MODERN GREEN HOMES

Sanctuary

INSIDE ISSUE 13 *120+ green building & renovating solutions; ask our experts; green design books reviewed; life cycle assessment; 51 pages of inspirational & sustainable homes*

Summer Eco Style
How to Build & Renovate Green

GREEN DESIGN EXPLAINED

Eaves – stop heat before it gets in

Natural ventilation

Thermal mass

WIN

An Edwards solar hot water system

IN FOCUS

Create your own raingarden

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BEST OF GREEN
BEST OF GREEN AWARD WINNER 2010
treehugger

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Letter from the Editor

Verity Campbell

Each issue in *Sanctuary* we try to assist you in your journey to build green. Like an increasing number of Australians, you've chosen not to wait for policy or regulatory action, you're just going ahead and doing it.

Sanctuary profiles environmental houses, focussing on design ideas and technology. With our house profiles you can see how others have approached their green renovation and building projects, to help you plan yours. Our features can help answer your questions such as: how should I overcome a small site with limited solar access? What solar hot water unit should I install? Should I choose timber or a concrete slab in the kitchen?

Essentially, we aim to make renovating and building green easier, more fun and more rewarding.

And so, in this bumper summer issue we have introduced a new back-to-basics series, a kind of *Sustainable Design for Dummies*. If you're starting from scratch, or even if you want to brush up on your knowledge, these reference articles are a good starting point. We've asked leading green architects and designers to write them, so you know they'll repay your attention. Don't do another thing with your renovation or new build until you've read our articles on thermal mass (p88) and eaves (p84). Even if you think you know all there is to know, you may be surprised to learn conventional thinking about fixed eaves is increasingly being called into question. Over the coming months, you'll probably be thinking a good deal about ventilation and cooling (p82), and this is another set of design principles it's vital to get right from the get-go.

Feedback we got from our readers' survey earlier this year was that you wanted more "warts and all" information. You wanted to know what didn't work about a renovation or new build, as much as what did. This issue we introduce the "*Sanctuary* retrospective" series. It's an opportunity to revisit a home we profiled some years ago to gather the learnings. What worked and what didn't? What do the homeowners wish they'd never done? This issue we revisit WestWyck (p67), that trailblazing eco development in West Brunswick, Melbourne. There are some great learnings to be had about blackwater systems and eco developments in general.

Being a summer issue, the products section focusses on things you might want to retrofit as the thermometer rises: shading, greywater systems and water tanks. See p90 for a range of solutions to help keep your "coolth".

And last but certainly not least are our house profiles. We have a fantastic range this issue, from the budget retro renovation in inner Melbourne (p30), to a simply gorgeous beach home in Seal Rocks, NSW (p10). Eco development and urban infill projects feature prominently. There's the three-home eco development in Tasmania (p50), designed without any fencing and with each home having a floor plan of less than 80 square metres. In inner-suburban Brisbane we profile a new home sharing a block with an old Queenslander (p58). And getting the gong for the most comprehensive employment of green technology and design, see the Melbourne home profiled on p20.

Enjoy *Sanctuary* 13 – and keep cool this summer.

Verity Campbell, Editor
sanctuary@ata.org.au

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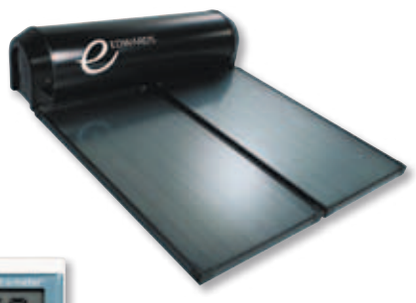

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SUN DRENCHED

Summer holidays along this stretch of the NSW coast are taken in uncomplicated sustainable style – is there any better way?

WORDS GINA MORRIS **PHOTOGRAPHY** SIMON WHITBREAD

ARCHITECTURAL DESIGN CAN BE INSPIRED BY weird and wonderful things. For Rachael Bourne and Shane Blue, the configuration of their "square doughnut" contemporary beach house (at Seal Rocks, just under four hours north of Sydney) was devised specifically for their children, to keep the goblins out. "We came here often when the kids were younger," Rachael explains, "and they used to imagine there were goblins hiding in the bushes. So when it came to designing our own holiday home we sought to address this issue. They wanted a sense of security, to know they were safe and that nothing could come in."

With no dramatic ocean views to consider and a reasonably busy road to shield from, Rachael and Shane drew up plans for an enclosed outdoor space. Loosely based on the idea of a Moorish courtyard house, the modest exterior borders an alfresco core that allows for an abundance of light and air by day and frames the starry sky by night.

The key to the home's success, both as a weekender and as a holiday rental, lies in its simplicity and functionality. Not having "a heap of money" to spend on the build inspired more creative ideas and practical solutions, from minor touches to major layout.

As a way to increase the floor space and living capabilities economically, 95 square metres of the 225 square metre structure is decking. To utilise the deck area fully and create seamless indoor-outdoor living, roller shutters were installed to most of the inner walls (only the living room has sliding doors). Acting as a fourth wall, they cost less than half the glass alternative and open up one hundred percent of the area. With all beds armed with mosquito nets, leaving the shutters up to sleep under the stars is positively encouraged. "It's like camping in luxury," says Shane.

The outdoorsy feel is taken further by the lack of a direct water supply and town sewage system. Instead, all waste is treated on-site and all water is collected and stored in four huge tanks for drinking, washing and potentially fire fighting purposes. The house also produces electricity via a 1.5kW grid connected solar system.

In keeping with the context of the tiny seaside hamlet, "city" materials (like glass splash-backs and polished stone) were consciously avoided. Instead, locally milled blackbutt decking and custom orb roofing were used, as well as economical, hard-wearing and corrosion resistant materials such as cement sheeting.

"You wouldn't mistake it for a city house," says Shane. "It's just a simple, low maintenance house that suits the setting and encourages leisure."

Partners in life and business, Rachael and Shane had completed other projects in Seal Rocks, dating back to the late 1990s. They finally began building on their own block eight years after they initially bought it "sight-unseen" from a classified ad. Having worked extensively in the area they were very familiar with the lay of the land and well-informed about any potential complications, be it authority regulations, soil conditions or weather issues. As a result, few mistakes were made and the house was built, on budget, for $370,000. Having benefitted from experience, knowledge and plenty of thinking time, they admit there is little they would change if they did it over again.

"If we'd had a bit more money to lavish on it," muses Shane, "we would have thought about putting in a slab floor, to moderate the temperature ranges, and installed a simple exhaust fan to duct the warm air from the fire and funnel it into the bedroom. We can still do that at a later date though."

The brief was all about getting back to basics but, as Shane insists, "it still has to work well."

"It's not difficult to do," he says. "It's not rocket science, it's about thinking through the processes. It's about considering what you really need, and discarding the rest."

The wall material is compressed fibre cement sheet which is durable, needs no top coat and requires little maintenance. The sheets are fixed with stainless steel screws. The dimensions of the cement sheets were instrumental to the design of the house, which was worked out dimensionally from the width of a sheet — 900mm plus a 10mm gap — reducing costs and product wastage.

Roller doors were chosen instead of glazing for many openings onto the courtyard. According to Shane, "We had a tight budget, and while a 4.2 metre wide glazed door suite is $2500, a roller door would only be about $1100 for the same size, with the added advantage of enabling a 100% openable area to the courtyard." The benchtop is Laminex Pillarbox, while the carcass of the kitchen cupboards is E0 MDF. Zincalume sheet was used as a splashback as it's "cheap, easy to clean, and has the unrefined feel we were after". It's also recyclable.

The central courtyard is lit by CFL floodlights. Locally milled blackbutt is used for decking, entry, seating and privacy screening throughout the house.

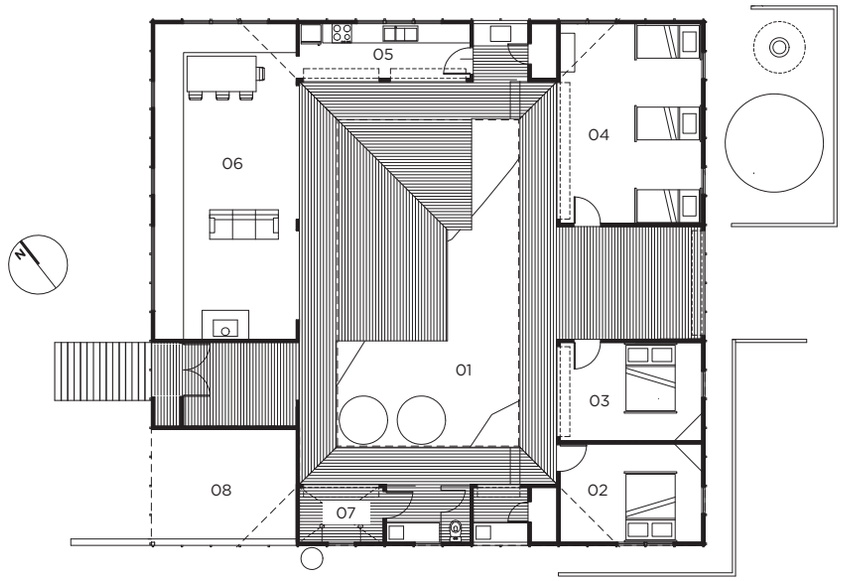
The living and dining room, painted in Murobond Ripple (green) and Espresso (brown), is lined by a custom-built long day bed. The day bed is topped with seven single futons with recoverable tops so they can be easily washed, and has built-in storage cupboards. The glass doors are fitted with sliding, stacking flyscreens so they can remain open for effective cross ventilation.

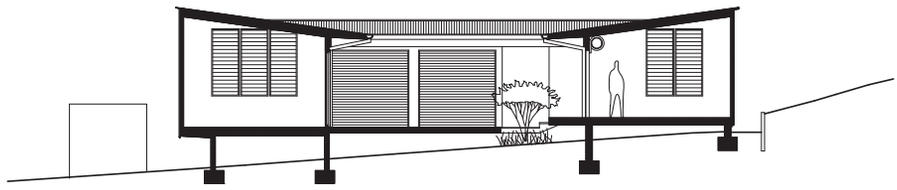
Shelves are made from cement sheet with blackbutt supports. The owners opted for zincalume sheeting behind the showers instead of tiling. The sheets just need a wipe down from time to time, and could last ten to 15 years before needing replacement. The replacement process would also be significantly easier and quicker than that for tiles.

"It's not rocket science, it's about thinking through the processes. It's about considering what you really need, and discarding the rest."

FLOOR PLAN

01 Central Courtyard
02 Bedroom 1
03 Bedroom 2
04 Bedroom 3
05 Kitchen
06 Living/Dining Room
07 Bathroom
08 Car Port





The owners bucked trends and opted for a one bathroom house. The water from the shower runs through the timber slats and into a waterproof tray, which then drains to the worm farm waste system. Twelve metres of copper piping was installed for hanging towels, instead of 12 separate towel racks. Copper piping is easily recycled, and is in high demand at recycling centres.

Seal Rocks Residence

Designer
Bourne Blue Architecture
—
Website
www.bourneblue.com.au
—
Builder
Sugar Creek Building
(Bruce Brown)
—
Project type
New building
—
Project location
Seal Rocks, NSW
—
Cost
$370,000
—
Size
house 130 sqm; deck 95 sqm;
land 800 sqm

SUSTAINABLE FEATURES

Hot water
Quantum Compact 340L heat pump. Heat pumps are a good choice where solar access is limited. They work better when the temperature differential is smaller, so warmer climates make them more efficient; so does mounting them in the sun!
www.quantumenergy.com.au

Renewable energy
Nuenergy 1.5kW grid connected solar system
www.nuenergy.com.au

Water saving
- Three 9000L Maitland Sheet Metal tanks for domestic use, with an additional 15000L for fire fighting
- Pacific Tapware Ecotap range including the WELS 6 star Parade Twin Mixers ($180) which use 3.8L of water per minute. This range was sourced from savewater! (**www.savewater.com.au**) which lists a range of water saving products, including tapware **www.pacifictaps.com.au**
- Doulton Superblock Twin under sink water filter system from Advanced Water Filtration for $664, including installation **www.advancedwaterfiltration.com.au**

Passive heating & cooling
Walls insulated with R1.5 batts and anti-glare Air-Cell Glareshield (R0.14) **www.air-cell.com.au**

Active heating & cooling
- Bedroom wall fans from Beacon Lighting **www.beaconlighting.com.au**
- Nectre MKII heater with a 15mm compressed cement sheet hearth **www.nectre.com**

Windows & glazing
- GJames 050 series aluminium frames (**www.gjames.com.au**) fitted with Breezeway Altair louvres (**www.breezway.com.au**)
- GJames 245 series sliding stacking glass doors, with stacking flyscreens. The doors have been finished with a thicker-than-standard 25 micron clear anodised finish for longevity

Building materials
- Lysaght Custom Orb roofing **www.lysaght.com**
- Walls lined with 9mm compressed cement sheet cladding and aluminium channels

Paints, finishes & floor coverings
Internal and external no to low VOC paints by Murobond **www.murobond.com.au**

Seal Rocks Residence

SUSTAINABLE PRODUCTS

HOT WATER DIVERTERS

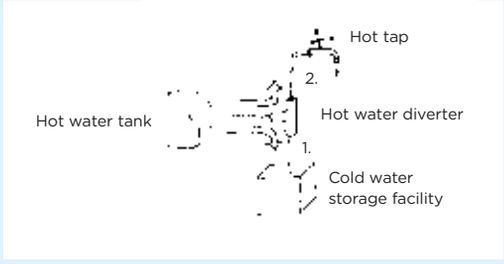
A US-based Chili Pepper water diverter has been used under the kitchen sink in this house.

Hot water diverters divert cold water sitting in the hot water line back into the cold line, hot water holding tank or a nominated outlet such as a water tank or water feature. They can save thousands of litres of water per year.

There are a number of water diverters on the market. Some systems are connected to electric pumps which remain on continuously. These tend to be used in commercial applications such as hotels and are energy hungry. Others are on demand – the pump turns on and off as needed or after activation by the user. The most common system in Australia is based on purely mechanical technology, meaning they require no electricity for operation and instead use thermal switching valves. How do they work? In a nutshell, when the hot water tap is turned on the closed valve pushes the cooled water out through the outlet pipe to the nominated storage facility; as the hot water comes through the pipe the valve simultaneously closes the cold outlet and opens the hot outlet allowing the hot water to flow through the line to the tap. Systems on the Australian market include:

- Redwater Diverter **www.redwater.net.au**
- Enviro Save Water System **www.enviro.net.au**
- Ecoverta **www.advecotech.com.au**

These systems cost between $170 and $300, excluding installation. When you're choosing a system, speak to the manufacturer about warranties and maintenance.



1. Cold water sitting in the pipe flows into storage facility
2. Once hot water arrives, the diverter sends it through to the hot tap

WORM FARM WASTE SYSTEM

A&A Worm Farm Waste Systems treat sewage, all kitchen compost and greywater without the use of chemicals. Septic systems can also be retrofitted with this system. The A&A system cost around $12,000 for this house, fully installed. The architects have installed a number of these systems on different projects and have been very happy with how they perform. "While there is more up-front cost than a septic system, for example, the system is a better result for the environment: it treats all kitchen waste and it is great 'karma' having all sewer and kitchen organic waste treated on-site! Also, the common system in Seal Rocks is pump-out septics, which means a truck comes every fortnight in peak times to pump it out (with cost and environmental implications). By using the worm farm, this is completely avoided, and it may work out cheaper in the long run."

For more discussion of the merits of the A&A system over septic or other blackwater treatment systems, see the ATA's forum at: **www.ata.org.au/forums/topic/sewage-treatment-technology-vs-worms** and **www.ata.org.au/forums/topic/wastewater-treatment-black-and-grey-and-greasetraps**
www.wormfarm.com.au

The block runs east-west with the northern side of the house up tight against the boundary. The design response brings light into the house, and includes a rooftop terrace and sun-drenched deck – without encroaching on the garden. Paddy's Bricks (www.paddysbricks.com.au) were used for garden paving, while reclaimed Red Iron Bark used for the deck is from Urban Salvage (www.urbansalvage.com.au).

NEW LEASE ON LIGHT

Clever design brings light and warmth into a quaint inner Melbourne home.

WORDS FIONA NEGRIN
PHOTOGRAPHY RHIANNON SLATTER

FOR ALL ITS PERIOD CHARM, THE QUEEN ANNE house that Danielle and Nathan bought was dim, dark, and rated just one star for energy efficiency. On a typically tight inner-Melbourne block with close neighbours, their challenge was to increase solar gain and internal space without encroaching on the garden.

"The first thing that struck us when we saw the site was the limited solar access to the house," agree Jeremy and Chi of design and build company Positive Footprints. "The home is very close to the boundary and the neighbour's building," says Chi. "This made it very hard for sun to penetrate to the ground floor." Faced with this obstacle, their solution was a creative one: to reinterpret the existing roof angle to let in northern light.

The new roof pitch of the extension at the back of the house mimics that of the 1892 original but is inverted. A tall northern wall with high windows catches sunlight over the neighbour's roofline. The light falls directly onto thermal mass in the new kitchen and living area (an original double brick wall and new polished concrete floor) to maintain stable internal temperatures. In summer, external blinds can be lowered to keep the room cool, and ambient heat is flushed out through windows and doors later in the day. Jeremy describes this as "an effective response to the limitations of solar access at ground level. When we design, we try to imagine it from the sun's position, trying to get sunlight deep into the house."

The second major challenge – of creating more space without reducing the size of the garden – was overcome by building into vacant areas beneath the roof and under the stairs. "It was a challenge fitting the downstairs bathroom under the stairs, because the height of the stairs encroaches into the headspace. The upstairs bathroom was also a challenge because it's built within the existing roof pitch. We had to do a lot of tweaking!" says Chi. The successful outcome is evidence of how well designed small spaces can work wonders: in the downstairs bathroom, the shower is hidden behind the door, while the washing machine is tucked away under the low ceiling below the stairwell.

Because the original, front part of the house is 118 years old with double-brick walls and high ceilings, it's usually cool. To control and distribute heat flow between the new and old sections of the house, a glazed dividing door and heat shifters were installed. The heat shifters, for use in cooler weather, are a system of ducts and vents within the walls and ceilings that suck warm air from upstairs down into the front rooms. They can be regulated by individual controls. "It's like opening a window and getting a warm breeze coming through," says Danielle. Alternatively, on warm days, the couple can close the dividing door and retreat to the cool of the old part of the house.

The house is predicted to use one third of the average amount of water, thanks to measures including 100% roof area collection of rainwater and a 9000 litre tank; gravity-fed greywater diversion from the bathroom and laundry to the garden; efficient tapware, toilets and shower roses; and thermal transfer valves (which divert 'cold' hot water back to the water tank so it's not wasted). The house also has a 1.5kW photovoltaic array, and an evacuated tube solar hot water system which provides about 75% of the couple's annual hot water needs.

Preferring sustainable products and resource efficiency at every stage of construction makes this house a model of energy and materials conservation from the ground up – literally. The concrete slab in the living area replaces 60% of its cement content with waste products in a combination that broke new ground for the concrete and polishing companies involved. Timber for the entire house, from the frame to the floors, stairs, shelves and cabinets, is recycled or harvested from sustainable sources. Even the pipe bedding material for the greywater system is made from recycled plastic.

Jeremy explains, "The idea going from the foundations up is that we've looked for environmental alternatives where they're existing and economically feasible. It makes a difference not only to saving precious energy and natural resources, but indoor air quality and health outcomes." To that end, all paints and adhesives are low VOC; architraves, door jambs and skirtings are E0 MDF; and there are no dust-attracting surfaces like carpets.

The heart and soul of the home is the kitchen, and this new one celebrates Danielle's feel for texture and colour. The cupboards and cabinets are crafted from reclaimed, Melbourne-sourced timbers. At the centre of the kitchen stands a magnificent apothecary's cabinet whose karri and redwood frame is embellished with pressed metal to match the kitchen walls. True to its origins as a dispensary, it stores herbs, glasses and necessary items, and like the house itself, has found a new life and purpose.

The high wall lined with windows and inverted roof line along the boundary bring northern light onto the concrete slab. The kitchen cupboards are made from a poplar tree that blew down in a storm in 2005 in the Royal Botanic Gardens in Melbourne. The benchtop is Red Iron Bark originally used in the 1840s in the Botany Bay Wool Stores in Sydney. The old kauri pine floorboards at Albert Park Railway Station have been reborn as overhead kitchen cabinets. Cupboard carcasses are made from EO MDF and EO particle board. The spashbacks are pressed metal. Cabinets by Wally Johnson Antiques (03) 9376 9341.

The original home as seen from the street. The new addition is not visible. Photo by Positive Footprints

Insulation was installed in the ceiling in the original part of the home and all drafts were sealed. The heat shifting system feeds warm air from the new addition through the ceiling into this room in the cooler months.

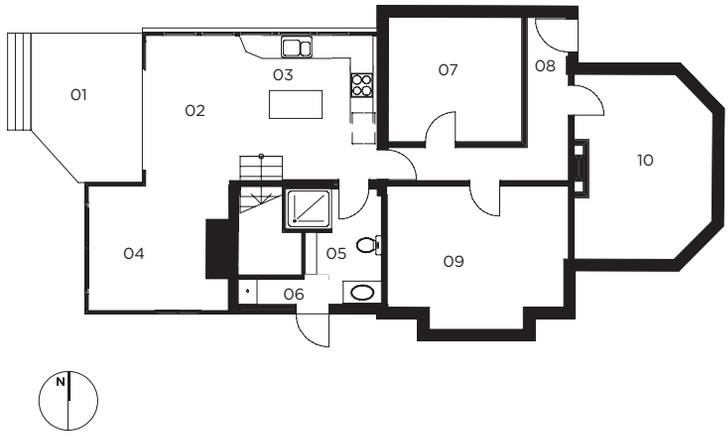
Preferring sustainable products and resource efficiency at every stage of construction makes this house a model of energy and materials conservation

From the roof terrace, views over the backyard illustrate some of the more obvious elements of the green renovation: the tank and photovoltaics. The rear fencing is Outdoor Timber Tanalised-E H3 pine treated with an arsenic-free preservative (www.OutdoorTimber.com.au). The posts for the fence are reclaimed cypress from Golden Cypress Rescued Timbers (www.goldencypress.com.au).

Staying true to a philosophy of embracing the existing, the designers made a feature of the original external brick wall of the house, repainting the detail and incorporating it into the design of the living room. It also acts as thermal mass when low winter sun passes through the clerestory windows set high in the ceiling.

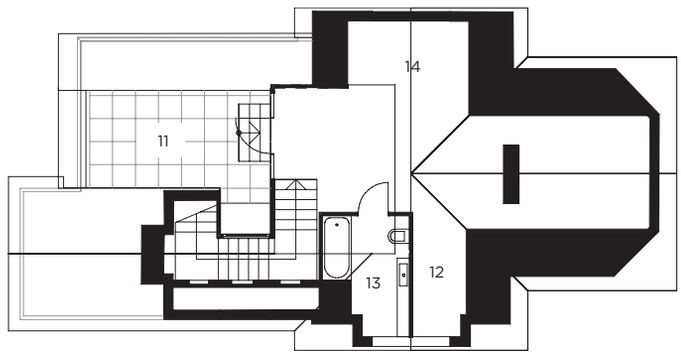
GROUND FLOOR PLAN

01 Deck
02 Dining
03 Kitchen
04 Living Room
05 Bathroom
06 Laundry
07 Bedroom 1
08 Entrance
09 Bedroom 2
10 Lounge



FIRST FLOOR PLAN

11 Upper Deck
12 Study “nook”
13 Bathroom
14 Bedroom 3



The upstairs addition includes spare bedroom, study “nook” and second bathroom. Nullarbor Timber recycled spotted gum floors were chosen and finished in Livos low VOC oil. The grilles for the heat exchange system are visible to the right of the original chimney (retained as a feature of the room).

Tiles are from Erneste Tile Concepts, while the shelves are recycled Tallowood from the seats of a demolished Melbourne Cricket Ground stand.

Thornbury Residence

Designer & Builder
Positive Footprints
—
Website
www.positivefootprints.com.au
—
Project type
Renovation
—
Project location
Thornbury, VIC
—
Cost
$289,000
—
Size
house 160 sqm; land 330 sqm

The Tadpole downpipe filter is fixed at shoulder height and is easily removed for cleaning. Photo by Verity Campbell

SUSTAINABLE FEATURES

Hot water
Apricus evacuated tube solar hot water system with 315L stainless steel tank and Bosch 21E instantaneous gas booster **www.apricus.com.au** **www.bosch.com.au**

Renewable energy
1.5kW eko-Kinetics grid connected crystalline solar panel array **www.eco-kinetics.com**

Water saving
- 9000L Teampoly rainwater tank plumbed to laundry and toilets and available for garden watering **www.teampoly.com.au**
- Pentair Onga Waterswitch, coupled with pump and float switch for automatic mains diversion if required **www.ongawaterswitch.com.au**
- Enviro Save Water System diverts cold water in the hot water pipes back to the water tank **www.enviro.net.au**
- Methven Genesis Satinjet 7.5L showerhead with twin jet "big drop" technology to both showers **www.methven.com**
- Caroma Smartflush 4 star (3/4.5L) suites in both bathrooms **www.mycaroma.com.au**
- Silvan H20 Tadpole Primary Filter to each downpipe ($49) **www.silvanh20.com.au**
- Silvan H20 Wet Frog secondary filter to tank ($87) **www.silvanh20.com.au**

Passive heating & cooling
- Reflex electric external venetians to kitchen north facing windows. These cost around $6000 for around 14sqm of venetians **www.reflexshade.com.au**
- CSR Bradford Anticon R1.5 foil backed blanket with up to 80% recycled glass wool to roof **www.bradfordinsulation.com.au**
- R3.5 Tontine 85% recycled (from PET bottles) polyester batts between roof rafters
- CSR Bradford SoundScreen R2.5 batts plus EnviroSeal reflective foil to walls

Active heating & cooling
- Martec Precision marine grade stainless steel reversible ceiling fans. This fan has the optional light fitting with CFL globes installed and runs (forward) at 9.9W and 68RPM **www.martecceilingfans.com.au**
- Radiant gas boosted hydronic heating (retained and expanded from original house)

Windows & glazing
- Mouldright Joinery recycled karri bifold doors and plantation hoop pine windows each with 14mm spaced argon filled double glazing and low-e coating. Windows include a pull-down flyscreen **www.mouldright.com.au**

Lighting
- Kitchen, upstairs bathroom spotlights and downlights in nooks are LEDs from The Environment Shop **www.enviroshop.com.au**
- Barc wall lighting in study and bathroom are from Axiom lighting **www.axiomlighting.com**

Building materials
- Alex Fraser Group recycled Ecobase is used to all greywater and stormwater subsurface piping and under paving. This product is made from recycled concrete and brick and can also include reclaimed asphalt pavement. Although Alex Fraser Group mainly supplies to commercial projects they will supply to residential projects; ring and enquire about delivery costs **www.alexfraser.com.au**
- Boral Envirocrete concrete slab with 60% cement replacement with slag and flyash **www.boral.com.au**
- Polish of the concrete slab by Pro Grind **www.progrind.com.au**
- Smorgon ARC 100% recycled steel mesh to concrete slab **www.arcreo.com.au**
- Boral Enviro Plasterboard with up to 10% recycled content and GECA accreditation **www.boral.com.au**
- Key Plastics recycled PVC slotted pipe
- Bostik Roof & Gutter low VOC Silicone Sealant
- Carter Holt Harvey Ultraprime low VOC pre-primed E0 MDF was used for skirtings and architraves throughout the home

Paints, finishes & floor coverings

- Livos low VOC finish on internal floors **www.livos.com.au**
- Rockcote EcoStyle internal ultra low VOC paints with GECA accreditation **www.rockcote.com.au**
- Intergrain UltraDeck low VOC finish on timber doors **www.intergrain.com.au**
- Wattyl Solagard high durability paint with 15 year between recoat warranty on Scyon Linea cladding. Light colour to maximise life **www.wattyl.com.au**

SUSTAINABLE PRODUCTS

HEAT TRANSFER SYSTEM

This house has an IXL EasyDuct Thermal Transfer System installed. This is a heat shifting system, using 40W to shift heat from the new upper rooms back into the cooler rooms in the original part of the house. A thermostat is installed in the kitchen/living rooms; when the kitchen/living room reaches a certain temperature the occupants can turn on the heat shifter. The heat in the upstairs room is then pumped through insulated flexible duct and released from a ceiling mounted interior grille. This simple system cost around $200, excluding installation.
www.ixlappliances.com.au

"WATER BRAKE" LEVER TAPS

Hansa Vantis Green six star taps with integrated two stage "water brake" installed in all basins. The "water brake" gives a subtle reminder to users (especially children) not to turn the tap on full if high flow is not needed. It works by use of Hansa's ECO 3.5 Control Cartridge – when you lift the lever up a reduced flow is supplied; you need to lift further, through the friction point, to achieve full flow. $285 per mixer
www.hansaaust.com.au

GREYWATER SYSTEM

Two Nylex Greywater Diverta systems are installed in the house, one for each bathroom. This is a simple gravity diversion system, in which greywater from the bathrooms runs to the units and is then diverted, by gravity, to subsurface irrigation around the garden. With this system no water is held in the unit or pipes, eliminating the possibility of water going septic, and relieving the need for pumping and electrical maintenance. The only downsides of this system are that you have to have external pipes to attach the diverter to and the filters are pretty basic and require regular rinsing. According to the Alternative Technology Association's water projects manager, Anjali Brown:

"Low cost greywater diverter systems are a straightforward way to reuse your bathroom water. To be most effective, ensure that the water is being dispersed widely and is being absorbed subsurface by plants that can handle the constant quantity of water. Systems like the Nylex allow you to divert the water to the sewer, which would be recommended during winter rainy periods so you do not overwater your garden. The filters in simple diversion systems also need to be regularly cleaned out and users should be careful not to send any harsh chemicals or products high in sodium down their bathroom drains. These diverter systems give householders flexibility in the way they use their greywater and are straightforward to use - they're a good place to start for 'greywater novices'."

Each Nylex Greywater Diverta unit costs around $199, excluding subsurface irrigation
www.nylex.com.au

This wall mounted interior grille is installed in the upper rooms. When turned on it transfers heat through ducts to the cooler rooms of the home. Photo by Verity Campbell

Shown here are both Nylex Greywater Diverta units for the home. Photo by Verity Campbell

BACK TO BASICS

A routine restumping transforms an old weatherboard in inner-suburban Melbourne into a charming home.

WORDS VERITY CAMPBELL
PHOTOGRAPHY RHIANNON SLATTER

The light fitting in the kitchen uses CFL bulbs. Lucy chose black cabinets for longevity and to match her eclectic furnishings. Rather than installing overhead cupboards she bought a second-hand hanging shelf unit which she turned into kitchen shelves to hold tea, coffee, oil, jars and spices.

TRANSFORMING A RAMSHACKLE HOME INTO A DELIGHTFUL, inviting haven on a budget of under $50,000 takes talent, but that is exactly what Lucy and Darren have in spades. Lucy's flair as a ceramics designer and illustrator obviously inspires the aesthetic of the home, but both members of the partnership worked hard at the renovation. Darren took time out from his Masters in Renewable Energy to turn his hand to carpentry, painting and more – much more than they initially expected!

Lucy and Darren bought their home four years ago knowing that it needed some surgery. The front corner of the timber house leaned right down to the ground, and obviously needed restumping, but the rest of the house seemed fairly solid.

The couple had lived in the house for a year before getting started on the restumping. Then, a few days after the stumpers started, Lucy received a phone call at work: "We think you should come and look at this". When she returned home she was told that the straightforward restumping needed on the front corner should involve extensive work on the whole house. The stumpers also suggested the lean-to kitchen at the back be demolished, being an add-on structure clumsily connected to the home's original foundations. Signing off on the extra restumping was a must, but Lucy and Darren decided to keep the lean-to.

When the restumping was finished the couple were left with a house needing replastering, rewiring, replacement of the original floorboards damaged during the restumping process, and repainting. Their simple restumping had turned into an epic undertaking which would have them renovating on the weekends over a year-long period.

Only two rooms remained untouched throughout the renovations – the bathroom and bedroom – but the couple decided to stay living in the house, tiptoeing along the floor joists and rugging up against the winter cold in the unplastered rooms. Most of their furniture was in storage for the entire year.

The silver lining with the restumping disaster was that it allowed them to comprehensively insulate. With the original plaster taken off the walls they could place thick batts within the wall framing. They also put in roof insulation. They chose a thicker-than-normal plasterboard for the underlining of the external timber cladding, which provides an added insulative layer. With the home stripped back to bare bones they could seal gaps, replace old timber veneer cladding and give the house a general health check.

"Anyone with a hot water system who wants to upgrade to solar should plan ahead and upgrade before their system breaks. Once it breaks your options are limited!"

"Lots of the floorboards were sadly ruined with the stumping, with boards split lengthways as well as being crudely cut to access the stumps. We had no idea what to do about the floor," says Lucy. "It would have been good to have had the experience or knowledge to explore other ways of keeping the original boards, and perhaps replacing the ruined boards with recycled boards. The research we did however seemed to suggest that second-hand karri pine boards are hard to find because they split the length of the boards when being removed, and any good condition ones are therefore expensive – but it probably would have been worth it to keep the original floor." Instead they opted for bamboo flooring laid over the original boards. "As much as we love the bamboo flooring and are really glad we opted for a more sustainable floor rather than new timber boards or laminate flooring, the original karri pine boards were lovely and it would have been nice to have kept these and not put a new floor in at all."

They replaced the chipboard doors throughout the house with second-hand hardwood doors, and they were able to reuse the door handles on the new doors. Bricks dug up in the front yard were reused to extend the rear courtyard. More bricks were found when they uncovered the original fireplace, as well as a lovely mantelpiece which they reused over the kitchen fireplace.

At a critical point in the renovation, Lucy and Darren's existing gas hot water system packed up. They had no kitchen, no oven (they were cooking on a single burner camping stove), and then no hot water in the middle of winter. They wanted to install a solar hot water system through their local council solar bulk buy scheme, but the earliest they could get even a quote involved at least a four week waiting period. "It sadly meant we couldn't get a solar system which was very disappointing," says Lucy. "Anyone with a hot water system who wants to upgrade to solar should plan ahead and upgrade before their system breaks. Once it breaks your options are limited!"

The transformation of the house as an exercise in making the most of what you've got carried through to the home's extensive furnishing with retro and vintage finds. According to Lucy, "the majority of the furniture in the house is re-used and recycled from local charity shops, tip shops and markets. I think this is one of the easiest ways to recycle – and often the older pieces of furniture are far nicer, better built and more robust than newer pieces." Her homewares are an eclectic mix of beautifully coloured and patterned found treasures, providing inspiration for her artwork and keeping her home a model of modest sustainable living.

Lucy and Darren bought the shelving unit from Lair in Lygon St, East Brunswick, for $600. Here it works as a display cabinet for Lucy's treasures and as an informal room partition.

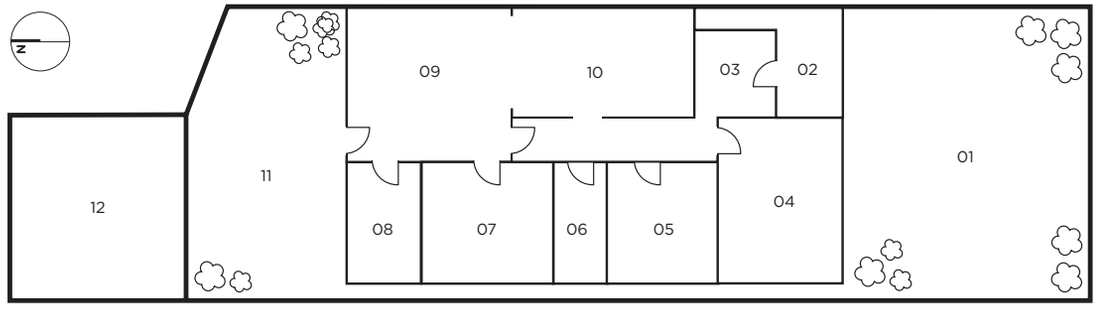
Bricks dug up from the garden were reused to extend the rear courtyard and to create a neat path to the front door. Repaired and repainted weatherboards now shelter 2.5R wall insulation, improving the acoustic and thermal performance of the house.

Lucy and Darren refurbished an existing mantelpiece. They installed it over a stove they bought on a weekend visit to Bright — a lady was selling it outside her house for $80.

Lucy's eclectic collection of found crockery inspires her art and adds colour to the home.

GROUND FLOOR PLAN

01 Garden
02 Porch
03 Hallway
04 Studio/Bedroom
05 Bedroom 1
06 Bathroom
07 Bedroom 2
08 Laundry
09 Kitchen/Dining Room
10 Living Room
11 Courtyard
12 Carport



Coburg Residence

Builder
Owner Builder
—
Project type
Renovation
—
Project location
Coburg, Melbourne, VIC
—
Cost
$43,000
—
Size
house 120 sqm; land 278 sqm

SUSTAINABLE FEATURES

Passive heating & cooling
- Blockout interior blinds and curtains on the bedroom windows
- Exterior bamboo blinds cover windows and help to block out the sun on hot days

Windows & glazing
Dowell triple glazed window in studio room for both warmth and noise reduction. $1,975 installed
www.dowell.com.au

Building materials
- 3.5R Insulco insulation batts in the roof
- 2.5R Insulco acoustic and thermal batts in external walls
- Boral 10mm plasterboard on internal walls and 13mm on external walls

SUSTAINABLE PRODUCTS

BAMBOO FLOORING

Bamboo flooring was installed throughout the house over existing floorboards, which had the benefit of adding an insulative layer to the floors. Bamboo is a good choice environmentally because it's a renewable, fast growing resource. It's also hardwearing, attractive and comes in a range of widths and finishes. When you're shopping around bear in mind that with bamboo, like most things, you get what you pay for. The most robust bamboo flooring systems on the market are planks of solid bamboo, rather than veneer. These planks can be sanded back several times just like regular hardwood, which means you can get years of life from them, and you don't need to restain after each sanding. Look for an E0 rating for emissions, formaldehyde-free adhesives and finishes, and a supplier offering a long warranty, which shows they have confidence in their product.

Lucy and Darren chose a solid plank floor (pictured, left) about 14mm thick from Bamboo Timber Select for $7,500 installed, or around $80 per square metre.
www.bambooandtimber.com.au

INSTANTANEOUS GAS WATER HEATING

When Lucy and Darren's hot water system broke they needed a quick fix. Although they would have liked to install a solar hot water system, with prohibitive waiting lists they instead chose an instantaneous gas hot water system. Instantaneous units are at least 30% more efficient than hot water storage units. Instantaneous units measure the incoming water temperature and burn only enough gas to heat the water to the required outlet temperature, which is set using a digital keypad. Because of this capability, these units are often used as boosters on solar hot water systems. This means that Lucy and Darren could look at adding solar to their system in the future. According to online discussions, people have installed solar hot water to existing gas systems like the one Lucy and Darren chose; do your own research before buying, however, if you plan to add solar capability later.
www.renovateforum.com/f194/can-you-add-solar-instantaneous-gas-90447/

This home is installed with a Rinnai Infinity 26 instantaneous gas hot water system.
www.rinnai.com.au

CENTRAL OR DUCTED HEATING

According to the *Your Home Technical Manual*, "Central heating usually uses more energy than space heating as more of the house tends to be heated. However, an energy efficient house with central heating may use less energy than an inefficient house with space heating." So if you're planning on installing central or ducted heating choose a high efficiency model (the more stars the better) and ensure your home is well sealed and insulated. Models that can be zoned, so that you can "turn off" rooms which don't need to be heated, are essential. Solar or gas run systems create lower greenhouse gas emissions and running costs per year. Ensure ducts are insulated.

This home has a Brivis 4 star gas central heating system installed with six ceiling outlets. It cost around $3,000 fully installed.
www.brivis.com.au

LIGHT AS A BREEZE

A new build on Queensland's southeast coast rises to the challenge of its coastal environment.

WORDS FRANCENE RIDLEY
PHOTOGRAPHY CHRISTOPHER FREDERICK JONES

IN A PERFECT WORLD, A HOUSE NEAR THE BEACH WOULD be open – doors thrown back for the sea breezes, verandas positioned to catch the sun, and in every room a view of the ocean. In reality, the Australian coastal environment is one of the harshest for houses, the corrosive mix of severe sunlight and salty air wreaking havoc on everything from the veranda decking to the grill on the barbecue. Is it possible then to build a house that not only survives this environment but also has a high level of sustainability?

A home in Hervey Bay, on Queensland's southeast coast, offers some solutions to the quandary, focusing on the long-term benefits of using material and design to suit that particular coastal site.

On first inspection, the overall structure looks simple and, curiously, rather exposed to the elements with the long, rectangular, single-level home sprouting from the ground on thin supports. But, explain architects Stephen Guthrie and Lindy Atkin of Noosa firm Bark Design Architects, it's lightweight and simple by intention.

"Lightweight materials are economical," Stephen explains. "We used plantation-grown stained plywood and raw galvanized recyclable steel, chosen specifically because they make for easy and speedy construction."

Forming the skeleton of the house is a series of ten steel portal frames. These become standard building components that minimise wastage and labour, Stephen says. "The steel portals were craned and bolted into place, and the whole structural frame took shape over a few days. The roof went on quickly and infill construction between the steel members could continue no matter what the weather."

When in place, the steel skeleton creates a physically strong structure that also has a visual presence when viewed from a distance, Stephen notes.

"The steel-framed structure was also used for its spanning and bracing capacity, enabling the northern wall to be predominantly glazed and open to the view. At every junction, the steel is juxtaposed with aluminium, glass, timber and plywood. It's a clear, honest expression of the materials."

With the materials so exposed, the matter of maintenance immediately springs to mind. Why choose steel when the salty air is so detrimental to its long-term life? Stephen subscribes to the belief that if you treat the steel right in the first instance, it will return the favour.

"A hot-dip galvanised coating system has proved to be one of the most successful steel protection systems over many years in these harsh environments," he explains. "It will minimise the need for extensive maintenance of the house over time. And with exposed structural members you can inspect to see whether there are any corrosion issues, whereas paint systems can conceal potential problems."

Besides the harmful effects of the salt, there's also the wind factor to consider in the micro-climate of this Hervey Bay site. While the northern side is open to capture those views of the ocean, it also means it's open to the gusts. This is where the architects' concept for a "calm" area comes into play. It's a walled courtyard on the south side that gives

Casement windows were chosen for the eastern rooms along the northern facade for their capabilities as “gills” which allow the building to breathe whilst being controllable during windy conditions. Edmond roof ventilating outlet grilles visible in the ceilings ventilate from the rooms directly. They can be closed in winter so that warm air doesn’t escape.

the owners a private, wind-protected outdoor living space throughout the year, providing an alternative to the northern deck.

The courtyard is accessed from the corridor that runs the length of the house. This is the "concrete spine" that helps to anchor the house to the site. So, in a cross-section, the southern side of the house is embedded in the ground while the northern side hovers lightly on the slope on those fine supports. The roof over the main part of the house is a simple skillion shape, which aids the collection of rainwater stored in the tanks. Stored rainwater is used primarily to irrigate the revegetation of Australian native species over the lower northern and western slopes of the site.

"The masonry structure of the courtyard contrasts with the lightness of the steel frames, while the plywood sheet cladding provides warmth, a natural patina and again, that feeling of lightness," Stephen says.

By dealing so neatly with the harsh realities of Australia's coastal climate, this is a house that is not only light and airy to live in but treads lightly environmentally, too.

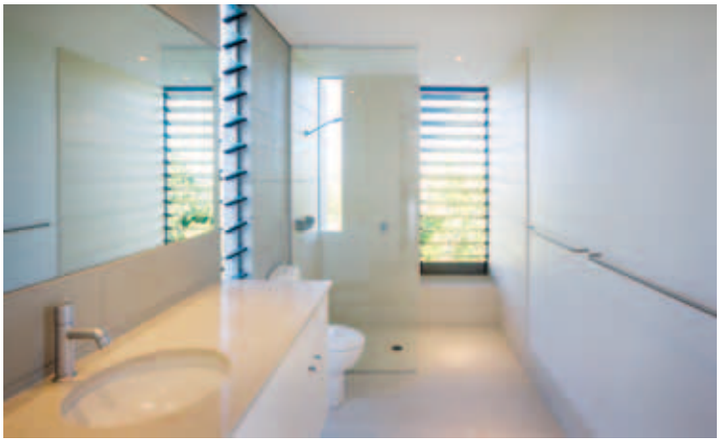
"A hot-dip galvanised coating system has proved to be a successful steel protection system over many years in these harsh environments."

The western facade is protected from the harsh western sun by large eaves over the structure and eaves protecting the thin horizontal window. The aluminium louvred window can be closed against the sun.

"With exposed structural members you can inspect to see whether there are any corrosion issues, whereas paint systems can conceal potential problems."

The spotted gum slatted sky screen jutting northwards from the central axis provides modulated sunlight and shadow patterns to the deck.

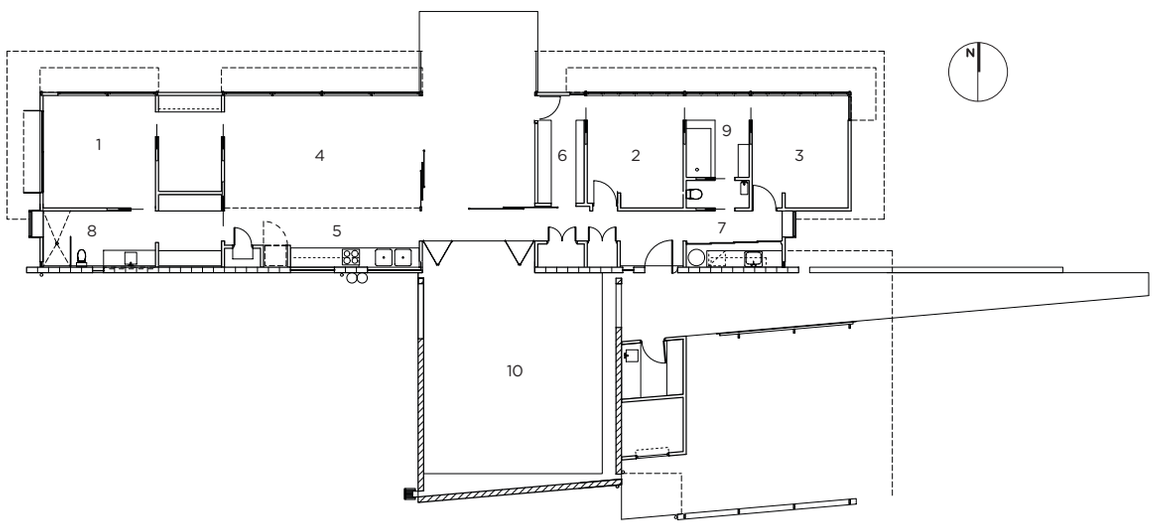
Uncomplicated bathroom design with easy to clean and maintain surfaces and aluminium louvres for effective ventilation. Plumbing fittings are four- to five-star WELS rated from Rogerseller.



Push-out gas strut awning or hopper windows facilitate ventilation. These windows are hinged from the top, providing a degree of weather protection when fully opened. Low level louvres with fly mesh allow cross ventilation throughout the night and through windy days. Internal floors are selected recycled tongue and groove timbers.

GROUND FLOOR PLAN

01 Bedroom
02 Bedroom
03 Bedroom
04 Living Room
05 Kitchen
06 Study
07 Laundry
08 Bathroom
09 Bathroom
10 Courtyard



Hervey Bay Residence

Designer
Bark Design Architects
—
Website
www.barkdesign.com.au
—
Builder
O'Rourke Homes
—
Project type
New building
—
Project location
Hervey Bay, QLD
—
Cost
$350,000
—
Size
house 178 sqm, excluding decks etc; land 2683 sqm

SUSTAINABLE FEATURES

Water saving
- Two 11,000L BlueScope zincalume rainwater tanks
- 4-5 star WELS rated plumbing fittings from Rogerseller **www.rogerseller.com.au**

Passive heating & cooling
- Insulco polyester batts R3.5 and double-sided sarking to roof **www.insulco.com.au**
- Edmonds "Windmaster" roof ventilators with dampable ceiling grille **www.edmonds.com.au**

Active heating & cooling
Concept ceiling fans from Hunter Pacific **www.hunterpacific.com**

Windows & glazing
- Gas strut opening hopper windows
- Bradnam's Windows & Doors anodised aluminium framed doors and windows **www.bradnams.com.au**
- Breezway louvre windows **www.breezway.com.au**

Lighting
- CFL uplighting and LED lights from Noosa Lighting **www.noosalighting.com.au**

Building materials
- Galvanised prefabricated steel portal frames
- Modular ECOply sheet cladding **www.chhwoodproducts.com.au**
- Recycled tongue & groove floor
- Spotted gum decking and sky screen
- Stackbonded, painted concrete blockwork "spine" wall

Paints & finishes
- Bio Paints wall paints **www.bioproducts.com.au**
- Sikkens Ebony exterior wood stain **www.tenaru.com.au**

Other ESD features
- House sited for maximum solar gain
- Simplicity in roof form for rainwater harvesting
- Maximum cross flow ventilation but protection from strong winds to external spaces
- Large overhangs and awnings to shade glass areas
- Minimised earthworks

SUSTAINABLE PRODUCTS

HOT WATER

The Bosch 26eco+ gas hot water system has an equivalent 6.9 star energy efficiency rating. It uses a condensing unit to capture heat from the exhaust gas to preheat the incoming cold water, making the 26eco+ one of the most energy efficient gas hot water systems on the market. The heater is rated to heat 26 litres per minute to the factory-set 55°C output temperature. Output temperature can be adjusted though, with up to four separate temperature controllers able to be connected to the one heater. The Bosch 26eco+ is available in both natural gas and LPG versions. RRP $1999
www.bosch.com.au

AHEAD OF ITS TIME

An eco development on Tasmania's east coast prioritises the local bush, small floor plans and sustainability - on a modest budget.

WORDS JUDITH ABELL
PHOTOGRAPHY MATTHEW NEWTON & MARIA GIGNEY

WHEN HEADING TO THE BEACH, DECISIONS ABOUT packing are often prefaced or suffixed by the mental note "...well I won't need that". Four spare pairs of shoes and a hair straightener can seem a little superfluous at the best of times, let alone when all you might do is wear a track from your abode to the beach, where you promptly abandon your footwear and let the wind do what it likes with your hair. Architect Maria Gigney's development of three houses on a block at Spring Beach in Orford, some 70 kilometres north-east of Hobart, is built on of the idea of leaving things behind and living more simply.

To Gigney, the core of this project is "convincing people that they don't need enormous houses." Finding the block just off the main road at Spring Beach a couple of years ago, she and her partner decided to delve into the speculative market, setting up a tiny development company to design and construct three strata titled dwellings on the sloping, east facing block of about 2600 square metres. An equally important idea for these buildings was to "see how far you could take sustainability on a low budget".

The fastest route to reducing all aspects of an ecological footprint is to build small; another is to increase living density so that more people and things can be accommodated in less space. With the second aspect covered by the strata division, Gigney trimmed each of the two-bedroom dwellings to an enclosed space of around 75 square metres. Splitting each building into two pavilions sandwiching a covered deck offers both efficiency and generosity. The deck becomes an outdoor living room and allows for the removal of ancillary spaces. With a bathroom placed between the two bedrooms in the sleeping pavilion, occupants either step directly into this service space or onto the deck from their bedrooms. Importantly, this simpler mode of enclosure provides a more direct connection with the external environment, which is part of the unencumbered pleasure of beachside living.

With overall footprint reduced, the dwellings come with a range of features that are now standard in homes built with a sustainable emphasis. The buildings are oriented to the sun, with insulated, polished slabs that soak up its warmth throughout the day. Dimensions are set out to panel sizes so that wastage is reduced and the walls and roofs are heavily insulated to retain warmth, although the scale of each space reduces the requirement for heating. Low opening sash windows catch sea breezes and large sliding doors facilitate cross ventilation. Water from the roofs is collected in tanks, fixtures are selected to conserve water and greywater and sewage is treated on-site.

"An important idea for these buildings was to "see how far you could take sustainability on a low budget".

Each house is surrounded by bush, and with no fences between dwellings or bordering the property, wildlife is free to roam throughout the development.

This facade illustrates the design of each home: two pavilions separated by a covered deck. The windows enable northern sun access onto the concrete floor, utilising its thermal mass to stabilise the internal temperature. The homes are clad in Boral "Evolution" exterior plywood.

Gigney would have liked to go even further with the environmental features, but knew that "you have to draw a line," as this type of augmentation comes at a premium for the initial build cost. To her disappointment, she could not afford to provide solar within her allocated budget, even though the site is perfect for this. She discovered that there are no incentives or subsidies for developers who want to go down this route.

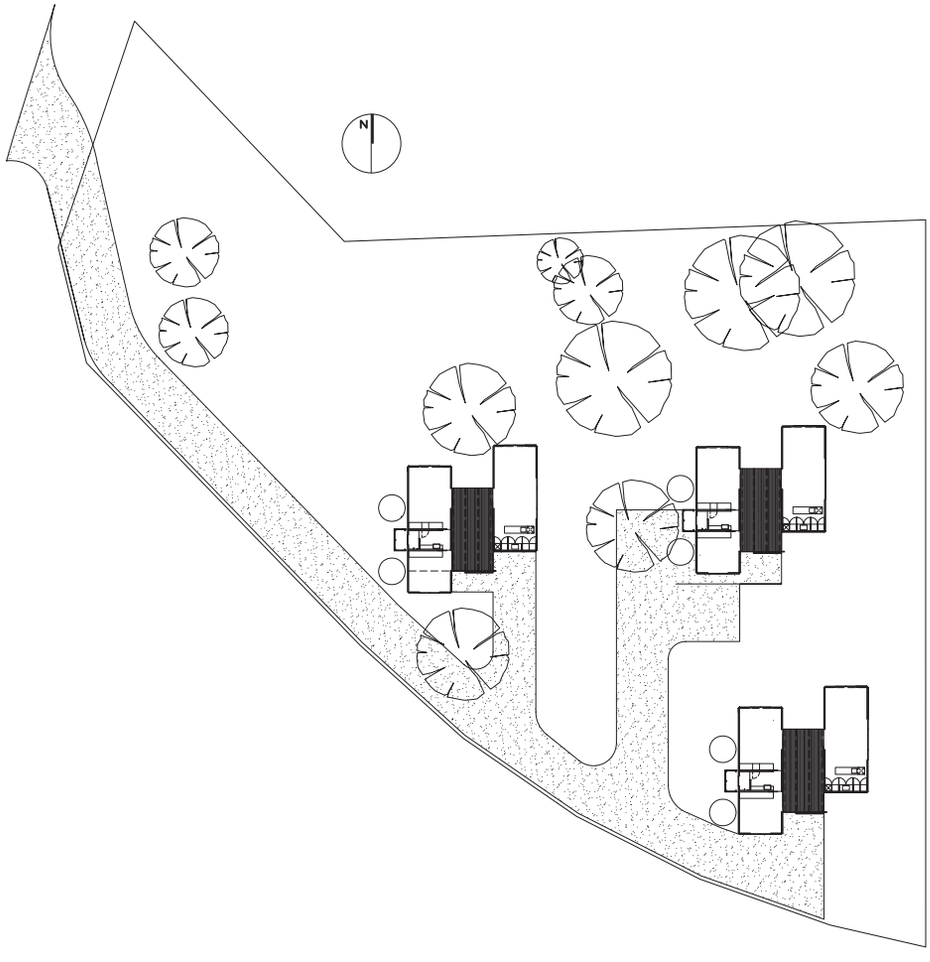
Building houses in close proximity to each other requires another whole level of design thinking. Gigney spent considerable time in the planning process, placing each of the pavilions such that they sit within the existing vegetation and allow neighbours to live independently of each other. Windows are aligned so that views through to the sea or surrounding bush are captured and blinds aren't necessary for privacy. Slatted screening is strategically placed to shield living spaces while still retaining direct connections to the surrounds. In a nice touch for the evening hours, lighting for the outdoor area is located above the translucent acrylic ceiling, transforming it into a giant lamp and cleverly luring insects away from the deck. The fence-free layout means that the site feels larger than it is, as its edges blur with adjacent bushland and native animals can move freely across the richly coloured, vegetated slope.

The architect-cum-developer pushed the envelope of speculative building when it would have been easier and possibly more profitable to veer away from sustainability as a governing philosophy. She has found the process of selling the development somewhat disappointing. "Whilst the buildings have generated a great deal of public interest they were a hard sell because the sustainable aspects are not immediately apparent – the extra insulation and double glazing can't really be 'seen' – and the low running costs are also not visual selling points easily placed on a marketing flyer. It was difficult to 'sell' these benefits, whilst they added to the build costs and thus had to be passed onto the purchaser. Greater developer incentives in this area would have assisted enormously." [Ed note: *ReNew* 113 includes a feature "Sustainable but not selling," discussing this very issue from the viewpoint of homeowners, rather than developers. There are other examples, however, where eco features have made a difference to sales. NatHERS – Nationwide House Energy Rating Scheme (www.nathers.gov.au) features a report which found that "if a house has a higher EER (energy efficiency rating) than another house, but in all other respects the houses are the same, the house with the higher EER will command a higher price". The national introduction in May 2011 of the scheme for mandatory disclosure at time of sale or lease will surely increase buyers' demand across the board for sustainably designed homes.]

The kitchen overhead shelving is plywood. To minimise waste, the cupboard dimensions were dictated by the size of the laminate sheets.

Between the pavilions, the covered deck and its screening are made from eco pine and roofed with translucent acrylic.

The development shortly after construction finished. Vegetation works had yet to begin in earnest.



Spring Beach Residences

Designer
Maria Gigney Architects
—
Website
www.mariagigneyarchitects.com
—
Builder
In2 Construction Services Pty Ltd
—
Project type
Three new buildings
—
Project location
Spring Beach, Tasmania
—
Cost
$700,000 for three houses including site works
—
Size
Houses 75 sqm each; land 3500 sqm

SUSTAINABLE FEATURES

Water saving
- Caroma "Opal II Smartflush" toilet suite **www.caroma.com.au**
- Methven Satinjet "Genesis" shower handset on "Minimalist Stilo" wall bracket **www.satinjet.com**
- Two 6000L galvanised water tanks per house, manufactured by TankTec. Tanks are connected to all plumbing fixtures in the house and also serve as water storage for fire fighting. All roof water fills the fire fighting tank first, which has an overflow connection into the household tank, ensuring that both tanks get flushed out regularly **www.tanktec.com.au**

Passive heating & cooling
- Polished concrete floors to internal spaces, with north and east facing windows allowing floors to act as thermal mass (slabs poured on fill reused from excavation)
- 30mm Isolite foam board insulation under slabs **www.rmax.com.au**
- Bradford Gold R 5.0 ceiling batts and Gold R 2.0 wall batts **www.bradfordinsulation.com.au**
- Breezeway located between pavilions allows sea breeze to be drawn through from opening windows facing water – all natural ventilation

Active heating & cooling
Each pavilion contains a Devi In-slab electric heating element with in-slab probe and wall mounted thermostat. The probe and thermostat ensure that the system activates only if there has been insufficient sun heating the slab during the day. [Ed note: With no gas supply to the houses, electric heating was chosen. This option would be preferable with renewable energy - either created on-site or sourced through GreenPower.]

Windows & glazing
- Clark fixed and awning aluminium window frames **www.clarkwindows.com.au**
- Custom-built sliding doors framed with plantation-sourced Tasmanian oak
- Windows and doors glazed with Viridian ComfortPlus and ThermoTech low-e insulating glass **www.viridianglass.com**

Lighting
- mLight magazine ceiling mount (T5 DSI dimmable) **www.mlight.com.au**
- Ligman Gino 1 rectangular wall up-down light 31071 **www.ligmanlighting.com**

Building materials
Boral "Evolution" exterior plywood cladding

Paints, finishes & floor coverings
- Dulux "EnvirO2" low VOC, low odour, water based acrylic paints on interiors **www.dulux.com.au**
- Woodmans "Cladcoat" on exterior plywood cladding **www.wood-mans.com.au**
- Laminex "Lamiwood MR Greenfirst" for most cabinetry **www.laminex.com.au**

Other ESD features
- Minimal removal of mature trees to locate houses
- Site regrown with entirely native vegetation: dought-resistant and low maintenance
- No fencing between houses or along site boundaries, resulting in a true bush environment allowing free access for kangaroos and other native wildlife

SUSTAINABLE PRODUCTS

AERATED WASTEWATER TREATMENT SYSTEM

An AWTS is a system designed to recycle bathroom, kitchen and laundry wastewater, treating it using natural processes in an underground tank to a purity approved by health authorities. Solid and liquid waste are separated and digested by aerobic and anaerobic bacteria. The Spring Beach houses share a single 10NR system from Envirocycle, consisting of a three-chambered concrete tank. The bacterial processes are supplemented by a UV disinfection process rather than chlorine. Treated water is used for subsurface garden irrigation. The system cost around $10,000 fully installed
www.envirocycle.com.au

A void between the garage and the master bedroom houses a pond to cool breezes heading for the kitchen and dining area. Custom-built, the pond is approximately five square metres and 30cm deep, complete with water plants and fish.

DIVIDE & PROSPER

Lateral thinking and design flair fit an airy and roomy house in the backyard of an inner-city Brisbane block.

WORDS FRANCENE RIDLEY **PHOTOGRAPHY** CHRISTOPHER FREDERICK JONES

SEEN FROM THE ROOFTOP TERRACE OF MICHAEL'S house on its small inner-city Brisbane block, the immediate neighbourhood is an eclectic mix of housing styles. Further afield are the jagged skyscrapers of the CBD, and in the far distance to the north there's a backdrop of mountains. Michael likes to take in the big picture from up here, and he's proud of the way his sustainably built house fits into its urban environment.

"For me, one of the major qualities of the house in terms of sustainability is how much has been achieved in a tight space, while keeping the footprint of the building to a minimum," he says. "There are three bedrooms and two bathrooms – this is quite rare on such a small block."

It's also a classic and yet relatively uncommon tale of urban infill – something that's going to need to happen a lot more often in the future to increase urban density. Michael bought the land as part of a larger block with an old Queenslander on it. He subdivided, renovated the original house, and enlisted Shawn Godwin of Base Architecture to design a new home for the remaining 229 square metres.

Shawn arrived at the final design by prioritising the passive design performance of the home instead of building to the boundary. "I thought about how best to orientate the house to get breezes and light, which meant not using every inch of land," Shawn says. "The house proves that creative compliance with Brisbane City Council's Small Lot Code can provide liveable spaces while contributing to the goal of higher urban density in our sprawling cities."

Shawn admits the orientation of the house posed some challenges: Michael's brief called for maximising the views, but the best outlook from the block was to the west. The solution was to pay a little more for solar control glass on west-facing windows and doors, coupled with battens and plantings for screening from the harsh western sun.

The shading benefits of the site's existing vegetation were also harnessed. An unusually large lemon tree sits in the western corner of the block, its leafy branches reaching high enough to shade the living room on the middle level of the house.

"The lemon tree helps to block the house from the western sun. It's also a lovely visual feature – especially from the living room at night," says Michael.

A moment of forethought when the block was subdivided led Michael to plant a row of trees along the dividing boundary between the original home and the back block instead of opting for a fence. "The trees are quite tall now and they lend a feeling of serenity to the home," Michael says. A fence, of course, would have impeded the breezes that cool the downstairs bedrooms when the hopper windows and louvres are opened.

Surveying the outlook from the living room, Michael says he can't wait to see the effect created by 12 evergreen Cissus climbers, when they eventually cover the batten screening of the balcony on the western side.

"I'll prune the vines in certain spots so you still get the view. But essentially you'll be sitting inside the living room looking at a cooling wall of green," he says. "I was going to install blinds, but instead the vines will provide natural shade."

Also on this level is the kitchen with a delightful surprise feature, a fishpond. Separated from the kitchen by a wall of louvres, the pond sits on top of the garage in a void roofed by the floor of the main bedroom upstairs. When the louvres are opened, breezes cooled by passing over the water enter the kitchen and dining rooms. With a small pump and a biofilter that needs changing only every three months, the pond's maintenance is minimal, Michael says.

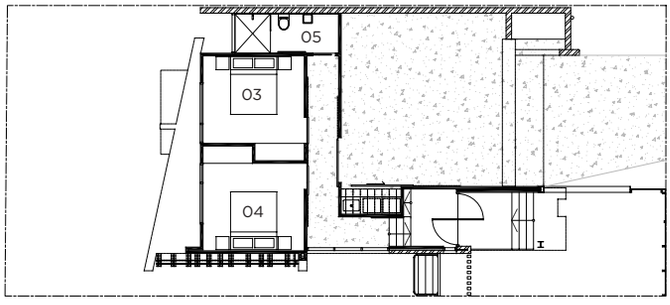
It was Shawn's suggestion to put a pond in this spot and from this Michael has learnt the benefit of combining an aesthetically appealing feature with something that can provide practical benefits.

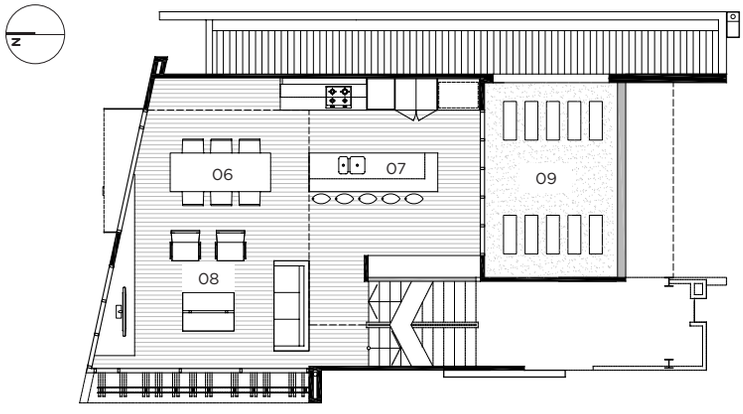
"There's nothing about this house I would change; in fact, the more I live in it, the more I understand how it works."

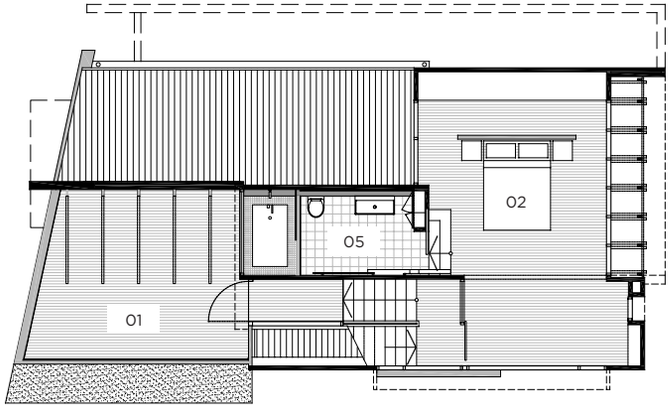
Pilkington Eclipse Advantage "EverGreen" glass helps to reduce glare and keep the west-facing living room cool.

Adjustable Breezway louvres on each floor are the mainstay of the cross ventilation strategy.

01 Rooftop Terrace
02 Main Bedroom
03 Bedroom 2
04 Bedroom 3
05 Bathroom
06 Dining
07 Kitchen
08 Living Room
09 Fish Pond

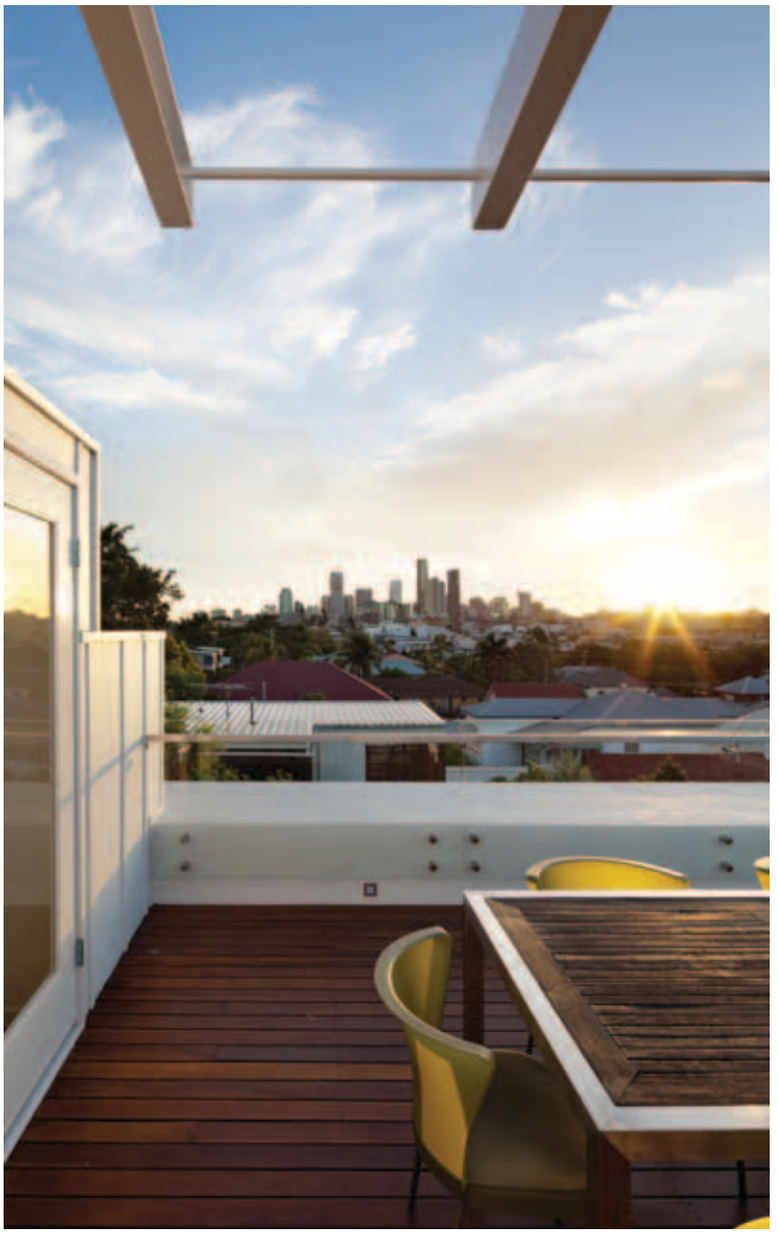




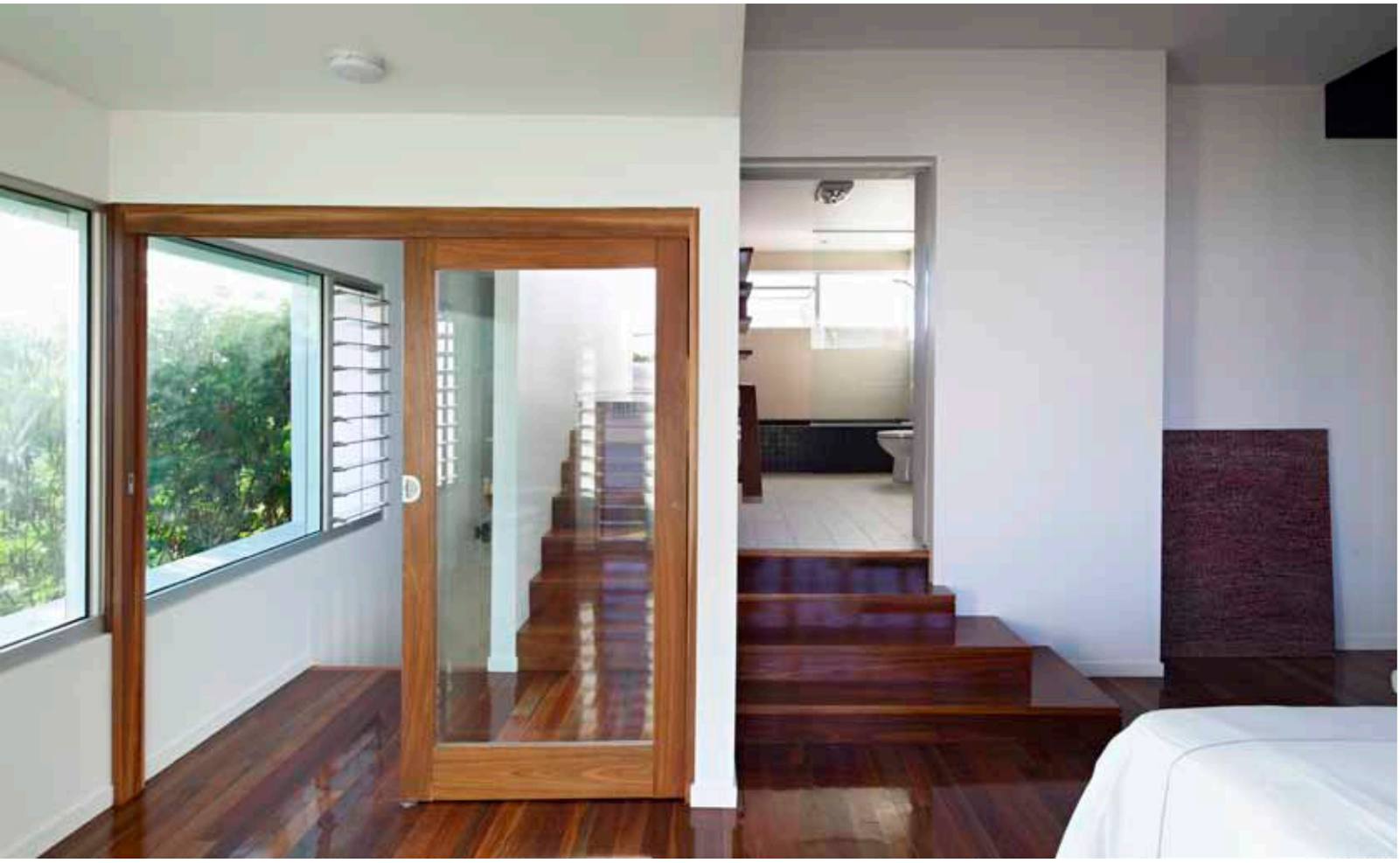


Evergreen Cissus climbing vines will one day cover the west-facing balcony with a natural curtain of green.

A rooftop terrace is a great way to maximise living space on a small block. Michael's makes the most of the Brisbane city views. Vines will be grown over the painted steel frame overhead for shading and privacy.



Open stairwells and an open layout without hallways allow maximum airflow through the house. The stair treads are supported by steel mono-stringers with steel brackets.



"I thought about how best to orientate the house to get breezes and light, which meant not using every inch of land."

The entire north wall is angled to preserve the neighbours' view, and also acts as an eave to protect the downstairs bedrooms from the summer sun. An angled surround gives privacy to the low living room window. The grey CSR Cemintel ExpressWall cladding is lightweight and quick to install.

Newstead Residence

Designer
Base Architecture
—
Website
www.basearchitecture.com.au
—
Builder
McIvor Constructions
—
Project type
Urban Infill; New Build
—
Project location
Newstead, QLD
—
Cost
$710,000

SUSTAINABLE FEATURES

Hot water
Rinnai Infinity 26+ instantaneous gas system
www.rinnai.com.au

Water saving
5000L tank plumbed into toilets, laundry and all garden taps, by PolyWorld
www.polyworld.com.au

Passive heating & cooling
- Painted timber and aluminium batten screens for shading on west windows
- Diagonal north wall provides an eave to shade the windows of the two bedrooms on the lower floor

Active heating & cooling
- Breezway louvres for cross ventilation, chosen for their ergonomic handles and robust mechanism
  www.breezway.com.au
- Custom-built ornamental pond on middle level cools air drawn over it and into the house
- Provision for Vanguard UV guard concealed external blinds between batten screens and glass on west windows, for privacy and heat protection; not yet installed as EverGreen solar glass is performing even better than expected
  www.vanguardblinds.com.au

Windows & glazing
- Pilkington Eclipse Advantage "EverGreen" low-e glass to west facing windows
- Capral aluminium frames for longevity, recyclability and low maintenance – good for upper storey windows in particular
  www.capral.com.au

Insulation
Rockwool R3.0 insulation in external walls and roof

Building materials
- Plantation-sourced Queensland spotted gum for all flooring, stair treads, handrails and feature shelving. Chosen as it's hard-wearing, handles temperature shifts well and is locally grown.
- External cladding is a mixture of stained ECOply – resistant to termites and easy to install – and CSR Cemintel ExpressWall, an 8mm compressed fibre cement sheet that is lightweight and easy to handle
  www.cemintel.com.au

Paints, finishes & floor coverings
- Dulux low VOC paints on interior walls and ceilings
- Feast Watson tung oil based satin finish on flooring and other internal woodwork
  www.feastwatson.com.au

SUSTAINABLE PRODUCTS

LOW-E GLASS

Low-emissivity (low-e) glass has a coating that reduces the amount of solar heat gain in a room, without sacrificing too much visible light transmission. According to *Your Home Technical Manual*, low-e glass can enable a dramatic improvement in both U-value (a measure of heat conductivity) and solar heat gain coefficient (SHGC). The SHGC is the proportion of solar energy that passes through a window, both directly as transmitted heat and indirectly as radiated heat. Uncoated glass has a SHCG of 0.84, but low-e glass is available with a coefficient as low as 0.03. This building used Pilkington Eclipse Advantage solar control glass in EverGreen colour, in which the coating is applied during the manufacturing process while the glass is still hot. This improves the durability of the product over coatings applied to finished glass, and allows a pane to be toughened or bent without affecting its properties. Eclipse Advantage is also available in five other colours.
www.pilkington.com

Lessons Learnt

Sanctuary revisits WestWyck, an eco-housing development in a Melbourne primary school, to see what's changed since it was first profiled three years ago.

WORDS FIONA NEGRIN
PHOTOGRAPHY EMMA CROSS, DAVID JOHNS & MIKE HILL

When *Sanctuary* first visited WestWyck in 2007, the sustainable housing development in West Brunswick, Melbourne, was still under construction. It's come a long way since then: stage one of construction is complete and stage two is underway. It's won industry awards, inspired real estate agent Lisa Roberts to start up SHARE – a national network of green-minded agents that focus on promoting sustainable properties – and been hailed as a "model for high-amenity urban living, heritage preservation and sustainability," says co-founder Mike Hill. *Sanctuary* returned to WestWyck on the eve of its official opening by the Environment Minister to find out from Mike how the development was tracking – what had worked and what hadn't.

Mike and his partner Lorna Pitt were the last to move into WestWyck. Their apartment, the former infant drill hall which had been used throughout stage one of the development as the work room, was only finished this year. It was designed by Multiplicity architects, while other architects and designers had designed and documented the rest of stage one WestWyck. Mike doesn't miss a beat when asked to name the most effective green technology they installed in the place: "The double-glazing, because it retains warmth and cuts down on outside noise." And his explanation of why the house has ended up being comfortable throughout summer and winter is a crash course in sustainable design. "The double-glazed, shuttered windows to the north, and heavy insulation, keep it cool in summer. Ceiling fans keep air moving, the thermal mass [in triple brick walls and E-Crete floors] works very well for us, and the ventilation was extremely well thought through. In winter, we use the fans' reverse cycle to keep warm air at ground level, double-glazing assists again, and the hydronic heating linked to the gas-boosted solar water heater is very effective."

View from the school main building to one of the townhouses, built during stage one of the eco development. The townhouses' roof infrastructure consists of skylights, evacuated tube solar hot water system and a 1kW photovoltaic system. Photo by Mike Hill

A visiting French sociologist researching WestWyck and other eco-villages this year found that residents believed they'd become more environmentally responsible simply through living there. They attributed their behavioural change to social factors (being positively influenced by their neighbours), and access to green technologies like electricity smart meters, greywater systems and rainwater tanks.

GREY AND BLACKWATER TREATMENT

Water conservation was one of WestWyck's briefs when it was first developed, and its water management system aimed to capture rainwater, treat grey and blackwater, and filter stormwater run-off. "We've had a really good reduction of mains water use against the average per capita," says Mike, "because we're capturing, treating and re-using so much water. Our current Yarra Valley Water bill shows we used 22.5 litres of mains water per person per day through the 2010 winter period."

But some of the systems proved disappointing. For example, the original custom-made blackwater treatment system was designed to treat sewage and kitchen waste water through worm farms. It was also designed to treat greywater from bathrooms and laundries to the standard where it could be used to flush toilets, but the design proved inadequate and the water was never able to be treated to the required quality. WestWyck Pty Ltd committed to a complete overhaul of the treatment system, isolating the blackwater and treating the greywater separately through a custom-designed AquaClarus system to a standard where it could be used to flush toilets, water gardens and potentially be fed to washing machines. The treated blackwater is fed sub-surface into a settlement tank and then to three lined evapo-transpiration beds.

"We switch the greywater system to mains if the treated water runs out or when there is a pump or other fault. This system is now remotely monitored and is covered by a service agreement," says Mike.

Another "failure" was the original design for a greywater-fed grass carpark in which treated greywater was drawn to the roots of the grass from underground agricultural piping through a "wick" effect. "This didn't work," Mike said. "There wasn't enough greywater to feed the grass during summer, the grass wasn't surviving and so the carpark was becoming a dustbowl. In the end we regretfully replaced the permeable surface with a hard paved carpark."

Mike says WestWyck Pty Ltd is re-thinking the logic of blackwater treatment and will make a decision before going ahead with stage two of the development. "We dedicate a lot of land to treatment of blackwater, and perhaps it would be of more environmental value to use that land for growing vegetables, for example. What do we achieve by treating blackwater in a distributed system on site rather than sending it to Werribee where a centralised system will make good use of the treated water?"

SOLAR HOT WATER

Rainwater from the schoolhouse building is collected in two 11,000 litre tanks and pumped to the evacuated tube solar hot water system on the roof of the main building; this provides hot water to four of the seven developed apartments within the schoolhouse building. The remaining three apartments, renovated five years earlier, were built with instantaneous gas hot water systems because "the only solar alternatives at the time were greenhouse gas intensive electric boosted solar systems," Mike said. All five townhouses have 5,000 litre subterranean rainwater tanks which feed into the hot water system. "Although there is provision for mains back-up, we have almost eliminated the use of mains water in our hot water supply."

Taking into account embodied and operational energy over a 25 year period, the solar hot water system has been found to be 30% more energy efficient than the gas-only system in the three original apartments. Consequently, the next stage of WestWyck will use gas-boosted solar hot water.

One further "failure" that Mike cites is the relatively high energy requirement for the Owners Corporate meter. Mike feels this is partly due to poor pump design including water pipe lengths, unnecessary pipe bends, incorrect pump selection and poorly chosen automatic pump cycles. "I think we can cut energy consumption further by careful planning of our piping and pumping systems," he says.

FIRST FLUSH DIVERTERS

The first flush (50 litres) of rain from the roof and the overflow from the rainwater tanks is channelled through swale raingardens out to the sewer, or back into the earth through permeable ground cover [Ed note: for more on Raingardens see p76]. Mike credits the landscape design with saving large volumes of water from rushing straight to the street stormwater drain, but acknowledges that "the first flush diversion system employed on the school building isn't great – it splashes all over everyone's yard when it's supposed to do its bit quietly. We still want a first flush device, but I'm sure we can find a better system."

COMMUNAL LIVING

Mike says the community aspect of living at WestWyck has been an unexpected success. "The village aspect is more of a success than we'd hoped: people are very cooperative, with

WestWyck's first stage of development included five apartments built into the original school building. The solar panels and evacuated tube solar hot water systems installed during stage one have worked well. Photo by David Johns

There wasn't sufficient leftover treated greywater to sustain WestWyck's original greywater-fed grass carpark, so it's now been replaced with a hard surface. *Kanookas* and *Goodenias* and *Dianellas* are planted in the carpark evapo-transpiration beds while native grasses and reeds are used in the swale drains to slow and treat stormwater runoff. All plants are thriving. Photo by Emma Cross

Mike and his partner Lorna Pitt were the last to move into WestWyck. Their apartment, the former infant drill hall, was finished this year and designed by Multiplicity architects. The kitchen, as seen in this image, is tucked under the mezzanine-level bedroom. It incorporates the school's original art room table raised to bench height on custom-made metal brackets. Photo by Emma Cross

gardening and composting, lots of networks and socialising. The financiers and marketing people originally told us 'Australians don't like to live like that, they like their own private space,' but we haven't found that. One of our learnings from our experience with WestWyck is that people are very keen to live in a village environment – they're sick of living in isolation. In our second stage we plan to be bolder about the shared parts of the village."

THE FUTURE

Stage two of the development, designed by Multiplicity, will see the building of another five apartments within the central school building, plus 13 new apartments in two new buildings, bringing the development to a total of 25 apartments and 5 townhouses. There's already a waiting list! Mike anticipates that stage two will be decidedly easier than stage one. "Things have changed dramatically since we started 12 years ago. Then, there was a distinct lack of products, systems and services so we were frequently innovating, experimenting and searching for solutions. We struggled to source solar, lighting, glazing and timber products and we've highlighted the difficulties we had with water treatment. Now there's greater availability, more competition, and more sophistication. Things have changed a lot in the building industry, too. Plumbers are more aware. It makes life a lot easier." When asked what he'd do differently if he was to do it all again, Mike is unequivocal: "We won't do it again, but we will certainly assist others!"

Mike welcomes questions via the website or through his annual Sustainable House Day tours.

RESOURCES

www.westwyck.com
WestWyck community website with blog, development information, news, links, and a copy of the independent report into WestWyck

On the mezzanine level in Mike and Lorna's apartment, original stained glass panels were rehung in the north facing wall to pivot inwards on farm gate hinges, allowing sunlight and fresh air in. The windows can be closed at night to reduce heat loss. Photo by Emma Cross

Mike and Lorna's study is in a module suspended above the main living space. The hall's original ceiling was retained and heavily insulated with a recycled polyfibre with R ratings up to 5.3; this makes the open-plan apartment comfortable through the seasons. Photo by Emma Cross

The front entrance hall to the apartment was once the student entrance to the drill hall and would have housed coat and bag racks and tiled handbasins along the walls. Later, the entrance spent many years housing a large boiler which provided heating for the school. The original tiles have been preserved, and a bench seat and a bank of the school's original hydronic heaters added. Photo by Emma Cross

"Mike doesn't miss a beat when asked to name the most effective green technology they installed in the place: "The double-glazing, because it retains warmth and cuts down on outside noise".

From cradle to grave

Life cycle assessment reveals the impacts of building products, from their raw material production, manufacture and distribution through to their disposal.

WORDS MICHAEL GREEN

If you want to reduce the environmental impact of your renovation or new build, sooner or later you'll need to dive into the murky world of materials.

Take a deep breath first. It's a place where everything is connected and the products have different impacts, but it's hard to tell exactly how they relate to one another, and how big the differences are.

In recent years, we've become accustomed to the concept of embodied energy: it's shorthand for all the energy used to make a product, from the mining and processing of base materials, to the packaging and delivery of the manufactured goods.

Now, life cycle assessment is becoming increasingly common. "Embodied energy measures only the energy aspect, whereas life cycle assessment measures all the environmental impacts," says Dr Usha Iyer-Raniga, assistant director of RMIT's Centre for Design. "It's not just about energy, but also about biodiversity, greenhouse gases, land use and toxins."

Tim Grant, from consultancy Life Cycle Strategies, says that the depth and rigour of life cycle research sets it apart.

"Life cycle assessment is an internationally standardised methodology for analysing the impacts of products and services. It looks at the cradle-to-grave impacts, including all the relevant environmental indicators," he says.

The function of the product is a key part of the analysis: nothing can be viewed in isolation. "The assessment becomes very complicated in the building industry, because we don't use materials independently," Iyer-Raniga says. "You've got to think about how those materials are assembled together to become a square metre of wall, and how the wall performs its role."

To help solve the puzzles, she suggests householders ask a lot of questions when sourcing products and materials. "People have to be really savvy. There's a lot of greenwash out there, particularly in the building industry – not just with materials, but with appliances and furniture as well," she says.

"You need to think about your needs. Is it a house you want to live in for the rest of your life? Think about using long-lasting materials that aren't entirely dictated by fashion. Consider where the materials come from, how durable they are and whether they need maintenance."

So far, not much life cycle information has been available for homeowners. The Australian Life Cycle Assessment Society is working on locally relevant environmental impact weightings and a database of products and services, but the project is progressing slowly.

Eco-product database ecospecifier recently launched GreenTag, a third-party certification system based on life cycle assessment principles. Technical director David Baggs agrees that the strength of life cycle analysis is its breadth. "There are lots of carbon calculators available, but as a society we have to be careful to not create counter-productive outcomes by focussing purely on greenhouse gases," he says.

Under GreenTag, products are compared against a worst-case business-as-usual scenario. They're rated in four tiers: platinum, gold, silver and bronze (although bronze signifies a health and eco-toxicity rating, not life cycle analysis).

"Once our new website is launched next year, people will be able to see the products' key performance indicators," Baggs says. "They could use it to specify minimum standards for their building materials."

For a rough guide to good life cycle choices, Grant says there are simple rules of thumb for householders to follow. "Firstly, anything that will improve operational efficiency is worth doing, whether it's solar panels or light sensors that switch lights off automatically. The environmental impacts of production will nearly always be outweighed by savings during the life of the home.

"The second thing is to reduce the size of everything. Smaller buildings use less material, less energy for heating and have less room for furniture and fittings."

It also means modification or refurbishment is usually preferable to building from scratch, if it can ensure energy efficiency. Earth building techniques such as mudbrick have very little embodied energy, but to remain ahead of the rest, they must also operate efficiently.

"There's nothing that has no environmental impact," Grant says. "After doing life cycle assessment, you come to realise that less is more. We really need to reduce our consumption of everything."

"People have to be really savvy. There's a lot of greenwash out there, particularly in the building industry."

RESOURCES

Life Cycle Strategies
www.lifecycles.com.au

RMIT Centre for Design Includes several YouTube seminars on Life Cycle Assessment by Tim Grant
www.rmit.edu.au/cfd

Australian Life Cycle Assessment Society
www.alcas.com.au

ecoSpecifier
www.ecospecifier.org

Photos by iStockphoto.com

Raingardens

The natural filtering capabilities of soil and plants can be used to clean up stormwater on both a residential and a broader scale.

WORDS JANE CANAWAY

Imagine a way to reduce erosion and pollution in waterways and help water and fertilise your garden too. The solution might be as simple as disconnecting your home's downpipes and letting the water flow into an "ephemeral creek" – if you have a large enough block and the right soil.

For the rest of us, rather than risk flooding your garden and those of your neighbours, consider building a simple raingarden to capture and treat run-off before it hits the drains.

But don't creeks and rivers need more water to stay healthy? The idea of reducing water flows might seem counter-intuitive, but the fast growth of Australia's cities – and with it increased amounts of hard, impermeable surfaces – has resulted in waterways in urban areas across the country damaged by fast and too frequent stormwater flows and pollutants.

"The problem we have is the quantity and quality of stormwater flowing into our waterways," says Phil Edwards, Melbourne Water's team leader for stormwater quality. "It flows into waterways too frequently, causing erosion; and the run-off from roofs and driveways also carries a degree of pollution and sediment, which is deposited in our waterways."

Raingardens are designed to collect water from any hard surface – roads, driveways, footpaths or roofs – and to filter and clean it before it hits the nearest river. The filtering is largely done by the soil structure and microbes as well as through absorption by the roots of plants in the raingarden – a process called biofiltration.

AIR POLLUTION

As well as obvious pollutants such as oil, litter and animal faeces that are swept into stormwater drains from the street, dust, leaves and airborne pollution can also flow in from house roofs. Nitrogen and phosphorus are the main culprits, but the good news is that both are essential for plant growth. The goal is to feed raingarden plants rather than encourage algae in waterways.

Surprisingly, tiny amounts add up to make a huge difference even in large bodies of water. According to Phil Edwards, in 1999 Port Phillip Bay received 7000 tonnes of nitrogen – 1000 tonnes more than it is able to process. In Western Australia the Swan River has been hit by algal blooms and in NSW in July there were 11 "red" alerts for algal blooms in various waterways. South-east Queensland has had an especially bad 12 months, with rains last summer washing high levels of pollutants into waterways.

PUBLIC STORMWATER HARVESTING

Stormwater harvesting programs are being introduced in most major cities as planning departments adopt the principles of Water Sensitive Urban Design (WSUD). "We're looking at alternative technologies such as small-scale filters that can fit into urban streets," says Edwards. "In all major cities you'll see these appearing, built by local councils or water authorities."

In Sydney more than 80 stormwater harvesting projects should save about two billion litres of water a year. The city of Orange has devised a scheme to supplement its drinking water supplies with stormwater. The scheme captures some of the high flows in Blackmans Swamp Creek during storms and transfers these into the nearby Suma Park Dam to augment the city's bulk water supply.

RESIDENTIAL RAINGARDENS

At its simplest, a raingarden can be a swale or depression alongside a driveway or footpath, or even at a low point in your garden, where rainwater can collect and gradually soak into the soil. (Swales created close to buildings should be lined like a pond to avoid damage to the foundations.) We covered this style of raingarden in "Rainwater Gardens" in *Sanctuary* 4.

If you have installed rainwater tanks plumbed to your laundry, bathroom, or kitchen, you have already reduced the amount of water that's going to the stormwater drain. Depending on the capacity of your tanks, during wetter months your tank may overflow. By absorbing and filtering the overflow water, raingardens can help ensure all or most of

Melbourne Water is asking residents who have already installed raingardens to register them to be part of the count of 10,000 raingardens. This is an above ground raingarden. Photo courtesy Melbourne Water

Filtering the overflow from your tank into a raingarden will help you get the most out of the rainwater on your roof.

This is an in-ground lined trench raingarden. Photo courtesy Melbourne Water

the water that falls on your home and garden remains on-site.

According to Anjali Brown, the Alternative Technology Association's water projects manager, "Filtering the overflow from your tank into a raingarden will help you get the most out of the rainwater on your roof. Keep in mind, however, that a raingarden which only receives irrigation through overflow will need highly drought resistant plants. One way to provide more water to your raingarden in this situation is to divert your first flush device into the raingarden as well. A first flush device diverts the first flow of water from your roof, which may contain pollutants, away from your tank each time it rains. Usually the first flush water gets sent down the stormwater drain but by diverting it to the raingarden, your filtering plants will get a little extra water every time it rains which will help them survive."

The best type of raingarden to work in conjunction with a water tank is a plant bed raingarden. Plant bed raingardens are either an above-ground planter box or an in-ground lined trench. Inside the plant beds are layers of gravel and sand that slow water flow, filtering out sediment and pollutants from the water as it passes through. The filtered stormwater is collected via a slotted drainage pipe at the bottom of the filtration bed, and can then be discharged into your garden or the stormwater system.

Raingardens should be planted out with species that are particularly good at removing pollutants, such as *Lomandra longifolia* or *Carex appressa*, and hardy, indigenous species that will survive the dry periods between rainfalls such as other *Lomandra* species and *Dianella* species.

It is important to remember that any run-off needs to be kept out of neighbouring properties and a registered plumber is needed to connect your raingarden back to the main stormwater drain. Some WSUD principles may clash with local council by-laws, while other councils may have incentive schemes that are worth registering with first, so check before you build.

INSTALLING RAINGARDENS

Melbourne Water is campaigning to get 10,000 raingardens built across the city by 2013. Its website (www.melbournewater.com.au/raingardens) has a range of information sheets about above- and in-ground raingardens, including the materials you will need to make them yourself, as well as which plants to select, and how to work out the size of raingarden you'll need for your situation. These information sheets would be applicable to conditions around the country (though it would be best to seek local information about indigenous plantings).

If you would prefer an above-ground raingarden you may need to buy or make a lined raised garden bed or buy a water tank and have a drainage hole installed – see the details on the Melbourne Water site to find out the size of the drainage hole you need.

FOR MORE INFORMATION

Water Sensitive Urban Design
www.wsud.org

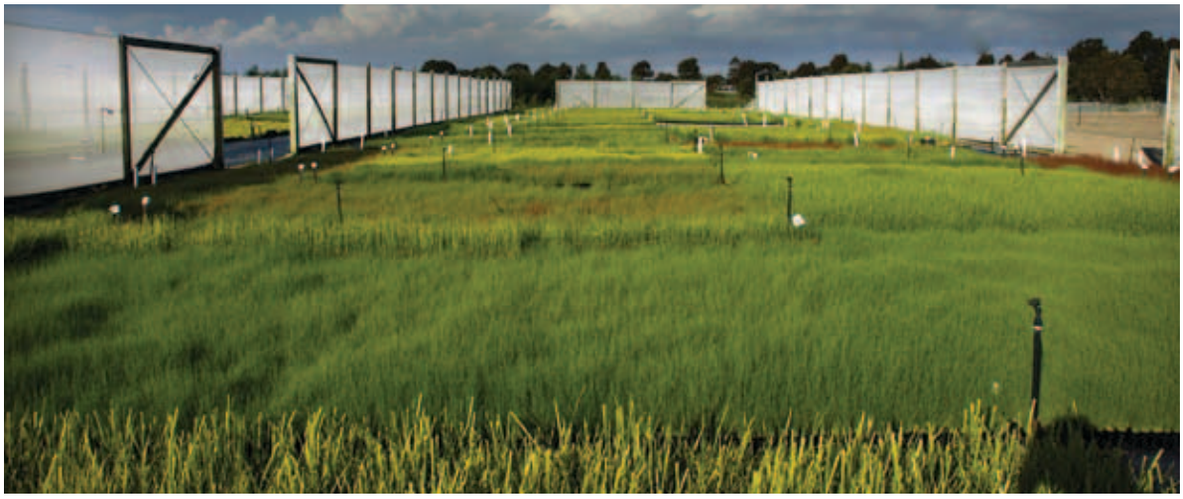
Melbourne Water, including links to instruction sheets for building
www.melbournewater.com.au/raingardens

Stuart McQuire's book, *Water Not Down the Drain*
www.notdownthedrain.org.au

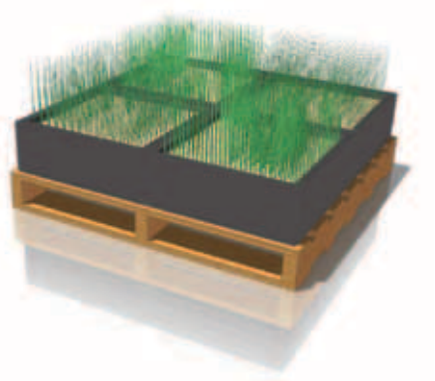
Healthy Waterways
www.healthywaterways.org

Alternative Technology Association
www.ata.org.au/sustainability/stormwater-capture/

Some tank suppliers include:
www.tankworks.com.au
www.cessnocktankworks.com.au
mtwatertanks.com.au/GardenBeds.php



Space is often at a premium for planning departments developing urban public stormwater harvesting. Designed for larger-scale rather than residential applications, Biofilta Stormwater Solutions' modular system of biofiltration "cells" allows for capture, treatment, and storage of stormwater with a much smaller spatial footprint than conventional biofiltration systems like wetlands. The approach allows plants to be pre-grown and properly established in a controlled nursery environment too, meaning that the system can work optimally from the day of installation. Image courtesy Biofilta Stormwater Solutions



In the Biofilta system, the plastic cells in which the plants are established are removed before installation and reused. Image courtesy Biofilta Stormwater Solutions

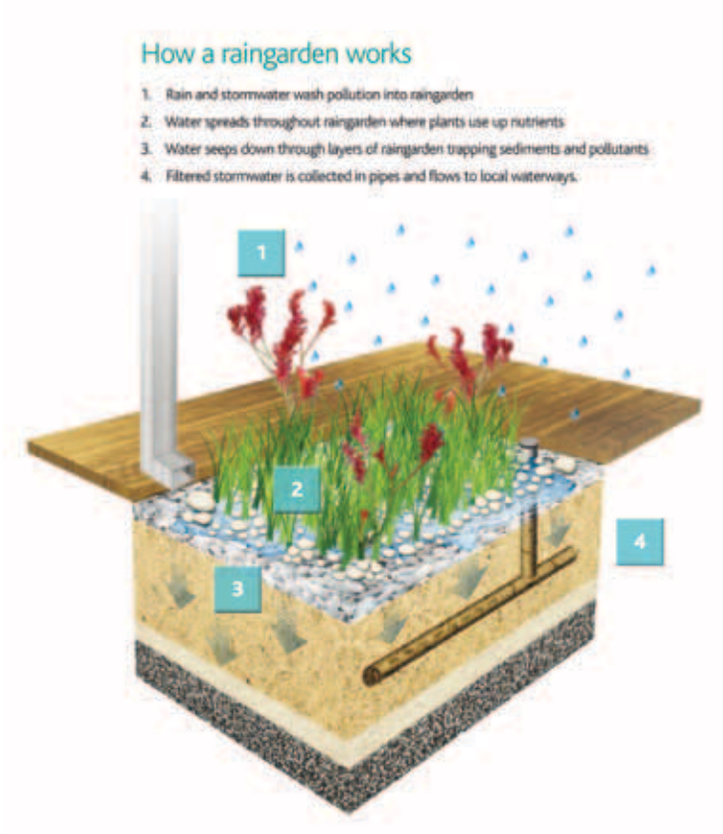
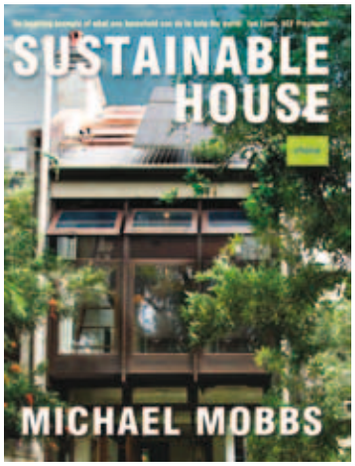


Image courtesy Melbourne Water

Book Reviews



01

SUSTAINABLE HOUSE 2ND EDITION

By Michael Mobbs
Published by Choice, October 2010, RRP $45

Michael Mobbs first published *Sustainable House* in 1997. In that first issue he aimed to illustrate the various decisions and regulatory hoops he had to jump through to renovate his double storey home in Sydney. But this was no standard renovation; it was a comprehensive and quite radical overhaul of traditional domestic energy, waste and water systems, making this humble Chippendale terrace a trailblazer in the adoption of green residential technology. Chapters were dedicated to the kitchen, waste-water systems, working with regulatory bodies and more. This long awaited second edition revisits the initial decisions the family made – what systems worked, what didn't? It looks at energy, water and waste data collected over the life of the renovation, details system costs, and offers Michael's updated advice for choosing the best suppliers, products and systems.

Sanctuary magazine has ten copies of *Sustainable House* 2nd edition to give away. Tell us in 20 words or less why you'd find a copy of *Sustainable House* invaluable. Email **sanctuary@ata.org.au** by Dec 20th 2010 with your answer.

02

A PLACE IN THE SUN: INNOVATIVE HOMES DESIGNED FOR OUR CLIMATE – AUSTRALIA AND NEW ZEALAND

By Stuart Harrison
Published by Thames & Hudson, November 2010, RRP $69.95

This first edition coffee table book profiles a range of architecturally designed Australian and New Zealand homes that each "use the sun as a creator of magic, of beauty". The selected homes, from the northern reaches of Australia to the far southern latitudes of New Zealand, are all bespoke design solutions for their latitude and microclimate, employing passive design principles in intelligent and creative ways. The houses offer "an attitude towards the sun. Often that attitude is about cleverly controlling it for when you want it; and then others are about beautiful ways of screening it, of bringing the light in, whether it's a nice ray of light moving across a room or beautiful screening and shadows." The designs profiled favour low-tech sustainable design solutions over high-tech. The author's "absurd ambition" is that the book might enable readers to better understand the fundamental principles of good passive solar design, and then to demand these from architects and designers. Stuart Harrison is a Melbourne-based practising architect and architectural advocate.

Ventilation & Cooling

Keeping the facilitation of air flow in mind when designing your home is crucial for good ventilation and passive cooling, writes Paul Downton.

WORDS PAUL DOWNTON

If you heat the end of an iron bar, the heat moves from the source of the heat towards the cooler parts of the metal. Air doesn't behave like that: warm air doesn't move towards cool air. Warm air is less dense than cool air so it wants to rise; cool air wants to sink. That's how the atmosphere works, with rising warm air masses drawing in surrounding cooler air – as Bucky Fuller said, "Wind doesn't blow, it sucks!"

Passive heating is relatively easy because all you do, in essence, is trap heat. Cooling is more difficult because it involves losing heat – when it's already hot outside. Heat moves in three ways: for a building to lose heat it must either radiate away, be conducted away, or be carried off by convection.

Cooling by thermal mass typically uses masonry that radiates heat away at night and absorbs heat during the day. "Earth coupling" connects the building to the mass of the earth to achieve a similar effect.

Radiated heat can cross "empty" space and pass through air; convected heat is carried by the air; but conduction happens through solid materials when they are connected or touch each other (which is why having "thermal breaks" is important for aluminium window frames with double glazing).

The most practical and direct way to reduce the internal air temperature of a building is by convection, letting the warm air rise and escape. Provide a source from which to draw in the "coolth" and you have passive cooling. Plants are natural evaporative air-conditioners, so shady courtyards or garden areas (think pergolas, green walls and layers of vegetation) can become sources of cooler air – ideally, using recycled water for irrigation.

Just like plants we feel cooler when air moves across our skin, so air movement is a vital part of energy efficient cooling. The numbers are less important in defining comfort than what we feel. Still air at 32˚C feels really muggy, but stir it gently with a ceiling fan and it can feel more like 28˚C – much cheaper than air-conditioning.

Air movement on still days is very important – develop a cool side and a warm side to your home and create air flow with the cooled, denser air flowing through the house to the warm side. Design for cross-ventilation – remembering that it can't take place if all you can do is open windows on one side of a room. You can't push the air without forcing it into pipes, which is exactly what we do with noisy mechanical air-conditioning systems and when we make musical instruments (if you want to make noise, force air through a constricted gap!). For good natural ventilation, ensure that the window or opening the air flows out of is bigger than the one where it comes in.

Capture cooling breezes. If you are near a large body of water, like a river or the sea, you'll have a major advantage in access to "coolth". In some environments, opening up your home to air movement can mean introducing unwanted dust and noise so careful design is vital. Insulation is as important to cooling as it is to heating and if you do have to seal the house up, a well insulated home will keep heat outside and need less air-conditioning.

Minimise the load by reducing ways your home can attract heat. Light coloured roofs, walls and paving absorb less radiation than dark colours. Shade structures have endless possibilities whilst solar panels or a deck raised above the level of the main roof (to allow air flow) can reduce the radiative heat load on the roof. Green walls, which can be as simple as a trellis and vine, help keep outside walls cool.

Dr Paul Downton's practice, Ecopolis Architects, has always been exclusively about ecological architecture and design. His Christie Walk project in Adelaide (profiled in Sanctuary *1) is recognised internationally as a leading example of sustainable urbanism. He was editor of the last two editions of the best-selling* Your Home Technical Manual *and is one of its primary authors. Over the past twenty years Paul has written extensively about sustainability and earned a reputation as one of the world's leading thinkers on ecocities.*

www.ecopolis.com.au
twitter.com/PFD311

Air movement on still days is very important – develop a cool side and a warm side to your home and create air flow

Cross ventilation: Air flows easily from small openings to large, but not the other way around.

This diagram illustrates convective air movement. As warm air rises and exits through ceiling vents and vented eaves and ridges, cooler air is drawn in through low level vents or windows. Convective air movement works in nil breeze situations, meaning that if your house is designed to facilitate convective air movement, it can be cooling down even on still nights. Diagram adapted from *Your Home Technical Manual*

Four kinds of controllable ventilation at Christie Walk use heat rising up stairwells to high level outlets. Clockwise from top left: openable skylight; vents in the peak of a roof; vents from attic; and openable louvres. Photo from Paul Downton, Ecopolis Architects

GLOSSARY

radiate	to send out waves or heat (the sun radiates energy)
conduct	to serve as a medium for transmission (many metals conduct heat)
convection	the transfer of heat through liquid or gas by molecular motion
earth coupling	building into the earth or with earth berms (banks) against the walls ("underground" and "earth sheltered" housing uses earth coupling)

Eaves

Dick Clarke takes a look the advantages of operable shading over fixed eaves in mixed heating and cooling climate zones.

WORDS DICK CLARKE

The myth of four seasons in Australia exists because our European forebears didn't understand the subtleties of the Australian climate. If they had, we would recognise at least six seasons and perhaps seven, much like Indigenous Australians have done for 50,000 years. The implications for building design are that "autumn" and "spring" are not predictable weather events – in simple terms, half the time they are a war between the advance of the incoming season and the reluctant retreat of the outgoing one. Today it's hot, tomorrow it's not.

The wild swings make life interesting. But if you are trying to passively heat or cool a building using fixed shading, it's not so much fun. For instance, in Dandenong, Melbourne, your fixed eaves might be designed to allow progressively more sun into the north facing rooms from the end of February, so that by mid-April you are getting quite a bit of sun inside. But April 16th might be 28°C, and by lunchtime the house is well and truly overheated. Similarly, in Canberra your pergola might be designed to keep October sun out, but on the 8th and 9th of that month the maximum temperature is only 5°C and the house is quite cold by the end of the second day.

In each example, passive cooling and passive solar heating were designed with seasonal averages in mind, but as these happen only half the time in reality, fixed shading only gives an average result too. Obviously if the rest of the building's eco design is up to scratch, these problems will not make it unliveable, but is it optimum?

It's worth bearing in mind that according to the *Your Home Technical Manual*, fixed shading is only recommended on north facing walls – see Table A on the right – but let's examine the case for operable shading on all facades. If you can move shading quickly and easily on a daily basis you can "trim the sails to stay on the breeze". In other words, passive houses need active users. In a late autumn heatwave, you can extend your deep north-face shading to make the building sail like it's mid-summer. In a spring cold snap, pull up the shading so that the house's thermal mass can reap every available kilowatt of solar heat the grey sky can give. It's that simple, and it's fun – just like sailing!

The *Your Home Technical Manual* says this in regard to shading:

Shading of glass is a critical consideration in passive design. Unprotected glass is the single greatest source of heat gain in a well insulated home. Shading requirements vary according to climate and house orientation. In climates where winter heating is required, shading devices should exclude summer sun but allow full winter sun to penetrate. This is most simply achieved on north facing walls. East and west facing windows require different shading solutions to north facing windows. In climates where no heating is required, shading of the whole home and outdoor spaces will improve comfort and save energy.

TABLE A

Orientation	Suggested shading type
North	Fixed or adjustable shading placed horizontally above window
East & West	Adjustable vertical screens outside window
NE & NW	Adjustable shading
SE & SW	Planting

Table supplied courtesy of *Your Home Technical Manual*

It goes on to explain with diagrams how, what and why, and should be the starting point for all enquirers and experts alike.

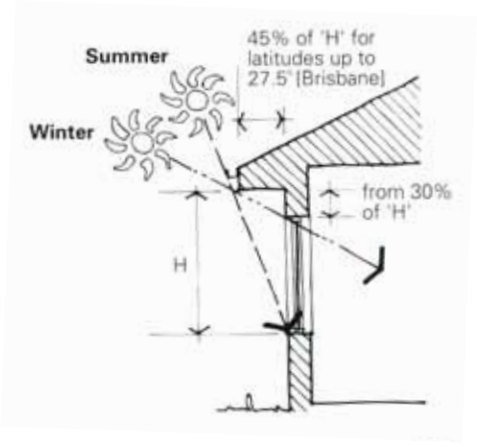
Diagram A on the right illustrates the general principles for calculating the width of eaves for all latitudes south of and including 27.5°S (Brisbane and Geraldton). But this can be a broad brushstroke prescription perhaps unsuited to a variety of unpredictable weather events.

The principle of shading is universally critical to the building's relationship with the only practical source of heat energy at the planet's surface. In southern climes it must be engaged in winter and shunned in summer (and toyed with in between). In the Top End it is to be kept at bay pretty much all year, although a small sun-trap is often a good idea for those wishing to seek out some warmth in July.

Traditionally, eaves and verandahs have been the tools of choice for providing this seasonal control. Fixed eaves are usually the lowest-cost option for achieving a passively heated and cooled house, but the question cannot be avoided – is this the best solution? Where space and budget permit, operable shading that can be adjusted daily is well worth considering.

Dick Clarke is the principal of Sydney-based Envirotecture. Envirotecture provides design and consulting services for people and organisations who want buildings that work well, feel good, and are culturally appropriate – and reduce their ecological cost toward zero. Dick is a contributing author to the Your Home Technical Manual.
www.envirotecture.com.au
twitter.com/Envirotecture

DIAGRAM A



It's worth noting the importance of the distance from the top of the window to the underside of the eave. If you don't get this right the top of your windows can be permanently in shade — not ideal in the middle of winter. *Your Home* gives a good rundown of any recommended variations to the "rule of thumb" illustrated. Image supplied courtesy of *Your Home Technical Manual*

FOR MORE INFORMATION

Your Home Technical Manual
www.yourhome.gov.au/technical/fs44.html#fixed

Geoscience Australia allows you to find the latitude of your home for free. Go to Map Connect **www.ga.gov.au/mapconnect**

The Bureau of Meteorology's Indigenous Weather Knowledge project aims to record 50,000 years of weather observation and the long term environmental changes by Indigenous Australians.
www.bom.gov.au/iwk

"Autumn" and "spring" are not predictable weather events – half the time they are a war between the advance of the incoming season and the reluctant retreat of the outgoing one

Clockwise from top left: Homes on sites with strong afternoon summer sun need "hats" pulled down over their eyes; In the tropics eaves are useful all year for protection from sun and rain; Windows facing north-west need deep eaves, just like west facing windows; Houses with mixed orientation to the north need eaves with varied overhangs. Photos from Dick Clarke, Envirotecture

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Thermal Mass

Thermal mass is one of the simplest green design principles, and one of the most important, writes Marie Wallin. Luckily it's easy to get right and there are no on-going costs.

WORDS MARIE WALLIN

If you're thinking about designing or renovating to achieve a green home, then you'll need to consider thermal mass. Thermal mass is one of the most important tools in passive solar design – a home that requires minimal active heating and cooling – but it's probably the least understood. Thermal mass stabilises interior temperatures year-round, keeping your house cool through the highs of summer and warm and toasty through winter chills at no on-going cost. But how does it work?

We know that like the doona on our bed, insulation is light and fluffy and contains lots of air pockets to slow down heat loss. Thermal mass, however, is hard and heavy and the perfect complement to insulation. Imagine a boulder that has been sitting in the winter sun all day. Were you to bring it indoors at the end of the day, you would have a gentle heat source that would release its heat energy during the evening and through the night. If the house envelope is well insulated, the energy released would escape the building slowly, thereby keeping the house warmer for longer. If you left this boulder beside a sunny window during the day, it would absorb solar heat and release it at night in the same way. The same principle applies in summer. A boulder left in a cool place all night will gently absorb energy if placed inside a house during a hot summer day, counteracting the house's heat uptake. The boulder would need to be left in the shade and the windows kept closed to maximise the daytime benefit. At night however, when the temperature drops, the windows would be left open to cool the house down, including the thermal mass.

The materials that act as thermal mass in a home are concrete, bricks, sand and stone. Interestingly, water has a very high thermal mass, as it can absorb more energy than a masonry product. However, water is not as effective as thermal mass in building because it releases its energy too quickly, which does not work within the 24 hour cycle. A masonry floor or wall will release its energy over six to ten hours provided it is at least 100mm thick (which means a tile floor on a timber structure will not suffice).

The ideal location of thermal mass is the floor as it is the surface most likely to be hit by winter sun. Heat rises uniformly from a floor, which is another advantage. The second best option is to have thermal mass in either internal or external walls, using double brick with cavity insulation or reverse brick veneer, where the insulation is on the outside. In these situations the house will be kept cool by the external insulation layer during summer; and in winter the heat energy inside the home will stay inside for longer.

It's worth bearing in mind that thermal mass is most effective with solar gain. If the house does not enjoy significant passive solar gains through well-insulated north-facing windows, there can sometimes be excessive thermal mass for winter conditions in cooler climates, as there would be in an unheated stone church for example.

Thermal mass will work better in climatic areas where there is a significant difference between day and night temperatures at all times of the year. In Australia, we can count on it to work everywhere except in sub-tropical areas where the temperatures don't drop enough at night. Thermal mass also needs to be insulated inside the building envelope to work, in the same way you put ice (thermal mass) inside an esky (insulation).

Thermal mass is not easy to retrofit as it belongs to the structure of a house, so it's best to integrate it at the planning stage. Suitable finishes to a concrete slab include polishing, tiling or stone flooring. Insulating materials such as timber flooring, cork or carpet prevent the thermal mass from fully exchanging energy with the indoor environment and are best avoided. Area rugs are acceptable.

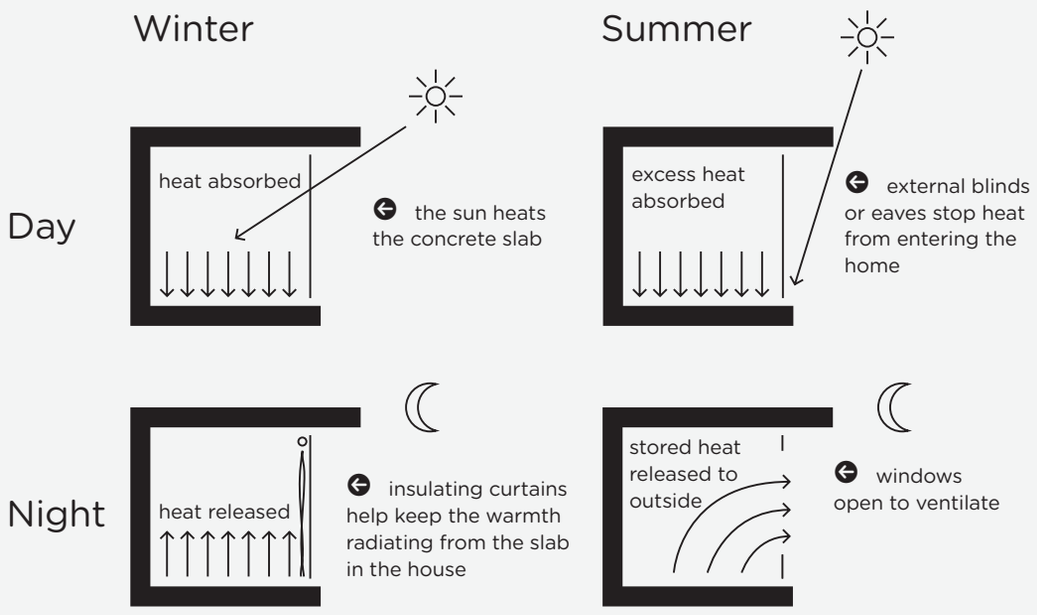
Marie Wallin is the principal of Planet Architecture, a Melbourne-based residential consultancy and design practice specialising in sustainable architecture for new homes, extensions and renovations.
www.planetarchitecture.com.au

See the *Your Home Technical Manual* for more information about passive design and thermal mass: **www.yourhome.gov.au/technical/fs41.html**

Thermal mass stabilises interior temperatures year-round, keeping your house cool through the highs of summer and warm and toasty through winter chills at no on-going cost.

Low winter sun streams through north-facing windows, heating the thermal mass of this polished concrete slab floor. This Castlemaine, Victoria house is profiled in *ReNew* 113. Photo by Nick Stephenson

THERMAL MASS – HOW DOES IT WORK?



Products

CREATING SHADE

Despite the improvements we make to our homes to ensure they're comfortable and energy and water efficient year round, the steaming summer months will highlight any deficiencies. In this summer issue we provide you with a range of easy-to-install solutions to help you through.

01

VERTILUX FULLY ENCLOSED KASSETT

Vertilux's fully enclosed kassett system for roller blinds that we featured in *Sanctuary* 12 is also suitable for external use. Consisting of an enclosed headbox containing the blind and its mechanisms, plus either side channels or guide wires, a kassett blind fitted externally blocks heat before it hits the window glass and stays put in windy conditions. Because the head box and side channels are powder-coated aluminium and the guide wires stainless steel, it performs well even in coastal climates. It can be motorised for easy adjustment and fabrics and components come in a wide range of colours.
www.vertilux.com.au

02

MODWOOD MINI SCREENING BOARDS

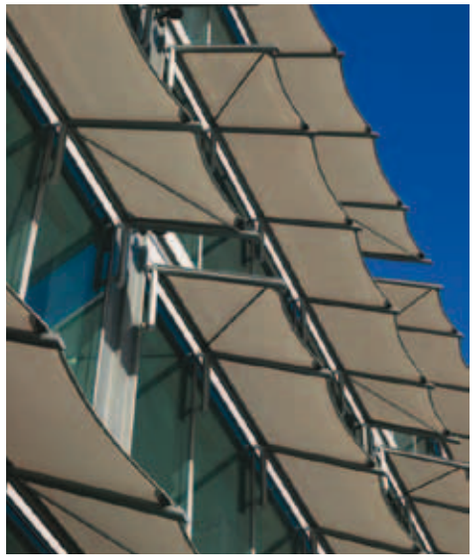
If you're looking for a low-maintenance material for fixed shade or privacy screening try Modwood Mini boards. Specifically designed for screens, the product looks and feels like wood but is actually made from a composite of recycled plastic (from milk containers) and plantation-grown pine dust, a by-product of timber milling. The boards come in a range of colours and don't need to be painted or stained – ever. They are also resistant to termite attack and do not splinter. Modwood is Australian made and owned, and comes with a 10-year residential warranty.
www.modwood.com.au

03

BRAX FOLDING ARM AWNINGS WITH SUN AND WIND SENSOR

Australian-made Brax folding arm awnings provide shade for your windows while maximising your outdoor living space: the cantilever design requires no extra support poles. Taking motorisation to the next level, the awnings are available with a sun sensor that adjusts the shade automatically to help your house achieve optimal passive thermal performance – even when you're not home. An accompanying wind sensor retracts the awning in blustery conditions that might damage it; no more rushing home to deal with it yourself. Brax has showrooms in Albury, NSW and Geelong, VIC, and prices start from around $3100 for a 3m x 1.6m folding arm awning with sun and wind sensor, fully installed. Brax is also a distributor for the Luxaflex range. [Ed note, see p84 for the benefits of operable blinds over fixed eaves.]

www.braxwt.com.au



04

MERMET SATINÉ 5500

Are you looking to shade north-facing windows in summer without sacrificing views? External blinds or awnings made from Mermet's Satiné 5500 fabric may do the job, with their balance of heat and glare protection with a twill weave that maintains your outlook. Made of fibreglass and PVC, the tough fabric is fire-retardant, carries a five-year warranty and is suitable for a range of window treatments; it's also listed on ecospecifier (www.ecospecifier.org). Depending on the colour, blinds and awnings made from Satiné 5500 can block up to 96% of UV rays before they hit your glass, keeping your house cooler. Look for Mermet's new Classic summer range.

www.mermet.com.au

05

S1E ECO-SCREEN

Australian company Centor has a neat new idea for screening large door and window openings from the sun. The S1E Eco-Screen consists of a single or a double solar blind that retracts sideways into its frame and can be left partially closed according to the sun's position. The blind is made from a durable fibreglass and PVC fabric and is available in a range of colours. Choose a lighter colour and your Eco-Screen solar blind can even double as a projection screen for indoor or outdoor viewing. You can also pair it with an insect screen within the same unit. Centor offers a five year limited warranty on its S1E Eco-Screen. POA; contact Centor for your nearest supplier or installer.

www.centor.com.au

CONSERVING WATER

06

MODTANKS

In many ways, increasing urban density is a good thing for our cities' environmental footprints, but as our gardens get smaller our rainwater tanks need to get smarter. Designed to connect together to form one large reservoir, Modtank modules hold nearly 80 litres of water each and can be stacked in all sorts of places standard tanks won't fit: under decks, around windows, even around corners. Their small size makes them easy to assemble yourself – and to reconfigure as your needs change, or even take with you when you move. Modtanks are made in Australia from food-grade, UV-stabilised polyethylene using a blow-mould process that consumes only about half the energy of regular tank production. $65 per module, Modtanks are guaranteed for ten years.
www.modtank.com.au

07

GREY WATER GATOR

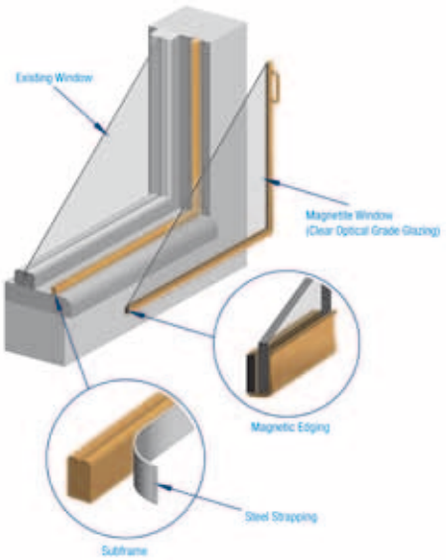
For those of us looking for a laundry greywater solution just a little more sophisticated than a simple hose, the Grey Water Gator provides a portable, quick-to-install option. Your washing water is collected in a cheery purple wheelie bin after going through a two-stage lint filter (there is no further treatment). The 550 watt pump allows you to give your garden a drink when it suits you, using the 20 metre greywater hose provided, or through a drip watering system. All you need for your Gator is a level spot outside the house within reach of your washing machine and a power outlet. Made in Australia, the Grey Water Gator comes with a 12-month guarantee on all components and retails for $495 for a 240 litre unit.
www.greywatergator.com.au

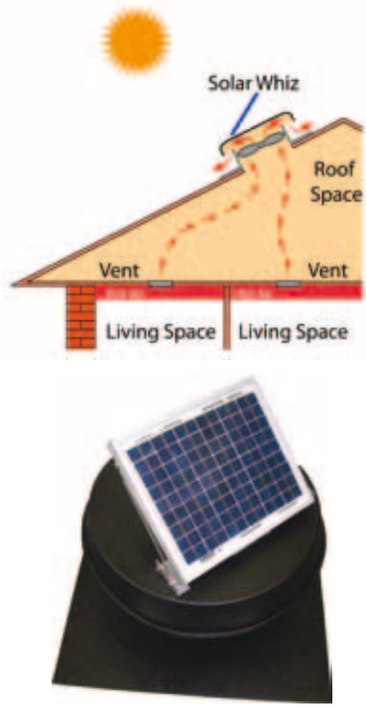
08

AQUAMONITOR

It can be tough to be water-wise when your only hard figures on household water consumption come with your quarterly water bill. The AquaMonitor makes being water-wise easier with direct, real-time information on how much water is being used for the current day and for the previous six days. The display unit collates water flow from sensors on the mains supply and on up to three water tanks, giving an easy insight into how your household is doing with its water use. AquaMonitor can also make managing your water tanks simpler with statistics on water level and inflow, and alarms to let you know when a hose has been left on or when the tank's about to run dry. On the market in late 2010, they cost $249 for a standard unit.
www.aquamonitor.com.au

KEEPING HEAT OUT





09

MAGNETITE

Double-glazed windows have undeniable thermal and acoustic benefits, but if replacing the existing single glazing in your home isn't possible, retrofitting with a secondary pane may still give you big improvements. Magnetite's retrofit double glazing system uses an optical grade acrylic pane held in place inside your window frame using a slim PVC subframe and a continuous, airtight magnetic seal. The air cavity created works in the same way as purpose-built double glazing to improve thermal and acoustic insulation. Window Energy Rating Scheme (WERS) test results show that installing the Magnetite system can improve a window's summer performance by up to 71%. The system is suitable for a range of window frames including timber, aluminium and steel, and the subframe comes in six colours. Magnetite costs $400-$500 per square metre including installation.

www.magnetite.com.au

10

VELUX SOLAR BLINDS

Skylights provide a canny way to get extra light into your home, but integral blinds that let you control that light - and radiant heat - can be vital in summer. Velux's new solar blinds, made to fit their existing range of VS (top-hung, openable) and FS (fixed) skylights, use a built-in solar panel and a wireless wall-mounted keypad to allow you to adjust them to suit the conditions. No wiring is required; the blinds are motorised by the solar battery (which stores enough power for around three days' use in case it's overcast). Solar blinds are currently available in white blockout fabric from $479 for a 550 x 700mm skylight. Solar blinds to fit Velux skylights preceding March 2010 are available by special order; contact Velux for information.

www.velux.com.au

11

SOLAR WHIZ

Get some help with your active cooling this summer. The Solar Whiz is a solar powered heat extraction fan that operates completely off-grid to vent hot air from your roof space, helping to alleviate the heat load on the entire building envelope. With the addition of closable ceiling vents, the system can also remove hot air directly from your living spaces. The Solar Whiz can be fitted with a thermostat, allowing it to be switched off during the cooler months; however, if your ceiling is well-insulated, leaving the system running through winter can help to keep the roof space ventilated and free of moisture, preventing mould and mildew. Designed in Australia by Global Eco & Environmental Solutions, a unit capable of moving 1400 cubic metres of air per hour (suitable for a home of up to 200 square metres) costs $770. A larger unit is also available.

www.ges.com.au

Ask Our Experts

Your design, product and specification questions answered by our expert columnists Dick Clarke and Lance Turner.

Dick is principal of Envirotecture, a sustainable building design firm in Sydney (www.envirotecture.com.au). Lance is the ATA's technical editor and a columnist in Sanctuary*'s sister magazine,* ReNew.

Email Ask the Experts at sanctuary@ata.org.au

Q

I'm planning to build a passive solar house at Dalton, a small town between Yass and Gunning in the NSW Southern Tablelands. I'm just wondering what the optimum width of the eaves should be? — ***Maryanne***

A

Dick — At this latitude (about 34°S) and altitude (over 500m), the south side needs eaves primarily to keep the rain off windows. East and especially west should be as deeply shaded as possible. This question really relates to the north facing glazing, where you need lots of solar gain in winter, but none in summer. One option is to have no eaves at all, and to have a shading device that you can adjust quickly and easily as the need arises. These can take various forms, from upmarket motorised awnings to simple canvas roller blinds. Being able to withstand strong westerly and north-westerly winds will be necessary in your locale. However, if you can't have operable shading, then two things need very careful consideration. One is orientation — you really need your windows to be between 5°W and 15°E of true north. The other is the eave width; the rule of thumb is for eaves to overhang glazing by about 45% of the height from the lower edge of the fascia to the bottom of the glass. If your site is much higher, it can be a little less, and if your orientation is further off north, especially west, it should be more. [Ed note: for more information about eaves see Dick's article on p84]

Q

I'm doing a renovation in Melbourne and I'm not sure whether or not I need slab insulation. I've heard that it's best to have no insulation under a slab to maximise the summer performance of the slab's thermal mass. Is this correct? — ***Michael***

A

Dick — In a nutshell, assuming good solar access to the slab — yes. But this is an area of ongoing research and hot debate, so don't be too surprised if we say no in future. In a well insulated domestic sized building, the surface temperature of a slab on ground will generally range from about 15°C in late winter to 19°C in late summer. You can see that winter is the problem, and there are a number of ways to fix this. Ideally you will have unimpeded solar access to the slab through high performance low-e glazing, in which case the sun will add 5°C or 6°C to the slab, and all will be well. If solar access is limited, however, or the slab is elevated, you should insulate under the slab. If elevated, add thickness to the slab to get the right amount of thermal mass. If solar access is the problem, borrow it from somewhere else on site (usually the roof will get sunlight) and use hydronics to add it to the slab. In either case, if your shading and ventilation are correct, passive cooling will still work fine, although a week of over 40°C will gradually raise the temperature of everything.

Q

My husband and I are in the process of building a house and are using concrete for the bathroom floors. I noticed on page 35 of *Sanctuary* 11 that you refer to a house with this in it. You state that you should make sure that it has a "microtexture finish so it isn't slippery". Could you please let me know what you mean by this? Is there a special non-slip product or finish or method? — ***Katrina***

A

Lance — Microtexture refers to the roughness of a surface on the millimetre scale. Normally, concrete is finished as smoothly as possible, but this makes it slippery when wet. A microtexture finish involves making the concrete more rough, much like the finish on a footpath. This makes it a higher friction and therefore safer surface when the concrete is wet. The degree of roughness of the finish generally depends on the size of the particles in the concrete, such as the sand used in the mix. There are also non-slip surfaces that can be applied to smooth concrete to make it safer, such as polyurethane coatings. Check out the website at: **www.globalsafe.com.au.**

Q

We are building our new 9.1 star house at the moment and I've made all the big decisions so now I'm worrying about silicone! One building professional I know has said "Polyurethane jointing compounds stick better and remain soft for longer than silicone. Everyone has seen the mould growing underneath silicone." But nobody else I've spoken with seems to have any idea. Can you help? — ***Elizabeth***

A

Lance — Yes, for many applications polyurethane can be a better material; silicone tends to let go after a couple of years, allowing mould underneath and requiring resealing. Other options include co-polymer acrylics like Selleys All Clear, which also last longer and are tougher than silicone. However, choosing a sealant is a bit of a trade-off between performance and toxicity. Some products might be more harmful in manufacture but last longer; others may be more benign but require application more regularly, meaning you'll end up using more of the product in the long term. My personal choice is to avoid silicone as it just doesn't perform well enough.

Visit the ATA's forum at www.ata.org.au/forums/ for questions and answers on everything green.

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and get an Australian Conservation Foundation 2011 Wilderness Diary (valued at $21.95) FREE.

See page 87 for details.

Photos (left to right) by Ford Kristo, Stephan Miechel & Sallyanne Cousans.