BUILDINGS 3

Buildings should exist to provide clean, safe and healthy environments in which we can live, work and enjoy ourselves – but this is not always the case. Building materials, building practices, energy and water consumption and waste production deplete and pollute the outdoor environment. Air conditioning, cooling towers, materials and machines that emit unhealthy gases and substances (off-gasing), electromagnetic radiation, mould, bacteria and rising damp can pollute our indoor environment. This can lead to the so called 'sick building syndrome' which can impact on our physical and mental performance.[1]

'Green buildings' minimise the total environmental impact of construction practices, materials, fit-out, operation and deconstruction using practices which can save money, conserve resources and reduce waste. They create a healthy living and working environment by reducing or eliminating many of the factors that contribute to sick building syndrome.

There are many ways a building may be "green" and still maintain or enhance efficiency, beauty, layouts and cost effectiveness. The basic areas of an environmentally oriented design are:[2]

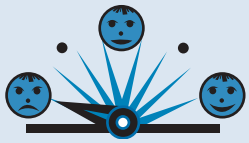
Building Form – The form of a building can respond to adjacent land form, vegetation and climate patterns. Incorporated into a design may be recycling facilities, layouts facilitating co-operative lifestyles, access to public transport, and indoor planting areas. The design itself can aesthetically reflect local or regional natural features, and respond to the local micro-climate.

Good Design – Consider what we are leaving those that will follow us. Buildings with healthy environments, longevity, ease of use, reuse, and beauty, will require less energy, less repair, and will be better value in the future. Thoughtful design, attention to details, and use of quality materials and building systems will be much easier to sustain in the future than the mass produced, cheap components we frequently encounter.

Energy Efficiency – Building designs should make best use of passive solar heating, natural lighting and ventilation, solar heat stored in thermal mass, insulation and double-glazing systems. This should be combined with energy-efficient heating, proven solar technologies and energy-efficient lights and appliances.

Materials – Choose environmentally friendly materials with low embodied energy, that don't require extensive processing, that don't produce toxic waste and are from renewable sources and are relatively safe to produce. Re-use existing non-toxic materials – especially in alterations to existing buildings. Avoid materials that are 'harder' on the environment than others, wood species from destructive forestry practices and products that 'off-gas' – which can continue for years after construction.

Queen Victoria Market goes solar.



The Envirometer
A range of green building tools are available for home and building design. These resources need to be used a lot more widely.

CASE STUDY

Let The Sun Shine On Queen Victoria Market

In April 2003, Melbourne's bustling 125 year-old Queen Victoria Market became the largest urban, grid-connected, solar panel installation in the southern hemisphere. The installation of 1328 solar panels covers one third of the roof. The project can generate up to 252 megawatts of electricity each year – enough to power 63 average homes a year. It is expected to deliver up to a third of the Market's energy needs for the next 30 years, at an estimated saving of approximately $38,000 in energy bills every year. The solar power will also save more than 369 tonnes of green house gas emissions each year and help the city meet its sustainable energy targets.

For more information contact City of Melbourne 9658 9658, *www.melbourne.vic.gov.au*

CASE STUDY

Scoring Green In The City Of Port Phillip

After a four-month introductory phase, the City of Port Phillip plans to make its sustainable design scorecard mandatory. The sustainability design scorecard is a simple way of judging proposed buildings or extensions against minimum environmental standards in energy, water, stormwater, building material and transportation energy and an optional sixth category of environmental sustainable development (ESD) excellence. Each section is given prescriptive scores against performance targets; a range of options for ESD excellence include Green Power, use of low toxicity material and indigenous planting. The Council's strategy and policy review committee recommended in mid-2002 that the sustainable design scorecard be incorporated into the City of Port Phillip planning scheme.

During the four month introductory phase, scorecards were attached to all residential planning applications pertaining to multiunit development, single houses (including row and town houses) and extensions/additions 50 sqm or over in floor space. Half the planning applicants utilised the scorecards. The majority of renovations are less than 50sqm and are difficult to trace through the planning application process. This will be remedied for the continuation of the scorecard implementation process. Another problem with implementing the scorecard occurred because of a lag time with some applications still being processed or awaiting supplementary information. Planners sometimes found it difficult to convince some applicants to comply with the scorecard as it lacked the 'statutory' weight to mandate its use, which is why the Council will incorporate the scorecard into its planning scheme.

Despite the many limitations of the introductory phase, the scorecard impacted 241 individual apartments or houses. It has proven itself to be a very effective tool in measuring and improving the sustainability of residential applications. Both the development industry and the Council's own planners are enthusiastic about the concept of sustainable design and the scorecard. The other benefit of the scorecard is its flexibility in the sense that when the benchmarks are no longer challenging, they can be raised quite easily.

The scorecard requires evidence of a First-Rate assessment and the energy efficiency of hot water, space heaters and other appliances. Brand details are also required. The Council provides a $50 rebate to applicants who undertake First Rate energy assessments required by the scorecard. A range of tools, such as waste minimisation plans and guides to energy efficient appliances, are supplied for applicants. Air quality indicators have been added to the optional section for environmental excellence.

The City of Port Phillip has sought to pick the "low hanging fruit" with this achievable and across-the-board tool that aims to be transparent and straightforward to planners and designers/developers alike. A series of guides have been prepared to assist applicants completing the scorecard. For further information contact the Sustainable Design Officer on 9209 6303,
www.portphillip.vic.gov.au/sustainable_design

CASE STUDY

Five Star Estate

An increasing number of developers are designing estates that are environmentally friendly by incorporating features such as wetlands, parks and positioning blocks of land to allow light, sunny homes. Villawood Properties have designed their new 'Seasons' estate with all these features but have further demonstrated their commitment to the environment by encouraging all buyers to build and live sustainably.

A 5 star minimum energy rating applies to homes within the estate. However, Villawood Properties have also identified that energy consumption in the home can be greatly reduced through the types of appliances/systems installed. Therefore, they have included a special 'Living green' star into their energy efficient rating system. Owners have the option to achieve a 5 star home by combining energy rated housing with energy rated appliances/systems. Rebates of up to $2000 can be claimed by owners who build a 5 star energy rated home and install water and energy efficient appliances.

Other tips for sustainable living are detailed in a booklet distributed to all owners. This guide provides detailed information about green loans, appliances, lighting, water efficient gardens, draught sealing and material selection. Its purpose is to help people make lifestyle decisions that are environmentally and socially friendly which also save them money.

Water and waste water efficiency – Buildings should incorporate water efficient appliances and fittings that gather and filter rainwater on site, use grey water where possible and maximize permeable surfaces to reduce stormwater run-off.

Involve people – One of the greatest impediments to the sustainable operation of a building can be the behaviour of the occupants – the people who flush water, create and dispose of waste, and turn on lights, computers and heaters. An important part of a green building is to develop a community with a shared intent to reduce the impact of its activity. 'Green' leases encourage tenants to reduce consumption of energy, water and material, to produce less waste and recycle as much as possible. Sophisticated monitoring systems can let tenants know their energy and water consumption in real time.

In this chapter we look at the greening of houses and commercial buildings in Melbourne.

CASE STUDY

Smart House, Smart Street

The story of how a humble semi-detached 1890s home in Hawthorn with outdoor toilet, bathroom and laundry, poor natural lighting, no north facing windows and inefficient heating was transformed at the hands of SunPower Design Pty Ltd into a super green house.

Added to the small block of 203m^2 were a 1,000 litre greywater treatment system, 9 x 1,000 litre polyethylene food grade rainwater tanks; and a 18 x 75 Watt solar photovoltaic system and a solar hot water system.

Environmentally friendly design features were chosen to deliver high occupant comfort, health and addresses the ecological footprint of the building. Building materials included: reusing bricks, flooring and window; recycled timbers; farm windbreak tree species for external weatherboard cladding, decking and solar pergola; sewerage pipes from recycled PVC and new concrete slab contained recycled slag ash. Building materials were selected to be long lasting. Breath easy paints and Biopaints were used throughout the alteration.

Design features included very high thermal efficiency using 3.5R polywool for the ceiling and 2.5R for the walls, 1.5R aircell under the whole house roof and under the old timber floor in hallway and southern bedrooms, double glazed and Comfort Plus glass windows, AAC brick, with three times the thermal efficiency of standard brick, in a new section of party wall, and high solar efficient detachable sail shades to protect the north facing glazing in summer. Passive solar design incorporated a large Marmolium(lino)-covered thermal slab exposed to north facing double glazing with a heat shifter (heat transfer system) located in the upper mezzanine floor to redirect heat to all south facing rooms. Given that gas under bench ovens which vent externally to the environment are not available, an electric oven was installed to protect occupant health from Nitrogen Oxides from gas burning in a super insulated building.

And the results…in the first 5 months, from Nov 2002 – April 2003, $155 was saved on electricity, gas and water bills compared to the previous 5 year average for the late Spring to early Autumn period. Despite the drought, about 60% of domestic water needs were met from the onsite rainwater and greywater collection systems. About 1190 kWh of renewable solar electricity was generated compared to 960 kWh of electricity consumption. A reduction in gas consumption of 66%. About 32,000 litres of public water saved (includes greywater treatment and recycling). Internal temperature rarely rises above 27 degree on a 40 degree summer day.

For further information contact Brod Street, 9637 8476.

Pressure

Increasing population, growing economic output, a trend towards smaller households in larger houses, an increasing standard of material well-being and continual upgrading of older-style dwellings creates a continual demand for renovations, new houses and buildings.

They may look sleek, but the city's gleaming, energy-hungry office blocks are large greenhouse producers. Commercial buildings account for almost 10% of Australia's greenhouse emissions (heating, ventilation, air-conditioning and lighting account for 84% of this[3]).[4] They are one of the fastest-growing sectors for greenhouse gas emission in Australia, but we don't often think about it because they don't emit pollution like a car. Without drastic change, greenhouse emissions from commercial buildings are predicted to double in the 20 years from 1990 to 2010.[5]

Our homes account for another 10% of Australia's greenhouse emissions (52% of this comes from electrical appliances, 28% from water heaters and 15% from other heating and cooling[6]).[7] Despite moves to make homes more energy efficient, Australians increased their residential energy consumption from 18 gigajoules per person in 1980 to 20 gigajoules per person in 1999.[8]

Condition

Greening of houses and buildings is a growing movement in Australia. In the past, the pressure to do things the same way others have done before them has limited options chosen by developers, architects, engineers and builders. There is often a perception that change is too hard, too time consuming, too costly and too risky. There can also be limitations to the availability of green designs and material specifications. But with increased media coverage on the economic and environmental advantages of sustainable designs we are starting to see green building practices move into mainstream design. Green designs, design tools, materials, fittings and furnishings are becoming more and more available.

ResCode is a mandatory package of provisions for residential development introduced through the planning and building systems in late 2001 in Victoria. ResCode aims to protect neighbourhood character and amenity and to help ensure environmentally sustainable residential development. It introduced new environmental standards including a four star energy rating for multi-unit development, a permeability standard to reduce stormwater runoff, and a standard to protect solar access to north-facing windows of existing buildings. While ResCode is a step in the right direction towards green housing, it doesn't go far enough towards reducing environmental impact and facilitating sustainable living. For more information contact the Department of Sustainability and Environment *www.dse.vic.gov.au.*

INDICATOR: Table 1: ***'Green' rating tools for residential and commercial buildings***

Rating tool	Description	Further information
Residential		
NatHERS (The Nationwide House Energy Rating Scheme)	A useful tool for architects, building designers, regulators and builders. Assess factors such as insulation levels, window orientation and area, wall type and ventilation to provide an estimate of the heating and cooling energy required and provide a 1–5 star rating of the efficiency of design. It does not consider heating and cooling appliance characteristics, other major energy uses such as hot water, clothes drying, cooking and lighting. Nor does it evaluate broader environmental issues such as impact of materials, indoor air quality, etc.	CSIRO *www.dbce.csiro.au/index.cfm*
BERS (Building Energy Rating Scheme)	A powerful tool developed by Solar Logic capable of simulating and analyzing the thermal performance of Australian homes. Unlike other a Home Energy Rating Schemes (HERS) programs, BERS allows the assessor to select whether mechanical cooling is used and can assess the performance of a number of natural ventilation options.	Solar Logic *www.solarlogic.com.au*
First Rate	A software package developed by the Sustainable Energy Authority of Victoria. It provides a simple method to assess and improve energy efficiency of new and existing houses. A five star rating, with 5 stars being the most energy efficient, is based on years of research and over 55,000 thermal performance simulations per climate zone.	Sustainable Energy Authority of Victoria *www.seav.vic.gov.au*
BASIX (The Building Sustainability Index for NSW)	Probably the most comprehensive approach to environmental rating of new residential buildings. A web-based planning tool to assess the potential performance for residential dwellings against an agreed set of sustainability indices. The BASIX tool has the ability to rate the sustainability of a development at two levels: the building construction stage and at the neighbourhood level. The eight BASIX indices are: site ecology, social, transport, water, stormwater, energy, waste and recycling and materials.	The BASIX project, Sustainability Unit, Planning NSW, (02) 9762 8033 *www.sustainability.nsw.gov.au*
NABERS (National Australian Building Environmental Rating System)	A national building rating system currently being developed by Environment Australia. It will encompass a range of building types and rate such things as energy and water efficiency, site conservation and biodiversity, indoor air quality, efficiency of resource use and other relevant environmental factors.	Environment Australia *www.ea.gov.au/industry/waste/construction/nabers* NB: due for completion mid-late 2003
Commercial		
The Australian Building Greenhouse Rating Scheme	The Australian Building Greenhouse Rating Scheme is a voluntary program for office buildings, designed to enable building owners, managers and tenants to get market recognition for superior greenhouse performance and identify ways in which greenhouse performance can be improved. Star ratings can be awarded for the base building (central services), a tenancy or the whole building. The ratings are based on energy-related greenhouse gas emissions, adjusted to account for climate and how the building is used. The more stars, the better the performance. Performance based ratings are obtained for existing buildings based on actual metered energy consumption.	Australian Building Greenhouse Rating Scheme *www.abgr.com.au*
Green Building Council green star rating tool	An interactive web-based rating tool for evaluating the environmental performance of Australian buildings based on a number of criteria, including energy and water efficiency, quality of indoor environment and resource conservation. The six star rating tool builds on existing tools in overseas markets including the British BREEAM (Building Research Establishment Environmental Assessment Method) system and the American LEED (Leadership in Energy and Environmental Design) system, while localising environmental measurement criteria and benchmarks to the Australian marketplace and environmental context.[9,10]	Green Building Council *www.gbcaus.org.html* The Green Building Council of Australia is a national not-for-profit property industry initiative. It aims to define and develop an environmentally sustainable property industry for Australia by driving the adoption of green building practices through market-based solutions in all aspects of building, from design to construction to ongoing building maintenance.
NABERS	*see above for more details*	*www.ea.gov.au/industry/waste/construction/nabers*

CASE STUDY

Aurora Epping

VicUrban working closely with the City of Whittlesea is creating a new environmentally sustainable development, Aurora, at Epping North. Aurora is approximately 1.5 kilometres from existing urban development in Epping (to the south) and three kilometres from the Epping Railway Station. The land to the immediate south of Aurora, has been designated as a future employment area by the City of Whittlesea. Construction is expected to commence late in 2003 and the community will be developed over a 10–15 year period. When completed Aurora will have up to 9000 homes housing an expected total population of 25,000 people.

Water use – The development will be a pioneer in the re-use of water, achieving a reduction in potable water use of about 54% compared with traditional developments. The development will boast a reclaimed water system whereby wastewater will be collected from all homes and treated to a Class A standard (as defined by the EPA Victoria) through a local sewerage treatment plant. This reclaimed water will then be directed back into all homes through a third pipe and used for toilet flushing, garden watering and car washing and also be used to irrigate public open space across the development.

Stormwater runoff will be captured and treated in local bioretention systems. In areas where runoff cannot be treated at the street scale, drainage will be directed to local wetlands, riparian wetlands or swales.

The design and development of this integrated water management system has evolved through a collaborative process between the VicUrban project team, Yarra Valley Water, Melbourne Water and the City of Whittlesea.

Energy Efficiency – All homes will be required to have a minimum mandatory energy rating higher than the standard required across Victoria. The detailed design will support lot orientation to maximise passive solar access making it easier for homes to achieve better energy ratings.

House builders will be required to ensure that a percentage of the total volume of all materials used to construct homes is sourced from recycled materials. VicUrban will work with EcoRecycle Victoria to ensure that the on-site recycling facilities and processes are of the highest standard in order to minimise the amount of waste generated on site during construction process and during the lifecycle of all homes.

Sustainable Urban Design – Streets have been designed to increase ease of access. The street network and better public transport links will hopefully encourage residents to use forms of transport other than the car – walking and cycling. Aurora will have higher densities than those currently experienced on Melbourne's fringe. These higher densities will be located within close proximity to the mixed-use town centres, which will feature a mix of commercial, residential and civic functions.

Environmental Conservation – Areas of environmental significance on the site have been retained. These areas, particularly a group of River Red Gums in the northwestern corner of the site and a series of stony rises in the centre of the site, are of high environmental value. Edgars Creek, which runs north-south through the site is currently in a degraded state due to many years of intense grazing and will be rehabilitated.

The Aurora development will be a model urban development, demonstrating pioneering approaches in sustainable development. There is wide community interest in the project.

For further information *www.vicurban.com.au*

The Department of Sustainability and Environment are currently developing a new project called Sustainability for the Built Environment. The initiative aims to deliver a more consistent and certain approach for both local government and developers by implementing new sustainability requirements in the development approval system built on improved water conservation, recycling and energy efficiency. For more information contact *www.dse.vic.gov.au.*

From July 2004, changes to the Building Regulations and the Plumbing Regulations under the Building Act 1993 will require new houses in Victorian to achieve a 5 Star rating. The introduction of the mandatory 5-star energy rating and water conservation measures for all new housing (including apartment buildings) into the Victorian Building Regulations will apply progressively from July 2004 to July 2005.

From July 2004, all new Victorian housing will be required to achieve:

- a 5-star energy rating under the First Rate Scheme, or
- a 4-star energy rating plus the installation of water savings measures and a solar hot water system, or
- a 4-star energy rating and install water savings measures and a rainwater tank plumbed into the toilet system.

From July 2005, all new Victorian housing will be required to achieve:

- a 5-star energy rating under the First Rate Scheme, and install water savings measures, as well as either a solar hot water or a rainwater.

For more information on the changes contact the Building Commission on *www.buildingcommission.com.au*
5-Star homes are estimated to save the average owner $200 per year in energy bills and within five years the homes are estimated to save Victoria an estimated 200,000 tonnes of greenhouse gases annually (which is equivalent to removing 45,000 cars from the road or planting 750,000 trees) and $30–40 million in energy.[11]

CASE STUDY

The International Green Building Pin-up.[15]

The 1987 Internationale Nederlanden (ING) Bank headquarters in Amsterdam uses only 10% of the energy of its predecessor and has cut worker absenteeism by 15%. The combined savings equals $US2.9 million per year.

The 540,000-square-foot headquarters of Netherlands second-largest bank is one of the most remarkable buildings in the world. The building (really a series of interconnected towers) is largely daylit, highly energy efficient, and architecturally innovative with features such as curvilinear form, local materials, plants, artwork, and flowing water incorporated into the building in a highly integrated fashion. Many of the organic features and unusual building geometries were drawn from the teachings of Austrian philosopher Rudolph Steiner, whose ideas may not be expected to be found in a commercial office space. The building does not use conventional air conditioning – a feat virtually unheard of for a building of this size – relying primarily on passive cooling with back-up absorption chillers. The building uses less than a tenth the energy of its predecessor and a fifth that of a conventional new office building in Amsterdam. The energy savings features added roughly $700,000 to the construction cost of the building – and were paid back in three months.

For further information *www.ing.com, www.rmi.org/sitepages/pid199.php*

Green Building Rating Tools

At the moment, it is difficult for the construction industry to define or measure exactly what constitutes green. Understanding the environmental performance of a building should be as easy as choosing a fridge if we want to see real change take effect. To facilitate greening of houses and buildings a range of specific purpose modeling and rating tools has been developed for Australian conditions.

Green building rating tools evaluate buildings based on a number of environmental and social factors including energy efficiency, performance of individual components, waste reduction, resource conservation, enhanced biodiversity and pollution prevention. The tools measure anything from a particular building element to the entire building envelope and either evaluate existing buildings and/or focus on new buildings. House Energy Rating Schemes (HERS) are one form of rating tool that will be used to assess the new Victorian 5 Star home regulations. The aim is to reduce residential energy consumption and increase thermal comfort by encouraging improved building envelope design. Currently, no completely functional tool exists that is capable of assessing the total environmental impact of a project.[12]

Green building rating tools relevant to Melbourne are described in Table 1. The Case Study: Scoring Green In The City Of Port Phillip describes a new mandatory score card for new residential developments and renovations in that municipality.

Response

Green houses and buildings are starting to sprout up all over Melbourne. Examples of green homes can be found in the adjoining case studies: Smart House, Smart Street; Five Star Estate; and Aurora Epping.

Melbourne got its first multi-storey green office block early in 2003. 60 Leicester Street, known as 6OL, in Carlton, on the edge of Melbourne's CBD, stands as a four-storey, 4500 square metre, multi-tenanted, commercial office building that provides a green benchmark to Australia's sustainable future. 60L is designed to reduce mains water usage by 90% by collecting and treating its own rainwater, reduce energy consumption by 66% using a roof top solar array, a smart natural ventilation system and a design that maximizes daylight throughout the building.[13] Building costs were only 5% above that of a conventional building, with significant savings estimated by recovering costs over the building's lifetime (for more information www.acfonline.org.au).[14] Data on energy savings from 60L are not yet available, however, the case study on the 1987 ING building in the Netherlands provides a stunning example of how much can be achieved with a green building.

Looking to the future, the City of Melbourne's proposed new building, Council House 2, on Little Collins Street, has been awarded a 6-star rating by the Green Building Council. Outstanding features will include its air cooling system, vertical gardens and wind turbines on the roof.

What can you do to encourage green buildings?

Councils

- Consider including planning policy and controls in the planning scheme to drive the use of a mandatory sustainability assessment tool to encourage the development of green buildings.
- Lobby the State Government to develop a mandatory sustainability assessment tool.
- Work with developers to incorporate green design and technologies in new housing estates.
- Set an example by ensuring that any works to Council buildings are as environmentally sound as possible.
- Develop incentive schemes to encourage the development of green houses and buildings.

- Develop and promote educational resources on green building design and materials:
  - Promote the use of non-toxic recycled building materials
  - Display brochures in the municipal office and community building foyers
  - Design programs to educate relevant council staff and developers on sustainable building design issues
  - Develop an information kit on sustainable building for builders, architects and designers
  - Design a model sustainable building for your local environment.

Individuals

- Use green building rating tools to assess your house plans.
- Only buy appliances with high energy efficiency or water conservation ratings, eg five star energy appliances.
- Choose Green Power – for more information *www.seav.vic.gov.au.*
- Install your own water tank and/or grey water system – for more information *www.greenplumbers.com.au.*
- Install and/or build with renewable energy sources such as solar – for more information *www.seav.vic.gov.au.*
- Replace your hot water system with a solar hot water unit or a five star gas unit.
- Choose products and building materials that have no or low toxicity, low environmental impact and/or are recycled.
- Learn about green building design and building biology. In Melbourne, course options include:
  - a two day course in 'Green Building and Works in Local Government' at RMIT. For more information *www.cfd.rmit.edu/building/greenworks.html*
  - a one year full-time Diploma in Building Biology at The Australian College of Environmental Studies offered for the first time in 2004. For more information *www.buildingbiology.com.au.*

Further information:

- Your home: design for life style and the future. A consumer guide and technical fact sheets developed by the Australian Greenhouse Office which show how to design and build a more comfortable home that has less impact on the environment. A home that will also be more economical to run and healthier to live in. *www.greenhouse.gov.au/your home/*
- Recycled materials: *http://ecospecifier.rmit.edu.au/flash*
  www.3rcentre.com
- Sustainable Energy Authority of Victoria *www.seav.vic.gov.au*
- Visit The Centre for Education and Research in Environmental Strategies (CERES) in Brunswick East *www.ceres.org.au*

CASE STUDY

Reservoir Civic Centre

The Reservoir Civic Centre has been redeveloped as a model environmental building by Darebin City Council. The design, construction and operation of the building are based on triple bottom line principles of building social capital; environmental sustainability and financial responsibility.

Good passive solar and ventilation design minimise heating, cooling and mechanical ventilation requirements of the building. Energy efficiency is achieved through sensor operated, energy efficient lighting, energy-efficient gas space heating, evaporative cooling, solar hot water and energy efficient appliances. Energy savings of 60-65% over a comparable building are expected. The northern façade and the roof of the building are clad in solar panels which will generate 40kWh of electricity per day or about 25% of the buildings energy requirements – additional electricity will be sourced from Green Power. Around 220 tonnes/year of greenhouse emissions are expected to be saved in comparison to a similar building.

Rainwater tanks will collect rain water for toilet flushing. Water efficient appliances including waterless urinals will minimise water consumption. Storm water will drain onto landscaped areas which will be planted with low-water resistant trees and plants. Expected water savings are 1, 300 kilo litres or 24 average swimming pools a year.

Waste minimisation has also been a key priority of the project with reuse and recycling of materials from the previous building a high priority; 200 tonnes of waste to landfill has been diverted. Recycled, environmentally preferable and low embodied energy materials have been incorporated wherever possible. Avoidance of materials which give off toxic fumes and hazardous chemicals will result in a healthier and more comfortable indoor environment.

The Reservoir Civic Centre will provide onsite education for visitors. An online information kiosk will provide building performance data. Brochures will provide residents with tips for incorporating environmental measures at home.

The sustainable features of the Reservoir Civic Centre build on the achievements of Moreland City Council in the refurbishment of their municipal offices in Coburg. It is anticipated that other Councils will further progress knowledge and implementation of green buildings.

For more information *www.darebin.vic.gov.au/rcc/*