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Department of the Environment, Water, Heritage and the Arts

Department of Environment & Climate Change NSW

ESD OPERATIONS GUIDE

for owners, managers and tenants

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Content written by Dr Dominique Hes of the Faculty of Architecture, Building and Planning, Melbourne University, in 2007, with input from Sebastian Immaraj and Jane Toner, Sean McArdle, David Oppenheim and Steve Moller of Sustainable Built Environments.

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ciu@environment.gov.au

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ESD OPERATIONS GUIDE for owners, managers and tenants

A guide to help building owners, managers and tenants to operate buildings more sustainably

A collaborative effort involving government, industry and the research community

Foreword

The environmental footprint of our buildings is a key sustainability challenge – both for Australia and the world.

The decisions we make about building design are important. It is at the design stage that we have the opportunity to make some of the cheapest and most effective interventions in the environmental performance of a building such as an office over its life cycle. But we also need to address the performance of buildings over their operating lives – while they are full of people working, communicating, innovating and producing.

In Australia, only about two per cent of our office building stock is demolished and rebuilt each year. Existing buildings offer some of our most cost-effective pathways to environmental gain, especially in areas such as energy efficiency and greenhouse gas emissions reduction. While these benefits are there, the property market involves building owners, managers and tenants – interests that do not always coincide.

This publication, the *ESD Operations Guide*, introduces the key environmental issues relevant to operating existing buildings. Importantly, the guide covers the opportunities available to owners, managers and tenants for better environmental performance, and how they can collaborate on common objectives. Facility managers have a particularly important role to play here, and the guide outlines (particularly through detailed case studies) the value of owners and tenants investing in skilled and effective facilities management services.

The guide uses examples from the private and public sector to show what has already been achieved in the Australian marketplace on issues including energy, greenhouse, water, waste, indoor environment quality, transport, materials, and land use.

This guide is the product of a partnership between the Australian Government, the New South Wales Government, and key industry associations, including the Australian Institute of Refrigeration, Air Conditioning and Heating. All the partners should be congratulated for their contributions.

The *ESD Operations Guide* is part of a developing suite of guidance publications, developed with agencies and industry, including three editions of the *ESD Design Guide*, the *Water efficiency guide – office and public buildings* and guidance on green leasing.

The Australian Government has released *Your Building* – a comprehensive best practice guide for commercial buildings at all phases of their life-cycles. This online guide will be a companion to the well-known guide for residential buildings called *Your Home*.

The *ESD Operations Guide* shows owners, managers, and tenants how to get started on more sustainable operation of office and public buildings. The challenge is now for each of these groups, across the diversity of Australia's built environment, to implement local solutions.

Contents

Main issues and activities for the ESD

Issue	Information needed	Form of the data needed	Make it meaningful with…?	How do I get the data, and how often?	Where can I get more info?
Indoor air quality	What is the overall quality of the air inside your building? What levels of each of the key contaminants are present? What initiatives are in place to maintain or improve air quality?	Levels of individual contaminants and total levels. Units will vary by contaminant (eg ppm, mg/m^3, etc). See NABERS indoor environment rating calculator for details.	Key contaminants: CO_2; CO; respirable dust; airborne viable bacteria; airborne viable fungi and mould; ozone; formaldehyde; total VOCs; individual VOCs.	Some of these contaminants (eg CO_2) may be measurable using equipment available in the building. A full picture of IAQ with appropriate sampling methods may require the use of a specialist IAQ consultant.	See the indoor air pages on the DEWHA website. Also the NABERS indoor environment rating calculator and technical information.
Occupant satisfaction	How do the occupants feel about working in your building?	Results from surveys of occupant satisfaction need to be issue-specific, but may also be aggregated into general measures of satisfaction, such as %s of occupants feeling satisfied with their working environment.	The questions in a survey should be meaningful for the building occupants and the results communicated back to occupants. Key issues: thermal comfort; ventilation comfort; noise; visual comfort; health; extent of occupant control over local conditions.	Depending on the method of surveying or sampling the occupants, you may wish to conduct and update this on an annual basis. Other frequencies may make sense if the mix of occupants changes or if there are significant changes to the operations of the building, such as new systems or operating parameters. NABERS provides a survey of occupant satisfaction. Other methods (including productivity surveys) may also work well.	The NABERS indoor environment rating includes a survey of occupant satisfaction.
Energy use	Total tenant light and power Central services	Total KwH MJ/person/m^2 MJ/person/m^2/day	Total floor area; average occupancy; possibly also hours of operation and total site area (eg grounds)	Monthly use data from BMS and utilities.	NABERS Energy rating calculator AGO DECC Energy utilities and regulators.
Greenhouse emissions	Total amounts of CO_2e from all sources (electricity, gas, other fuels, waste etc).	Star rating under NABERS Energy	Normalise to total $kgCO_2e/m^2$, also good to express as $kgCO_2e$/person	Use BMS cycles of data, plus billing periods. Frequency will vary by source.	Use NABERS Energy for star rating.
Water use	Total volumes of mains water	Total litres of metered water consumption in litres or m^3 per year. Do not include captured rain or stormwater.	Normalise by m^2, by person and by day.	If meters are linked to the BMS, then monthly series data can be checked against billing (may help to identify leaks)	NABERS Water online rating calculator Local area water utilities WSAA
Water reuse	Total volumes of water reused (may include rain/stormwater, grey water, black water)	Total litres per year, per day, and by type.	L/person/day or by floor/grounds area.	As for water use if reuse is metered.	As for water use, but include health agencies and planning schemes for grey and black water information.
Stormwater pollution	What proportion of stormwater is retained on site? How polluted is the volume of stormwater leaving your site? What is the evaporation rate?	Measure or estimate stormwater volumes using the run-off factors appropriate to the mix of surfaces on the site.	m^3 per year	Annual aggregate readings or estimates. May be more frequent if change of use or seasonal variation is significant.	See local water authorities and local councils.

operational management of buildings

Issue	Information needed	Form of the data needed	Make it meaningful with…?	How do I get the data, and how often?	Where can I get more info?
Sewage outfall volume	What is the volume discharged to sewer from your building?	Total volumes in m^3 or litres/kilolitres per year.	You may also wish to normalise this by m^2 and occupancy.	Three methods: direct measurement of metered sewerage outfall volumes; or, metered estimation where the difference between metered inputs and metered uses is the estimated outfall volume; or, unmetered estimation if you do not have submeters. Quarterly measurement recommended (by season).	Utilities and local councils may have advice.
Waste	What is the total weight of waste leaving the site (including recycling)? What is the total weight going to landfill?	Total kilograms.	Normalise for floor area and for occupancy. Express totals per year and per day.	You can get regular data from your own scales/hoists etc. A waste audit can help. Your contractors should also be required to provide weights on bills.	Sustainability Victoria, DECC, ACT No Waste, other waste agencies. See NABERS Waste online rating calculator.
Toxic materials	What toxic materials are present on the site? How are they stored, used and disposed? Are MSDSs provided and a register up to date?	Total list of materials (by weight and/or volume for each). For some (eg tubes and smoke detectors) absolute numbers may be relevant.	Key materials: Cleaning chemicals; garden chemicals; pool chemicals; water treatment chemicals; paints, varnishes and thinners; hydrocarbons; batteries; electronic equipment; smoke detectors; fluoro tubes.		See environmental agency sites for hazardous materials information.
Refrigerant use (global warming potential and ozone depletion potential)	Total amounts of refrigerants used by substance, plus estimates or measurements of leakage.	GWP/m^2 [$kgCO_2e/m^2$] ODP/m^2 [R11e/m^2]		Three ways: one is to keep a log of refrigerant movements; two is to use manufacturer's specs on chillers and estimate 15% leakage of refrigerants; three is to estimate leakage of 0.09kg/m^2 for water cooled systems or 0.01kg/m^2 for air cooled systems.	
Transport	How do people get to and from your building? What are the energy, greenhouse and environmental consequences of that mix of transport modes?	For a detailed picture, try a survey of building occupants to provide data on km travelled, mode and frequency. This should cover public and private transport.	The NABERS Transport online rating calculator is under development.	Surveys of occupants are to be conducted very infrequently. However, it is sensible to keep in touch with the changing transport needs of the building occupants between surveys.	NABERS transport rating calculator is under development; AGO Travel Smart; Local transport regulator or service provider; Greenfleet
Landscape diversity	What species are present on your site? How much of the area is covered with native vegetation? How complex is the mix of species?	Percentage of native species over total area (incl. vertically-stacked spaces) appropriate for the area.	Landscape diversity is a proxy for biodiversity. You may wish to provide occupants more details about the species used (incl. plants for indoor air quality).	Measure landscape area in manageable blocks, such as >25m^2 and assess species on each block.	Local botanic gardens provide help on choosing native species.

*Developed and written by Paul Starr

- While this is a fairly comprehensive list, not all facilities and all managers will be ready or able to have all of this data available on request. However, when comprehensive environmental ratings of buildings are being conducted, this suite of issues is what will be measured.
- It is worthwhile sitting down with tenants and assessing their sustainability awareness and priorities for sustainability in facilities management. Many tenants, such as Australian Government agencies, have requirements to report on their energy and environmental performance. It makes sense to stay in touch with these requirements to align your facilities management with the requirements of the tenants for performance data.
- For examples of what may be asked of a facilities manager from a tendering and contracting point of view, please see the Environmental Purchasing Checklist for Building Management Services at the DEWHA website www.environment.gov.au.

1. Introduction

This guide introduces the key environmental issues relevant to the operation of existing office buildings and public buildings. It also outlines what can be done to address these issues, supporting this with evidence from case studies of leading buildings.

The operational environmental performance of buildings is influenced by three types of stakeholders: building owners, building managers and tenants. This publication aims to provide guidance for each, and includes a basic introduction to ecological sustainability issues.

Relevant Australian building types covered by this guide are **office buildings** (Building Code of Australia — BCA class 5) and **public buildings,** such as libraries, art galleries, museums and similar cultural institutions (BCA class 9b).

ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The *Australia State of the Environment 2006* report found that the key issue arising from human settlements is the pressure they impose on the environment in terms of the demand for land, water, energy and other resources. According to the 2006 Australian State of Environment Committee, a long-term but immediate change in materials and energy balances is needed to give more efficient urban systems, and this requires a decoupling of resource use from economic progress. Reductions in both net consumption and waste are needed for a more sustainable human environment. This will involve greater population densities than currently is the case, significant increases in building and material recycling, the capture and use of stormwater, the recycling of wastewater and biological waste, and improvements in urban form and urban structures. It also requires changes in behaviour by individuals, so education and awareness-raising are important factors. The challenge is to implement this insight.

Buildings contribute significantly to human impacts on the environment, consuming 32% of the world's resources, including 12% of the world's fresh water and up to 42% of the world's energy. Buildings also produce 40% of waste going to landfill and 40% of greenhouse gas emissions.[1] In Australia, commercial buildings produce 8.8% of national greenhouse emissions and have a major part to play in meeting Australia's international greenhouse targets.[2]

The operational phase of a building contributes significantly to its total impact. For example, between 70% and 90% of a commercial building's total greenhouse gas emissions are produced during the operational phase. As only around 2% of total commercial building stocks are built new each year, improving the environmental performance of existing buildings during their life cycle is a crucial challenge.

The Intergovernmental Panel on Climate Change recently found that:

'Energy efficiency options for new and existing buildings could considerably reduce CO_2 emissions with net economic benefit. Many barriers exist against tapping this potential, but there are also large co-benefits.

- *By 2030, about 30% of the projected GHG emissions in the building sector can be avoided with net economic benefit.*
- *Energy efficient buildings, while limiting the growth of CO_2 emissions, can also improve indoor and outdoor air quality, improve social welfare and enhance energy security.'*[3]

Canberra office area (DEWHA, Mark Mohell)

[1] OECD, *Environmentally Sustainable Buildings: Challenges and Policies. A report by the OECD*, OECD Publishing, France, 2003.

[2] Department of the Environment and Heritage, *Australia State of the Environment 2006* report, DEH, Canberra, 2006.

[3] IPCC, Summary for Policy Makers, IPCC Fourth Assessment Report, Working Group www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf Accessed 7/5/2007. pp18–19

ESD AND AUSTRALIAN GOVERNMENT POLICY

Ecologically sustainable development (ESD) represents one of the greatest challenges facing Australia's government, industry, business and community.[4] In 1990, Australian governments endorsed the following definition for ESD in Australia:

'....using, conserving and enhancing the community's 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.'[5]

ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, we need to develop ways of using those environmental resources that form the basis of our economy in a way that maintains and, where possible, improves their range, variety and quality. We also need to use those resources to develop industry and generate employment.

The Australian Government has developed several strategies and policies in response to the need to ensure ecologically sustainable development. The *National Strategy for Ecologically Sustainable Development* (NSESD) was launched in 1992 after extensive consultation with industry, the community, conservation groups, scientific organisations and all levels of government. It identifies five key principles of ESD:

- integrating economic and environmental goals in policies and activities (the integration principle)
- ensuring that environmental assets are properly valued (the valuation principle)
- providing for equity within and between generations (the intergenerational principle)
- dealing cautiously with risk and irreversibility (the precautionary principle)
- recognising the global dimension.

ESD AND STATE AND TERRITORY GOVERNMENT POLICY

As well as sustainability policies and programmes from the Australian Government, state and territory governments have also responded to the challenges of ESD, including issues related to the environmental performance of existing buildings. Most Australian jurisdictions, for example, now require minimum levels of energy efficiency and greenhouse performance before they will consider entering into a lease for office space. Australian governments have collaborated on common tools and systems for evaluating aspects of building environmental performance (such as the NABERS scheme), and have then included these as requirements for their own properties and leases. Table 1 outlines the extent to which NABERS Energy requirements have been integrated into public agency property and leasing policies.

Jurisdiction	NABERS targets
Australian Government	4.5-star NABERS Energy by 2011/2012
New South Wales	4.5 star NABERS Energy and Water by 2011/2012
Victoria	Base building < 2000m^2 – 4 star NABERS Energy Base building > 2000m^2 – 5 star NABERS Energy Tenancy – 5 star NABERS Energy New building – 4.5 star NABERS Energy Commitment Agreement
Queensland	4.5 star NABERS Energy for new buildings, refurbishments, fitouts and leases > 2000m^2 4 star NABERS Water, 3 star NABERS Waste, 3 star NABERS Indoor Environment
South Australia	5 star NABERS Energy for new leases and new buildings
Western Australia	Base building – 3.5 star NABERS Energy Tenancy – 4 star NABERS Energy New building – 4.5 star NABERS Energy Commitment Agreement
Australian Capital Territory	4.5 star NABERS Energy for new buildings, new leases and new fitouts

Table 1 — *Various state and territory energy and NABERS Energy requirements (2009)*

[4] Australian Government, National Strategy for Ecologically Sustainable Development, Canberra, 1992, Introduction.

[5] Ibid, Introduction.

ESD AND LOCAL GOVERNMENT POLICY

Many local governments have their own ESD policies with regards to building operations. Their greatest influence is when buildings require approvals for refurbishment. Some councils, such as the City of Melbourne, require NABERS Energy and Green Star ratings, while others offer incentives such as reduced approval times and application fees for projects with clear ESD initiatives.

The City of Melbourne requires 4.5 NABERS Energy for all new buildings in the Melbourne CBD:

'The City of Melbourne's Environmentally Sustainable Office Buildings (ESOB) Policy (Clause 22.19 of the Melbourne Planning Scheme) is intended to ensure that all new office developments in the municipality incorporate measures to reduce their impact on the environment.

The policy applies to all new office buildings and to the new portions of an existing office building (such as additional floors of a building). It also applies to the refurbishment of existing buildings or where an office will be constructed as part of use (such as an office in a warehouse). Where the office component is small or an existing building is involved, the policy will be applied on a case-by-case basis depending on the circumstances.

The policy requirements are triggered wherever a planning permit is required for an office development. Applicants need to provide sufficient information to support their planning permit application and demonstrate how the policy requirements will be achieved.

Offices between 2500 and 5000 m^2 gross floor area:

- general environmental criteria PLUS
- specific performance outcomes Minimum 4.5 NABERS Energy Base Building Rating.

Offices greater than 5000 m^2 gross floor area:

- general environmental criteria PLUS
- specific performance outcomes 4-star Green Star Office Design rating; Minimum 4.5-star NABERS Energy base building rating; and Maximum water consumption of 30 litres/day/person using the Green Star Water Calculator.'

Source: www.melbourne.vic.gov.au/rsrc/PDFs/Planning/ESOBFactSheet2711.pdf

ESD AND THE PRIVATE SECTOR

As well as government policy responses to ESD and buildings, Australian companies — whether they are tenants, owners, managers or suppliers to property — are also acting on ESD issues. Similar to government, many large companies with significant office tenancy needs (such as large financial services organisations) are requiring that their new buildings and existing buildings meet minimum requirements for energy, greenhouse, water and other environmental issues.

For leading companies of various sizes and from different sectors, demonstrating good ESD practice is seen as good business practice, allowing them to better manage risk (including reputational risk), attract and retain talented staff, reduce their costs and stay ahead of their competitors. More explanation of the benefits to industry of ESD consideration in building operations will be provided in the business case section of this guide.

INDUSTRY LEADERSHIP

The Property Council of Australia has changed the market's expectations of buildings by integrating ESD requirements into their Building Quality Grades. They advocate a 'triple bottom line approach to business, balancing environmental, social and economic accountability.'[1] The PCA 2006 *A Guide to Office Building Quality* includes assessment criteria using both the Green Star rating tools available from the Green Building Council of Australia (www.gbca.org.au) and the NABERS Energy (formerly ABGR) base building rating. They specify that a Premium grade new building should achieve a 4 Star Green Star and 4.5 star NABERS Energy rating, a Grade A new building should achieve a 4 Star Green Star and 4.5 star NABERS Energy rating, and Grade B new building a 4 Star rating for both. Only existing buildings can qualify for a Green Star rating of below 4 Star, due to the different considerations of older properties.

David Pullan — Portfolio Operation Manager, ISPT — the main trigger for ISPT

'The main reason for this … is that the company needs to future -proof its properties, we (ISPT) are long-term owners and the market requires energy efficient and Green Star rated facilities. One of the big drivers for this approach … is that we want to retain our PCA quality rating, and these require ratings.'

David Pullan
(Erica Lauthier)

Stephen Ballesty — Director & Head of Advisory, Rider Levett Bucknall and Convenor of the PCA s Building Quality Steering Committee

'The inclusion of environmental criteria in PCA s 'a Guide to Office Building Quality' was crucial to reflect current perceptions of quality; higher, bigger, brighter is not necessarily better.'

Principles of environmentally sustainable building operations

Australian ESD legislation, policies and industry action provide a clear direction for:

- planning and managing buildings with a view to the long-term while being feasible in the short-term
- using the precautionary principle in all decision making
- taking a global approach to issues for example approaching greenhouse gas reduction through energy efficiency
- input from users and communities on building projects
- avoiding the use of materials that have a negative effect on biodiversity
- ensuring healthy indoor environments
- reporting on performance.

STRUCTURE OF THE GUIDE AND OTHER USEFUL RESOURCES

After the introduction, this guide outlines the business case for the integration of ESD into building operations for owners, managers and tenants. This is followed by an overview of the major environmental issues in building operations, as well as steps that owners, managers and tenants can take to improve performance. Finally, the guide closes with some case studies demonstrating the achievements possible when considering ESD in operating a building.

Wherever relevant, the guide will refer to existing tools and documents that will help in the implementation of strategies outlined, including:

- *ESD Design Guide: office and public buildings*, 3rd edition — this guide provides an introduction to the design opportunities for optimising the potential efficiency of office buildings. It is specifically designed to demystify ESD in building design.
- *Water Efficiency Guide: office and public buildings* — this guide provides in-depth information on water efficiency in buildings, including useful strategies and performance benchmarks.
- *Green Lease Schedules* — integrating effective ESD performance requires the commitment of all stakeholders and this set of schedules provides the tenant and building owner clear guidance opportunities for leases to drive better performance.
- *Sustainable Property Guide* — this online manual provides in-depth step by step guidance on the business integration of ESD into property portfolios, including proformas, check-lists and templates for practical implementation.
- *Your Building* — this online resource provides in-depth national and international knowledge on all aspects of commercial building design and operations. It will be the one-stop-shop for information on ESD building opportunities aimed at the entire industry.

There are also existing tools which will be discussed in Chapter 3 on implementation.

AUDIENCE

Building owners, managers and tenants each have distinct opportunities and reasons for implementing sustainability in existing buildings.

The building **owner** needs to ensure a return on investment. The main driver is to provide highly desirable accommodation and therefore consistent returns for their shareholders. This guide provides the business case and fundamentals to show how integrating ESD into the operations of the building will support these objectives.

John Arthur — Former Managing Director, Investa Property Group. Resigned as MD of Investa in 2007

Source: Green Lease Guide

'Investa believes there is a direct connection between the success of our tenants and our long-term investment returns.'

The building **manager** wants to make sure the building runs efficiently and provides the best possible outcomes for those owning and occupying the building. They are driven by improving performance from the point of view of least cost and least risk. This guide will provide both an outline of low risk effective opportunities and stories from the industry to demonstrate successful integration.

FMA environmental policy

Source: www.fma.com.au

'… FMA Australia's members must strive to give significant consideration to the need to achieve sustainable development. FMA Australia recognises the importance of caring for the environment and acknowledges that all members have a responsibility to the community to act positively and look for ways to protect and enhance the environments in which they live and work.'

The **tenant** looks for a space in which to carry out their business as effectively and productively as possible. They look for spaces that are healthy, attractive, and help them retain and get the most out of their employees. The operational cost for tenants is made up of salaries, energy, water and other service costs. As more than 90% of operating costs in office buildings are salaries, any workplace productivity benefits arising from better buildings can make for a persuasive business case supporting sustainability initiatives. This guide will introduce tenants to the benefits for their staff of many of the ESD opportunities.

'As tenants increasingly use sustainability as a criteria for location selection, those property owners who overhaul these older buildings using Environmental Sustainable Development (ESD) principles will be rewarded with cost reductions such as lower energy costs, waste disposal and water costs, lower environmental and emission costs and lower operations and maintenance costs.'

Romilly Madew, Chief Executive of the Green Building Council of Australia

Source: www.manningclark.org.au

CASE STUDIES

Several case studies are presented in this guide to illustrate the integration of ESD opportunities in the operation phase of buildings. They focus on those managing the building, as good performance is often related to good management and occupant behaviour. The building design sets up the potential for highly effective ESD buildings, but without buy-in from those operating and using the building, it may not reach its potential.

The case studies are:

Case study 1 – Medicare corporate ESD management

Case study 2 – Centrelink corporate ESD management

Case study 3 – Kador Group, Kamirice Pty Ltd

Case study 4 – Investa and SAS Trustee Corporation, QV1 Building, Perth

Case study 5 – Art Gallery of South Australia

Case study 6 – Queensland Department of Public Works, William McCormack Place, Cairns.

Harry Hullin — Building Manager, 500 Collins Street

'If I hear of something new I might look it up online or read what the consultants give me, but if I really want to know if it works I ring up other building managers and see if there are any installed in their buildings and then I go and have a look at it and ask them how it is going … you have to ask people at the coal face....'

Harry Hullin
500 Collins Street
(Erica Lauthier)

Example of how one industry body has worked with its members to integrate ESD throughout their building operations

The Tertiary Education Facilities Management Association (TEFMA) developed a guide to incorporating sustainability into facilities management. This includes a guide book and a series of documents and tools to help in its application. Guidance is given on the importance of how to:

- gain commitment from senior management
- find a champion at a senior level to support the change
- identify risks and priorities
- set policies, objectives and targets (long- and short-term) in conjunction with stakeholders
- develop a plan to implement the process
- allocate resources to action the plan
- effectively communicate those details to all internal and external stakeholders.

Particularly useful is their alignment of ESD opportunities to facilities management practice, as outlined in Figure 1:

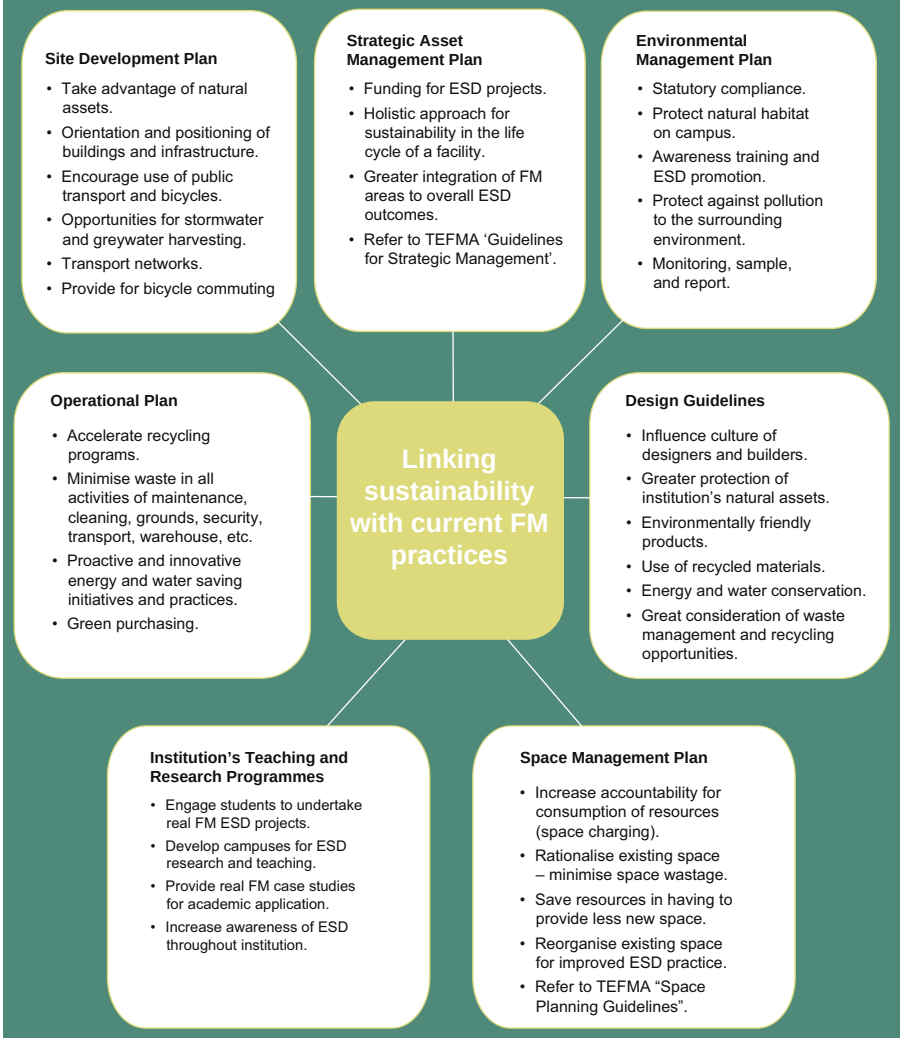
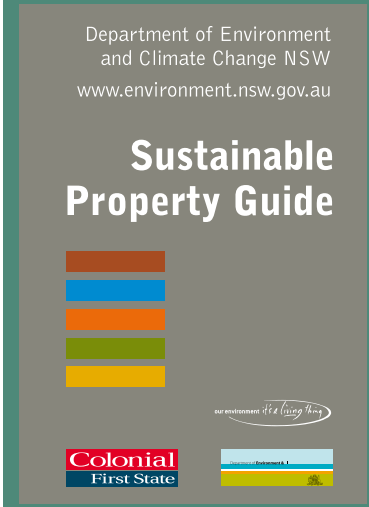


Figure 1 – *TEFMA Facilities management practice and sustainability*
Source: www.tefma.com/PDFs/Publications/SustGuideFinalWeb.pdf

2. The business case for introduction of ESD into the operational phase in existing buildings

This section provides the background and arguments for why ESD is good business. When integrating ESD, it is crucial to be able to provide an effective argument for the initiatives from a whole-of-life and total cost perspective.

The *Sustainable Property Guide (DECC, 2009)* provides a good set of tools to help property owners develop a business case for ESD projects. It includes a sustainability business case template and a sustainability project evaluation check-list.



COSTING SUSTAINABILITY

Any investment, whether in a new fit-out or a new building, should include consideration of the upfront costs and benefits, and also the costs and benefits over the life of the investment. When evaluating the financial costs and benefits of ESD, it is important to identify, quantify, and allocate the direct and indirect environmental and financial costs of operations over time.

In considering the full cost of an investment, the following six tiers of costs could be relevant:

- **direct costs of purchase** — these include cost of purchase, depreciation, labour, etc
- **direct operational costs** — these are the day-to-day operational costs; energy use, maintenance and so forth — the costs of staff attraction, retention and productivity should also be considered here
- **potential hidden costs** — these can include costs of maintenance and upgrades, cost of design, meeting regulatory requirements, voluntary operational activities such as reporting and monitoring, future decommissioning and disposal
- **contingent costs** — these are costs that are not currently clear, but which may occur — the best example is future carbon prices
- **relationship and image costs** — these are costs associated with market perception, goodwill, ethical investment and so forth
- **societal costs** — these costs are very hard to determine but may include externalities such as impact on an indigenous culture, environmental degradation, health etc.

The benefits of taking the full costs into consideration include[6]:

- identification of where ESD costs are greatest
- better informed decisions about how ESD will save the organisation money
- identification of potential productivity gains
- greater ease justifying ESD to senior management and 'bean-counters'
- demonstrating to investors, financial institutions, customers, employees and the community that the organisation is committed to forward planning and environmental responsibility.

Drivers for environmental sustainability in the commercial property sector:

- Lower operational costs
- Help achieve premium or A-grade quality
- Increased attraction and retention of tenants
- Limit or prevent environmental liabilities and risk
- Improved reputation through corporate responsibility leadership
- Lower employee turnover and help retain talented staff
- Meet tenant and community expectations
- Increased shareholder value and access to capital
- Long-term product/service sustainability.

Source: Sustainable Property Guide (DECC, 2009)

Some organisations, such as Industry Superannuation Property Trust (ISPT) and Stockland, are taking this approach when looking at the acquisition of buildings. Instead of just looking at the building and its outgoing costs during the due diligence period to determine the business case for purchasing the building they are carrying out the National Australian Built Environment Rating System for energy (NABERS Energy formerly ABGR) water ratings. Based on the results of these, they then estimate the cost of bringing the buildings up to acceptable ratings.

[6] Adapted from Sustainability Victoria's document of full costs accounting for waste management projects - www.sustainability.vic.gov.au/resources/documents/Waste_Wise_Industry_Advisor_Toolkit_-_Full_Cost_Accounting1.doc, accessed 27/5/2007.

Greg Johnson, National Sustainability Manager, Stockland Commercial Property

'Stockland is working towards better integration of sustainability decision making processes into acquisition strategies. When we include analysis of energy and water ratings as a part of our overall due diligence, we can model the likely cost to upgrade a building to meet tighter environmental ratings. This can influence our decision to buy an asset where the capital cost to upgrade a building may make the acquisition less attractive.'

Greg Johnson, National Sustainability Manager, Stockland Commercial and Industrial Division

WHEN TO ACT

Various triggers can occur throughout the life of a building that provide an opportunity to improve ESD performance. This section briefly outlines regulatory triggers such as the Building Code of Australia's new energy efficiency requirements, as well as non-regulatory triggers, such as demands from tenants, investors and the market.

Building Code of Australia

In 2006, the Building Code of Australia (BCA) introduced energy efficiency provisions for commercial buildings (classes 5 to 9) and made existing provisions for residential buildings more stringent. BCA energy efficiency provisions may affect building areas such as external glazing, building sealing, air movement, air-conditioning and ventilation systems (HVAC), artificial lighting and power, hot water supply and maintenance.

For new buildings, the application of the BCA is pertinent to all aspects of construction. However, for new work associated with an existing building the BCA is generally only applicable to the new work itself, to those parts of the building directly affected by the new work, or to those parts where the building's use is being changed. Under some circumstances (such as for change of classification), the whole of an existing building may be required to achieve compliance with the BCA. Under other circumstances (such as work undertaken on heritage buildings), exemptions may apply.

Building control is the responsibility of each state and territory, and details of when the BCA must be complied with and how legislation should be applied varies around the country. Owners or designers undertaking refurbishment work always should consult their jurisdiction to check their obligations.

Property Council of Australia

The Property Council of Australia has changed the market's expectations of buildings by integrating ESD requirements into their Building Quality Grades. They advocate a triple bottom line approach to business, balancing environmental, social and economic accountability. The PCA 2006 *A Guide to Office Building Quality* includes assessment criteria using both the Green Star rating tools available from the Green Building Council of Australia (www.gbca.org.au) and the NABERS Energy (formerly ABGR) base building rating. They specify that a Premium grade new building should achieve a 4 Star Green Star and 4.5 star NABERS Energy rating, a Grade A grade new building should achieve a 4 Star Green Star and 4.5 star NABERS Energy rating, and Grade B new building a 4 Star rating for both. Only existing buildings can qualify for a Green Star rating of below 4 Star, due to the different considerations of older properties.

Triggers through building practice

The building maintenance plan — a trigger for the integration of ESD into a property may be the periodic requirements of building maintenance. Many larger properties have a building maintenance plan, funded using a 'repairs and maintenance budget' organised by portfolio managers or property agents. An example of the type of item usually identified under these plans is equipment such as chillers. In general, people who activate these triggers will be the portfolio managers or property agents, or the project managers and/or consulting engineers who provide advice. It is therefore important that all of these people are aware of, and involved in, the setting of ESD priorities for the building.

The assets list and essential services list — the creation, review and implementation of these lists could also be a trigger for ESD initiatives. The people who activate these triggers will be the same as above. The assets list is used for maintenance and to show a building owner what is included in the property. It identifies individual assets and their state of repair, giving recommendations as to when they should be replaced. This is a key opportunity for replacement with better, more efficient systems, but it is also a time when new strategies that go beyond the piece of equipment could be considered. For example, when replacing a HVAC system, it should be asked whether the building could be upgraded so as to require a smaller system.

The essential services list is a check-list that outlines the major elements of the building services (fire, sanitary, lifts etc) and is a sub-component of the assets list.

Long-term service and maintenance contracts — the renewal of long-term contracts is a prime opportunity to integrate the ESD objectives of the building and the property owner. Contracts are generally negotiated and committed to by the building owner. There is scope in these documents to undertake ESD initiatives, and the trigger for this will be the preparation of the contract and its approval by the owner/owner's agent. The people who activate these triggers will be consultants and/or lawyers who prepare documentation for the maintenance contract, and the owner/owner's agent. It is essential that the ESD objectives of the owner are well known and understood by these key stakeholders in the preparation of the contracts. There are numerous examples where the renegotiation of a long-term contract has not only led to greater efficiency, but has also generated cost savings, particularly if reporting and monitoring become part of the contract requirements.

Waste and recycling service contracts — as above, the renewal of contracts provides an opportunity to introduce various ESD objectives, and the triggers and integration into the contracts are similar. It is therefore crucial that the consultants and lawyers who are part of this process are aware of the waste and recycling objectives of the organisation.

Green cleaning — cleaning contracts, as with the management contracts discussed above, are a major opportunity for the integration of ESD initiatives. Cleaning contracts are generally arranged by managing agents or by tenants. Cleaning companies are beginning to provide additional ESD services, if clearly specified up front, this can extend products, processes and procedures. Waste and recycling can also be included in this. The trigger will be the signing of the contract. The people who activate the trigger will be the managing agents/facility managers and beforehand, the pro-active cleaning company. In 2007 the IFMA Foundation www.ifmafoundation.org published 'The Business of Green Cleaning'.

Investa Property Group
Source: Green Lease Guide

An ongoing dialogue between cleaners and waste contractors has helped Investa to increase recycling levels by enabling everyone to learn about what works and what doesn't, and what strategies could be employed to make recycling more effective.

Green Cleaners
www.coopamerica.org/images/10cleaners_lg.jpg

Incoming electricity or gas bills for payment — owners who see no interest or benefit in ESD opportunities, and who seek only an immediate return on their investment, will be interested in reducing **opex** (operational expenditure), but with no capital outlay. Triggers for this type of owner could include an energy audit that identifies actions that have an immediate payback, and other actions that can employ an Energy Performance Contract (EPC) to provide the upgrade. This audit may to be triggered by an incoming bill from the utility. The utility could also offer to assist in the installation of meters and appropriate Building Management System upgrades that could assist in the auditing process.

Monthly reports by building managers/engineers back to owners/agents/building management committee — the monthly building reports are a major chance to highlight problems in the building and to identify ESD opportunities that might resolve them. The people who activate these triggers will be the portfolio managers or property agents who prepare and submit these reports, and a wider range of ESD initiatives could be proposed.

Tenant sustainability commitments — one of the triggers that could stimulate the integration of ESD into building operational management is the request of tenants for Green Leases. These will be covered in more detail later, but are a clear request for demonstrated commitment and collaboration between the tenant and the building owner, facilitated by the building manager. The tenants may also have data requirements on environmental performance as part of their own corporate responsibility initiatives.

Tenant complaints — tenant complaints can be a trigger to review aspects of the building, such as the HVAC system. The people who action this trigger would be those who receive the complaints. This varies from the owner in small buildings to the building manager/engineer in larger buildings.

Triggers from the property cycle

Traditionally, the property cycle is approximately seven years from peak to peak. In that time, it also swaps from a tenants' market to a landlords' market.

When it is a tenants' market, tenants will call for keen prices and incentives. The need for attractive features, such as ESD initiatives, could act as a trigger to undertake ESD work on property being refurbished. The trigger for this would have to come from the leasing agent.

When it is a landlords' market, there is less incentive to offer buildings with an emphasis on special features, such as ESD initiatives. However, astute landlords will seek to develop properties that are future-proofed, by incorporating into them ESD initiatives, for a time in the future when it becomes a tenants' market. The trigger for these actions would come from the landlord.

For example, in early 2007 the Melbourne commercial market was seen to be rising, but is expected to be approaching its zenith in 2009-10 (Figure 2). Currently, vacancy rates are very low and leasing incentives are high.

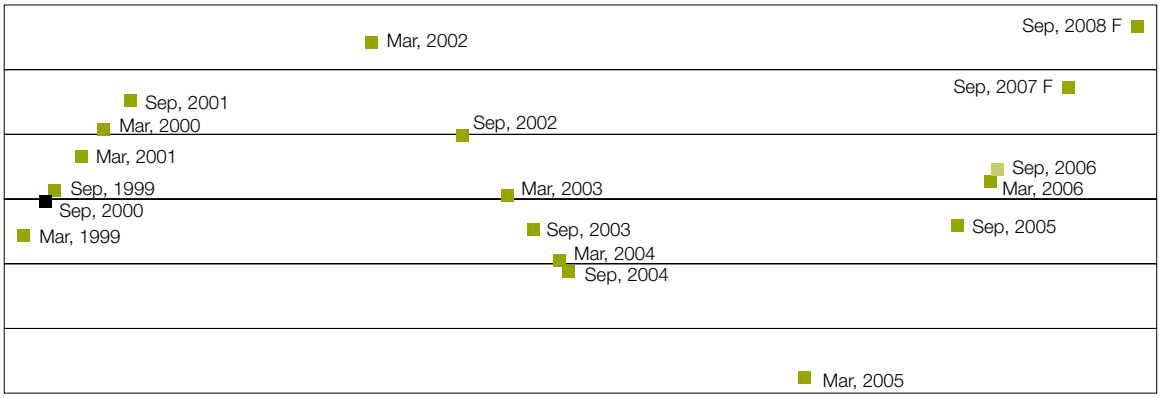


Figure 2 – *Melbourne commercial property cycle 1999–2006 (with forecasts for 2007–08)*
Source: API September 2006 Property Direction Survey

ROLES, BENEFITS AND OPPORTUNITIES FOR OWNERS, MANAGERS AND TENANTS

Building owners

The attitude of owners to ESD issues ranges from antipathy and total indifference, to pro-active and positively engaged. The attitude of the owners will affect the potential benefit they see in implementing ESD initiatives. The uptake of ESD initiatives into some very large property portfolios, such as Investa, ISPT, Stockland, Colonial and Lend Lease, has pushed a change in attitude away from the antipathy and indifference end of the spectrum.

What are the benefits of ESD for building owners? The benefits are varied and range from adding to the value of their stock (see JLL example below), to good corporate responsibility, to reducing future risk and attracting long-term tenants.

Valuation model by Jones Lang LaSalle, 2006

A case study presented on a Sydney CBD, single-tenanted building showed that with an investment in lighting, HVAC and commissioning costing $320 000, outgoings were reduced by $3.32/m^2 or $99 700, and $3 million in capital value return was added on an investment of 10.67%. The NABERS Energy rating was also raised by 1 star.

Building Service Element	Saving $/annum	Cost of Intiative	Payback in Years	Scope
Chilled water pumps	$4172	$11 000	2.64	Install variable speed drives
Condenser water pumps	$3872	$12 000	3.10	Install variable speed drives
Cooling tower fans	$2767	$7000	2.53	Install variable speed drives
Water cooled chillers	$14 348	$61 000	4.25	Increase effeciency of chiller
Primary supply air fans	$15 480	$19 500	1.26	Install variable speed drives
Base floor lighting	$39 131	$184 615	4.72	Install higher performance lights
BMCS commissioning	$19 934	$25 000	1.25	More thorough BMCS tuning
Totals	**$99 704**	**$320 115**	**3.21**	

Table 2 – *Sustainability initiatives and costs benefits*
Source: Jones Lang LaSalle, Assessing the Value of Sustainability, February 2006

Owners and managers of property, Investa sees the integration of sustainability into business practice as providing the following benefits:

- creates a culture which generates confidence in the landlord
- encourages long-term national relationships
- sponsors a culture of efficiency and innovation that benefits owners in the long-term, if not immediately
- is a motivator of its people through alignment with personal values.

Source: Sustainable Property Guide (DECC 2009)

Building managers

For building managers, the reason for actively integrating ESD principles into buildings is to provide a better service to the building owner and the tenants. Further, a well-integrated ESD strategy and a thorough environmental management system that have the commitment of the building owners may mean that the management of the building can be carried out more efficiently, with fewer emergencies and complaints.

Different sized buildings are managed in different ways:

- smaller buildings may be managed by a cleaner and/or owner who organises the appropriate response as required
- medium-sized buildings might be managed by a leasing agent who manages several properties at once, but is resident in none of them
- larger buildings may have a permanent building manager/engineer on site, who reports back monthly to a portfolio manager and the owner, and should also report to tenants.

Will tenants pay more for an ESD building? No, not yet, but they expect to pay less for, or will not lease, a non-ESD one.

'Surveys conducted by Jones Lang LaSalle have indicated that whilst tenants currently may not be willing to pay a premium rental for buildings with sustainability features, some tenants will very soon come to expect a discount to occupy buildings that do not have these features. This switch from a 'sustainability premium' to a 'non-sustainability discount' is expected to gather pace over the next two to four years.'

Source: Jones Lang LaSalle, Assessing the Value of Sustainability, February 2006, p6.

Tenants

While costs to tenants from office energy use, water consumption and waste disposal can be significant, their major expense will be staff salaries (Figure 3). From the tenant point of view, if investments in environmental performance can produce a happier and more productive workforce — one that sees their values aligned to those of their employer — then that investment can make excellent financial sense.

Research has shown that buildings in which ESD has been taken into account have higher employee satisfaction. Buildings that have introduced ESD initiatives usually have improved lighting and air-quality, which can lead to improved productivity, particularly through increased concentration and reduced sick leave.

The DECC Sustainable Property Guide provides tools to support the process of integrating ESD into property acquisition. It provides an evaluation worksheet and outlines their four step process:

Step 1 — Align responsibility

Step 2 — Agree on benchmarks by which to assess the building

Step 3 — Use an appropriate assessor

Step 4 — Assess and record

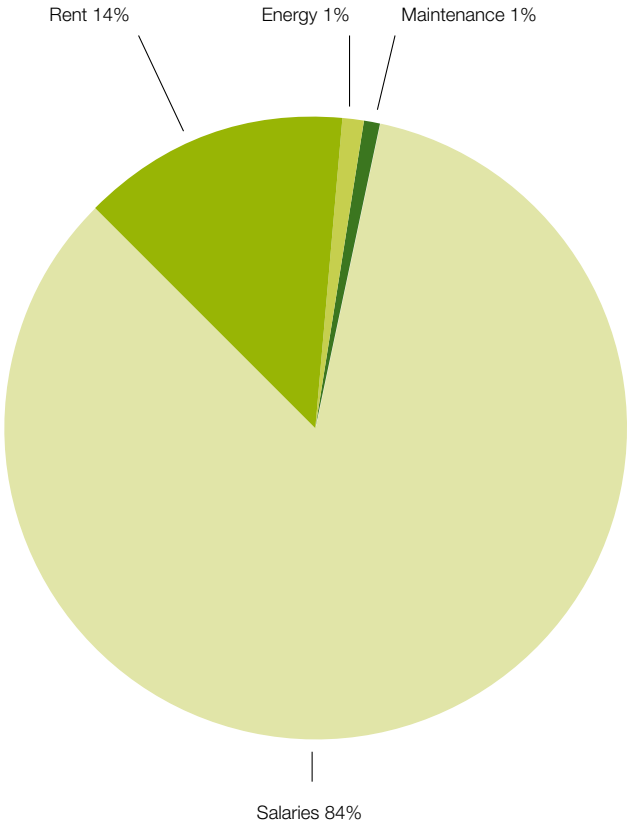


Figure 3 – *Breakdown of typical business costs*
Source: Browning and Romm (1994)
www.yourbuilding.org

ZEE Upton, programme leader in tissue repair and regeneration in the School of Life Sciences, has been in the $70 million Institute of Health and Biomedical Innovation at Kelvin Grove with researchers and laboratories since it was opened. She admitted to being very cynical about the new open plan office:

'Most of us thought "what a load of rubbish"… we had no faith in the architectural and design profession in providing us spaces that weren't noisy and disruptive … but it really works … recently I was just offered a new role taking up a more senior position … but I didn't take it because I do not want to leave this building … I mean I have a great team as well … but I just love working in this building.'

Open plan meeting spaces, Kelvin Grove
(Zee Upton, Institute of Health and Biomedical Innovation)

3. Implementation

This chapter outlines how to achieve ESD integration into building operations. It is about setting up good management systems, being able to build in ESD and monitor its integration and performance, and about planning for appropriate interventions depending on the operational building activity.

'If I was to distil the lessons learned in my time managing sustainability into the key elements of a successful sustainability strategy, I would say firstly you need to have a clear commitment from an executive level so that everyone can see that it is part of a broader business strategy. Secondly you need to have an effectively integrated management system including a reliable source of utilities data to establish your baseline. Thirdly make use of environmental rating tools to measure performance and set targets for improvement and finally you need to invest in technology such as sub-metering to see where energy and water is being used. Running a building without sub metering is like driving a car without a dashboard. Without reliable data and access to timely information on performance it is so much harder to effectively implement sustainability action plans.'

Greg Johnson, National Sustainability Manager, Stockland Commercial and Industrial Division

The chapter begins by outlining the barriers and challenges of integrating ESD into the operational phase. It then examines the rating tools and other approaches that have been developed to help minimise many of these barriers and to facilitate implementation. In particular, it provides details on the management of ESD in buildings and other opportunities within the maintenance and refurbishment stages of a building's life. This is followed by a discussion of various options for building space leasing, performance reporting and target setting.

The implementation of ESD in the operational management of buildings often faces barriers. While many of these are real, they can also be based on outdated notions of what sustainability costs, and what the market can deliver. Commonly raised barriers to integrating ESD into existing buildings (and responses to these) include:

Sustainability and ESD costs more — in the short-term, some initiatives may cost more, but if an owner cannot lease a building out because it does not have the ESD aspects expected by the market, then the investment becomes more cost-effective. Further, ESD investments need to be seen beyond their initial upfront costs; the full life cycle needs to be taken into account, particularly the future cost of carbon needs.

Lack of awareness of the market — there has been a marked increase in market awareness of ESD, particularly from government agencies (federal, state and local), the property industry (e.g. PCA quality guidelines) and major corporations. They not only see the benefits to their staff, but are also keen to demonstrate commitment to their stakeholders.

Poor access to knowledge, research and resources — this is no longer the case; the amount of knowledge that is now available in the market place provides clear guidance and support for ESD integration. Some of the resources that are available include: the tools and information published by the Green Building Council of Australia; NABERS; various design, building management, leasing and reporting guides and tools; and the *Your Building* online information source, which will provide comprehensive national and international knowledge on ESD and commercial buildings.

Green strategies are not well-tested in the market — this is rapidly changing as many of the buildings that innovated ESD integration now have several years of performance data on which to report. National and international experience is used to illustrate the ESD opportunities throughout this guide. Further, key bodies such as the PCA and the Green Building Council of Australia have recognised the benefits of ESD and provide clear guidance, technical information and rating tools.

Professionals are not well informed — engineers, builders and other tradespeople are quickly coming up to speed with the requirements of ESD. Their professional organisations are supporting them with professional development and training. There is also increasing integration of ESD into postgraduate studies and an increasing number of conferences.

Garth Bradbury — Manager Facilities Management, City of Melbourne

'… it is hard work — and the more you work in this area, the more specialised knowledge you need … particularly with this one (CH_2) … with other buildings, it is a little easier … this building is like owning a BMW — a lot more smarts, efficiency and features, but needs integration for the whole package to work … it is up to our contractors to be able to manage the system … We try to build a strong relationship with them and they need to have a background and understanding of the systems … and they do step up … they have to …'

Garth Bradburry, CH_2, Melbourne
(Erica Lauthier)

Split incentives and traditional approaches — taking in the whole-of-life costs of ESD initiatives means that traditional ways of financing need to be reviewed. This requires high-level policy and support, and is an issue that needs serious attention at the start of any project. There also seems to be less incentive for the owner-investor as they do not benefit from the ongoing savings, although this is starting to be addressed by market demand for ESD in their tenancies. It is not the ongoing costs that are the incentive, but the retention and attraction of key tenants. Green leases and thorough service contracts are helping to overcome this barrier.

The tenant is responsible for a significant amount of the impact — this is the reason that rating tools have base building and tenancy variations. The tenants can be engaged in the ESD initiatives by being informed of their role though a building user's guide and green leases. Also, through initiatives such as those by ISPT, relationships can be established with the best suppliers of materials (such as paints and carpets) who not only provide a more environmentally responsible product but do so at a reduced cost. The tenant can reduce this barrier through commitment, education, buy-in and behaviour change.

Greg Johnson, National Sustainability Manager, Stockland Commercial Property

'…at Stockland sustainability is one of the core pillars that drive our strategic business plan (along with growth, product, stakeholders, brand, systems and processes and people). After this commitment the first step to understanding our footprint is getting some idea of the performance of the portfolio.

The first place to start is to understand how your portfolio is performing particularly in relation to market expectations. Tools such as NABERS Energy and Water will help with this and for Stockland, has helped determine what benchmarks and targets we should set and over what timelines. Stockland has set a portfolio average base building NABERS Energy target of 3.6 stars and for new buildings at 4.5. In 2005, the portfolio average was 2.6 stars. By setting targets, we can identify potential improvement strategies and then it is a matter of implementation, measurement, evaluation and reporting.'

Stockland headquarters, Sydney
(Stockland)

RATING TOOLS

A range of building environmental rating tools that have been developed internationally and in Australia to measure various aspects of the environmental performance of buildings. There are two main approaches to ratings:

(1) a design-based approach, which seeks to predict the performance of a building based on an analysis of the design features and

(2) an outcome-based approach, which measures the actual consumption of resources and environmental impacts of the building in operation.

Both approaches provide useful information to building owners, managers and tenants, and have the potential to drive continuous improvement of the building stock. For assessing a range of environmental and sustainability aspects of commercial buildings in Australia, the Green Building Council of Australia's (GBCA) – Office Interiors v1.1 rating tool assesses a project's approach to fit-outs and refurbishments, while other Green Star tools can assess the design, construction and procurement sustainability initiatives and attributes of new buildings, with a separate rating tool to gauge sustainability characteristics of existing buildings. Green Star rating tools do not assess behaviour of building occupants, although the Green Star – Office Existing Building rating tool addresses Management Efficiency and elements of performance. The National Australian Built Environment Rating System (NABERS) uses an outcome-based approach to assess the environmental performance of existing buildings. Within this tool are subtools to assess energy, water, waste and the indoor environment. The NABERS Energy and Water tools are those most mentioned by the property industry as the tools they use for assessing a project.

Green Star www.gbca.org.au

The Green Star suite of rating tools has been developed by the GBCA with support from industry and government agencies. Green Star represents a range of rating tools that can be used according to the type of building and stage of development. Many of the rating tools for new buildings assess the attributes of the property, but for the operational phase the most appropriate rating tools are Green Star – Office Interiors v1.1 and Green Star – Office Existing Building.

GREEN STAR – OFFICE INTERIORS RATING V1.1

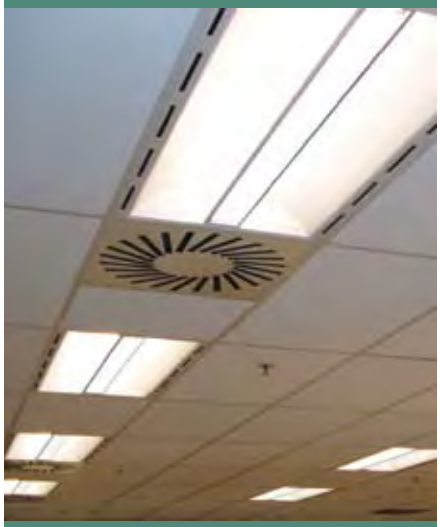
This rating tool enables office building tenants and owners to rate the environmental attributes and characteristics of their fit-out designs and refurbishments. More sustainable fit-outs may include features such as access to natural light combined with efficient office lighting, energy and water conservation measures, waste management, fit-out items with no emissions or low emissions and reduced environmental impacts, and timber from sustainable sources. The Green Star – Office Interiors rating tool has been developed to assess a tenancy fit-out once construction is complete, but should also be used during the design phase to ensure 'greener' fit-out initiatives are incorporated at the earliest possible stage.

GREEN STAR – OFFICE EXISTING BUILDING V1

Green Star – Office Existing Building rates the environmental and sustainable attributes of existing buildings, defined as buildings that have been constructed and handed over not less than 24 months prior to an application for a Green Star Certified rating. The rating tool assigns a Green Star rating to the physical building and its services, independent of its tenants' operations or behaviour, and assesses projects against a core group of categories including Management, Indoor Environmental Quality, Energy, Transport, Water, Materials, Emissions, Land Use and Ecology and Innovation. Each of these categories has points available for different credits relating to separate areas of the building, to provide a more integrated, holistic rating of sustainability. The Management Efficiency tool embedded within the rating tool enables proper assessment of the building's performance on an annual basis, and is designed to complement the Green Star rating achieved by the property.

Greg Johnson, National Sustainability Manager, Stockland Commercial and Industrial Division

'One of the main lessons I have learned is that it is fine to design a building to achieve a NABERS Energy rating, it is another to deliver and maintain it.'



Innovative lighting and ventilation, Stockland Headquarters, Sydney
(Stockland)

NABERS www.nabers.com.au

NABERS (National Australian Built Environment Rating System) is a tool for rating actual building performance. NABERS gives scores based on benchmarked research in the areas of Energy, Water, Waste and Indoor Environment. NABERS is a national initiative, managed by the NSW Department of Environment and Climate Change.

This tool makes it possible to report on both the base building performance and the tenant performance of existing buildings. Therefore, it is a powerful tool for building stakeholder commitment to reduce operational costs and environmental impacts. The tool allows users to carry out their own assessment and analysis for integration into building environmental management plans, but if an official assessment is required, then it needs to be carried out by an accredited assessor. To carry out a self-assessment using NABERS Energy, Water or Waste, the data requirements are:

- area of the office premises (m^2 NLA, preferably to PCA standards)
- occupancy (in hours per week)
- location (postcode)
- number of computers (for office tenants and owner-occupiers)
- energy and water use of the premises over the last 12 months
- waste and recycling in grams per person per day over an audit period

NABERS Energy (formerly ABGR)

To date, more than 40% of commercial office space nationally has been rated using NABERS Energy. As shown by the interviews carried out for this publication it has broad industry support and is being used for energy rating, target development and design requirements. The NABERS Energy scheme rates buildings from one to five stars, with five stars representing exceptional energy and greenhouse performance. NABERS Energy can be used for the base building (central services), individual tenancies or a whole building. Buildings that display the rating must be re-rated every 12 months, to ensure that the rating represents current building usage.

In the near future, it may be mandatory to disclose NABERS Energy ratings for all commercial buildings at point of sale. As discussed previously, this may have significant implications on the ability to sell a building[7].

NABERS Energy provides an excellent tool for defining the requirements of both the building owner and the tenant. It represents a clear target for the building manager to use when planning operations. It is also a way of self-rating, allowing owners, managers and tenants to look at how they are performing compared to national data.

NABERS Energy was first designed to rate the actual energy performance of existing buildings while in use, with the rating based on energy consumed. It has since been modified to also be useful at the design stage, with building designers or owners being able to commit to a predicted performance rating. This rating is granted provisionally and only becomes a formal rating after a year of post-occupancy performance data is available. Many major owners and tenants of office building space, such as government, are requiring minimum levels of energy performance as a condition of leasing and managing buildings.

Each of the tools report in the form of a 5 star rating in a little more detail:

NABERS Water – is based on water bills. It allocates a star rating of water used per square meter. NABERS Waste – uses a guidance document for carrying out a waste audit called the 'NABERS Waste for offices Waste Audit Guidance Document'. It outlines the data to collect on waste streams and recycling streams. NABERS Indoor Environment – assesses the indoor environment based on thermal comfort, air quality, acoustic comfort, lighting and office layout.

Taking buildings from a 2.6 star portfolio average NABERS Energy to 3.6 stars — Stockland

Stockland is taking its average portfolio NABERS Energy to 3.6 by: (1) installing sub-meters in its buildings on major energy and water consuming plant and equipment; (2) identifying inefficient operational and housekeeping issues that can be improved such as ensuring the buildings have been commissioned properly, ensuring lights are not on when not required, ensuring lifts power down at night, building controls and HVAC systems are performing optimally, systems that can be on economy cycle are working, etc; (3) installing variable speed drives to pumps and fans, lighting control systems and upgrading Building Management Systems on existing buildings.

When building refurbishments are necessary, upgrading and replacing inefficient plant and equipment is a great opportunity to improve performance and avoid the risk of future obsolescence.

Greg Johnson, National Sustainability Manager, Stockland Commercial and Industrial Division

Stockland Headquarters, Sydney
(Stockland)

[7] Sourced: www.nfee.gov.au/buildings.jsp?xcid=121, accessed 17/5/2007.

Tools in practice

Two programmes – CitySwitch Green Office (previously 3CBDs), which is active in eight CBDs around the country, and Building Tune-Ups in Adelaide – have been in place for several years to support the integration of ESD. These programmes used NABERS for energy and water targets (Green Star was not available when they began). The Adelaide programme has had varied success, with some buildings improving by 1.5 stars for both water and energy (see Table 3).

The main lessons from these programmes have been:

- get commitment from high up in the organisation for changes
- ensure audit results and recommendations are put into practice
- if audits are planned, also ensure the resources to implement the recommendations are committed and
- plan implementation in line with maintenance schedules.

Programme Measure	Target	Achieved at end of stage 3
NABERS Energy rating	Improved by 1 star	Average improvement of 0.2 stars
NABERS rating	Improved by 1 star	Average improvement of 0.6 stars
Energy consumption	Reduce by 6616 MWH p.a.	Reduced by 3233 MWH p.a.
Energy savings	$840 000 p.a.	$341 955 p.a.
Reduce greenhouse emissions	6351 tonnes of CO_2 p.a.	2883 tonnes of CO_2
Water savings	$36 750 p.a.	$27 790 p.a.
Reduce water consumption	48 000 kL p.a.	27 160 kL p.a.

Table 3 – *Summary of Adelaide building tune-ups results (2006:5)*[8]

BUILDING ACTIVITY ESD OPPORTUNITIES

Four main activities occur in the operation of a building (see Tables 4 and 5):

(1) the building is used by the tenants

(2) the building is managed with management plans and reporting requirements

(3) the building is maintained through periodic replacement of components and correction of failures, from replacing lights to temperature adjustments

(4) the building is retrofitted. There are two levels of retrofit activity. The first is minor activity, related to cosmetic alterations such as paint, office walling and carpet replacement. The second is major activity, where a significant retrofit is planned, such as façade and HVAC replacement. The ESD opportunities for each activity are different. These are introduced below and expanded on in the specific sections under opportunities.

Stage	Opportunities
Tenant operations	Tenant Environmental Management Systems (EMS), behaviour change, procurement, etc.
Management	Management system, incremental improvement, procurement, etc.
Maintenance	Sensors, meters, improved lamps, filters, etc.
Level 1 refurbishment	Low emission carpets, paints, fittings, etc., minimise waste from churn
Level 2 refurbishment	Windows, HVAC system, open plan, shading, thermal mass, etc.

Table 4 – *Operational building phases*

50 Lonsdale Street, ISPT target 4.5 Star Base Building NABERS Energy and 4 Star Green Star
(ISPT)

[8] www.capcity.adelaide.sa.gov.au/pdf/ABTUP%20Stage%203%20Final%20Report%20Public%20Release.pdf, accessed 15/5/2007.

Stage	Owner	Manager	Tenant
Tenant operations	Support tenant in their ESD requirements	Meet tenant requirements Respond to complaints Support information and reporting needs of tenant	Develop and implement ESD policy and systems Participate in the ESD committee Tenant behaviour and education
Management	Set priorities and policy Allocate appropriate resources Read and review EMS reports Set ongoing priorities	Set up EMS Develop building user guide Propose improvement opportunities Integrate ESD into contracts	Participate in ESD committee Comply with management initiatives Use procurement strategy
Maintenance	Approve appropriate resources	Carry out maintenance Continually look at maintenance plan for opportunities	Use procurement strategy especially if organising own cleaning contract
Level 1 refurbishment	Approve appropriate resources	Ensure communication with tenants on activities and ESD initiatives Update building user guide Manage commissioning if required Ensure procurement strategy is followed Monitor and report on results	Use procurement strategy
Level 2 refurbishment	Approve appropriate resources	Ensure communication with tenants on activities and ESD initiatives Update building user guide Manage commissioning Ensure procurement strategy is followed Monitor and report on results	Use procurement strategy

Table 5 – *Roles and responsibilities for implementation of ESD at each activity level*

MANAGEMENT

The management of the building means different things to each of the stakeholders.

The building owner — for the owner, building management is crucial for the maintenance, improvement and continued occupation of the building. Owners must set the strategic direction for the building and make sure that resources and tools are available to meet that direction.

The building manager — for the building manager, the management of the building includes ensuring that the building functions and that the tenants are satisfied. Managers have a crucial role in understanding the building and being able to make it run optimally. Central to this is the ability to work and communicate effectively with the tenants, as noted by Harry Hullin, the Building Manager of 500 Collins Street:

'If you look at the tenants as your allies, then you have 15 000 pairs of eyes that can let you know when things aren't right…'

David Pullan — Portfolio Operation Manager, ISPT

'The first thing I did when I started at ISPT was determine what was wanted from the integration of sustainability … I felt it was important to approach these things strategically … by having an integrated policy and implementation plan. It was also important to make sure the direction came from the top of the organisation, so the chairman and many of the members of the board sit on the sustainability committee with the portfolio staff.'

Activities for the facilities manager within the Environmental Management Plan (EMP):

- measuring current performance
- integrating sensors, meters and other methods of data collection
- identifying issues and anomalies
- planning and integrating improvements over time
- keeping an eye out for future developments and technologies that could be integrated into the building.

The tenant — tenants are central to the building's performance; without them, there would be no building or impact, so their commitment to ESD and its impacts on their own behaviour are critical. For the tenant, there is also a role to play in the management of the building. Not only are they the eyes and ears of the building, but they can also push the ESD agenda back onto the building manager and owners. They can request to have a green lease, can be involved in building committees, can provide feedback, and often have their own service contracts with providers such as cleaners, IT services and recycling system providers. If these contracts are commissioned by the tenants, they need to be aligned with the aspirations of the building owners and managers.

Summary of ESD opportunities in building management

Management is an activity of everyday checking and reviewing of performance of the building and its systems. This occurs before maintenance is needed, though it often brings up inconsistencies that lead to things needing to be replaced or serviced. ESD opportunities will be maximised if the following management initiatives are developed and implemented:

Commitment from the building owners — key to the integration of ESD into building projects is building owner commitment. There needs to be policy from the top that supports the development and integration of initiatives, as well as adequate resourcing and support.

Environmental management system (EMS) — to integrate ESD into a building, it is very important that there is a thorough and well-planned management system. These can take many forms and be as simple or complicated as is required. An EMS is usually a broader document with targets, procedures and reporting protocols (sometimes at a portfolio level), while environmental management plans (EMPs) and plans for energy, water, waste and so forth, tend to be site, and sometimes aspect, specific. These plans are part of the broader EMS.

An EMS is the over-arching system that catches a variety of compliance requirements, and can also capture the information requirements of the building owners, managers, tenants, regulators and investors. An EMS can be initiated by the tenant, the building manager or the building owner.

'…it is not just 'green' buildings, it is about good integrated design and ongoing implementation that incorporates users' needs and wants and that minimises the environmental impact of the workplace … both of these key elements can result in performance improvement...'

— Monica Vandenberg, Principal, Encompass Sustainability Melbourne, sustainability consultant and author.[9]

Evacuated solar hot water tubes. 40 Albert Road, South Melbourne.
(Erica Lauthier)

[9] CSIRO media release: www.csiro.au/files/mediaRelease/mr1998/Beating12BillionCostpollutedAir.htm accessed 27 May 2007

An environmental management system (EMS) is a tool for measuring and improving an organisation's compliance with regulations and management of environmental risks.

The procedures that are implemented at a building level are called an environmental management plan (EMP). The main phases of an EMP are outlined below. Phases directly related to everyday facilities management are phases 2, 3, 4 and 5 (but particularly phase 3).

1. The environmental policy phase documents the organisation's commitment to protect the environment.
2. The planning phase identifies the scope of the organisation's operations and its major environmental impacts, develops a set of objectives based on the environmental policy, and documents a program of action to achieve those objectives.
3. The implementation and operation phase establishes a set of procedures to achieve the identified objectives. These procedures include communicating and documenting the requirements of the EMS, and training staff to identify and meet these requirements.
4. The checking phase monitors the success of the EMS and implements corrective measures where practices are not being followed or where the system is in some way deficient.
5. Finally, in the management review phase, the EMS is reviewed in detail and the progress towards achieving the defined targets and objectives is determined. This phase may also involve a review of the environmental policy and its appropriateness in the light of the evolving nature of the organisation or a change in its environmental obligations and expectations.

Diagram representation of EMS
(Source: ISO 14001:2004: v)

The EMS is a well-known and standardised method of planning and enacting a cycle of monitoring, reporting, reviewing and continuous improvement. The international standard for this is ISO 14001:2004. Several organisations, including DEWHA and PCA, have guides that can be used to help set up these systems. If aiming for certification, it must be noted that the EMS process is often quite time consuming and may not be appropriate for individual small buildings. The important lesson to take on board is the continuous process of positioning, review, planning, implementation and reporting.

Medicare Australia is committed to best practice environmental performance through an environmental management system (EMS) that aligns to the international standard ISO 14001.

A structured management approach has been adopted to report the ongoing performance of managing Medicare Australia's environmental risks and environmental initiatives. After undertaking an environmental review of Medicare Australia's environmental impacts, an environmental policy was developed to systematically address these issues – namely in business decision and procurement processes, energy, water, paper and waste management.

After a number of environmental audits and data gathering exercises to determine baseline measurements, Medicare Australia has developed a series of initiatives surrounding energy, water, paper and waste management. These initiatives are performance managed (or governed) under Medicare Australia's corporate scorecard through environmental key performance indicators and targets.

Computer based training screen
(Russell Kerrison)

Audits — to develop an effective EMS, it is critical to carry out baseline audits of the performance of the building or portfolio. Generally these are carried out on energy, water and waste, though there are some organisations that also carry out an occupant satisfaction audit. There are three non-assessable guides for carrying out environmental audits:

- ISO 14010: 1996 Guidelines for environmental auditing — General Principles
- ISO 14011: 1996 Guidelines for environmental auditing — Audit procedures — Auditing of Environmental Management Systems
- ISO 14012: 1996 Guidelines of environmental auditing — Qualification criteria for environmental auditors.

There is a difference between baseline audits and EMS certification audits. A baseline audit can be done by an external auditor to determine current performance (including against NABERS benchmarks). Once the EMS is up and running an accredited provider can be used to have the EMS certified to the ISO 14001: 2004 standard. In Australia, the NABERS tools specify how ratings are to be conducted.

Building users guide — this is an important tool to engage tenants in ESD opportunities. It details the systems with which the building users, occupants and tenants will interact to provide better performance outcomes. This document can also be used to provide guidance on how the building's performance can continue to be optimised through monitoring and improvement. A key to this guide is that it provides pertinent useful information, such as the all-hours phone number for reporting problems.

Green procurement system — most of the procurement in buildings is done by the tenant. However, building managers and owners also make key procurement decisions; for example, of base building electricity purchases and replacement components such as lamps etc. Part of the management of a building is to have an effective procurement system. These also provide an excellent opportunity for ESD. The system can ensure that the standard materials that are ordered as part of the procurement system of the building are as environmentally responsible as possible.

It can also give guidance on equipment; for example, the use of high performance office equipment that reduces the amount of energy consumed by a product by either automatically switching it into a 'sleep' mode when it's not being used and/or reducing the amount of power used when in 'standby' mode. Power is another element that can be covered under a procurement plan; the purchase of green power can mean a significant reduction in the climate change impact of building operations. Finally, the procurement system can provide guidance on negotiating the cleaning and other contracts for the building.

Checking air flow readings from supply air diffuser
(Source: AIRAH)

Tuning and re-commissioning — a significant opportunity in the management planning of a building is to have regular tuning of systems, and even regular re-commissioning. Tuning tends to be carried out on a system by system basis, adjusting minor elements, while re-commissioning looks at the whole system, examining opportunities for efficiency gains as well as testing that the system as a whole is functioning to its optimum capacity.

Australian Government use of EMS

Progress reports indicate more than 60 EMS projects underway in the Australian Government. For example, government departments certified to ISO 14001 include Defence, Department of the Environment, Water, Heritage and the Arts, the Australian Greenhouse Office, Airservices Australia and Centrelink. The main reason for the use of EMS is that it is seen as an effective way to integrate risk management and performance improvement.

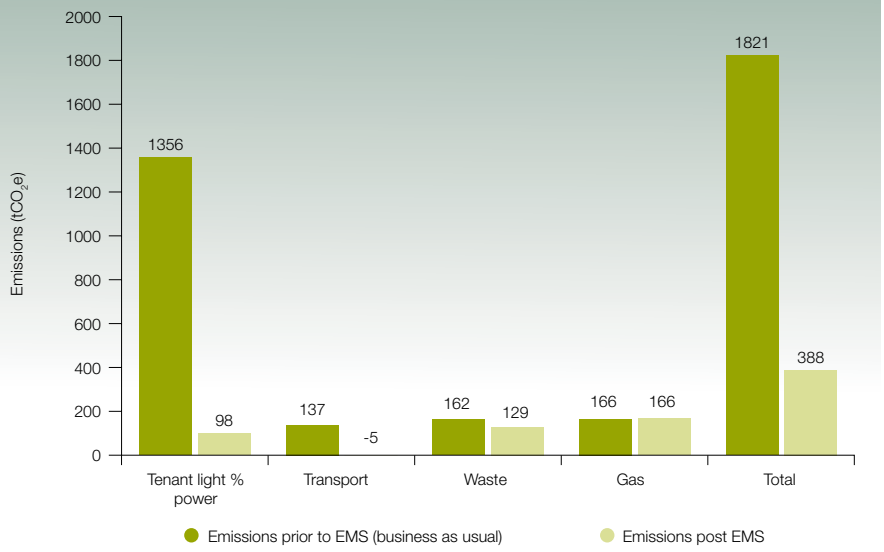
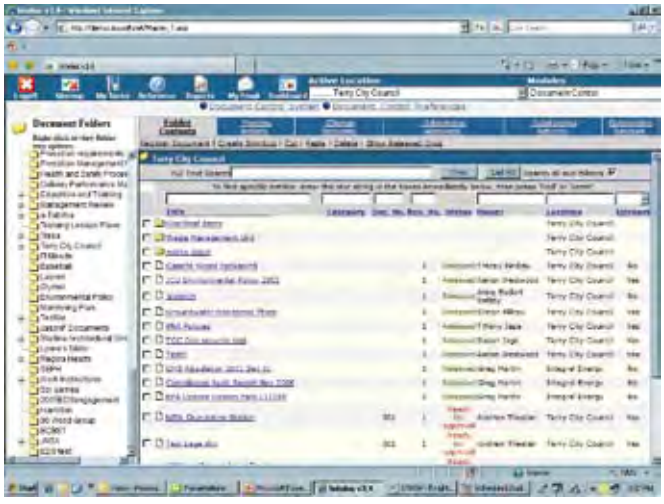


Figure 4 – *DEH net greenhouse emission emissions*
(Source: DEH TBL report 2003–04)

Tools that support ESD integration into building management

Environmental management system software — there are various tools available that can help with the integration of an EMS within building management.

The then Department of the Environment and Water Resources installed a multi-site EMS, aided by dedicated management system software. Figure 5 shows the elements that this software encompasses.



Intelex document and dashboard screens, used by DEWHA.
(Source: Intelex)

	Measure	Metric	Frequency	Updated	Actual	Target	Target Date
Energy	**Electricity and gas**						
	Office tenant light and power	MJ/person pa	Yearly	Nov	6 944	7 500	EEGO 2011-12
	Office central services	MJ/m² pa	Yearly	Nov	325	400	EEGO 2011-12
	Other buildings	MJ/m² pa	Yearly	Nov	119	119	
	Green power	% of total electricity	Yearly	Nov	2.5%	8.0%	EEGO 2011-12
	Note: Medicare Australia is currently meeting the Energy Efficiency (EEGO) targets for 2011–12 set by the Government.						
	Motor vehicles						
	Vehicle fuel consumption	MJ/km	Yearly	Nov	3.99	3.79	Aug-07
	E10 usage	% used of total petrol	Monthly		4.9%	20%	Jul-07
	Green vehicles	% of fleet over 10.5 GVG rating	Yearly	Nov	30%	39%	Jul-07
	Total energy						
	Total energy 2005-06	GJ		Nov	78 876	TBA	
Paper	Internal recycled A4 Paper use	% of total copy paper (reams)	Monthly		31%	100%	Jun-07
	Internal A4 copy paper use	A4 sheets/person pa	Yearly	Feb	6 234	5 735	Jan-08
Waste	Landfill waste (net refurb)	kg/person pa	Yearly	Feb	33	24	Jul-07
	Fluorescent tubes recycled	% of total tubes	Monthly		0%	100%	Jul-07
Water	Potable water use	kl/m² pa - air con	Yearly	Feb	0.345	0.345	Feb-08
		kl/m² pa - personal use	Yearly	Feb	0.371	0.334	Jul-08
		kl/m² pa - total	Yearly	Feb	0.716	0.679	Jul-08

Table 6 – *Balanced score card.*
(Source: Medicare)

Benchmarking and performance tools — the NABERS building performance benchmarking tools also provide a good methodology by which to locate building performance within the broader Australian building market. These tools have been used by numerous large building portfolio owners to determine what they would like to aim for and where their portfolio is in regards to these targets (Figure 19 shows an approach to using this information). They provide an excellent starting point for determining where to focus resources and to report relative improvement.

Submetering — among all of the people interviewed for this guide, there was one lesson that was repeated: the fundamental importance of submetering. Metering allowed them to quickly determine where the main loads were, identify errors and demonstrate the effectiveness of efficiency initiatives.

Smart meters are meters that can provide real-time information on energy use and estimated greenhouse gas emissions and could also advise, for example, half-hourly fluctuations in the price of energy to encourage low use during peaks. These provide real opportunities for both understanding energy use in a building and for generating savings by using energy outside peak times.

'Not installing meters because it is time consuming and expensive is a real fallacy because you may end up in a position where you may be investing much larger amounts of money addressing issues that aren't there! Further, how are you going to know if your investment is paying off if you aren't measuring what is going on ?'

Roger Kluske
(AIRAH)

Typical clamp meter used by HVAC technician to check correct electrical current
(AIRAH)

Revenue metering refers to measuring the usage of a particular resource, such as electricity, gas or other fuel. The revenue owed to the retailer or supplier is calculated from these meters. Digital meters are installed and data is collected and reported on by accredited service providers. Digital meters for buildings over 2000 m^2 for combined meter data services and meter provision cost no more than $750 a year. Minor leased premises should expect to pay approximately $65 for installation and $65 a year.

Online resources — Environmental management system (EMS)

DECC — template of EMS for building data collection in section 3.3E shows what data needs to be collected in order to produce useful figures on all ESD operational aspects. look on **www.environment.nsw.gov.au** and **www.livingthing.net.au**

DEWHA — EMS **www.environment.gov.au/settlements/publications/government/ems/model.html**

Victoria EPA — Victorian Government EMS **http://www.epa.vic.gov.au/projects/government_ems.asp**

Accredited EMS certifiers are listed at **www.jas-anz.com.au**

Revenue metering **www.greenhouse.gov.au/government/publications/pubs/eego-fs12.pdf**

REPORTING

Building owners, managers and tenants may all have internal and external requirements to report on sustainability performance. One point for guidance on what needs to be reported on, and therefore what information needs to be collected, is the Global Reporting Initiative (GRI). The GRI has emerged as the internationally accepted framework for sustainability reporting and is widely supported by Australian organisations.

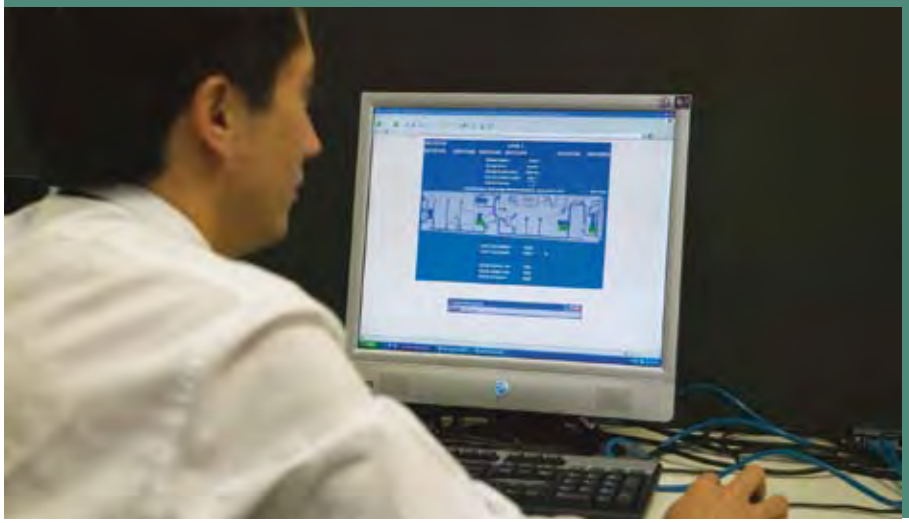
Founded by the Coalition for Environmentally Responsible Economies (CERES), the GRI is an official collaborating centre of the United Nations Environment Programme (UNEP), which, since its first publication in 2000, has focused on assisting reporting organisations and their stakeholders in articulating their overall contribution to sustainability through the *Sustainability Reporting Guidelines*. The third version of these guidelines, the G3, was developed through a multi-stakeholder process. The G3 defines an international voluntary reporting framework for triple bottom line (TBL) performance.

Tony Dorotic — National Sales & Marketing Manager ECS, 40 Albert Road

'The most important lesson from this project was the importance of metering and ongoing commissioning.

For example, with the night purge, our intention was that the windows would open automatically when the climatic conditions were right and cool the building. The BMS programmer understood this to mean that after 6pm all the air conditioning fancoil units needed to go on ... so in the first winter in this building, we would spend all day heating up the building and at 6pm, all the heat would get sucked out!

… to go back to the metering, our solar panels did not seem to be working; without the meters we would not have found out that the inverters had failed, as with high levels of sunshine we assumed that things were working. With the solar hot water system, we found that our gas usage was unusually high and we weren't getting any of the hot water from the solar system. Through looking at the meter information, we found that in fact the solar hot water system was generating sufficient hot water but it wasn't being circulated through the building because the pumping system was not connected correctly. So we had tanks of solar hot water going to waste for over 12 months.'



Tony Dorotic
(ECS)

Christopher Seeley looking at BMS online at 40 Albert Road
(Erica Lauthier)

Reporting requirements for Australian Government agencies[10]:

Mandatory

- The annual energy consumption data and relevant normalisation factors for all relevant end-use categories
- Energy use over which they have direct control, based on a financial year basis, by fuel type and by end-use category
- Building floor area (NLA) and number of people
- Central services energy use
- Kilometres travelled
- Reasons for any major changes in energy use

Voluntary

Some public and private sector organisations are choosing to report publicly on their environmental performance. Others are choosing to provide information about their social and financial performance in a sustainability report (or a triple bottom line report). This means collecting and reporting on:

- financial year figures on water use, waste, complaints, materials purchased, refrigerants used and cleaning materials used as outlined below (Table 7)
- all of the above, linked to specific activities and organisational units
- previous years figures and explanations for any major changes.

Table 7 is adapted from GRI G3 guidelines[11] and indicates some of the information that will be requested of facilities managers by their own organisations, or by owners or tenants, to feed into internal and external sustainability reports. To meet these demands, this information needs to be planned for, collected and summarised periodically as part of everyday business practice.

Category	G3 — Indicator (core are in black, additional in green)
Materials	EN1 Materials used by weight or volume
	EN2 Percentage of materials used that are recycled input materials
Energy	EN3 Direct energy consumption by primary energy source
	EN4 Indirect energy consumption by primary source
	EN5 Energy saved due to conservation and efficiency improvements
	EN6 Initiatives to provide energy-efficient or renewable products and reduction in energy required
	EN7 Initiatives to reduce indirect energy consumption and reductions achieved
Water	EN8 Total water withdrawal by source
	EN9 Water sources significantly affected by withdrawal of water
	EN10 Percentage and total volume of water recycled or reused
Biodiversity	Not as relevant for operational phase, unless building is in a sensitive habitat
Emissions, effluents, and waste	EN16 Total direct and indirect greenhouse gas emissions by weight
	EN17 Other relevant indirect greenhouse gas emissions by weight
	EN18 Initiatives to reduce greenhouse gas emissions and reductions achieved
	EN19 Emissions of ozone-depleting substances by weight
	EN20 NO, SO, and other significant air emissions by weight
	EN21 Total water discharge by quality and destination
	EN22 Total weight of waste by type and disposal method
	EN23 Total number and volume of significant spills
	EN24 Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally
	EN25 Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organisation's discharges of water and runoff
Products and services	EN26 Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation
	EN27 Percentage of products sold and their packaging materials that are reclaimed, by category
Compliance	EN28 Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations
Transport	EN29 Significant environmental impacts of transporting products and other goods and materials used for the organisation's operations, and transporting members of the workforce
Overall	EN30 Total environmental protection expenditures and investment by type

Table 7 – *Summary of G3 environmental indicators*

[10] Summarised from www.environment.gov.au/esd/national/epbc/guidelines/index.html and www.greenhouse.gov.au/government/index.html Accessed 9/5/2007.

[11] Global Reporting Initiative, RG Sustainable reporting guidelines v2 (2006), www.globalreporting.org/NR/rdonlyres/A1FB5501-B0DE-4B69-A900-27DD8A4C2839/0/G3_GuidelinesENG.pdf, Accessed 9/5/2007, pp. 28–9.

TARGETS

Targets are central to ongoing improvement in building operations. These targets should be set with the building manager and owner for base building performance, and by the building manager and tenant for tenancy-level targets. Tenants may also want to set targets with their cleaning, waste and IT contractors. ISO 14001 EMS use targets as part of the management framework, and these need to be achievable and verifiable.

Example of targets in the Australian Government

The Australian Government has a specific policy regarding government energy use. This was originally announced in November 1997 as part of a package of measures in *Safeguarding the future: Australia's response to climate change*, and was launched as the *Energy Efficiency in Government Operations (EEGO) Policy* in 2006. This is an updated version of the Australian Government's 1997 policy, *Measures for Improving Energy Efficiency in Commonwealth Operations*.

Some of the targets the policy sets are:

- energy intensity portfolio targets by the 2011–12 financial year: 7500 Megajoules (MJ)/person/annum for office tenant light and power; and 400 MJ/m^2/annum for office central services
- minimum energy performance standards (generally 4.5 stars on the NABERS Energy Rating or equivalent scheme) in contracts, leases and other relevant documentation for new buildings, major refurbishments and new leases over 2000 m^2
- annual reports on energy performance.

Les Cruikshank checking lighting control board, Medicare.
(Russell Kerrison)

At the building owner level, the Stockland and ISPT representatives interviewed both spoke of NABERS Energy and Water as their main portfolio-wide, short-term targets. These were 3.5 NABERS Energy stars for existing buildings, at least 4.5 stars for new buildings and 3–3.5 stars NABERS Water rating.

For building managers, these broader targets act as guides for setting their own specific building targets based on energy, water and waste volumes.

For tenants, targets can include tenancy ratings with Green Star, but also specific per person and per m^2 of NLA energy, water, material use reduction, and waste targets. Roger Kluske[12] writes:

'I remember the day when the final month's energy data was added into a spreadsheet, [the] result was proved, and the 15% energy reduction was delivered. After six years of work, that was it!

A few close colleagues were conciliatory and peers outside the department knew the effort involved and were happy for me. But energy management is like that; a lot of hard work for no thanks and no rewards. "Energy management" isn't seen as "sexy". However, as we now know, energy management is about the simplest and most cost-effective way of stopping and reversing climate change. It is a good method of saving money and has no adverse determent on business productivity or profits. There are bigger rewards!

On the day when I delivered the 15% energy reduction target I did treat myself to a lovely bottle of Shiraz, in celebration!'

Roger Kluske
(AIRAH)

[12] Roger Kluske – Sustainability Victoria, formerly Manager Sustainability for the Department of Treasury and Finance – Victorian Government Property Group (VGPG).

OWNING AND LEASING – GREEN LEASE

For owners and tenants, the lease is the binding contract that can drive ESD integration into a building. There are specific green leases, which are outlined below, although tenants can include targets on performance in the body of standard leases.

The *Green Lease Schedule* (GLS) is a new type of leasing arrangement developed by the Department of the Environment, Water, Heritage and the Arts and the Australian Government Solicitor (AGS) for government agencies. It contains mutual obligations for tenants and owners of office buildings to achieve efficiency targets. The GLS improves energy efficiency by setting a minimum, ongoing, operational building energy performance standard. It also provides methods for incorporating water and waste targets. The standard used is the *NABERS Energy rating.*

For the building owner, NABERS Energy gives clear expectations and performance parameters, while for the building managers, it gives specific expectations of their services and the tenants engagement. It addresses traditional structural barriers to ESD implementation, such as split incentives between developers, building owners and tenants, by ensuring that the parties with influence over key aspects of energy performance obtain some benefit from implementing the improvements. The GLS provides a transparent legal and management framework, to ensure that the parties identify and address problems promptly and efficiently. The lease is a way of acknowledging the need for cooperation between building owners and tenants (and any relevant service providers and contractors).

DECC — *Sustainable Property Guide* has an excellent Green Lease check-list (see section 3.4B), which gives an overview of the roles of the tenant and the owner in achieving the aims of ESD. It also has model lease clauses that can be used in standard leases (see section 3.4A).

DEWHA green leases can be used and adapted by industry, as Stockland has done, but were initially developed to help the Australian Government meet its energy targets set in the *Energy Efficiency in Government Operations* (EEGO) policy. Green lease schedules have been developed where the rent is gross and the net lettable area of the premises is 2000 m^2 or more. There are slightly different schedules, depending on the percentage of occupancy:

- Schedule A1 (Gross Lease - Tenant occupies 100% of the building)
- Schedule A2 (Net Lease - Tenant occupies 100% of the building)
- Schedule B1 (Gross Lease - Tenant occupies 50-99% of the building)
- Schedule B2 (Net Lease - Tenant occupies 50-99% of the building)
- Schedule C1 (Gross Lease - Tenant occupies 49% or less of the building)
- Schedule C2 (Net Lease - Tenant occupies 49% or less of the building)
- Schedule D1 (Gross Lease - Voluntary)
- Schedule D2 (Net Lease - Voluntary)

'Stockland's recent relocation of its Sydney Head Office to one of its trust buildings led to the signing of a 'Green Lease' which embodies some of the requirements of the Australian Government's EEGO policy as well as the intent of Green Star. Under the lease, we are developing management plans for energy, waste and water. We intend to promote this lease with our tenants as an addendum to their leases.'

Greg Johnson, National Sustainability Manager, Stockland Commercial Property.

Stockland Headquarters, Sydney
(Stockland)

Attaching a GLS to a lease for a commercial building obliges both the tenant and building owner to work towards achieving the operational NABERS Energy requirement.
The emphasis is on prevention and rectification, rather than retribution. The GLS and EMP templates make it easier to identify problems, work out who is responsible, and ensure that appropriate steps are taken to remedy the situation promptly (EEGO 2006:6).

Caution needs to be taken though, as even with a green lease in place, owners and tenants also need to ensure that contracts for facilities management services, cleaning services, waste management services and recycling services all support the environmental performance improvement objectives of the building. Good facilities management requires good facilities management professionals and skilled services should be priced into what owners and tenants are prepared to pay.

Mini case study — State Law, 50 Ann Street, Brisbane — Investa and QLD State Government — energy opportunities written into lease agreements

Space — 25 382 m^2

Driver — State Government lease requirements

Facilitator — Investa's Greenhouse Guarantee

Outcome — $2 million valuation uplift, improvement from 2.5 stars to 4 or 4.5 stars (NABERS Energy), saving $150 000 a year, emission reduction of 16.2% and water savings of 11.7%

Source: www.investa.com.au/reports/2006/sustainability/case_studies/energy_opportunities.asp

Clarification of the opportunities in leasing

Leasing is an opportunity to achieve ESD outcomes in building operations. As discussed above, a lease can encourage all agents involved in a building to work together. Leases can be gross, net, double net or triple net. Gross means that the tenant pays a fixed rate and the building owner pays for most of the outgoings (tenants may still pay for light and power, waste and cleaning services). A net lease means that the tenant pays both for rent and for all other outgoings. A double net lease means that both the tenant and owner pay for maintenance, while a triple net lease means that the tenant pays rent to the owner, as well as all taxes, insurance, and maintenance expenses that arise from the use of the property.

Which type of lease does the market prefer?

Landlords may prefer gross leases because:

- they can compete in the market place on gross lease prices
- if they operate the building efficiently, they make additional profit
- they can reduce the level of aggravation in recovering outgoings from tenants.

Tenants may prefer gross leases because:

- they know what their costs are going to be and can budget for them
- they may not have the skill set to operate the building efficiently and benefit from lower running costs
- they are usually covered for quality of services in the building by special provisions in the lease.

With respect to ESD, gross leases are preferred because:

- lower operating costs should result, as those looking after the building are more skilled at reducing costs and emissions
- landlords can take a long-term view and invest.

With respect to ESD, net leases have some advantages, as they link resource use with the user, encouraging tenants to be more mindful of their energy and water use practices

If gross leasing is the preferred option, then an adequate monitoring, metering and management plan must be in place. Australian Government policy is for agencies to prefer gross leases.

Clarification of the opportunities in property acquisition

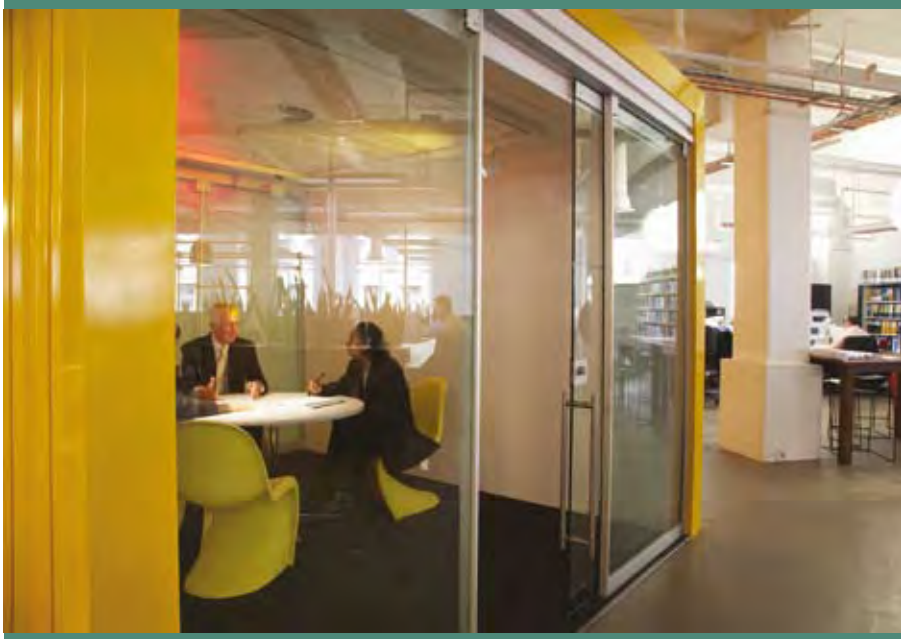
Property acquisition is a major part of the portfolio owner's day-to-day activities. There are significant risks and benefits in which ESD issues, particularly energy and water, are starting to be considered. Both ISPT and Stockland consider the NABERS Energy and Water rating of a building during the acquisition process.

The DECC *Sustainable Property Guide* provides tools to support the process of integrating ESD into property acquisition. It provides an evaluation worksheet and outlines their four step process:

Step 1	Assign responsibility for the sustainability evaluation within the acquisition team
Step 2	Gather information
Step 3	Assess the property and benchmark it
Step 4	Liaise with the property appraisal team
Step 5	Develop a building improvement strategy

David Pullan — Portfolio Operation Manager, ISPT

'Our ESD strategy for new acquisitions depends on what we are planning to do with it … for new acquisitions, for example, at 363 George Street in Sydney, we take it into consideration during the due diligence period … we undertook an NABERS Energy rating and carried out a gap analysis of what was required to bring it up to an acceptable level. Particularly in terms of cost. This is then factored into the acquisition investment model. The question we ask is "how much will it cost us to buy this property [and] to take it from the rating it has got to the rating the market requires?"'



David Pullan and Sebastian Immaraj converse in a Lincolne Scott, reused shipping container meeting room, Melbourne
(Erica Lauthier)

4. Opportunities

OPPORTUNITY 1

Optimising indoor environment quality

Indoor environment quality (IEQ) is a measure of the indoor environment that considers air quality, noise, thermal comfort, visual amenity and control. Indoor air quality, in turn, depends on pollutants released within the space from furnishings and equipment, ventilation rates and cleanliness of the air being supplied.

WHY IS IT IMPORTANT?

IEQ is important because people spend around 90% of their time indoors.[13] Minimising the toxicity of their indoor environment is therefore a priority, particularly when indoor air is shown to be more toxic than outdoor air.[14] The US EPA estimates that 20% to 35% of all workers in modern mechanically ventilated buildings may experience negative air-quality related signs and symptoms.[15] Furthermore, it declares that indoor pollution is estimated to cause thousands of cancer deaths and hundreds of thousands of respiratory health problems each year.

A 1984 World Health Organisation Committee report suggested that up to 30% of new and remodelled buildings worldwide may be the subject of complaints related to indoor air quality.[16]

Several studies have established links between increased productivity and improved IEQ; these can be seen in the *ESD Design Guide* as well as other publications, such as *Green Buildings Pay* (Edwards, 2003) and *The Dollars and Sense of Green Buildings* (GBCA, 2006 and 2008).

Source of Productivity Gain	Potential Annual Savings of Gains
Reduced respiratory illness	$1 - $2 billion
Reduced allergies and asthma	$0.1 - $0.5 billion
Reduced SBS symptoms	$1.1 - $3.5 billion
Increased work performance: improved thermal, lighting, acoustics	$2 - $15 billion
Total	**$4.2 - $21 billion**

Table 8 – *Potential productivity gains in Australia from improved indoor environments*
Source: Adapted from Fisk (2002)
www.yourbuilding.org

IEQ can have a significant impact on the health, well-being and satisfaction of the building's occupants, which in turn has an impact on worker productivity, sick days taken and staff retention. According to CSIRO estimates, the cost of poor indoor air quality in Australia may be as high as $12 billion per year[17], while Fisk (2002) puts the figures at between $4.2 and $21 billion per year (Table 8). Therefore, it is in the best interest of tenants and owners to ensure that workers are content with their surroundings and that their needs are being met, particularly as a large percentage of organisational costs are associated with salaries (see Figure 6).

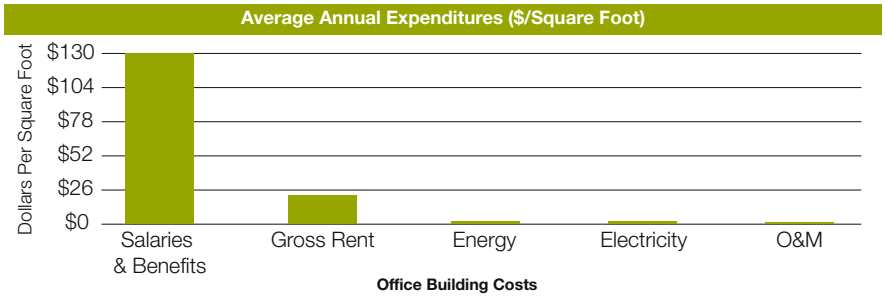
Sick building syndrome

Sick building syndrome (SBS) is the name given to a range of symptoms that arise from exposure to a poor indoor environment. SBS symptoms include[18]:

- headache
- eye, nose, or throat irritation
- dry cough
- dry or itchy skin
- dizziness and nausea
- difficulty in concentrating
- fatigue
- sensitivity to odours.

Building manager

For the building manager, IEQ is crucial because the management of the building, particularly air handling and heating and cooling systems, will significantly affect comfort and can impact on performance. The sections below will go into more detail but the key lesson for building managers, which can be relatively inexpensive, is to give users a sense of control over their space and to respond quickly to any reasonable complaints.



Office Building Costs

Average office employee cost per year	Average square feet of office space per employee	Impact of 1% loss of productivity
$40,00 per year	150 square feet	$2.66 per square foot*

*BOMA and BOSTI estimate $2-$18

Figure 5 – *Relative operational costs*
(Source: Advanced Buildings Benefits Guide 2004:28)

[13] P Wargocki, DP Wyon, YK Baik,G Clausen, & PO Fanger, 'Perceived air quality, sick building syndrome (SBS) symptoms and productivity in an office with two different pollution loads', *Indoor Air*, 1999, p 9, 165–179, and WJ Fisk & AH Rosenfeld, 'Estimates of improved productivity and health from better indoor environments', *Indoor Air*, vol. 7 (3), 1997, pp. 158–172

[14] K Patrick, 'IEQ: coming to a building near you', Property Australia, Property Council of Australia, Sydney, 2004, p. 8

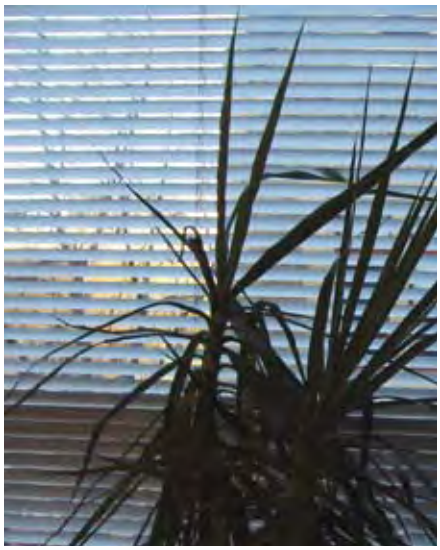
[15] ibid, p. 8

[16] Indoor Air Facts No. 4 (revised) *Sick building syndrome*, 20th April 2007, www.epa.gov/iaq/pubs/sbs.html, Accessed 8/5/2007.

[17] SK Brown, 'Beating the $12 billion cost of polluted air', *CSIRO media* release, www.csiro.au/files/mediaRelease/mr1998/Beating12BillionCostpollutedAir.htm, Accessed 8/5/2007.

[18] Indoor Air Facts No. 4 (revised) *Sick Building Syndrome*, www.epa.gov/iaq/pubs/sbs.html, Accessed 8/5/2007

People's perception of control over their environment affects their comfort and satisfaction … People seemed to be more tolerant of conditions if control opportunities (switches, blinds and opening windows, for example) were available to them.[19]



Blinds help people to be more tolerant of their conditions
(Dominique Hes)

Noise

Internal noise is a significant factor in terms of occupant satisfaction and well-being. It can have a major influence on productivity in the workforce and is recognised as a health hazard by the World Health Organisation.[20] Sources of noise include internally generated noise (photocopiers, speech), externally generated noise (traffic, planes), impact noise (door closure, steps) and noise from building services (lifts, fans). Note that it is common to find productivity scores of -5% because of exposed hard surfaces reflecting noise.[21]

Numerous studies have indicated that lack of environmental control is the single most important concern for people, followed by lack of control over noise.[22]

55 St Andrews Place, task lighting
(Cundall)

HOW DO WE MEASURE INDOOR ENVIRONMENTAL QUALITY?

IEQ is commonly measured by assessing thermal comfort, air movement (air change effectiveness), ventilation rates (quantities of fresh air), acoustics, access to daylight and views, and user control. Some measures are instrumental or observational, while others are based on surveying building users — see Attachment 1 for a summary of measures for ESD.

Underneath these general headings that comprise the elements of indoor environmental quality, what performance targets are used by industry at present? The list below identifies some of these [from *Green Star — Office Design Technical Manual v2*]:

- *Daylighting* - daylight factor of 2% to >60% of floor plate (NLA)
- *Air change effectiveness* - >0.95 (ref. ASHRAE F25-1997)
- *Thermal comfort* - PMV + or – 1 (Predicted Mean Vote)
- *Views* - all seating within 8 m of glazing
- *Occupant control* - of temperature, air flow, internal shading or other
- *Acoustic* - acceptable levels nominated in AS ISO 717, choose lowest (better performance) values
- *Ventilation rates* - fresh air values set by AS1668 Part 2, generally 10 L/second per person.

Measuring indoor air quality

An IAQ (indoor air quality) audit is a systematic inspection of the indoor environment of a building. It provides a profile of the building, its operation and its performance.

The IAQ audit involves a review of existing records to identify original design intent and operational performance. Next, a walkthrough is conducted to identify obvious IAQ problems and clashes between original design intent and current occupant behaviour. This will also highlight areas that have been changed from the original design. Next, a thorough review is conducted of the HVAC plant and equipment to test that it is in correct working order. Finally, the building occupants are interviewed to obtain anecdotal evidence of building performance and to assist in discerning real complaints from those that may stem from sources other than IAQ.[23]

The result of an IAQ audit may take the form of an IAQ management plan, containing guidelines on how to address operational and occupant behaviour issues as well as how to address systems that may need maintenance or adjustment.

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[19] A Leaman and B Bordass, *Productivity in buildings: the 'killer' variables*, www.airah.org.au/downloads/2005-06-01.pdf, Accessed 9/5/2007.

[20] Green Star Office Design Technical Manual, Version 2, 2006, www.gbca.org.au

[21] 'Building green – the sound of silence', *Ecolibrium*, November, 2006, p 10.

[22] A Leaman and B Bordass, *Productivity in buildings: the 'killer' variables*, www.rgc.salford.ac.uk/peterbarrett/resources/uploads/File/KillerVariablesNewChapter2006%20-%20AL.pdf, Accessed 9/5/2007.

[23] AIR-DA26-2004: *Indoor Air Quality*, p. 65.

Air quality health goals – pollutant concentrations

There are no best practice standards as such for NABERS Indoor Environment. Instead NABERS Indoor Environment uses pollutant threshold levels and an overall quality synthesis index calculated from the measured pollutant levels, and their weighting based on their health impacts and ability to effect productivity. For example, particulate matter (PM_{10}) is considered a very high priority pollutant with a weighting of 3, compared with carbon monoxide that is ranked lower as an indoor pollutant.

NABERS Indoor Environment Air quality – pollutant concentrations thresholds:

- Particulate matter (PM_{10}) – 0.05 mg/m^3
- Formaldehyde – 0.10 mg/m^3
- Carbon monoxide – 10 ppm
- Total VOCs – 0.5 mg/m^3
- Ratio of Indoor Airborne

Microbials to Outdoor Airborne Microbials (measured as cfu/m^3) is 1

Measures of thermal comfort and discomfort

PMV (Predicted Mean Vote — test of perceived thermal sensation for a large number of people) and PPD (Predicted Percentage of people Dissatisfied) are methods of predicting user comfort within buildings beyond the standard measure of temperature. They also include air movement, radiant heat and humidity, and can take account of other adaptive comfort measures such as radiant sources, air movement, clothing etc. A successful PMV is usually given as a range. A PMV of + or – 1 for example indicates 90% of the occupants are predicted to be comfortable, and a PMV of + or – 0.5 indicates 95% are predicted to be comfortable.

It follows that PPD is the inverse of PMV. In an existing facility, PMV can be measured with a suite of tools measuring each of the PMV variables, or an actual survey of staff can be taken at intervals to record their level of satisfaction over a given duration.

Occupant satisfaction

It is important to develop procedures to gain an understanding of occupants' satisfaction with their workplace and the building, and to ensure that any problems that may arise are appropriately addressed. This can be achieved by:

- developing a survey that covers occupant thermal, acoustic and visual comfort and their satisfaction with heating, cooling, ventilation, lighting systems etc. Complete the survey annually with staff, collate the results and compile an action list. Ensure that the issues raised are addressed by the appropriate person within an appropriate timeframe
- providing a building user manual that is accessible to all staff. It should contain basic information on how the building and its systems operate and their controls
- conducting regular staff education seminars to ensure that staff understand how the building works and how their actions affect indoor environment quality and other ESD aspects.

Measuring daylight availability

The standard that gives guidance on how to assess this is AS 1680.2.

Measuring noise levels

AS 1191–2002 Acoustics: Method for laboratory measurement of airborne sound insulation of building elements.

APPROACHES TO IMPROVE INDOOR ENVIRONMENTAL QUALITY

Management and operation strategies for maintaining and optimising indoor environment quality relate to thermal comfort, visual amenity, ventilation, pollutants, humidity and noise.

1. Thermal comfort

The building should be operated for occupant thermal comfort, not temperature.

- Optimise thermal comfort in the office environment by obtaining a balance of air temperature (internal temperature range should relate to ambient conditions), air movement, relative humidity and the radiant temperature of surrounding surfaces.
- If carrying out a major refurbishment, undertake thermal modelling to design for appropriate comfort levels.
- Zone office spaces appropriately to reflect usage patterns and activity levels.

Stephen Moses checking the BAS, 50 Lonsdale Street, Melbourne
(Erica Lauthier)

- Provide individual and direct control over the thermal environment for the building occupants by positioning labelled heating, cooling and ventilation controls in a central, easily accessible location. Ensure occupants are able to control the amount of daylight entering their workspace.
- Include an outline of how the HVAC system and controls operate in a tenant manual accessible to all staff.

The international standard for thermal comfort is ISO7730.

Fisk and Rosenfeld (1997) conducted studies where sample calculations indicated that the potential financial benefits of improving indoor environments exceed costs by a factor of 18 to 47.[24]

2. Visual amenity

- For major refurbishments where increased access to windows is possible, optimise the amount of natural daylighting, carefully balancing any heat loss, heat gain or glare problems that may result. As a general rule, the average daylight factor for offices should be 2.5%. To control daylight and minimise glare, install appropriately designed external shading and/or adjustable internal blinds/screens that are able to be directly controlled (automatically or manually) by building occupants.
- Maximise views to the outside by carefully locating the internal spaces and partitions. All workstations should be within 8 m of the façade and have a direct line of sight at eye level to the outside through glazing.
- Optimise the electric lighting levels for each office space by ensuring the correct level of luminance is set according to the tasks and activities undertaken in that space. AS1680.2.2 – 1994 Interior Lighting – Office and Screen-based Tasks specifies recommended values for illuminance for a range of office-based tasks.

Allen McCowan checking light levels at CH_2, Melbourne
(Erica Lauthier)

- Install or retrofit fluorescent lighting with high frequency electronic ballasts in place of low frequency magnetic ballasts to promote energy efficiency, reduce eye flicker and promote visual comfort.
- Provide individual and direct control over the visual environment for the building occupants by positioning labelled lighting controls (e.g. switches, dimmers) in a central, easily accessible location.
- Include an outline of how the lighting system and controls work and how the daylight and glare control devices operate in a tenant manual accessible to all staff.

[24] WJ Fisk and AH Rosenfeld, 'Estimates of improved productivity and health from better indoor environments', *Indoor Air*, vol. 7 (3), 1997, pp. 158–172.

Mini case study — 2% productivity gain can be worth $270/m² per annum

After 30 years of research into the effects of indoor environment on occupants, there is now intensive research and assessment of the effects on occupant productivity and payback via life cycle cost analysis.

Dr Vyt Garnys of CETEC attended the two major IEQ International Conferences, namely, Indoor Air 2005 in Beijing and Healthy Buildings '06 in Lisbon. It was confirmed to him and fellow attendees that a consensus has now been reached that a better indoor climate creates better productivity and improved well-being for building occupants. For example, in one study, relative performance was enhanced by 15% for a 7°C reduction in temperature and that a 2% office productivity gain can be worth $270/m² per annum to employers.

This has culminated in a consensus European protocol, representing 31 countries, for methods of measuring the financial benefit to organisations of their improved IEQ by integrating productivity into life cycle cost analysis of building services.

Dr Garnys previewed these findings at a productivity workshop for IIR's 4th Annual Green Buildings Conference on 28 June 2006 in Sydney (CETEC, 2006).

3. Ventilation

- When redesigning air handling systems and HVAC, optimise the building's ventilation rates, intake of fresh outside air and air change effectiveness, in order to facilitate the distribution of air through the occupied spaces, to eliminate the build-up of stale air and to expedite the dilution and expulsion of indoor air contaminants (e.g. VOCs, body odours).
- Ensure that ventilation rates in mechanically ventilated buildings exceed AS 1668.2-1991. The Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) recommends a minimum fresh air supply of 10 L/second/person. Ensure that naturally ventilated buildings are ventilated in accordance with AS 1668.2-2002. The mechanical ventilation component of a mixed-mode building should exceed AS 1668.2-1991 and be naturally ventilated in accordance with AS 1668.2-2002.

CH_2 wind turbines for drawing air out of the building
(Erica Lauthier)

- For mechanically ventilated buildings that recirculate a proportion of air, install sensors in the return air ducts that monitor carbon dioxide (CO_2) levels and adjust ventilation and fresh outside air supply accordingly. CO_2 sensors are not necessary for buildings that are mechanically ventilated with no air recirculation or for naturally ventilated buildings where air flows can be controlled by the occupants.
- Incorporate an active humidity control system into the mechanical ventilation system that regulates and adjusts the relative humidity in the supply ductwork and occupied spaces.
- Ensure that HVAC controls are regularly checked and adjusted to ensure maximum use of economy cycles. Regularly test HVAC equipment for contaminants and recommission.
- Regularly clean, maintain and service filters, coils and ducts to prevent contaminants developing and to eliminate mould growth.
- Regularly monitor and test indoor air quality. Devices to test indoor air quality are available and there are some firms specialising in this service, including CETEC, a private firm in Melbourne, Australia, and Mobile Architecture and Building Environmental Laboratory (MABEL) from Deakin University.
- Provide an appropriate level of control over the atmospheric environment for the building occupants by positioning labelled ventilation controls (e.g. variable speed fan switches) in a central, easily accessible location.

4. Pollutants

- Ensure that there is no asbestos in the occupied spaces. If there is, it should be removed in accordance with legislation.
- Ensure that any products or materials within the office space contain low levels of volatile organic compounds (VOCs), including those that emit formaldehyde.
- Ensure that printing/photocopying facilities are located in a separate room to the general occupied office space and have a dedicated exhaust to extract the air contaminants.
- Ensure that all thermal and acoustic insulation material and plant refrigerant has zero Ozone Depleting Potential (ODP) and low Global Warming Potential (GWP).[25]
- Ensure that combustion plants are maintained to minimise pollution and greenhouse gas emissions. Ensure that cooling plants are maintained to eliminate water-borne atmospheric pathogens.
- Introduce suitable indoor plants into the office environment. One per person is a rule of thumb used in some projects, like CH_2.

Plants to use for IEQ benefits:

- Weeping Fig
- Peace Lily
- Aglaonema or Silver King
- Kentia Palm
- Dracaena deremensis or Janet Craig
- Areca Palm

Source: Investa Property Group, *Green Lease Guide*

Lincolne Scott Office
(Erica Lauthier)

[25] Green Star – Office Design Technical Manual v2. Emi-1 & Emi-9 www.gbca.org.au

- Develop a procurement strategy where environmentally preferable office products, equipment, cleaning products, processes and services are outlined and implemented.
- Ensure that cleaning and maintenance contracts stipulate that low emission cleaning agents will be used.

The AIRAH IEQ guide DA26 identifies the following indoor pollutants and their sources:

Carbon monoxide	From car parks and tobacco smoke
Carbon dioxide	People
Ammonia	Wet process copiers
Ozone	Photocopiers
Formaldehyde	Particle board within furniture
Other volatile organic compounds (VOCs)	Paints, solvents, adhesives
Methanol	Duplicating machines
Radon	Building materials derived from soil and rock taken from radioactive areas
Trichloroethane	Found in correction fluids
Vinyl Chloride	Found in most plastics

Table 10 – *Recommended maximum concentrations of these pollutants, as identified in the AIRAH IEQ guide DA26, p.39*

GREEN CLEANING OPTIONS

Attention should be paid to the products used during the cleaning process. Products that have low irritant and reduced off-gassing properties should be favoured. Wherever there is a chemical-free alternative these should be pursued, such as micro fibre cleaning cloths. Materials and finishes that require intensive maintenance might be tagged for replacement in future maintenance and capital works programmes.

STRINGENT SITE CLEANING AND DECONTAMINATION DURING REFURBISHMENT [26]

During construction and renovation activities, large amounts of dust and potential contaminants are often generated. Controlling these contaminants can be achieved by:

- suppressing dust with wetting agents
- increasing the cleaning frequency of the site (using high powered HEPA filtered vacuum cleaners is recommended)
- ensuring all surfaces and furnishings are covered or relocated during construction activities
- using cleaning compounds sparingly. Spills of an offensive or contaminant nature should be removed as soon as possible
- keeping areas dry after clean up to avoid moisture accumulation, which could lead to future microbial exposure issues
- keeping porous material, such as carpets and internal insulation in air handlers, dry. Where they become wet, it is recommended they be replaced.

Cleaning requirements for areas of significant hazard will dictate more stringent approaches.

5. Humidity

Optimal levels of humidity will help control the spread and health risk caused by bacteria, fungi, viruses, mites and so forth (refer to Figure 7).

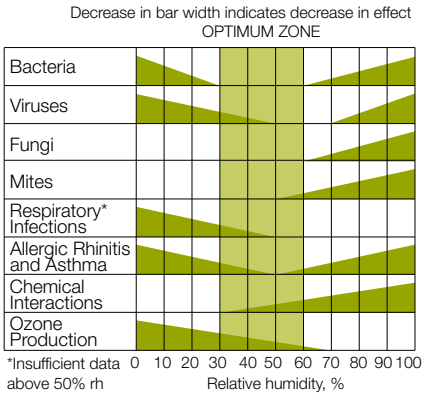


Figure 6 – *Humidity ranges and implications*
Source: ASHRAE Handbook HVAC Systems and Equipment 2004

Periodic testing of humidity should be undertaken, in association with inspections of ductwork and filters.

6. Noise

- Minimise noise by locating rooms with comparable internal noise levels together, by ensuring a clear separation of quiet rooms from noisy spaces and services and utility areas (lifts, toilets), by carefully locating apertures away from noise sources, by limiting air speeds in ducts to 3 or 4 m/s, and by installing acoustic insulation and/or absorbing materials where appropriate.
- Good practice for ambient internal noise levels is considered to be 40–45 dBLAeq in open office spaces and 35–40 dBLAeq in private offices.[27]
- Undertake periodic sound and acoustics measurements to verify levels.

Recycled cardboard meeting room, acoustically isolated from open office, 50 Lonsdale Street, SV, aiming for worlds best practice in sustainable office fitout
(Erica Lauthier)

Resources

Standards Australia
www.standards.com.au

Australian Institute of Refrigeration Air Conditioning and Heating
www.airah.org.au

National Occupational Health and Safety Commission
www.ascc.gov.au

The Australian Environmental Labelling Association
www.aela.org.au

EcoSpecifier
www.ecospecifier.org

International Organisation for Standardisation
www.iso.org

The Chartered Institution of Building Services Engineers (UK)
www.cibse.org/

American Society of Heating, Refrigerating and Air-Conditioning Engineers
www.ashrae.org

Environmental Protection Agency (US)
www.epa.gov/iaq/

[26] AIRAH-DA26-2004: *Indoor Air Quality*, pp. 76-81

[27] Green Star – Office Design v2 Indoor Environment Quality, Technical manual IEQ-12 'Internal Noise Levels' www.gbca.org.au

OPPORTUNITY 2

Minimising energy use

In 1990, Australian greenhouse gas emissions totalled 379.6 Mt/annum CO_2-e, of which 293.3 Mt/annum were energy-related (Commonwealth of Australia, 1997). Of this, 80.9 Mt/annum is attributable to the building sector (EMET Consultants, 1999), which represents 27.6% of energy-related emissions. Figure 8 shows an approximate break-up of where this energy is consumed in a range of climates.

In addition to the resource depletion and greenhouse gas emission issues, energy consumption represents a significant and controllable outgoing cost for building owners and tenants. Good energy performance can also be linked to performance payments in facilities management services contracts, giving these managers a financial incentive to improve energy efficiency.

Energy is charged based on consumption and, on many tariffs, peak demand. Typical energy costs range from $6 to $12/m² per annum for owners and $5 to $10/m² per annum for tenants[28], though this is expected to increase significantly. As a demonstration of this, the price of electricity for the federal government has increased by about 50% on the whole of government electricity contract.

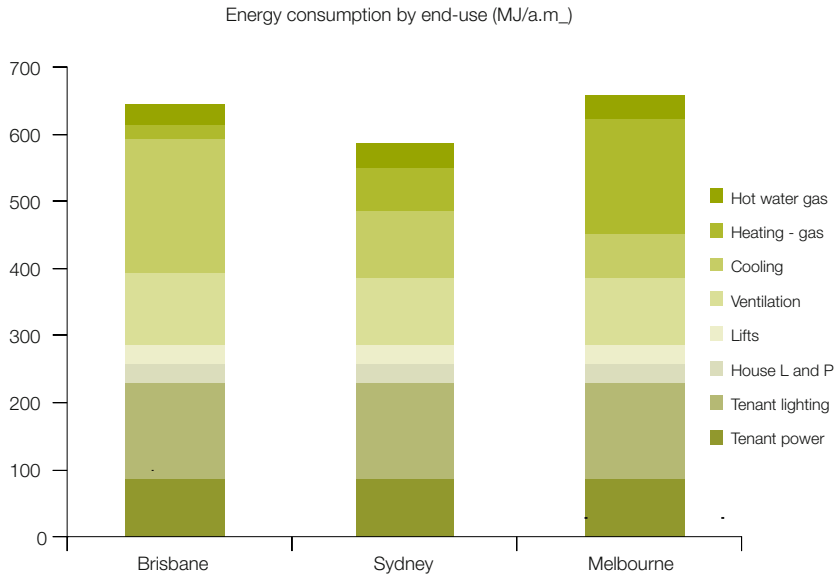


Figure 7 – *Office building energy consumption by end use*
Source: adapted from EMET Benchmarks, 2007

ENERGY – HOW DO WE MEASURE IT?

Energy monitoring

Energy consumption should be monitored at least on a monthly basis to provide ongoing feedback on performance. This can be done manually by walking around, recording each meter and sub meter, or automatically via the building management system (BMS) or as a service from the energy supplier.

Sub-metering should be attached to each tenancy and to systems or areas that use substantial amounts of power (>100KW), such as HVAC plant rooms and data centres.

Monitoring on a more detailed level (weekly, daily, hourly, real time daytime/after hours) for short periods of time can provide valuable insights into patterns of energy consumption. This analysis can extend down to individual items of plant or groups on a single circuit, using trend logging on a BMCS or a stand-alone data logger.

Smart meters are meters that can provide real-time information on energy use and estimated greenhouse gas emissions, and could also advise, for example, half-hourly fluctuations in the price of energy to encourage low use during peaks. These provide real opportunities for both understanding energy use in a building and generating savings by using energy outside peak times.

Equipment that is left operating continuously, even though only required during office hours, can have a large impact on overall energy consumption, as operating hours are often only 1/3 of total hours in a year. A programme to identify and control this equipment will be rewarded.

The Energy Smart Tracker software programme can assist businesses to monitor energy consumption and greenhouse gases, and to minimise energy costs (refer to *Resources* for a link to download).

Energy auditing

An energy auditor will examine the equipment within the building, as well as operating patterns, to estimate the break-up of energy consumption between various systems. This estimate will be adjusted to match patterns of consumption indicated by billing and other energy monitoring. The energy audit will identify opportunities for reducing energy consumption and may extend to a cost/benefit analysis of the options (refer to *Resources* for a list of auditors).

[28] Property Council of Australia, *Energy Guidelines*, PCA, 2001 (Electricity tariff 9 cents/kWh).

John Gerantidis measuring energy use CH_2, Melbourne
(Erica Lauthier)

Re-auditing may prove beneficial after major changes to the building or after several years of operation.

Costs

Between 10% and 20% of annual energy costs should be allowed for an audit, depending on the level of detail and complexity of building services. It may be possible to split costs between the owner and tenant(s).

AS 3598:2000 Building energy audit types		
Level	**Scope**	**Accuracy**
1	Evaluate overall energy consumption for site using billing data, brief report with list of high priority actions.	+/- 40%
2	Site investigation, reconcile energy accounts with loads, recommend improvements with brief description of work required, full written report.	+/- 20%
3	Level 2 plus, on-site metering, detailed analysis of improvements with cost/benefit analysis, presentation to senior managers.	+/- 10%

Table 11 – *AS 3598:2000 Building energy audit types*

Note: An energy audit is different to a NABERS Energy rating. The NABERS Energy assesses the greenhouse performance of the building at a point in time, whereas an audit is more focussed on determining actions to improve energy performance.

APPROACHES TO MINIMISATION

NABERS Energy commitment ratings

NABERS Energy facilitates the ability to set commitment ratings for both base building and tenancy energy operations. This gives clear guidance to the building owner, manager and tenant of what is being aimed for and a way of assessing their performance.

Energy management

OVERVIEW

Energy management is the business of understanding where and when energy is consumed within the building and implementing processes to control it, while ensuring that services are delivered and indoor environmental quality is maintained.

Investa greenhouse guarantee

'The Investa greenhouse guarantee allows tenants easy access to savings in their energy bills through better energy management. The guarantee cuts energy use, greenhouse gas emissions and costs by challenging management practices and incorporating new systems into the design of your new or existing fit-out. Potentially, the guarantee can deliver you savings of up to 20–30% off your energy bill, covering the cost within a year or two and generating rates of return in the order of 20% per annum. If your energy consumption exceeds the guaranteed target, the cost of any energy consumed in excess of those targets will be refunded and Green Power will be purchased to deliver the reduction in greenhouse emissions. If the tenancy performance is better than the guarantee, you keep the savings.'

(Source: www.investa.com.au/Upload/News/News.2005629.IPG%20Greenhouse%20flyer.pdf)

COMMITMENT

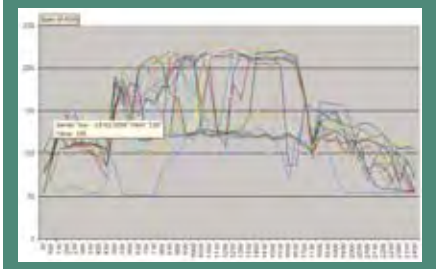
A successful energy conservation programme relies on the ongoing commitment of upper management to planning, funding and educational aspects. It is important to give responsibility for the programme to one individual, so that it becomes a part of normal business operating and review processes and not always left until there is 'spare time'.

Mini case study — the impact of poor energy management

A building within the Australian Government, simply through poor management of its energy system, used 16% (or 186 200 kWh/yr or around $28 000 per year[29]) more energy than it should.

This consisted of:

- energy using systems being on when they weren't required on public holidays, leading to 26% or 6200 kWh/year unrequired energy use
- energy using systems being on when they weren't required on weekends, leading to 29% or 80 000 kWh/yr unrequired energy use
- energy using systems being on when they weren't required on weekdays, leading to 21% (off-peak hours) or nearly 100 000 kWh/yr unrequired energy use.



Figures 8 and 9 – *Well functioning system showing consistent energy usage compared to an erratic system*
Source: AGO

[29] Note that this is as of early 2007 prices; expectations are that this will increase significantly over time.

Maintenance

A programme of regular maintenance must be designed to reflect the specific equipment in a building. It should also be designed to maintain each item of equipment in peak condition and to detect problems. In many cases, a damper or valve can stick open or shut and the system will simply work harder to compensate.

Under BCA Section I, maintenance for energy efficiency is now mandatory for new and refurbished buildings (sample activities are shown Table 11).

From time to time, it may be prudent to review new technology becoming available in each of the key energy end-uses. The asset plan should identify equipment that is nearing the end of its economic life and highlight opportunities for energy-efficient replacement.

Energy Allstars makes it straightforward to find and compare the most energy efficient appliances and commercial and industrial equipment for sale in Australia (see www.energyrating.gov.au/library/details200517-allstars-database.html).

Action	Interval months	Explanation
1. Check fan operates.	1	
2. Check for vibration, bearing noise or overheating.	1	Vibration can be due to out of balance of the fan rotor or failure of one of the bearings. Heat or noise from the bearing will confirm that this is the source of the problem and appropriate steps can be taken to replace the offending bearing. It is frequently necessary to replace both bearing as vibration from one can cause damage to the second.
3. Adjust belt tension as necessary, check for wear.	1	See 5-150 Drives for the steps to be taken.
4. Check mounts and holding down bolts for security.	1	
5. Check drive and drive shaft guard firmly in place.	1	All drives should be checked in accordance with the appropriate section of “5-150 Drives”.

Table 12 – *Sample table from AIRAH manual: DA19 HVAC&R Maintenance.*

Equipment purchase

When equipment is being purchased, either as a new item or as a replacement for an existing item, an opportunity arises to improve energy efficiency. An estimate of the annual energy consumption and cost should be made. High efficiency equipment may cost more to purchase, but savings in energy can quickly outweigh the difference in purchase price, so life cycle costing should be used to support the decision. Improving the efficiency of equipment located in an air-conditioned space will also save cooling energy.

When replacing existing equipment, current and future requirements should be evaluated, rather than just replacing ‘like for like’. The requirements may have changed since the original equipment was selected and/or the actual requirements may be able to be determined from system measurements.

Commissioning

Commissioning is a process of confirming that systems and controls are operating the way the designers intended. Air and water systems are balanced to ensure that the correct flow rates are available in each duct or pipe. Commissioning is normally done when construction is completed.

Re-commissioning may be required when tenancy changes occur or to solve operational problems after a number of years. For instance, valves, dampers and other controls may have been adjusted in an ad-hoc manner and this may have ‘upset’ the system balance.

Tony Dorotic — National Sales & Marketing Manager ECS, 40 Albert Road

‘The most important lesson from this project was the importance of metering.

For example with the night purge, our intention was that the windows would open automatically when the climatic conditions were right and cool the building. The BMS programmer understood this to mean that after 6pm all the exhaust fans needed to go on ... so in the first winter in this building, we would spend all day heating up the building and at 6pm, it would all get sucked out!

… to go back to the metering, our solar panels did not seem to be working; without the meters we would not have found out that the inverters had not been connected properly and would just have assumed that things were working. With the hot water solar system, we found that our boosters were continually on and we weren’t getting any of the hot water from the solar system. Through looking at the meter information, we found that the temperature sensor in the solar hot-water system was not connected correctly so the system continually thought the water wasn’t warm enough and just used the gas hot-water system. So we had tanks of solar hot water sitting there, not being used.’

Sebastian Immaraj checking meters measuring water, electricity and gas at 40 Albert Road, Melbourne
(Erica Lauthier)

Commissioning return air: testing to ensure required air rate is being achieved
(Source: AIRAH)

The top ten deficiencies discovered when commissioning new and existing buildings[30] are:

- incorrect scheduling of HVAC and lighting equipment
- incorrect cooling and heating sequences of operation
- incorrect calibration of sensors and instrumentation
- lack of control strategies for optimum comfort and efficient operation
- malfunctioning air and waterside operation
- under-utilised computer-based control systems
- short cycling of HVAC equipment, leading to premature failure
- non adherence to design intent and missing building documentation
- lack of training for building operators or service contractors on complex systems
- missing specified and paid-for equipment.

[30] Portland Energy Conservation Inc., Benefits Guide™ A design professional's guide to high performance office building benefits, PEC, 2004 p.19

Useful case studies

Department/ Agency	Case study topic
Department for Victorian Communities	Energy management
Victoria Police	Variable speed drives for the World Trade Centre
Department of Sustainability and Environment	The Arthur Rylah Institute
Equal Opportunity Commission	Energy reduction at little or no cost
Department of Innovation, Industry and Regional Development	Switch Off campaign scores big results
Department of Infrastructure	Energy savings
Victorian Government Property Group	Energy improvement project at Geelong State Office

Set of case studies outlining specific initiatives undertaken in various government departments in Victoria.
(Source: www.energy-toolbox.vic.gov.au/success_stories.html, Accessed 22/5/2007)

Education

Education is a key component of a successful energy management programme. The building and equipment can be designed or selected for energy efficient operation, but if equipment is left switched on or incorrectly controlled, then good energy performance will remain just a target. The responsibilities of various personnel are outlined below:

Managers
Need to understand the major energy consumers and the plans for energy management.

Service personnel
Need to understand how each system should operate and how to check that controls are working as designed.

Occupants
Need to understand the influence their switching habits can have on energy consumption. Well-informed and motivated staff can alert operations staff to potential problems (e.g. I was in on Saturday and the air-conditioning system was still running) and can also identify energy saving opportunities. Energy conservation should be included in induction procedures.

Cleaners
Need to be instructed to switch lights ON and OFF as they work through the building.

Security staff
Need to know which items of equipment can be switched off after hours.

Energy procurement

Different energy sources have different costs and different greenhouse gas coefficients. Substituting one source for another may save energy costs or emissions.

In particular, gas is approximately one third of the cost of electricity per unit of metered energy and has approximately one eighth of the greenhouse gas emissions compared to electricity. Opportunities to replace electricity include gas hot water, absorption chillers, co-generation and gas engine drives. Gas boosted solar hot water systems may be appropriate for some buildings.

Accredited green power can be purchased at a premium in order to reduce greenhouse gas emissions. Alternatively, carbon offsets may be purchased that aim to balance the emissions associated with energy consumed by planting trees or investing in renewable energy — look for offsets certified under the Greenhouse Friendly label.

Renewable energy may be directly incorporated to actively utilise solar, wind or geothermal energy sources to reduce fossil-based energy consumption. Rebates are offered by various governments to reduce the cost of installation.

ENERGY CONSERVATION OPPORTUNITIES

This section gives an overview of energy conservation opportunities that arise during a building's operational phase. Naturally, the benefits of heating and cooling related strategies will vary with climate.

Mini case study — Martin Street and smart meters

Analysis of the smart metering data at 39 Martin Place Sydney showed a mismatch between occupation and operating hours that led to a reduction of over 80% in overnight base load from 400 kWh to 75 kWh. This, together with other initiatives, saved $9 660 per annum.

(Source: DECC Sustainable Property Management Guide)

HVAC

Heating, ventilating and air-conditioning (HVAC) plants can account for up to 70% of all energy consumed in a commercial building. A range of strategies exist for maintaining and/or improving the energy efficiency of HVAC systems.

- Control settings — operating schedules and thermostat settings should be adjusted to suit the current tenant's requirements. Irregular requirements for after-hours operation should be handled with 'on demand' controls, rather than just extending the operating hours.
- Maintenance schedules should be developed to show up operating problems and verify correct operation. They should require the service person to read and record a gauge reading, rather than just 'ticking a box'.
- Sub-metering of major HVAC plant groups will enable performance to be monitored and improved.

HVAC controls are initially commissioned to provide comfortable conditions for the occupants. Considerable scope exists to fine tune these controls to improve efficiency.

Mini case study — HVAC upgrade and tune-up

The HVAC system for a 19 000 m^2 office building in Parramatta, NSW was upgraded and tuned-up, which resulted in the building's ABGR (now NABERS) improving from 1.5 stars in 2002 to 3.5 stars in 2005. The HVAC upgrade included:

- installing new Variable Speed Drives (VSD) on chilled and condenser water pumps
- recommissioning Variable Air Volume boxes and fan VSD controls
- repairing leaking water control valves and correcting fresh air damper operation
- adjusting chilled water and condenser water temperature controls
- switching off pumps with the related chiller.

Total cost was $98 000, excluding replacement of the Building Management and Control System ($5/$m^2$).

(Source: Parramatta CBD Greenhouse Leaders Programme, ABGR Re-Rating Report, 2005)

Ventilation

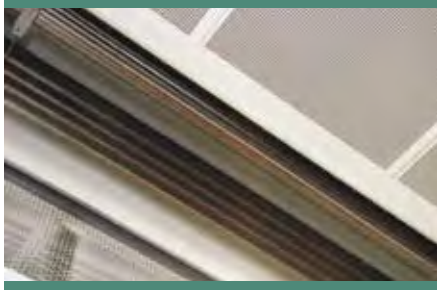
Good ventilation is critical to indoor air quality, but at times ventilation carries an energy penalty. When ambient temperatures are comfortable to cool, increased ventilation rates can save cooling energy, but when ambient temperatures are too cold or too warm, there is additional heating or cooling energy required. However, some buildings are able to achieve good energy efficiency while also using 100% fresh air (no recirculation).

AS1668 Part 2 1991 sets out minimum ventilation rates required by the BCA for various space usages, based on design occupancy levels. From an energy point of view it makes sense to control ventilation rates to this minimum level when ambient temperatures are too cold or too hot, but this should be balanced with negative impacts on IEQ. Control systems are available to sense occupancy levels (using CO_2 sensors) and increase ventilation levels when needed. Similarly, car park ventilation systems can be controlled using CO_2 sensors.

Mini case study — retrofit of chilled beams into 500 Collins Street

When discussing his initial scepticism about the 'greening' of 500 Collins Street, Harry Hullin reflected: 'you know, I am a convert to this sustainability stuff … I was very interested when we started on the first floor to retrofit beams [chilled beams]. I thought 'this isn't going to work' … but then we had a function and they came on and worked! It is really a clever and logical system ... the more heat that goes up, the more cooling occurs, which comes down … and it provides a better working environment for the tenants ...

… we did productivity studies of a couple of levels in their old offices and then their new ones (with the chilled beams, etc.). You know, the ones where we ask them how they felt, what they thought their levels of comfort were and how many sick days they had … we found a marked improvement in how they felt about their work and their productivity …'. (Results of this survey are shown in Figure 10.)



500 Collins Street chilled beam
(Erica Lauthier)

Figure 10 – *Overall satisfaction study 500 Collins Street, Melbourne*

Lighting

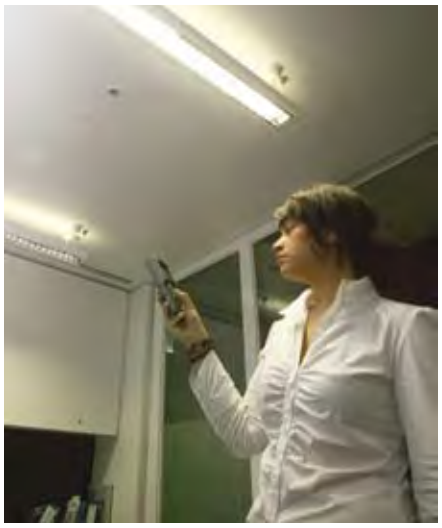
Energy efficient lighting involves getting the right level of light to each space using the most efficient combination of lighting fixtures and controls. Perimeter groups of lights can be automatically dimmed or switched off in response to natural daylight levels. The right level of lighting must be determined based on the tasks being performed in the space.

Mini case study — Treasury Place, Melbourne

Access to daylight and high quality sources of artificial lighting are vital for good office conditions, leading to productivity gains and less eye strain and associated issues. At Treasury Place, the following initiatives were put in place to achieve this:

- In 1999–2000, an Energy Conservation System (ECS) lighting control system was installed through both buildings.
- Most meeting rooms were fitted with occupancy sensors and the buildings were re-tubed at the same time.
- In 2003, the automatic 'on' time was revised *from* 7am to 7.30am. As an aid to staff, appropriate (high quality) signage was installed adjacent to light switch' panels and 'out of hours' buttons. The automatic 'off' time is 7pm. The cleaners were also engaged to assist in energy management by ensuring that lights in all enclosed offices and meeting rooms are switched off when cleaning is completed.
- A lighting survey found areas where lights were on all the time and this was corrected.
- The opportunity was also taken to selectively remove fluorescent lamps in back-of house areas and to label fittings appropriately (the signs stated that the tube was *removed on purpose – do not replace*). Timer delay switches were installed in selected areas, such as lighting over compactuses.

These changes contributed to the significant overall energy saving of 15% for this building, with the new lighting strategies specifically resulting in savings of $74 900 a year.



Lisa Feleppa using dimmer at 40 Albert Road, Melbourne
Erica Lauthier

EFFICIENT LIGHTING AND CONTROL

Existing lighting fixtures can be improved by removing excess tubes, fitting efficient tubes and ballasts, adding reflectors and replacing old, cloudy diffusers. Typical controls improvements are grouping of light switches into more logical zones, motion detectors, and dimming in response to daylight levels. Low glare ambient lighting, combined with task lighting appropriate to each area, can produce an efficient lighting outcome.

Office equipment

The modern office environment contains an array of electrical and electronic equipment that enables business to function, such as computers, printers and photocopiers, refrigerators, microwave ovens and coffee machines. This equipment not only consumes substantial amounts of energy, but also contributes to the load on the cooling system.

Successful energy management of office equipment involves:

- purchasing energy-efficient equipment
- operating equipment in the most efficient manner
- switching equipment off when it's not needed.

PURCHASING POLICY

It is important to ensure that energy consumption is considered when equipment is being purchased. Annual energy consumption and cost can be estimated. A multiplier of 1.3 should be applied to include the impact of cooling energy required to remove the heat gain from equipment. For photocopiers, this analysis should extend to all consumables: (paper, cartridges etc.). The cost of operating equipment can quickly overtake its purchase price.

OPERATION

Most computers in use today have ENERGY STAR energy saving features built in, but are not always 'enabled' to use these features. Enabling energy saving simply involves changing some settings within the 'control panel' and can be done manually or automatically on a single PC, or across a company via its network. EZ Wizard is a free, simple programme that will enable power management on a monitor in seconds. www.energystar.gov/ia/products/downloads/PMWiz-XP.exe

If left inactive, ENERGY STAR enabled computers enter a low-power mode and use 15 watts or less. New chip technologies make power management features more reliable, dependable, and user-friendly than even just a few years ago. A key recent improvement is the ability to 'wake' on a signal from a LAN, which enables software updates, system settings and the like to occur after hours.

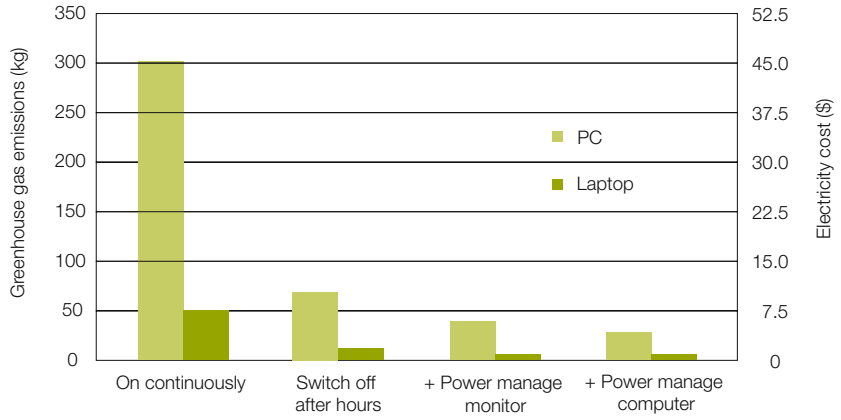


Figure 11 – *Annual greenhouse gas emissions and electricity consumption for PCs and laptops.*
(Source: Green Office Guide)

After hours and weekend operation

There are 168 hours in a week, yet most offices are only used for 50 to 60 of those hours. In the 118 hours that the office isn't occupied, anything unnecessarily left on consumes more than twice the energy it does during occupied hours. Standby mode reduces this energy waste, although not to zero.

SUMMARY OF OPPORTUNITIES

Outlined below is a summary of opportunities for minimising energy use:

- Tenant operations — consider energy efficiency when purchasing new equipment and implement a staff energy awareness campaign.
- Maintenance — develop maintenance schedules and report forms specific to the building, and check for correct operation of HVAC controls.
- Management — set energy targets, monitor and report energy consumption, audit energy on acquisition and periodically thereafter, educate staff and tenants, install sub meters and obtain NABERS Energy ratings.
- Level 1 refurbishment — review lighting fixtures and controls, and reduce solar heat gain.
- Level 2 refurbishment — consider alternative energy sources, HVAC upgrade and tune-up.
- Re-occupancy — ensure there is training for new tenants, introduce efficiency benchmarks into leases, and rebalance HVAC.

RESOURCES

Australian Building Greenhouse Rating: **www.nabers.com.au/new/default.asp**

Developing an Energy Management System **www.sustainability.vic.gov.au/resources/documents/Module4.pdf**

EMET Consultants and Solarch Group, *Baseline Study of Greenhouse Gas Emissions from the Commercial Building Sector*. Report for AGO. May 1999.

Energy Allstars makes it easy to find and compare the most energy efficient appliances and commercial and industrial equipment for sale in Australia **www.energyrating.gov.au/library/details200517-allstars-database.html**

Minimising office energy use after hours, on weekends and on holidays at **www.energy-toolbox.vic.gov.au/summer_push/minimising_office_energy_use_after_hours%2c_on_weeke.html**

Energy Smart Tracker — CD with information at **www.epa.vic.gov.au/greenhouse/greenhouse-management-toolkit.asp**

Green Office Guide: A guide to help you buy and use environmentally friendly office equipment **www.energyrating.gov.au/library/pubs/greenofficeguide.pdf**

HVAC ESD training is available from: **www.airah.org.au**

Registered energy auditors can be found at **www.airah.org.au/ene_aud.asp**

Energy Smart WA **- http://www1.energysmartdirectory.com/**

Sustainability Victoria – Buildings page: **www.sustainability.vic.gov.au**

The Australian Energy Star website **www.energyrating.gov.au/library/details200517-allstars-database.html** has information about how to purchase and operate energy efficient office equipment.

Working Energy website of the AGO provides a simple and structured solution for ensuring the more efficient use of energy in Australian Government operations and achievement of energy performance targets through development of best practice.

Printed Resources

Tenant energy management handbook is a step-by-step guide to assist commercial tenants and building managers in using energy more efficiency. Hard copy available from offices of the Property Council of Australia.

Energy guidelines was published by Property Council of Australia in 2001. Covers setting energy targets and operation, maintenance issues.

Sustainable property guide, to be published in 2009 by Department of Environment and Climate Change, gives an excellent approach to improving sustainability in the operating phase.

OPPORTUNITY 3

Water conservation

WHY IS IT IMPORTANT?

Water scarcity is a major issue for Australia. While buildings, including residential ones, only consume 11% of water in Australia (the major user being agriculture at 65%)[31], it is easy to get 20%–50% reductions in building use through simple measures. It is also worth mentioning that though office buildings only use such a small percentage of the total water in all catchments in Australia, they are drawing from urban catchments, and therefore have a much larger impact on the water availability in cities.

The main driver for water efficiency in office buildings comes from restrictions that are being placed on water usage. These restrictions are in place in cities because of the limited supply of water from their catchments; Melbourne's catchments, for example, have dropped under 30% capacity in 2007. The main uses of water in a commercial building are amenities, HVAC and leakages (see Figure 13).

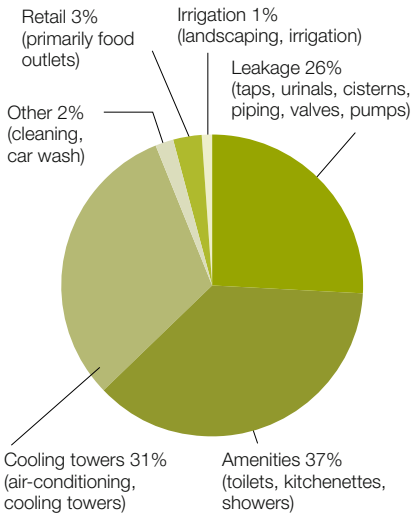


Figure 12 – *Water usage figures*
Source: *Water Efficiency Guide* (DEW 2006:5)

[31] Australian Bureau of Statistics, *Water account, Australia, 2004-05*, cat. no. 4610.0, ABS, Canberra, 2006.

Water use and impacts on owners, managers and tenants

For owners, water efficiency can ensure the continued viability of their assets (as is the case for energy). Several of the large property portfolio managers interviewed for this guide mentioned that when they looked at the acquisition of any property, they carried out an NABERS Water and Energy assessment. The performance of the building then became a factor in the decision about whether the building was worth purchasing.

For managers, water is now a critical operational consumable that needs to be monitored and reported on, as energy has been for the last ten years. If the pressure is on building owners to ensure that their buildings perform, then it is up to the building manager to ensure that the building is managed to facilitate this.

For the tenant, the main implication of considering ESD and water is ensuring processes are in place within the business to support water use minimisation. For example, if waterless urinals are in place and the tenant manages the cleaning contract, they need to ensure proper procedures are communicated on the management and cleaning of these urinals. Tenant behaviour will influence the water used through leakage and amenities. Tenants can alert building managers if there are leaks and ensure that toilets, showers and taps are used effectively.

The main benchmarks used nationally to rate a building's water performance are those developed within the NABERS framework. A score of 2.5 stars represents Australian average practice, while 5 stars represent possible best practice. Most companies spoken to have said they are aiming at 3 to 4 stars as a minimum for their portfolios.

HOW YOU MEASURE IT?

As with energy, the key to the management of water in the operational phase of a building is to measure consumption through adequate sub-metering. This data can then be used for comparisons with benchmarks, audits, ongoing planning and improvement.

The *Water Efficiency Guide* developed by the then Department of Environment and Water Resources (DEW, 2006) provides a thorough outline for carrying out a water management plan, auditing and effective water minimisation.

Water audits are a key part of water management. There is no standard for carrying out water audits, though many lessons can be learned from energy. A variety of companies can deliver water audits. The *Water Efficiency Guide* (DEW, 2006) divides audits into basic and detailed, depending on the project, suggesting that the basic audit be used to highlight the benefits of carrying out a comprehensive audit while already identifying key problem areas.

The audit scope should include:

- a breakdown of usage across the site and site activities, reconciled against total metered water consumption
- inspection of equipment, devices and processes
- investigation of consumption by major equipment, devices and processes

Level	Sydney	Melbourne	Canberra	Adelaide	Brisbane	Perth
1 star	1.73	1.03	0.99	1.08	2.53	1.41
2 stars	1.39	0.86	0.83	0.9	1.99	1.14
2.5 stars	1.21	0.77	0.75	0.8	1.72	1.01
3 stars	1.04	0.69	0.67	0.71	1.44	0.88
3.5 stars	0.87	0.6	0.59	0.62	1.17	0.75
4 stars	0.7	0.53	0.51	0.53	0.9	0.61
4.5 stars	0.52	0.43	0.43	0.44	0.62	0.48
5 stars	0.35	0.35	0.35	0.35	0.35	0.35

Table 13 – *NABERS benchmarks for office buildings (kL/m²/year).*

- investigate usage trends and patterns
- preparation of Key Performance Indicators (KPIs) of consumption (using baseline data) in relation to an appropriate business activity indicator
- comparison of monthly KPIs with industry benchmarks considering influential factors, such as climate
- linking equipment to water usage through a flow chart
- identification and feasibility assessment of water savings measures — simply noting cost is not a true assessment of the value of water (adapted from *Water Efficiency Guide*, DEW, 2006, p.11).

Hot water related costing should also include considerations of energy prices.

Tony Dorotic — National Sales & Marketing Manager ECS, 40 Albert Road

'…our water system is another story; if we didn't have meters and didn't have it all online for anyone to check, we would never have had the following interesting story to tell. I got to work early one Monday morning and saw an email from someone from outside the organisation saying that we should check our plumbing because we had a significant leak. What had happened was that we hadn't had rain or grey water to fill our tanks and the sensor telling the tank to use main water was not working, so we had no water for flushing our toilets. So I went down there and overrode the system and just filled both tanks up with main water, so our water use spiked significantly … that is, there was no leak, but if there had been one, we would have been alerted …'

Craig Middleton checks water tanks at 40 Albert Road
(Erica Lauthier)

Metering, as discussed previously, is crucial to understanding what is happening in buildings. The story below from 40 Albert Road, highlights the potential of thorough metering. The use of sub-metering allows for the apportioning of water use to tenancies, equipping them with the information needed to manage their own water use.

Common issues with metering (DEW, *Water Efficiency Guide,* 2006, p.11) include:

- no metering at all for a building
- no sub-metering for sections of a building (e.g. base building or retail services)
- no sub-metering for individual tenancies
- meter oversized for the actual load.

Regular monitoring of meters and sub-meters, either manually or by connection to the building management system is necessary; this is particularly useful in establishing base flow rates and then identifying leaks when water use exceeds normal variability ranges.

APPROACHES TO MINIMISATION

There are many water minimisation opportunities and specific initiatives that can be used as part of the management plan. Using the water management plan, a systematic approach can be applied to the building. The *Water Efficiency Guide* (DEW, 2006) provides resources and guidance on this process. Figure 17 shows the priority of activities.
As with energy, the first step is good housekeeping and data collection, either through an audit or installation of meters and sub-meters. The next steps are to review and assess where the major water use is and if it is required. Next, it is simple to look at the data and develop priorities for areas where water use can be reduced. The last two stages relate to re-use and recycling opportunities. All of these will be discussed in more detail below.

Using the green lease to encourage water reduction

Tenants can encourage good water practice by setting water intensity targets as part of their green lease agreement. NABERS Water offers a clear way of doing this, suggesting that targets should be set as kL/m^2 NLA and/or at the desired NABERS Water star rating.

Figure 13 – *Hierarchy of action in water management*
Source: Water Efficiency Guide (DEW 2006:6)

Reduce — water reduction opportunities

There are many opportunities that can be implemented quickly and cheaply to reduce water consumption.

…studies show that reductions of up to approximately 80% of scheme water demand and 90% of sewage discharge can be achieved in a sustainable commercial building compared to a conventional building, through the integration of innovative water efficiency measures, rainfall capture and use, treated effluent re-use and evapotranspiration through roof gardens.[32]

'The potential savings available from Australian Government buildings and operations are between 4296 and 7405 ML/year. This is based on savings assumptions by building type developed through the desktop study and site assessments. Achieving these savings would cost between $8.2 and $14.6 million based on cost assumptions derived from empirical case studies in the literature.'[33]

Leak avoidance

One way of detecting leaks is to install adequate sub-metering. However, even with sub-metering, leaks may still take a little while to be detected by the building management system. Communicating with tenants is a clear and simple method to ensure leaks are detected. The building occupants need to be aware of where and to whom they can report any leaks. Clear, concise signage will help with this communication. It is important to promptly fix any reported leakages for positive feedback. Tenants do become desensitised to leaks over time, so regular inspections of all facilities are also recommended with regular reporting of performance to maintain motivation. It is important to carry out frequent inspections of toilets, urinals, taps and showers, particularly in areas where tenants do not have access.

Choosing efficient appliances — labels

The Water Efficiency Labelling Scheme (WELS) introduces mandatory water efficiency labels for all showerheads, washing machines, toilets, dishwashers, urinals and some types of taps, as well as minimum water efficiency standards for toilets, and voluntary labels on flow control devices.

Smart Approved WaterMark is Australia's water saving labelling program for products and services which are helping to reduce outdoor water use. The voluntary and not-for-profit Smart WaterMark was set up as a sister scheme to WELS. Both WELS and Smart WaterMark are being used as criteria within water rebates. For a list of approved products and services visit: www.smartwatermark.org

Toilets and urinals

A dual flush toilet (4.5/3 litre) replacing a single flush unit (11 litre) in an office building will save approximately 170 litres each working day (60kL per year) in a female toilet. This represents an annual financial saving from potable water alone of about $150 per year (per unit) in Sydney.

Waterless urinal – 40 Albert Road, Melbourne
(Erica Lauthier)

For urinals, there are now many options to minimise water usage. Waterless urinals avoid the need to use water altogether. Some require a change in the cleaning regime and have a larger ongoing cost, while other newer models have overcome the need for the cartridge. New products have also come onto the market that can be used to retrofit existing urinals. Small dissolvable cubes contain surfactants and microbes, which allow for an odourless, waterless, effective urinal.

The Pier Hotel in Port Lincoln, South Australia, recently saved 80 000 litres of water in three months by using the cubes, which were nominated for an annual SA water industry alliance award.

Source: *Water Efficiency Guide* (DEW 2006:24)

[32] V Chanan, S White, M Jha, & C Howe, 'Sustainable water management in commercial office buildings', paper presented at *Innovations in Water: Ozwater Convention & Exhibition*, Perth, 6–10 April, 2003.

[33] T Berry, N Edgerton, G Milne, M Jha, & S White, *Feasibility study for a policy on water in government operations*, ISF, Sydney, July 2004.

The *Water Efficiency Guide* (DEW, 2006) has many more suggestions on water saving options. Some of the key opportunities it outlines are:

- *Showers* — typical showers use 15–25 litres per minute. Instead, use flow regulators to reduce pressure (but take care to provide adequate spray), or replace shower heads with efficient ones that only use 6–7 litres of water per minute.
- *Taps* — typical taps discharge 15–18 litres per minute. Low-flow and aerating models may use as little as 2 litres per minute, depending on the intended application.

Cooling towers

The *Water Efficiency Guide* (DEW, 2006) discusses opportunities for reducing cooling tower water loss, including overflow, leaks, evaporation, bleed, drift, splash, plant management, maintenance, water treatment and tower water and air infiltration. The publication not only gives guidance on how to minimise these impacts, but presents the case for sub-metering and connecting them to the BMS. The other option is to use a system that is based on air chillers, which reduces water consumption dramatically, can reduce energy use and eliminates chances of legionella. The drawbacks of these systems include increased special requirements, such as space.

Sprinkler water testing

- Ensure sprinkler testing water can be captured for re-use.
- Preferably, use captured water for potable uses.

Water sensitive landscaping (Xeriscape)

- Use native and indigenous plants for the garden, as they require less water compared to exotic varieties.
- Use mulch in the landscape to minimise the loss of water from the soil by evaporation.
- Schedule the irrigation time using timer controls, so that irrigation is done after sunset, to minimise loss of water to evaporation.
- Install soil moisture sensors.

Source substitution

Other than water efficiency measures, three additional options for reducing water use from mains are:

(1) collect and use rainwater

(2) re-use grey water

(3) recycle all waste water (including black water). There may be additional substitution options involving stormwater from other surfaces, such as roads and car parks.

Mini case study — extensive garden water retention system, Investa

The Kings Row complex on the outskirts of the Brisbane CBD was heavily affected by water restrictions, particularly in maintaining its gardens. To still comply, yet retain their gardens, they used a water-storing product called Hydrocell. This product was injected into the soil under the grass and plants. This has reduced water consumption by 40% (9.45 million litres), by capturing moisture in the soil after rain. Figure 14 demonstrates these savings and savings from other measures:

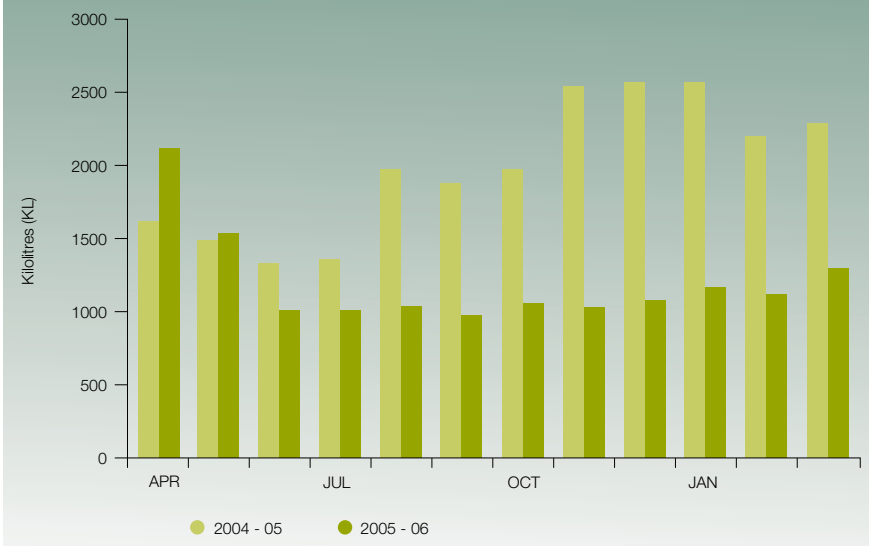


Figure 14 – *Water consumption at Kings Row*
Source: Investa (Brisbane Water Invoices)
www.investasustainability.com.au/reports/2006/sustainability/case_studies/water_restrictions.asp

Rainwater

This is water collected off the roof or other surfaces of a building. It is dependent on collection area, rainfall and the amount of space available for water storage tanks.

Mini case study — Investa rain water collection and use

At 73 Miller Street, North Sydney, a system was installed to capture rainwater from the roof. This was then held in the basement and pumped through a dedicated riser to drip feeders for use in the daily irrigation of balcony and rooftop gardens.

Source: www.investasustainability.com.au/reports/2006/sustainability/case_studies/rainwater_capture.asp

Grey water

Grey water is the water from showers, clothes washing and non-kitchen sinks. For most commercial and other government buildings the amount of grey water is not significant, since there is little water generated from these sources. Local regulations will need to be investigated with regard to the classification of grey water. In some states, treated grey water is seen as waste (or black) water, and therefore requires approval from the appropriate authorities before being re-used. In Canberra, the John Gorton Building has been recycling grey water since the late 1990s.

Waste or black water

Black water is the water from kitchens and toilets. Recycling this water is possible with current technology, but requires appropriate permits and a thorough system of maintenance and monitoring. There are two types of recycling — biological (using bacteria and worms) and mechanical (using filters). Some examples include the 60L building in Melbourne (a mixed system), the Bendigo Bank HQ in Bendigo (which uses a biological system), and CH_2, which has a mechanical system.

Recycled water pipes for car washing, CH_2, Melbourne
(Erica Lauthier)

Stormwater

Stormwater is the rainwater that runs off surfaces such as roads and roofs into the stormwater system. This water is a potential resource, but currently it is mainly collected as run off into rivers, lakes and the ocean.

For commercial buildings, the main issues with stormwater (adapted from DEW stormwater guidelines — see link below) are stormwater effective landscaping, on-site detention, roof gardens and aquifer storage.

Stormwater effective landscaping refers to:

- using landscaping to absorb stormwater runoff from paths
- using semi-permeable surfaces.

On-site stormwater detention (OSD)[34]

Best practice on-site stormwater detention involves:

- increasing the quality of the water captured by separation of first flushes from later flows. First-flush water can be contaminated by dust on roofs, oil on roads and other pollutants. These can be diverted to landscaping or can be treated
- using screened outlets to closely control flow rates and capture litter, debris and sediment
- using frequency-staged storage systems that employ 'storage' in lawns and garden soils, depressions in public open spaces, and open and covered pavements (such as car parks), which are designed in a staged fashion, so that each storage comes into operation only when the preceding one is full
- using tail-water compensation to control discharge when the bed of the water storage facility lies below the water surface in the receiving drain
- using pump discharge regulation for controlling pumping from basement tanks in buildings.

The benefits of OSD are:

- it can be funded immediately (i.e. by the developer) and does not require capital outlays from stormwater management authorities
- it protects downstream properties against increases in flooding resulting from new developments.

[34] Ribbons, S., Warwick, M. and Knight, G. (1995). Section 94 contributions or on-site detention: Council's dilemma. In Preprints of papers: the second international symposium on urban stormwater management 1995: *Integrated management of urban environments*, p. 27.

[35] H Urriola, 'Roof gardens: an environmental asset', in JA Wood (ed.), *Water sensitive design and stormwater re-use: seminar proceedings*, Stormwater Industry Association: Sydney, 31 March 1999, p.1.

Roof gardens

In cities, roofs cover 40%–80% of built areas, leading to problems including higher volumes of stormwater runoff. A number of countries in Europe have acknowledged this problem and have legislated that all public buildings should be covered with a roof garden.

The German Government contributes 50% to the cost of building a roof garden on either private or public buildings. Roof gardens absorb about 76 litres of water per square metre of garden space. Super imposed loads on the roof structure, plus retained rainwater, means that the roof needs to be designed for the extra loading.[35]

Green roofs are an example of one initiative that minimises several impacts; stormwater run off, insulation of the roof, and importantly, reduction of the urban heat island effect (the significant increase in air temperature in built-up areas). Further, roof gardens not only have many benefits environmentally, but can also add to the social spaces available to tenants in the building.

Aquifer storage and recovery (ASR)

This involves the harvesting of surplus stormwater from a variety of sources and then storing it below ground. Stormwater can be temporarily stored in a suitable aquifer, and then retrieved for potable, irrigation or industrial applications by pumping it underground.[36]

SUMMARY OF OPPORTUNITIES

- Tenant operations — ensure that all new staff understand the water management policy of the office, including who to contact if leaks are detected. Run an information campaign on water efficiency and encourage staff to reduce their water use.
- Maintenance — ensure prompt response to leaks, carry out regular checks of appliances and fittings, install sub-meters as part of ongoing maintenance, and minimise stormwater pollution through clever landscaping and car park area design.
- Management — ensure regular monitoring and reporting of water usage, include reviews of water efficiency in commissioning, choose the highest WELS rating when replacing fittings or appliances, put in place specific management systems for cooling towers, provide training on water efficiency measures for staff, include proactive management of valves, washers and other leakage points, include water intensity targets in new leases, and benchmark water performance as soon as possible.
- Level 1 refurbishment — invest in opportunities to upgrade cooling towers, investigate water storage and recycling, replace appliances and fittings with the highest WELS rating possible, benchmark base flows before refurbishment, identify leaks and fix while carrying out refurbishment, and introduce sub-meters.
- Level 2 refurbishment — invest in opportunities to upgrade cooling towers, investigate water storage, recycling and third pipe options, replace appliances and fittings with the highest WELS rating possible, benchmark base flows before refurbishment, identify leaks and fix while carrying out refurbishment, and introduce sub-meters.
- Re-occupancy — ensure that there is training for new tenants and introduce efficiency benchmarks into leases.

RESOURCES

Water Efficiency Guide – DEWHA
www.environment.gov.au/settlements/publications/government/water-efficiency-guide.html

Stormwater
www.environment.gov.au/coasts/publications/stormwater/pubs/stormwater.pdf

Savewater.com.au
www.savewater.com.au

Clearwater
www.clearwater.asn.au/

Water Efficiency Labelling
www.waterrating.gov.au/publications/wels-brochure.html

Water Saving Gardens - Melbourne water **www.conservewater.melbournewater.com.au/content/water-wise_gardens/water-wise_plants.asp**

CITY WEST WATER – Water conservation solutions
www.citywestwater.com.au/business/water_and_resource_efficiency_publications.htm#wcspublications

Roof garden CH_2
(City of Melbourne)

[36] NZ Gerges, *Aquifer storage and recovery: type and selection of aquifer*, Primary Industry and Resources, Canberra.

OPPORTUNITY 4

Material choice

WHY IS THIS IMPORTANT?

Materials impact the environment in the following ways, which are discussed in more detail below:

- consuming energy in manufacture and transport (embodied energy)
- potentially having an impact on toxicity in manufacture and in use
- using water in manufacture (called embodied water)
- consuming other materials that have their own impacts (e.g. mining, land clearing, etc.).

Materials choice is an activity that impacts ESD. The owner, the manager and the tenant each have a role to play in minimising this impact. Though the initial construction of the building has a considerable material impact, it is in fact the ongoing building management, refurbishment and fit-out churn that results in a larger impact. In minimising material impact in the operation of a building, there are two distinct areas to focus on: (1) the refurbishment and fit-out churn (plasterboard, carpet etc.); and (2) the procurement of everyday business (paper, pens, lights, etc.).

Materials can also have an impact on the indoor environment quality of a building, as they can emit volatile organic compounds that can cause headaches, nausea and so forth (see Opportunity 1).

LCA-indicated environmental impacts of building materials range from 2% (of total national emissions in energy and greenhouse) to 30%–40% (of the demand on minerals use and solid waste generation). Specific impact areas are as follows:

- photochemical oxidant emissions (smog) are dominated by cement production
- cumulative energy demand is dominated by steel, softwood and brick production and construction energy
- water use is dominated by steel, concrete and polystyrene production
- land use is dominated by softwood, followed by hardwood production.

Source: *Your Building*

Recycled aluminium tiles, 40 Albert Road, Melbourne
(Erica Lauthier)

1. REFURBISHMENT AND CHURN

The choice of materials used in refurbishing a building has an impact on the environment. Whether it is plasterboard, paint, electrical conduits, carpet or glazing, each has the opportunity for being specified in a manner that reduces their impact.

2. PROCUREMENT

Procurement has a significant impact because of its sheer volume over the life of a building. Choices of paper, lights, pens, computers and so forth can significantly impact the overall environmental performance of the office.

Mini case study — ceilings: landlord's opportunity, Investa

The impact of ceilings relate mainly to the raw materials they are made of and how often they are replaced. Fricker supplies and installs ceilings for a large proportion of Investa's portfolio and collaborated on addressing both these issues.

In their online case studies, they give an example:

'… at 55 Market Street, Sydney as tenants vacate and new ones arrive we are progressively "making good" the ceilings, using replicas of the original ceiling tiles with the original face pattern. This has allowed us to maintain the building's as new appearance and avoided the need to replace the aluminium grid, reducing materials churn and costs.

The new tiles have a high mineral fibre content, which is made from blast furnace slag, a bi-product of the steel industry. They are formaldehyde free, VOC free, have naturally high thermal resistance and have been certified as "environmentally friendly" by Eco Mark. Eco Mark is a Japanese certification programme in accordance with "Type 1 environmental label programmes" defined in ISO 14024 and operated by GEN (Global Ecolabelling Network)".

Source: www.investa.com.au/reports/2006/sustainability/case_studies/ceilings.asp

HOW YOU MEASURE IT?

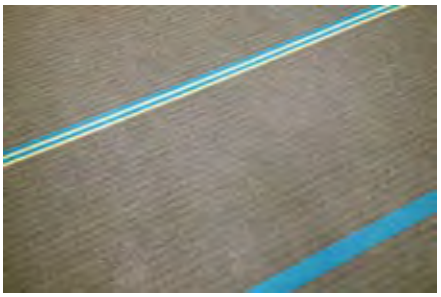
The measurement of material impacts is mainly in volume of materials consumed and in documentation of the environmental credentials of the materials. The volumes of materials used can be collected through reports from the suppliers, and need to be linked with the waste audits. Material ESD credentials can be obtained from manufacturers through environmental performance data sheets, eco-labels and material safety data sheets.

APPROACHES TO MINIMISATION

For both refurbishment and standard operations, a purchasing policy can be a useful way to minimise the impact of materials. This policy should be developed at the various levels of stakeholder influence. For example, there should be a procurement policy for maintenance activities and a policy for tenant activities. There should also be a policy for materials specification in refurbishment and churn. ISPT provides a good example of how a building owner can work with the tenant to provide clear opportunities of material impact minimisation with clear financial benefits (see below).

David Pullan — Portfolio Operation Manager, ISPT

'ISPT have also worked to offer improved services to their tenants. We have set up a relationship with the best performing environmental paint and carpet manufacturers. As part of being tenant in our buildings, you can order from these companies and get the best performing green products on the market with improved indoor air quality and eco-footprint credentials — it will also save you 5%–10%.'



Recyclable Carpet 40 Albert Road, Melbourne
(Erica Lauthier)

Material selection

1 – REFURBISHMENT AND CHURN

A comprehensive way of comparing and selecting materials is Life Cycle Assessment (LCA). This allows for the analysis of different materials with very different impacts, for example aluminium windows that have a energy and climate change impact and do not perform as well thermally with timber windows that have biodiversity impacts, need more maintenance and perform better thermally. The main barrier to using LCA through is that material decisions tend to be made quickly and may not be able to wait for an LCA, and there are also many other factors that need to be considered: costs, functionality, aesthetics and so forth. For this reason, simplified methods, guides and rules of thumb are often used for choosing materials. For example, choose materials:

- with a high recycled content
- that are reused
- with no or low toxic emissions
- that do not contain toxic materials listed in the National Pollutant Inventory (NPI)
- with low embodied energy and embodied water
- with an ability to be easily recycled
- easy to clean and maintain
- pre-finish or no finish requirements
- independently certified by a third party – the Forest Stewardship Council (FSC for timber) and Australian Environmental Labelling Association etc.

There are tools that can help identify manufacturers and suppliers. These are often based on a life cycle approach and are outlined in the resources section at the end of this chapter.

Churn (also covered in the waste section of this guide), is a major source of unnecessary material use and expense. Though the same rules of thumb apply for selecting material for fit-out, the specific emphasis should be on how to minimise removing completely viable materials. For more information on what is possible see the New Zealand guide to sustainable fit-outs (www.mfe.govt.nz/publications/sus-dev/office-fitouts-dec05/html).

2 - PROCUREMENT

Guidelines are available for the specification of materials for everyday use. For example, purchasing guidelines have been developed by various government bodies:

- the Department of the Environment, Water, Heritage and the Arts — in example below
- the Queensland government — www.qgm.qld.gov.au
- the NSW government — www.greengoods.nsw.gov.au
- the Victorian government — www.vgpb.vic.gov.au.

In general materials that need to be considered are:

- paper — high recycled content
- electrical equipment — high energy star rating (see opportunity 3)
- pens — refillable, recycled and recyclable
- cartridges and inks — refillable, recycled and recyclable
- lighting elements — fluorescent and energy efficient
- cleaning supplies — low emission, natural, non-toxic, biodegradable, in reusable containers
- toilet supplies (soaps) — natural, refillable
- toilet supplies (paper) — recycled.

Australian Government: the Commonwealth procurement guidelines and best practice guidance

The core principle governing Australian Government procurement is value for money, a concept evaluated on a whole-of-life basis for the goods or services being procured. Yet 'officials should be aware of any relevant environmental legislation and targets set by the Commonwealth, and ensure they take into account matters affecting the environment … when formulating requirements. They should include relevant environmental criteria in specifications and requests for tender'.

Purchasing guidance can be downloaded from: www.environment.gov.au/settlements/government/purchasing/index.html

Specific environmental purchasing checklists for goods and services relevant to existing building available from that site include:

- building management services
- cleaning services
- dishwashers
- fax machines
- miscellaneous office equipment
- office equipment consumables
- packaging
- paper and cardboard
- personal computers and monitors
- printers, photocopiers and multi-function devices
- printing services
- recycled products
- refrigerators
- task lighting/desk lamps
- waste management services.

Embodied energy

Embodied energy is a term used to describe the inherent amount of energy in all the materials used to make a product. For a building, this is the sum of energy expended to make the bricks, windows and steel beams etc. To minimise embodied energy, less energy intensive products that perform the same function should be chosen.

One way of minimising the embodied energy in products is to use products that have recycled content. Many products use much less energy to be recycled than the initial manufacture: for example, only 10% of the energy used to make aluminium is needed to make recycled aluminium. Embodied energy impacts can be justified in a building designed for longevity or in the refurbishment of an existing building to increase its life.

Embodied water

Like embodied energy, embodied water is the amount of water needed to produce a product. Currently there are no Australian guides and databases on this issue. The most up-to-date information on embodied water and its calculation can be found in the BDP Edge guide GEN58. This resource contains tables that include some embodied water figures, showing how important it is to think about material re-use and recycling, not only from a waste and energy perspective, but also in terms of water.

Mini case study — Investa, Melbourne

Carpet

Investa use modular carpet to minimise waste when replacing damaged or stained areas. They use suppliers and products including InterfaceFLOR, which is made of 80% recycled yarns and recycled vinyl backings. In addition, a large proportion of the worn out carpet is reclaimed via InterfaceFLOR's ReEntry™ programme. An added advantage with this system in practice is that the InterfaceFLOR's Renovisions™ furniture lifting system allows replacement with a minimal amount of disruption to staff. Products from Onteracre also used.

Source: www.investa.com.au/reports/2006/sustainable/case_studies/modular_carpet.asp

Toxicity in manufacture and use

Toxicity is the release of substances into the environment that are detrimental to its normal functioning. Its effects are often talked about in human life year equivalents (i.e. the number of years early the average person will die because of an emission) or human disability equivalents (the amount of impairment to normal function because of an emission). Toxicity has a much broader impact to animals and plants. This is too broad a topic to be fully explained in this guide, but the strategies for minimising human toxicity are linked to reduction in other toxic impacts.

Toxicity falls into two areas: (1) toxicity to the users of the building; and (2) toxicity to the environment through the production of materials and electricity. Toxicity to building users is covered in the Indoor Environment Quality (IEQ) section and the guide to volatile organic compounds (VOC) limits in Green Star — Office Design.[37] VOC emissions are a problem because some (such as formaldehyde) have been shown to be carcinogenic.[38]

VOCs also have an impact on concentration and can cause (to a varying degree) headaches and nausea. Minimising the impact on the environment from the production of particular materials can be achieved by specifying substances that avoid or minimise toxicity. Toxic substances are listed in the National Pollutant Inventory (NPI). Minimising the impact of the production of pollution from power stations can be achieved by manufacturers using green power.

Biodiversity

This refers to being efficient with material use and careful in the choice of materials that may effect the environment and biodiversity. There are two elements to minimising these impacts: (1) choose materials with a high recycled content and which can be recycled at the end of their life; and (2) choose materials that have third-party certification, indicating that sustainable management strategies are in place.

Endangered spotted-tailed quoll
(Source: DEWHA, Dave Watts)

[37] Green Star — Office Design v2 Indoor Environment Quality credits IEQ-13 'Volatile Organic Compounds' www.gbca.org.au

[38] International Agency for Research on Cancer (part of the World Health Organization), *Formaldehyde classified as human carcinogen*, press release, 06/15/04, www.aerias.org/DesktopModules/ArticleDetail.aspx?articleId=40 accessed 27/05/2006

Principle	Questions
Water and energy conservation	Do you have an energy and water management programme for the manufacture of the product?
	Is the product energy and/or water efficient (i.e. energy efficiency/water conservation rating schemes)?
	Does the product have a water and/or energy efficiency rating?
Minimal impact on indoor air quality	Does the product release volatile organic compounds (VOCs), formaldehyde or other emissions that reduce indoor air quality during its manufacture or use?
Toxic and hazardous materials minimised	Does the product contain toxic or hazardous materials or use toxic or hazardous materials in its manufacture, use or disposal?
Reduction of waste	Can I buy the product in the exact size and quantity I need (i.e. what sizes are available)?
	Can the product be re-used, refilled or recycled at the end of its useful life?
	Does the product have recycled content?
	Will you take back the packaging?
	Do you have a waste minimisation programme?
	Is the product made of a single material or materials that are easily separated for recycling and re-use?
Renewable and sustainably harvested materials, biodiversity protection	Are the materials in the product obtained from renewable and sustainably harvested sources?
	Do you have a positive management programme for habitats and native species?
Minimal pollution of air, land and water	Do you have a pollution prevention programme?
	Do the instructions supplied with the product provide guidance on minimising pollution when installing, operating, maintaining and disposing of the product?
Environmental stewardship	Is your company ISO 14000 certified? Do you have an environmental policy statement? Do you provide information about the composition of products, take-back schemes, lease options, and other information over and above regulatory requirements?
Durable and upgradeable	Does the product contain upgradeable, repairable or replaceable parts?
	Is the product durable (life expectancy)?

Table 14 – *Questions to ask materials manufacturers*
Source: www.mfe.govt.nz/publications/sus-dev/office-fitouts-dec05/html (accessed 8/5/2007)

SUMMARY OF OPPORTUNITIES

- Maintenance — ensure that equipment and fit-out elements, such as carpets and partitions, are maintained in accordance with recommendations from the manufacturers to ensure longevity and the potential for future re-use. When ordering products, ensure that they are protected with either recyclable or returnable packaging.
- Management — ensure that the procurement system includes the most environmentally responsible products. Have a review process as part of the periodic reporting to discuss new materials that can be included — for example, lighting technology is continually improving. When ordering products, ensure that they are protected with either recyclable or returnable packaging. Further, ensure that there are appropriate facilities for the collection and storage of products, so that they stay clean and in good condition.
- Level 1 refurbishment — in carrying out a 'spruce-up' type of refurbishment, ensure that glues, caulking, paints, varnishes and other finishes are all water-based and have low VOC emissions. Choose new fittings that support energy-efficient lighting. Choose carpets that are modular, recycled or recyclable (see the resources at the end of this chapter for more specific check-lists for material and equipment procurement). Ensure that design considers resource efficiency; that is, using materials efficiently, minimising off-cuts and waste. Where possible, look for recycled or re-used material opportunities. When ordering products, ensure that they are protected with either recyclable or returnable packaging. Further, ensure that there are appropriate facilities for the collection and storage of products, so that they stay clean and in good condition.

- Level 2 refurbishment — in major refurbishments where major structural elements and windows are being rearranged and replaced, in addition to the energy saving opportunities, also look for opportunities to use high recycled content concrete, steel, aluminium, certified timbers and effective insulation etc. Ensure that design considers resource efficiency, that is, using materials efficiently, minimising off-cuts and waste. When ordering products, ensure that they are protected with either recyclable or returnable packaging. Further, ensure that there are appropriate facilities to collect and store products, so that they stay clean and in good condition.
- Tenant operations — develop a green procurement plan for material purchases, such as computers, paper and other stationary, electrical equipment and toner cartridges etc. Encourage employees to see the value of paper and materials, and encourage effective use, such as double siding, re-use of pens and so forth. Also, if managing cleaning contracts, ensure environmentally responsible materials are used to minimise VOC emissions and toxicity.

Resources

DECC Sustainable Property management Guide, look on **www.environment.nsw.gov.au** and **www.livingthing.net.au**

Green Building Council of Australia **www.gbca.org.au**

NZ Sustainable fit-outs guideline **www.mfe.govt.nz/publications/sus-dev/office-fitouts-dec05/html**

EcoSpecifier **www.ecospecifier.org**

Australian Government procurement guidelines – **www.environment.gov.au/settlements/government/purchasing/index.html**

The Queensland Government procurement guidelines **www.qgm.qld.gov.au**

The NSW Government procurement guidelines **www.greengoods.nsw.gov.au**

The Victorian Government procurement guidelines **www.vgpb.vic.gov.au**

National Pollutant Inventory **www.NPI.gov.au**

OPPORTUNITY 5

Minimising waste

Australians are the second highest producers of waste, per person, in the world with each of us sending almost 690 kg of waste to landfill each year (the United States is the highest waste producer).[39]

Waste estimates for office buildings

7.8 kg of waste and recycling generated/ m^2/year *

173 kg of waste and recycling generated/ employee**/ year

1.7 reams of copy paper are thrown out or recycled/ m^2/year

39 reams of copy paper are thrown out or recycled/ employee/year

55% paper and 10% cardboard is in the general waste stream

5% commingled (glass and plastic drink containers, aluminium cans) is in the general waste stream

$23 worth of reusable stationery thrown out/ employee/year

* Year = based on 261 working days

**Employee = full-time employee, or the equivalent

Source: www.livingthing.net.au/rc/tips/DEC_WasteRecy_FS.pdf

WHY IS IT IMPORTANT?

The two main sources of waste in the operational phase of a building are:

(1) the waste created by the running of the building — packaging, papers, etc. and

(2) the waste created by the various maintenance and refurbishment cycles.

Waste is a problem for several reasons; firstly it is an inefficient use of resources — for example, of the trees used to produce the fibre used for paper. A good rule of thumb is to remember that for one tonne of product, there have been five tonnes of materials used in manufacturing and 20 tonnes in site and resource extraction. Secondly, this waste needs to be stored somewhere. If it is placed in landfill, it takes up land, can cause run-off into water ways, and results in visual pollution and pollution into the air, including greenhouse gasses, such as methane, that effect climate change.

Mini case study — Treasury EMS results: food waste to compost

The Federal Treasury has an environmental management system (EMS) in place, which includes energy management, water conservation, waste and recycling, and purchasing. This EMS and its associated plans and activities have resulted in the recycling of 2.4 tonnes of food waste to compost each year.

Source: Paul Starr, DEWHA

HOW YOU MEASURE IT?

During the life of the building, waste minimisation is a building management and tenancy issue. There is a real opportunity for savings by implementing a programme of waste and recycling reporting, auditing and management as part of the everyday management of the building (see the Property Council's building EMS). Particularly important is measuring the actual waste leaving the building and knowing where it is taken (e.g. recycling or landfill), as this allows for active management of the waste streams.

NABERS waste benchmarks

Star rating	g/person/day
1 star	420
1.5 stars	392
2 stars	365
2.5 stars	337
3 stars	310
3.5 stars	282
4 stars	255
4.5 stars	228
5 stars	200

Table 15 – *Waste generation (tenants/whole buildings)*
Source: NABERS

Star rating	Recycling rate %
1 star	42–47%
1.5 stars	48–53%
2 stars	54–59%
2.5 stars	60–65%
3 stars	66–71%
3.5 stars	72–77%
4 stars	78–83%
4.5 stars	84–89%
5 stars	≥90%

Table 16 – *Recycling rate (tenants/whole buildings)*
Source: NABERS

In the above NABERS benchmarks, the whole building ratings are determined by the average of waste generated and recycled, with a double weighting on the rating for waste generated.

Measuring waste requires reliable data on the total kilograms of the materials sent to recycling, landfill and re-use. There is also the waste created by the tenants and the waste created by building operational maintenance; these should be accounted for and reported on separately.
A separate waste management plan should be put in place for refurbishments that functions outside of this.

One government agency recently carried out an audit of the waste being taken away by a contractor over the period of two weeks. They were paying on the basis of a service (not mass charging) arrangement. They found that the contractor's guess about the amount going to landfill was 16 times more than their direct audit. The audit also found that they could reduce their waste to landfill by 75% by simply getting all staff to use the recycling facilities already available.

As part of the EMS, it is important that a waste audit is undertaken on the day-to-day operation of the building. Data on the amount of waste produced can be derived from the building's scales and hoists, and the waste contractors should provide total weights on their invoices.

[39] Sustainability Victoria, *Waste wise fact file* www.sustainability.vic.gov.au/resources/documents/fact-file.doc Accessed, 27/05/2007.

Data collected should be normalised for floor area, and tenant specific waste by FTE (full time equivalent). Cleaning services are a good resource to use for the waste accounting procedure. Below is an example of how one cleaning service provider now reports on this as part of their everyday service to their clients.

An organisation's IT services should also be brought onboard with any ESD initiatives, particularly for waste and energy. A great deal of packaging and electronic waste can be incorporated into any waste minimisation and recycling plan.

Waste segregation 50 Lonsdale Street, Melbourne
(Erica Lauthier)

APPROACHES TO MINIMISATION

In the everyday operation and management of a building, waste minimisation can be achieved via a waste management plan (WMP), which can be part of an overarching single or multi-building EMS. A WMP sets out the expected waste types, volumes, storage and onsite treatment plan, destination and contractor details. Critical in minimising waste for the building owner and manager is that waste minimisation requirements are clearly outlined in the contract to the service or material provider (for several model clauses for contracts, refer to the resources section at the end of this chapter). For example, if the supplier is to take back any faulty equipment or packaging materials, this needs to be part of their contract. When waste minimisation is part of a refurbishment or fit-out, as shown below with the Investa case study, then it is crucial to work with the contractors and ensure that planning is done up front.

Churn

Churn is one of the main opportunities to reduce waste in the operational phase of the building. Landlords, managers and tenants can work together on this so that everything that has been put in place for the old tenant is not automatically pulled out before the new tenant comes in. This will require some communication with the new tenants on the benefits of not seeing a 'blank' space.[40] These benefits include cost savings in not needing to install new fit-out items, reduction of waste, and the reduction of the indoor air impacts of new materials.

Another building manager opportunity, which may also apply to the tenant if they manage cleaning contracts, is to ensure waste management occurs through the cleaning contracts. As mentioned above, not only can cleaners help in the collection of waste data, they can actively support the waste initiatives in a building.

Mini case study — INVESTA: waste minimisation in office refit, landlord and tenant collaboration, Sydney

As part of the re-leasing of 255 Elizabeth Street, Sydney, Investa had the opportunity to work with fit-out contractors FDC and Eastview to maximise recycling of all waste from the strip out, demolition, make good and subsequent preparation of four floors (7383m^2).

To ensure this was achievable the tender specification also included a reporting section, setting out a system for determining, reporting and verifying the volume/mass of waste re-used on-site, recycled off-site and disposed to landfill on a monthly basis.

The contractor was required to:

- focus on the elimination of waste as the priority
- identify and communicate responsibilities for waste minimisation to staff contractors and suppliers
- educate and inform personnel about the reasons for waste reduction and provide training in support of this communication
- conduct an analysis of the projected waste profile
- integrate cost-control, reporting and monitoring of waste minimisation throughout the course of the project
- make arrangements for site separation of materials and contractor collections.

On completion of the works, Investa verified dockets and declarations that showed 307.61 tonnes of waste had been either re-used or recycled, with only 15 tonnes sent to landfill. This represented a diversion rate of more than 95 percent.

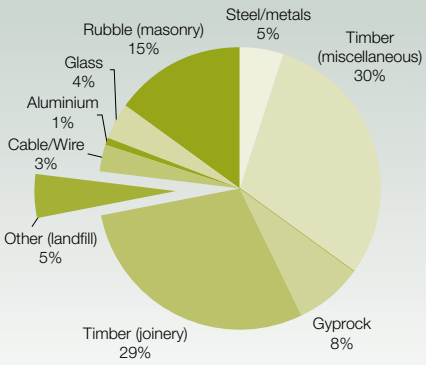


Figure 15 – *Material recycling break-down from releasing retrofit of INVESTA property*
Source: www.investa.com.au/reports/2006/sustainability/case_studies/fit-out_churn.asp

[40] www.investa.com.au/reports/2006/sustainability/case_studies/fit-out_churn.asp Accessed 29/05/2007

Tip — shredding paper will reduce the length of the fibres and reduce its recyclability; only shred sensitive papers.

Tenant management is another area of opportunity for waste reduction. Tenant behaviour can be influenced by ensuring easy access to recycling facilities, describing what happens to the recycling and waste streams from the building, and including reports to the tenants on performance. This can also be integrated, from the tenant's perspective, into a green lease requiring the building owner to provide reporting of waste and facilities for recycling. Tenants should develop their own simple waste management plan (see the resources sections for useful links to best practice office waste management.

An important element of managing waste in a tenancy is effective communication with staff. Signage is a key communication device and the organisations mentioned previously have dedicated signage developed specifically with clear communication in mind.

Specific material waste minimisation opportunities

This section outlines the opportunities for waste minimisation for many of the operational waste streams.

Paper — Paper is completely recyclable and needs to be collected in such a way as to meet the recycling providers' needs. Some providers can take coffee cups and paper hand towels, while others need the paper to be completely uncontaminated — check what the requirements are when negotiating the contract and ensure this is passed onto the tenants and staff.

Approximately 1.35 million tonnes of printing and writing paper was used in Australia in 2002–03. However, only a fraction of this paper (169 000 tonnes) was recovered though recycling.[41]

Toner cartridges — are completely re-usable unless damaged. Special collection services are available from service providers and free collection is available.

Florescent lamps — can harm the environment, as they contain mercury. There are companies who will safely recycle these lamps — consider also offering this recycling service to all staff.

Batteries — are another waste stream that can create environmental damage. They can be disposed of safely, but need to be kept separate from general waste —install a specific battery recycling bin on each floor.

Mobile phones — need to be recycled once they are no longer used. Most mobile phone companies will happily take an old phone when a new one is purchased — within the procurement plan, ensure that staff are aware of this and can effectively collect and return phones. A free recycling service is available.

Electronic equipment, printers and computers — with the high rate of obsolescence in many equipment categories, these can become a large waste problem. There are companies that re-use and recycle electronic equipment, ensuring that all data are removed before re-use. A free recycling service is available.

Commingled recyclables — the general term for any materials that can be recycled and are generally collected together for separation at the recycling plant. These tend to be aluminium and steel cans, plastics (1–7 and unsealed food grade rigid plastics), cardboard and glass. What is recyclable varies in each state and will need to be verified before informing tenants and staff.

Organic waste — includes food scraps, leftovers, coffee grounds, tea leaves and things that have been left in the fridge for too long. These can be recycled into organic soil enhancers through composting and use of biological agents such as worms. Managing these systems is more complex than simply putting things in a bin — if the facility is on site, it needs to be integrated effectively into the waste management plan. In some regions, organic waste can be collected for recycling off site.

Mini case study — fluoro lamps waste

Investa recycles the fluorescent lamps it takes down as part of its regular maintenance schedule; current figures show they have recycled around 17 600 lamps.

'The recycling process from Investa's end is very simple; we simply place the tubes in a box for collection. Once they leave the building, the fluorescent tubes are fed directly into a compact crusher separator machine that separates the glass, aluminium end caps and the phosphor powder. The machine captures the phosphor powder containing 80% of the mercury, as well as the vapour that accounts for the other 2%. Up to 99.9% of the recovered mercury can be re-used for other purposes and the process reclaims 100% of the glass, aluminium and other metals for re-use as well.'

Source: www.investa.com.au/reports/2006/sustainability/case_studies/fluorescent_lamps.asp

Chemsal provides this service in most areas in Australia www.zerowaste.sa.gov.au/greening_government/managing_materials_fluorotubes.php

Amount of space for adequate recycling storage

A rule of thumb used in the UK for planning recycling space allocation is that 2 m^2 of area per 1000 m^2 of net floor area (and up to 10 m^2 when areas are over 5000 m^2) are required (BCO 2006).[42] There is also a trend not to allocate a general bin under every desk, and this ensures that people consider their waste every time they have to stand up to go to the bin. Alternatively, there are innovative bins with various compartments for different waste streams.

SUMMARY OF OPPORTUNITIES

- Maintenance — ensure that bins that are damaged and have odours are cleaned, and ensure that there is a rapid response process to full bins.
- Management — under the procurement strategy, ensure that single life products (plastic/paper cups, single portions of sugar, milk, paper towels, etc.) are not purchased unless there are no viable alternatives. Integrate a waste management policy and plan into the general building management plan, and include regular audits, reviews and

[41] Sustainability Victoria, *Waste wise fact file* www.sustainability.vic.gov.au/resources/documents/fact-file.doc Accessed, 27/05/2007

[42] BCO, BCO guide to environmental management, British Council of Offices, London, 2006.

improvement opportunities. Provide clear signage to tenants to encourage understanding and participation in recycling and waste collection schemes.

- Level 1 refurbishment — ensure that any material taken away is re-used or recycled. Plan storage areas for waste and recycling.
- Level 2 refurbishment — ensure that any material taken away is re-used or recycled. Plan storage areas for waste and recycling. Use recycled content materials, such as concrete and carpet, etc. Use recyclable materials. Use modular and reusable materials that are easy to replace when damaged without major cost or impact.
- Tenant operations — ensure all new staff understand the waste management policy of the office. Negotiate packaging type (recycled and recyclable) or take back services with suppliers. Include waste management objectives and clauses into service contracts, such as cleaning and maintenance. Collect waste data and disseminate information to staff.

Resources

Waste wise office guide
www.nevrwaste.vic.gov.au/businesses/waste-wise-office-kit/

Clauses which can be used in waste management contracts
www.sustainability.vic.gov.au/resources/documents/model_contract_clauses.pdf

Waste collection contract checklist, waste minimisation plan form and model property waste review form – DECC Sustainable Property Management Guide look on **www.environment.nsw.gov.au** and **www.livingthing.net.au**

Clean Up Australia
www.cleanup.com.au

The Nowaste best practice in office waste management guide
www.tams.act.gov.au/live/Recycling_and_Waste

Computers for schools
ctfs.edna.edu.au/ctfs/go

OPPORTUNITY 6

Social Sustainability

WHY IS IT IMPORTANT?

Buildings are places for people. They function as both social and physical spaces and are connected to the broader community around them. Sustainability requires the integrated consideration of environmental, social and economic factors, which is why social aspects of buildings are relevant for this guide. The social opportunities of a building are in its interaction with the community, its ability to cater to all building users, and in its fit within the context of the site (including heritage). More generally, social sustainability is about equity, inclusion, access and quality of life.

Mini case study — thinking about the social and collaborative potential of space

The Queensland University of Technology found surprising results when they designed their laboratories by focusing on their staff and supporting potential collaboration. In designating their new laboratories, they located different disciplines in an open plan layout around a central atrium. This created what Zee Upton describes as 'an opportunity to do things differently … the fact that we can see each other all the time, passing each other in the corridors and in the lifts, in the open spaces, people drop in to chat and attend each others' seminars'. In this way, the building's design supports increased collaboration and innovation.

Programme leader Zee Upton working with students in the tissue repair and regeneration laboratory in the School of Life Sciences, Brisbane
(Zee Upton)

Planning and community issues

Managing a building according to ESD principles requires a certain amount of attention to be paid to the local contexts, such as planning requirements and local needs. For example, the major redevelopment (level 2 refurbishment) of a building could include the integration of a community facility, such as a crèche or meeting space. Agenda 21, adopted in 1992 by the United Nations Conference on environment and development, highlights the importance of community consultation and participation. Thus when planning major work, local Agenda 21 plans and council ESD objectives should be considered, and a community consultation process should be included. Local community education opportunities that could also be explored, such as highlighting and teaching about ESD innovation in the building, or providing online information that can be used by students, as well as those looking at doing similar projects. Many projects also put money and space aside for community and public art projects; this shows commitment to the community and provides a visual representation of the project's commitment. Finally, the impact of any proposed changes to landscaping, external façades, shading, noise and wind that may affect the local context and community should be considered.

Working with tenants

Crucial in engaging the tenants in operational and refurbishment ESD activities is inclusion and clear communication. Consultation with tenants should be carried out before major maintenance or refurbishment works, both to get their input into the activities and to ensure they know when disruptions will take place.

Harry Hullin — Building Manager, 500 Collins Street, Melbourne: Building manager and creating inclusion, access and quality of life for the tenants

When talk of sustainability and the retrofit of 500 Collins Street came on the agenda, Harry was sceptical, particularly as the new owners wanted the project to be completed while the tenants remained in the building. To his and the project's credit, Harry was involved in all of the planning, design, project and construction meetings, and so could be the interface between the builders and the tenants: 'I had to make sure that they did not get impacted too greatly by the project. I needed to be there to make sure that the builders — who don't have an understanding of our tenants — didn't plan or do things that disrupted our tenants' ability to do their work.'

Harry also gave input into the best ways to plan and implement new technologies and design changes as the building went through a floor by floor upgrade to a 5 star Green Star rated building.

Harry Hullin outside 500 Collins Street
(Erica Lauthier)

Catering for building users

There are two main elements to catering for building users. The first is meeting the Disability Discrimination Act (DDA) when planning changes to building layouts, spaces and access. The second is meeting the needs of the building users through information provision, response to complaints, and supporting their own ESD objectives. Tied into both of these are the concepts of health and safety.

Fitting within the context

Managing how buildings fit in with their immediate site context (visually, physically and socially) is crucial, especially with regards to heritage issues. Any changes to a building's external appearance will have an effect on its aesthetics and can have implications for its value as a historical representation of architecture at a particular period. The integration of ESD within heritage requirements means sensitivity in the design of façade interventions, and the addition of floors, plant and so forth.

40 Albert Road, solar pergola and social space with BBQ
(Erica Lauthier)

HOW DO YOU MEASURE IT?

To measure the social sustainability of those in the building, an occupancy or satisfaction survey can be used. Most of these surveys also look at IEQ and employee self-perception of their working environment. The Global Reporting Initiative (GRI) has specific indicators for social sustainability, including labour practices (a number of core and additional reporting criteria — 12), human rights (7), society (8), and product responsibility (9). Several international and national organisations offer survey services either online or face to face (these get a higher response rate but are more costly) — see the resources section below.

Mini case study — 30 The Bond

The results — Social

- Building occupants extensively consulted throughout the design and construction phases
- Post-occupancy surveys and actions
- Local residents group formed to work with Bovis Lend Lease throughout construction and move-in
- Ongoing youth mentoring programme
- 60-place childcare centre on the ground floor

APPROACHES TO INTEGRATING SOCIAL SUSTAINABILITY

As the aim of social sustainability is to foster equity, inclusion, access and quality of life, actions by the owners, management and tenants need to facilitate this. This requires a combination of education of each stakeholder and consideration of social sustainability issues in decisions made during the operational phase of the building.

For the owner, there needs to be a clear commitment to the principles of social sustainability, with a translation of what this means for their portfolio. For the building manager, integrating social sustainability is centred on the tenants in the building, supporting their needs and keeping them informed. For the tenant, the responsibility lies in being aware of the best ways to function within the building, setting plans for achieving social sustainability, and ensuring the plans are monitored, reported and reviewed.

The Tertiary Education Facilities Management Association has a guide for incorporating sustainability into facilities management, which includes a succinct description of what this means for facilities and building managers. Under social responsibility, they discuss how to ensure the integration of cultural heritage, workplace, human rights, community development and stakeholder inclusion.

Social sustainability —TEFMA

Cultural heritage

The Queensland Environmental Protection Agency (EPA) highlights that 'cultural heritage significance' of a place or object includes its aesthetic, architectural, historical, scientific, social or technological significance to the present, past and future generations. Cultural heritage places are protected under various pieces of legislation. Lodge a permit with the relevant authority before commencing any activities that could impact on the cultural significance of a heritage-listed facility.

Workplace

A part of implementing sustainability is creating a better workplace.
This begins in the planning process by practising good design principles for natural ventilation and lighting, and minimising toxic emissions in the workplace.
A cleaner indoor environment leads to increased productivity.
There should be an emphasis on continual improvement and knowledge improvement.

Human rights

Incorporating human rights into facilities management is as easy as being aware of the consequences of your choices.
In the life cycle of the products that you choose, are human rights being exploited to supply a 'cheaper' end product or does any part of a product life cycle have negative environmental impacts that ultimately affect the lives of others?
Always consider the real cost of the product that you use.

Community involvement and development

Include the community in the decision making process in all stages of facilities management. Consider and include aspects in the project that will enhance community development.

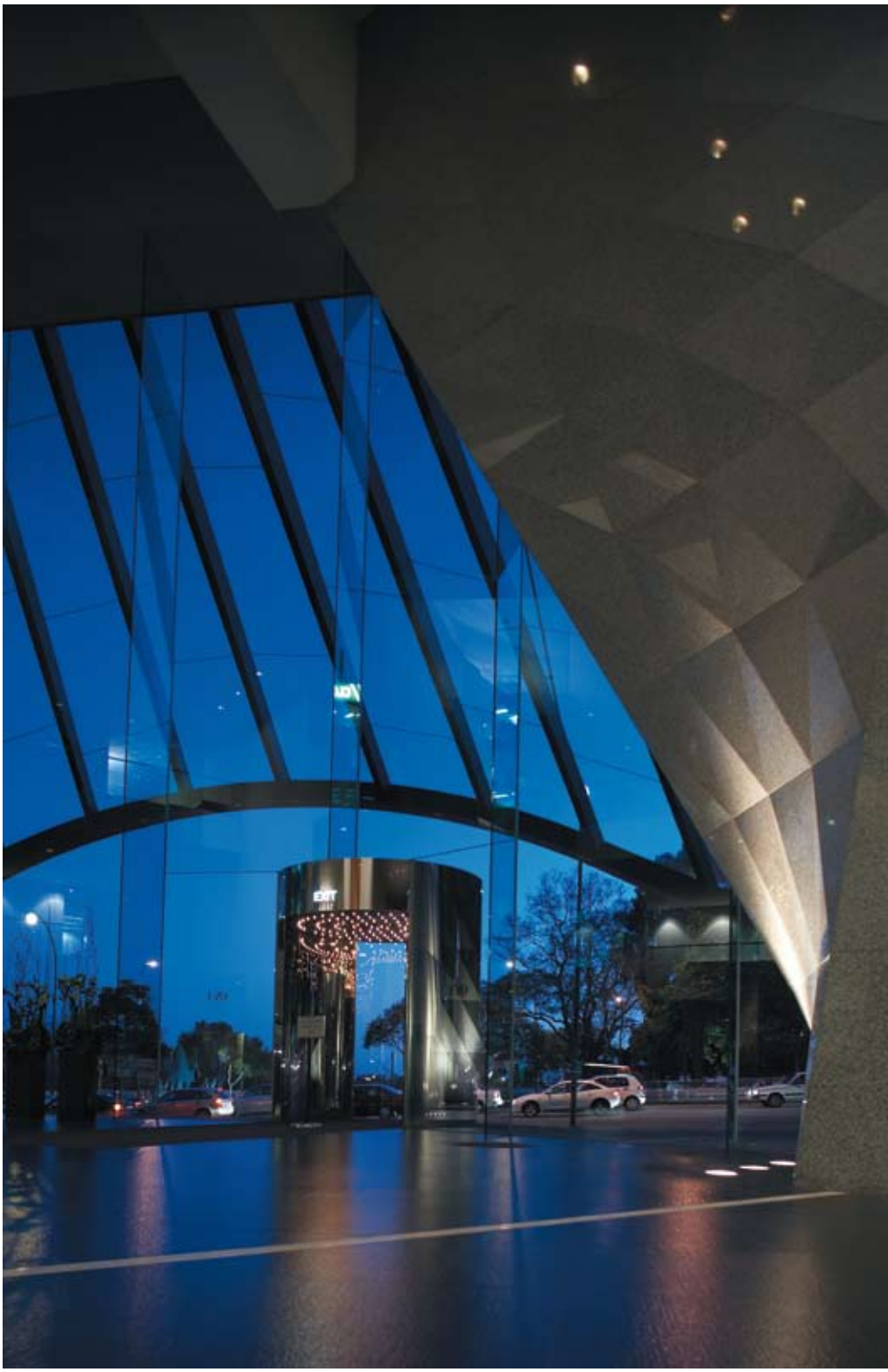
Stakeholder inclusion

Include stakeholders in every stage of the facilities management cycle. Stakeholders include all of those who will have input into the project such as the client, planners, architects, designers, engineers, environmental managers, energy specialists, services managers, operations and maintenance managers, compliance agencies and government departments, plus those who will be affected by the outcomes of the project, such as community members and building users. Communicate sustainability aspects through all areas of facilities management.

Source: Tertiary Education Facilities Management Association — A guide to incorporating sustainability into facilities management.

SUMMARY OF OPPORTUNITIES

- Maintenance — ensure quick responses to complaints.
- Management — instigate a plan of communication with tenants and community, develop a corporate responsibility plan, and develop a communication/training/building guide for tenants.
- Level 1 refurbishment — look for opportunities to improve access, reference heritage and culture, and include input from tenants and the public into proposals.
- Level 2 refurbishment — look for opportunities to improve access, reference heritage and culture, and include input from tenants and the public into proposals. Ask whether it is possible to increase public space or improve external spaces, and aim to respect heritage aspects.



QV1, Perth
(CB Richard Ellis Pty Ltd)

OPPORTUNITY 7

Minimising transport impact

WHY IS IT IMPORTANT?

Transport to and from work, and within the working day, can have a significant impact on the environment. Vehicles produce emissions such as carbon dioxide (CO_2), particulates and nitrous oxides (NO_x). Public transport also produces impacts, but these are reduced because they are divided among a greater number of passengers, whereas the average number of people travelling in a car is 1.15.[43] These emissions contribute to climate change, smog and respiratory problems. Further issues that result from transport are congestion and the associated frustration with congestion. Air travel also has a significant environmental impact, including emissions of greenhouse gasses.

HOW YOU MEASURE IT?

The main way to include transport information in the operational management of buildings is to collect relevant data on travel caused by the activities carried out in the building (i.e. travel to and from work, transport of materials to the building, and travel because of the activities in the building). Though the building owner can consider transport when planning the building (by providing bicycle facilities, smaller car parks, proximity to public transport etc.), and the building manager can ensure that transport of materials to and from the building are optimised, the main source of impact is from the tenants.

Monitoring

Tenants can manage transport impacts by identifying baseline travel patterns (by conducting a survey), and by planning for minimisation opportunities, putting these in place, and conducting an annual review. Various schemes have already developed proformas and methods to support this activity, such as TravelSmart.

Example of transport survey questions:

- Where do you live? (home suburb and postcode)
- How did you travel to work during the last week (tick one box for each day?
- Do you have a car included as part of your salary package?
- Do you have parking included as part of your salary package?
- What time do you usually arrive at work?
- If you drive to work, what kind of car do you drive?

The TravelSmart website has tools to help in this process, including a business case tool, a planning guide and specific tools for supporting walking and cycling activities.

Source: www.travelsmart.vic.gov.au

Tip: Log all public transport providers and sell/give tickets to staff at cost, accompanied by transit information in building user guides and organisational internet sites.

Other sources of information are the company car logs and corporate fuel card reports. Also, travel providers (such as travel agents) can often provide summary reports as part of their services on distances travelled and so forth.

Mini case study — UK transport reduction targets

- Introduce a travel plan which identifies a strategy to reduce overall pollution emissions relating to transport due to commuting and travel to meetings
- Target of 15% reduction in car use in the initial year of the transport plan
- Provide showers, change rooms and lockers
- Provide these for 5-10% of staff
- Cut transport emissions by 5% each year or 25% over 4 years or 50% over 10 years

Source: BCO guide to environmental management (BCO:2006)

APPROACHES TO MINIMISATION

Tenants

Tenants should ensure that contracts with travel service providers — such as travel agents — deliver the data needed for reporting and achieving ESD performance objectives. Further, these should form part of transport plans, as outlined below.

Transport plan

A transport plan should be implemented as part of the building management system to minimise transport-related impacts. A transport plan is a structured method for planning for and managing the transport needs of staff and visitors. These needs include:

- staff commuter journeys
- customer and visitor travel to the office or events
- staff travel whilst at work
- purchase of company vehicles.

Commitment and aims

The aim of the travel plan is to reduce the environmental impact of travel through targeted programmes of encouragement and education, which allow for wiser and more considered decisions about travelling options. As such, travel plans should include measures to:

- reduce flights
- reduce car use (by reducing the number of trips, by reducing the length of trips, by increasing the number of people using one car through car pooling, and by providing viable alternatives)
- support alternative transport options (through incentives such as salary sacrifice, yearly public transport tickets and annual bicycle servicing)
- purchase energy efficient low emission vehicles for company use and to provide incentives for purchase of low emission high efficiency vehicles
- encourage practices that reduce the need to travel, such as video conferencing.

[43] Public Transport Users Association, www.ptua.org.au/myths/carpool.shtml, Accessed: 8/5/2007.

Carbon offset

An increasingly popular method for minimising the impact of travel is to use carbon offsets. This means that, depending on the vehicle, distance and fuel type, the amount of greenhouse gas emissions is calculated and then offset by the planting of trees, investment in renewable energy generation, or other robust abatement measures. An example of this type of opportunity is the BP Global Choices scheme that allows businesses to offset the greenhouse emissions related to their fuel use.

Fleet management

If travel cannot be avoided, then viable fleet management alternatives include the use of hybrid cars (which are much more efficient than standard cars), replacing high usage cars with efficient small cars, and ensuring that the fuels used produce the least impact (see below). Recycled and re-refined oils can also be specified.

Day-to-day travel by individuals in cars can also be reduced by supporting car pooling, integrating green travel plans and providing adequate numbers of cycling facilities. If cycling is to be encouraged, the building design needs to include enough space for secure bicycle parking, clothes storage, changing facilities and showers (providing for 5% of the staff is common practice). In addition, by choosing local materials, the transport impact of bringing these materials to the building will be minimised, during both its construction and operational phases.

Bicycle storage, 50 Lonsdale Street, Melbourne
(Erica Lauthier)

Fuel substitution

Below is an outline of options for fuel substitution.

- Diesel is a good choice, if vehicles are well maintained, because it is less greenhouse gas intensive than standard fuel.
- LPG is also less greenhouse gas intensive than standard fuel.
- Biofuels are made from renewable sources, such as vegetable oils and plant starches. However, caution needs to be taken that the production of these is not energy intensive or causing other environmental impacts.

Green Vehicle Guide ratings

This is a rating developed by the Australian Government to rate new Australian vehicles, based on greenhouse and air pollution emissions. The rating is calculated using data provided by manufacturers from testing the vehicle against Australian standards.

Building managers

Building managers can support more environmentally friendly travel to work by providing amenity for public transport users, walkers and bike riders by providing well lit, clean, safe facilities and secure showers, lockers and bike parking opportunities.

At the end of March 2006, 42% of Centrelink's pool vehicle fleet had a GVG rating of 10.5 or higher, which significantly exceeds the Australian Government target for 28% of agency vehicles to have a GVG rating of 10.5 or higher. This is an increase of approximately 50% since 30 June 2005 where 28.7% of vehicles achieved this GVG rating.

Education

Education should be provided at all levels of the company. Understanding the impact of transport is the first step in integrating and working towards its minimisation. The implementation of the transport plan will also need to be explained and any processes and opportunities that have been created through the plan should be outlined.

Alternatives to face-to-face meetings

Many companies are now avoiding the time consuming and costly practice of personally attending interstate or international meetings by using tele- and video conferencing.

SUMMARY OF OPPORTUNITIES

- Maintenance — ensure cycling facilities are adequate, clean and secure.
- Management — instigate a travel plan, set targets for emission reductions, and offset impacts.
- Level 1 refurbishment — plan for the integration of extra bicycle parking spaces and lockers. Plan for spaces where effective video and teleconferencing can occur.
- Level 2 refurbishment — as above, but increase the number of showers if appropriate. Provide safe, well lit access to public transport. Plan for spaces where effective video and teleconferencing can occur.
- Tenants — develop a travel management plan and provide incentives for alternative means of getting to work. Integrate data supporting ESD plans into travel provider contracts. Provide education and training on alternative ways of meeting (e.g. how to run a teleconference, etc.).

Resources:

Calculating air travel distance and associated emissions
www.chooseclimate.org/flying/mapcalc.html

Government TravelSmart website — tool kit for employers
www.travelsmart.gov.au/employers/toolkit.html

Working 9-to-5 on climate change: an office guide world
www.wri.org/publication/working-9-5-climate-change-office-guide

Resources Institute
www.resourcesaver.org/file/toolmanager/CustomO16C45F39728.pdf

Green vehicle guide
www.greenvehicleguide.gov.au

Electric bicycle, Lincolne Scott Mid Town Plaza, ISPT, Melbourne
(Erica Lauthier)

OPPORTUNITY 8

Minimising ozone layer depletion

WHY IS IT IMPORTANT

The ozone layer is a layer of ozone (O_3) situated far above the build up of greenhouse gases that protects the earth from harmful (to humans) solar radiation. Research has shown a thinning of the ozone layer all over the globe. However due to specific meteorological conditions the most dramatic depletion is over Antarctica. Its absence results in increased exposure to solar radiation and its detrimental effects – such as skin cancer, cataracts, disruption of normal functions of micro-organisms, and melting of the ice caps.

Chlorofluorocarbons (CFCs), halons, methyl chloroform, carbon tetrachloride, HCFCs, hydrobromofluorocarbons and methyl bromide are responsible for the ozone layer depletion. The impact on the ozone layer is measured by the Ozone Depletion Potential with CFC-11 set as one and all other gasses given a relative value. Ozone depleting substances used in buildings include chemical refrigerants used in air-conditioning systems and fridges, and expanded materials such as polystyrene.

Australian Government buildings' responsibility to reduce, and where possible eliminate use of ozone depleting substances, is invoked because Australia is a signatory to the Montreal Protocol on substances that Deplete the Ozone Layer. The manufacture, import, and export of CFCs, halon, methyl chloroform and carbon tetrachloride has been controlled in Australia since 1989. These activities were banned for halon from 31 December 1992, one year ahead of the Montreal Protocol requirements. For the other chemicals, these activities have been banned since 1 January 1996, except for a small range of essential uses.

Australia banned importation and manufacture of CFCs from 31 December 1995. HCFCs are ozone depleting, but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to assist in the phasing out of CFCs. They are commonly used as refrigerants, solvents, and blowing agents for plastic foam manufacture, and are scheduled to be phased out by 2020.

Many ozone depleting substances were replaced by hydrofluorocarbons (HFCs) and other fluorocarbon-based chemicals. While these substances do not cause ozone depletion if released to the atmosphere, most still have a high global warming potential (GWP). Carbon dioxide, as the base greenhouse gas, is taken to have a GWP of 1, and all other substances are assigned a value relative to this. HFC-134a, a common refrigerant gas, has a GWP of 1300, and some HFCs can have GWP values as high as 3900.

HFCs fall under the broader category of 'synthetic greenhouse gases', the import and use of which is governed in Australia by the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*. The Act requires all importers of synthetic greenhouse gases to hold an authorisation and report on the amount of gas they import. It also requires anyone who handles these gases to hold an appropriate Australian Refrigeration Council license (see www.arctick.org).

The majority of refrigeration and refrigerative air conditioning equipment in use in Australia today contains a fluorocarbon refrigerant (HCFC or HFC, thought some small numbers of CFC units are still in operation) to facilitate the cooling process.

HOW YOU MEASURE IT

The information required for reporting on performance in reducing the impact on the ozone layer and direct greenhouse gas emissions is the total amounts of refrigerants used (by substance, as each substance has different ODP/GWP values) with an estimate of the leakage. The table below shows that data to be collected and the most appropriate form for reporting. Suggested ways to collect data are:

1. one is to keep a log of refrigerant movements
2. two is to use manufacturer's specs on chillers and estimate 15% leakage of refrigerants
3. three is to estimate leakage of 0.09kg/m^2 for water cooled systems or 0.01kg/m^2 for air cooled systems.

Minimising emissions that affect the ozone layer can be done by choosing non-ozone depleting refrigerants (such as HFCs, water, air, CO_2, ammonia and hydrocarbons) and ensuring there are systems in place to minimise or eliminate refrigerant leaks.[44]

Refrigerant leaks can be up to 15% of the volume of refrigerants per year. This not only affects the ozone layer, but also adds to the greenhouse effect. The global warming caused by cooling system refrigerant leakage can be as much as that caused by the electricity consumed by the cooling plant.

Direct emissions of synthetic greenhouse gases in Australia (of which fluorocarbons are the major component) are estimated to comprise around 1% of total Australian greenhouse emissions.

As suggested in the NAB case study below, the most effective measure that can be taken immediately to reduce the emission of ozone depleting substances and synthetic greenhouse gases is to ensure that an effective preventative maintenance program is put in place for all equipment containing these substances.

In the case of refrigeration and air conditioning equipment, this maintenance should be carried out by technicians licensed under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*. The Australian Refrigeration Council (ARC) is responsible for issuing these licenses and its website (www.arctick.org) provides a search facility to find licensed parties.

It should be noted that the practice of 'topping up' the refrigerant gas in a refrigeration or air conditioning system is not recommended – usually, if a system requires a 'top up' of gas, it is an indication that there is a leak in the system. In these cases, all refrigerant should be evacuated from the system into

[44] Green Star — Office Design v2 Emissions Em-1 'Refrigerant ODP' and Emi-2 'Refrigerant GWP', www.gbca.org.au

a safe storage container, and the leak(s) should be located and repaired before the refrigerant is returned to the system.

Note that while this is a good environmental practice, there are also other reasons behind it – some refrigerants contain blends of different gases, and it can be impossible to determine how much of each component gas has leaked and hence the correct mixture in a "top up" situation. Refrigerant gas that is unusable should be returned for disposal.

In the middle to long term, plans should be made to replace these systems with ones using less harmful refrigerants

Green Star – Office Design v2 specifies that to achieve the relevant credits, refrigerants need to have an Ozone Depleting Potential (ODP) of zero and a Global Warming Potential (GWP) of ten or less[45]. At the time of writing, no fluorocarbon refrigerant could meet these criteria, meaning 'natural' refrigerants such as ammonia, carbon dioxide or hydrocarbons were the only alternative. Use of these refrigerants in air conditioning applications in particular is limited at the time of writing. While the use of these refrigerants in an air conditioning system is technically feasible, careful consideration would need to be given to both occupational health and safety concerns: ammonia carries a B2 (toxic, and medium flammability) safety classification and hydrocarbons carry an A3 (high flammability) safety classification. Consideration should also be given to the projected energy use of any replacement system.

Mini case study – NAB sustainability report

'During 2005, in the UK and Australia, we have improved our management of ozone depleting substances (ODS) that are associated with refrigerants in the cooling systems we use. These substances are found in small volume equipment such as water chillers or domestic refrigerators or in large chillers making up part of building cooling systems.

In Australia, we developed an inventory of ODS and we have estimated that around 7724 kg of ODS are contained within our cooling and refrigeration equipment. We do not currently have data on recharge volumes to allow us to estimate the potential contribution to greenhouse emissions from this source. However, we are now planning a replacement and phase out program for refrigerant gases with the highest global warming potential. In the UK, we undertook phased replacement of some refrigeration and cooling equipment, which saw the reduction in our use of ozone depleting substances. We also expanded our preventative maintenance program to help early detection of refrigerant gas leaks.'

Source: www.nabgroup.com/0,,76555,00.html

Resources

Ozone Layer Depletion Montreal Protocol **www.unep.org/ozone/Montreal-Protocol/Montreal-Protocol2000.shtml**

Department of the Environment, Water, Heritage and the Arts **www.environment.gov.au/atmosphere/ozone/**

US EPA **www.epa.gov/ozone/ods.html** a list of class 1 ozone depleting substances

CSIRO **www.dar.csiro.au/information/ozone.html**

Bureau of Meteorology **www.bom.gov.au/lam/Students_Teachers/ozanim/ozoanim.shtml** provides an animation on the chemistry behind ozone layer depletion

Standards Australia - (HB 40.1-2001): Appendix 3 & 4 summarise OPD potential for most common types of refrigerants **www.standards.com.au**

AIRAH Refrigerant Selection Guide 2003 **www.airah.org.au/downloads/AIRAH_RSG2003.pdf**

DECC – briefing on refrigerant impact on ozone for building owners **www.environment.nsw.gov.au**

SUMMARY OF OPPORTUNITIES

- Maintenance – ensure preventative maintenance programs are put in place, using ARC licensed technicians, and that the practice of 'topping up' is discouraged.
- Management – plan, monitor and evaluate performance of refrigerants, and ensure all systems have been switched over to zero ODP and less than 10 GWP in the next 10 years.
- Level 1 refurbishment – as above
- Level 2 refurbishment – if replacing plant – look for effective refrigerant systems – where there is automatic leak detection and collection to minimise any emissions to the atmosphere.

HFCs are not genuinely ozone friendly. The production of HFCs uses the very same halogenated CFCs and HCFCs, which they were intended to replace, as emissions during the manufacturing process are inevitable.

[45] Green Star — Office Design v2 Emissions credits Em-1 'Refrigerant ODP', www.gbca.org.au

1. Case studies

CASE STUDY 1

Medicare – operational management

Medicare Australia plays a vital role in the Australian health and human services sectors. It has in excess of 5000 staff nation-wide and operates a network of 238 Medicare Offices as well as two contact centres across Australia. Medicare Australia also has offices in each capital city and a head office in Canberra.

Medicare Australia adopts an environmental management approach that seeks to improve environmental performance as well as addresses adverse environmental impacts from its business operations. To achieve these outcomes over a large distributed property network, Medicare Australia has introduced a comprehensive environmental policy, which is strongly supported by the executive management. The policy is used as an instrument to instigate structural change through setting standards for internal processes and external interactions. The environmental policy forms the basis for an evolved Environmental Management System (EMS) compliant to international standards – ISO EMS 14001.

Environmental management system (EMS)

A key requirement of the EMS framework is raising environmental awareness among staff, as well as among individuals and companies that directly or indirectly contract to the organisation. Medicare Australia has established the following processes to meet this requirement:

- fully interactive e-learning modules on energy, paper, water and waste recycling, which are deployed on the corporate intranet site to raise staff awareness
- an intranet site dedicated to environmental information, initiatives, targets and general performance
- a nation-wide network of environmental coordinators to attain consistency and standardisation of environmental practices
- induction training on environmental awareness for new employees
- inclusion of whole-of-life cycle assessment and environmental provisions into the procurement process, such as the use of certified environmental labelling meeting ISO 14000 series standards
- enhanced business planning processes to mitigate risk of adverse environmental impacts
- inclusion of environmental impact statements into costing templates for new business proposals.

Medicare Australia has developed a series of initiatives surrounding energy, water, paper and waste management. These initiatives are performance managed (or governed) under Medicare Australia's corporate scorecard through environmental key performance indicators and targets.

Les Cruikshank audits a water system
(Russell Kerrison)

OPPORTUNITY 1 — OPTIMISING INDOOR ENVIRONMENT QUALITY

Medicare Australia uses its environmental policy as a management mechanism to optimise indoor environmental quality. It specifies the use of products and materials that have low environmental impact as well as indoor plants to absorb the effect of volatile organic compound emissions and improve staff amenity.

OPPORTUNITY 2 — ENERGY MINIMISATION

Medicare Australia is currently achieving the 2011–12 energy targets set in the 2006 Energy Efficiency Government Operations (EEGO) policy. This is as a result of using energy-efficient technologies and maximising occupancy density, based on a three dimensional fit-out design approach.

These efficiencies have been achieved in a business environment where Medicare Australia has extended its branch office trading hours to late night shopping and Saturday morning trading. Medicare Australia strives for continuous energy improvements in its 257-site property network, with independent energy audits scheduled for 2007. In addition, to offset greenhouse gas emissions, Medicare Australia purchases 2.5% green energy with an expected increase to 8% by January 2008.

Checking a HVAC system
(Russell Kerrison)

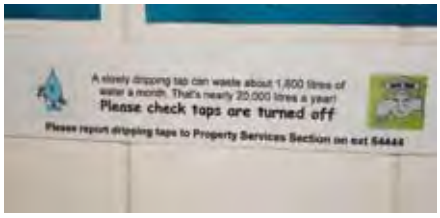
The total energy consumption for Medicare Australia during 2005–06 is 78 876 gigajoules, which translates to 18 095 tonnes of gross CO_2-e greenhouse gas emissions or 3.36 tonnes per person. In order to minimise greenhouse gas emissions, Medicare Australia has joined the Australian Greenhouse Office Greenhouse Challenge Plus programme. As part of the programme, Medicare Australia will undertake an independent verification to quality assure energy data, and will take an active role in seeking new energy-efficient technologies and/or offsets.

Checking a lighting system
(Russell Kerrison)

Installing flow restrictor
(Russell Kerrison)

OPPORTUNITY 3 — WATER CONSERVATION

As the drought continues in most parts of Australia, local governments have applied harsher water restrictions to minimise water consumption. Medicare Australia staff and property owners have assisted in this process by complying with water restrictions and developing initiatives to further address water consumption.



Water minimisation signage for staff
(Russell Kerrison)

Low flow taps and showers and high pressure flush systems have been introduced into the larger Medicare Australia property sites. New technologies and innovative designs to conserve water will be introduced into existing and new building designs.

Mick Dawes checks the flow rate
(Russell Kerrison)

During 2006, the total estimated water usage for Medicare Australia was 54 million litres. This translates to water intensity consumption of 0.72 kl/m^2 per annum. On a per person consumption level, the average water consumption during the year was 10 031 litres per person per annum. Of this amount, air conditioning represents 4831 litres per person per annum and the remaining 5200 litres per person per annum is for drinking, showers, toilets, cleaning, hand basin, kitchen and garden use. Medicare Australia expects personal consumption (net of air conditioning) to decline by 10% over 2007 through the above initiatives. However, if water restrictions are lifted during the 2008 summer, water consumption for garden use is likely to increase marginally.

OPPORTUNITY 4 — MATERIALS CHOICE

Medicare Australia selects products and materials based on a standards approach, where fit for purpose and cost effective. These requirements are outlined in Medicare Australia's environmental policy, where all products and materials are procured on a life-cycle basis – aiming to meet environmental labelling standards under the ISO 14020 series. In addition, Green Star principles are applied during the planning and design phases for new building refurbishments.

OPPORTUNITY 5 — MINIMISING WASTE

Medicare Australia consumes 33 million sheets or 174 tonnes of internal copy paper per annum. This equates to 6,234 sheets per person per annum.

In order to improve environmental performance, Medicare Australia has introduced 50% recycled copy paper for internal printers, faxes and photocopiers. This initiative is expected to save 2.7 million litres of water, 1120 trees, 353 354 kilowatt hours, 215 barrels of oil, 345m^3 of landfill, and 353 tonnes of greenhouse gas emissions.

On a consumption level, internal copy paper has steadily grown over the past few years due to an increase in business activity, as well as to the rapid movement to high-speed printer technology and competitive pricing structures of high-speed printers. To mitigate this issue, Medicare Australia has undertaken an extensive staff education programme to reduce consumption through re-promoting double-sided printing and introducing a tighter printer policy. It is expected that internal copy paper will reduce by 15% by January 2008 as a result of these initiatives.

On an external level, Medicare Australia has achieved significant environmental benefits with the introduction of e-claiming and the associated declines in paper-based claiming channels. Benefits have also been achieved through other projects, such as the 'forms and envelopes consolidation strategy'. Combined, these initiatives are expected to deliver a saving equivalent to 5 million A4 sheets or 25 tonnes of virgin fibre paper in 2007. Over the coming years, Medicare Australia will be seeking to introduce recycled paper for external business arrangements, providing that the paper is fit for purpose and cost-effective.

It is Medicare Australia's aim to maximise recycling streams and to minimise waste to landfill. Key to this objective is providing easy accessibility to recycling bins and improved signage. In addition, the adverse environmental impacts of landfill and the benefits of recycling (waste to resources) are promoted to staff. Medicare Australia will continue to develop new recycling streams in order to divert landfill waste.

Teresa Kidson recycling corks
(Russell Kerrison)

Medicare Australia sends 33 kg of waste per person per annum to landfill — net of office refurbishments. With the introduction of recycling standardisation practices across the 257-site property network, as well as improved recycling infrastructure and signage, and the development of new recycling streams, Medicare Australia expects to reduce personal landfill waste by 25% over 2007.

In addition, Medicare Australia has successfully introduced Medicare Australia Reuse Stations (or MARS) into communication centres, as a mechanism to re-use usable office supplies and equipment. Staff seeking office supplies or equipment are encouraged to investigate MARS before placing new orders.

Waste minimisation signage for staff
(Russell Kerrison)

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

Given its national presence and responsibilities, Medicare Australia has sought to position itself as an employer of choice across Australia. Fundamental to this outcome is fostering a culture that emphasises social harmony, equity, respect, teamwork and values its people. In the 2006 staff survey, 70% of staff stated they were satisfied or very satisfied with working for Medicare Australia. These corporate values are extended to its customers as well as the diverse network of Australian local communities, and are measured carefully. For example, Medicare Australia received a 96% public satisfaction in its 2006 external market survey.

Perhaps the most significant challenge to face Medicare Australia, in ensuring its sustainability, is identifying the capabilities required in its future workforce. Intimately linked to this, are the additional challenges of recruiting people with these capabilities, and developing existing staff, helping them to acquire those capabilities. With the ageing of the Australian population and workforce, the ongoing recruitment and staff development programs are crucial to maintain the high standards expected of the organisation.

OPPORTUNITY 7 — MINIMISING TRANSPORT IMPACT

Medicare Australia has 156 fleet motor vehicles, including both pool vehicles and executive vehicles. Of these, 30% have a green vehicle guide rating of 10.5 or above, with an expected increase to 39% by December 2007 and 57% by December 2008. Greenhouse gas emissions produced from all fleet vehicles have been offset through an offset subscription scheme. Medicare Australia also reports on motor vehicle fuel consumption and E10 usage in its corporate scorecard.

Further information

The material in this case study has been adapted from the Medicare website: **www.medicareaustralia.gov.au/about/governance/emu.jsp**

CASE STUDY 2

Centrelink – operational management

Centrelink is an Australian Government agency with more than 25 000 staff delivering welfare-related services and payments to the Australian community on behalf of 25 government agencies. Its customers total 6.5 million people (nearly one-third of the Australian population) and include retired people, families, sole parents, people looking for work, people with disabilities, illnesses or injuries, carers, widows, primary producers, students, young people, Indigenous peoples and people from diverse cultural and linguistic backgrounds. Its aim is to serve Australia by supporting those in need and assisting people to become self-sufficient.

Environmental policy statement

Centrelink has a very large environmental impact throughout Australia. It is a large consumer of materials and energy, and manages sizeable physical resources. Due to its size and geographical spread, it is in a strong position to influence environmental better practice and to demonstrate environmental stewardship and social responsibility to the wider community.

Centrelink's environmental policy statement says that:

'Centrelink will continually improve its business performance and conduct its operations in an environmentally responsible manner, clearly reflecting a commitment to fostering the sustainable use of the Earth's resources.'

Centrelink team with the 2006 ACT NOWaste Award for leadership in government
(Source: Centrelink)

Environmental management system

Centrelink also implements and maintains an EMS that meets ISO 14001 requirements and ensures that the organisation:

- complies with all relevant environmental legislation and regulations, and other initiatives to which Centrelink subscribes
- incorporates environmental better practice into its core business plans and management processes
- minimises negative impacts it may have on the environment, through efficient use of resources, and reduction in emissions and waste
- develops an agency-wide framework for setting and reviewing its environmental objectives and targets, which includes key environmental management and performance indicators against aspects of Centrelink's operations
- provides regular monitoring and reporting against these indicators to all staff
- incorporates environmental better practice into all technological solutions, and the fit-out and operation of accommodation
- works closely with clients, suppliers, local communities, and other interested parties to continually improve processes in environmental better practice
- fosters the initiation and ownership of environmental activities by all staff, thereby promoting a strong, environmentally aware business culture.

Environmental management plan and environmental performance

Implementation of Centrelink's EMS led to the development of a corporate environmental management plan, which created the framework for Centrelink's environmental performance. Centrelink's environmental performance at September 2006 is shown below.

Centrelink environmental performance (September 2006)

- 7% reduction in electricity consumption over the last two years
- 15% reduction in fuel fleet consumption over the last two years
- 7% reduction in greenhouse gas emissions over the last two years
- Almost 30% reduction in Centrelink office paper use in the last two years
- Introduced greenhouse gas abatement strategies to cut emissions by 50 000 tonnes of CO_2 over the next three years (equivalent to taking 13 000 cars off the road)
- 900% increase in Greenfleet subscriptions in the 2005–06 financial year, resulting in a 'Centrelink-specific' forest in Eddington, Victoria, of 11 000 native trees planted by Greenfleet
- 42% of Centrelink's vehicles have a green vehicle guide rating of 10.5 or higher in 2005–06 (exceeding the Australian Government target of 28%). This represents a 50% increase in the fleet's overall performance compared to 2004–05 results
- The building of a 4.5 star NABERS Energy National Support Office headquarters
- Almost 300 'environmental champions' Centrelink-wide in the 2005–06 financial year
- 100% of new PCs with flat screens, reducing energy, raw materials and hazardous materials usage.

Source: www.centrelink.gov.au/internet/internet.nsf/filestores/co311_0605/$file/co311_0605en.rtf

Staff commitment

Staff commitment is the most critical element to ensuring the success of environmental programmes, the integration of environmental considerations into resource management decisions, and, therefore, in improving environmental performance. Without staff support, many programmes would fail.

Centrelink has established a number of strategies to build an environmentally aware business culture. In particular, a set of environmental stewardship principles have been developed for staff, allowing them to apply a high level of environmental awareness and responsibility within their work. These follow the principles as laid out in Centrelink's environmental policy statement.

To ensure awareness of the environmental stewardship principles, a corporate environmental stewardship training video was developed in November 2005 and endorsed by the CEO. This video is shown to new employees via employee induction programmes. During 2005–06, in-house environmental awareness training was provided to over 400 employees.

Centrelink has developed a network of volunteer environmental 'champions' — staff members who take on the responsibility to act as role models for promoting and upholding the environmental stewardship principles in their local area, and who provide support to local and national environmental initiatives. The champions share best environmental practice via an intranet-based discussion forum, newsletters, national teleconferences and an annual Environmental Champion Coordinator conference.

The environmental champions are integral to getting Centrelink's environmental messages out to the network.

Sustainable business processes

In October 2005, Centrelink's CEO issued an eco-efficient chief executive instruction (CEI). It directed staff to consider environmental impact and value for money in all procurements. The CEI has been applied to major IT procurement activities and is being integrated into standard procurement operating procedures and environmental purchasing policy (currently under development). Centrelink's sustainable business processes now include the following:

- Centrelink's environmental policy is included in the standard Centrelink Request for Tender proforma
- an environmental risk management tool has been integrated as standard business practice into the corporate project planning process, to ensure that project managers assess and address the environmental impacts of their proposals
- environmental initiatives that complement the objectives and targets outlined in the environmental management planning process are incorporated in organisational business plans where appropriate.

OPPORTUNITY 1 — OPTIMISING INDOOR ENVIRONMENT QUALITY

As part of their energy audits and upgrades, Centrelink has looked for opportunities to improve the indoor environment of their offices, aiming for

'a lighter, brighter working environment for our staff with less computer glare'.

OPPORTUNITY 2 — ENERGY MINIMISATION

Centrelink is the third largest greenhouse gas producer within the Australian Government, due to the number of employees, its activities and the size of its property portfolio.

Centrelink's response has been to become a member of the Greenhouse Challenge Plus Programme, to look at ways to reduce energy consumption and combat climate change by reducing greenhouse gas emissions.

Centrelink has demonstrated a continual reduction in its overall energy consumption and greenhouse gas emissions, with a 7% reduction in both, or a saving of 37 000 gigajoules of energy and 8500 tonnes of carbon dioxide over the last two years.

'The majority of Centrelink's energy consumption and greenhouse gas emissions are generated by tenant light and power and fleet vehicle usage. Centrelink needs energy in order to operate effectively, however through a series of energy efficiency and greenhouse gas minimisation and abatement strategies we have managed to reduce our overall energy consumption and significantly reduce our impact on the environment, created by the energy we consume to do our business.'

Energy management and audit programme

Centrelink has developed an innovative energy management programme to reduce energy consumption from office light and power. Energy audits were conducted in 203 offices to identify the potential for cost efficient energy saving upgrades within Centrelink offices, such as re-lamping inefficient lighting systems with high-energy efficient lamps and implementing automatic timing controls. Some of the recommended upgrades have been implemented, with an average reduction of 10% in electricity consumption.

Lights off campaigns

'Lights off' campaigns are another efficient way of saving energy. By encouraging staff to switch off lights when not in use, Centrelink has saved energy and reduced operating costs. For example, in the Woden National Support Office, the implementation of energy conservation measures has resulted in an average reduction in electricity consumption of 12%.

Energy efficient appliances

Centrelink purchases office appliances and equipment with energy star ratings. This includes multi-functional devices, desktop computers and flat screen

monitors (that are equipped with sleep modes for periods of non-use) and kitchen appliances.

Greenhouse gas emission abatement strategies
Centrelink has entered a new contract for the supply of 25% Green Balance energy to 178 Centrelink sites. This arrangement will result in approximately 42 000 tonnes of greenhouse gas emissions being abated.

Renewable energy
In addition to the Green Balance abatement programme, 8% of Centrelink's energy in the ACT is produced from green power, as part of a new Australian Government supply contract.

OPPORTUNITY 4 — MATERIALS CHOICE

One tonne of virgin office paper requires the equivalent of 24 trees.

Since 2004, Centrelink has reduced its office paper purchases by almost 30%. This not only has environmental benefits but also substantial financial benefits.

This result can be attributed to:

- the rollout of Windows XP operating system in mid-2004, which made double-sided printing the standard default setting for Centrelink's PC network
- an eco-efficient office consumables programme being integrated into business plans, which focused on paper reduction
- various local initiatives within Centrelink offices to reduce paper consumption. For example, Maryborough Rural Call Centre staff re-use non-sensitive office paper by making notebooks to be used by call centre staff.

Other initiatives aimed at increasing the use of recycled paper-based products include:

- using recycled and re-usable envelopes in customer correspondence, allowing customers to re-use these resources
- using recycled fibre content paper in Centrelink's printed information products — 2.5% of customer brochures were printed on recycled paper in 2005–06.

OPPORTUNITY 5 — MINIMISING WASTE

Centrelink encourages material efficiency, by both reducing the generation of waste at its source and by resource recovery (recycling).

Recycling
Tuggeranong Office Park has adopted a zero waste to landfill policy for all internal office redesign. The office park uses modular partition components for all internal office construction. This allows for the components to be removed, placed in storage and re-used when needed.

Waste audits
During 2006, waste audits were undertaken at Tuggeranong Office Park in NSO and in two sites within the office network, so that the core waste streams could be understood. The audits will be used to support the development and implementation of a new national waste management strategy that will focus on minimising waste to landfill and divert waste to recycling streams.

A significant start has been made to recycling Centrelink's most prominent waste stream — paper. Paper is recycled in all offices across Centrelink through secure paper waste contracts and via the secure paper waste bins in all offices. In many cases, Centrelink staff have led by example, demonstrating good environmental stewardship behaviour and social responsibility.

Recycling and re-use
Cairns Call Centre recycles their aluminium cans. Money raised from this recycling is donated to the Royal Flying Doctor Service.

In 2005, Centrelink's Communication Division introduced an initiative to replace plastic bags (which were being used to deliver publications and products to customers during roadshows and exhibitions) with sturdy recycled paper bags. Over half a million plastic bags had been used previously for this purpose and were most likely ending up in landfill.

Toner cartridges are recycled through arrangements with the equipment suppliers and (if that is not possible) through the Planet Ark programme.

When desk phones are no longer required or are faulty, they are returned to the supplier where they are cleaned and re-used, either as parts or as whole units.

Work mobile phones no longer in use are either returned to the National Support Office (where they can be re-used internally), are sent back to the supplier (where they are recycled), or are recycled locally at mobile phone recyclers.

Centrelink currently recycles all its fluorescent lamps from the energy conservation measures rollout (approximately 20 000 old lamps will have been recycled through the first stages of the programme).

Centrelink is aiming to minimise the amount of packaging waste ending up at landfill by ensuring their suppliers are aware of their focus on minimising waste. For example, all new PCs purchased by Centrelink will be delivered in minimal packaging, which:

- uses recyclable and re-usable packaging materials, such as paper
- uses other shock-absorbing materials, not polystyrene
- labels plastic materials, facilitating separation for recycling.

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

In line with the concept of corporate social responsibility, Centrelink is in the process of developing and implementing the Environmental Management (EM) Star Programme — a framework for acknowledging the efforts of business units that integrate Centrelink's corporate environmental management plans into their unit business plans. Acknowledgement will occur through the allocation of ratings for 'planning' (1 star), 'doing' (2 stars), 'sustaining' (3 stars), 'sharing' (4 stars) and 'leading' (5 stars).

By joining the EM Star Programme, business units receive a range of incentives, depending on their level of commitment to improved environmental performance. The incentives will range from being listed on the EM website pages as a business unit committed to supporting improved environmental performance, to a special presentation at the annual Environmental Champion Coordinator conference and nomination for Centrelink or external awards.

OPPORTUNITY 7 — MINIMISING TRANSPORT IMPACT

Reducing fuel consumption
Centrelink's activities in this area have centred on reducing fleet size by approximately 10% in 2005–06, and the lease of vehicles with smaller engine sizes that are fuel efficient (not to exceed 10.8 litres per 100 kilometres) and that have higher Green Vehicle Guide (GVG) ratings (rating levels of air pollution and greenhouse gases).

At the end of March 2006, 42% of Centrelink's pool vehicle fleet had a GVG rating of 10.5 or higher, which significantly exceeds the Australian Government target for 28% of agency vehicles to have a GVG rating of 10.5 or higher. This is an increase of approximately 50% since 30 June 2005 where 28.7% of vehicles achieved this GVG rating.

Alternative fuels
Centrelink also promotes the use of ethanol/petrol-blended bio-fuels in Centrelink fleet vehicles where possible. To increase the uptake of this renewable fuel, all new vehicles leased by Centrelink after 1 July 2006 will be able to operate on ethanol/petrol blended fuels.

Travel programme
Centrelink, through its sustainable staff travel programme, has also encouraged fleet managers to subscribe their fleet vehicles to the Greenfleet emissions offset programme. Since July 2005, the number of Centrelink fleet vehicles covered by Greenfleet subscriptions has increased dramatically from 9% to 89%.

Each Greenfleet subscription facilitates the planting of 17 native trees to absorb the carbon dioxide released by the car. The planting of these trees (or reforestation) also helps tackle salinity, improve water quality and increase habitat for native flora and fauna.

CASE STUDY OF A NEW CENTRELINK BUILDING — GREENWAY PROJECT

The Greenway project provides a good example of Centrelink's commitment to ecologically sustainable development.

In October 2005, development commenced on a 40 000 m^2 4.5 star NABERS Energy national headquarters building in Tuggeranong, ACT. Environmental considerations were at the forefront of this project, and some of these are outlined below.

Use of materials
Most of the building is made from precast concrete panels. This process reduces the level of waste (especially to landfill) when compared to reinforced concrete formwork construction. Fit-out design is currently being addressed, taking materials with low toxicity into account.

Water conservation measures
The building will incorporate the following water conservation systems:

- a grey water recycling system
- rainwater and stormwater recycling systems, used to maintain the landscaping
- 50% solar hot water augmentation to the underlying gas-fired domestic hot water systems
- taps that have a timing system to reduce water wastage.

Energy efficient systems
The building will incorporate the following features to ensure that it remains energy efficient:

- energy-efficient fluorescent lamps
- the use of a lighting control system to switch off the lights when rooms are unoccupied
- in-floor hot/cold water air-conditioning for the atrium floor space
- the design of the office floor will ensure that no office workstation will be further than 12.5 metres from a natural light source
- the tying of rental payments to the achievement and maintenance of a 4.5 star NABERS Energy rating.

In addition to all of the above, there are arrangements in place with the landlord to have the building EMS certified, thus ensuring continual improvements in environmental performance.

Further information
Most of this case study was adapted from the document at:

http://www.centrelink.gov.au/internet/internet.nsf/filestores/co311_0605/$file/co311_0605en.rtf

Former Centrelink CEO, Jeff Whalan, with former GreenFleet CEO, Henry O'Cleary, at the launch of Centrelink's first environmental performance report
(Source: Centrelink)

CASE STUDY 3
500 Collins Street, Melbourne

CLIENT	Kador Group, Kamirice Pty Ltd
PROJECT MANAGER	Bovis Lend Lease
ARCHITECT/DESIGNER	Peddle Thorp Architects
INFORMATION	David Oppenheim, Sustainable Built Environments (Environmental Consultant)
FACILITIES MANAGER	ECS Property Group

Harry Hullin, entrance 500 Collins Street
(Erica Lauthier)

PROJECT

The 28-level building was originally constructed in the 1970s, and consisted of 25 000m^2 of lettable office space, a retail component at ground floor level, and a basement car park for 141 cars over 1.5 levels.

When the building was purchased by the Kador Group in 2002, it required significant upgrades to its services to meet market expectations. In addition to the service upgrade, additional space was added at ground floor level to provide a social outlet for building occupants. 500 Collins Street has become the first high rise refurbished building in Australia to achieve a 5 star Green Star office design certified rating.[46]

INITIATOR

Building owner — Kador Group, Kamirice Pty Ltd.

WHY UNDERTAKEN

The initial ESD report prepared by SBE in 2003 revealed that

'Kamirice have expressed the desire that this building represent the ethos of their portfolio'.

The intention for the project was to improve the quality of the building and raise its profile through the incorporation of ecologically sustainable design features, as well as demonstrate to the property market that such a refurbishment could be done commercially. The result would be to future-proof the building for a market increasingly driven by concepts of sustainability.

EXTENT OF REFURBISHMENT

The strategy for upgrading the building involved retaining the tenant occupancy rate at 80%, so a staged refurbishment was required. The project team developed a six stage process to upgrade the building and its services.

Stage 1	(2003) replacement of chillers in rooftop plant
Stage 2	plant, equipment, infrastructure upgrades and refurbishment of ground level retail areas
Stage 3	reconfiguration of car park and inclusion of 55 bicycle spaces
	retail to Lt. Collins and Church lane
Stage 4	floor-by-floor refurbishment
Stage 5	the extension of levels three, four and five
Stage 6	improvement of the building façade and crown.

ESD ELEMENTS INTEGRATED

OPPORTUNITY 1 — OPTIMISING INDOOR ENVIRONMENT QUALITY

The chilled beams that were installed reduced the need to circulate air around the building, resulting in significant energy savings. The indoor air quality is enhanced by the ability to increase the air change rate by more than 50% of the required level of outside air AS1668.2 (1991) (see the response from building users to the air in Figure 16).

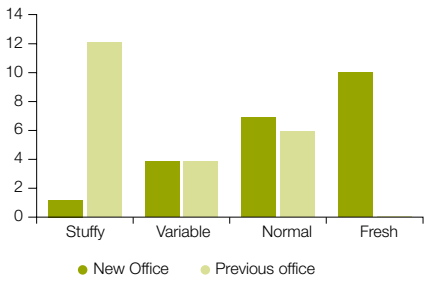


Figure 16 – *Rate the air quality in your office*
(Source: Bevege, 2006)

[46] www.gbca.org.au

Other initiatives undertaken to improve the indoor environment quality include:

- carbon dioxide monitoring and control systems
- thermal modelling to determine levels of occupant satisfaction during the design stage
- acoustic modelling to determine acoustic treatments needed in the building
- low VOC paint, carpet, sealants and adhesives being used throughout the building
- pre- and post-occupancy studies to assess impacts of improvements on productivity of tenants
- cleaning contractors using environmentally friendly products and practices
- daylighting and external views being maximised.

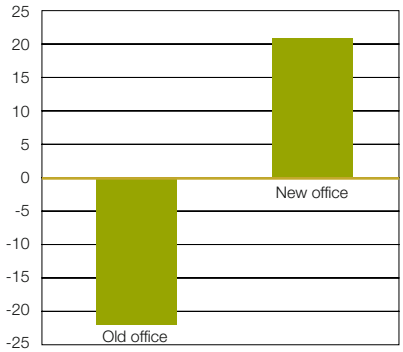


Figure 17 – *Fresh air index*
(Source: Bevege, 2006)

OPPORTUNITY 2 — MINIMISING ENERGY USE

The building has been designed to meet 5 star NABERS Energy base building levels and is predicted to achieve a 45% CO_2 emission reduction compared to standard practice. Energy savings were achieved through the upgrade of existing equipment to state of the art building services. As the building is still undergoing the upgrade, these figures are not yet available.

The old chillers needed to be upgraded and this involved designing a purpose built crane, getting it onto the building roof, and then hoisting the chillers up the side of the building to the rooftop plant room and chilled beams were installed.


5 star rating

500 COLLINS STREET - THE PATH TO RENEWAL

THE STORY SO FAR.....

RECOGNITION	• 5 Star GreenStar Certified Rating Awarded By The Green Building Council of Australia	★
	• 4.5 ABGR (Australian Building Greenhouse Rating)	★
Rating	• High "A" Grade Building	✓
Air conditioning	• New Energy Efficient Chillers, Cooling Towers, Pumps	✓
	• Dedicated Chilled Water Riser	✓
BAS	• New Building Automation System - Controls and Monitors all Services	✓
Lifts	• New Solid State Lift Controls	✓
	• Upgrade of Lift Cars, Doors and Ride	✓
Electrical	• New Main Switchboard	✓
	• Standby Generator	✓
	• Solar Panels Supply 25% of Domestic Hot Water	✓
Security	• New Security/ Access Control - CCTV	✓
Communications	• New Communications Infrastructure and Dedicated Riser	✓
Fire Protection	• New Compliant Fire Sprinkler and Alarm Systems	✓
Ground Floor Foyer	• Upgraded Finishes	✓
	• Polished Marble Wall Panels	✓
	• Commissioned Artwork	✓
	• New Concierge Desk	✓
	• New Tenant Directory Board	✓
Change Facilities	• New Male and Female Changerooms, Showers and Lockers	✓
Bicycles	• Dedicated Secure Bicycle Cage	✓
Office Floors	• New Innovative Chilled Beam Air Conditioning	✓
	• T5 Light Fittings	✓
	• Metal Pan Perforated Ceiling Tiles	✓
	• New Lobby Finishes	✓
	• 100% Wool Commercial Grade Carpet	✓
	• Refitted Male and Female Toilets	✓
	• New Waterless Urinals and Water Efficient Bathroom Fittings	✓
	• New Tea Making Facilities/ Shower/ Store - Optional	✓
	• New Window Blinds	✓
Disabled Toilets	• New Toilets Located on Levels 1, 9 and 17	✓
Façade	• New Alucabond Spandrel Panels	✓
	• Painted Pre-cast Concrete	✓
	• Crown to Display the Building's New Identity and Address	✓
	• New Building Maintenance Unit	✓
Car Park	• Reconfiguration of Basement to Provide Secure Car Park	✓
Building Management	• Building Managed by ICS Property – Located Level 24	✓
	• Onsite Operations Manager Located on the Ground Floor Foyer Adjacent to the Concierge Desk. Over 30 Years Experience	✓
New Retail Precinct	• New Retail Precinct on Little Collins Street Plaza and Church Lane.	Underway

Communication to building users: list of ESD features at 500 Collins Street, Melbourne
(Erica Lauthier)

A variable air volume system was considered, but instead an active and passive chilled beam system was chosen. Active beams have been installed around the perimeter of the building, while passive chilled beams are installed in the interior zones. The chilled beam system was designed for flexibility to accommodate future changes to office layout by incorporating flexible hoses that can be shifted.

'I was very interested when we started on the first floor to be retrofitted with [chilled] beams. I thought "this isn't going to work". But then we had a function and they came on and it worked! It is really a clever and logical system; the more heat goes up, the more cooling occurs which comes down'

Harry Hullin

Chilled beam, Level 17, 500 Collins Street, Melbourne
(Erica Lauthier)

Due to a reduced requirement for fan power and the need to reject less heat from the building, the system is expected to reduce energy used for air-conditioning by 30%. In addition, the old oil-fired boilers were upgraded to gas-fired boilers and variable speed drives on major plant and equipment reduced greenhouse gas emissions further.

The second largest energy user in the building was lighting. An average luminance level of 370Lux and lighting density of 2.8W/m^2 per 100Lux was achieved through the replacement of existing light fittings with T5 recessed luminaries with diffusers. The system also provides tenants with the capacity to install perimeter daylight sensors, and occupancy sensors.

T5 lighting, 500 Collins Street, Melbourne
(Erica Lauthier)

The building has an array of 30 solar thermal collectors for heating domestic hot water (DHW). The solar system has been designed to provide 25% of the hot water supply to the tower, cutting total DHW energy use by 14%.

Solar hot water, 500 Collins Street, Melbourne
(Erica Lauthier)

Finally, the sub-metering of all major loads and tenancies has allowed for ongoing assessment of potential problem areas and tracking of behavioural changes. An extensive energy management plan has been developed for the building. The energy consumption data recorded by the BMS will be analysed and presented to the building owner on a monthly basis.

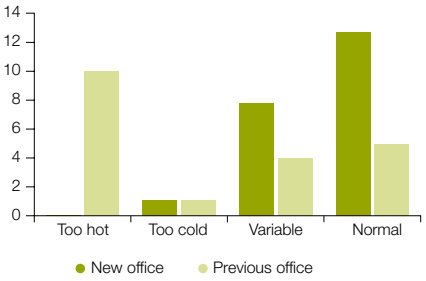


Figure 18 – *Rate the temperature in your office*
(Source: Bevege, 2006)

OPPORTUNITY 3 — WATER CONSERVATION

The water use in the building has been reduced through replacing the existing toilet cisterns with low flush toilets (3/6L dual flushing) and waterless urinals. To achieve flow rates equivalent to 5 stars or 4 L/min, a combination of flow control valves and o-rings were tested and installed on the tap fittings. Flow control valves were also added to the showers to achieve a lower flow rate than was available in the market.

A rainwater collection system capable of providing at least 90% of the irrigation requirements has been set up, with tanks in the basement leading to trickle irrigation in the planter boxes.

Finally, the water use in cooling towers has been reduced by increasing the cycles of concentration. A rate of 13.8 cycles of concentration was being achieved on site during initial testing.

OPPORTUNITY 4 — MATERIALS CHOICE

The re-use of the existing building façade and structure led to a significant saving in raw materials use. Other considerations in material choice included the use of low VOC carpet and paints and a 67% reduction in PVC through the use of non-PVC cabling and drainage pipes.

OPPORTUNITY 5 — MINIMISING WASTE

The construction waste management plan for the site committed the contractor to diverting in excess of 80% of construction waste from landfill.

500 Collins Street has achieved 'Waste-wise' certification through EcoRecycle Victoria (now Sustainability Victoria), achieving a 30% reduction in operational waste to landfill in the first year. As part of this strategy, full recycling facilities

are available, including a worm farm for organic waste.

'We are testing how the worm farm works, feeding them scraps we find until we are happy and then we will set up a system to collect green waste. Hopefully we will end up with five to six 40 gallon drums of active worm farms to deal with the green waste and to produce lovely castings for our plants and gardens.'

Harry Hullin

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

In order to assess the effect of changes to the building on a social level, productivity studies were undertaken by a legal company, Oakley Thompson, and a securities trading company, Lonsec.

The studies were conducted as a partnership agreement between the building owner, a tenant and Sustainability Victoria's Commercial Office Building Energy Innovation Initiative. They considered the results of staff surveys, leave records, ratios of billable hours and keyboard speeds.

According to Harry Hullin, the Building Operations Manager:

'We did productivity studies of a couple of levels in their old offices and their new ones (which includes the chilled beams, etc). We ask them how they felt, what they thought their levels of comfort were and how many sick days they had … we found a marked improvement in how they felt about their work and their productivity'

Harry Hullin

The results of the studies indicated that the Satisfaction Index went from -11 for the previous office, up to +16 for the newly refurbished office. The figures below show the marked decrease in headaches, decreased concentration and frequency of illness.

OPPORTUNITY 7 — MINIMISING TRANSPORT IMPACT

As the building is located in the Melbourne CBD, it has great access to public transport.

Secure bicycle storage facilities with associated change rooms, showers and lockers have been provided for 5% of the building occupants, or 84 people. In addition, visitor bicycle parking spaces have been provided near the entrances to the building.

In order to encourage alternative transport options, the number of car parking spaces was reduced and small car parking spaces and motorbike parking spaces were included.

OPPORTUNITY 8 — MINIMISING OZONE LAYER DEPLETION AND OTHER EMISSIONS

Low Ozone Depletion Potential (ODP) refrigerants and insulants were specified and a refrigerant leak detection system was installed.

High WELS rated fittings also had the added benefit of reduced flow, or emissions, to sewer.

Commissioning

The Building Operations Manager, Harry Hullin, was included in commissioning meetings from an early stage to ensure a smooth handover.

'I like to get to know any new piece of infrastructure that goes into my building … I really try to get into it … really get to know it and how it will work with everything else … so I am not afraid to adjust things here and there … to keep experimenting with running things better … it is important that you know the building well enough that you aren't afraid of anything.'

Harry Hullin

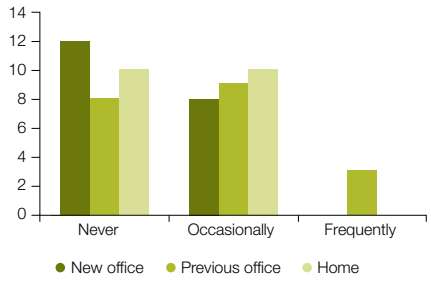


Figure 19 – *Frequency of headaches in the office or at home*
(Source: Bevege, 2006)

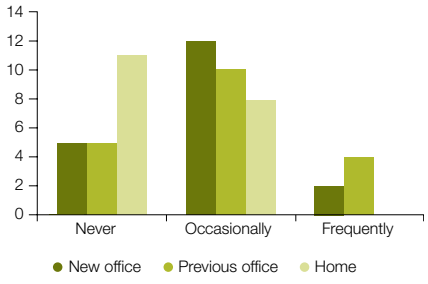


Figure 20 – *Frequency of poor concentration in the office and at home*
(Source: Bevege, 2006)

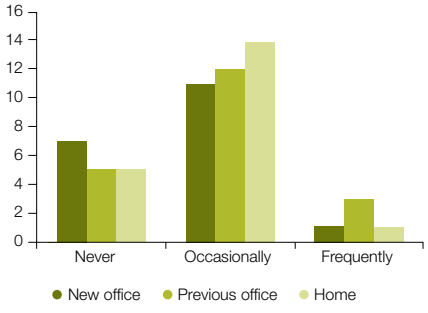


Figure 21 – *Frequency of cold and flu in the office and at home*
(Source: Bevege, 2006)

Commissioning has been integral to the process of upgrading the building. AG Coombs were engaged early on in the Green Star process to look at the issues surrounding commissioning. They undertook a commissioning engineering review of the design and documentation of the project. This review identified key issues for commissioning that affected the design; without the review, 'control' issues would not have been in place to allow for effective commissioning.

Pre-commissioning of the chilled beams enabled AG Coombs to make any necessary adjustments prior to installation.

Wayne Melvern auditing digital control unit for air-conditioning, 500 Collins Street, Melbourne
(Erica Lauthier)

A 12-month commissioning plan with quarterly checks was developed and conducted by the building's Independent Commissioning agent in conjunction with Warwick Stannus of AG Coombs. Warwick comments:

'Commissioning is the key stage between design and the desired outcome. The key issue is for people to change the way they think about construction away from ideas of practical completion to getting a building that performs environmentally and sustainably'.

Harry Hullin

A building user's guide has been prepared to assist occupants in maximising the benefits of the building's infrastructure. The document also provides new tenants with ESD guidelines for the design of their interior fit-outs. The guidelines are not mandatory but their use is encouraged to ensure interior fit-outs are compatible with, and maximise the benefits of, the base building design.

Rental outcome
The current rental rate is $350–$420/m^2 per annum, gross GST exclusive.[47]

Special leases
Direct Lease.

Main barriers encountered
As the first high rise office refurbishment to achieve Green Star certification, there were a number of challenges for the project team. The level of documentation required to achieve certification and the limited support available for applicants were quoted as being the major impediments for the design team.

Where benchmarks exist for new buildings and were applied to existing equipment, the design team often had to think laterally about how to achieve the required outcome. A simple example of this was achieving a 5 star tap rating. A combination of different types of flow control valves and o-rings were tested on site to ensure that the desired flow rates were achieved — in a new building, one would simply specify compliant tapware.

500 Collins Street
(Source: SBE)

Cost/m^2
Not available.

Return on investment
Not available

Other comments
Due to the staging of the project, the final outcome of the refurbishments has yet to be measured.

Further Information
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Bevege, L (2006) *Business outllook and evaluation*, PowerPoint presentation as part of workplace productivity study for Kador Group and Sustainability Victoria.

[47] www.propertylook.com.au/listing/default.asp?lk=42154, Accessed: 10/5/2007.

CASE STUDY 4

QV1 building, Perth

CLIENT/OWNERS	Investa and SAS Trustee Corporation
FACILITIES MANAGER	CBRE
BUILDING SERVICES MANAGER	Paul Buss, CBRE

QV1, Perth
(CB Richard Ellis Pty Ltd)

PROJECT

The QV1 Tower was designed by Harry Seidler and built in 1991. Since that time, the building has been considered a premium grade building.

General maintenance of the base building is undertaken by CBRE. The Building Services Manager has a policy of undertaking an annual review to determine what systems will need to be upgraded to improve the performance of the building.

INITIATOR

Tenants are responsible for initiating their own efficiency and improvement programmes within their tenancies.

Maintenance and upgrade works to the base building are the responsibility of the building services manager. This is done through an annual systems review.

WHY UNDERTAKEN

Many of the building tenants have their own requirements for energy efficiency and reduced greenhouse gas emissions. A number of tenancies have focused on improving the efficiency of the lighting systems, as this was their area of greatest energy use and would provide the most significant returns.

The base building is managed to ensure that its premium grade listing is maintained and operational performance is improved.

EXTENT OF WORK

Larger tenancies in the building have installed smart lighting solutions, including C-Bus and Lux metres. The base building obtained a 4 star NABERS Energy in 2005.

ESD ELEMENTS INTEGRATED

OPPORTUNITY 2 — MINIMISING ENERGY USE

The building is constantly reviewed and tuned. All common lights go to half lighting after business hours. Ecolights have been installed in the car park, resulting in a 30% reduction in car park lighting energy.

Lifts had previously been lit with 36x40W incandescent globes. These were replaced with 7W Megaman compact fluorescents for a saving of $13 000 a year. Where the incandescent globes had a life of 1000 hours, the compact fluorescents have a life of 10 000 hours. The chiller is also due to be replaced and a new turbo pack chiller, with a coefficient of performance (COP) of 12 (the higher the better), is being considered.

OPPORTUNITY 3 — WATER CONSERVATION

Tap fittings are being upgraded throughout the building. When flow restrictors were installed the previous year, building management received a number of complaints from tenants unable to rinse their hair. Showerheads were replaced with more efficient ones and no complaints have since been received.

Waterless urinals have been tested, although at this stage there has not been one that management has found satisfactory.

QV1 has installed an Ecowash car washing facility to the car park of their building, which has been very well received.

OPPORTUNITY 5 — MINIMISING WASTE

Waste facilities located in the basement provide for the separation of waste and recycling.

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

A sustainability committee has been established with the tenants and building management (May 2007). The intention is for the committee to work through sustainability strategies for their tenancies and the building. At the first meeting, the

QV1 open social space, Perth
(CB Richard Ellis Pty Ltd)

group determined that they would select a few high impact strategies to initially focus on. These strategies are:

1. Use recycled paper for 50% of printing requirements.
2. Turn off computers at night.
3. Turn off lights at night.

QV1 Generator
(CB Richard Ellis Pty Ltd)

Rental outcome
Not available

Special leases
Not available

Main barriers encountered
Not available.

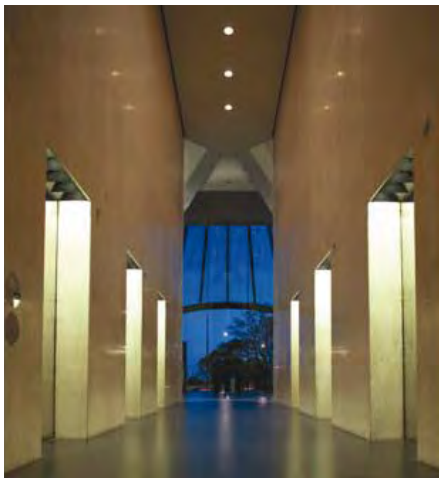
Cost/m²
The total project cost for the lighting upgrade to the PwC offices was $25.7/m².

Return on investment
PwC had a 16% return on their investment in new lighting.

Other comments
PwC report positive feedback from staff, visitors and the broader marketplace.

Further information
CB Richard Ellis, *QV1.Perth*, www.qv1perth.com/qv1/features.htm

Energy efficient lighting, QV1, Perth
(CB Richard Ellis Pty Ltd)



QV1
(CB Richard Ellis Pty Ltd)

CASE STUDY 5

Art Gallery of South Australia

NORTH TERRACE, ADELAIDE, SOUTH AUSTRALIA, 5000

CLIENT	South Australian Department of Administrative and Information Services (DAIS), on behalf of the Art Gallery of South Australia
FACILITIES MANAGER	Spotless
DESIGN MECHANICAL ENGINEER	Connell Mott MacDonald
DESIGN, CONSTRUCT AND INSTALL	Air Con Serve (SMAC system)

PROJECT

The Art Gallery of South Australia is a heritage-listed building that has been extended over the years with the addition of a number of new wings and additional services to meet modern expectations (e.g. café, bookshop). The Elder wing was designed in 1897; the Melrose wing in 1937; and a back wing in 1962. In 1996, the addition of a new wing on the west side of the building doubled the size of the gallery.

Data logging was initially used to analyse building performance and a staged strategy for improvement was developed:

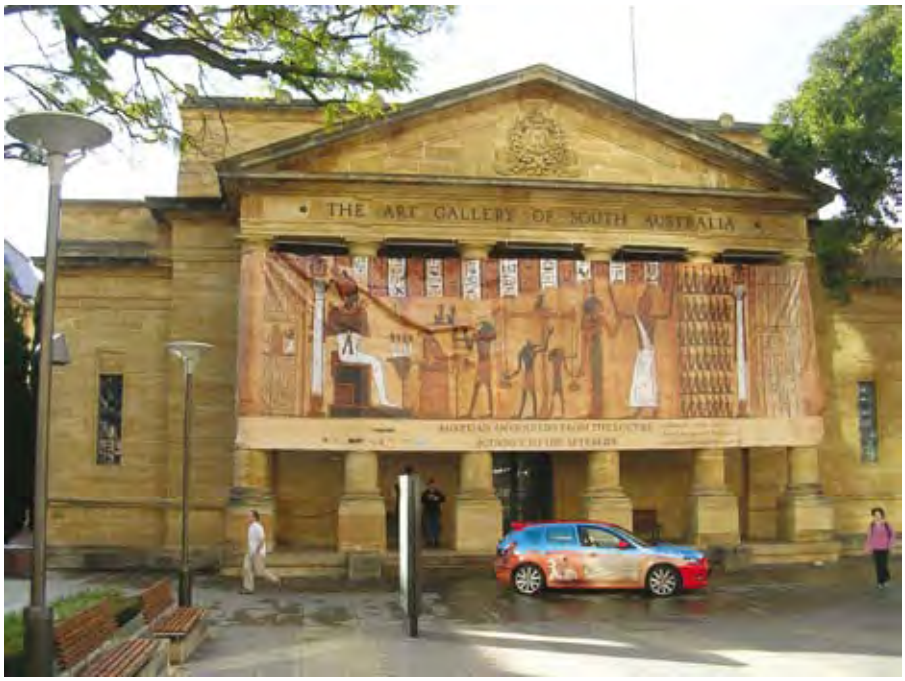
Stage 1 variable speed drives, new fans, CO_2 monitoring

Stage 2 photovoltaic panels installed to roof in 2003 (this was not part of the original plans)

Stage 3 shaw method of air-conditioning (SMAC) installed to 1996 building wing in July 2004 and August 2005

Stage 4 CO_2 monitoring to other building wings (yet to be done).

Art Gallery of South Australia – integration of new and old buildings
(Sebastian Immaraj)



Art Gallery of South Australia
(Sebastian Immaraj)

INITIATOR

The South Australian Government initiated an *Energy Efficiency Action Plan* in 2002, requiring government agencies to reach energy reduction targets. Through the Gallery's energy stakeholder committee, Arts SA was responsible for initiating the project as part of ongoing energy initiatives to comply with the action plan.

REASONS

The project was undertaken to upgrade the air-conditioning system for effectiveness and energy efficiency. An unexpected outcome of the project was improved humidity control.

EXTENT OF REFURBISHMENT/ PROCESS

In order to develop a strategy to improve the efficiency of the gallery, a project team was gathered to review overall system performance and determine what strategies would most feasibly meet government targets.

In order for the project team to understand the difference between traditional and more innovative air-conditioning systems, computer models were developed by Air Con Serve, a building energy management company. The Shaw method was determined to be the most efficient system to meet specific indoor climate targets (system explained under energy). Air Con Serve was contracted on a performance requirement to achieve certain levels of energy savings.

Risk management was considered in the installation of the system, with a single twin coil installed in the common air supply for twelve air handling units that served the west wing, instead of individually to each unit. This strategy meant that the system could more easily be reverted back to its initial state if it failed to meet expectations.

To ensure that the gallery could remain in use while works were going on, installation was undertaken over the coldest months.

ESD ELEMENTS INTEGRATED

OPPORTUNITY 1 — OPTIMISING INDOOR ENVIRONMENT QUALITY

The Shaw method has provided a system that is able to maintain a relative humidity of less than 55%, with an indoor temperature less than 23 °C.

CO_2 sensors connected to variable speed drives increase supplied fresh air in response to demand.

OPPORTUNITY 2 — MINIMISING ENERGY USE

In 2003, a 20 kW photovoltaic array was installed to the roof of the gallery to demonstrate solar energy technology to the community. The array is expected to produce around 32000 kWh of greenhouse gas emission free energy per year.

Kaj Lindstrom and Syd Bower inspect solar panels at the Art Gallery of South Australia
(Sebastian Immaraj)

For an art gallery, air-conditioning is one of the greatest energy uses, due to the need for strictly controlled temperature and humidity bands.

The SMAC system differs from conventional air-conditioning systems through the innovation of an additional coil. Outside air is pre-treated through a dehumidification coil and cooled with chilled water before coming into contact with inside air. The second coil is part of the original system and treats the supply air. This system reduces energy use by not over-cooling air to prevent condensation through humidity. As the same water is used by both coils, energy used in pumping is also reduced.

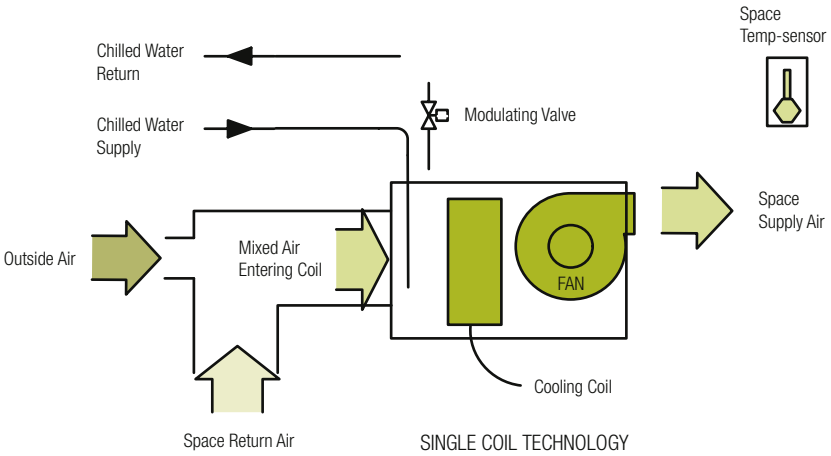
Humidity levels are monitored and adjusted through a building management system.

Variable speed drives are connected to CO_2 sensors. The air-conditioning system operates at 25%–30% of capacity, until defined levels of CO_2 cause the speed drives to ramp up to meet increased demand for fresh air. Building automation controls for the system were developed by Air Con Serve.

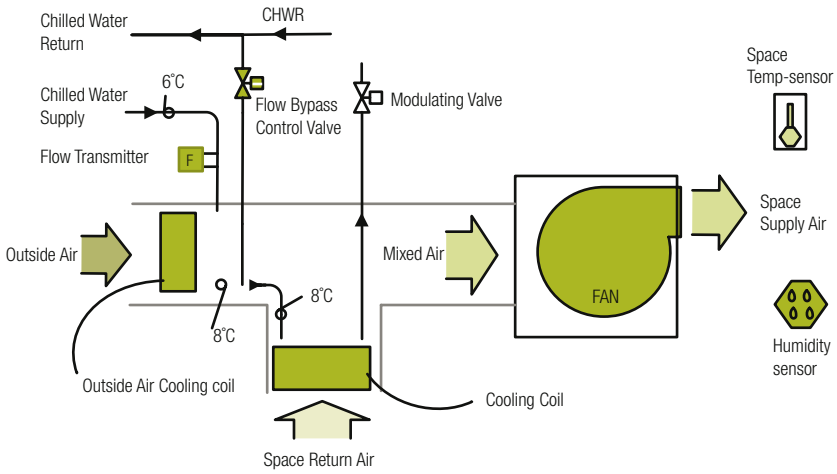
Since the system has been installed, the maximum energy demand for the facility has reduced by 14%, with savings of up to 177 GJ.

Heat Transfer and Mass Transfer principle

Conventional Air Handling System



New Invention SMAC, Air Handling System



Conventional and SMAC air handling systems. Image from Wayne Ryan presentation.[49]

Kaj Lindstrom – General Manager, Art Gallery of South Australia, checks the SMAC system.
(Sebastian Immaraj)

[49] W Ryan, *Demanding reliability – Dealing with air-conditioning load*, Powerpoint presentation, 2006, www.businessofsustainability.org/Wayne%20Ryan.pdf, Accessed: 09/05/07

Commissioning
Performance is being monitored over 12 months to compare to the base line for the previous 12 months. Insufficient sub-metering pre- and post- to the retrofit has made analysis difficult, with only one gas meter for the site, and no electrical sub-metering for different areas.

Syd Bower Operations manager, Art Gallery of South Australia, inspects the pre-filter for SMAC system

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

In order to preserve art work for future generations, international standards have been developed to define the most suitable indoor environment. Improving the air-handling systems for the gallery meant that these standards could be met with greater levels of control.

Outcomes
Since the system has been installed, the maximum energy demand for the facility has reduced by 14%, with savings of up to 177 GJ. The application of the Shaw method has provided in excess of a 75% saving in gas usage and a 50% reduction in electrical consumption and associated greenhouse gas emissions.

Air Con Serve, who designed and installed the twin-coil system, has received a number of industry awards for their work at the SA gallery:

- NECA State Award of Excellence for Environmental and Energy Efficiency (November 2006)
- AIRAH Excellence Award in Sustainability (December 2006)

Rental outcome
Not available

Special leases
Not available

Main barriers encountered
Despite the proven energy efficiency of the SMAC system, the patent holder, Air Con Serve, still has difficulty in gaining acceptance for its use by other mechanical engineers. This is seen to be due to competitive tendering processes for air-conditioning systems and the lack of time to investigate non-conventional practices.

Art Gallery of SA — West Wing					
Year	Process	Annual electricity use		Electrical peak load	
		Consumption GWh	Base savings	kW	Base reduction
2002 - 2003	Base	2.39	BASE	582	BASE
2003 - 2004	Variable Speed Drives	1.56	35%	441	25%
2004 - 2005	Shaw method	1.38	42%	393	33%

Table 17 – *Adapted from Wayne Ryan presentation.*

Cost/m²
The total project cost for installing the SMAC twin-coil system was $180 000. This included repairs to the existing system.

Return on investment
The payback for the system has been less than two years.

Other comments
The SMAC system can be retrofitted to existing air-conditioning systems through limited modification of existing infrastructure.

Risk was reduced on the project by Air Con Serve waiving the license fee for the equipment and committing to an energy performance contract that guaranteed energy savings.

Further information
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UniSA (2006) *Students@UniSA — Art of airconditioning*, www.unisa.edu.au/studentsatunisa/2006/August/aircon.asp (Accessed 23/05/07).

Government of South Australia (2002) *Energy Efficiency Action Plan 2002*, (Accessed 23/05/07).

Other buildings with Shaw method
1 - Barmera Hospital, South Australia

2 - Headquarter Building No. 1 of Siam Cement, Hong Kong

3 - Citi Centre, Adelaide

The retrofit of the South Australian Health Commission offices (at Citi Centre in Adelaide) was undertaken as part of the City of Adelaide's Tune-Ups programme. This was the first commercial office building in Australia to have a Shaw method air-conditioner installed.

Other elements of the refurbishment included:

- replacing the existing VAV system with induction variable air volume boxes
- upgrading the building automation system and
- providing energy management technologies.

The Tune-Ups programme required an NABERS Energy assessment of the building to be undertaken, so that strategies to improve building performance could be formulated. The initial rating for the building was 2 stars; improvements have increased the rating to 5 stars and have resulted in a 50% reduction in greenhouse gas emissions and a reduced electrical peak demand of 30%.

CASE STUDY 6

William McCormack Place, Cairns

CLIENT	Queensland Department of Public Works
PROJECT MANAGER	Queensland Department of Public Works/Barclay Mowlem Construction Ltd
ARCHITECT/DESIGNER	Cox Rayner and C.A. Architects
FACILITIES MANAGER	Queensland Department of Public Works
NLA	4568 m^2

William McCormack Place
(www.build.qld.gov.au)

PROJECT

William McCormack Place is a relatively new 4-storey commercial office building, constructed in 2002.

INITIATOR

The building is owned and was developed by the Queensland Department of Public Works (QDPW). The QDPW manages the building.

WHY UNDERTAKEN

The office building was developed to prove that strict environmental sustainability targets could be achieved by an office development, with it remaining economically and commercially viable in a normal commercial market. The project also met the Queensland Government energy efficiency guidelines.

ESD ELEMENTS INTEGRATED

OPPORTUNITY 1 — OPTIMISING INDOOR ENVIRONMENT QUALITY

The fit-out was designed to maximise indoor environment quality, and minimise maintenance and churn costs. For example, workstations were mechanically fixed to both avoid glue use (minimising VOCs) and maximise re-use. Also, painted finishes were minimised by using coloured render.

Low maintenance floor and wall finishes were specified where possible, in order to minimise the use of chemical cleaning agents.

OPPORTUNITY 2 — MINIMISING ENERGY USE

The achievement of a 4 star NABERS Energy base building rating was a contractual obligation contained within the original project brief. Subsequently, the building has been rated operationally at 5 stars NABERS Energy, with energy use being 40% lower than the original target.

The excellent energy performance of the building is a product of both its passive and active energy conservation measures. The building has been oriented to reduce the solar load and has also been provided with sun shading from the extended roofline and external shading elements. External sun shading provides almost 100% shade throughout the year, while maintaining views, and the shading equipment is also used to provide maintenance access to the façade.

Also reducing the heat load on the building are the building materials, which were chosen to reduce heat transmission to the building interior and include roof insulation and thermally efficient façade materials and window glass.

The active energy conservation measures include a heat recovery system that pre-cools outside air and has displaced approximately 25% of the cooling load. In addition, the chilled water storage system means that the chillers operate in their most efficient mode and negate the need for a low load chiller, also reducing maintenance costs.

All pumps and fans in the building are operated with variable speed drives and the zoned VAV system matches the energy use to the local cooling requirement. After-hours air-conditioning is operated by a 'pay for use' swipe card system, which encourages managers to monitor access and reduce after-hours air-conditioning demand.

Electrical

All lighting at William McCormack Place is controlled by the BMS. Normal office lighting is on from 8am–6pm, and 50% lighting is provided for cleaning staff from 6pm–8pm. Approximately 5% of lighting in the office and lift lobbies is provided at other times for security.

Lights in utility areas are switched on during office hours, and when the after-hours switch is activated, a low wattage light is permanently on so that these areas are never in darkness. Stairwell lights are operated by movement detectors and timer buttons on each landing.

There is no external display lighting and the security lighting is operated on a daylight sensor.

Due to Cairn's frequent adverse weather, the building has a standby generator. The generator is tested monthly and has been set up to use the electricity produced during the test within the building.

Energy performance

Design based on achieving 4 star NABERS Energy, after construction and implementation of facilities management processes, actually achieved 15% better than 5 star NABERS Energy.

Energy — 109 kWh/m^2 per year.

Greenhouse gas emissions — 108 kg CO_2/m^2 per annum (757 060 kg CO_2 per annum) normalised.

OPPORTUNITY 3 — WATER CONSERVATION

Artworks were chosen to simulate waterfalls, using no water.

OPPORTUNITY 4 — MATERIALS CHOICE

Long lasting, low maintenance and recyclable materials were chosen. These included mobile units, partition screens and shelves made of high-density polyethylene (HDPE) and polypropylene (PE), sourced from recycled residential and commercial waste. Screens are upholstered with fabric made from recycled PET bottles. Carpet tiles can be replaced singly or rearranged around wear patterns and are also recyclable at the end of their life.

Finishes on floors and walls were targeted to minimise maintenance and excessive chemical cleaning. Walls were rendered instead of painted and the simple access to the façade, via the sun shades, will encourage regular maintenance and extend the façade life.

The use of PVC was minimised, and no timber products derived from non-sustainable sources were used.

OPPORTUNITY 5 — MINIMISING WASTE

It was a contractual requirement that environmental issues, particularly pollution from water run-off, dust, mud and noise, be minimised during construction.

The office fit-out design was based on the *Ecologically sustainable office fit-out guidelines*, developed by the Queensland Department of Public Works in 2001. The fit-out programme was integrated into the base building construction programme, to reduce construction/re-work waste.

The fit-out design included standardisation and construction of doors and workstations to facilitate relocation and re-use, and the use of carpet tiles that can be easily replaced on a piecemeal basis, avoiding the waste normally associated with large scale repairs and replacement of broadloom carpet.

Provision has been made for the recycling of paper and cardboard with appropriate bins and the appointment of a recycling contractor.

OPPORTUNITY 6 — SOCIAL SUSTAINABILITY

Social sustainability was included in the design brief from the outset. The building is a pleasant place to work, with landscaped open spaces and large scale artworks. Social sustainability was also addressed through the use of local firms and materials, together with a focus on training apprentices.

The management team was included in the design process so facilities management concepts were integrated into the building at design stage. They had input into the practicalities of system selections and materials finishes with respect to performance, maintenance and life cycle costs

OPPORTUNITY 7 — MINIMISING TRANSPORT IMPACT

The building is located near other government buildings and consideration for pedestrian and cycling access was integrated into the landscape design to encourage walking and cycling.

Secure bicycle parking and shower and change facilities also encourage staff to cycle to work.

Rental outcomes

The occupancy agreement for this building is the same as other Queensland Government buildings managed by the QDPW.

Small refurbishments and alterations to the building are managed within the interior design group of QDPW. This close relationship with the original designers and managers of the building means that all involved can 'keep an eye' on the material selections and processes used, in order to maintain the original intention of the building as a green building.

Cost/m²

$17.1 million/4568 m² = $3743/m², including office fit-out.

Awards

- SEDA FM Environmental Excellence Award by the Facility Management Association of Australia, 2004
- High Commendation in the Property Council of Australia's Queensland Division Rider Hunt Award 2004
- Environmental Development Award in the Australian Property Institute's Excellence in Property Awards.

Other comments

With the experience and process of working on this building, Graham Messenger now sees it as 'pretty standard', with the industry and opportunities for green buildings having moved forward.

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Glossary

A

Australian Building Greenhouse Rating Scheme (ABGR) – a voluntary scheme that rates building energy consumption between one and five stars, originally developed by SEDA. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Active noise control – electronic masking of sound to cover unwanted or intrusive sound such as speech or equipment noise, typically used to enhance speech privacy by reducing speech intelligibility.

Adaptive comfort – adds human behaviour to the comfort analysis. It assumes that, if changes occur in the thermal environment to produce discomfort, then people will generally change their behaviour and act in a way that will restore their comfort. Such actions could include taking off clothing, reducing activity levels or even opening a window. The main effect of such models is to increase the range of conditions that designers can consider as comfortable, especially in naturally ventilated buildings where the occupants have a greater degree of control over their thermal environment. (Andrew Marsh Square one – http://www.squ1.com).

Adhesive – a substance capable of holding materials together by surface attachment. Adhesives are one source of off-gassing in indoor environments. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Australian Greenhouse Office (AGO) – now part of the Australian Government's Department of the Environment, Water, Heritage and the Arts.

Air quality – to do with the level of particulate, gases, vapours, pollens and micro-organisms in the air. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Air temperature – a measure of the heat energy contained in ambient air.

Alliance partnerships – a long-term commercial partnering arrangement that enhances project team innovation and avoids the cost of tendering for team formation on every new project. This can assist integrated delivery of sustainable design objectives. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Ambient noise – the background noise level in a space, which is not identifiable as being from a specific source, such as a nearby piece of equipment.

Aquifer – a geological formation that will yield water to a well in sufficient quantities to make the production of water from this formation feasible for beneficial use; permeable layers of underground rock or sand that hold or transmit groundwater below the water table. (Property Council of Australia, *Sustainable Development Guide*, 2001).

B

Base building brief – working document which specifies at any point in time the relevant needs and aims, resources of the client and user, the context of the project and any appropriate design requirements within which all subsequent briefing (when needed) and designing can take place. (Adapted from definition of brief in ISO 9699).

Building Code of Australia (BCA).

Australian Council of Building Design Professionals (BPD) – has published a multi-volume Environment Design Guide containing literature on how to reduce environmental impact of the built environment. (*Melbourne Docklands ESD Guide*, Oct 2002).

Biodegradable – a material capable of being decomposed by bacteria or other living organisms as a result of the action of micro-organisms. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Biodiversity – the variety of all life forms; the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Brownfield site – land within an urban area on which development has previously taken place. (Corus Construction Centre glossary, http://www.corusconstruction.com/page_9041.htm).

Building commissioning – refers to completion for occupation by the contractor from a physical facility viewpoint. Typically the activities include successfully running of all plant and equipment (DHS, 1998).

Building monitoring systems or building management system (BMS) – also referred to at times as the building management system. A building management system includes more of the systems and plans for review and improvement while the building monitoring system is a computerised system that monitors the engineering services, security and other building systems for the purpose of recording, reporting and operational control of the systems to maximise safety, security, operational performance and for overall cost minimisation and efficiency. (Property Council of Australia, *Sustainable Development Guide*, 2001).

C

Carbon credit – a term that refers to three types of units of greenhouse gas reductions defined under the Kyoto Protocol:

- emissions reduction units are generated via joint implementation under Article 6 of the Kyoto Protocol
- certified emission reduction units are generated and certified under the provisions of Article 12 of the Kyoto Protocol, the Clean Development Mechanism
- verified emission reductions are verified reductions in greenhouse gas emissions below a pre-determined baseline. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Carbon dioxide equivalent gases – greenhouse gases that contribute to the greenhouse effect are referred to as carbon dioxide equivalent gases since this is the most abundant greenhouse gas. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Chlorofluorocarbons (CFCs) – synthetic products which do not occur naturally and contain chlorine and fluorine; commonly used in various industrial processes and as refrigerants and, prior to 1990, as a propellant gas for sprays. CFCs are a powerful greenhouse gas. (Property Council of Australia,

Sustainable Development Guide, 2001). CFCs are used as a refrigerant. They are the worst ozone depleting product and the most significant cause of ozone layer depletion. CFCs are being phased out as part of the Montreal Protocol. (*Melbourne Docklands ESD Guide*, 2002).

Climate Change Levy – a tax on corporate energy use introduced by the government in 1999 aimed at reducing energy consumption. (Corus Construction Centre glossary, www.corusconstruction.com/page_9041.htm).

Cogeneration – generation of electricity combined with the production of heat for commercial or industrial use. Excess electricity produced can be fed back into the power grid. Cogeneration is an energy efficient way of using fossil fuels. (National Greenhouse Strategy http://ngs.greenhouse.gov.au/glossary/).

Colour temperature – a method of specifying colour based on an absolute temperature scale, degrees Kelvin (K). The colour is equivalent to the colour of light that would be emitted if a pure black object were heated to that temperature. Higher colour temperatures are bluer, lower temperatures are redder.

Commercial buildings – typically refers to any non-residential building such as a shopping centre, office tower, business park, industrial property or tourism and leisure asset. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Commingles – materials all mixed together, such as plastic bottles with glass and metal containers. Commingled recyclable materials require sorting after collection before they can be recycled. Current collections in the CBD are usually plastics marked 1, 2 and 3; glass beverage containers and aluminium and steel cans. Fully commingled collections also include paper. (Department of Treasury and Finance, *Reporting of Office-Based Environmental Impacts by Government Departments: Guidance to Financial Reporting Direction FRD24*, July 2003).

Commissioning – the start-up phase of a new or renovated building which includes testing and fine tuning of the HVAC, electrical, plumbing and other systems to assure proper functioning and adherence to design criteria. Commissioning also includes preparation of the systems operations manual and instruction of the building maintenance personnel. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Continuous commissioning – verifies that a project continues to meet current and evolving project requirements, activities occur throughout the life of the facility; some of these will be close to continuous in implementation, and others will be either scheduled or unscheduled (adapted from *ASHRAE Guideline 0-2005*).

Copper chrome arsenate (CCA) – a powerful preservative most commonly used to treat softwoods for external use to provide protection against fungi, termites and wood boring insects. Spills of CCA can leave short-term residues of arsenic and long-term residues of chromium in affected soils, which have serious health and environmental implications. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Cost benefit analysis – a method of evaluating projects or investments by comparing the present value or annual value of expected benefits to costs. (Property Council of Australia, *Sustainable Development Guide*, 2001).

D

Double net lease – a property lease in which the tenant pays rent to the owner, as well as all taxes and insurance expenses that arise from the use of the property. The owner pays maintenance expenses.

Dual pipe system – a system where one pipe feeds potable or drinking water, the second feeds treated water, typically for toilet flushing or irrigation – also called the purple or lilac pipe. (Property Council of Australia, *Sustainable Development Guide*, 2001).

E

Embodied energy – the non-renewable energy consumed in the acquisition of raw materials, their processing, manufacture, transportation to site and the construction process. Also the non-renewable energy consumed to maintain, repair, restore, refurbish or replace materials, components or systems during the lifetime of a building. (Corus Construction Centre glossary, www.corusconstruction.com/page_9041.htm).

Environmental Management Plan (EMP) – this document outlines the environmental requirements and responsibilities (of developers and the Docklands Authority for the development of Melbourne Docklands). (*Melbourne Docklands ESD Guide*, 2002).

Environmental Management System (EMS) – this is a document which outlines specific requirements for planning implementation, operation, checking and correct actions regarding environmental issues. It is a management system to identify, manage and reduce an organisation's impact on the environment. (Department of Treasury and Finance, *Reporting of Office-Based Environmental Impacts by Government Departments: Guidance to Financial Reporting Direction FRD24*, July 2003).

Energy Conservation Systems (ECS)

Environmentally preferable products/materials – products that embody one or several positive environmental attributes as a result of deliberately eliminating or reducing potential environmental impacts across its life cycle. These products do not have negative impacts on human health and the environment when compared with competing products. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product. (EcoRecycle 2003).

***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)** – is the Australian Government's major piece of environmental legislation. It protects the environment, particularly matters of National Environmental Significance.

Ecologically Sustainable Development (ESD) – development that does not compromise the ability of future generations to enjoy similar levels of development. This is done by minimising the effect of development on the environment. (*Melbourne Docklands ESD Guide*, 2002) Also defined by the Australian Government as 'using, conserving and enhancing the community's 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.' (*NSESD*, 1992).

F

Forest Stewardship Council (FSC) – an international organisation promoting responsible forest management. FSC has developed principles for forest

management which may be used for verifying the management of forest holdings and a system of tracing, verifying and labelling timber and wood products that originate from FSC certified forests. (Australian Paper www.australianpaper.com.au/environs/glossary.asp).

Formaldehyde – a resin used as an adhesive, surface coating, foam or in the manufacture of laminates and sandwich panels. Formaldehyde adhesives can present a health hazard due to their off-gassing tendencies. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Fuel cells – used in electrical generation. This is an apparatus used for combining fuel and oxides to generate electricity. It is the conversion of chemicals to electrical energy. (Energy Australia www.energy.com.au).

G

Global warming potential (GWP) – GWP is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale which compares the gas in question to that of the same mass of carbon dioxide whose GWP is one. An exact definition can be found at the IPCC web site. Examples of the GWP of gases are as follows:

- carbon dioxide has a GWP of exactly 1 (since it is the baseline unit to which all other greenhouse gases are compared)
- methane has a GWP of 21
- nitrogen dioxide has a GWP of 310
- some hydrofluorocarbon (HFC) compounds have GWPs of several thousands (HFC-23 is 11 700).

Green Lease Schedule (GLS) – a lease schedule that sets out the mutual obligation for building owners, managers and tenants regarding environmental performance.

Green power – electricity generated from clean renewable sources, such as the sun, wind, water and organic matter. The electricity is bought by energy suppliers on behalf of their customers. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Green Star – Green Star has been developed by the Green Building Council of Australia (GBCA) with support from industry and some government agencies. It is a rating tool that assessed a building's ability to meet ESD goals.

Greenhouse gases (GHG) – gases which contribute to global warming by preventing the outward radiation of heat from the Earth which increases the atmosphere's absorption of sunlight (the greenhouse effect). Greenhouse gases are measured in carbon dioxide equivalent units. Some greenhouse gases are naturally occurring (water vapour, carbon dioxide, methane, nitrous oxide and ozone). Others result from human activities, the most powerful of which are: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). (Property Council of Australia, *Sustainable Development Guide*, 2001).

Gross lease – a property lease in which the landlord agrees to pay all expenses that are normally associated with ownership, such as utilities, repairs, insurance, and (sometimes) taxes.

Groundwater – water within the earth that supplies wells and springs; water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table. (Property Council of Australia, *Sustainable Development Guide*, 2001).

H

Heating, Ventilating and Air-conditioning (HVAC) systems – the equipment, distribution network and terminals that provide either collectively or individually the processes of heating, ventilation or air-conditioning to a building. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Hydrofluorocarbons (HFCs) – transitional replacements for CFCs, they - are also greenhouse gases. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Hydrochlorofluorocarbons (HCFCs) – HCFCs were used as the original replacement for CFCs and are still commonly used. HCFCs, like CFCs, cause ozone depletion, but to a lesser extent. HCFCs are being phased out under the Montreal Protocol. (*Melbourne Docklands ESD Guide*, 2002).

I

Illuminance – the standard international unit that is used to measure the amount of light per unit of surface area, also known as lux (symbolised lx).

Indoor air quality (IAQ) – includes the introduction and distribution of adequate ventilation air, control of airborne contaminants and maintenance of acceptable temperature and relative humidity. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Indoor environment quality (IEQ) – this factor describes the cumulative effects of indoor air quality, lighting and thermal conditions. Poor IEQ is responsible for health problems in the work place. (*Melbourne Docklands ESD Guide*, 2002).

Integrated design – a design process that mobilises multidisciplinary design input and cooperation, ideally to maximise and integrate environmental and economic life cycle benefits. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Intergovernmental Panel on Climate Change (IPCC) – the IPCC was established in 1988 by two United Nations organisations, the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) to assess the 'risk of human-induced climate change'. The Panel is open to all members of the WMO and UNEP. Its reports are widely cited and have been highly influential in forming national and international responses to climate change.

ISO 14000, ISO14001 and ISO14004 – are international standards concerning Environmental Management Systems, and include specifications and guidelines. *(Melbourne Docklands ESD Guide*, 2002).

ISO 7730 – international standard for thermal comfort – this standard is based on a determination of the PMV (Predicted Mean Vote) and PPD (Predicted Percentage Dissatisfied) indices, and specification of the conditions for thermal comfort. (*Melbourne Docklands ESD Guide*, 2002).

J

K

Kyoto Protocol – an international agreement reached in 1997 in Kyoto, Japan, which extends the commitment of the United Nations Framework Convention on Climate Change. In particular, it sets targets for future emissions by each developed country over the first commitment period and foreshadows further action over future commitment periods. (Property Council of Australia, *Sustainable Development Guide*, 2001). An international agreement

to limit greenhouse gas emissions. The protocol was adopted in 1997 and has been ratified by 54 countries, including most developed countries. (*Melbourne Docklands ESD Guide*, 2002).

L

LAeq – this scale measures the average energy of the noise level. It is the equivalent steady state level of a fluctuating noise level. When considered over a period of time T, this is represented by the scale dB LAeqT. ASINZS 1269.1:1998 sets out the method for calculating this level. (Green Star- Office Design (v2)).

Life cycle assessment (LCA) – a technique for assessing the environmental aspects and potential impacts associated with a product or process, by compiling an inventory of relevant inputs and outputs, evaluating the potential environmental impacts associated with those inputs and outputs, and interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Life cycle costing (LCC) – a technique that enables a comparative cost assessment to be made for various investment alternatives, over a specified period of time, taking into account all relevant factors, both in terms of initial capital costs and future estimated cost. The objective is to identify the most economic overall choice. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Lux – measure of the amount of light at a certain point.

M

Montreal Protocol – on Substances that Deplete the Ozone Layer this international treaty was first signed in 1987 (now signed by 181 countries). It sets a time schedule for the reduction and eventual elimination of ozone depleting substances. (*Melbourne Docklands ESD Guide*, 2002).

N

NABERS – National Australian Built Environment Rating System – measures and compares the environmental performance of a building. NABERS can be used to rate a variety of building types, for environmental impacts such as energy and greenhouse, water, waste and indoor environment. NABERS is a national initiative managed by the NSW Department of Environment and Climate Change on behalf of federal, state and territory governments.

National Strategy for Ecologically Sustainable Development (NSESD) – sets out the broad strategic and policy framework under which governments will make decisions cooperatively and take actions to pursue ESD in Australia. It will be used by governments to guide policy and decision making, particularly in those key industry sectors which rely on the utilisation of natural resources.

Net lease – a property lease in which the tenant agrees to pay all expenses that are normally associated with ownership such as utilities, repairs, insurance and taxes. Also called a closed-end lease.

O

Off-gassing – the release of gases or vapours from solid materials in a form of evaporation of a slow chemical change which produces indoor air pollution for prolonged periods after installation of a material. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Operational commissioning – refers to activities undertaken leading up to handover of the building to the users. Typical activities include familiarisation of staff with safety, security and communications systems (DHS, 1998).

Operational energy – the energy consumed in heating, cooling, lighting and powering equipment and appliances in buildings. (Corus Construction Centre glossary, http://www.corusconstruction.com/page_9041.htm).

Operative temperature – a measure representing perceived temperature, which can be approximated as the average of air and radiant temperatures.

Ozone Depletion Potential (ODP) – a number that refers to the amount of ozone depletion caused by a substance. The ODP is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11. Thus, the ODP of CFC-11 is defined to be 1.0. Other CFCs and HCFCs have ODPs that range from 0.01 to 1.0. The halons have ODPs ranging up to 10. Carbon tetrachloride has an ODP of 1.2, and methyl chloroform's ODP is 0.11. HFCs have zero ODP because they do not contain chlorine. (US EPA web site www.epa.gov/ozone/defns.html).

Ozone layer depletion – the ozone layer protects earth from ultra violet rays, which are known to cause cancer. Refrigerants such as CFCs and HCFCs contribute greatly to ozone layer depletion. (*Melbourne Docklands ESD Guide*, 2002).

P

Phase change materials – materials which turn from one phase to another (for example liquid to gas, or solid to liquid) at a certain temperature – such as water at zero degrees Celsius.

Photo electric cell (PE) – these are used to monitor the amount of light in a room.

Photovoltaic – generation of electricity from the energy of sunlight using photocells. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Predicted Mean Vote (PMV). This international measure, used for determining thermal comfort, is based on surveys of the most acceptable levels of indoor temperature, humidity and radiant heat for different clothing and activity levels. (*Melbourne Docklands ESD Guide*, 2002).

Polychlorinated biphenyls (PCBs) – a group of synthetic chlorinated organic compounds, toxic to humans and identified as a carcinogenic substance, which were used mainly in older electrical capacitors or transformers. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Polyvinyl chloride (PVC) – this common building material is mostly used for pipes and electrical cables. Production of PVC requires toxic chemicals and heavy metals. These additives risk polluting soil and waterways during PVC disposal. (*Melbourne Docklands ESD Guide*, 2002).

Potable water – water that is fit for human consumption. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Predicted Percentage Dissatisfied (PPD). This measure is linked with PMV. A PMV of 0 indicates a PPD of 5% and a PMV of +/-1 indicates a PPD of 25%. This means that 25% of occupants perceive the space to be either warm or cool. (*Melbourne Docklands ESD Guide*, 2002).

Project brief – typically a response to a client brief and is prepared by the integrated design team. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Q

R

Radiant temperature – the average temperature of the objects and surfaces that surround us, which radiate heat to (and absorb radiant heat from) our bodies.

Re-commissioning – focuses upon verifying and documenting that any new or updated systems or equipment planned, designed, installed, tested, operated, and maintained to meet the project requirements (adapted from *ASHRAE Guideline 0-2005*).

Recycled material – material that would otherwise be destined for disposal but is diverted or separated from the waste stream, reintroduced as material feedstock, and processed into marketed end products. (Property Council of Australia, *Sustainable Development Guide*, 2001). Materials that have been reprocessed from recovered material by means of a manufacturing process and made into a final product, or into a component for incorporation into a product. (EcoRecycle 2003).

Recycled products – materials that have been recovered, processed and used as a raw material for the manufacture of a useful new product through a commercial process. These products will contain a specified percentage of material that would otherwise have been disposed of as wastes. (EcoRecycle 2003).

Recycling – includes paper, commingles and compostables accepted and recycled by your contractors or internally (i.e. through on site worm farms). These figures can be extrapolated from waste assessments. (Department of Treasury and Finance, *Reporting of Office-Based Environmental Impacts by Government Departments: Guidance to Financial Reporting Direction FRD24*, July 2003).

Relative humidity – the ratio of the amount of water vapour in air to the maximum amount of water that the same volume of air can hold at the same temperature, expressed as a percentage.

Re-manufactured – means to renew or restore a used product into its original form or into a useful new product through a commercial process. (EcoRecycle 2003).

Renewable – a renewable product can be grown or naturally replenished or cleansed at a rate that exceeds human depletion of the resource. (Property Council of Australia, *Sustainable Development Guide*, 2001).

Renewable energy – renewable energy is obtained from sources that can be sustained indefinitely. Examples of renewable energy systems include photovoltaic solar collection, solar thermal turbine generation and wind power. (*Melbourne Docklands ESD Guide*, 2002).

Retro-commissioning – is carried out on a building that did not have or only had partial commissioning at the end of the construction period (adapted from *ASHRAE Guideline 0-2005*).

Reuse – the recovery of a material to be used again for a similar application without reprocessing. (Property Council of Australia, *Sustainable Development Guide*, 2001).

S

Site Environmental Management Plan (SEMP) – this document guides and sets standards for construction and operation of new developments. It includes strategies and processes to manage and minimise environmental impacts. (Melbourne Docklands ESD Guide, 2002).

Sick building syndrome (SBS) – a range of non-specific health symptoms that occur in a high proportion (30% or more) of occupants of specific buildings without clearly identified causes. These buildings are generally, but not exclusively, air-conditioned offices.

Sustainable development – development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Property Council of Australia, *Sustainable Development Guide*, 2001).

T

Toxic – any substance which causes harm to living organisms, from very low to extreme toxicity. (Property Council of Australia, *Sustainable Development Guide*, 2001) Toxic substances are identified in the Australian National Pollutant Inventory.

Triple Bottom Line – measures the economic, social and environmental sustainability of a project. A sustainable development aims for synergy rather than compromise between these factors.

Triple net lease – a property lease in which the lessee pays rent to the owner, as well as all taxes, insurance, and maintenance expenses that arise from the use of the property.

U

V

Visual Display Units(VDU) – computer monitors and other office equipment which include artificially illuminated surfaces.

Volatile organic compounds (VOCs) – chemical compounds based on carbon and hydrogen structure that are vaporised at room temperatures. VOCs are one type of indoor air contaminant. Although thousands have been identified in indoor air, only a few are well understood and regulated. (Property Council of Australia, *Sustainable Development Guide*, 2001) These chemicals are found in paints and other building products. They are known to cause health problems, including asthma and other respiratory ailments. (*Melbourne Docklands ESD Guide*, 2002).

W

Waste – all waste placed in landfill waste and recycling streams (paper, green waste, composts, commingles), including 'one off' clean outs, office relocations etc. (Department of Treasury and Finance, *Reporting of Office-Based Environmental Impacts by Government Departments: Guidance to Financial Reporting Direction FRD24*, July 2003).

Waste Management Plan (WMP) – the waste requirements and responsibilities of project, it is usually site specific and looks at the minimisation, recycling and reuse of waste through all onsite processes. It usually forms part of an EMP.

X

Xeriscape – xeriscaping is derived from the Greek word 'xeros', meaning 'dry' and combined with 'landscape', xeriscape means gardening with less than average water. A trademarked term referring to water-efficient choices in planting and irrigation design. It refers to seven basic principles for conserving water and protecting the environment. These include: (1) planning and design; (2) use of well-adapted plants; (3) soil analysis; (4) practical turf areas; (5) use of mulches; (6) appropriate maintenance; and (7) efficient irrigation. (see http://ecolodgical.yourhomeplanet.com/glossary.php).

Y

Z

Acronyms

ABCB:	Australian Building Codes Board.
ABGR:	Australian Building Greenhouse Rating. (now NABERS)
AGO:	Australian Greenhouse Office, now part of the Australian Government's Department of The Environment, Water, Heritage and the Arts.
AIRAH:	Australian Institute of Refrigeration, Air Conditioning and Heating.
BMCS:	Building management control system
DECC:	NSW Department of Environment and Climate Change.
DEH:	Federal Department of the Environment and Heritage, now the Department of the Environment, Water, Heritage and the Arts.
DEW:	Federal Department of the Environment and Water Resources, now the Department of the Environment, Water, Heritage and the Arts.
DHW:	Domestic hot water
GBCA:	Green Building Council of Australia.
GFA:	Gross floor area
LAN:	Local area network
MSDS:	Material safety data sheets
NABERS:	National Australian Built Environment Rating System
PCA:	Property Council of Australia
PPM:	Part per million
IEQ:	Indoor environment quality.
IAQ:	Indoor air quality.
WSAA:	Water Services Association of Australia

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Printed resources

The *Tenant Energy Management Handbook* is a step-by-step guide to assist commercial tenants and building managers in using energy more efficiency. Hard copy available from offices of the Property Council of Australia.

Energy Guidelines published by Property Council of Australia in 2001. Covers setting energy targets and operation, maintenance issues.

Sustainable Property Guide to be published in 2009 by the NSW Department of Conservation and Climate Change gives an excellent approach to improving sustainability in the operating phase.

www.investasustainability.com.au/reports/2006/sustainability/case_studies/water_restrictions.asp