

Green Fit-out

This Green Fit-out guide provides a list of ecologically sustainable measures for consideration by design teams and building occupants and applies to government fit-outs i.e. the physical products and spaces controlled and used by Government to make habitable space in a base building.

ESD involves the use, conservation and enhancement of resources so that ecological processes, on which life depends, are maintained, and the total quality of life now and in the future can be increased. The built form has the capacity to have a damaging impact on the environment during its construction, operation and eventual deconstruction and it is therefore crucial that information and guidance is available at the design stage to develop a fit-out that encompasses the principles of ESD and reflects the alliance between economic, social and environmental considerations (Triple Bottom Line) in all levels of decision-making.

This is the intent of this Green Fit-out guide note.

Objectives

The overarching ESD objectives are to:

- reduce energy
- conserve water
- reduce waste
- reduce pollution
- improve IEQ
- reduce operating costs

The purpose of the guide below is to complement the structured fit-out planning and design process provided by design professionals. A fit-out does not necessarily require changes to the base building, however there may be circumstances which allow for negotiation with the building owner, particularly in the case of new construction. These have been listed under 'Possible Base Building Opportunities' within each of the categories.

GUIDE	
1. Integrated Design Management	
Holistic decision-making	
	As the decisions made on the project are interdependent, bring together all the parties who will be involved in the fit-out for a documented charrette-type workshop.
	Since sustainability is going to be considered at the same level as cost, quality and schedule, consider any competing priorities equally and carefully to balance and support the project.
	Ensure that all parties are clear and committed to the vision and the level of sustainability the project is aspiring to achieve.
Environmental rating tools	
	Use an existing rating tool as a framework for decision-making, such as Green Star for a design-based approach:

Green Star Rating Tools - Rating Tools - GBCA	
or, NABERS OFFICE for an outcome-based approach: NABERS OFFICE - Welcome	
Certification	
Stipulate that the contractor holds a formal Environmental Management System certification ISO 14001.	
Building users guide	
Develop a building operational 'users guide' to help provide better building performance outcomes. The guide may include information relating to: energy saving strategies, monitoring and targeting, building services, transportation facilities, waste recycling and water saving policies.	
With building owner assistance, develop a tenant behaviour charter outlining common environmental expectations e.g. recycling, paper-saving practices, noise attenuation, and water and energy saving practices.	
Maintenance Plan	
Prepare a maintenance plan that incorporates provisions for monitoring, commissioning processes and maintenance; including energy and waste audits.	
Education	
Ensure that environmental initiatives within government fit-outs are demonstrated and communicated to the community. This can include online information, external signage and the reporting of ongoing monitoring.	
Possible Base Building Opportunities:	
Commissioning	
Ensure comprehensive pre-commissioning, commissioning and quality monitoring are performed by the appropriate contractors and trades on-site [developed in accordance with relevant ASHRAE Guidelines and CIBSE Commissioning Codes].	
For new base building HVAC installations, commit to 12 months HVAC commissioning, fine tuning and reporting of commissioning outcomes to the building owner and manager. Tuning should be required at least quarterly with final recommissioning at 12 months.	
For larger projects, or if attempting to obtain a 5 or 6 star Green Star rating, plan for the appointment of an independent commissioning agent to support the contractor commissioning process and to audit the process and outcomes.	
Maintenance Plan	
Prepare a maintenance plan that incorporates provisions for monitoring, commissioning processes and maintenance for water.	
2. Indoor Environmental Quality	
Daylight	
Maximise the amount of useful natural light.	
Ensure workstations are located on an area of the floor plate that has a daylight factor of > 2.5% (as measured at the finished floor level under a uniform sky).	
Daylight glare control	
Install occupant controlled blinds/screens.	
Ensure all workstation monitors provided as part of the fit-out are flat-screen and are mounted on an adjustable arm that enables the monitor to be pivoted and adjusted horizontally and vertically.	

External views	
	Ensure that workstations have a direct line of sight through vision glazing, either externally or to an adequately sized and naturally lit internal atrium.
Internal noise levels	
	Stipulate that any new HVAC equipment installed is provided with sufficient attenuation to mitigate noise in the occupied space.
	Ensure noise intrusion in the overall building achieves sound levels of 40-45 dB LAeqT in general offices and 35-40 dB LAeqT in private offices [where LAeq is the scale that measures the average energy of the noise level, and T (time) is taken as the normal working day (8 hours)].
	Ensure group meeting rooms are designed to manage noise intrusion level exchanges between noisy spaces (meeting rooms, work cafes, breakout spaces) and quiet areas (general office space).
VOCs)	
	Ensure that all paints used are VOC-free or low-VOC.
	Ensure new carpets and floor tiles are VOC-free or low-VOC.
	Ensure that all adhesives and sealants are low-VOC, or that no adhesives/sealants are used.
	Ensure that all new tenancy fit-out items (workstations, walls/partitions, chairs, tables and storage units) are VOC-free or low-VOC.
	Encourage implementation of procurement, cleaning and maintenance practices that prohibit formaldehyde, toluene and benzene.
	Stipulate the use of cleaning products that are biodegradable, non-toxic and contain no phenolic compounds or petroleum solvents.
	Following construction and prior to occupation, implement a building flush-out period (2-4 weeks) to reduce possible indoor air quality contamination. If a mechanical system is installed, run it with tempered 100% outside air.
Formaldehyde minimisation	
	Ensure all composite wood products used are low emission (E1 limit) or that no composite wood products are used.
Dust borne microbes	
	Ensure a cleaning regime that suitably addresses dust/dust borne issues e.g. floor and window treatments, general surfaces.
Indoor plants	
	Provide one large plant (300mm pot) or two small plants (200mm pot) per workstation. The following is a list of the plants that recorded the highest VOC removal rating (in Bill Wolverton's NASA tests) that are available at most South Australian nurseries.
	Boston fern (<i>Nephrolepis exaltata</i> 'bostoniensis')
	Dwarf date palm (<i>Phoenix roebelenii</i>)
	Bamboo palm (<i>Chamaedorea seifritzii</i>)
	Janet Craig (<i>Dracaena deremensis</i> 'janet craig')
	Chinese evergreen (<i>Aglaonema modestum</i>)
	English ivy (<i>Hedera helix</i>)
	Weeping fig (<i>Ficus benjamina</i>)
	Gerbera daisy (<i>Gerbera jamesonii</i>)

	<p>Peace lily (<i>Spathiphyllum 'mauna loa'</i>)</p> <p>Marginata (<i>Dracaena marginata</i>)</p> <p>Corn plant (<i>Dracaena fragrans</i>)</p> <p>Lady palm (<i>Rhapis excelsa</i>)</p> <p>Mother-in-law's tongue (<i>Sansevieria laurentii</i>).</p>
	Implement a horticultural maintenance plan to ensure that the health of the plants is maintained.
Occupant response	
	Implement a recurrent, documented building occupant response survey covering thermal, acoustic and visual comfort, as well as satisfaction with HVAC, lighting and humidifying systems as a means of attaining and maintaining an optimum indoor environment.
Possible Base Building Opportunities:	
Natural ventilation	
	Assess natural cross-flow ventilation opportunities.
	Do not consider mechanical air conditioning unless it is established that natural ventilation is unsuitable or inadequate.
Mechanical ventilation	
	Stipulate that outside air is provided at ventilation rates that exceed the requirements of AS 1668.2-1991.
	Install a CO ₂ and VOC monitoring system with one CO ₂ sensor per return duct in the tenancy fit-out.
	Ensure ventilation flow rates are maintained to recommend minimum levels and above.
Daylight glare control	
	Install reflective film on windows.
High frequency ballasts	
	Ensure high frequency ballasts are installed in fluorescent luminaires, if installing new lighting or replacing old.
Individual comfort controls	
	Stipulate that workstations are provided with individual control of the air supply rates, air temperature or radiant temperature, if fit-out includes HVAC installation and it permits.
3. Energy	
Energy audit, existing	
	Undertake an energy audit and technical review of energy used at the site, including an assessment of bills, practices and existing equipment.
Office lighting zoning	
	Provide separate switches for all individual or enclosed spaces. Ensure the size of individually switched lighting zones does not exceed 100m ² . Ensure switches are clearly labelled, conveniently located and easily accessed.
	Provide light timers on switches or occupancy sensors for rooms with intermittent use.
High efficiency lighting	
	Determine activity-specific lighting levels for each space.
	Provide task lighting.
	Install photocell-dimming sensors that adjust electric lighting in response to available daylight.

Equipment	
	Ensure that all equipment conforms at least to ENERGY STAR requirements: ENERGY STAR Australia Home Page
	Enable equipment to switch into 'sleep mode' when not being used.
	Implement periodic reviews of equipment settings.
NABERS Office Performance Assessment	
	Post construction; assess the building's performance rating. A minimum 4.5 Star NABERS OFFICE Energy Rating should be achieved: NABERS OFFICE - Welcome
Possible Base Building Opportunities:	
Passive thermal efficiency	
	Optimise ceiling and wall insulation.
	Utilise materials with high thermal mass where appropriate.
	Provide shading with external louvres, eaves and native vegetation.
	Use best practice air/vapour barriers to provide thermal comfort and prevent condensation.
	Install double glazing with low-e coating, or tinted/low-solar-gain and argon-gas filled.
Energy improvement	
	Install solar hot water heaters.
	Install photovoltaic arrays.
	Install stand-alone solar powered lighting.
	Install wind powered devices.
	Install cogeneration and tri-generation.
	For existing buildings, negotiate with building owner to replace existing thermal plant with a more efficient type.
Electrical sub-metering	
	Provide separate energy sub-metering to car parks, chillers, air handling fans, lifts and common light and power areas.
High efficiency lighting	
	Install high efficiency fluorescent lights and fittings e.g. triphosphor T5, linear, compact fluorescent, low mercury, inductive, LED.
Energy provider	
	Ensure 100% of remaining electricity purchased for the tenancy is provided by green power i.e. renewable source(s).
4. Transport	
Possible Opportunities:	
Cyclist facilities	
	Provide secure bicycle storage for at least 5% of staff.
	Provide accessible showers.
	Provide changing facilities (with secure lockers) - one for each bicycle space.
5. Water	

Potable water efficiency	
	Select wash hand basin taps with at least a WELS 4 Star rating.
	Select kitchen taps with at least a WELS 4 Star rating.
	Select showerheads with at least a WELS 3 Star rating.
	Select dual flush toilets with at least a WELS 4 Star rating.
	Select urinals which are waterless or sensor rated to at least a WELS 5 Star rating.
	Select dishwashers with at least a WELS 4 Star rating.
	WELS Scheme home page
Water metering, monitoring and management	
	Provide separate sub-metering for tenancy.
	Provide separate sub-metering for major water uses such as cooling towers and rainwater collection systems.
	Link meters to a BMS to provide a leak detection system.
Possible Base Building Opportunities:	
Water Audit	
	Undertake a water audit and technical review of water used at the site, including an assessment of bills, practices and existing fittings.
Water Recycling	
	Treat grey water collected from showers, hand basins and kitchens, and reuse for cleaning, cooling tower make-up, toilet flushing or sub-surface irrigation.
	Treat black water collected from toilets and reuse for toilet-flushing.
Rainwater/Stormwater management	
	Collect rainwater from roof for reuse e.g. for toilet flushing.
	Capture stormwater run-off from impervious areas of the building for irrigation or reuse.
NABERS OFFICE Performance Assessment	
	Post construction; assess the buildings performance rating. A minimum 4 Star NABERS OFFICE Water Rating should be achieved: NABERS OFFICE - Welcome
6. Waste	
Waste audit, existing	
	Establish how effective current waste practices are, how they can be improved and set targets for a Waste Reduction Program.
Possible Negotiations with Building Owner:	
Waste management during fit-out	
	Stipulate requirement for a site-specific waste management plan for the development, requiring the contractor to demonstrate that all waste that can be is re-used or recycled, and that records are kept accordingly.
Tenancy generated waste	
	Provide adequately sized, separate bins and locations for the recycling of rubbish generated at the tenancy; including paper, glass, plastic, batteries, toner, printer cartridges and kitchen organic materials for compost (collected in biodegradable, compostable bin liners).

	<p>Information relating to recycling and waste reduction in the workplace can be accessed at the Zero Waste SA website: Zero Waste SA</p>
	<p>Waste service provider requirements</p>
	<p>Ensure that the Waste Service Provider provides documented evidence of tenancy generated waste types, quantities and landfill diversion rates as part of a Waste Management Plan to ensure that no recyclable materials end up in landfill.</p>
<p>7. Materials</p>	
	<p>Modularity and flexibility</p>
	<p>Ensure spaces and systems can be easily adapted to changes in management and structure.</p>
	<p>Workstations, tables, chairs and storage systems</p>
	<p>Ensure manufacturer has an EMS in place, externally certified to ISO 14001.</p>
	<p>Ensure that the manufacturer offers more than 7 years warranty.</p>
	<p>Select equipment that is modular and designed for disassembly and reuse.</p>
	<p>Reuse existing.</p>
	<p>Flooring</p>
	<p>Ensure flooring systems are from certified organic/renewable products, or if timber, are manufactured from FSC certified timber or similarly certified sustainable timber.</p>
	<p>Stipulate that the floor manufacturer has an EMS, externally certified to ISO 14001.</p>
	<p>Ensure that the manufacturer offers more than 7 years warranty.</p>
	<p>Select flooring that is modular and designed for disassembly and reuse.</p>
	<p>Select flooring that has been recycled from a previous use.</p>
	<p>Walls and partitions</p>
	<p>Ensure walls and partitions are from certified organic/renewable products, or if timber, manufactured from FSC-certified timber or similarly certified sustainable timber.</p>
	<p>Stipulate that the walls and partitions manufacturer has an EMS, externally certified to ISO 14001.</p>
	<p>Ensure that the walls and partitions manufacturer provides a warranty of more than 7 years.</p>
	<p>Select walls and partitions that are modular and designed for disassembly and reuse.</p>
	<p>Select walls and partitions that have been recycled from a second-hand distributor.</p>
	<p>Timber and joinery</p>
	<p>Ensure all timber is FSC-certified or similarly certified sustainable timber.</p>
	<p>Ensure the joinery is modular and designed for disassembly.</p>
	<p>Fixtures, fittings and furniture</p>
	<p>Acoustic insulation - stipulate: low VOC, significant recycled content, non-toxic, durable, mechanically fixed (pinned or nailed), recyclable.</p>
	<p>Armchairs - stipulate: recycled content, low embodied energy, designed for disassembly, take back and refurbishment, no PVC or CFCs during manufacture, manufactured locally.</p>
	<p>Blinds - stipulate: low VOC, PVC free, manufactured locally.</p>
	<p>Bins - stipulate: recycled content, manufactured locally.</p>
	<p>Carpet - stipulate: low VOC, modular, designed for disassembly and dematerialisation, take back</p>

	and refurbishment, durable, renewable material, solvent free installation, manufactured locally.
	Coffee tables - stipulate: recycled content (e.g. recycled glass bottles), manufactured locally.
	Cupboards - stipulate: low VOC, low emission formaldehyde, moisture resistant, pre-consumer recycled content, manufactured locally.
	Fabric panels - stipulate: low VOC, post-industrial recycled content, no toxic by-products, does not present health hazard during manufacture, manufactured locally.
	Glazed sliding doors - stipulate: low greenhouse gas emissivity, self-cleaning, noise reduction, manufactured locally.
	Lounges - stipulate: recycled content, low embodied energy, designed for disassembly, take back and refurbishment, no PVC or CFCs used during manufacture, manufactured locally.
	Paint - stipulate: low VOC, non-toxic, solvent free, biodegradable, non-allergenic, low odour.
	Partitioning systems - stipulate: low VOC, EO (low formaldehyde emission MDF, take back system, post-consumer recycled content, designed for disassembly, manufactured locally.
	Plan storage unit - stipulate: low VOC, high recycled content, designed for disassembly, easy maintenance, 100% recyclable, no PVC, manufactured locally.
	Plasterboard - stipulate: low emission formaldehyde, low VOC, low embodied energy, manufactured locally.
	Refrigerator - stipulate: free of HCFCs and CFCs, manufactured locally.
	Rubber flooring - stipulate: natural rubber (holds carbon), low VOC, low toxic, magnetically fixed, easily replaced, recycled and reused, manufactured locally.
	Rugs - stipulate: low VOC, recyclable, manufactured locally.
	Task chairs - stipulate: they be designed for disassembly, recycled content, no PVC or CFCs used during manufacture, manufactured locally.
	Wall and ceiling linings - stipulate: high recycled content, high strength, high durability, high mould resistant, manufactured locally.
	Workstations - stipulate: low toxicity, recyclable, modular, flexible, durable, manufactured locally
Possible Base Building Opportunities:	
	PVC minimisation
	Avoid the use of PVC, particularly within floor coverings, stormwater pipes, blinds, sewerage pipes, cladding, electrical cables, finishes, telephone cables, window framing, data cables, and cable conduits.
8. Emissions	
	Refrigeration ozone depletion
	Ensure all HVAC refrigerants by volume have an ODP of zero and a GWP of 10 or less.
	Insulation ODP
	Ensure that the thermal insulation avoids the use of ozone-depleting substances in both its manufacture and composition.
Possible Base Building Opportunities:	
	Carbon sequestration
	Install a vertical garden along the building façade(s).
	Install a roof garden.
	Calculate the remaining carbon footprint in tonnes of CO2e and purchase carbon offsets from a provider.

Contact

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Glossary

Term	Explanation
Argon	An inert, nontoxic gas used in insulating glass units to reduce heat transfer.
Benzene	A known carcinogen; colourless and highly flammable. Found as an industrial solvent and as a precursor in the production of drugs, plastics, synthetic rubber and dyes.
Biodegradable	Capable of being broken down by microorganisms.
Building Management System (BMS)	A system for centralising and operating the monitoring, operation and management of a building.
Carbon Sequestration	The capture and long-term storage of carbon in plant material, soils and the ocean.
Chlorofluorocarbons (CFC)	A class of compounds comprising of chlorine, fluorine and carbon. Formally used as a refrigerant and as a propellant in aerosol cans.
Cogeneration	Generation of electricity combined with the production of heat for commercial or industrial use. Excess electricity can be fed back into the grid. Co-generation is an energy efficient way of using any energy source that requires combustion.
Commissioning	A process by which the operating systems of a building are tested and adjusted prior to occupancy.
Cross-flow ventilation	Air flowing from a supply point to an extraction point.
Embodied energy	All the energy invested in bringing a material to its final product, including transportation.
Environmental Management System (EMS)	An overall management system for handling environmental issues within a company, certified in accordance with ISO 14001.
Formaldehyde	A colourless, highly flammable and pungent gas considered to present a carcinogenic hazard to humans. Used as an adhering component of glues in many wood products.
Global Warming Potential (GWP)	A measure representing the potential of a greenhouse gas to contribute to global warming.
Greenhouse Gas Emissions	The release of greenhouse gases into the atmosphere. A greenhouse gas is an atmospheric gas that absorbs and emits infrared or heat radiation, giving rise to the greenhouse effect.
Greenpower	An accredited electricity product that guarantees production from renewable energy sources.
High frequency ballast	A device intended to limit the amount of current in an electric circuit. Higher frequency ballasts reduce the possibility of perceptible lamp flicker as the lamp phosphors are refreshed more often and because more gas remains ionised in the arc stream, the lamps operate with higher efficiency than low-frequency ballasts.
Hydrochlorofluorocarbons (HCFC)	An organic chemical compound composed of hydrogen, chlorine, fluorine and carbon atoms. It is less stable than CFC and therefore more liable to break down before reaching the ozone layer. However, a significant amount of HCFCs do break down in the stratosphere and they have contributed to more chlorine build-up than originally predicted.

Term	Explanation
Indoor Environmental Quality (IEQ)	All aspects of the indoor environment including air quality, ventilation, thermal comfort, lighting and noise.
Low-E Coating	A coating applied to the surface of window glazing to reduce heat transfer by reducing the emissivity.
Microbe	A minute living organism which can only be seen by using a microscope e.g. bacteria, viruses, fungi and protozoa.
Ozone Depletion Potential (ODP)	A relative measure of the expected degradation to the ozone layer.
Photovoltaic	Converting light into electricity.
Polyvinyl chloride (PVC)	A thermoplastic polymer.
Submetering	Separating of the utility metering of a building to determine the energy use of particular building systems and appliances.
Thermal mass	The ability of a material to absorb heat.
Toluene	A key petrochemical and an organic solvent.
Trigeneration	Combined cooling, heating and power generation from a single source.
Volatile Organic Compounds (VOC)	Organic compounds that evaporate readily into the air at everyday temperatures.

Acronyms and Abbreviations

Acronym	Explanation
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BMS	Building Management System
CFC	Chlorofluorocarbons
CIBSE	Chartered Institution of Building Services Engineers
CO ₂	Carbon Dioxide
CO _{2e}	Carbon Dioxide equivalent
EMS	Environmental Management System
ESD	Ecologically Sustainable Development
FSC	Forest Stewardship Council
GBCA	Green Building Council Australia
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HVAC	Heating, Ventilation and Air-Conditioning
IEQ	Indoor Environmental Quality
LED	Light-Emitting Diode
MDF	Medium-Density Fibreboard
NABERS	National Australian Built Environment Rating System

Acronym	Explanation
NASA	National Aeronautics and Space Administration
ODP	Ozone Depletion Potential
PVC	Polyvinyl Chloride
VOC	Volatile Organic Compounds
WELS	Water Efficiency Labelling and Standards