, T5 fluorescent tubes using an electronic ballast, installed in a standard 'white box' type housing with a K19 prismatic diffuser over each fitting. The combination of reflector and diffuser chosen is known to perform poorly, in comparison to many other fittings on the market, which also require significantly less material in their manufacture. The newly installed lighting system has been retained but represents a compromise between energy efficiency and avoiding excess waste.

The positive attributes of the T5 tubes used in the lighting system chosen are that they are smaller, therefore fewer resources (such as glass, phosphor and mercury) are needed; they have twice the life expectancy of standard T8 tubes; and their longer life expectancy reduces maintenance requirements. The positive attributes of the electronic ballasts used in the lighting system include: a 50% greater service life than standard magnetic ballasts; approximately 20% greater energy efficiency; consequent lower energy draw of lamps; and flickering elimination, giving better quality lighting, which can increase staff performance and morale.<sup>18</sup> Furthermore the entire lighting system emits less waste heat than a standard type of system, reducing airconditioning loads and associated energy costs. Although the lighting system installed by building management required additional expenditure, in comparison to current conventional systems, future energy costs avoided through use of this system, detailed previously, will partially offset this additional cost.

Building managers had difficulties in the process of specifying a new lighting system, given the unusual physical dimensions of the existing lighting fixtures and their being recessed into the ceiling space with holes in ceiling materials, rather than being exposed like most modern, efficient lighting fixtures. It is understood that the key driver for the lighting system selection was cost, based not only on the relatively low initial

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<sup>17</sup> SEDA, 2000, Energy Savings Manual

<sup>18</sup> SEDA, 2000, Energy Savings Manual

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cost of the system chosen, but also on the fact that replacing the recessed lighting system with an exposed system would have also required substantial additional work to fill the resulting exposed holes in the ceiling.

The majority of highly efficient luminaires currently available on the market use a diffuser that is not recessed or covered to provide the greatest light output for a given source (e.g. 28 watt, T5 fluorescent tubes), while still meeting relevant lighting quality standards. The lighting system that would have best met the specifications of the fit-out would consist of two 28 W, T5 fluorescent tubes, surface mounted in an ultra-low brightness diffuser, using a dimmable electronic ballast. It has been estimated that the use of this type of luminaire could have avoided between one and two rows of light fittings, which corresponds to a reduction of between seven and 14 light fittings for the office space, with no reduction in lighting quality. In addition to the energy savings based on fewer light fittings and more efficient light generation, it is likely that the surface-mounted fixtures would have required less capital cost than the recessed fixtures chosen.

It was originally specified that lighting near windows, on the perimeter of the office space, would be dimmable but the electronic ballasts installed do not have this capability. In addition to the obvious reduction in the energy efficiency potential of the lighting system, based on a lack of photosensor-controlled dimming, it is likely that further efficiency gains could have been achieved following occupancy of the office space. Based on information from experienced lighting consultants,<sup>19</sup> it is very common for Australian Standard based computer modelling techniques, used in lighting system specification, to overestimate light level requirements. Where dimmable ballasts have been used in such situations, these can reduce lighting levels to minimum requirements and thereby improve the baseline energy efficiency of the system, which represents a cumulative saving in addition to that made through photosensor-controlled dimming. Furthermore, dimming also extends the life of a lamp, thereby reducing associated wastage.

The lighting system does, however, have independently switchable lighting zones so that, at times when natural light availability is high in specific areas, such as those containing the aforementioned perimeter lights, lighting in these individual zones can be switched off. The lighting system will also have occupancy sensors incorporated, so that when certain areas of the office have not been in use for a specified length of time, associated banks of lighting will be automatically switched off.

The lighting system is controlled by the Building Management System (BMS), which ensures that lighting is switched off outside office hours, and the existence of lighting zones will allow staff working after hours to isolate the areas they require to be lit, rather than needing to switch on all lights in the office space, thus facilitating further potential energy savings.

It has been specified that all existing fluorescent tubes that were removed from the office space during luminaire refurbishment were to be returned to the building owner for subsequent reuse in other areas of the building, where possible. This has

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<sup>19</sup> D Low, Manager, Energy Conservation Systems, personal communication, 3/11/05

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apparently happened; however should the entire building change over to T5 lighting these tubes will no longer be useful and will most likely be discarded. Reductions in artificial lighting requirements, based on high access to daylight, provides energy savings, and associated increases in natural light are likely to generate productivity gains through improved environmental quality of office space.<sup>20</sup>

### Office equipment

A large proportion of office equipment used in the previous Zero Waste SA office space will be transferred to the Statewide House offices to avoid unnecessary wastage. In some cases this is not possible, for example a shared photocopier cannot be moved. Newly purchased office equipment with high star ratings specified for the fit-out, includes a multifunctional device, capable of servicing the photocopying, printing, faxing and scanning needs of the office. The multifunctional device is a Lanier LD124c and although little information relating to expected energy consumption was located, this device represents a sustainable choice, based on the minimisation of materials and associated waste at end-of-life, associated with its multifunctionality. The device manufacturer has a detailed environmental management program, in accordance with ISO14001, aimed at mitigating the environmental impact of their products. There is also significant potential for minimising disposal based waste related issues, through product specific recycling programs that are offered by the manufacturer.

The use of a multifunctional device has allowed up to four office machines to be replaced by one, which has likely economic benefits, as well as the waste and resource minimisation related benefits. This also means that only one device, rather than four, will be consuming standby power. Standby power, which is energy consumed by a device when switched on but not operating, represents a significant proportion of office equipment energy consumption. The reduction in standby power will therefore result in significant energy savings over the lifetime of the device. Energy consumption of this device is likely to be further reduced by using an energy saving feature, such as the ENERGY STAR facility available in many electronic products. The advantages of such energy saving features, with specific regard to photocopying and printing, include: automatically entry into 'low-power' and/or 'off' modes after a period of inactivity, potentially reducing a device's annual electricity costs by over 60% in comparison to conventional practice; double-sided copying and printing recommended as the default option on standard-sized machines resulting in a reduction in paper costs and associated energy savings based on the fact that it takes 10 times more energy to manufacture a piece of paper than to copy an image onto it.<sup>21</sup> In addition to the likely reduced initial cost of the multifunction device, in comparison to the devices it replaces, the future energy and waste costs avoided through use of this device represent further cost savings achieved through using this device.

Although existing computers will be transferred to the new office space, existing cathode ray tube (CRT) screens will be replaced with LCD screens, which consume significantly less energy. It is predicted that this will more than halve the energy

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<sup>20</sup> Green fit-out makes commercial sense, *Ecolibrium*, November 2005

<sup>21</sup> US Environmental Protection Agency, [www.epa.gov/](http://www.epa.gov/)

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consumed by computers in the office. Furthermore, aforementioned CRT screens will be reused in the former Zero Waste SA premises by the Department for Environment and Heritage (DEH) to reduce associated material wastage.

The LCD screens are constructed using less materials than conventional CRT screens, therefore at the end of their life less waste is produced. A significant amount of material from this type of screen can now be recycled, the proportion of which will be likely to have grown by the end of their operable life.

Electromagnetic fields, to which staff receive prolonged exposure and are generated by computer screens, are substantially lower for LCD monitors than for conventional CRTs. Furthermore, LCD screens generate less heat than conventional CRT screens, thus they are responsible for less associated load on airconditioning systems.

The LCD monitors cost more to purchase than conventional CRT screens. The future energy and waste related costs avoided through use of this technology, discussed earlier, are likely to repay the additional initial cost within a relatively short timeframe.

It is proposed that wireless technologies will be used for data transfer and networking. These technologies could increase the energy used for these activities; however this option was chosen based on perceived reductions in materials required at the fit-out stage and waste associated with data cabling infrastructure during office restructuring or relocation. Furthermore, wireless networking is perceived to have benefits in office mobility and flexibility, simplifying office space restructuring or complete relocation. A current lack of information relating to the safety of prolonged exposure to electromagnetic radiation, associated with wireless network technologies, prevents an accurate assessment of the overall sustainability of this choice.

### **Kitchen appliances**

Zero Waste SA is responsible for selecting and installing a refrigerator and dishwasher to the kitchen area of the office space. Both appliances have been selected for their appropriateness to the designated task and based on their high star ratings and associated energy and, where applicable, water efficiency.

A 'bar fridge' in the former Zero Waste SA office does not meet the perceived needs of the new office space and therefore will remain there. The new refrigerator specified has no freezer, as this was considered surplus to the needs of Zero Waste SA and would consume energy unnecessarily. The refrigerator selected is a Westinghouse RP432V, an Australian manufactured, 5-star rated product with an expected annual energy consumption of 390 kWh. Only two refrigerators with similar specifications and better expected energy performance were identified as being readily available in Australia, and these were the Liebherr KP4260 and Kes4260, with expected annual energy consumptions of 200 kWh and 335 kWh respectively. These alternative devices are known to be considerably more expensive than the chosen product and, unlike the Westinghouse fridge, Liebherr products require importation, thus increasing their associated embodied energy in transport. These factors could have influenced the selection process.

The average annual expected energy consumption of all fridges, with similar size to the RP432V, is approximately 460 kWh. This suggests that the fridge selected for use

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in the fit-out uses 15% less energy than a similar, conventional model. In terms of future direct energy costs, avoided through use of this refrigerator, an estimated saving over the life of the fit-out of approximately \$120 is likely to result. Additional energy savings associated with load reduction on the airconditioning system can not be estimated with an acceptable accuracy, but will be significant and will also add to the value of future energy savings.

Although the refrigerator to be purchased will require additional expenditure, in comparison to a conventional appliance, the future energy costs avoided through use of this technology are likely to completely offset the additional initial cost within the life of the fit-out.

The new dishwasher specified is a Fisher and Paykel, Double DishDrawer DD603. This appliance is a New Zealand manufactured, 3-star rated product with an expected annual energy consumption of 275 kWh and a water consumption of 16.88 L per full wash. It should be noted that this device has two separate dish compartments allowing potential water savings, and accompanying energy savings, through the capability of washing a half sized load with as little as 7.5 L of water. Many dishwashers with similar physical specifications and better expected energy performance were identified as being readily available in Australia, including various four star rated, products by ASKO and BOSCH, with expected annual energy consumptions of as little as 225 kWh, or approximately 20% lower than the specified product. These alternative devices are known to be considerably more expensive than the chosen product. It should also be noted that the chosen DD603M has comparable water efficiency to the aforementioned models with higher energy efficiency, which is further enhanced through the half load wash capability. These factors are likely to have influenced the selection process and represent trade-offs between project brief specifications of energy and water efficiency.

The average annual expected energy consumption of all dishwashers, with similar cycle specifications to the DD603, is approximately 366 kWh. This suggests that the dishwasher selected for use in the fit-out uses 25% less energy than a similar, conventional model. In terms of future direct energy costs, avoided through use of this dishwasher, an estimated saving over the life of the fit-out of approximately \$110 is likely to result. This saving is likely to be higher, depending on the extent to which the half load feature is utilised. Additional energy savings associated with load reduction on the airconditioning system can not be estimated with an acceptable accuracy but could be significant and therefore also add to the value of future energy savings. Although the dishwasher to be purchased will require additional expenditure, in comparison to a conventional appliance, the future energy costs avoided through use of this technology are likely to completely offset the additional initial cost within the life of the fit-out, based on the aforementioned expected savings.

### **Control systems**

The active BMS of Statewide House, in which the Zero Waste SA office fit-out is located, controls lighting and airconditioning systems. As well as these elements, a BMS usually incorporates controls for energy management. A BMS should be able to manage energy use through monitoring various parameters in the building such as temperature, humidity, energy use and occupancy patterns. By doing so, services such as airconditioning, ventilation and heating, lift services, hot water systems and

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lighting can be controlled in ways that minimise energy use while optimising comfort and functionality.

The BMS installed in Statewide House is known to lack a number of desirable features relating to energy management in the building and therefore the system is currently relatively inefficient. This system is in the process of being upgraded; however the specifications of these upgrades were unknown at the time of writing.

### **Heating, ventilation and airconditioning**

During the fit-out the type of airconditioning system used could not be influenced, as there is a centralised HVAC plant. Therefore the existing system will be used to meet the requirements of the office space. The inability to influence the configuration and operation of the HVAC system has led to a number of inefficiencies associated with the airconditioning of the office space.

The building HVAC system was originally designed to service one open-plan office on each floor of Statewide House. The implementation of multiple tenancies, like those on Level 8, mean that the system is at a disadvantage from a performance perspective, since this complicates the establishment of efficient return air paths. The HVAC air supply system has two components: the main component uses the ceiling void as the supply air plenum for the majority of the office space; and a separately ducted system services high heat gain areas, such as those near the windows of the building, and also services some enclosed spaces. All air is extracted via the main corridor; therefore vents or open spaces are required in all doors and at the reception area to the Zero Waste SA area, to provide a zero pressure air path for return air extraction. From one perspective, open spaces and vents required for return air create a small economy in materials not required for these spaces. However, this is likely to be relatively insignificant.

The existing HVAC plant uses a series of gas-fired boilers, which provide heating to the two separate air-supply systems previously described. These items have a life expectancy of approximately 10 years, have recently had control systems upgraded and are thought to be operating effectively. Technology associated with the gas-fired boilers is relatively simple and there is thought to be little room for improvement, other than replacing the entire system, which would represent significant wastage, given the life expectancy of the equipment. The existing HVAC plant also uses two relatively old chillers, which provide cooling to the two separate air-supply systems previously described. Both chillers are known to be inefficient from a technical and operational perspective. Building management has indicated that it would be preferable to replace the entire chiller plant as soon as possible with one of the many highly efficient technologies locally available, and also to install more temperature sensors in all office spaces, rather than having only the existing one, to improve the accuracy and controllability of the system. These options are constrained by economic limitations, however, and it is therefore expected that building managers will upgrade the chiller plant within five years, at which point there will be significantly greater scope to implement energy-efficient technologies and systems.

Zero Waste SA intends to investigate the potential for efficiency improvements associated with the building HVAC system following occupancy of the office space.

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Such improvements are likely to be control-based and limited in scope, based on the aforementioned configuration of the main HVAC system and the fact that it is being used in a way for which it was not designed. Even if the office space had windows that could open, their use would be impractical, since this would require that all offices on the entire floor behaved identically.

As mentioned in other sections of this report, through the installation of energy-efficient equipment throughout the fit-out, a reduction in the heating load for the office space will be achieved, thereby reducing the airconditioning load and associated energy consumption during times of cooling.

The aforementioned reduced heating load will also reduce the required size of future replacement airconditioning systems.

Part of the fit-out specification was a requirement that staff be seated at a distance from windows, to reduce thermal discomfort associated with rapid temperature changes that can occur in close proximity to windows. This specification arose through the use of the Green Star Rating tool and is likely to have an impact on the HVAC needs of the office space. The existing lack of control over the HVAC system could result in excess heating or cooling being introduced into the office space and corresponding energy wastage. This configuration is, however, likely to facilitate energy reductions when new, more flexibly controlled HVAC systems are installed in the future.

### **Water heating**

During the fit-out, it was not possible to influence the type of water heating system used as it is centralised. Therefore the existing system will be used to meet the water heating requirements of the office space. The existing water heating plant comprises two relatively small gas-heated tanks, configured to supply hot water to the entire building on demand. The plant is currently functioning satisfactorily and is expected to require replacement within six years, at which point there could be scope for efficiency improvements.

Centralised water heating plant in a large building such as Statewide House requires extensive pipework throughout the building and, given the large distances water could need to travel from the tank to an outlet combined with extensive periods that a large volume of water remains in the pipework, there is considerable potential for large-scale heat loss.

The hot water requirements of the Zero Waste SA office space are likely to be minimal, based on office activities, therefore the scope for associated energy savings is likely to be minimal. It is proposed that, in the future, showering facilities could be incorporated into the office space for the benefit of employees who cycle to work. It has been indicated that, should these services be added, attempts will be made to use existing plumbing to minimise waste and avoid unnecessary resource consumption where possible.

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## 4.2 Furniture

A diverse array of office furniture types has been used in the Zero Waste SA office space. The items of furniture discussed in this report are workstations and associated components, chairs, storage devices, partitions, pin-boards and recycling receptacles.

One of the key aspects of the fit-out brief in relation to furniture was the ability for furniture to be disassembled and/or reused. Modular systems and mobile units have therefore been specified, in preference to fixed joinery, to facilitate subsequent removal and reuse and avoid the need for destruction. Furthermore, the ability to easily disassemble components often facilitates more efficient and effective recycling, where reuse is not an option.

During the Ecospecifier workshop, three fabrics with sustainable characteristics in design and manufacture were identified as being preferable for use as furniture coverings in the fit-out (Table 3).

**Table 3: Fabrics identified in workshop**

Supplier	Model/description	Specification details
Designtex	McDonough Collection	Fabrics made from post-consumer and post-industrial yarns or 100% recyclable fibres that can be composted at end of life Manufacture also includes sustainability initiatives
Knoll	Alignment	Textiles made from 100% recycled polyester
Lane	Various fabrics	Unspecified

The tender documentation designates that Instyle's 'Atlas' fabric is to be used to upholster office and meeting room chairs, where necessary, including both new and reused chairs. The attributes of this fabric are discussed in depth in the chair section of this report.

## Workstations

There are a significant number of desks and associated materials being used in the existing Zero Waste SA office space in Level 8, Chesser House. It is proposed that when vacating the existing premises, where possible, desk materials will be reused by DEH to reduce material wastage associated with the move to Statewide House.

A total of 18 new workstations in the new open office area, with a further two to be used in the closed offices, will be placed at a distance from windows, which will reduce the impact of localised temperature fluctuations that occur via radiant heat transfer between the office space and the outside environment. This feature and the associated distance was specified using the Green Star Rating tool. The number and placement of workstations has been highly influenced by the constraints of maximising spatial efficiency, while meeting the government's minimum area requirements for office space, more than any other sustainability criteria. 'Pod'-style workstations were chosen for open office areas, based on their ability to maximise spatial efficiency. L-shaped desks, although preferable, would not allow minimum requirements to be met

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by 18 workstations in the allocated space. L-shaped desks have, however, been used in the two closed offices.

During the Ecospecifier workshop, one desk systems and two associated materials with sustainable characteristics in design and manufacture were identified as being preferable for use in the fit-out (Table 4).

**Table 4: Desk materials identified in workshop**

Supplier	Model/description	Specification details
Schiavello	'QED' Desking System	Lightweight, flexible, modular and movable workstation system designed for reuse or disassembly and recycling at end of life
Alpine	'Four Star' MDF benchtop material	Ultra-low emission, locally made product; 10–15% more expensive than standard material
Alpine	'Alpine E0' MDF benchtop material	Made to meet stringent Japanese 'E0' standard; uses a modified glue and formaldehyde 'scavengers' to reduce emissions to approximately half of those required by the Australian 'E1' standard

The tender document indicated that a choice between three different desk systems, including the Schiavello QED listed above, could be made in the fit-out. The details and specifications of each desk system are shown in Table 5.

**Table 5: Desk systems specified by JPE**

Supplier	Model	Specification details
Schiavello	'QED'	Desk-based systems furniture including accessories with reticulated power and communications with characteristics as described in Table 4
Innerspace Regal	Clover	Desk-based systems furniture including accessories with reticulated power and communications
Steel case	Emerge	Desk-based systems furniture including accessories with reticulated power and communications

The Schiavello QED workstation was eventually chosen for the fit-out for numerous reasons, primarily its relatively low cost; economical material use; option to use low-emission materials; ability to be disassembled; and reduced number of components. Other factors that influenced the selection of the QED workstation were that they are locally manufactured; contain relatively small components; are delivered in flat packs to reduce transport costs and interim storage requirements; and use less partition material than standard workstation systems. The design of the QED workstation also facilitates disassembly at end of life, making these products more easily recyclable. Furthermore Schiavello is a company that has demonstrated sustainable credentials and is therefore a preferred supplier for this type of office fit-out.

The QED workstations to be used in the fit-out will use the Alpine E-Zero (E0) MDF (medium density fibreboard) material (Table 4) for both desktop and partition material, except for the uppermost partition, which will be glass to minimise obstructions to natural light infiltration.

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The E0 board will be laminated with Laminex for use as desktops, based on the durability of this surface coating and associated relative ease of repair, in order to support the intention to reuse these workstations should Zero Waste SA relocate within their lifetime. Furthermore, Laminex is a company that has demonstrated sustainable credentials and is therefore a preferred supplier for this type of office fit-out. The use of a powder-coated desktop surface would theoretically have been more sustainable, since this coating method is known to produce less waste and be more efficiently recycled than laminates. However this surface is less durable and can not be repaired as easily as laminates. This was a compromise that was made between the objectives to maximise recyclability and reusability.

The cost of the E0 material is estimated to be approximately 15% greater than standard materials<sup>22</sup> and, according to the Ecospecifier website, its availability tends to be limited and erratic.

Workstations will hold computers below the desk in suspended housings and LCD screens will be suspended on a moveable arm to optimise desk space availability. The screen height of 1500 mm is thought to be higher than necessary and is likely to cause some obstruction to air flow in the building; however this remains to be seen. The screen height is a compromise between minimising materials and maximising staff amenity, since staff expressed concerns about various acoustic issues relating to the use of lower screens. As previously mentioned, the use of an upper transparent screen reduces additional obstructions to natural light, based on the screen height. Further material savings have been made by incorporating various components into screen-type partitions, including pinboards and whiteboards.

Workstation partition materials were available that could theoretically have better met the sustainability objectives of the project. One such example was a screen bulk-material, available as an option for the QED workstation, consisting primarily of recycled cardboard. This product is relatively new to the market and those responsible for specifying such materials had no associated experience with its use. Concerns were expressed that the product might not perform to specifications and this strongly influenced the decision to not use this product, based on an associated burden to rectify any future performance failures and preserve the reputation of the firm. An intention to monitor the performance of such products was expressed, along with an intention to use such products should they prove to be reliable. This situation highlights a barrier to promoting a material containing a large proportion of recycled content.

Workstation systems are designed to include electrical cabling to facilitate waste avoidance on their removal from the office space or refurbishment of the space itself, due to their reusability.

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<sup>22</sup> [www.ecospecifier.org/](http://www.ecospecifier.org/)

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### Chairs

A number of chairs with sustainable characteristics in design and manufacture were identified as being preferable for use in the fit-out during the workshop conducted by Ecospecifier (Table 6).

**Table 6: Chairs identified in workshop**

Supplier	Model	Specification details
Formway-Knoll	'Life'	Lightweight, ergonomic commercial office chair designed for refurbishment, reuse and, at the end of life, disassembly with approximately 90% component recyclability
Steelcase	'Think'	Audited and certified with the 'Eco-audit Seal', a European standard for environmental management
Folio	task chair	The seat and back are moulded from Recopol resin (a resilient ABS recycled, recyclable plastic sourced from post-consumer and post-industrial engineering grade resins, constituting 55% of total chair weight)

In the tender documentation, none of the above chairs are mentioned as options to be used in the fit-out. Instead, it has been proposed that a total of six new gas-lift task chairs and 25 new visitors' chairs will be purchased, with the remaining seating requirements to be met by reupholstering existing chairs. The details and specifications of each chair type to be used are shown in Table 7 below.

**Table 7: Chairs specified by JPE**

No.	Supplier	Model	Specification details
6	Interlink	Performer	Gas-lift task chair Fabric: Instyle 'Atlas'
14	Existing		Gas-lift task chair Fabric: Instyle 'Atlas' (Reupholstered)
8	Existing		Sledge-base meeting room chair Fabric: Instyle 'Atlas' (Reupholstered)
25	Style furniture	Flow Chair	Stackable plywood armless visitor's chair

All chairs used in the Zero Waste SA office fit-out will be upholstered with the Instyle Atlas upholstery fabric which consists of 98% wool, 2% dye and 0.025% insect resistant agent. All wool is organically grown and manufactured in Australia and is certified as 'eco wool', which has been tested and found to have low pesticide residue (e.g. organochlorines, synthetic pyrethroids and organophosphates), which could otherwise be absorbed through the skin of staff or off-gassed and inhaled. The manufacturer of this fabric refers to it as 'Low Impact for the Environment' (LIFE), and specifies that features include: rapidly renewable and non-hazardous fibres; manufacturers in the supply chain have been surveyed prior to producing LIFE textiles; no flame retardant or anti-static treatment used; biodegradable; reuse potential; low-

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impact dyes used; water and energy efficiencies are undertaken through processing and manufacturing stages; production additives (e.g. lubricants and detergents) are biodegradable; eco packaging; reduced off-gassing; and reduced chemical toxicity through its lifecycle.

The choice to reupholster the majority of existing office chairs with the Instyle Atlas fabric should significantly reduce waste, material and energy consumption that could have otherwise occurred through the office fit-out. This is a highly successful attribute of the fit-out and appears to meet all associated specifications.

The Interlink 'Performer' task chair chosen provides basic functions and has no known significant sustainable features, apart from the fabric that has been selected. Selection of the Performer chair by JPE was primarily based on its relatively low associated cost, and the fact that, with a small number of this type of chair being required, there was little perceived benefit in selecting a more sustainable option. This decision appears to be in contradiction to the terms of the brief, since using furniture with sustainable attributes has indirect benefits, such as stimulating market demand for such products, as well as the direct benefits of reduced environmental impact and improved recyclability and reuse. All chairs identified through the Ecospecifier workshop represent far superior alternatives to the new chairs chosen.

The Style 'Flow' visitors' chairs are a simple, stackable plywood-based unit, with no significant sustainable features, apart from their durability and associated longevity. Selection of the Flow chair by JPE was primarily based on the relatively low associated cost. Again, in the same manner as previously mentioned, this decision appears to be in contradiction to the terms of the brief, since using furniture with sustainable attributes has indirect benefits, such as stimulating market demand for such products, as well as direct benefits associated with cost.

The basic configuration of all chairs used in the fit-out, and the associated reduction in components, is likely to facilitate disassembly and subsequent recycling of these elements. However, as previously mentioned, these were chosen over far superior available products.

### **Cupboard, shelf and drawer units**

It has been specified that storage systems from the former office space will be reused where possible. The outcome of the investigation into their reuse was unknown at the time of writing this report.

All new cupboard, shelf and drawer units to be used in the fit-out will be manufactured from the Alpine E-Zero (E0) MDF material (see Table 4). It has also been specified that only two material coating colour variations will be allowed for the fit-out to capitalise on financial and material savings. These savings are associated with minimising the amount of material that needs to be produced and purchased by the manufacturer and correspondingly minimising the amount of leftover material that will need to be retained along with the potential for subsequent material disposal. Where possible, all cupboard, shelf and drawer units have been designed with physical dimensions in multiples of 300 mm to maximise the efficiency of material use, based on the fact that the MDF to be used is only available in sizes with multiples of 300 mm.

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Furthermore, all cupboard, shelf and drawer units will be moveable to facilitate reuse in future Zero Waste SA office spaces and avoid the necessity for demolition and associated wastage in these circumstances.

The office space will incorporate a central storage facility to maximise spatial efficiency within the office, particularly on and around desks, given limited space. The facility, used for storage of files and associated materials, will be located in the utility area, next to the photocopier.

This area is a high traffic zone and is an efficient choice, based on the likely high frequency of staff visits and the fact that accessing the facility will cause no disruption to other staff. It is likely that these factors will increase the use of the central storage facility and associated staff productivity. All furniture in the central storage facility will have the aforementioned characteristics of being moveable with physical dimensions in multiples of 300 mm for reasons already mentioned.

### **Recycling receptacles and equipment**

Recycling receptacles and associated equipment are treated as an element of furniture in this report, based on the role and function of these components in the office space. The proposed components include worm farms, various recycling wheelie bins and other recycling receptacles.

At present, the recycling systems and associated receptacles in the former office space include paper/cardboard, commingled, fluorescent tube recycling; worm farms; and soft plastics recycling. It is proposed that most systems will remain in place in that building to serve current and future tenants and thus meet the objectives of Zero Waste SA. All of these systems will also be implemented in the new building, with most being located in the utility area. Certain recycling receptacles, such as fluorescent tube recycling boxes, require storage in a secure location accessible by the relevant electrical services contractor to minimise OHS&W issues and prevent the boxes being inadvertently discarded in the general waste. It is expected that these and any other larger receptacles could be stored in the basement of the building, but this decision has not yet been made. Overall, Zero Waste SA management seems satisfied with provisions made for recycling receptacles in the fit-out.

It is expected that worm farms will be located in kitchen areas, as in the current facilities. The current system of documenting and monitoring the waste turnover associated with each worm farm is expected to continue in the new office space, with the possibility for extension throughout Statewide House, pending tenant cooperation.

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## 4.3 Fixtures

Numerous fixtures have been used in the Zero Waste SA office fit-out. The fixtures discussed in this report include: flooring, wall partitions, kitchen fixtures, doors, toilet facilities and ceiling tiles.

### Flooring

It is a standard policy of the building management organisation responsible for Statewide House, and many similar organisations, that a tenancy such as the Zero Waste SA office space must start with identical conditions to those at the start of the previous tenancy. As such, before the office fit-out began, office flooring was investigated and repaired, where necessary. Replacement was deemed unnecessary, based on the fact that the carpet was only about three years old.

It is understood that those responsible for building management were unaware that the new tenant desired floor coverings with sustainable features. Therefore the system used is standard to such tenancies and at the lower end of the sustainability performance spectrum.

Two carpet types with sustainable characteristics in design and manufacture were identified as being preferable for use in the fit-out during the workshop that was conducted by Ecospecifier (Table 8).

**Table 8: Carpet types identified in workshop**

Supplier	Model	Specification details
Ontera		Reconstituted (post-consumer) fusion-bonded modular carpet system
Interface	Climate	

Although it would have been possible to remove the existing carpet, this action would have generated a large quantity of waste, which would have most likely been sent to landfill, and this would have been counter to the specifications of the fit-out and the objectives of Zero Waste SA. Based on these factors, the existing flooring system has been retained.

Interface, the world's largest carpet manufacturer with highly sustainable credentials, now offer environmentally sound carpet tiles for rent, through a product stewardship process.<sup>23</sup> These carpet tiles are known as a 'cradle to cradle' product, based on the fact that they are designed to never enter landfill and be perpetually remanufactured. These tiles consist of a PVC backing and 100% nylon 'overlay', both of which are completely recyclable. Instead of requiring disposal, these specific Interface carpet

<sup>23</sup> Ness et al., 2005, (Approaches towards) Sustainability in the built environment through dematerialization, *Proceedings of the World Sustainable Buildings Conference SBO5*, Tokyo

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tiles can be returned to the company for subsequent recycling and remanufacture of used components. The probability of reuse and recycling is enhanced through the fact that these tiles are an easily removable service delivery item, rather than a permanent fixture, and also based on the fact that the burden of disposal is placed on the company rather than the consumer. At the time of carpet replacement in the Zero Waste SA office space, and for all future office refurbishments, the Interface 'cradle to cradle' carpet tile is recommended for all conceivable applications, based on its unparalleled sustainable attributes.

An exception to the retention of existing flooring will occur in the kitchen space, where an area of existing carpet will be removed and replaced with a resilient flooring material. During the Ecospecifier workshop, several different types of resilient floor coverings with sustainable characteristics in design and manufacture were identified as being preferable for use in the kitchen area of the fit-out (**Error! Reference source not found.**).

**Table 9: Flooring materials identified in workshop**

Supplier	Model/description	Specification details
Amtico	Stratica	Durable, chlorine free, contains no plasticisers, emits virtually no VOCs, does not require dressing and cleaning with caustic chemicals, minimising lifetime cost and environmental impact
Forbo	Artoleum	Biodegradable, resilient floor covering for heavy duty commercial and industrial use
Not specified	Cork tiles	High percentage of recycled content, low toxic content, not applicable for all areas

The kitchen flooring product finally chosen is 'Neoflex', a homogenous recycled rubber sheet material, which is manufactured locally by RepHouse, almost entirely from used automobile tyres. Although this material was not identified in the workshop and therefore not listed in **Error! Reference source not found.**, it has obvious advantages over the two synthetic products that are listed, based on its recycled content. It has been specified that carpet removed to make way for kitchen flooring will be returned to the building owner and re-used where possible.

### Wall partitions

Certain materials used in the construction of ceilings and walls, such as ceiling tiles, plaster boards and timber studs, are known to be responsible for some of the largest volumes of waste production and associated issues in the construction industry. This was the case in previous DAIS office refurbishments, including a sixth level office refurbishment in an education building where over 70% of waste by mass originated from these materials. Attempts have therefore been made to eliminate, where possible, the use of these materials in an attempt to avoid subsequent waste generation and satisfy the requirements of the Green Star Rating tool.

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During the Ecospecifier workshop, two wall partition systems and one associated material with sustainable characteristics in design and manufacture were identified as being preferable for use in the fit-out (Table 10).

**Table 10: Wall partition materials identified in workshop**

Supplier	Model/description	Specification details
Acousta	Wall stud	A lightweight, acoustic and fire-rated non-load bearing, dry-wall system, using recycled content rubber dampeners and fewer materials than equivalent systems
Ortech	Durra	Compressed straw self-supporting wall panel system with integral paint-ready finish
Enviropanel	Acoustic insulation	Recycled paper-based acoustic insulation

An alternative partition system to that listed above was eventually chosen for use in the fit-out. Pre-fabricated, demountable partition systems would theoretically have been the best system for use in the fit-out, based on their generally enhanced waste minimisation characteristics. The primary reason this type of system was not chosen was that it would not have met well with the existing, exposed beam ceiling profile, requiring significant on-site works to fill resulting voids between the ceiling and partitions. The architect has instead chosen a wall partition system that is non-demountable in a commercial sense but has been designed to facilitate removal for subsequent recycling and reuse of materials during future refurbishment, though the success of this will be dependent on the contractor employed to remove materials. The base material for the wall partitions is specified to be E0 MDF (see Table 4), fixed to a steel stud with screws. All dimensions have been specified in multiples of 300 mm to minimise wastage associated with the size of the MDF sheets. The system chosen has also been designed to minimise plastering wherever possible.

The local manufacture, reuse potential and reduced off-gassing of the Alpine E0 MDF product make it a good choice for use throughout the office refurbishment. The favourable attributes of this material include reduced embodied energy, improved associated environmental quality and reduced impact on terrestrial systems, from the perspective of production and disposal of the product. Although this product is manufactured from plantation timber, there are issues of habitat destruction associated with its use. However, in comparison to alternatives, it is believed that this product was a good choice for the fit-out. Furthermore, the use of this product in a large proportion of timber needs in the fit-out will help to demonstrate the versatility, and possibly even the superiority, of this material to contractors and Zero Waste SA visitors, which could also stimulate market demand for its use in similar applications.

There are two small exceptions to the aforementioned wall material specifications. The first is the installation of a plasterboard wall in the elevator lobby, based on a requirement set out by building management. This was apparently unavoidable and will represent the only plasterboard wall used in the fit-out. The second exception is a proposal to construct a rendered straw-bale-type wall in the reception area, for promotional purposes. This may not eventuate, based on difficulties with procuring economically viable installation.

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## Kitchen fixtures

In the fit-out specifications, JPE have stated that a new 'kitchen unit' will be included in the office space set aside for kitchen facilities. The architect has stated an intention to source and refurbish a used 'kitchen unit' for the fit-out, based on availability and associate project time constraints. The outcome of this was not known at the writing of this report. If successful, the reuse of material would preserve resources that would otherwise be consumed to produce new fixtures, and remove the likelihood of such materials going to landfill.

Kitchen facilities have been located to ensure that water services are as close as possible to existing infrastructure currently servicing the office toilet facilities. This decision was made to minimise additional infrastructure requirements, associated building works and materials wastage. Minimisation of additional pipework will also accordingly reduce potential for heat loss incurred in hot water pipes.

## Windows and glazing

The fit-out documents specify the use of standard internal glazing, including 6 mm clear laminated safety glass and 12 mm clear toughened glass with bevelled edges. Although these materials incorporate significant embodied energy, no superior alternative materials have been identified from a sustainability perspective. Specifications also state that minimal materials will be used in the installation of glass. However, superior alternatives do exist to the proprietary products specified for glass installation. One such alternative is Spectrem 2 Architectural Sealant by Tremco, which is an ultra-low VOC (volatile organic compound) structural silicone sealant for glazing applications.<sup>24</sup> This material also carries a premium price, which would have influenced the selection process. However, based on the intention to use a relatively small quantity of this type of material, it is expected that this decision is in conflict with the fit-out specification.

## Doors

Wooden doors constructed from western red cedar and finished in natural tung oil with either clear or frosted glass panel inserts have been specified for the fit-out. Wood is superior to aluminium from a sustainability perspective, due to its greater longevity, its lower embodied energy and associated pollution, and the greater likelihood of reuse, given its easier workability.

Most doors will be fitted with glass inserts to increase daylight availability and preserve aesthetic appeal. This represents a conflict between material selection constraints: although in general glass has significantly higher embodied energy than wood, the potential reduced energy and increased productivity benefits associated with improved access to natural light could offset this to some extent.

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<sup>24</sup> [www.ecospecifier.org/](http://www.ecospecifier.org/)

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All door frames have been specified to be aluminium, based primarily on the fact that this is less expensive than wood, even though many wood products are far more sustainable from most perspectives. This appears to be a situation where, once more, economically motivated decisions drove the material selection process over sustainability-based motivations. All aluminium components are specified as mill finished, avoiding the additional energy, resource requirements and pollution associated with applying various coatings to this already highly resilient material, which represents a slightly more sustainable practice than standard. However, it is once again likely that this decision was motivated primarily by the reduced cost associated with this finish.

### **Toilet facilities**

Existing toilet facilities are used by a number of occupants of the 8th floor and, as well as being shared, these facilities belong to the building, rather than the tenants. Replacement of the existing toilet facilities, which are currently functional and constantly in use, would require significant works, generate significant waste with high embodied energy and disturb existing office tenants. There is subsequently little scope for making improvements in the water efficiency of toilet fixtures that will be used by Zero Waste SA staff in the Statewide House office space.

It is proposed that, upon future replacement of existing fixtures, where possible Zero Waste SA management will attempt to influence building management to select highly efficient fixtures and, furthermore, Zero Waste SA staff will attempt to ensure that existing fixtures are maintained to maximise efficiency on an ongoing basis.

### **Ceiling tiles**

As previously mentioned, ceiling tiles contribute to a large proportion of construction-related waste. Based on this factor, and the fact that existing fibrous plaster ceiling tiles are acceptable for the requirements of the Zero Waste SA office space, these have been retained. It has been specified that any broken ceiling tiles will be either repaired or replaced as required. Extension of the lifespan of reused materials represents better use of embodied energy and reduced waste related issues.

During the Ecospecifier workshop, the 'Ultima' ceiling tile, manufactured by Armstrong, was specified as a preferred ceiling tile product, being a high recycled-content, high-durability, high-reflectivity, acoustic ceiling tile system. For future fit-outs, and in the event that existing ceiling tiles require replacement during the Zero Waste SA occupancy, this product appears to have significant sustainable features.

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## 4.4 Other materials

Many different building materials were required to fit-out the Zero Waste SA office space. Materials discussed in this report are: veneers and panelling products; insulation; paint; cabling and conduit; and plaster, adhesives and fasteners.

### Veneers and panelling

The use of veneers and panelling products has been kept to an absolute minimum in the Zero Waste SA office fit-out. During the Ecospecifier workshop, a number of veneers and panelling products with sustainable characteristics in design and manufacture were identified as being preferable for use in the fit-out (Table 11).

**Table 11: Veneers and panelling materials identified in workshop**

Supplier	Model/description	Specification details
SMARTtimbers	Sugar gum	Veneer comes from guaranteed agro-forestry plantation timbers, native to South Australia
Alpi Plantation	Poplar timber veneers	Manufactured (reconstituted) timber veneers made from plantation poplar
Distinction wall & ceiling linings	Powerscape	97% recycled plasterboard replacement product, suitable for use in wet areas and generally where high durability and moisture resistance is desired

In most cases, the Alpine E0 MDF has been used in preference over the materials identified through the workshop, based on aforementioned characteristics.

### Insulation

All insulation used in the fit-out will be thermally bonded polyester batts (Tontine Industries Sound Batt with STC (sound transmission class) rating 43), based primarily on the acoustic performance of this product, but also on the perceived safety of the product from a toxicity perspective. The use of this material will however be restricted to the ceiling space above acoustic partition walls and within these walls themselves. This product can be reused and recycled.

A number of products are available that have superior features to the chosen product. One such product is Insulfleece, an Australian wool-based acoustic and thermal insulation product, which is a non-toxic, non-allergenic, renewable natural fibre, and is moth, mildew and fire proofed. Another alternative product is Enviro Acoustics ceiling insulation, which is a 100% recycled paper-based insulating material that is spray-applied, and treated with non-toxic fire-retarding and vermin-resisting chemicals. It is thought that this material would have better met the specifications of the fit-out. It is likely that it was not chosen due to increased handling difficulties, especially in relation to insulating wall partitions.<sup>25</sup>

<sup>25</sup> [www.ecospecifier.org/](http://www.ecospecifier.org/)

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### Paints and coatings

During the Ecospecifier workshop, Wattyl 'ID' paint was identified as having sustainable characteristics, based on its reduced VOC content and local manufacture, which made it the preferred choice for use in the fit-out. This paint was not selected by the interior designer however, based on a belief that colour homogeneity could not be guaranteed between batches with this or any other low VOC content paints.

In practical terms, if colour homogeneity was in fact not achieved between batches and paint from two different batches was used in the fit-out, a noticeable colour difference could have been detected by Zero Waste SA. If this was to occur, it would be the responsibility of JPE to rectify this, which could require repainting of large areas of the office space. This represents a potential conflict between the requirements of the fit-out specifications and the contractual obligations of JPE. That is, the use of low VOC paint was preferred. However it is believed that colour homogeneity between batches can not be guaranteed, and therefore painting contractors could not be confident in meeting contractual specifications at a reasonable cost.

Paints selected for use in the fit-out include Dulux and Wattyl latex-based paints. These paints are, like most on the market today, water-based and responsible for relatively low emissions. This selection is not, however, thought to contribute in any way to sustainable product markets, based on available alternatives, though as previously mentioned there were significant complications in the selection process.

The specifications of the fit-out state that tung oil resin will be used for all timber finishes. Tung oil is a natural product, extracted from the nuts of the tung tree, and has many advantages over synthetic products normally used for timber finishing, including reduced VOC emissions. It must be noted, however, that the composition of the resin component in the product specified is unknown. Therefore this may somewhat cancel some of the positive environmental impact of the natural product.

Tung oil is a relatively common component of many wood finishes and therefore does not represent a significantly sustainable attribute of the fit-out, unless the product is 100% pure, which is unlikely given its somewhat lower performance in comparison to blended products.

### Cabling and conduit

It was specified that all wiring outlet plates should be free from PVC not only to minimise out-gassing of toxic substances associated with this material, but also to take into account lifecycle issues in terms of production and disposal – its omission seeks to minimise impacts elsewhere. It was also specified that wireless data transfer should be considered. It should be noted that conclusive research could not be located relating to the safety of prolonged exposure to wireless technologies such as this. Therefore the sustainability of this option, from the perspective of staff health and well-being, is unknown.

The fit-out specification also stated that all 'piping sleeves' be made from metal or UPVC, based on the toxicity of alternative materials. Based on the small quantities of this type of material that are likely to be used in the fit-out, alternative products to those mentioned have not been explored in this report.

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### Plaster, adhesives and fasteners

It has been specified that autoclaved, aerated concrete plaster and gypsum plaster could be used in the fit-out. As previously indicated, the use of plaster has been kept to a minimum in the fit-out; therefore the two proposed areas for use are a plasterboard wall in the elevator lobby area, as per building management specifications, and the proposed straw bale wall to be located in the reception area. Based on time constraints and the limited scope of plaster use and the sustainability-based preference that this be eliminated where possible in office fit-outs, alternative products to those mentioned above have not been explored in this report.

Mastic adhesive has been specified for use with wallboards in the architectural specification document. A more sustainable alternative to the Mastic adhesive is Maxbond Fastgrip by HB Fuller. This is an ultra-low VOC, acrylic, water-based, general purpose construction adhesive that is suitable for interior use with a variety of porous construction materials. According to the manufacturer this product exceeds Green Star low VOC requirements by more than 95%.<sup>26</sup>

Hot dip galvanised nails have been specified for all linings. However JPE has stated an intention to use screws for all fixings, including wallboards, based on the perception that this will facilitate reuse of durable and sustainable wall materials used in the fit-out, upon subsequent refurbishments.

## 4.5 Environmental quality

### Air quality

A high proportion of materials that will be used in the fit-out have been selected for their low emissions of potentially harmful gases, such as VOCs. VOCs are emitted as gases from certain solids or liquids and include a variety of chemicals, some of which may have short- and long-term adverse health effects.<sup>27</sup> These gases are emitted by a wide array of products such as paints and lacquers, building materials and furnishings, office equipment such as copiers and printers, glues and adhesives. Immediate symptoms that some people have experienced soon after exposure to some organics include eye and respiratory tract irritation, headaches, dizziness, visual disorders and memory impairment,<sup>28</sup> which can all have a significant impact on the well-being and productivity of staff.

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<sup>26</sup> [www.ecospecifier.org/](http://www.ecospecifier.org/)

<sup>27</sup> US Environmental Protection Agency, [www.epa.gov/iaq/voc.html](http://www.epa.gov/iaq/voc.html), accessed 2/11/05

<sup>28</sup> US Environmental Protection Agency, 2005

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### **Natural lighting**

All enclosed spaces such as closed offices and quiet rooms have been located along walls without windows, the only exception being the kitchen area. A significant amount of glass has also been incorporated into the doors and walls of enclosed spaces. Furthermore, the majority of office space is an open-plan design, with glass upper screens being used for workstations. The office space has therefore been designed to minimise obstructions to natural light and thereby increase natural light infiltration throughout, which correspondingly increases potential energy and productivity gains.

A number of potential improvements to light infiltration in the fit-out could be achieved through various measures, including the reduction of workstation screen heights to 1200 mm; more glass in wall partitions of enclosed spaces; and light coloured floor coverings, either through replacement or overlaying. The potential barriers to these improvements have been discussed before and primarily involve acoustic and economic constraints. However there could be opportunities for retrofitting such measures.

### **Bicycle facilities**

Zero Waste SA will attempt to establish bicycle storage and employee showering facilities within Statewide House to encourage occupants to cycle to work and thus reduce greenhouse gas emissions associated with employee commuting. Although DAIS is likely to incur the additional cost associated with these facilities, it could also receive economic benefits based on reductions in car parking requirements of building occupants. Many other economic, social and environmental benefits associated with displacement of cars by bicycles have been identified in numerous publications.

## **4.6 Educational aspects**

In an attempt to highlight the efforts undertaken in the 'green fit-out' it is proposed that interpretive signage, and possibly many other creative methodologies, will be incorporated into the office space. This will allow the fit-out to be used as a promotional and educative tool for Zero Waste SA clients and other visitors.

In order to maximise spatial efficiency and associated productivity in the office space, Zero Waste SA management intends to educate staff about desk management and storage, specifically encouraging staff to use the central storage facilities. As part of this program, staff will also be encouraged to minimise noise during phone conversations, using quiet rooms for all meetings and respecting people's space.

Zero Waste SA also intends to establish a 'GoGO committee' within the organisation that will meet regularly to determine areas that require improvement from a GoGO perspective. This committee could meet to discuss issues such as energy efficiency and could also facilitate the identification and implementation of tools such as education programs to address associated issues.

### 4.7 Summary of fit-out element characteristics

Throughout the preceding section, a number of attributes associated with elements to be utilised in the office fit-out, have been identified as sustainable. A number of areas which conflicted with the project brief were also identified. The aforementioned characteristics of the fit-out are detailed below, along with several associated key learning outcomes of the process:

#### Electrical appliances

##### Sustainable attributes

- The decision to source electrical energy from Greenpower
- Specification to source new electrical equipment that is highly energy efficient and, where relevant, high water efficiency
- Minimisation of waste, energy and resource consumption through use of multifunctional device and associated avoidance of multiple devices
- Expected economic payback through avoidance of future energy and waste costs associated with the multifunction device
- Choice of multifunction device manufacturer with green credentials
- Choice of energy and resource efficient LCD screens
- Choice of relatively energy efficient refrigerator without freezer
- Choice of relatively energy efficient dishwasher with features providing exceptional water efficiency
- Specification of a lighting control system with energy efficiency features
- Expected offset of additional cost of LCD screens, refrigerator and dishwasher through avoidance of future energy costs, based on energy efficiency features
- Waste and embodied energy minimisation associated with retaining existing, functional electrical equipment
- Waste minimisation in replacement of the former lighting system, through reuse of old components
- Reduction in lighting system requirements through improved access to daylight
- Specification of a lighting system with energy efficient characteristics, including the use of T5 tubes and movement sensors to zones
- Expected offset of additional cost of new lighting system, based on avoidance of future energy and waste related costs
- Reduced load on HVAC system associated with energy efficient appliance use
- Reduction in data network infrastructure associated with wireless network

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### **Conflicts**

- Lack of communication with building management staff
- Installation of luminaires with performance specifications outside fit-out brief, relating to inefficient diffusers and non-dimmable ballasts
- Lack of photosensors in lighting control system
- Inefficient diffusers recessed into ceiling, resulting in greater resource consumption and likely increased associated capital cost, in comparison to higher performance diffusers, and increased energy consumption
- Failure to select most efficient refrigerator and dishwasher available
- Office space utilises currently inefficient BMS
- Relatively inefficient HVAC system and water heating system in combination with associated inability to improve performance of either system
- Use of wireless network facilities increases associated energy consumption and could compromise environmental quality associated with sustained staff exposure to increased levels of high frequency radiation

### **Key learning outcomes**

- Increased initial capital costs of electrical appliances with sustainable features can be offset or repaid by savings in future energy use and waste avoidance
- A green fit-out requires effective and transparent communication with building managers, particularly at the instigation of the fit-out process
- A green fit-out requires a thorough assessment of building system and infrastructure capabilities prior to selection of fit-out location

# CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

## **Furniture**

### **Sustainable attributes**

- Reuse, where possible, and refurbishment, where applicable, of existing functional office furniture e.g. chairs
- Specification for sustainable fabric in all furniture upholstery and refurbishment
- Specification for workstation system with many sustainable characteristics: low embodied energy; reticulated power; design for disassembly and reuse; and componentry minimisation for waste reduction on disposal
- Workstation configuration characteristics, e.g. suspended LCD screen and under-desk computer storage rack, to maximise spatial efficiency of work surfaces
- Design of workstation layout to maximise overall office spatial efficiency
- Workstation partition design to minimise obstruction to natural light infiltration and air flow of HVAC system
- Specification for low VOC MDF with sustainable manufacturing features, e.g. low embodied energy and resource preservation, in construction of all furniture
- Dimensions of all manufactured, MDF based office furniture elements, e.g. cupboards and shelving, standardised to minimise material wastage
- Additional cost of furniture with sustainable features expected to be offset by avoidance of future waste related costs, associated with reusability, ease of disassembly and recyclability
- Incorporation of designated areas for recycling receptacle placement

### **Conflicts**

- New chairs have insignificant sustainable features and were selected based on questionable economic rationale, in the presence of more sustainable alternatives
- Height chosen for workstation screens exceeds perceived requirements

### **Key learning outcomes**

- Increased initial capital costs of furniture with sustainable features can be offset through savings relating to future waste avoidance
- Choose from readily available, highly sustainable furniture products and materials available that meet the requirements of the GoGO framework

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- Reuse of existing office furniture is a highly sustainable and aesthetically acceptable option, based on the potential for repairing and reupholstering components, where necessary
- Ensure all selected fit-out elements demonstrate maximum possible adherence to project specifications
- Conflicts between sustainability aspects of fit-out elements and staff amenity are likely and further investigations are warranted into solutions

### **Fixtures**

#### **Sustainable attributes**

- Use of recycled rubber resilient flooring for the kitchen area and associated reuse of removed carpet
- Retention of existing carpet and ceiling tiles, avoiding associated waste issues
- Specification for low VOC MDF with sustainable manufacturing features, including low embodied energy and resource preservation, in construction of all wall partitions
- Design of wall partition system to minimise waste and facilitate disassembly and associated reuse and recycling of materials
- Potential for showcasing strawbale walling in foyer area, pending availability
- Potential to use reused kitchen fixtures in the kitchen area, pending availability
- Expected offset of additional cost of fixtures with sustainable features, through avoidance of future waste related costs, associated with reusability, ease of disassembly and recyclability
- Location of kitchen facilities to minimise additional wet services infrastructure
- Use of a significant amount of glass in partitions to maximise natural light availability

#### **Conflicts**

- Likelihood for disassembly and reuse of the non-modular wall partition system selected is less than that for a modular system
- Unusual building characteristics complicated the process of element selection for fixtures, such as wall partitions
- Wall partition system components, such as insulation, selected in preference over more sustainable materials
- Aluminium, a highly unsustainable material, was the chosen framing material for doors and glazing, for economic reasons, although alternative sustainable materials were available

# CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

## **Key learning outcomes**

- Increased initial capital costs of fixtures and associated materials with sustainable features can be offset through savings in future waste avoidance
- Retention of existing fixtures is a highly sustainable and aesthetically acceptable option, based on the potential for repairing or replacing broken components, where necessary
- Materials with substantial waste issues associated with construction and disposal can be successfully avoided
- Economic considerations are sometimes given precedence over sustainability goals
- Complex interrelationships between different fixtures and fit-out specifications can create conflict that is difficult to avoid, therefore solutions should be investigated
- There is a need to ensure all selected fit-out elements should demonstrate maximum possible adherence to project specifications

## **Other materials**

### **Sustainable attributes**

- Use of natural tung oil products in coating timber finish elements and associated reduction in VOC content
- Avoidance of PVC and associated VOCs in materials used throughout the fit-out
- Minimisation of plaster use and associated waste related issues
- Specification to use screws, rather than nails and adhesives to facilitate disassembly and subsequent reuse of materials

### **Conflicts**

- Specification of a number of products, such as paints and adhesives, that do not meet fit-out specifications, in the presence of more sustainable alternatives

## **Key learning outcomes**

- Entrenched building practices perceive difficulties when there is a deviation from the norm. This culture of resistance to the selection of sustainable materials needs to be addressed at the outset.

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## **Environmental quality**

### **Sustainable attributes**

- High proportion of materials used contain low concentrations of VOCs for minimised impact on air quality, improved staff health and higher productivity
- Maximised natural light availability, minimising artificial lighting and associated energy requirements and possibly increasing staff productivity
- Potential to establish bicycle facilities to support staff with cycling to work and reduce associated transport related resource use and waste

### **Conflicts**

- Some building materials used, e.g. paints and adhesives, will be responsible for emission of toxic substances, e.g. VOCs, into the office environment
- Artificial light levels are possibly in excess of requirements and could therefore adversely influence staff productivity

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### **Key learning outcomes**

- Increased initial capital costs of activities undertaken to improve environmental quality can be offset or repaid through productivity gains associated with improvements to staff health and amenity
- A high proportion of materials responsible for reductions in environmental quality and associated issues can be avoided using readily available materials
- Careful management of the balance between staff requirements and other aspects of sustainability should be carefully managed to avoid unnecessary conflict

### 5 Human resources management and the fit-out

#### GoGO objectives for human resources management

- Equip employees to meet the requirements of all applicable environmental regulations, guidelines and policies.
- Encourage employees to incorporate environmental considerations into their daily activities. Actions are aimed at increasing staff ability to sustain productive effort to lead to higher productivity in the workplace and more functional working relationships between staff. To facilitate uptake, employers should provide full information at an early stage about the proposed or anticipated changes; including the reasons, objectives and means involved. GoGO Education actions will aim to raise staff awareness of the environmental, social and economical impacts of workplace practices, identifying areas of particular relevance to the agency and the means of addressing those issues, and to relate these with occupational health, safety and welfare system outcomes.

#### Foundation Program

In implementing GoGO Framework foundation programs in South Australia, and gaining experience from Greening of Government programs worldwide, it is recommended the following best practices be adopted:

- consistent with Office of Public Employment's personnel policy, adopt human resource management practices that foster innovative working arrangements, such as job sharing and working from home, that support environmental objectives
- infuse environmental awareness into all training programs, particularly employee workplace and work practice orientation
- improve the safety and quality of workplace environments, and subsequently empower, protect and motivate employees.<sup>29</sup>

One of the aims of HR management is to facilitate the productivity benefits anticipated in the greening of office space. The GoGO framework suggests that this can be accomplished when staff are fully informed and involved in change processes in a way that is empowering. During the fit-out process management at Zero Waste SA adopted HR processes with reference to the framework principles for HR management. HR processes discussed in this report focus in particular on improving the quality of workplace environments by empowering and motivating staff during the design stages of the fit-out. The following is a description and analysis of those processes from the management and staff perspective.

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<sup>29</sup> Government of South Australia, 2003, Greening of Government Operations Framework, [www.greening.sa.gov.au/docs/GoGo\\_Booklet\\_low.pdf](http://www.greening.sa.gov.au/docs/GoGo_Booklet_low.pdf), p. 9

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### 5.1 Management philosophy for sustainability

The management philosophy advocated by Zero Waste SA management is one of inclusivity, vision and commitment. Inclusivity is a term that here means engaging staff in decision making processes and in processes that help to achieve overall sustainability goals.

Management believes that sustainability is best achieved when a vision is established that permeates all aspects of the organisation. In the case of Zero Waste SA, the vision is of a society free of waste, and this vision becomes 'a way of life' when it is enacted by Zero Waste SA staff and management in their day-to-day practices. Practicing a zero waste policy within the organisation itself is a way of demonstrating commitment to a vision. Zero Waste SA management believes that it needs to show leadership in the field of sustainability and this can only be achieved when sustainability goals are integrated into daily practice. When this commitment is shared by all staff and practiced by all staff then this will in turn lead to a sense of confidence in the organisation, which will, it is hoped, permeate into outcomes within the broader community.

### 5.2 Fostering commitment to sustainability through HR management

Zero Waste SA is a small government agency with 16 staff members who were originally drawn from the Environment Protection Authority but are now drawn from other organisations. Their age group is spread between 20s and 60s with the average age in the low 40s. Staff are described by management as diverse in their backgrounds yet share a commitment to the environment.

One of the criteria for staff employment at Zero Waste SA is an interest and commitment to the goals of sustainability. Not all staff, however, arrive at Zero Waste SA with the same level of commitment, experience or understanding. Management believes that it is important to foster that initial level of commitment through measurable outcomes:

it's part of my role and the role of other key staff to not brainwash but to demonstrate and show that this is what we need to do and part of the job satisfaction here is actually doing, achieving and making a difference and making a difference that you can actually see and measure.<sup>30</sup>

This management strategy was contrasted to that of other environment organisations where staff may 'make a difference' but because that difference is not measured it tends to go unnoticed. Where staff innovations go unnoticed it becomes more difficult to use those actions to build commitment to the organisations goals.

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<sup>30</sup> Interview with Vaughan Levitzke, Zero Waste, 24 October 2005 (Interviewer: Simon Robb, UniSA. p. 3)

### 5.3 Challenges for sustainability HR

Management identified the following as areas of challenge that have been encountered

- **Eliciting diversity of opinion.** This problem was addressed by “having other people chair staff meetings, encourage people to put things on the agenda under other business making sure they get a fair hearing around the table and there's not someone putting them down”.<sup>31</sup>
- **Consistency between levels of management about management philosophy and processes.** The response here is to emphasise the philosophies of inclusivity and respect for diversity of opinion to other levels of management: “to make sure that they're not dismissive of ideas or issues” and that they “understand where they fit within the organisation in terms of its workings and they understand how everybody else fits as well”.<sup>32</sup>
- **Clash between consensus and leadership models.** There will always be a trade-off between an inclusive, consensus based approach and the necessity of management to make decisions within time and economic constraints. This needs to be acknowledged as being part of the process and as such needs to be communicated to all staff.
- **Staff anxiety about change to work culture.** The fit-out implied changes to work culture and some staff had anxieties about this. A consistent topic of anxiety was the introduction of open-plan offices and workstations (see below for further discussion of this point). Management's general approach to this was to include staff in the green fit-out decision making process. With respect to the open plan and workstations, staff were engaged with visits to offices and showrooms where these were in operation. Staff were given the opportunity to decide where they were seated in the new premises and allocated on a first, second and third preference basis.
- **Staff cynicism.** Some staff were cynical that the green fit-out was simply a way to save government money by being able to fit more staff into an office space: sustainability goals are met by reducing the space allocated to staff. Management response to this was not to dismiss this claim, but to acknowledge that it may have some validity.<sup>33</sup> The validity here is not that the GoGO process (the office plan was based on Government office accommodation guidelines, not GoGO requirements) is a smokescreen to reduce government expenditure on staff working conditions, but rather that in achieving GoGO goals there will be changes to work culture

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<sup>31</sup> Interview with Vaughan Levitzke, Zero Waste, 24 October 2005 (Interviewer: Simon Robb, UniSA. p. 5)

<sup>32</sup> Interview with Vaughan Levitzke, Zero Waste, 24 October 2005 (Interviewer: Simon Robb, Uni SA. p. 5)

<sup>33</sup> Interview with Vaughan Levitzke, Zero Waste, 24 October 2005 (Interviewer: Simon Robb, Uni SA. p. 8)

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which some staff may interpret in a negative way. The response to this cynicism, which is similar to the response to staff anxiety, has been to continue the process of inclusive discussions, making forums available where staff can express their concerns, including staff in the decision-making processes, and importantly acknowledging that issues will arise once the staff have moved to the new building and that the process of open discussion will continue.

### 5.4 Key HR learning outcomes for management

- form core staff groups to provide advice
- involve staff from the beginning in the process
- get staff views
- invite staff to see various options for green fit-out
- encourage staff to understand the benefits of a green fit-out from a work process point of view
- encourage staff to understand the benefits of a green fit-out in terms of the broader issues of sustainability<sup>34</sup>
- ensure that forums for HR issues among staff in relation to the fit-out are ongoing

### 5.5 Staff and the HR process

Staff were aware of the need for involvement with the green fit-out and in general were happy with the processes they were involved in. There were, however, reports from staff of dissatisfaction with the process of involvement which are significant. Staff reported that their anxiety about the changes in their working environment were largely focused on the change to an open-plan 'pod' environment. Staff reported that these anxieties were largely addressed by the inclusive approach to the decision-making processes but that they had residual anxieties associated with these changes that could only be addressed once the move had been made. Staff recommended that fit-outs always include staff from the beginning in decision-making processes and that the limits of the consensus based approach be clearly articulated from the beginning.

### 5.6 Importance of sustainable HR processes to staff

Staff generally reported that their involvement with the fit-out was important to them. Staff understand involvement in decision-making processes both from a personal and work culture point of view. Staff understood that their involvement was important in:

- having a sense of ownership
- addressing personal anxieties about the changes

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<sup>34</sup> Interview with Vaughan Levitzke, Zero Waste, 24 October 2005 (Interviewer: Simon Robb, Uni SA. pp. 3, 1–2)

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- having an opportunity to be heard (which indicates that an individual's opinions are being valued by management and other staff)
- engendering a sense of confidence about the change among staff (some reported anxiety about staff resistance to the change, in other words, that staff resistance would create a negative working environment for all; the inclusive approach which aimed at levels of consensus addressed this anxiety and encouraged confidence in the staff group as a whole)
- recognising staff are experts in their work environment and this expertise needs to be called on for effective decision making
- recognising that an involved workforce is more productive than one that has been excluded from decisions that affect it.

### **5.7 Staff anxieties about the fit-out changes**

Staff reported varying levels of anxiety about the changes involved in the fit-out. Many staff at the time of the survey reported low or no levels of anxiety. The most consistently cited reason for past or present anxiety was to do with the open-plan office environment – staff who were anxious about it saw it as a threat to the way that they had conducted business in the past. They saw it as an impingement on the 'personal space' which they felt was necessary to deal with, for example, sensitive phone conversations. Other staff were concerned that the new space would not allow them to store the documents that they were used to referring to. Other staff were concerned that negativity to the new environment would lead to an overall decline in the work culture. In general the anxiety was that the change would impact in a negative way both on staff's ability to work in the way they were used to and on the broader work culture. These concerns were consistently the focus of staff meetings about the fit-out. Evidence from staff surveys and discussion with staff suggest that the physical work environment is very important to them. They understand changes to the physical work environment to be changes to their identity as workers. Changes to that environment represent, potentially, a loss of aspects to identity that the staff value. The potential loss of something that is valued seems to be crucial to an understanding of staff anxiety. The loss may be of a sense of privacy or access to files, the object of concern differs from staff member to staff member. The thing that unites these differences is that something valued by staff will be lost and that this loss will not be compensated.

### **5.8 Addressing staff anxieties about the fit-out changes**

Although most staff reported that they understood the fit between the changes to their work conditions and the philosophy governing Zero Waste SA there is evidence to suggest that this congruence does not in itself adequately address anxieties about loss. If a sense of uncompensated loss is at the heart of staff anxiety about change then it is reasonable to suggest that processes need to be in place to address this. A sense of loss will only be exacerbated by feelings of isolation and the belief that there is nothing positive to be gained. This argument is supported by research results. Staff who were satisfied with their engagement and consultation process felt that their anxieties had been addressed. Indeed staff who were given decision-making powers

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during the changes reported high levels of satisfaction. Likewise staff who could see benefits in the new work environment reported low levels of anxiety. Staff reported favourably about viewing examples of open-plan/workstations environments and being invited to ask questions about these types of work environments. This can be understood as a way for staff to see that there may be something positive and 'workable' about the changes that they were engaged with. Staff were introduced to a variety of work environment options and given the opportunity to make decisions about what they preferred. In this sense staff were integrated into the process of change and their preferences for how the changes would operate were acknowledged. Integration into decision-making processes about the new working environment were acknowledged by staff as crucial to their level of satisfaction.

### **5.9 Cynicism towards the fit-out HR processes**

Although cynicism towards the changes was statistically marginal it should be noted that under this category were some of the most insightful criticisms of the process. One criticism was that major decisions about changes were made before the consultation process. In particular the choice of open-plan offices and pods was felt to have been a top-down decision that was not open to discussion. (It should be acknowledged that this decision was a whole of government mandate rather than a specific GoGO initiative.) Given that changes to the physical work environment were the key concern of most staff and that the key change was already decided, it was not surprising that some staff should be cynical about the consultation process. The cynicism here is that staff engagement has no real effect on the decision-making processes; decisions happen elsewhere and staff are left to feel isolated from the real decision-making processes and locus of power. Cynicism will fester where staff empowerment occurs only at the fringes of change. There is a perception among some staff therefore that their sense of loss is not being addressed, or is being addressed in only a superficial way. This will in turn exacerbate their sense of isolation and will inevitably impact negatively on the general work culture. It could be argued that any processes that are put in place to address a sense of loss need to be aware that staff are highly intelligent and sensitive to processes that could be described as tokenism. Cynicism is really a critical assessment that suggest that all is not as it seems. Reports from staff suggest that the limits of their empowerment in the change process needs to be transparent. Staff cynicism about the economic imperatives driving the GoGO process need to be openly addressed. Reports from staff suggest that there is a need for total transparency in any change process, and that this transparency becomes the articulated limits of a consensus process.

### **5.10 Key HR learning outcomes for staff**

- Consultation with staff needs to be genuine.
- Consultation needs to be transparent: what is negotiable and what is 'set' and not open to change needs to be made obvious.
- There needs to be an opportunity for open discussion and debate.
- Staff need opportunities to view and consider alternatives.
- Staff engagement needs to be actively pursued.

# 6 Conclusions and recommendations

## 6.1 Costing

The increase in predicted capital cost of the Zero Waste SA 'green fit-out', compared with other State Government green fit-out costs identified, appears to be a negative aspect of the project. As previously indicated, however, all other figures obtained related to fit-outs of more than double the size of the Zero Waste SA project. This is a very significant factor, given that as the area of a space increases, the per square metre cost of a fit-out decreases but it is not a linear relationship. Fundamentally, comparisons between the cost of the Zero Waste SA fit-out are not relevant when made to those of larger projects. Instead, it is recommended that information on the cost of the fit-out be used to inform other State Government activities on similarly sized projects, especially as relevant information is so limited. It is also recommended that positive aspects of this case study be utilised in future, similarly sized fit-outs, to reduce resource requirements and associated costs in the design process and thus make small scale green fit-outs more economically attractive.

As sustainable practices are employed more often, in a similar manner to the Zero Waste SA fit-out, the cost of such practices and associated materials is likely to reduce, relative to conventional practices, based on improved efficiencies in work performance and economies of scale relating to material procurement and service provision. Furthermore, a great deal of potential for offsetting or paying back increased initial capital costs has been identified in the fit-out, based on avoidance of future energy needs and waste issues, thus further enhancing the appeal of green building and design.

## 6.2 Literature review

It is recommended that relevant members of SA State Government responsible for procurement of office fit-out projects, from DAIS and other departments, contact the Property Council of Australia and attempt to instigate a local COBELL type program, in collaboration with local academic and industry based experts. In this way, State Government and the wider community could achieve similar successes and benefit from the lessons learnt through this program. It is also recommended that DAIS investigate the possibility of using outcomes of the CH2 Study and Outreach Program that are likely to be produced in the near future, following occupancy of this building.

In the event that Adelaide is successful in their application to the Solar Cities program, it is recommended that DAIS and other State Government bodies use mechanisms within this framework to facilitate future green building and design activities.

### 6.3 Fit-out elements

The experience with the replacement of the lighting system to an undesirably low 'performance specification' clearly shows that all stakeholders from project commencement to completion of the fit-out process, including building managers, should be involved in similar future projects.

It was suggested that this could be achieved by inviting a member of each relevant party onto the project team at the instigation of the project or at the earliest possible stage. This could either avoid or reduce the impact of undesirable outcomes, such as those from the lighting system replacement. The importance of integrating building management into project management was also highlighted by the stated inability, at the time of writing this report, to obtain plans for certain fit-out aspects, which would allow the project team to better facilitate elements of the fit-out process for which they are to be responsible.

It is preferable to choose buildings and associated building managers with existing sustainable characteristics. Gross leasing arrangements and associated energy-efficiency based benefits to both Zero Waste SA and Colliers suggest that the establishment of an interactive and communicative relationship would be highly advantageous. In addition to increasing the likelihood of improving the sustainability of an office fit-out and operation, this could also stimulate other building managers to implement sustainable practices and infrastructure.

Information contained in this report leads to the conclusion that, in order to maximise the efficiency and effectiveness of a fit-out and subsequent occupation, there is a need for more communication between all stakeholders, including prospective building tenants and building managers. The intention to form a GoGO committee has been discussed in this report. Strategies such as inviting building managers and representatives of other tenants to join the proposed GoGO committee could use integrated relationships to achieve efficiency improvements; increase and enhance the body of knowledge of both parties; and foster a sense of community and associated building ecology to create a more sustainable overall system. This would undoubtedly help to maximise the efficient use of a fit-out, benefiting all parties, and could also generate a body of knowledge that could then be used to benefit stakeholders in future green fit-outs.

Based on the establishment of a strong, communicative relationship between Zero Waste SA staff and building management, it is recommended that Zero Waste SA ensures that an investigation is carried out into the operation and performance of the BMS, following the impending upgrade to these facilities. This investigation should include ensuring that existing controls are working properly; all desirable controls are being used; and the system has been upgraded to maximise flexibility and correspondingly maximise energy efficiency.

It should be ensured that, based on participation of building managers on the GoGO committee, there is a commitment to optimise the chiller plant in proposed upgrades likely to be carried out by Colliers in approximately 2010. Technologies available at that point could differ significantly from those available today; therefore these should

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be well researched. Furthermore, such a GoGO committee should also attempt to contribute to optimisation of water heating facilities during upgrades likely to be carried out by Colliers in approximately 2011. Efficiency could be improved by installing localised water heating facilities, such as on demand, tankless systems, to reduce heat loss and associated energy inefficiencies attributable to long runs of pipework throughout the building. This strategy could also reduce pipework and insulation requirements at the end of the life of existing pipework, in combination with eliminating accessibility-based maintenance issues associated with considerable concealed pipework.

Zero Waste SA and Colliers both aim to maximise efficiency of the HVAC system, therefore both entities should work together to this end, using the committee structure where appropriate. Possible strategies to be explored could include: investigating the performance of the existing HVAC system and using existing control systems to maximise energy efficiency; investigating methods to optimise the HVAC system, such as opportunities for 'night purging' and the use of economy cycles; and investigating methods for reducing waste associated with eventual replacement of the existing HVAC system, such as using existing infrastructure, where this does not compromise the performance of the new system.

Energy savings relating to the existing water heating system could be achieved by implementing an office-wide or building-wide education campaign, aimed at reducing or avoiding hot water consumption wherever possible. Such an education campaign could also induct other office tenants in the building into sustainable processes and raise awareness of other related issues. Collaboration between building management and Zero Waste SA could be used to: investigate the performance of the existing water heating system and use existing control systems to maximise energy efficiency; investigate methods to optimise the existing water heating system, such as increased insulation of the system and associated pipework, where possible; and investigate methods for reducing waste associated with replacement of the existing water heating system.

Most locally and internationally made products/materials lack information relating to embodied energy (life cycle assessment (LCA)). Thus there needs to be better/maximised education of specifiers (e.g. EcoSpecifier type services with high product/material subscription rates), and efforts to improve the availability of accurately comparable information. It should be noted that most companies who do conduct LCA on their products appear to do so with the belief that they have a superior product from an embodied energy perspective. It is therefore possible that this factor alone could serve as a quasi-indicator for the sustainability of a product, when comparing it to a product that has not undergone LCA. Great care should be exercised using this approach and it should only be a last resort.

Factors such as the profile of the existing exposed beam ceiling unavoidably complicated the selection of sustainable elements for the fit-out in the elements of, for example, wall partitions for offices and the lighting system. The unusual ceiling also complicates the implementation of future alternative airconditioning and associated control methodologies. It is therefore recommended that considerable effort be made to find innovative solutions to this critical energy-efficiency issue. The unusual ceiling profile did, however, yield a number of benefits in executing the fit-out, including

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providing an acoustic buffer to the space, thus minimising noise attenuation requirements and associated materials; and eliminating the need for columns, thereby helping to maximising spatial efficiency and flexibility of the office space and avoiding obstruction to natural light infiltration and air flow.

The perception was identified that the colour of sustainable paint tends to vary unacceptably between batches. Thus it is recommended that measures be taken to remedy this situation, for example obtaining assurances of paint colour homogeneity for low VOC paints from associated suppliers.

It is recommended that all electrical and electronic appliances used in all fit-outs have the ENERGY STAR facility enabled and, where possible, the ENERGY STAR control menu should be password-protected so it can not be disabled.

It is recommended that the Interface 'cradle to cradle' modular carpet hire service be used for future needs of the Zero Waste SA office space and future government office fit-outs, based on the alignment between the attributes of this product and the objectives of Zero Waste SA and all other government agencies operating within the GoGO framework.

It is recommended that a simple users manual be produced, possibly by the GoGO committee, to ensure that staff are given the best possible opportunity to use the office space as efficiently as possible. Such a document could be produced as part of aforementioned education programs. It could include suggestions for effective use of the central storage facility.

Based on attempts to maximise overall environmental quality, through minimisation of office air pollution and maximisation of natural light infiltration, it is expected that staff well-being and concentration levels will improve, which will also generate productivity benefits. It is recommended that such quantitative and qualitative aspects be monitored throughout the tenancy, in an attempt to confirm this and thereby further enhance the appeal of green fit-outs.

### 6.4 Human resources management

In terms of the HR processes deployed during a fit-out it appears that staff are happy to be involved with decision-making processes and expect to be involved. A level of anxiety can be anticipated among staff in relation to changes to their physical work environment. In a green fit-out that anxiety will revolve around issues to do with uncompensated loss. Processes that integrate staff into decision making, that allow them to articulate their anxieties and discuss them, that present future change in a tangible and positive light, are likely to succeed in addressing these anxieties. Communication between staff and management needs to be totally transparent in terms of what the limits of staff involvement and empowerment are. Where processes are perceived to be not entirely transparent, staff support for green changes will diminish. A summary of recommendations based on research with staff and management suggest that HR processes needs to:

- be genuine
- be transparent
- allow opportunity for open discussion and debate
- be inclusive
- involve staff from the beginning in the process
- ensure that forums for HR issues in relation to the fit-out are ongoing.

It is recommended that staff responses to the fit-out be assessed in a follow-up study six months after the move to the new offices.

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## APPENDIX A – Ecospecifier Workshop outcomes

### SECTION A: Andrew Walker-Morrison presentation

*Key aspects: Energy, water, waste, built facilities:*

*Energy consumption & greenhouse gasses*

*Bio-diversity impacts*

*Landfill management and procedures*

*Broader impact on the environment and social aspects*

#### **Three basic points:**

##### *REDUCE*

Design-out-components

Dematerialise

Long life components

Downstream savings

##### *REUSE*

Modular design

Re-manufacture + refinishing

Thinking ahead

Managing expectations

##### *RECYCLE*

Specify VOC content

Specify reusable + recyclable

Design for disassembly

It's about *fate* through *choice*

#### **Points of interest:**

Energy consumption, travel, fleet, employee movement

Human resources: amount of person hours

Interior walls: very significant part of fit-out work

Fit-outs: human health very important

Energy consumption: 17% increase today and increasing

5–40 years operational energy to make a commercial building

3-storey buildings are a little less

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Fit-outs 7–10 years

Note: operational energy can be greater than a larger commercial building

Can achieve up to 60% reduction of energy

### **Elements within fit-out upgrades can be very wasteful:**

Fixed joinery

Carpet tiles

Cheap furniture/furnishings

i.e. Typical reception desk unless mobile

Therefore: utilise modular, off-shelf, stand-alone joinery items

30% of office buildings have sick building syndrome;

i.e.; inadequate ventilation,

chemical contaminants from indoor and outdoor sources (off-gassing of materials, urban pollution)

biological contaminants (bacteria, moulds – stagnant water, carpets)

Material selection: problems

VOC: volatile organic compounds

Combinations of toxic compounds

Key area of concern: kitchenettes, burning sandwiches, chemicals used for dishwasher

Air quality: interior chemicals and gas emissions

Outdoor air quality much better

Indoor air quality can be up to 20–30 times more polluted than outdoor air, irregardless of pollution levels outside

This is due to the character of materials, ventilation system

### **SECTION B: Building Products**

CARPET

Ontera

Reconstituted (post-consumer) fusion-bonded modular carpet system

Interface

Climate carpet

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### RESILIENT FLOORS

Stratico from Amtico

Forbo Artoleum

Biodegradable resilient floor covering for heavy duty commercial and industrial use

### CORK TILES

High percentage of recycled content

Low toxic content

Not applicable for all areas

### CHAIRS

Formway-Knoll 'Life'

Lightweight, ergonomic commercial office chair designed for refurbishment, reuse and, at the end of life, disassembly with approximately 90% component recyclability

Steelcase 'Think'

Folio task chair

The seat and back are moulded from Recopol resin – an ABS recycled plastic sourced from post-consumer and post-industrial engineering grade resins and constitutes 55% of the total weight of the chair.

The Recopol shell will not deteriorate and is recyclable.

### CEILING TILES

'Ultima' by Armstrong

High recycled content, high-durability, high-reflectivity acoustic ceiling tile system

### WORKSTATIONS

'QED' Schiavello

Lightweight, flexible, modular and movable workstation system designed for reuse or disassembly and recycling at end of life

'Four Star' MDF from Alpine

ultra-low emission

locally made

10–15% more expensive

'Alpine E0' MDF from Alpine

Made to meet the stringent Japanese 'E0' standard, Alpine MDF uses a modified glue and formaldehyde 'scavengers' to reduce formaldehyde emissions to approximately half of those required by the Australian 'E1' standard

### FABRICS

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### Designtex McDonough Collection

Fabrics are made from post-consumer and post-industrial yarns, or 100% recyclable fibres that can be composted at end of life.

Manufacture also includes sustainability initiatives.

### Knoll Alignment

Textiles made from 100% recycled polyester.

### Lane Fabrics

## VENEERS

### 'Sugar gum' from SMARTtimbers

Veneer comes from guaranteed agro-forestry plantation timbers

Sugar gum (*Eucalyptus cladocalyx*) is a species native to South Australia

Alpi plantation poplar timber veneers

Manufactured (reconstituted) timber veneers made from plantation poplar

## SCREENS + PARTITION

### Woven Image Echopanel

100% recycled PET product designed to replace textile-covered tiles in workstation systems as a lighter, more flexible, recyclable partitioning system

## PARTITIONS

### Acousta wall stud

A lightweight, acoustic and fire-rated non-load bearing, dry-wall system for new or retrofit residential and commercial applications. Uses recycled content rubber dampeners and fewer materials than equivalent systems.

### Ortech: Durra

Compressed straw self-supporting wall panel system with integral paint-ready finish

### Local product

### Enviropanel Acoustic Insulation

Recycled paper-based acoustic insulation

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### PANEL PRODUCTS

Distinction wall & ceiling linings: Powerscape

97% recycled product

Plasterboard replacement

Suitable for use in wet areas and generally where high durability and moisture resistance is desired.

### PAINTS

Wattyl 'ID'

Reduced VOC content

## **SECTION C: Brainstorming session**

*Key Issues: Sustainable Practices + Expressing Sustainability*

### PHYSICAL ELEMENTS:

#### PARTITIONS:

Walls

Glass

Doors

Insulation

Grilles

Operable walls

#### FURNITURE:

Reception

Desks/workstations

Filing

Storage

Compactus

Chairs

Tables

Utility room

Joinery

Kitchenette

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### EQUIPMENT:

PABX

IT: telephone, PCs, printers, scanners, photocopiers

Kitchen equipment: dishwasher, fridge, microwave

Recycling

Plants

Worm farm

### FINISHES:

Flooring: carpet, mats, etc.

Paint

Laminates

### MATERIALS:

#### WALLS:

Straw: 'Durra' straw panels by Ortech

Timber studs

Corrugated iron panels

Substrates: 4-star MDF, marine-grade ply, HMR low-emission particleboard

Recycled materials

Glass & silicone

Steel/aluminium – lacquered steel

Polyester batts

Wattyl ID paint

### FURNITURE:

*Major elements:* Workstations + chairs

*Key principles:* Ability to re-use or recycle

*EcoCore:* Polyester panels with 60% recycled content

*Sugar gum veneer:* SMARTimber Co-op

*Avoid fixed joinery:* use flexible, modular units

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### EQUIPMENT:

Plates etc (?) PVC free

Wireless

Sensor lights

Natural light

### PRESENTATION:

*Primary and secondary indicators*

Demonstrate sustainable practices and initiatives:

Grey water

Worm farms

Recycling

Multimedia presentations: general displays, records, etc.

Map materials, sources, life cycle assessment

Case studies

Comparisons: old versus new office

Graphics, signage

### RATING ISSUES:

Green Star:

Highly rated: reuse, modularity, flexibility, daylight, no PVC

Local versus imported not assessed

Evaluate available rating tools:

## CASE STUDY DOCUMENTATION OF ZERO WASTE SA GREEN FIT-OUT

### OTHER CLIENT ISSUES:

Make rating issues visible as examples

Organic waste: recording and monitoring; show outcomes to visitors

Documentation of Zero Waste procedures

Decommissioning of materials and fit-out equipment

25% reduction of landfill

Lifetime; cycle and life-chain of products

Possibly 2 counterpoints:

Physical aspects

Social aspects

GOAC guidelines for fit-out

GoGO guidelines for sustainable practices

10% of floor area closed offices