

The case for 'greening' Sydney's buildings



If the city was the Titanic we might put a few solar panels on it, but at the same time it's travelling towards an iceberg that's melting... An interesting equation posited by David Gottfried on his recent visit to Australia and one that illustrates the balance needed to achieve sustainable outcomes.

Founder of the US and World Green Building Councils and author of the book "Greed to Green", Gottfried was here to launch The Australian Green Building Council's report, "The Dollars and Sense of Green Buildings 2006". It builds a business case for green buildings in the example of other countries whose shift to a sustainable commercial property industry has been helped by this kind of documentary evidence.

It provides a snapshot of how this shift is developing in Australia and the challenge we have in providing leadership on an issue that has the potential to reduce energy and water consumption of buildings by up to 60 per cent. Estimates suggest that lighting could be contributing up to 25 per cent of total commercial sector greenhouse gas emissions and almost five per cent of Australia's non-transport energy emissions. Improving education, monitoring and incentives around the design and upgrade of lighting in office buildings will have a crucial part to play in determining sustainability goals.

Lighting Magazine's Paula Wallace decided to ask the experts what would happen if all Sydney's major office buildings "went green"...

This page –

The first refurbished building to receive a 6-Star Green Star Office Design Certified Rating, the Szencorp building at 40 Albert Road in South Melbourne. Image courtesy of ECS.

Page 32 –

Energy Conservation Systems offices at 40 Albert Road, South Melbourne. Image courtesy of ECS.

PAGE 31

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HOW DO YOU RATE?

There are a plethora of green rating tools, new building codes and other Government initiatives targeting commercial office buildings in all States of Australia. The main ones that relate to lighting principles and practices are the Australian Building Greenhouse Rating (ABGR) scheme, the Green Star rating system, Minimum Energy Performance Standards (MEPS), the Building Code of Australia (BCA) and the Greenlight Australia strategy.

The latter, administered by the Australian Greenhouse office, has predicted that lighting energy consumption could increase by 3.2 per cent per annum between 2000 and 2010, or reach 29 million M/Wh per annum in 2015. The program aims to reduce annual lighting energy consumption by 20 per cent by the year 2015 when compared to the 'business as usual' case. In 2015 this will result in Australia saving an estimated 6.7 mega tonnes of CO₂-e greenhouse emissions.

The Greenlight strategy co-ordinates MEPS across a number of different lighting products and comparative lamp labelling as the primary means of achieving "green" outcomes, and is designed to provide certainty for suppliers and manufacturers of lighting products.

The two rating schemes (ABGR and Green Star) are developed for the end users of lighting products and also for specifiers such as designers, architects and consultants. The schemes are voluntary programs that provide detailed diagnostic tools that allow builders, building owners, designers and tenants to predict, measure and benchmark the performance of their buildings.

Currently seven buildings in Australia have been Green Star rated (one in Sydney CBD): two awarded a six-star rating and five awarded a five-star rating.

CASE STUDY: 40 ALBERT ROAD, SOUTH MELBOURNE

When the time came to retrofit the 1200m² office space at 40 Albert Road in South Melbourne, the owner Szcencorp Group decided to use cutting edge sustainability technology. The result is a building that features many 'firsts' not the least of which is 6-Star Office Design Certified Rating (GreenStar).

The building, which features world's best practice lighting design and installation, has achieved a 70 per cent reduction in energy, an 82 per cent cut in piped water and 72 per cent drop in sewer discharge when compared to a conventional office building. The power consumption of the lighting system is integral to the ABGR rating, and the subsequent performance of the Szcencorp building, as the lighting represents the single biggest base load on the electrical supply.

Cost savings were achieved by removing the need for conventional light switches. Only one conventional wall light switch (in a stair well) is used in the building. An Energy Conservation System's proprietary MLS occupancy control system was installed throughout the entire building. This is a fully automated lighting control system, where each detector is linked by a communications bus. It incorporates motion detectors and photoelectric light sensors to turn lights on and off based on occupancy, and dim to any pre-determined level.

Whilst the lighting is not to exceed 400 lux uncontrolled, throughout the building, the MLS will actually maintain 320 lux at the working plane, therefore automatic control will take into account daylight where available, and also the lamp performance over time. In addition, the lighting controls are also utilised for the HVAC. More than 90 per cent of all lights are New Generation Triphosphor T5 (16mm) lamps, and all fluorescent lamps have high frequency dimming ballasts. The base building uses 5.24 W/m² (1.4 watts per 100 lux). There is no upward waste light (sky glow), glare (TI, GR and maximum intensity), or light trespass (vertical spill light) as there are no external flood lights, or internal luminaires contributing in anyway to external light pollution.

The design team and the management of 40 Albert Road conservatively estimate the overall energy consumption and CO₂ emissions for the whole building will reduce a further 20-25 per cent on the ABGR calculations.

THE 3CBDs GREENHOUSE INITIATIVE

To put the scale of Sydney's office space into another context, there are three major Local Government Areas (Sydney, North Sydney and Parramatta) that have come together to encourage tenants to reduce the greenhouse impact of their offices by becoming more energy efficient. Participating companies benchmark their current energy performance using the Australian Building Greenhouse Rating and set greenhouse targets of 4-stars or higher.

These LGAs are home to Sydney's largest business districts and as a combined block their CBDs provide 30 per cent of Australia's commercial office space. Twenty-five partners have signed up to the Initiative and between them are developing action plans to improve the energy efficiency of 42 tenancies in the three CBD's. These organisations are responsible for more than 435,000m² of office space (around 7 per cent of the net lettable area in the three participating CBDs).

In the Initiative's first progress report in August 2005 it said that 20 benchmark ratings had been completed and they show that the rated tenancies account for more than 17,500 tonnes of CO₂ emissions.

PAGE 33

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The ABGR scheme rates the market penetration of ABGR as a percentage of available net lettable area that has obtained an accredited rating since the inception of the scheme.

Their figures suggest 36 per cent of the net lettable area of commercial buildings in Sydney have been rated using ABGR and the national percentage is 24 per cent.

Currently, there is a suite of Green Star rating tools for commercial offices at all phases of development – design, construction, and operations. By the end of 2006, there will be Green Star tools for Retail, Health, Education, Convention, and Residential buildings.

Green Star is aimed at recognising and rewarding environmental leadership in the top 25 per cent of the market. It provides a standard of measurement that identifies building life-cycle impacts and promotes integrated, “whole-building design”.

The ABGR is designed to encourage best practice in the design, operation and maintenance of commercial buildings to reduce greenhouse gas emissions.

The scheme rates buildings from one to five stars with five stars representing exceptional greenhouse performance. Current market best practice in Australia is three stars. It rates a building according to its actual performance, using 12 months’ energy data, and can be used for the base building (central services), whole building or individual tenancies.

ABGR can be used by itself, if greenhouse gas emissions are the main focus, and it also forms the greenhouse component of the Green Star scheme.

Changes to the Building Code of Australia will also be introduced in New South Wales from November 2006 that will set minimum energy efficiency for overall energy performance, including interior lighting for all types of non-residential buildings. The Code requires

that the illumination power density for general office spaces start at between 7-10W/m² depending upon light levels. These can be increased for small rooms and where particular lighting control devices such as motion detectors and dimmers are used.

The BCA applies to new work that requires building approval, be it a new building or in an existing building. There is also a 50 per cent rule that may require the whole building to be considered.

THE KINDS OF BUILDINGS IN SYDNEY?

By using some of the diagnostic tools available and the most current data on office space in Sydney’s CBD, Lighting Magazine has created a hypothetical situation and calculated the maximum amount of energy and greenhouse emissions that could be saved over a 12 month period. The research is based on figures from the Property Council’s January 2006 “Office Market Report”,

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PAGE 35
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which states that the amount of office space in the Sydney CBD and Walsh Bay is 4,718,270 square metres (m²). This is office space only (no retail), for all commercial buildings within Sydney CBD & Walsh Bay with a net lettable area (NLA) of greater than 500m².

The areas included in the Sydney CBD in the context of the Property Council's figures include six sub-locals; The Rocks, Walsh Bay (both defined by foreshore), Citycore, Western, Midtown and Southern. In addition, it states that new developments due for completion in 2006 equal 81,104m².

Furthermore, the commercial property market is classified by the Property Council's Office Quality Grade Matrix – Premium and Grades A, B, C or D. Each grade includes a number of quality parameters which define a building's grade, including Environmental, Configuration, Mechanical, Lifts, Electrical, Standby

Power, Building Management, Communications, Hydraulics, Security, Amenities and Parking.

Grade-A commercial buildings are usually newer, larger than 30,000–40,000m², and located in the CBD, with a high quality space and quality presentation and maintenance including: environmental initiatives; flexible floor plates; full BMCS including on floor control; in building mobile phone coverage; rated fittings; water storage; showers; and bicycle parking, to name a few features. On the other end of the spectrum are D-grade buildings which are older (usually 25 years plus) and are described as poor quality space.

In 2004 the Property Council of Australia initiated a review of its Quality Matrix, and the resultant Draft Quality Matrix includes a provision that new buildings seeking to achieve Premium Grade and A-Grade will have to achieve a 4-Star Green Star Certified Rating.

TABLE 1: Sydney CBD buildings graded using the Property Council of Australia Office Quality Grade Matrix

Type	NLA (sqm)
Premium	597,431
A-Grade	1,539,980
B-Grade	1,578,010
C-Grade	771,044
D-Grade	231,805
Total	4,718,270

Source: Property Council of Australia's January 2006 Office Market Report.

This is where the economics of building ratings schemes will really be noticed, as those buildings that do not include green initiatives, under such a scheme, would be at a distinct disadvantage. And older premium buildings will need to upgrade their environmental performance over time to maintain market position.

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This page –
 The first refurbished building to receive a 6-Star Green Star Office Design Certified Rating, the Szencorp building at 40 Albert Road in South Melbourne. Image courtesy of ECS.

Some of the more progressive tenants in the commercial office market are also starting to ask for environmental commitments from buildings owners and developers.

Indeed, some Governments are beginning to demand them. For instance, by July 1st this year all NSW Government tenancies must achieve a 4-star ABGR rating and all tenancies or owned offices of over 1,000m² are required to achieve ABGR performance targets (4 stars for tenancies and 3 stars for base or whole building).

The “Dollars and Sense of Green Buildings” reports; “As improvements in the measurement of employee productivity, the monitoring of building use, and benchmarking of properties continues, there will be increasing prospects for building owners to directly capture the quantitative benefits of green buildings by negotiating lease agreements and lease rental reviews linked to such factors as organisational productivity gains and green building targets.”

It has been shown in studies conducted in North America (based on several hundred buildings that have been designed, constructed and operated

within ‘green’ initiatives) that increases in upfront costs (up to 2 per cent) to support ‘green’ design will result in lifecycle savings of 20 per cent of total construction costs – more than ten times the initial investment.

Other benefits include lower operating costs, high productivity, higher returns on assets and increased property values, enhanced marketability to tenants and the community and reduced liability and risk.

A recent high achiever is the new office of the Melbourne City Council, known as CH². According to the “Dollars and Sense of Green Buildings 2006”, the CH² project looks at internal rates of return. On an optimistic view, the Council estimated it would receive a savings return of 7.5 per cent a year for about 10 years, 13.67 per cent a year after 20 years, increasing to 15.17 per cent a year for a 50-year investment.

MEASURING THE LIGHTING “FACTOR”

Where split incentives present in the building industry can effectively mute “green” voices, the one area of development that is not in this position is the lighting of a building. Whilst the

lighting is often still affected by being classed under the banner of sustainable development, it is unique in the sense that both owners and tenants or occupiers have a shared stake. Although the design and installation of lighting systems is the responsibility of the owner, it is the tenant or occupier who will pay for their ongoing energy needs and operation. Their effective operation, in turn, has an influence on an owner-driven aspect of the building in the air conditioning loads.

This has meant that a significant amount of development has been done on sustainable lighting systems, which we have seen installed in some new buildings, such as CH² in Melbourne. Lighting has also been targeted as a means of significantly reducing energy costs in existing buildings.

Energy consulting firm, Exergy says that a good lighting system will be 10W/m² or less; best practice for open plan offices is around 7W/m² and average practice seems to be around 15W/m².

“In practice, one can generally bring an existing lighting system down to 12W/m² without spending an exorbitant amount of money on it

and typically one can obtain a payback of less than two years on this sort of exercise. If your current lighting power density is greater than 20 W/m² a total replacement may be in order.”

If we take the example of organisations participating in the 3CBDS initiative, out of the first 20 benchmark ratings obtained, 50 per cent of these tenancies achieved a 3- or 3.5-star rating. This would suggest that at least half existing buildings/tenancies are operating at higher than 12W/m². Using the model of the Green Star category – Ene-4 Office Lighting Power Density we came up with a ‘best practice’ figure of 8W/m² (at 400 lux).

However, it is important to distinguish between installed W/m² and average usage in W/m². Advanced lighting with daylighting, dimming and occupancy sensors will have a lower actual W/m² than its installed W/m².

While a ‘best practice’ figure on paper for the installed power density might be 5-8 W/m², actual usage may be more

TABLE 1: Sydney CBD estimated ‘baseline’ office lighting energy usage over 12 months and ‘green’ alternatives.

Type	NLA (sqm)	Average approx. W/m ² for lighting –		
		‘Baseline’ current usage	‘Best Practice’ high rating	‘Best Practice’ low rating
Premium	597,431	10	5	8
A-Grade	1,539,980	10	5	8
B-Grade	1,578,010	13	5	8
C-Grade	771,044	15	5	8
D-Grade	231,805	20	5	8
New Development 06	81,104	10	5	8
Total	4,718,270	<i>Note: approx ghgs 1 tonne per MWh</i>		

like 3-6 W/m². With standard lighting systems actual usage is closer to installed W/m² because most of the lights are left on all the time.

To accommodate this we have provided a conservative ‘best practice’ example that shows the performance using the installed W/m² values and a second example that uses a lower figure

that could be more realistic in terms of actual W/m² usage. Although there is no actual relationship between lighting and the Property Council’s Office Quality Grade Matrix, we have simply used this quality matrix to hypothesise a range of probable lighting power densities.

From these figures we were able to estimate annual energy consumption

Continued on page 41

STANDING THE TEST OF TIME.



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RETAIL LIGHTING “EXPERIMENT” A SUCCESS

Project location: Retravision Auburn, Sydney NSW

Project completion: February 2006

Savings in energy consumption from lighting: 47%

Reduction in heat load from new lighting installation: 75%

Annual savings in electricity costs: \$10,000

Annual greenhouse gas emission savings: 70 tonnes

As part of the Greenlight Australia program, Lighting Council Australia, with assistance from the Australian Greenhouse Office, undertook a complete refit of Retravision’s lighting installation to find an energy saving solution for small business and to significantly reduce greenhouse gases from lighting. Retravision Auburn is a medium sized homemaker/bulky goods style retail environment of approx. 1400m². A professional lighting consultant, DJ Coalition, was engaged to conduct an initial audit, propose a new energy efficient design, carry out a detailed design and conduct a final energy audit on completion of the refit. The initial audit identified the following issues:

- poor light levels and uniformity
- wasted upward lighting to the ceiling and walls above bulkheads
- poor colour rendition through the store
- cavernous effects of space
- little or no direct highlighting of stock
- little thought given to aesthetic presentation of retail stock

The revised design adopted the concept of presenting the retail space as a number of visually distinct ‘rooms’ through which shopper may wander and be drawn to through the use of different light fittings, colour temperatures and sources. Each zone was treated with lighting specific to its display needs while at the same time offering visual interest. Other areas addressed in the re-design including point of sale, display posters, AV rooms and offices. The initial energy audit identified the following main areas where savings were possible:

- large numbers of 400W Ovoid lamp high-bays with transparent reeded diffusers causing considerable light wastage to the ceiling;
- large numbers of ELV downlights used on the main retail floor;
- continuous overlapping T8 fluorescent battens lighting up the walls above the bulkhead.

Comparisons made between the old and new installations showed an energy saving of approximately 47 per cent and a 75 reduction in heat load. “The results from the pilot program at Auburn Retravision are outstanding,” said David Tilbury, Chairman of Lighting Council Australia. “Our aim was to demonstrate significant savings in a commercial environment using current affordable lighting technologies. We have doubled our initial savings targets.”



This page –

Official unveiling of the energy efficient lighting system at Retravision, Auburn Megamall, 7 March 2006.

Opposite page –

TOP:

The first refurbished building to receive a 6-Star Green Star Office Design Certified Rating, the Szencorp building at 40 Albert Road in South Melbourne. Image courtesy of ECS.

BOTTOM:

MLS system used to control lighting at the Szencorp building in South Melbourne. Image courtesy of ECS.

Continued from page 39

and associated greenhouse gas emissions. The results show that greenhouse gas emissions could be reduced by more than 100,000 tonnes a year by upgraded lighting systems in the Sydney CBD alone. The difference between using 5W/m² and 8W/m² is more than 43,000 tonnes CO₂-e per year.

This is all based on a 'baseline' estimate that the Sydney CBD buildings in 2006 will emit 173,000 tonnes of CO₂-e. However, this figure is conservative and could be more like 240,000 of CO₂-e when you cross reference against net emissions data from the Australian Greenhouse Office.

These figures also do not include additional energy consumed by lighting systems that are left on overnight or in unoccupied buildings, or that have limited controls. The savings on air conditioning costs through reduced heat output of lighting will further add to the benefits.

To put these figures into a larger context; it is estimated that commercial lighting accounted for around 13 Mt of greenhouse gas emissions in Australia in 2004, around 6.2 per cent of emissions from electricity generation.

Total greenhouse gas emissions in Australia in 2003 were 550Mt and the non-transport energy emissions were around 49 per cent of that (268Mt) of which commercial lighting contributed around 4.8 per cent. This means that we are discussing an area of industry that affects about two per cent of Australia's overall emissions.

We are still a long way off from the vision shared by David Gottfried at Sydney's Town Hall in February that buildings should reach a point where they don't just conserve but also generate energy. However a few standout projects are proving that the Australian market can certainly raise the bar much higher. ●



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