



TAKE STOCK OF GREEN BUILDINGS

Retrofitting and improving existing buildings, from offices blocks to commercial facilities, is just as important as headline-grabbing green designs, writes Richard Collins.

Each year, only two per cent of Australia's buildings are considered new. For all the buzz around iconic new buildings, the biggest opportunity in greening the built environment lies in existing building stock.

One of the five election priorities of the Green Building Council of Australia (GBCA) for 2010-2013 is to "retrofit and improve existing buildings".

Commercial buildings alone account for approximately 10 per cent of Australia's greenhouse emissions. Those kinds of numbers prompted the Federal Government to introduce, from November 1, the Commercial Building Disclosure (CBD) scheme requiring office buildings of more than 2000m² to reveal a NABERS Energy rating out of five stars when they are sold or leased.

But it is not just office blocks in the crosshairs. The GBCA listed "green[ing] education and health-care facilities" as a top five priority, while Canberra has flagged action on building types such as industrial, hotel and retail properties.

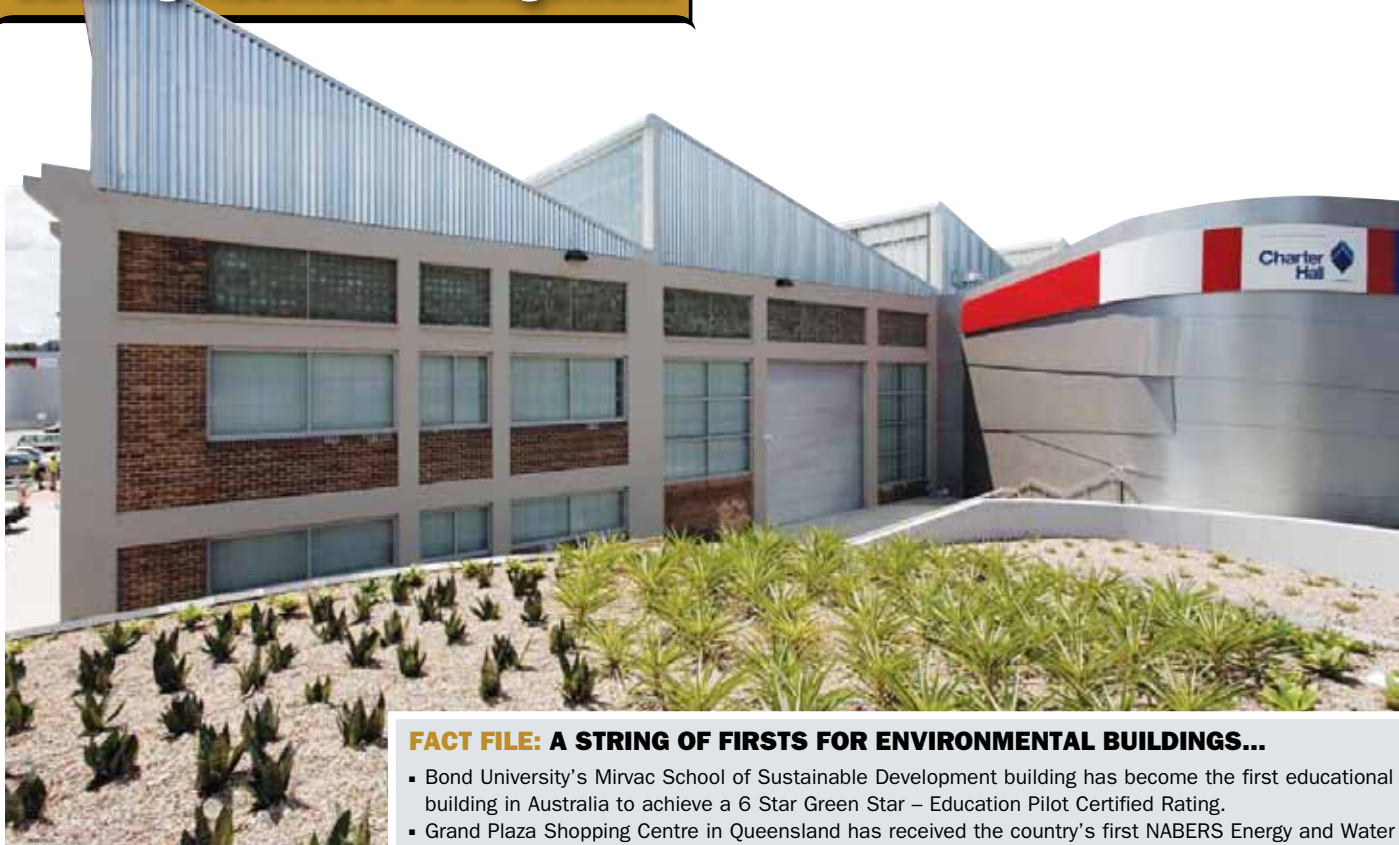
For example, it intends to progressively expand the coverage of the CBD scheme. Rowan Griffin, head of sustainability for the property portfolio of Colonial First State Global Asset Management, expects the retail sector to be the next cab off the rank, with 2012 talked about as the start date.

"It is the most likely because there is a NABERS Energy tool available, but I do not think it will be 2012," he said.

"I think there should be a longer transition period. And the lifeing tool they are proposing, we need to see that and to see that it is feasible and what it means. My own prediction is that it will be 2014 before we get a retail tool off the ground in mandatory disclosure."

The government has also included shopping centres and hotels in its expanded Green Building Fund and new 'Tax Breaks for Green Buildings' initiative, both promised during the election.

Under the tax break, any capital works from July next year to mid-2015 to improve the energy efficiency of



FACT FILE: A STRING OF FIRSTS FOR ENVIRONMENTAL BUILDINGS...

- Bond University's Mirvac School of Sustainable Development building has become the first educational building in Australia to achieve a 6 Star Green Star – Education Pilot Certified Rating.
- Grand Plaza Shopping Centre in Queensland has received the country's first NABERS Energy and Water rating for a shopping centre (more page 36).
- The \$15 million EcoEnterprise Park at the Gold Coast is the world's first carbon neutral industrial estate and "100 per cent self-sustaining", thanks to solar energy for street lights, water pumps, septic systems and security.
- The new ANZ Centre at Melbourne's Docklands uses cool water from the Yarra River to reduce demand on cooling towers, and installed vertical wind turbines on the roof.
- Home HQ North Shore (above) in Sydney's leafy Artarmon has just become the country's first 4 Star Green Star rated retail bulky goods development.

existing buildings – from two stars or lower to four stars or higher – will be able to claim a deduction of 50 per cent on the cost of capital works or any eligible plant and equipment.

The government hopes it will boost retrofit investment by about \$1 billion. While details remain sketchy, it is certainly the kind of financial mechanism the industry has been crying out for as, according to ASBEC's *2nd Plank* report, "market information suggests that it currently takes up to 15 years to obtain a payback on the cost of upgrading a two star energy rating building to a four star rating".

From untouched to untapped

So, what is the future of green building? At the Facility Management Association of Australia's Ideaction 2010 conference in May, the GBCA called for a fundamental revision, "from the 'first do no harm' approach of today to develop buildings that are producers of resources".

Green Star executive director Robin Mellon, in a paper sub-titled 'From Design to Management', said "at last we are starting to achieve the balance between good passive design processes, intelligent systems, technologies, approaches and innovation, and facility management techniques that allow for more interaction between owner, occupant and manager.

"With diverse energy production in the

form of wind, solar or cogeneration, water harvesting and reuse, and waste recycling measures, we can begin to look at buildings as producers of resources as well.

"We must start the design, construction and management processes with the question: 'What will this building be able to do for the environment?'"

Examples? Sydney harbourside development Workplace6 has a sewer mining plant in the basement that provides all the building's non-drinking water needs and irrigates two neighbouring parks. A 600kVA tri-generation plant provides heating, cooling and air-conditioning, while 40 solar panels on the roof provide the hot water.

Mirvac's Orion Springfield Town Centre in Queensland was designed to use half the energy of a similar-sized shopping centre. It's also the first Australian project to incorporate variable air volume air handling systems in all its retail tenancies, and features mixed mode air conditioning in common spaces, including natural ventilation.

It has minimised or eliminated volatile organic compounds in all paints, adhesives and floor coverings. Lifecycle analysis

work in Europe is providing useful data on the comparison of building materials and accurate examination of procurement and the supply chain. Locally, the Building Products Innovation Council (BPIC) and Australian Life Cycle Inventory (AusLCI) projects are examining lifecycle inventories, data and analysis within an Australian context. Details are expected soon.

Carpet manufacturer InterfaceFLOR has implemented a take-back program to ensure its products have a useful 'second life'. Its national manager for sustainable solutions, Bobby Ali-Khan, argues facility managers are in a prime position to activate a take-back clause in their lease agreements.

"Facilities managers should start by looking for products which can deliver the longest possible first life – and then purchase from companies that have implemented end-of-life take-back schemes to ensure the products are recycled to make new resources or new products," she said.

Facilities managers have an enormous amount of power to bring about positive cultural shifts in their organisations, argues Ali-Khan. They are well placed to grab that 98 per cent opportunity. **WME**

Ongoing energy consumption and greenhouse gas reductions guaranteed

With the uncertainty around climate change and associated regulation, fluctuating energy costs and a changing economic environment posing challenges for business, it's important to bring some certainty to your business strategy. The benefits of energy efficiency and improved energy management in reducing business costs in a difficult economic climate can prepare your business to ensure continuing viability. Effectively reducing your consumption delivers savings year after year. With an Energy Performance Contracting approach to delivering energy efficiency projects, low-carbon, high-value solutions can become a reality for your business particularly when you're seeking greater certainty for the return on their investment.

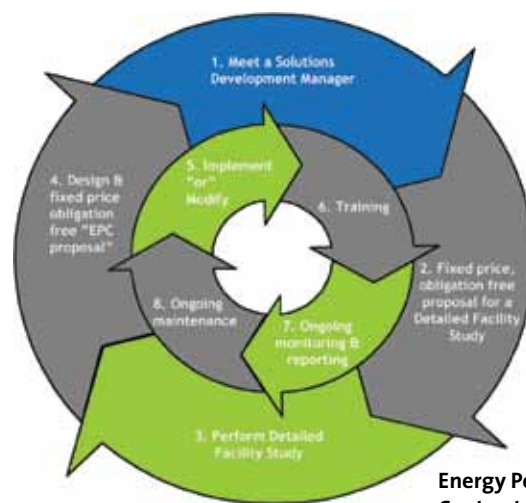
There have traditionally been a number of ways to achieve energy efficiency: Perform an audit & implement the findings (lowest cost, no certainty); Perform a limited guarantee project (often receiving a guarantee for recompense if savings are not within a band e.g. within 20% of commitment); An Energy Performance Contract (where savings targets are guaranteed lowering your risk). Each approach involves differing levels of commitment and complexity for both the customer and service provider so it is important to work with a trusted provider and find the approach best suited to you.

Energy savings with minimum risk

An Origin Energy Performance Contract (EPC) provides businesses with a low risk way to implement energy efficiency improvements that may pay for themselves. Customers are guaranteed* energy consumption reductions by upgrading to more efficient energy management infrastructure. We can design, project manage and implement the upgrade of plant equipment and through monitoring and verification, measure the savings and performance of your project.

Our Energy Performance Contract process takes you through the following stages:

- Step 1 Initial meeting to understand your business requirements**
- Step 2 Free Site Assessment** – A free assessment is undertaken by our technical specialists who take a holistic approach to savings in all areas i.e. Water, Lighting, Heating, Ventilation, Air Conditioning and Building Management systems. This will help you determine savings opportunities and whether your project is best suited to an EPC.
- Step 3 Fixed Price, Obligation-Free Proposal for a Detailed Facility Study (DFS)** – Upon completion of the site assessment we provide you with a proposal for a Detailed Facilities Study outlining the approach and approximate savings for each solution and an indication of estimated savings and Return On Investment (ROI).
- Step 4 "EPC Proposal" & Project Design** – The Detailed Facility Study will outline the maximum project costs, minimum energy savings and the internal rate of return achievable based on recommendations.
- Step 5 Project Implementation** – When you proceed with the Energy Performance Contract, an Origin team member will work with you throughout the project management process and coordinate suppliers on behalf of your project. A Certificate of Completion / Acceptance will be provided to you as the project is delivered and monitoring and verification will commence for the agreed period of time.
- Step 6 Training** – Training is provided to key staff on key changes including major equipment, systems and operating procedures, along with appropriate technical manuals being provided.
- Step 7 Ongoing Monitoring & Reporting** – A savings target is guaranteed by Origin. If it is not met as part of the initial design & installation, further changes will be implemented at no cost to the customer in order to achieve the result.
- Step 8 Ongoing Maintenance** – Origin can provide ongoing maintenance and servicing of equipment providing you with even greater peace of mind.



Energy Performance Contract Process

The Origin Guarantee

We guarantee* the energy savings for suitable projects, which may translate into dollar savings based on your energy charges. An EPC savings guarantee provides the assurance that the implementation of energy efficiency projects will deliver the specified results. This guarantee is 100% backed by Origin and is often used in supporting business cases for project approval and financing.

If the guaranteed savings are not achieved Origin will either install alternative or additional equipment to achieve the guaranteed savings or pay you the saving shortfall for the savings guarantee period.

Energy Performance Benefits

You can get a range of benefits besides savings when you implement a sound energy efficiency project (with or without the EPC guarantee).

- Energy and cost savings – energy savings may fund capital and reduce operating costs, greenhouse gases and minimise exposure to future electricity price volatility and potential CPRS obligations.
- Financial project backing - the energy savings are guaranteed making it easier to get finance for capital allowing you to tackle energy efficiency projects now.
- Improved work environment and facilities - through better equipment performance.
- Improved environmental credentials - promote 'Environmental Credentials' of the business or location.
- Ongoing support and maintenance - ongoing monitoring, operations and maintenance of equipment to ensure that you get optimal long term energy performance.

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For more information on how Origin or our Energy Performance Contracts can help you achieve your operational and sustainability objectives, contact us now on 13 23 34 or email originsolutions@originenergy.com.au

*If the guaranteed savings are not achieved Origin will either (a) install alternative or additional equipment to achieve the guaranteed savings; or (b) pay you the savings shortfall for the agreed savings guarantee period.

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make a difference.™



KNOW YOUR RETAIL NABERS

With water, energy and waste prices set to rise, many of Australia's major retail centres are shopping around to lock in and gain greater purchase on efficiency savings. By Richard Collins.

Grand Plaza Shopping Centre in Browns Plains, south of Brisbane, has its share of bells and whistles when it comes to energy and water efficiencies – metering on the big ticket uses, chiller plant monitoring, harvesting of air-conditioning condensate and top-level technical audits. However, the country's first ever NABERS Energy and Water rating for a shopping centre has revealed further savings opportunities for the centre, most at minimal cost.

NABERS Retail is an industry benchmarking scheme launched in December that adds context to individual shopping centre performance – against similar centres – and highlights their broader operational opportunities.

“This more accurate and independent ‘apples to apples’ comparison of the Grand Plaza's performance gives us significantly more information with much less effort,” said Scott Horsnell, sustainability manager in the property division of centre owner Colonial First State Global Asset Management.

Colonial and the six other major shopping centre owners have been working with the NABERS team at the NSW Department of Environment, Climate Change and Water to extend the rating

framework for office buildings to shopping centres with a gross lettable retail area (GLAR) of more than 15,000m², some 340 centres nationally representing 70 per cent of available GLAR.

Colonial's Rowan Griffin said the business case is different to office buildings, where A-grade tenants are increasingly demanding high-scoring buildings. For shopping centres, it is about cost savings and future proofing.

“The internal business case is one of saying how I can be more efficient. I know that electricity and water are going to go up massively in the future, so how can I keep my operating costs at a reasonable level and not skyrocket the rate at which utility costs are going to go up,” he said.

Griffin supports the market feel that energy prices may double in five years and quadruple in 10 – and already factors this into cost-benefit analyses around Colonial's capital decisions.

Tips and tricks rollout

The Browns Plains store scored just three out of a possible five NABERS stars. It uses 329MJ/m² of energy (for the base building and tenants “centrally serviced” with air conditioning) and 59ML of water for the entire centre.

Highlights of its existing energy program include variable speed drives on selected pumps and fans, base building electricity metering and EffTrack chiller

plant efficiency monitoring, a web-based analysis and trending tool installed on water cooled chillers that at Grand Plaza provides a simple payback of about 16 months. Colonial is also currently working with EffTec and Airmaster Australia to rollout the next generation of total plant performance monitoring, called Plant Pro.

On the water front, it has installed sub-metering for high consumption areas and hooked up rainwater tanks to supply amenities and cooling towers. It has also plumbed the condensate drainage from eight of the centre's 14 air conditioning units into the rainwater tanks, harvesting 875kL of condensate in 2009/10.

Colonial doesn't plan to break its return on investment rules simply to boost its star rating, but Horsnell said the NABERS assessment – married in this case to a full performance audit – threw up a range of low-cost opportunities.

“We're using the results to re-evaluate our efficiency and performance strategies. Based on our NABERS ratings, we believe that we can achieve improved operational performance through less expenditure than previously forecast,” he said.

Colonial expects to boost the centre's rating between 0.5 and 1 NABERS stars, in large part by tweaking management

perspectives and practices thanks to the increased visibility the scheme provides.

Horsnell is also developing a tips and tricks guide for the other 34 centres in Colonial's portfolio. He says it's basically a "standardisation of control" strategy applicable to building management systems in all the centres, from set point adjustments, seasonal scheduling of lighting and plant to the more advanced functions of plant operation.

FACT FILE: INSIDE NABERS RETAIL

NABERS is based on 12 months of consumption data, such as utility invoices and lease information and a series of questions on the attributes of the shopping centre. It compares actual performance with the average performance of a centre with the same attributes, and then adjusts for local climate conditions to determine the star rating.

The attributes are:

- Number of food court seats, cinema theatrettes and car parking spaces;
- Total gross lettable retail area (GLAR); and
- GLAR of gyms and of centrally serviced area.

It should take one day and require the facility's operations manager and an external NABERS assessor. It cost Grand Plaza about \$6,000, including DECCW costs, but this will vary by site.



Bringing tenants on board

Specialty tenants at Grand Plaza account for almost 59 per cent of the centre's core energy use (excluding major tenants) and 66 per cent of its total water use. NABERS only rates base buildings, but Griffin is keen to see that change.

"I would like them to bring tenants into the mix because what you have at the moment in retail is a total disconnect. Tenants are very concerned with their own CSR and sustainability policies... but there is not a lot of coordination between what

they are doing inside their box and what we do in the mall," he said.

DECCW's principal program manager for commercial property, Yma ten Hoedt, said they had identified that need and are exploring the viability of creating a rating tool for large retailers.

They will also look at adding a waste category. While Griffin acknowledges waste costs will climb markedly in coming years, he urges greater clarity before heading down that path, including proving

the waste assessment in the office tool.

Two more shopping centres have been star rated since Grand Plaza in August and two more are in the pipeline. Ten Hoedt reckons there could be upwards of 30 by the end of next year, though the number will surely take off when the new mandatory disclosure provisions for large commercial offices are extended to retail centres in 2012, as proposed.

More at www.nabers.com.au

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BUILDINGS WITH BRAINS

A building that can really learn and adjust to its occupants' patterns may have arrived with the commercialisation of a CSIRO technology called BuildingIQ Energy Management System.

It uses sophisticated mathematical algorithms and other advances to learn the building's thermal characteristics, and then incorporates weather forecasts, electricity tariffs and external factors such as demand response strategies to continuously manage energy use in the building.

Trials at CSIRO's Newcastle Energy Centre provided early evidence of its potential, achieving cost and energy savings of up to 30 per cent without compromising tenant comfort.

And it's not just for office buildings but retail malls, government buildings, hospitals – really any areas with zoned heating, ventilation and air conditioning (HVAC) systems, enclosed spaces and variable uses.

The initial focus will be on HVAC systems, which consume up to 60 per cent of total energy in commercial buildings. BuildingIQ continually optimises the HVAC operation by pre-planning start times and adjusting set points throughout the day, including chilled water temperature, supply air temperature, and room air temperature.

How? By using a multi-objective optimisation framework combined with an intelligent HVAC supervisory control system that uses "multi-agent systems science and machine learning techniques to automatically evaluate different control scenarios".

BuildingIQ is backed by Sydney venture capital firm Exto Partners and founded by Michael Zimmerman, a former venture capitalist and technology executive. He said interest from building owners and property fund managers had been very strong.

Craig Roussac, GM of Sustainability, Safety & Environment at Investa, which first trialled the system commercially, said "BuildingIQ is unique in its potential to maintain or improve tenant comfort while improving energy efficiency".

Lend Lease is testing it in four buildings. Its Asia Pacific head of sustainability, Cate

Imagine a building capable of using technology to adapt and integrate into its environment. CSIRO's BuildingIQ is bringing this to life. By Richard Collins.



The Perth Council House is energy demand responsive.

peak electricity periods. Buildings have not been such a fertile field for the approach as owners rightly prioritise tenant operations and comfort.

BuildingIQ promises to change that. It has just completed the world's first trial of 'OptimizedDR', using the system's ability to predict and then dynamically manage energy through a DR event without disturbing tenants.

Its DRiQ application was installed in Perth's Council House building and sponsored by Western Power, whose demand management manager is a fan.

"Reducing peak loads during critical demand days is an important focus of Western Power," said Peter Martino. "Being able to dynamically manage this while considering tenant comfort is a key to getting building owners to participate in demand response management programs."

Zimmerman says OptimizedDR is streets ahead of even the advanced 'AutoDR' systems now emerging, which still employ relatively crude pre-programmed, static control strategies. BuildingIQ promises truly intelligent buildings that adapt and integrate into their environment.

Collins, sees the smart system "as an opportunity to innovate beyond simple building re-tuning".

One of the key selling points is it requires no infrastructure upgrades, capital expenditure or new structural data. It is simply a software retrofit of the existing building management system (BMS), with each building needing just one server to link to BuildingIQ's cloud-based optimisation engine.

"We particularly like that the BuildingIQ system can be easily installed in buildings of varying ages with varying existing building management systems without increasing risk of system failure," said Collins.

It integrates with systems such as Honeywell, Johnson Controls and Siemens, which together hold some 60 per cent of the BMS market.

The future of demand response

Demand response (DR) has typically focused on industrial facilities able to switch off or dial down their power during



One of the key selling points is BuildingIQ requires no infrastructure upgrades, capital expenditure or new structural data

THINK-TANK SOLUTIONS

Tasman Tank Company engineers tanks that fit around columns and awkward shapes. By Richard Collins.

Industrial and commercial buildings are under increasing pressure to find space for green technologies, including wastewater processing and recycling tanks.

The Tasman Tank Company has turned its hand to such situations by engineering tanks that fit around columns and awkward shapes to optimise the use of available space.

For example, a new 5-star building in Adelaide's CBD called for the storage of 100kL of potable and non-potable water, including fire and rain water, in the carpark basement. With limited access, limited roof height and a number of building support columns to contend with, there was no way a pre-fabricated unit was going

to work. Tasman went with a bolted industrial tank, in two weeks drawing up the plans, fabricating the parts and erecting it on-site.

Tasman Tank's Ross Edwards said the company had used the flexible tanking system in a number of difficult situations. "Just recently, for example, we completed a 1.1ML tank inside an existing warehouse. It was constructed around a building column 6.8 metres high."

On a Brisbane building they built a 1ML chilled water tank that gets cooled overnight using off-peak power and then employed the next day to boost the

building's air conditioning system.

There are various materials available, including stainless steel, galvanised steel and an option to coat the panels internally with a two-pack epoxy coating to extend life expectancy.

More from Tasman Tank GM Jason McLaughlan at jason@tasmantanks.com.au **WME**



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TRI-GENERATION NATION

Sydney and Melbourne councils are looking to outperform each other with ambitious greenhouse and energy efficiency initiatives. Sydney wants to cut CO₂ by 70 per cent by 2030, while Melbourne's 1200 Buildings retrofit project speaks for itself.

One key technology both councils are tapping is tri-generation, which generates electricity, heating and cooling from local gas-fired power units. From a physics perspective, a combustion process cannot be more than 30 per cent efficient, so capturing and using the waste heat can lead to great savings.

Sydney Lord Mayor Clover Moore said a third of the council's carbon reduction goal of 3.9Mt a year by 2030 will come from tri-gen. Melbourne is aiming to achieve zero net emissions by 2020, which means eliminating 5.8Mt of CO₂, a lot of it through tri-gen.

It has already seen a surge among landlords. GPT, Stockland and Mirvac have all stuck tri-gen units in Sydney office developments, while newly carbon-neutral NAB has installed the technology on its data centre in Melbourne and expects to save 20,000 tonnes of CO₂ a year.

But one expert, while welcoming the spike in popularity, says there are traps for the unwary. Johnson Controls' Peter Moser sees two core drivers for its uptake.

"First is the prominence of GreenStar and NABERS. Many companies will move to tri-gen as they will want the extra points or stars," he told *WME*.

"Secondly, there is the continuous increase in the price of energy. At the same time there may be an [emissions trading scheme] or a carbon price introduced, and that puts pressure on the consumer. Combining those two scenarios will see more people adopt tri-gen because it will become more economically viable and the payback periods of tri-gen will come down considerably."

But he points to the importance of pre-planning when considering tri-gen, warning. "To put tri-gen into a building, let alone retrofit a whole city and make it work, you need highly complex teams working together. A lot of the time these teams don't work well, they run out of money only months into a 20-year process."

RSL leads the way

Sydney's Rooty Hill RSL has become the first RSL in Australia to go down the tri-generation route, in September switching on a 1,000kW generator. Its design consultants, Haron Robson, did the legwork.

"This included an audit process and a cost benefit analysis of several options before settling on the tri-generation scheme. We built up a conservative economic model and came up with a payback period of seven years, based on current electricity prices," said Tom Russell, group director at Haron Robson.

Both Sydney and Melbourne are scoping out tri-gen technology and expect to use it in ambitious ways, but have they planned it properly? By Max Pichon.



Waste heat is ducted away for reuse; Tom Russell (L) and RSL chief Richard Eddington.

"But since then, prices have gone up 20 per cent. The club ended up investing \$4.5 million with a seven-year payback as worst case scenario, with a best case scenario of four years based on projected electricity increases."

It also based the modelling on an expected life of plant of 14 years because Haron Robson expects the technology will advance rapidly, warranting an upgrade ahead of the 20-year design life.

So what's involved? The new equipment consists of a gas driven generator in the RSL's basement and a new absorption chemical reaction chiller on the roof, which operates from the waste heat from the generator. It required ventilation and exhaust modifications, but Russell said building works were far less than with other technologies, which kept the costs down. The gas generator was connected to the existing main switchboard at minimal cost.

The cold water from the chiller was connected to the RSL's refrigeration plant, further reducing its electrical load, while the hot water will cut the load for heating water. But the big savings will be in reduced air conditioning energy demand. Roughly 60 per cent of site electricity demand is for air conditioning – the new chiller will cut that in half.

All up, average power consumption will be slashed from 2,200kVA to 1,600kVA, almost a 25 per cent reduction in peak demand and 50 per cent reduction in CO₂ emissions.

Finally, the club now has an additional income stream courtesy of its participation in various energy demand reductions schemes (interruptible supply), as well as selling power back into the grid in future. Now that's win-win.

“
From a physics perspective, a combustion process cannot be more than 30 per cent efficient

EASY ENERGY SAVINGS

The key to many successful energy-reducing strategies is simple – reduce how much energy you need and be smarter about the energy that you do use. Here are some prompters from the Facility Management Association of Australia.

ENERGY CONSERVATION MEASURE	COST	BENEFIT	DIFFICULTY
Heating, Ventilation & Air Conditioning (HVAC)			
Chilled water temperature reset – reset chilled water temperatures higher when conditions permit, improves system efficiency.	\$\$	✓✓	XXX
Adjust Setpoints – adjust setpoints to maximum levels that still provide acceptable comfort conditions.	\$	✓✓	X
Correct operation and sequencing of outside air dampers – ensure dampers are free to move and actuators operate correctly.	\$	✓✓✓	X
Check for air leaks in ductwork – leaks increase the energy required to deliver required conditions. Can compromise air quality.	\$	✓✓✓	X
Occupancy sensors – ensure air conditioning does not operate unnecessarily	\$\$	✓✓	XX
Suitable preventative maintenance program – ensure equipment is working at optimum levels	\$\$\$	✓✓✓	XX
Time and calendar controls – limiting equipment/system operation in facilities that operate on a predictable schedule. Turn off equipment when not needed.	\$\$	✓✓✓	XX
Condenser water reset – allows accurate control of condenser water temperature so chillers can operate efficiently. Some engineering required.	\$\$	✓✓	XXX
Keep condenser tubes clean – clean regularly to prevent fouling and maintain heat exchange efficiency.	\$	✓✓✓	X
Water treatment program – minimises condenser losses and the need for intensive condenser cleaning.	\$	✓✓	XX
Variable speed fans – modulate heating and cooling requirements by adjusting fan speeds to suit.	\$\$	✓✓✓	XXX
Efficient motor replacement – when replacing motors, use one that has the highest practical efficiency.	\$	✓✓	X
Hot water zone reheat – convert electric zone heating to hot water where practical.	\$\$\$	✓✓	XXX
Run timer switches – can be used on air conditioning for after hours use or intermittent day use.	\$	✓✓✓	X
Demand ventilation control – monitors the CO ₂ in the air and adjusts ventilation to match the actual occupancy levels.	\$\$	✓✓✓	XXX
Outside air economiser cycle – suitable for use where ambient conditions allow outside air to meet the cooling requirements of the air handling system.	\$\$\$	✓✓✓✓	XXX
Variable speed pumping – pump power is adjusted any increase/ decrease to meet changing load conditions.	\$\$\$	✓✓✓✓	XXX
Purge cycle – can be used for overnight and early morning cooling in dry climates.	\$\$	✓✓✓	XXX
Reduce building air leaks – prevent any increase load for HVAC systems by reducing air leaking in and out of the building.	\$	✓✓✓	X
Adjust control dead bands – increase the gap between control settings for heating and cooling.	\$	✓	X
Internal shading devices – a method of reducing solar heat gain.	\$\$\$	✓✓	XX
Solar control films – a powerful method of reducing both heating and cooling load on glass.	\$\$\$	✓✓✓✓	XXX
Insulation – critical for blocking the flow of heat to or from items like pipe work, ducting and heat exchangers.	\$\$	✓✓✓	XX
Control systems maintenance – ensure that controls are functioning, calibrated and set to the correct settings for minimum energy while meeting comfort conditions.	\$	✓✓✓	X
Control systems (new or upgrade) – will allow accurate and flexible control of energy consuming systems such as HVAC and lighting.	\$\$\$	✓✓✓✓	XXX
Continual commissioning of plant & equipment – rebalance air flow, water flow and other system variables on an ongoing basis to increase energy efficiency.	\$\$\$	✓✓✓✓	XXX
LIGHTING			
Light switch labelling – helps know which light switch is for what, as well as conveying a message to turn off when not in use.	\$	✓✓✓	X
Energy efficient fittings – change to efficient lamps and ballasts to reduce internal heat loads as well as reduce energy consumed.	\$\$\$	✓✓✓✓	XXX
Occupancy sensors – control lighting for use in areas that have irregular use such as store rooms, meeting rooms and toilets.	\$\$	✓✓✓	XX
Daylight sensors – can be used to dim or switch off lights in work areas when conditions allow.	\$\$	✓✓✓	XX
LED lighting – can be used in some areas to provide reduced energy consumption and increased life cycle.	\$\$	✓✓	XX
Lighting zones – create small zones so that spaces are not unnecessarily illuminated.	\$\$	✓✓	XX
Individual light switches – individual switches can be used with movement sensors for isolated spaces.	\$\$	✓✓	XX
Programmable light control systems – can provide outstanding control of lighting energy throughout a building or portfolio.	\$\$\$	✓✓✓	XXX
Switch off monitor – have a designated member of your staff who walks around at the end of the day switching off lights. Your cleaning crew can do this task.	\$	✓✓✓	X
Delamping – compare illumination levels with minimum recommended standards and identify over-illuminated areas.	\$	✓✓✓	XXX
Upgrade to energy efficient lamps – get the same amount of light and use less power.	\$\$	✓✓	X
COMPUTER & OFFICE EQUIPMENT			
Timers – plug in or wired timers to turn off items such as hot water boilers in kitchens, vending machines, chilled water drink units.	\$\$	✓	X
IT equipment (energy save mode) – ensure that equipment goes into standby or shutdown when not in use.	\$\$	✓✓	X
Computer monitors off – turn them off when not in use or away from the desk – screensavers do not save energy!	\$	✓	X
Switch off at power point – equipment will still draw energy in standby mode when the power switch is still on.	\$	✓	X
IT equipment selection – laptops use up to 25% less power than PCs and their monitors.	\$\$	✓✓	X

Extract from 'Tools for Change', a 37-page guide to energy management. Download from www.fma.com.au