Australia's leading environmental homes

sanctuary

Sustainable living with style

WIN
AN EDWARDS SOLAR HOT WATER SYSTEM WORTH $7000
see p7 for details

XAVIER RUDD'S SYMPHONY IN STRAW BALE

GREEN BATHROOM RENOVATIONS

BEAUTIFUL RAMMED EARTH HOMES

SOLAR HYDRONIC HEATING
HOUSES WITH STATE-OF-THE-ART SYSTEMS

8 BEAUTIFUL SUSTAINABLE HOMES

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Editorial

Welcome to the second quarterly edition of *Sanctuary*, our second as editors. It's the edition where some of the big changes that you, our readers, have been asking for have been put into effect.

People have been asking for more detail on house features and products. "Who makes that greywater system, and how does it work?" We've obliged by expanding the listings of sustainable features for each house, with photographs and background information on key products.

People have been asking for more costings. We've starting putting prices to projects and products, and we'll be doing more of it in issues to come.

People have been saying they want more practical advice on doing sustainable retrofits and renovations. We've responded with features like "Green bathroom renovations" and "Greening your Victorian-period home", where we interview a bevy of experts and survey numerous green (and not-so-green) products.

People are also wondering when we're going to put our content online. The answer is at www.sanctuarymagazine.org.au. (Selected articles can also be found at www.yourhome.gov.au.)

Of course, many things haven't changed. We're still 100 per cent about environmental houses. Our house profiles are and will remain at the centre of what we do. Our features are still squarely focussed on ideas and inspiration for the sustainable home builder and renovator.

Most importantly we are still – and always will be – published by the Alternative Technology Association (ATA), a not-for-profit organisation which has been going for almost thirty years, whose members strive to lighten their households' environmental footprint through better practice, design and technology.

And we are still supported by the Your Home project, an Australian Government initiative whose suite of publications and tools are an invaluable resource to homebuilders, renovators, architects and designers.

For all our innovations, the thing we're most proud of in this issue is the houses. This issue we profile some absolute beauties. We take particular inspiration from the exquisite Surf Coast straw bale house by Ric Zen which graces our cover, the elegant Mona Vale enviro-home by John Choi, and the budget Castlemaine home by Lifehouse Design, built using reclaimed materials.

Let us know how you enjoy this issue.

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Your Home is a suite of consumer and technical guide materials and tools developed to encourage the design, construction or renovation of homes to be comfortable, healthy and more environmentally sustainable.

Your Home is a joint initiative of the Australian Government and the design and construction industries.

For further information go to www.yourhome.gov.au

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For the home

[1] Living Edge is building a reputation on taking sustainability seriously with many of their stocked brands receiving the Good Environmental Choice Australia (GECA) tick of approval. Their Emeco Nine-O and Navy chair range made from 80 per cent recycled aluminium is designed to last for 150 years. And even when they do give up the ghost they can be recycled again and again. The only negative is that they're made in the US (high embodied energy in transportation).

www.livingedge.com.au
www.emeco.net

[2] The makers of the popular Power-Mate have trumped themselves with a cheaper *and* improved model, the Power-Mate Lite. With this gadget you can read energy use for all your electric appliances. The meter displays energy used, cost per hour, and greenhouse gas production. The Lite model also boasts an intuitive three-button operation and simplified menus. Note that if you want to read energy use for your whole house, you'll need another type of gadget, such as the Wattson or Efergy energy monitors we profile on p10.

$99.95 from the Alternative Technology Association: (03) 9639 1500
www.ata.org.au

[3] Lightly's new dEco-ware range includes floor mats made from recycled Australian cork and rubber in "daffodil" or "daphne" style and a range of heat-resistant biodegradable and recycled cork placemats and coasters. Designed and made in Australia.

www.lightly.com.au

Gollings Photography

[4] Tretford carpets are made from 80 per cent Mongolian goat hair, a by-product of goat farming for the cashmere industry. They come in a variety of colours (including undyed, in the natural colours of the goat), are made from a readily renewable, sustainably farmed resource, and they're non-toxic and extremely durable (there's a lifetime warranty against edge ravel and fraying). Tretford is also available as a tile. From a sustainability point of view carpet tiles can be a good choice because you can replace worn areas as needed without having to replace the whole room (choose carpets where a dye colour match would not be an issue).

www.gibbongroup.com.au

[5] Trent Jansen's Sign Stool 450 stools are made from reused road signs complete with bumps, grazes, stickers, or whatever other evidence they have from their lives by the road. Made in Australia for $363.

www.trentjansen.com

[6] Koskela are very particular about the materials they use in their furniture: leathers can be supplied from tanning facilities that only use organic dyes (and no formaldehyde or chromium); they don't use MDF in any of their products and they use FSC (Forest Stewardship Council) certified plywoods with low urea formaldehyde glues. And all furniture is made in Australia.

www.koskela.com.au


[7]

[7] When winter comes to the cooler states, it's time to turn to the portable line or clothes horse. Gone are the days of spindly white-wired frames bent double with the weight of a woolly jumper. These days the humble indoor line comes with high-tensile, thin-wall steel tubing, steel fasteners and springs and 17 metres of hanging line. Hills' latest offering, the Portable 170, looks particularly good.

www.hills.com.au


[8a]

[8a] If you've ever wanted to monitor how much electricity you consume in your home, you'll want to get a Wattson. It's a stylish, portable, wireless energy monitor that reads in real time your home's energy use, giving you a rating in dollars, watts or coloured lights. When the lights glow blue, you're using less electricity than your home's average; when there's a purple glow you're using the average, and when they're red, you're using more – and it's time to tour the house and switch off appliances. What sets these gadgets apart from their competitors is their ability to be hooked up to a PC so you can download historical data, plus you can connect extra sensors for 3-phase or solar/wind inverters. Available from ausenergy for $295.

www.ausenergy.com.au

[8b] Another energy monitor on the market is the Efergy Energy Meter. Unlike the Wattson, this model doesn't allow you to connect your photovoltaic panels (if you have them) or download your data to a computer, but if you just want a simple model this could be the one for you. Retails for $99.98.

www.efergy.com.au


[8b]

[9] There's nothing like throwing open the doors at the end of a hot day, but along with the cooling breezes can come swarms of mozzies ready to feast. That's where Centor Architectural's S1 range of retractable insect screens for large doors and windows come in. A single span screen can be up to 3.05 metres high and 7.4 metres wide, and they retract invisibly into the door frame. Centor also makes a range of screens, the ES2, which work with bi-fold doors.

www.centor.com.au


[9]


[9]

Earl Carter

Symphony in straw bale

Xavier Rudd's Surf Coast haven

By Verity Campbell

> "Xavier and I can be on the road for up to six months a year. We wanted our home to be an antidote to the frenetic pace of touring"

Earl Carter

The house is clad with silvertop ash, a bushfire resistant timber

We don't do things by halves," laughs Marci Lutken-Rudd when asked about her dream home. "We wanted a home that connects us to the earth, a home that confirms our passion for and commitment to the environment." Marci and her husband, singer-songwriter and didgeridoo virtuoso Xavier Rudd, chose to build **a completely autonomous home complete with an off-the-grid solar power system, 40,000 litres of water storage, straw bale walls, and solar hydronic water and space heating.**

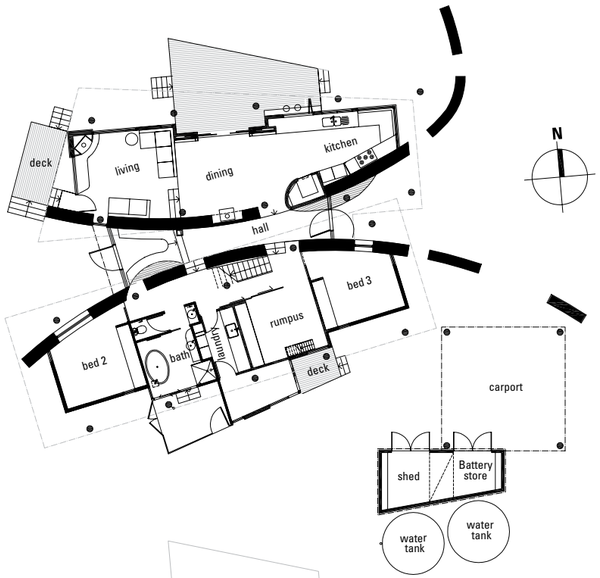
Although less than 100 kilometres from Melbourne, their five acres of bush along the Surf Coast is a world away from the hustle and bustle of city life. "Xavier and I can be on the road for up to six months a year. We wanted our home to be an antidote to the frenetic pace of touring, and a place where we could raise our children with a working knowledge of sustainability. One of our son's jobs is to go through the house each night turning off appliances at the wall."

Xavier had a personal history with the area and the site in particular. As a boy he'd grown up in the area and with his family he'd camped by the creek near the spot where they would eventually build their home. "The house is built on Wathaurong

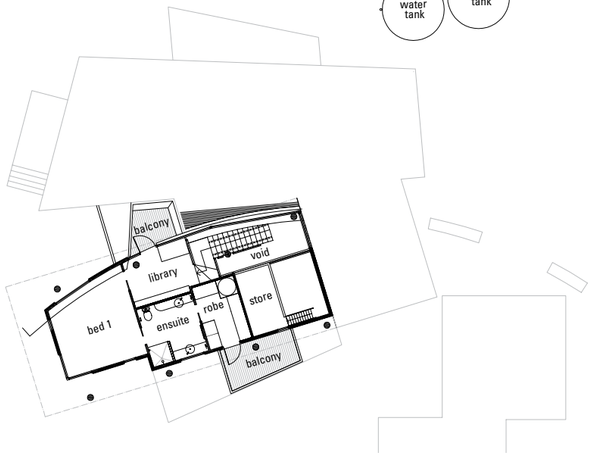
Sharyn Cairns

Sharyn Cairns

Ground level



Upper level



Country. There's a creek bed meeting place which we felt had a strong energy about it. We camped there as a family before the house was built, so we asked the architect to design the house around that particular area."

They also wanted to site their home with as little impact as possible on the forest of tall, stringy barked Eucalyptus obliqua (messmate); luckily they found a spot where a tree had recently fallen, opening up northern light, and through which a wallaby track ran.

When Zen Architects came on board they found clients with a sound idea of what they wanted. Xavier and Marci had travelled widely and were well acquainted with natural building vernacular; they were also sure they wanted to used reclaimed materials in the home. **Xavier sourced posts from a local pier, complete with barnacles. So Ric Zen designed the home around the posts and incorporated the wallaby track into the central axis of the building, so that this well-worn animal path would become an integral part of the building and be maintained as the access path to the site.**

Along with the pier posts, the design also incorporates reclaimed timbers for the stairs, rails and bench tops. Together these elements create a

Earl Carter

> “The eight solar collectors help fuel the hydronic heating system during the day”

Earl Carter

The home’s 3.3kW photovoltaic system is completely independent from the grid

found-object aesthetic in the home that celebrates the provenance of each item, instead of trying to hide it.

Hand rendered, non-load-bearing straw bale is used in the central core of the building to accentuate the thickness of the wall and highlight its beauty. Straw bale, says Marci, was chosen because of “its excellent year-round insulating properties and its earth finish; it gives a beautiful Moroccan feel”.

The home is powered by an off-the-grid (stand alone) power system. Unlike grid-connected systems, which feed electricity generated back into the grid during the day but draw from the grid at night, stand-alone systems store excess electricity produced during the day into batteries, which supply the house at night or when it is overcast.

In addition to the home’s photovoltaic system, it has a hydronic heating system. **While conventional hydronic heating systems are fuelled entirely by natural gas or electricity, this system uses a combination of solar power and wood fuel**, sourced from fallen trees in the surrounding forest, with an instantaneous gas boost available as a backup only. The eight solar collectors on the roof fuel the system during the day. During the evening it’s boosted by the wood-fired combustion stove which heats the living room as well as providing a source for cooking meals and a warm cuppa. Heat from the system warms the concrete slab in the living and dining rooms and kitchen downstairs, and runs through wall panels in the bedrooms and bathrooms upstairs.

For active cooling there are ceiling fans, while passive cooling is augmented by double glazing throughout, insulated walls, the superb insulating effects of the straw bale, and rooms designed to

Earl Carter

Custom-made curved bed bases lend the home an organic aesthetic, and they’re really comfy to sleep on!

Houses of straw

Straw has been used as a building material for centuries. It’s an agricultural waste product, so using straw as a building material saves it from being burnt, which would release carbon dioxide. It’s a safe and biodegradable material, low in embodied energy and in cost, and is surprisingly resistant to decay and vermin. Being comprised mostly of air, straw bale is an excellent insulator and low in thermal mass, though this can be changed by the thickness and composition of the render.

While the material costs of straw bale are low, labour costs can be high. Brian Hodge of Anvill Straw Bale Building Consultants says, “While we advise owner-builders to allow $650 per square metre we have seen cases where owner builders have been able to reduce this cost to as low as $350 per square metre. To subcontract out the work we would expect it to cost around $1000 per square metre, which is a bit higher than a brick veneer home.”

Earl Carter

If you’d like to build with straw bale but you want to keep costs down, consider being judicious with its use – carefully chosen feature walls could give you the maximum impact of straw’s insulating and aesthetic qualities while keeping cost to a minimum.

More information:

www.ausbale.org

Building your Straw Bale Home, from foundations to the roof, by Brian Hodge (CSIRO Publishing)

Earl Carter

When the exterior door in this upper-floor room is opened, hot air rises from the ground floor through the stair void and is expelled

Earl Carter

capture southerly breezes. **The house has also been designed to encourage convective air movement via a "thermal chimney".** The "chimney" is essentially the stair void joining the ground floor with the upper. When the exterior door in the library at the top of the void is opened, hot air is expelled, drawing cool air up from the lower floor. This system works particularly well for purging hot air at night. In a sweltering heat wave when temperatures tipped 46 degrees, Marci says "We were amazed and completely delighted. Despite the conditions outside, the house remained comfortable throughout."

Water is collected in three rainwater tanks, two 15,000 litre plus one 10,000 litre reserved for fire fighting. All grey and blackwater is treated in a worm farm waste system, which is essentially a biodynamic mix of worms, mulch and other ingredients treating the liquid and organic matter (even meat and citrus) in a chamber. Xavier and Marci just open the lid to the chamber, sited on the deck outside the kitchen, and drop in their kitchen waste.

Care was taken not only to limit the impact of the house on its environment, but also to ensure the longevity of the home and its furnishings.

Earl Carter

The living room will always be a living room, so the couple had the furnishings built in. Organic curved sofa benches and beds with hidden storage cupboards underneath reduce the need to replace furniture, instead offering fabric and cushion renewal opportunities over time.

Marci is an artist and draws inspiration from her home and its "peaceful and quiet" environment. She paints outside on the ground using the natural palette she finds in the bush around the house – bark, seed pods, boiled down sap from the black wattle. Xavier makes her frames from fallen trees on the property.

"On chilly winter nights we join together in the lounge entranced by the open fire. I open a bottle of red wine for Xavier and myself, while the kids enjoy a hot chocolate slow-cooked on the combustion stove. Finojet grabs some djembe drums, Joaquin a harmonica, Xavier a guitar, and we play and sing for hours...mesmerized by the beauty around us."

Earl Carter

Surf Coast residence

Designer **Riccardo Zen, Zen Architects**
www.zenarchitects.com
Builder Roy Kahle
Straw bale John Bushby
Location Surf Coast, Victoria
Project type New home

Photography Earl Carter and Sharyn Cairns


Earl Carter

Sustainable features

HOT WATER SYSTEM

- 400L solar hot water connected to hydronic heating system

RENEWABLE ENERGY

- Stand-alone power system, designed and installed by the Environment Shop (www.environmentshop.com.au)
- Selectronic off-grid sine wave power inverter (6kW 48volt)
- 24 Concorde Lifeline sealed AGM (absorbed glass mat) batteries (1074 amp-hours)
- Two Morningstar regulators
- 20 x 165w BP Solar photovoltaic panels: 3.3kW array
- Back up generator: biodiesel Kubota

WATER SAVING


Earl Carter

- All taps and shower outlets made by hand to Wels 4 star rating
- 2 x 15,000L rainwater tanks; 10,000L tank for fire fighting
- Excess storm water channelled into a water course at the western edge of the house
- Caroma 3/6L toilets

PASSIVE HEATING & COOLING

- Timber walls: R2.5 CSR Rockwool and Air-cell Retroshield
- Roofs: R3.5 CSR Rockwool and Air-cell Retroshield
- Concrete slab edges insulated with 25mm extruded Foamular polystyrene

ACTIVE HEATING & COOLING


Earl Carter

- Hydronic system consisting of a flat panel solar collector (8 x panels) and a 20kW wood-fired stove boiler feeding a 400L domestic hot water system. Hot water heats coils in a concrete floor slab and wall panels. Occasionally boosted by gas.

  Wall panels are a good choice when you want instantaneous heat in a room; concrete infloor coils are a better choice for more sustained heating, but they take longer to warm up and cool down. Systems start at $25,000.

  Wise Living: www.wiseliving.com.au

BUILDING MATERIALS


Earl Carter

- Reclaimed timber from the burnt-down Yarra Street Pier (Geelong)
- Recycled timber for all bench tops and stairs
- Local straw bales on brick base and concrete slab, tied and reinforced with wire and reinforced at openings with plywood bucks. Finish in a natural lime based render. By John Bushby (0427 836 178)
- Vertical weatherboards in silvertop ash by Radial Timber Supplies

WINDOWS & GLAZING

- Bushfire-resistant toughened glass outer layer with minimum 6mm air gap by Cedar Windows (www.cedarwindowsgeelong.com.au)

LIGHTING

- LED lighting throughout except for pendant lights which are compact fluorescent

PAINTS, FINISHES & FLOOR COVERINGS

- Concrete slab finished with Keim's 'Granital' mineral silicate paint finish and Agar's First Base sealer for concrete, terrazzo or timber floors.

OTHER SUSTAINABLE FEATURES

- Worm farm waste system: 3000L chamber feeding a sand filter and transpiration area. System treats all sewage, grey water and organic garbage generated onsite. A&A worm farm waste systems (www.wormfarm.com.au)
- Bushfire-resistant kiln dried Brush Box windows
- Granitgard to all penetrations and to decking/slab edges
- All framing in Termipine
- Plantings: indigenous endemic species by Graeme Stockton of Geelong Indigenous Nurseries

Select salvage

A Melbourne demolition is revived in rural Victoria

By Fiona Negrin

Two homes share the low-maintenance garden, watered by a 7100L water tank

Try to picture a house built on a shoestring budget using mostly second-hand materials sourced from a demolition. You're probably conjuring a rambling structure with a hodgepodge of materials. *Au contraire*. This professionally designed house is built largely from reclaimed materials, but it cuts no corners in terms of style and comfort.

Kir Larwill and her brother Sid are close. Sid and his family were looking to buy a property in Castlemaine, one of Victoria's former gold mining towns. Kir was also looking for a new home, so Sid and Kir decided that they'd buy a block with enough space to build a modest house down the back for Kir and her young son. The family found a site within walking distance of the town centre, and Sid took on the role of project managing the construction of Kir's place.

Given Kir's restricted budget, she was planning to buy a kit house until her friends Kim and Jeremy offered the materials from their partial home demolition in Melbourne. (*Sanctuary* 3 profiled their extension, by Zen Architects.)

The Larwills contacted Robyn Gibson and Paul Hassall of Castlemaine firm Lifehouse Design. Robyn and Paul welcomed Kir's brief to design a house to her budget using reclaimed materials.

Reduce landfill and reuse

Over a third of all waste in Australia that ends up in landfill is from the construction and demolition industries, and over two thirds of this is clean material – bricks, concrete and timber – that could be reused. If you're undertaking a renovation or building demolition and you'd like to ensure the materials are put to good use, there are a number of things you can do.

One of the first things you need to do is to create an inventory of all the materials available to be reclaimed, including number, size and condition. You need to ensure that the builder and/or demolition contractor you hire is sympathetic to your goals, is willing to work to this inventory, and that you discuss and agree upon any extra labour costs that you may incur by using reclaimed materials.

Get in contact with your local second-hand or reclaimed building materials company to sell the materials. Alternatively you could put the materials up for free on a website such as Freecycle Today – Australian Recyclers Community (www.freecycle.org.au), Freecycle (www.freecycle.org), Freecycle – Melbourne and Australia (http://searchenginez.com.au/freecycle.html) or sell them on eBay.

Even the kitchen cabinets and cubby holes were reclaimed from the demolition

"We'd previously designed houses where people wanted to use recycled materials, but not as extensively as this," says Robyn. "From a design point of view, 'reduce, re-use, recycle' is the first priority, as far as being able to reduce the impact on the environment and energy use."

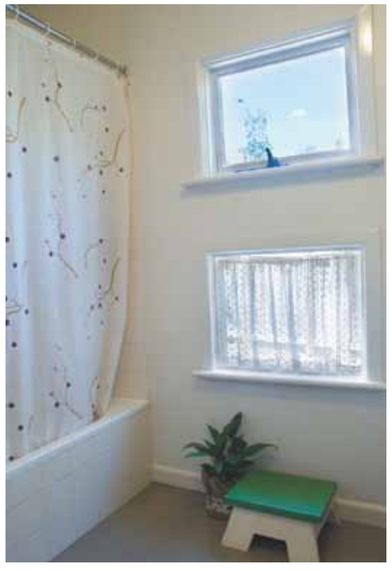
Kir's friends Kim and Jeremy not only gave the materials for free, but also supplied Lifehouse with a detailed inventory of all the materials their demolition was making available. "We saved a lot of time and money by integrating the ideas and reclaimed materials up front, in the design stage," Robyn remarks.

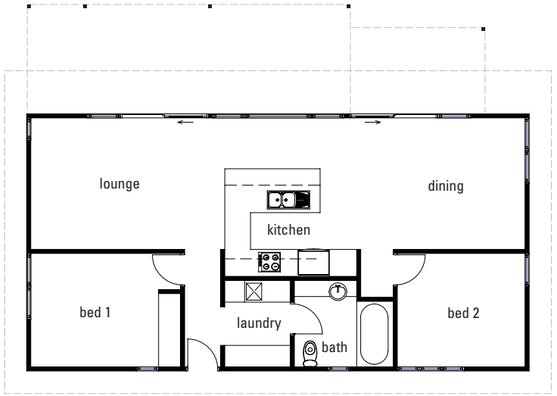
She recalls the process of designing the house. "I looked at the site, and the inventory of items. **We wanted to include passive solar principles and it was easy to integrate this because the site has a great northern aspect.** I looked at Kir's sketches of a rough floor plan, and we played around to see where the windows would fit well, and how they related to the proportion of each room."

Other parts of the house that were reclaimed from Kim and Jeremy's place include the kitchen cabinets; the laundry cupboards, bench and trough; the toilet, bath and vanity cabinet in the bathroom; the built-in robes in the master bedroom; the office

> "Kir is a recycler at heart, and takes pleasure in giving new life to old objects"

Recycled mirror, wall cabinet, bath, toilet, sink and even the windows. This bathroom makes the most of a limited budget





> All agree that using second-hand materials saved a lot of money; Sid's 'back of the envelope' sums suggest as much as $40,000

desk; the roll-up blinds; and the pergola beams in the garden, which had been used as internal beams in their former lodging. Tapware throughout the house is recycled too.

Walls and ceilings are made from new plasterboard, with new insulation. The floor is a new concrete slab.

Kir is a recycler at heart, and takes pleasure in giving new life to old objects. The door handles and light fittings are from op shops, the kitchen chairs and sink came from the tip, the gas heater came from an old school, and the kitchen stove was bought through the *Trading Post*. Robyn comments, **"Kir's aesthetic is really about collectables, so it works well with the house. For us it was a fantastic design challenge to incorporate these recycled elements into something retro, simple and clean, but not a pastiche. We wanted it to actually *look* designed."**

Kir and Sid agree that this has been the outcome. Kir says of her home, "It's gorgeous! When I sit here at night, I just look at it and think, how lovely." Sid concurs. "It was terrific to work with designers willing not only to give it a go, but to make it into something beautiful."

Sid is emphatic that hiring a willing builder is key. "If you're not doing the actual building work yourself, you need a builder who is keen to work with the idea of building a home out of a mixture of new and second-hand materials. We had a great builder who took pride in the careful re-use of the materials we provided." Robyn adds that this was also true of the builders on the Melbourne demolition site, who " were willing to be gentle with delicate materials, who were glad these materials were being salvaged."

The time frame of construction (excluding design process and planning permission) was eight months, and the cost of building the house (excluding planning approvals, underground works, laying the concrete foundation and landscaping) was $72,000. All agree that using second-hand materials saved a lot of money; Sid's "back of the envelope" sums suggest as much as $40,000.

The predominant use of recycled materials means the house has minimal embodied energy (that's the energy expended to make a product and bring it to the end user). Operationally it's also low-energy. There is no airconditioning, and cooling is achieved through cross-flow ventilation and ceiling fans in the living area and two bedrooms. Kir has hung some sail cloth and is establishing grapevines

Beautiful and light, this home shows what can be achieved on a minimal budget

on the pergola outside the north-facing windows to give shade in summer. In winter, the combination of a concrete slab and wall insulation retains the day's heat and there's a gas heater for back up. The garden, shared with Sid's family, is planted with vegetables, natives and succulents and is watered by a rainwater tank.

Kir is a painter, and her pleasure in colour and texture is evident in every room. Piles of vintage fabrics are stacked in wooden cupboards in the living area; vibrant roses from the garden spill out of a jug on the kitchen table; and colourful biscuit tins and handmade pottery line the kitchen cabinets. Kir smiles, "This kitchen's quite familiar from the years I've been in Kim and Jeremy's kitchen. I can envisage how those kitchen cubby holes looked when they were full of their crockery. There's a lovely thing in re-using recycled materials. You get that warm feeling that people have been there before, and things have been touched by others... whether you knew them or not."

Castlemaine residence

Designer **Lifehouse Design** www.lifehousedesign.com.au
Builder Brent Heath
Location Castlemaine, Victoria
Project type New building from recycled materials
Cost $72,000 (building only)

Photography Rachel Pilgrim, Well Earth Studios

Sustainable features

HOT WATER SYSTEM

- **270L Quantum heat pump unit**
  www.quantumenergy.com.au
  from $3,410

  How it works: Heat pump water heating systems work like a refrigerator in reverse. They are an efficient cost-effective system and a good choice if you have limited solar access. You can put your heat pump system on a timer to run during off-peak periods so it will be cheaper to run.

RENEWABLE ENERGY

- GreenPower

WATER SAVING

- 7100L Polymaster PVC tank

PASSIVE HEATING & COOLING

- 100mm thick concrete floor slab for thermal mass
- Autex Greenstuf 100% polyester R1.7 insulation batts, plus Sisalation in walls; Greenstuf 100% polyester R3.0 batts, plus Sisalation in ceiling

ACTIVE HEATING & COOLING

- Multi-speed, reversible ceiling fans in bedrooms and living areas
- Second-hand gas space heater (from local school) in living area
- Polished concrete slab floor for thermal mass

BUILDING MATERIALS

- Plantation pine frame, including some elements of second-hand timbers (beams etc)
- Carter Holt Harvey Shadowclad structural plywood

WINDOWS & GLAZING

- 90% second-hand windows. New windows with pine frames

LIGHTING

- All fittings second-hand, with compact fluorescent globes fitted

PAINTS, FINISHES & FLOOR COVERINGS

- Concrete slab finished with Keim's 'Granital' mineral silicate paint finish and Agar's First Base sealer for concrete, terrazzo or timber floors

OTHER SUSTAINABLE FEATURES

- All doors second hand, including flywire screen from local tip
- Second-hand cupboards, appliances and hand sink in kitchen (new Laminex benchtop)
- Second-hand bath, handbasin, toilet and vanity unit (re-built) in bathroom
- Second-hand door handles, cupboard handles, taps and blinds to windows
- Second-hand beams in pergola
- Landscaping to communal garden – drought-tolerant succulents, native and exotic species; vegetables
- Second-hand furniture throughout, except new couch

- **Recycled plastic table** from Ausplaztik, Mildura
  www.ausplaztik.com.au, from $806

  Ausplaztik recycles the plastic grape vine covers used around Mildura into a range of garden tables available in green, terracotta and charcoal.

> **“The stunning rammed earth wall that runs along the southern entry side of the home utilises the dramatic red dirt in the area”**

Think local, act global

Native plantings and local building materials are the keys to this sustainable house

by Danielle Dunsmore

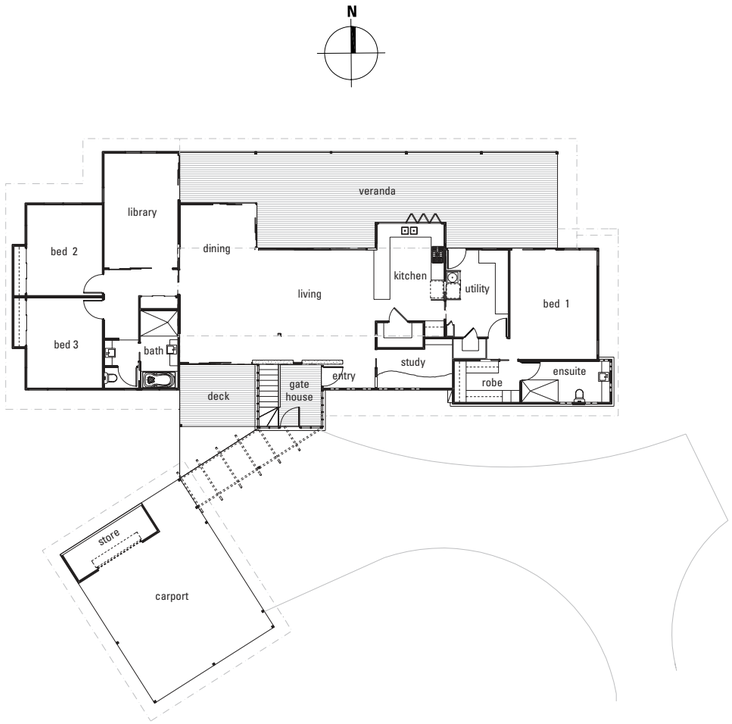
In little Woombye (pop 2094) on the Sunshine Coast hinterland, Queenslanders Norm and Betty Morwood concluded their search for the perfect site for their sustainable rural home. Ticking all the Morwoods' boxes, it faces north, is on the top of a hill and is only a 10-minute walk to a train station (and the pub).

Designed by Brisbane architect Neville Kurth of Sustainable Buildings, and constructed by the Morwoods' builder son Tony, the Morwoods' home is funky and modern with an angular roof and minimalist colours. It's a home you might pass and think, "that looks pretty cool". But this house is a lot more than just eye candy.

Neville's design, over a single level, is perched in the elbow of a slope that was once part of a pineapple farm and falls away to a creek and small forest at the bottom of the hill. The home is wide along the slope, but only really one room deep. Almost the entire home is open to indirect sunlight and fabulous views of trees and rolling hills.

On entering the house you are immediately struck by the fabulous views. In only a few steps you cross the living area and are on the huge veranda that runs along almost the entire length of the house. Open to the living area and kitchen,

> “Norm made it his policy to buy locally whenever possible for the building products”



High louvred windows on the north side allow in the winter sun, while picture windows and folding doors open onto the deck and stunning views

the line between inside and out is a fuzzy one. The ground slopes away underneath and you have that wonderful sensation of being suspended in mid air.

Sections of Vergola louvres run along the veranda roof, for the dual purpose of catching breezes and allowing in sunlight. Weather sensitive, they close at the first hint of wet weather. The Morwoods say they virtually live out here.

In hindsight, Norm would have staggered the line of Vergolas to allow the Queensland winter sun on one part of the veranda instead of all being directed inside the house. Note to readers: if you can wait a full year before building, do it! Spend time on site during the different seasons.

Inside, the main living room and kitchen open to the veranda, with the couple's private areas – bedroom, laundry/crafts room, bathroom and office – all to one side of the house. A suite of spare bedrooms and a bathroom lies at the other end. This section can be locked up and forgotten about, using little or no energy during its down time.

The home runs off a large solar photovoltaic system using amorphous panels. Low-energy compact fluorescent and LED lights were installed, and with only one fridge, no airconditioning and minimal heating for winter, the home's operational carbon footprint is virtually nil.

Giant, semi-submerged rainwater tanks feed the house and the garden. **Sewerage is taken care of on site with a Biolytix system – a process that acts as a giant worm farm (which means the Morwoods can use an insinkerator as well) and creates fertiliser for the garden.**

And the garden promises to be every bit as stunning as the house.

In his previous life as a mining company engineer, Norm was in charge of rehabilitating mining sites, as well as advising mining companies in countries such as Indonesia and the Philippines on practices

Know your solar panel

Until a decade or so ago, amorphous (aka thin film) solar panels were lumbering giants, dwarfing their crystalline counterparts. They had an efficiency of around four per cent, so were large for their energy output. (Lower efficiency just means that a panel of a particular capacity is larger, not that it produces less energy than a higher efficiency panel of the same rating.) Then Uni-Solar pushed the efficiency to around eight or nine per cent, making for smaller panels. Other brands like Kaneka and Schott Solar followed suit.

The main advantage of amorphous panels is that they use about one per cent of the silicon that crystalline panels do, so their embodied energy is a lot less. They also perform better in hot conditions, partial shade and overcast conditions.

Many manufacturers are focusing on amorphous panels now due to the lower cost and simpler methods of manufacturing.

Vergola louvres run along the veranda roof, catching breezes and controlling sunlight

> “Note to readers: if you can wait a full year before building, do it! Spend time on site during the different seasons”

Smaller openable windows on the south side minimise thermal loss while still permitting cross ventilation

to minimise the environmental effects of mining. So it comes as no surprise that on his own patch of dirt he has plans for a rainforest – “The One Acre Wood”.

Norm’s plantings – much of it bought as tube stock – include bunya and hoop pines, six varieties of banksia, five of callistemon and nine of eucalypts. There’s also native frangipani, quinine bush, native guava and sarsaparilla, some peanut trees, a river cherry and a Wollemi pine. Just to name a few of the approximately 100 local native species planted so far.

Not content to stop with native plantings, Norm made it his policy to buy locally whenever possible for the building products as well – meaning less transport as well as generating income for local services and tradespeople.

The stunning rammed earth wall that runs along the southern entry side of the home was built by Rammed Earth Constructions and utilises the dramatic red dirt in the area. Norm secured a pile of the stuff from nearby roadworks (with surplus going to the animal hospital at nearby Australia Zoo). They also included in the mix some soil excavated from under the home.

Grasscrete grass/ concrete hybrid. Limits runoff and makes for a cooler load-bearing surface

The upper hillside wall made of rammed earth doubles as an aesthetic and a practical feature. Winter sun comes through high louvred windows on the northern side and strikes the rammed earth which acts as a heat sink, releasing its warmth at night. In summer the wall is shaded, helping to keep it – and the house – cool.

Considering the Sunshine Coast hinterland is a bushfire prone area, the fire resistance of rammed earth serves another vital function.

As the hill slopes away underneath the home, some steel reinforcing was an engineering requirement, but otherwise the building has a timber frame made from locally sourced Cypress pine. While termites are of a concern in Queensland, keeping the home and especially its structural base well ventilated helps deter pests, and Cypress is not on the termites' favoured lunch list.

Norm researched his timber, a confusing process by any standards, to ascertain which timber had the best environmental properties, and decided that using products as close to home, sustainably grown, were the key elements.

His only concession to importation was the desk in his office and the timber used in the windows and doors – all a New Guinea Rosewood from a sustainable Greenpeace-endorsed operation in the Solomon Islands.

Woombye residence

Designer **Neville Kurth, Sustainable Buildings**
www.sustainablebuildings.com.au
Builder Tony Morwood
Rammed Earth Rammed Earth Constructions
Location Woombye, QLD
Project type New building

Photography Rix Ryan Photography

Sustainable features

HOT WATER SYSTEM

- 300L Solarhart solar hot water system

RENEWABLE ENERGY

- 2.5 kW amorphous Uni-Solar solar power system connected to grid. Designed to produce excess to current requirements to allow for future needs

WATER SAVING

- Land contoured to retain rainfall and excess roof runoff after collection in tanks
- 2 x Nylex Zone 3, 22,700L rainwater tanks (45,400 litres total) under house with pump to supply all outlets
- 2m-long Rainharvesting 300mm diameter stand-mounted first flush devices on tank inflow
- Sankey Australia "Smartflo" gutters with integral leaf exclusion
- Biolytix sewerage and greywater treatment system providing water and nutrients to garden
- All taps RAM Park Pin Lever ¼-turn arm/wrist operated for cleanliness and ease of use. No mixer taps to remove accidental use of hot water
- Toilets 5-star 4.5/3 litre flush systems – Caroma Profile suite to workshop, Imperialware Lucerne back to wall EVO suites for ensuite.
- Grasscrete grass-concrete hybrid for driveway near house to reduce runoff and provide a cool surface near the house (www.enviroconcrete.com.au)

PASSIVE HEATING & COOLING

- Openable Vergola roof sections on north veranda to allow sun entry or ventilation as required (www.vergola.com)
- Oriented with living areas true north. Sun in kitchen/living in morning/winter
- House mostly only one room deep to minimise dark areas
- High south windows to catch SE breeze when desired
- R2 Glasswool batts and Green Insulation Reflecta Guard insulation under roof. Green Insulation Reflecta Shield to walls. R2 Acoustitherm glasswool batts between floors and in some internal partition walls
- Rammed earth heatsink wall in living room
- Openable clerestory windows provide winter sun to rear of house and heat rammed earth wall. Also provide summer convection ventilation when no breeze

ACTIVE HEATING & COOLING

- Hunter Pacific ceiling fans – 2 x Concept and 3 x Typhoon in sleeping and work areas
- Fridge separately ventilated by a vent in the floor under the rear of the fridge

BUILDING MATERIALS

- Rammed earth heat sink wall in living room by Rammed Earth Constructions
- Cypress pine naturally termite resistant timber as most of the frame
- Cladding a mix of Hardie's Linea cement-based weatherboard (long lasting and low maintenance) and Carter Holt Harvey Shadowclad Ecoply groove preprimed with Bluescope Custom Orb sheeting
- Kitchen and laundry floors are cork tile for soft feel and low environment impact
- Timber framed windows of New Guinea Rosewood sourced from The Woodage, certified by Greenpeace as sustainably harvested

WINDOWS & GLAZING

- Openable clerestory window on upper north wall
- Fully opening shaded windows on north. Louvre windows where appropriate for ventilation
- Windows exposed to occasional sun are Viridian Comfortsave or Comfortplus clear glass

LIGHTING

- All lighting is low energy with a mix of compact fluorescent and LED lights

PAINTS, FINISHES & FLOOR COVERINGS

- Living room floor finished with Feast Watson China Wood Oil, a product that contains tung oil but comes without the high maintenance

WASTE DISPOSAL

- All waste from construction segregated and disposed of sustainably – recycled and reused
- Insinkerator (ISE) model 45 for onsite disposal of biodegradable rubbish not suitable for mulching through Biolytix system

OTHER SUSTAINABLE FEATURES

- Single-level house and carport for ease of access for persons of all ages and abilities
- Limited and low door sills for wheelchair access
- Small LG 9485SA Solardom Light Wave convection microwave oven for cooking small meals efficiently
- Native plantings to garden

Rammed earth

Building from the ground up

Unique Earth

As arcane terms such as thermal mass and passive solar design creep into the mainstream, so rammed earth is gaining in profile and popularity.

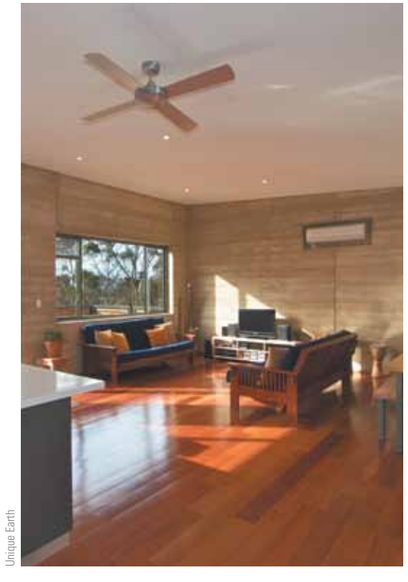
Not to be confused with mud brick, rammed earth, or something like it, has been practised since neolithic times. But modern rammed earth buildings have very little in common with their traditional forebears.

Today's rammed earth is a precisely controlled mixture of gravel, clay, sand, cement, and sometimes lime or waterproofing additives. The contents are carefully proportioned and mixed, and then machine-compacted in removable formwork to yield a stone-like wall that is massive, water resistant, load bearing and long lasting.

One of the attractions of rammed earth is its low embodied energy (another one of those arcane terms). Most of the energy used in rammed earth is in quarrying and transportation. There is a slim possibility materials can be quarried on site, but generally they will have to be trucked in.

Though you can always tell a rammed earth wall, no two are ever the same. The appearance of rammed earth is a function of its materials and of the ramming process. Most walls are horizontally stratified, a result of ramming the materials layer by layer. Colour and texture can be controlled during the ramming process, and features such as niches, embedded stones and leaves can be added.

Being a niche product, rammed earth sells at a premium over conventional building materials. **"Generally speaking, I find that rammed earth is about 20 per cent more expensive than conventional brick veneer,"** says Andy Powell of Tasmanian company Unique Earth. But the highly customised qualities of rammed earth are what attract people to it. Stephen Dobson of Perth's Ramtec reports: "Most rammed earth homes are custom designed. They are rarely on-sold but when they are, people comment that the number of clients is fewer but their enthusiasm is higher. Commonly they are sold at a high premium over the construction cost."



Unique Earth

Rammed earth will give you a thermal lag of about 12 hours – perfect for levelling out day and night

Rammed earth has a number of practical advantages. **Tests by CSIRO have given it a four-hour fire resistance rating, which is very favourable.** Rammed earth is also highly durable and moisture resistant. While you need to prevent continued exposure to water at the top and bottom of walls – just as with clay brick – most Australian rammed earth walls do not require additional waterproofing. Which is just as well, because the breathability, non-toxicity and naturalness of rammed earth are some of its main attractions.

Unique Earth

Mass, beautiful mass

As any aficionado will tell you, rammed earth has mass. It is an excellent sound barrier which won't give you harsh echoes. **It is particularly renowned for its thermal mass, which is its ability to store heat then release it hours later.**

When there's a big difference between outside and inside temperatures, and daytime and nighttime temperatures, thermal mass can give you heat when you want it and store it when you don't. It's called thermal lag, and rammed earth will give you a thermal lag of about 12 hours. Perfect for levelling out day and night. But beware, to get the best out of rammed earth you have to know how to build with it. Poorly installed, it will radiate heat all night during summer and absorb the heat you produce at night in winter.

Rammed Earth Constructions

The mass/insulation paradox

Materials with high thermal mass are not good insulators – they don't stop heat, they just slow its flow. And that is the main drawback of rammed earth. Even though it has low embodied energy and excellent thermal mass, **its R value – the measure of its insulating qualities, crucial for a home's energy rating – is low.**

But, retort rammed earth builders, the problem is not the material, it's how you use it. With appropriate passive solar design (and in some cases the addition of insulation within the thickness of the wall) rammed earth can achieve comfort conditions in every one of Australia's climate zones.

So don't let a narrow focus on R values put you off. Coupled with appropriate design, rammed earth can be a powerful material for increasing the comfort and liveability of your home. Not to mention its beauty and uniqueness.

How much?

For a vertical square metre of rammed earth with 30cm thickness, the usual cost is $250 to $300. The more complicated the job, the more it will cost.

For more information

Your Home
www.yourhome.gov.au

Murchison Rammed Earth
www.murchisonrammedearth.com.au

Rammed Earth Constructions
www.rammedearthconstructions.com.au

Rammed Earth Tasmania
www.rammedearthtas.com

Ramtec
www.ramtec.com.au

Unique Earth
www.uniqueearth.com.au

In this issue we feature two houses with rammed earth, one in Queensland and the other in Tasmania. See p32 and p42.

Warmed by the sun

A rammed earth beauty in Tasmania's gorgeous south

By Gabi Mocatta

Large eaves over equally large double-glazed windows are not only architecturally striking but provide light, views and year-round comfort

The beautiful village of Coningham, just south of Hobart, is a domain of rolling green hills and eucalypt forests set on the wide sweep of North West Bay. It's blissful and sun-soaked – the kind of place where coming home must feel like a quiet waterside holiday.

When a 4.3 hectare waterside block of land came up for sale a group of like-minded Coningham residents jumped at the chance to buy the acreage to protect the area's character. Says Arko Lucieer, one of the purchasers, "A developer was proposing to subdivide the block into 26 house and land parcels." Arko and his fellow residents had other ideas.

Punctuating the sweeping green pastureland of what was once a micro-sized farm are now just five houses built on sustainability principles, using natural materials like straw bale, stone and rammed earth. There are no fences between the houses and each household has equal access to 6000 square metres of common land that goes right down to the beach and includes a pretty reed-fringed dam and plenty of trees.

One of the new homes here is the rammed earth house of Arko and his wife Vanessa. "We'd seen mud brick and liked the organic qualities of that, and then we saw how rammed earth could be used

“We saw how rammed earth could be used in such a modern and sophisticated way”

A covered deck with rammed earth wall, skylight and eaves is perfect for year-round outdoor entertaining

in such a modern and sophisticated way at the Home Hill winery near here," they explain.

The couple had spent three years living on a neighbouring property while they planned and built their house. "It gave us plenty of time to get a feel for the place, the movement of the sun through the seasons, and what kind of layout and materials would work well here."

The design the Lucieers came up with, in conjunction with draftsman Dallas Wilson, was for a sunny, north-facing home with a flexible two to three bedroom layout, open living areas, and plenty of glass to bring in the views.

Builder Barry Duggan and rammed earth expert Chris Westcott built what came next. The house has a steel structure with internal timber framing and floors. Rammed earth makes up almost all of its wall space – inside and out – together with a few exterior walls in Colorbond, in an attractive hue complementing the gunmetal grey roof. The earth in the walls is sourced from Tasmania's northeast – an earth Arko and Vanessa chose for its warm, honey colour. The rest is comprised of a mix of gravel, sand and concrete, with some silicone

The house is a warm haven, all hours and all year round

added to give a durable finish.

"It's not cheap to build rammed earth," says Arko. "It's essentially thermal mass similar to having a concrete slab – it absorbs heat well. Our heating bills are minimal though, so the rammed earth should pay for itself in terms of energy savings over time. Also, it needs no painting and plastering – another saving to factor in."

To enhance the home's thermal properties, there's ample insulation in the walls, roof and floors, and all windows are double glazed.

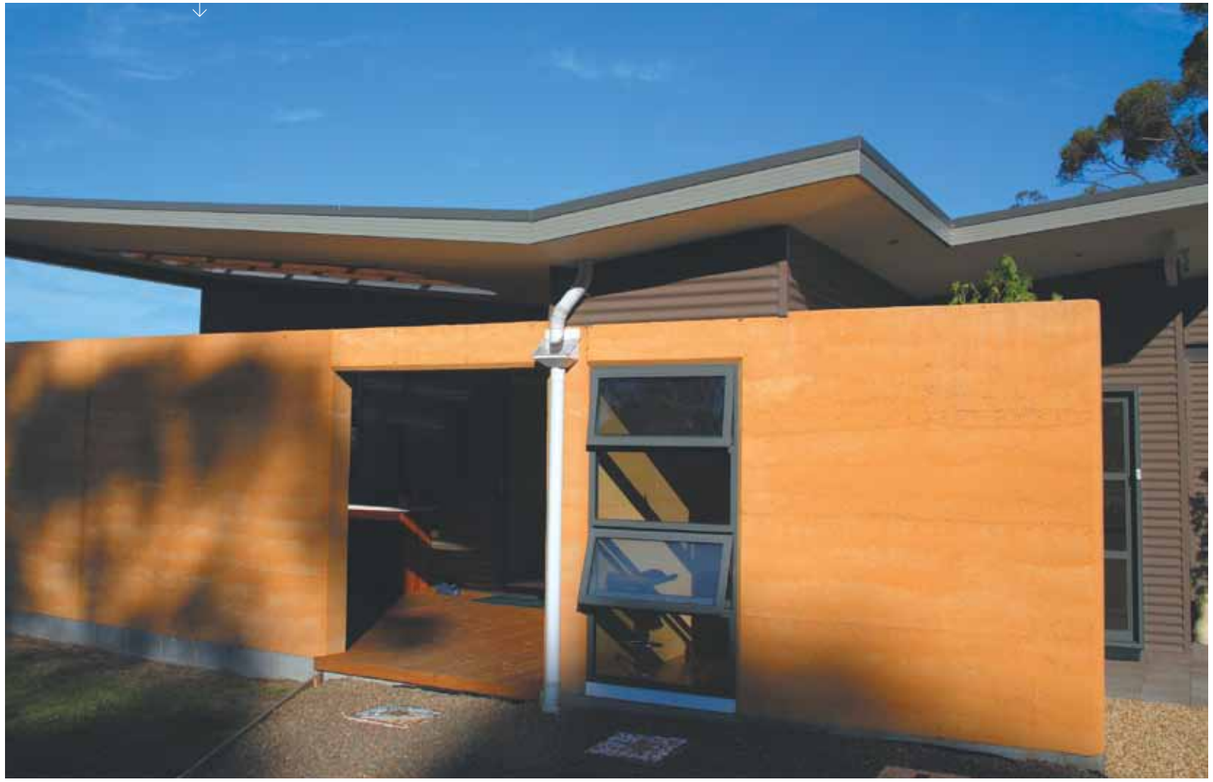
The house is built to passive solar principles – orientated toward the north, it makes the most of warmth from the sun. The 1.2 metre-wide eaves protect the interior from the hottest summer sun, while letting warming winter rays reach right into the living area. The owners use their cellar as a passive cooling hatch: on the hottest days of summer the couple open the trap door to the cool cellar space below.

In contrast to the solidity of the rammed earth, high clerestory windows under the eaves give a sense of lightness and space. A cantilevered corner allows glass doors to slide right back, without the need for corner support, giving unobstructed views. A vast double-glazed window frames water and

(cont p48)

> Our heating bills are minimal, so the rammed earth should pay for itself over time. Also, it needs no painting and plastering – another saving to factor in

The butterfly roof funnels water to a central collection point, and down to five water tanks beneath the house



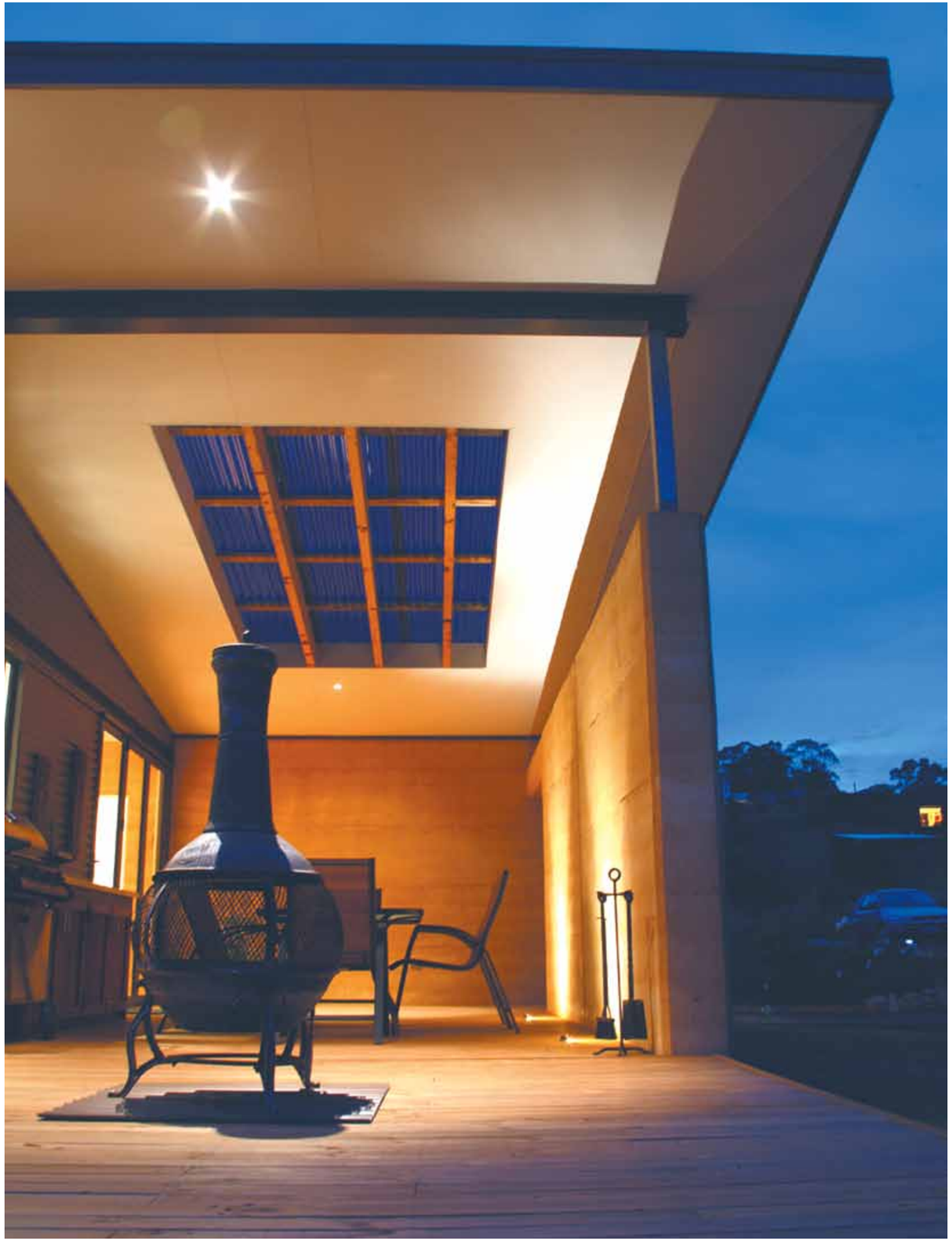
Blackwater – Taking care of business

The conventional and most popular blackwater treatment system used in rural environments is the septic system. This works by an anaerobic bacterial decomposition system which doesn't use chemicals or electricity, but it can be odorous and it doesn't make the water available for reuse.

There are a number of newer systems on the market which use aerobic processes, using pumps to circulate and aerate the wastewater, and biological filter systems. Some use chemical treatments like chlorine, others use UV filters to additionally treat the blackwater, and others just use worms. All these systems have the advantage that the water can be used after treatment, though in most states and territories the treated water can only be used for garden irrigation. Some of these systems, including Aqua Clarus and A & A Worm Farm, have been installed in urban environments.

When you're weighing up the pros and cons of different blackwater treatment systems think about energy consumption of the system (if any), servicing requirements, the amount of chemicals needed (if any) and check with your local council to ensure you have approval to install the system.

More info:
www.biolytix.com
www.aquaclarus.com
www.wormfarm.com.au
www.ozzikleen.com



> “There’s a feeling of space, both inside and out. There’s something really calm about the atmosphere here”

Windows and deck command views over the sea and Mt Wellington

mountain views. The south-facing rear of the house contains all the wet areas – laundry and bathrooms – and bedrooms.

All the home’s water is collected from the butterfly roof and fed down a single, central gutter into five large rainwater tanks which inhabit the subterranean cellar space. Both greywater and sewerage (blackwater) are treated in the home’s water treatment plant, which produces clean water for irrigating the garden. “We plan to add a solar hot water system in the future,” say Arko, “and we have plans to convert the house to solar power to contribute back to the grid.”

With its warm terracotta-hued walls and soaring butterfly roof, this well thought-out home is already part of a peaceful eco-housing community that has succeeded excellently in its mission to preserve the beauty and quiet of Coningham. “It’s a very peaceful house because of the rammed earth walls,” says Vanessa. “We have this wonderful outlook over the water and Mt Wellington – so there’s a feeling of space, both inside and out. There’s something really calm about the atmosphere here.”

Coningham residence

Designer **Dallas Wilson Design and Drafting**
Builder Barry Duggan, Alchera Builders
Rammed earth Rammed Earth Tasmania www.rammedearthtas.com
Location Coningham, Southern TAS
Project type New building

Photography Gabi Mocatta

Sustainable features

RENEWABLE ENERGY

- GreenPower

WATER SAVING

- **RP10 Ozzi Kleen blackwater system**

  How it works: This type of blackwater treatment system uses an aerobic process. In a nutshell the water is aerated, solids settle, then the water is decanted and chlorinated before being available for irrigation. The average Ozzi Kleen system uses 2 to 3kg of chlorine per quarter, plus energy for pumps, and needs to be serviced every three months.

- Five 4000L PineCrest UV stabilised polyethylene rainwater tanks plumbed to kitchen and bathroom.

- Mizu water-saving taps and shower heads
- Caroma Opal 2000 toilet with 4.5/3L dual flush cistern

PASSIVE HEATING & COOLING

- R3.5 Pink Batts in roof and R2 Pink Batts in walls
- Retrotherm polystyrene insulation under floors
- Passive cooling hatch to utilise cool air from under house
- Large eaves built to passive solar principles

ACTIVE HEATING & COOLING

- **Mitsubishi 10.2KW reverse-cycle airconditioner**, only used during winter

  Airconditioning has a bad name but reverse-cycle, or split-system, air conditioners can be some of the most energy-efficient heating appliances around. For every unit of energy they use they can produce up to six units of heat, which makes them much more efficient than many other forms of heating. Cooling is a different story: split systems generally use more electricity than evaporative coolers (but evaporative coolers use large amounts of water). Still, if you know you’ll be using it for heating much more than cooling, a split-system is well worth considering.

BUILDING MATERIALS

- Rammed earth from Piper’s River, Tasmania

WINDOWS & GLAZING

- Double-glazed windows by Architectural Windows and Doors

PAINTS, FINISHES AND FLOOR COVERINGS

- 100% New Zealand wool carpets
- Floors oiled with non-toxic wood oil

OTHER SUSTAINABLE FEATURES

- Energy efficient appliances
- Drought tolerant native landscaping

Rebirth of an icon

The Queenslander reimagined

By Michael Day

“Any timber that is not recycled has been sustainably sourced”

When Mark Thomson, himself a proud Queenslander, bought into the vernacular building form a couple of years back it would have been unthinkable for him not to have preserved it.

But moving from a purpose-built sustainable house on Brisbane’s outskirts to a 0.5-star rated existing house in an established suburb was never going to be an easy transition.

The Queenslander form is iconic and in many ways climatically appropriate, but as with most old buildings this old digs could do with a sustainability makeover.

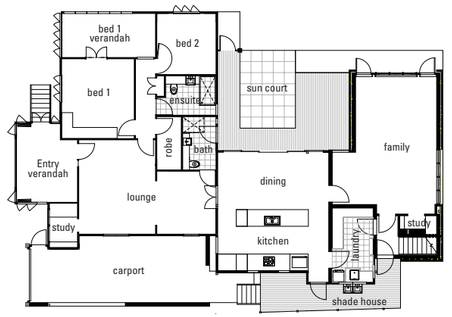
“The real challenge with Queenslanders is trying to maintain the original construction form,” explains Mark. And he should know. “I’ve been working in sustainable design for the past 15 years, and this renovation was a great opportunity to put a lot of my ideas into practice.”

Beside being an architect, Mark’s other professional hat is as President of the Australian Green Development Forum, which brings together the building and development industries and the sustainability lobby. He is also the author of a book, *The Environmental Brief: Pathways For Green Design*, published by Routledge Architecture.

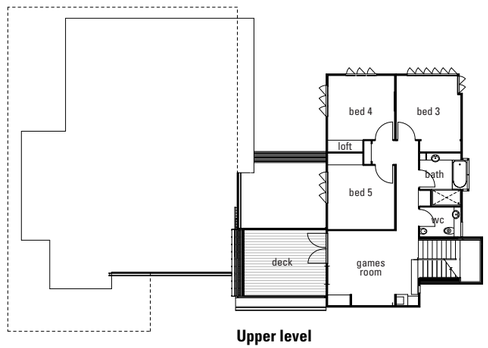
With his own home, Mark’s challenge was to retain the heritage value of his building, keeping it in sympathy with its surrounds, while at the same time improving its environmental performance.

“Queenslanders are generally timber, so we’ve maintained that and not used any plasterboard throughout the new work. From the outside it looks fairly conventional, but on the inside we have added thermal mass in a way that is not conventional for old Queenslanders.”

Add insulation and clever strategies for bringing in ventilation and light, and you have a period-style house whose liveability has moved from 0.5 stars to five stars.



Lower level



Upper level

> “We’ve experienced four or five degrees temperature difference between the areas with thermal mass and the areas with more lightweight construction”

One of the challenges with renovating a Queenslander is bringing light into it. **The central rooms of a traditional Queenslander can be gloomy places**. “Queenslanders are known for being quite dark inside,” agrees Mark, “so with skylights we’ve brought light into the house.” In the new addition Mark has gone one better. “We’ve used light shelves to bounce light onto the ceiling, which means in the daytime we don’t need to turn lights on.”

Cross ventilation was dramatically improved in the old house by opening up the previously closed-in verandas “to get those prevailing north-easterlies flowing through the house.

“High ceilings and ceiling fans mean that even on those really hot, humid days we get good airflow through the rooms.”

High-level louvred windows in the new addition further increase ventilation while optimising natural light.

The project afforded another opportunity to redress another failing of the old Queenslander design. **“The old Queenslanders were really cold in winter.” The lightweight construction style meant that heat from inside the house always escaped to the outside.** “What we’ve done in the new extension is introduce some thermal mass – suspended concrete floors and split-face concrete block walls. It really helps retain the heat in winter and keep the cool in summer.”

Splitface concrete blocks

A splitface concrete block is a decorative or architectural block that has a rough, stone-like texture created by splitting the block during production. The look is rock-faced masonry (see picture p54). It has good thermal mass and low embodied energy.

As someone long familiar with lightweight construction styles, the difference that thermal mass can make in the semi-tropical Queensland climate came as a revelation. “It’s quite amazing.

> Mark's challenge was to retain the heritage value of his building, keeping it in sympathy with its surrounds, while at the same time improving its environmental performance

Reverse block veneer: The new addition stays true to the traditional Queenslander timber exterior but introduces a splitface concrete block wall to the interior for thermal mass, hugely improving the building's thermal efficiency

The original house awnings were modified and recycled

We've experienced four or five degrees temperature difference between the areas with thermal mass and the areas with more lightweight construction. The combination of Queenslander construction and thermal mass is working incredibly well."

Mark has also gone to great lengths to ensure the new addition does not contribute to his house's environmental footprint, but rather lightens it. "The new addition is thermally super-efficient, which is what gives the house its overall five-star rating." What is more, much of the timber used in the addition was sourced from the careful demolition of an asbestos-ridden 1960s extension that adjoined the old house. "Reusing timber has been a really important part of the renovation strategy." What is not recycled is sustainably sourced.

The new addition will also extend the operational life of the house. If the kids wanted to stay on as adults, Mark explains, the new addition would accommodate them: "It's separately zoned both acoustically and thermally". The same principle would apply if two families ever wanted to live separately on the property. **Everything is zoned to facilitate the future needs of occupants and to minimise the need for additional renovations.**

Sustainable features in the house extend beyond materials and thermal efficiency to the use of renewable energy (solar panels), energy-efficient appliances and lighting, rainwater tanks and water-saving fixtures.

One of the most commented-upon fixtures is the waterless urinal, which with three males in the house (Mark and his two teenage boys) has been a huge success. "Visitors love it too. They expect it to be smelly but it's not at all. It works incredibly well."

Another success story has been the 500-litre header tank installed above the first storey bathroom. Now the family only needs to pump water upstairs every other day, instead of after every flush, saving energy.

All of which goes to show, even the most enduring Aussie icons can be brought into the 21st century. And from the street, no-one need even know.

Indooroopilly residence

Designer Mark Thomson, TVS Architects
www.tvspartnership.com.au
Builder Anthony Morris Constructions
Location Indooroopilly, QLD
Project type Renovation and addition

Photography Ross Eason, Eason Creative Photography

Sustainable features

HOT WATER

- 315L Quantum Heat pump hot water system (see p31)
- Armacell (foam CFC-free) lagging to hot water pipes

RENEWABLE ENERGY

- 2KW grid-connected PV system comprising 10 x Suntech 210 watt solar modules with Australian-made Latronics PVE2500 inverter

WATER SAVING

- Caroma H2Zero waterless urinal
- 21,300L water storage for roof water collection comprising four 5200L Allcast precast inground concrete tanks and one 500L Polyworld header tank
- Caroma Fowler Seido Icon 4-star rated 4.5/3L flush toilets
- Grohe water efficient water mixers and showerheads
- Stormwater management on site via integrated landscaped design concept
- Drought tolerant "Sir Walter" Australian pedigree turf to yard

PASSIVE HEATING & COOLING

- Reverse block veneer to new addition walls comprising LOSP-treated pine weatherboards and Adbri splitface concrete block walls for thermal mass
- Suspended concrete slab to new addition floor for thermal mass
- Air-Cell R2.5 reflective foil with Autex R1.5 polyester bulk insulation in ceiling cavities
- Rock wall and fernery at south side of house introduces microclimate effect to interior via louvres
- Extension creates channelled breezeway

- Opening up closed verandas in original house enhances cross-ventilation

ACTIVE HEATING & COOLING

- Ceiling fans to all bedrooms

BUILDING MATERIALS

- Modwood recycled plastic/timber decking to upstairs deck. Modwood is a recycled plastic/timber composite that does not require finishing and is durable for external use (www.modwood.com.au).
- Reuse of recycled timber and fittings from previous site demolition
- Recycled timber and Finlayson Envirowood to doors and windows
- Recycled pine wall framing to selected applications
- Sustainably-sourced Boral blackbutt flooring and decking (Chain of Custody certification)
- LVL laminated veneer lumber as structural timber
- FSC selected timber veneers to kitchen and bathroom joinery
- 10mm Type A hoop pine plywood profiled wall and ceiling sheeting
- EO rated Particleboard/MDF in kitchen and bathroom carcass construction
- Colorbond light-coloured roof and wall cladding to fernery area

WINDOWS & GLAZING

- Jalousie Security louvre windows (motorised to high-level applications)
- Hoop pine pelmets to window openings
- Verosol PVC-free rollerblinds to windows
- Skydome ventilated skylights

LIGHTING

- LED lighting to kitchen, study and hallways
- Envirolux Odeon 22w T5 low-energy fittings
- Envirolux Horizo T5 fluorescent wall-mounted bathroom fittings
- Cosmoluce GreenEco 9W CFL downlights with Megaman compact reflectors
- Light shelves (created from recycled window hoods) redirect light from floor to ceiling, brightening rooms

PAINTS, FINISHES & FLOOR COVERINGS

- Low VOC Rokecote paints and finishes
- Kordon Termite Barrier
- Toby Aquamax waterbased polyurethane floor sealer to internal timber floors

OTHER SUSTAINABLE FEATURES

- Stair Lock stairway system comprising EO (low formaldehyde) MDF (www.stairlock.com.au). Certified by Good Environmental Choice - Australia (www.geca.org.au)

Greening your Victorian-period home

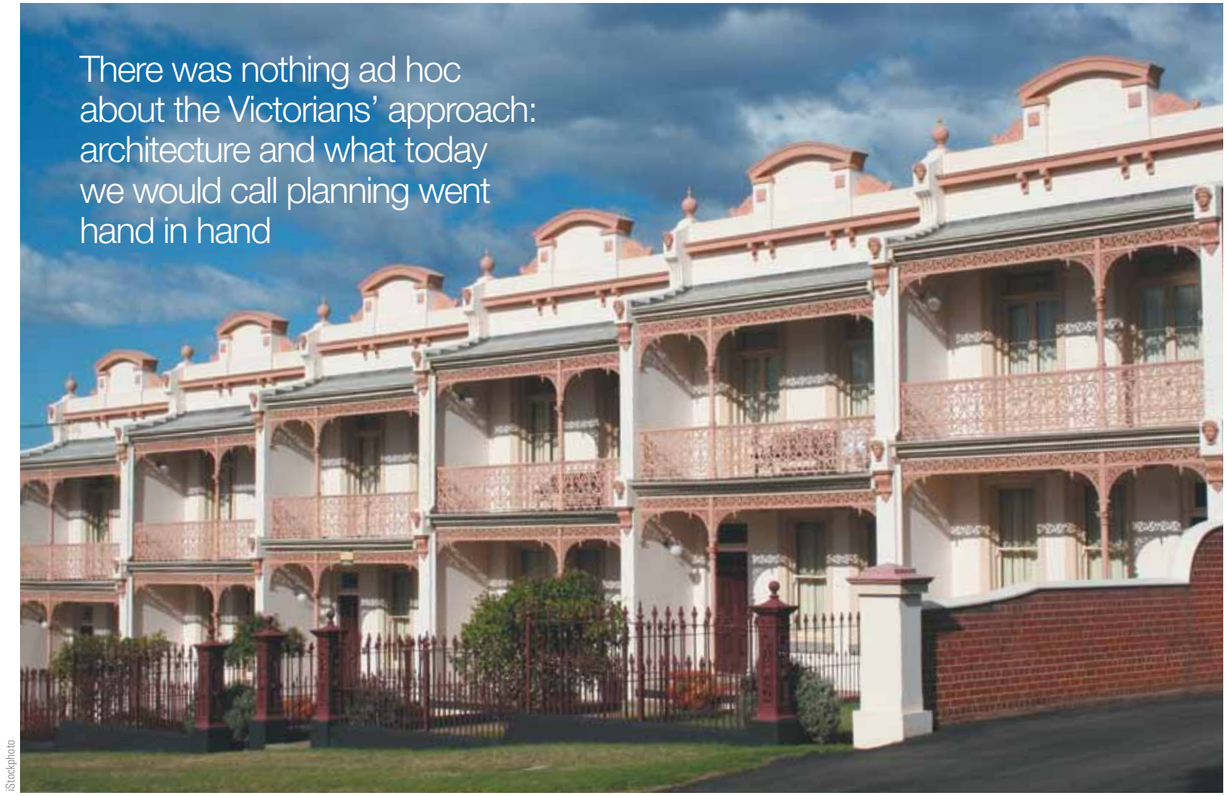
Heritage and sustainability: you can have it both ways

If there's one architectural style that defines the inner suburbs of Sydney, Melbourne and Adelaide it's the Victorian style. Walking the streets of Paddington or Fitzroy, the tastes and values, aspirations and economies of another time are preserved on every street, from the embellishments of "boom period" facades, to the reassuring regularity of the terrace row.

There was nothing ad hoc about the Victorians' approach: architecture and what today we would call planning went hand in hand. That's why a stroll through a Victorian suburb can make a person feel relaxed and harmonious: it's the deep sense of history and place, and the unity of vision.

But the focus on "street architecture" had its downsides. The balcony or veranda, being an admired feature of a house, was always placed at the front: even if it would have made more sense for passive solar purposes to put it on the back. And the windows of a terrace house always face the front and the back, regardless of orientation. That means that on a street running north-south you can have large windows facing east and west with no eaves, letting in all that blistering summer sun.

So how do you fix these things without betraying your home's Victorian pedigree? *Sanctuary* magazine asked a hand-picked crew of sustainability gurus.



iStockphoto

Draughts

The good news is that many of the most significant things you can do to upgrade your Victorian-period home won't affect its heritage look.

Maurice Beinat of ecoMaster points out: "Almost always the single biggest problem is draught proofing.

"The thing is that even if your home is well insulated, if the wind blows straight through then summer heat will permeate the home and winter heating will be quickly lost."

Wherever you find a gap, you'll find a draught. Ill-fitting doors, window architraves, wall vents and open fireplaces are big offenders. Even decorative ceiling roses can be a problem. In old homes with wooden floors there are typically lots of gaps between the skirting and flooring, particularly after carpets have been removed and floors polished.

With a bit of gap sealant, sealing strips (check out www.raven.com.au), and draught stoppers for the doors you can seal most of those draughts yourself.

Rhiannon Slatter

Fireplaces

In the latter half of the twentieth century, many Victorian houses had their draughty and notoriously inefficient fireplaces sealed up and plastered over, cast-iron insert and all, as gas heaters found favour over wood fires.

This may have improved thermal efficiency, but it came at a cost to charm and heritage appeal. For all their problems, fireplaces with ornate surrounds are one of the principal features of a Victorian home. **If you wish to keep or restore your fireplace, there are ways to do it energy-efficiently.**

Ninety per cent of heat from a woodburning open fireplace goes up the chimney. Replacing your woodburning fire with a fireplace-fitted gas heater will be more efficient than a wood-burning fire, but a regular flued gas heater will still allow a draught up the flue. It will also burn oxygen from within the home, which may necessitate a wall vent (unventilated rooms with gas heaters are a serious hazard).

Maurice Beinat recommends that "heaters should be fitted with a balance flue, also known as a power flue, which draws the air used for combustion from outside the home. These have no possibility of draught as the combustion chamber is fully isolated from the air within the home."

When they're not being used in winter, open fireplace flues should be sealed. Sealing a fireplace, says Andreas Sederof of Sunpower, "can be as simple as stuffing a hessian bag into the throat of the chimney or (for more control) having a damper fitted into the flue". In summer you should keep your chimneys open, as they can act to vent hot air out of the house.

Windows

The frames on the old double-hung sash windows are a common source of draughts, and their thin glazing is an insulation disaster – but replace them with something modern that's out of character and you could be stripping thousands off your resale value.

It's also important not to underestimate the environmental benefits of retaining your old windows. Replacing old features entails waste – unless you recycle in which case you're merely trusting that someone else will adopt the "inefficient" technology you discarded. It also means installing a new window, whose embodied energy, the energy invested in its manufacture, transport etc, will offset its efficiencies for some time.

And old windows are not as inefficient as all that. As Paul Downton, principal architect of Ecopolis Architects, points out, **"old sash windows provide very good controllable ventilation options that other windows do not".**

Sash windows are notoriously tricky to upgrade. There's no point even looking at glazing solutions until you've sealed your window's draughts, and while there are a range of draught-sealing solutions for sash windows opinions vary as to the effectiveness and appearance of each of them. ecoMaster make their own custom treatments, as do companies like Classic Windows and Sash Window Specialist.

Assuming you can seal your window against draughts, glazing treatments range from higher performing single glazing, to solar films, to discrete double-glazing substitutes such as Magnetite and Clear Comfort (www.clearcomfort.com.au).

And yes, it is even possible to retrofit double glazing in old windows. "It's a bit technical," says Dick Clarke of Envirotecture, "but any competent carpenter can do it".

Rhiannon Slatter

Shading

When the heat is on and it's streaming through your windows, you must think past the glazing. **"External shading is the only way to significantly improve summer comfort,"** advises Andreas Sederof.

Sunpower

The Victorians made extensive use of shutters, which on east and west-facing walls are still a fantastic investment.

In many Victorian-period houses, when the shutters fell into disrepair they were not replaced. Recesses on the window frame show where they were set. If you want to stay true to the Victorian style, the old shutters were two leaves fitted with louvres. They were also painted (in heritage colours, of course!).

Awnings, pergolas and deciduous plantings can be used to shade the high summer sun on north-facing windows while still permitting in the low winter sun. The Victorians also used canvas awnings on balconies and verandas.

Curtains

Another way to reduce winter heat loss – and some summer heat gain – through your old windows is curtains. "Given the difficulties of installing double glazing, curtains and pelmets can be very useful," says Paul Downton.

Adds Maurice Beinat: "Full length drapes are best as they usually extend well past the edge of the window unit. If you don't like pelmets it is an easy task to install invisible pelmets" – pearl-coloured Perspex that performs the same function as the bulky box pelmet.

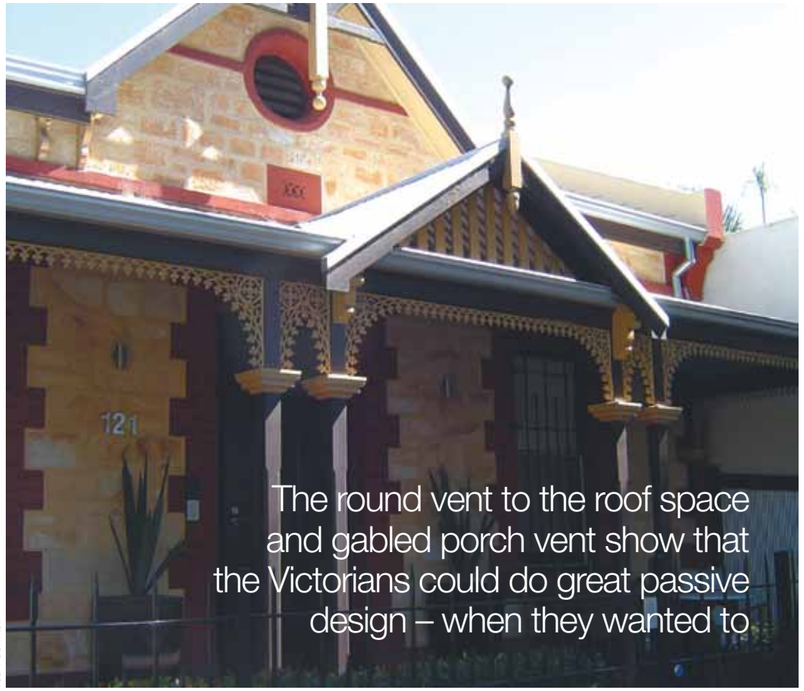
The downside to curtains is that they cut out daylight. And proper heavy curtains can be very expensive.

Insulation

Insulation is frequently absent from Victorian homes, and installing it should be one of your first tasks (for rebate information, see www.environment.gov.au/energyefficiency/insulation-homeowner.html). Andreas Sederof recommends a rating of R5 to R6 for roofs. But if you do install roof insulation, don't undo all your good work with unsuitable lighting.

Belonging firmly in the category of offending non-Victorian additions is halogen downlights. Wildly inefficient, they create so much heat you have to cut holes in your insulation around them because of fire risk. Explains Graham Hunt, "if you put six or eight of these in a room, which often happens, then you have six or eight small 'chimneys' all losing heat out of the room. It is much better and more in keeping with the period to use ceiling pendant lamps, wall lights or floor and table lamps."

Insulating floors in Victorian homes can be problematic. Underfloor insulation products such as Foil Board and Air-Cell are very effective, providing you can wriggle under the floor. But if underfloor access is limited, it may be necessary to lift the floorboards to install the insulation. That's a degree of trouble and expense that many will elect to skip. The Alternative Technology Association's Adam Maxey says "these floors were designed to be carpeted and what happens is everyone rips out the old carpets and exposes these floorboards, polishes them up and then shivers in winter. The insulation was the carpet, so to keep to period, put back the carpet!" For those loath to give up polished timber, a nice big rug is still much better than nothing.



Paul F Downton

Exterior treatments and plantings

When it comes to insulating walls, look to the outside.

The Victorian clay brick has good thermal mass, which means it stores heat or stays cool for long periods. What that means is that when you have long days of summer sun or winter cold, your walls will store the heat or cold and move it from the outside to the inside of your home.

If your exterior walls are painted, says Stuart McQuire of Green Makeover, and they're heating up in the summer, "paint them with an insulating paint".

Using insulating paint, or a non-toxic and readily available additive such as Thermilate, will help prevent heat moving through your brickwork. This goes for interior walls, too. And on sun-exposed exterior walls, remember to use light colours. Plain old white paint has excellent reflective qualities.

If exterior walls are unpainted, *don't* paint them! You will take your home's period authenticity a giant step backward, and there is no way to remove the paint without huge expense and the likelihood of further damaging your walls.

Says Paul Downton: "One option is to place a vertical trellis against that wall and grow plants that are happy to climb across it. The plants don't need to be deciduous, as they offer some insulation value (about R1.0) against heat loss in winter as well as protection from summer sun. The trellis can have shade cloth on it initially until the vegetation takes over. The trellis should be about 75 to 100 mm from the wall surface to allow an air gap."

If you plan to grow a creeper directly onto the wall, the best option by far, advises Simon Collings of Fitzroy Nursery, is Boston ivy: "it's the least destructive of walls, can take sun or shade, and colours up beautifully in autumn. It sits out from the wall and gives you a good thermal air barrier, and is easy to maintain, as long as you keep it out of your gutters."

At all costs, he says, avoid English ivy, "which really is just a noxious, invasive weed".

Roofs are an easy fix – just do as the Victorians (mostly) did and go with corrugated iron, or its latter-day equivalent Zincalume. "You can't get a more practical material," says Andreas Sederof. "So long as the colour is light. Dark colours will raise the roof temperature by as much as five to 10 degrees."

On sun-exposed exterior walls, remember to use light colours

Consultants

Adam Maxey works for the Alternative Technology Association (ATA), the publisher of *Sanctuary* magazine. ATA Sustainability Consultants can advise on all aspects of sustainable house design and practice.
www.ata.org.au/news/ata-sustainability-consulting-service

Maurice Beinat is Chief Technical Officer of ecoMaster, a sustainability assessment and retrofit firm based in Gisborne, a historical gold-rush town northwest of Melbourne.
www.ecomaster.com.au

Dick Clarke is Director of Envirotecture, Sydney-based building designers specialising in sustainable buildings.
www.envirotecture.com.au

Simon Collings is the owner of Fitzroy Nursery, a local landmark in inner-city Victorian-period Fitzroy.
www.fitzroynursery.com.au

Paul F Downton is Principal Architect and Urban Ecologist for Adelaide's Ecopolis Architects. He was also the editor and a major contributor to the Australian Government's *Your Home Technical Manual*.
http://ecopolis.com.au; www.yourhome.gov.au

Graham Hunt is an architect based in Sydney specialising in sustainable design, environmental ratings and home sustainability assessments.
greyhound@idx.com.au

Stuart McQuire is an environmental scientist who runs Green Makeover, a sustainability assessment firm based in Melbourne. He is the author of *Water Not Down the Drain*, published by the ATA.
www.greenmakeover.com.au; www.notdownthedrain.org.au

Andreas Sederof is a Director of Sunpower Design, a Melbourne firm specialising in environmentally sustainable building design.
www.sunpowerdesign.com.au

Further Reading

How to retrofit double-glazing: *ReNew* magazine, issue 84 (http://shop.ata.org.au)

Intelligent design

The hi-tech house with a business in the basement

by Judy Friedlander

> “The family has reduced its environmental footprint dramatically”

A thermal chimney helps purge hot air from the house in the summer months

People who grow up in Sydney’s northern beach suburbs tend either to stay or to nurse a desire to return as soon as possible.

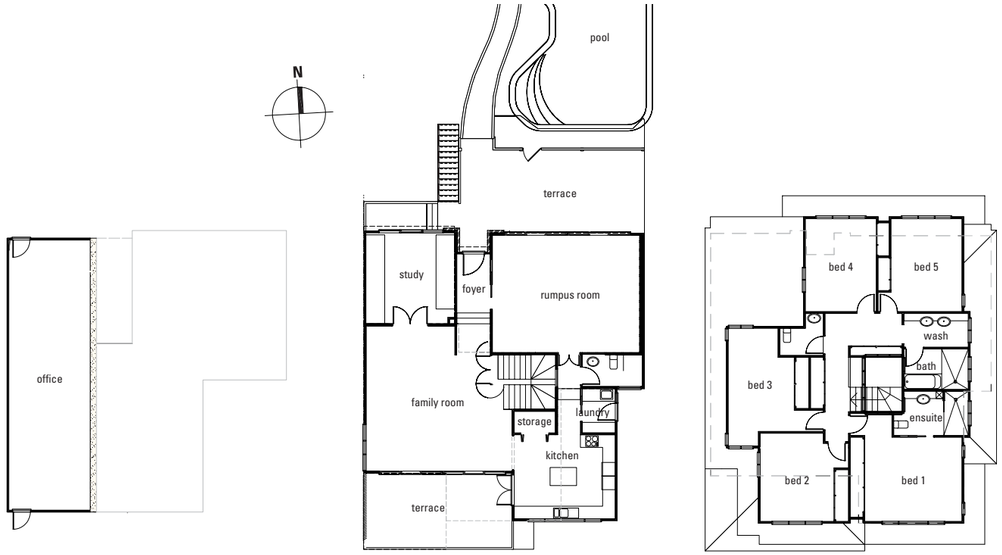
It might have something to do with the custard-coloured sands cosseted by Hawkesbury sandstone headlands and a micro climate that yields an inordinate number of tropical flowers and birds. Majestic Angophora trees offer cobalt blue sea views through filigree branches.

Being “environmental” could be said to be a natural state of play in such surrounds. Certainly Jim and Tara Boyle saw it as a given that their home would be simpatico with the landscape.

“We’ve had wallabies, echidnas, lyrebirds, possums, bandicoots, brush turkeys and lots of birds,” Jim says, and even adds “snakes” in the same delighted tone.

Their home, which sits atop the plateau overlooking Narrabeen Lagoon, encompasses a family of six, including four children ranging in age from nine to 15 years.

The transformation from a weatherboard flat-roofed cottage to a home suitable for six with an added office hub was carefully planned so that even with the heavier workload sustainable features contribute to living lightly on the land.



Basement **Lower level** **Upper level**

The basement office

Large tiles in the bathroom minimise the need for cleaning

The Boyles and building designer Dick Clarke have incorporated an extraordinary number of sustainable features into their renovation.

Arguably the most sustainable feature of the new construction is the home office, which has its own separate entrance and replaces headquarters previously located in a 700-square-metre warehouse a few suburbs away.

By incorporating the head office of the Boyle's IT company into the basement of the Elanora Heights residence, the couple have reduced their overall environmental footprint dramatically.

"As an IT company, most of what we do is virtual so we realised that having a huge office space with a three-phase air conditioning unit was a waste," says Jim. "Only a handful of people were ever in the building at one time."

He estimates this move alone has reduced the carbon footprint of the business by almost 80 per cent and lowered running costs.

"There is less petrol and car wear and tear," he says. The office in the home is in the basement, which has excellent cross-ventilation and sandstone and concrete slab foundations for thermal mass, which means no airconditioning is required.

Says Clarke: "**Conceptually the main thing we did was get the north-south orientation right.** The southern side which overlooks the lake wasn't a problem because it is cooler there."

The whole house, previously described by Tara as "the hot house", benefited from new insulation encasing the shell. The corrugated aluminium foil insulation (Solartex Foil Batts) has been particularly effective on the western side, even though that side is constructed from a single skin timber frame.

The same insulation is used in the roof space and keeps the heat out of the bedrooms on the top floor.

The northern side of the house, which also incorporates the entrance, is cooled by the sea breeze and heavy drapes are extremely effective for staying cool in summer and warm in winter. The eastern wall of the north-facing rumpus room was constructed from reverse brick veneer to assist temperature control.

Specially designed eaves on the hotter sides of the house are angled to stop summer sun access and allow for winter sun access.

"In the past, you could hold your hand near the Gyprock inside the house and feel the heat radiate," says Jim. "Now, even on the hottest day, you can't feel it."

> "The Boyles and building designer Dick Clarke have incorporated an extraordinary number of sustainable features into their renovation"

Ceiling fans to the bedrooms are the home's only active cooling devices

A light well and three-storey high air shaft in the centre of the house provides excellent internal lighting and allows hot air to be vented in summer through the heat stack effect.

The heat stack and extensive use of louvres to maximise air flow and cross-ventilation mean that airconditioners are not required.

"No matter how hot the day, the house can pick up a breeze and even on stupidly hot days you can close the house down with the heavy drapes and feel cool in it," says Jim.

The Boyles opted to have two large water tanks, each capable of holding 24,000 litres. "We can isolate them if ever one needs to be cleaned or specifically used," says Jim. All water needs are catered to except for drinking and showers.

"We have cut our water use by about 80 per cent, which is pretty good for a family of six."

The tanks also act as a stored water supply for bush fire fighting purposes. The house also has 18 high-pressure fire sprinkler heads around the rear of the property in the event of a blaze and the property is built to bushfire regulations: for example, non-combustible materials, toughened glass and stainless steel screen mesh.

Of course, with IT expertise abundant, the very latest technological innovations have been incorporated into the house. Numerous motion and light level sensors around the house mean that if a space isn't being used for a period of time, the central automation system will shut down the load. "No more nagging kids to turn lights and fans off," they say.

The success of the house says Tara is that "I take it all for granted. We put a lot of thought into the design but it's an easy home to live in and is perfect in every season."

Elanora Heights residence

Designer **Dick Clarke, Envirotecture** www.envirotecture.com.au
Builder Nick Kaufman, NAK Building
Location Elanora Heights, NSW
Project type Renovation with new addition

Photography Tim Wheeler

Sustainable features

RENEWABLE ENERGY

- House preplumbed and prewired during construction for solar hot water – plans to move to solar in next 12 months.

  Like all households with electric hot water service, the Boyles will be eligible for a $1600 rebate when they make the switch. See www.environment.gov.au/settlements/renewable/solarhotwater/index.html

WATER SAVING

- Low flow Grohe tapware throughout house
- Low flow showerheads in bathrooms
- 2 x 24,000L TankMasta rainwater tanks (48,000L total) for everything except drinking water and showers

PASSIVE HEATING & COOLING

- Reorientation of living spaces to be north facing
- Wide eaves angled for winter sun, summer shade
- Concrete and masonry walls and tiled floor for thermal mass in new addition
- Light well and air shaft in centre of the house – for internal lighting into centre of house and heat stack on hot summer days
- Louvred windows to maximise air flow and cross ventilation
- Reverse brick veneer to family room (Bluescope Mini Orb and Blue Board outside)
- Wall insulation and roof space insulation Solartex Foil Batts
- Tara Boyle Design heavy drapes with pelmets for insulation (www.taraboyledesign.com)

ACTIVE HEATING & COOLING

- Ceiling fans to bedroom

BUILDING MATERIALS

- Materials chosen for maximum lifespan and minimum maintenance: Colourbond roofing; Bluescope Mini Orb cladding and rendered Blue Board; Aluminium windows and doors

WINDOWS & GLAZING

- Hanlon Windows louvres to maximise air flow and cross ventilation

LIGHTING

- Clipsal CBUS motion and light level sensors around the house with central automation to shut down unused load

WASTE TREATMENT

- Sorting of construction waste and reuse where possible to minimise landfill

OTHER SUSTAINABLE FEATURES

- Home-office minimises need to maintain separate office

Green Renovators Bathroom Guide

Part 1: Hot water, showers, taps, basins and baths

Not everyone can afford to renovate their home or undertake a new build, but most of us at some stage will want to update our bathroom. A bathroom renovation can be as extensive as replacing all fixtures and surfaces, rewiring and plumbing, or it can be as simple as regrouting your tiles.

Archicentre's latest cost guide estimates comprehensive bathroom renovations cost from $9200 to $24,000, less for ensuites, making a bathroom metre-on-metre one of the most expensive rooms to renovate. So it makes sense to take time to research and plan, to get it right from the outset so that you'll be happy with the results for a long time.

Once you commit to a green bathroom renovation you need to do your homework. Do the materials, fixtures and appliances minimise or avoid environmental harm during their production and use? Are they made from renewable or recycled materials? Are they made locally? Can they be reused or recycled? With all these considerations you will need to factor in the time it will take to locate, order and deliver each item.

Bathroom renovators, parts 1 to 3

The first instalment of our Green Bathroom Renovators Guide will give you a heads up on solar hot water, showers, taps, basins and baths. Our second instalment features the gritty behind-the-scene systems: wastewater, toilets, plumbing and fans. And our final instalment features floors, walls and grouts, joinery and green cleaning.

Solar hot water

Renovating a bathroom is a good excuse to have a look at your water heating system and to get it right from the outset if you're starting from scratch.

Rhiannon Slater

There are many reasons to choose a solar hot water system over a conventional gas or electric unit. Probably the most important benefit is that of greenhouse gas emission reduction. **A solar water heater can reduce the greenhouse emissions of an average family by as much as four tonnes of CO_2 per year – the equivalent of taking a car off the road.**

Solar hot water rebates

On 3 February 2009 the Australian Government announced a new rebate of $1,600 to eligible home owner-occupiers to replace existing electric hot water systems with solar and heat pump hot water systems. For more information see www.environment.gov.au/energyefficiency. This new rebate is in addition to the Renewable Energy Certificates (RECs) your system may be eligible for – see www.orer.gov.au/swh/index.html.

The initial purchase price of a solar hot water system will probably still be higher than a similarly sized non-solar water heater but the savings made in operating costs will generally pay for this difference in less than 10 years — in as few as four years in some cases. Also a solar system generally has a longer lifespan than a conventional unit, so financial returns can be considerable over the life of the system.

Showers

Showers typically use 30 per cent of a household's water, so choosing the right showerhead will not only make a huge difference to saving water around the home it will also reduce your water and energy bills. Old style shower heads can use more than 20 litres a minute; new showerheads can give you a decent shower for less than half that.

The government's WELS (Water Efficiency Labelling Scheme) compares, rates and labels a range of products for water efficiency. Showers rated by the WELS scheme are rated from zero to three stars. Shower heads which have a flow rate of nine litres of water per minute and under are accredited three stars (WELS is testing higher-rating showerheads, but for the time being three stars is tops).

When you're buying a showerhead, choose the highest star rating but also take note of the flow rate displayed on the label. The WELS website (www.waterrating.gov.au) has a list of shower heads with the lowest flow rate. These include the Astra Walker, with 4.7 litres per minute, and the Quoss system (which is available from most hardware stores) with a 5.5 litres per minute rating. If you're looking for the more contemporary aesthetic of a larger rose there is the Phoenix with a flow of around eight litres a minute or the Methven Satinjet Kiri and Genesis range (7.5 litres). The Abey ovale range (www.abey.com.au) is an overhead rainshower with seven litres per minute (one of the lowest rainshower flow rates around).

Astra Walker showerhead

Steer away from showerheads that emit a fine spray of water. The water will get cold quickly, which means you'll end up turning up the hot water, thereby using more energy, or you'll need to stay under the shower longer.

Note that some three-star rated showerheads are not compatible with gravity fed or older instantaneous hot water systems due to the low water pressure or high flow rates required in such systems.

Abey Ovale Showerhead

Ever wanted to turn off the water when you are soaping up or shampooing your hair, then turn it back on to rinse, all without losing your temperature settings? The Every Drop Shower Saver (www.showersaver.com.au) allows you to do just that.

The Oxygenics shower heads from CleverLad (www.cleverlad.com.au) have a similar feature built into them. They have a lever on the side that allows you to turn the water flow down to just 1.5 litres per minute – so you stay warm while using very little water.

Every Drop Shower Saver

Third Ecology Architects. Photo: Neville Wright

Minosa's Puddle Basin

Taps & Basins

Like showerheads, taps are rated by WELS. Look for the highest ratings, five or six stars, which can reduce water use to as little as 1.5 litres a minute, depending on the application.

Steer away from one-lever basin mixers as they tend to be left in the middle position, adding hot water to the mix when it's not necessary.

Reduce the water flow on existing taps by up to two thirds by installing an aerator or flow restrictor.

When you're thinking about basins look for ones that are as shallow as possible, to reduce the temptation to fill it with water. Minosa makes a range of shallow basins such as their Puddle Basin, designed and made in Australia, and with up to 13 per cent recycled content.

Baths

There's no denying that bathtubs are a luxury in water-parched parts of Australia, but if you can afford to fill one there are ways you can reduce its impact.

Consider buying a salvaged or restored bath – these can be bought in mint condition if you're lucky, and they'll cost a fraction of the price of a new bath.

If you're buying a new bathtub invest in a cast iron or pressed steel bath, which have long-lasting enamel coatings. Cheaper acrylic-fibreglass bathtubs tend to scratch easily, lose their shine quicker and can crack over time. Acrylic baths retain heat better than iron or steel baths though, so if you are considering the latter, you should line the outside of the bath with insulation.

You should also consider the size of the bath. Taking a standard-size bath can use at least 100 litres of water. **Some of the freestanding deep-soaking models use over 200 litres per bath, which is very hard to justify when you'd use only 32 litres to wash yourself with a three-star rated showerhead and a four-minute shower.** Obviously the smaller the bath, the less water you'll use. There are a number of prototype designs out there for baths that follow the contours of the body to minimise water consumption, but these have yet to be mass produced – keep an eye out for design's like Chris Hardy's (pictured), a recent finalist in the Reece Bathroom Innovation Awards.

If you're renovating a bathroom do everything you can to keep your existing bath, as removing an existing bath can require an enormous amount of effort and expense. If you have an existing bathtub but it needs another lease on life, consider refinishing or resurfacing it instead of replacing it. Refinishing means the bath can be resurfaced in situ over two to three days, you can choose any colour you like, and the new surface should last as long as the original surface on the bath (ensure you get a warranty). If you go down this route it's worth going with a professional resurfacer with good waste management and ventilation procedures. The coatings used during the process contain toxic isocyanates – you need to ensure the applicator wears appropriate breathing protection, that professional air evacuation systems are used (the built-in exhaust fan in the bathroom should not be used) and that the work area is appropriately sealed off from the rest of the house.

Rachel Pilgrim, Well Earth Studios

Designer Chris Hardy's Sop bath is designed to use only 60 to 70 litres of water per bath, while still giving you an enjoyable soak. It was a finalist in the Reece Bathroom Innovation Awards, but is not available for sale - yet

Reece Bathroom Innovation Awards

Dick Clarke from Envirotecture likes to design bathrooms with a view to their longevity and ease of use. His ideal green bathroom would be designed with a polished concrete floor with a microtexture finish (to avoid slippage) and with large wall tiles. "By taking away the things that harbour dirt and grime you eliminate the need for cleaning," says Dick. He also recommends single glass pane showerscreens embedded in the wall and floor to eliminate the need to use silicone. "Keeping silicone out of bathrooms should be a major goal."

Sanctum Design Consultants. Photo: Marian Riabic

Steer away from one-lever basin mixers as they tend to be left in the middle position, adding hot water to the mix when it's not necessary

All water for this luxurious soak bath comes from the home's 50,000L capacity rainwater tanks, and is later used for irrigation

Rhiannon Slater

Tomorrow house

A beautiful marriage of green technologies and sublime design

by Judy Friedlander

The south-facing living room features sea views so a deck and extensive glazing were unavoidable, but solar hydronic heating and clerestory windows help offset the problematic orientation

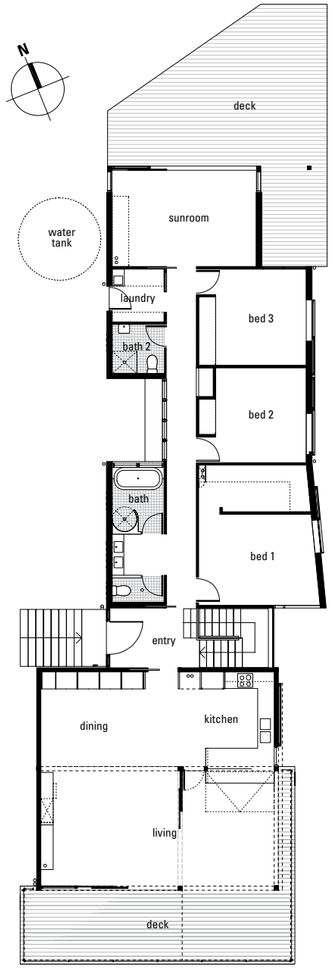
Engineers, as Graeme Jessup proves, can also be ardent environmentalists. And what a combination it is. His background working for the NSW government's Sustainable Energy Development Authority has enabled Graeme to understand and apply cutting-edge sustainable technologies in his own home.

Graeme and his partner Barbara Elkan worked closely with architect John Choi of Choi Ropiha Architects to design their house, located in the northern Sydney beachside suburb of Mona Vale.

"We wanted a house that was dropped into the environment, which features native timbers and a garden that grows up to meet the structure," she says. "John, our architect, understood this and has succeeded in helping us design a natural house that blends into the landscape."

Technologically, **the home's *piece de resistance* is its solar hydronic heating system. The system involves evacuated tube solar collectors on the roof heating water which runs through pipes embedded in the concrete slab floor.** Graeme's intention with the system was "to show how a modern home can be both a joy to live in and have minimal impact on our environmental footprint".

Graeme says, **"We expect the hydronic heating to supply about 50 per cent of our space heating needs.** On cold winter nights we will need to



“The home’s *piece de resistance* is its solar hydronic heating system”

Shadowclad radiata pine eco cladding insulates reverse brick veneer walls to the rear of the house

supplement the hydronic heating with a high efficiency gas heater installed in the living area. The concrete floor slab will take several hours to respond to hot water flowing through the heating pipes, so the heating will operate continuously through the winter months.”

According to Graeme, there might be a handful of houses in Australia that employ a solar hydronic heating system [including Xavier Rudd’s house, profiled on p14], and he hopes his will be a prototype for an efficient and cost-effective, commercially available application. He says little information is available on other systems’ performance or how to size a system to suit specific applications.

The hydronic system generates minimal greenhouse gases, only requiring two low-energy electric circulating pumps. Temperature sensors embedded in the floors are connected to the controller which maintains a comfort level.

The system is being used in the cooler southern portion of the house, which incorporates the kitchen, a living room and the major eating area. The house was configured this way – living areas to the south – to showcase the stunning view of the coastline.

John Choi explains: **“It is not an ideal orientation so we had to supplement the design with an active system to keep the house warm in winter. This was achieved with the hydronic heating and north-facing clerestory windows which fall from an angled roof-line.”**

Says Graeme, “We played with the various options for introducing cross ventilation to give us a wonderful feeling of interaction with the house and with nature. It is a rare day when we cannot introduce a cooling breeze, no matter what the wind direction.”

A high-efficiency gas heater, reverse brick-veneer construction, energy-efficient laminated glass and R3.0 rated ceiling insulation also assist in maintaining a comfortable temperature.

> It is a rare day when we cannot introduce a cooling breeze, no matter what the wind direction

Clerestory windows on the north wall of the south-facing living areas bring in light and warmth in winter. The rooms are also warmed by a solar hydronic system with pipes buried in the concrete floor, boosted by a high-efficiency gas heater

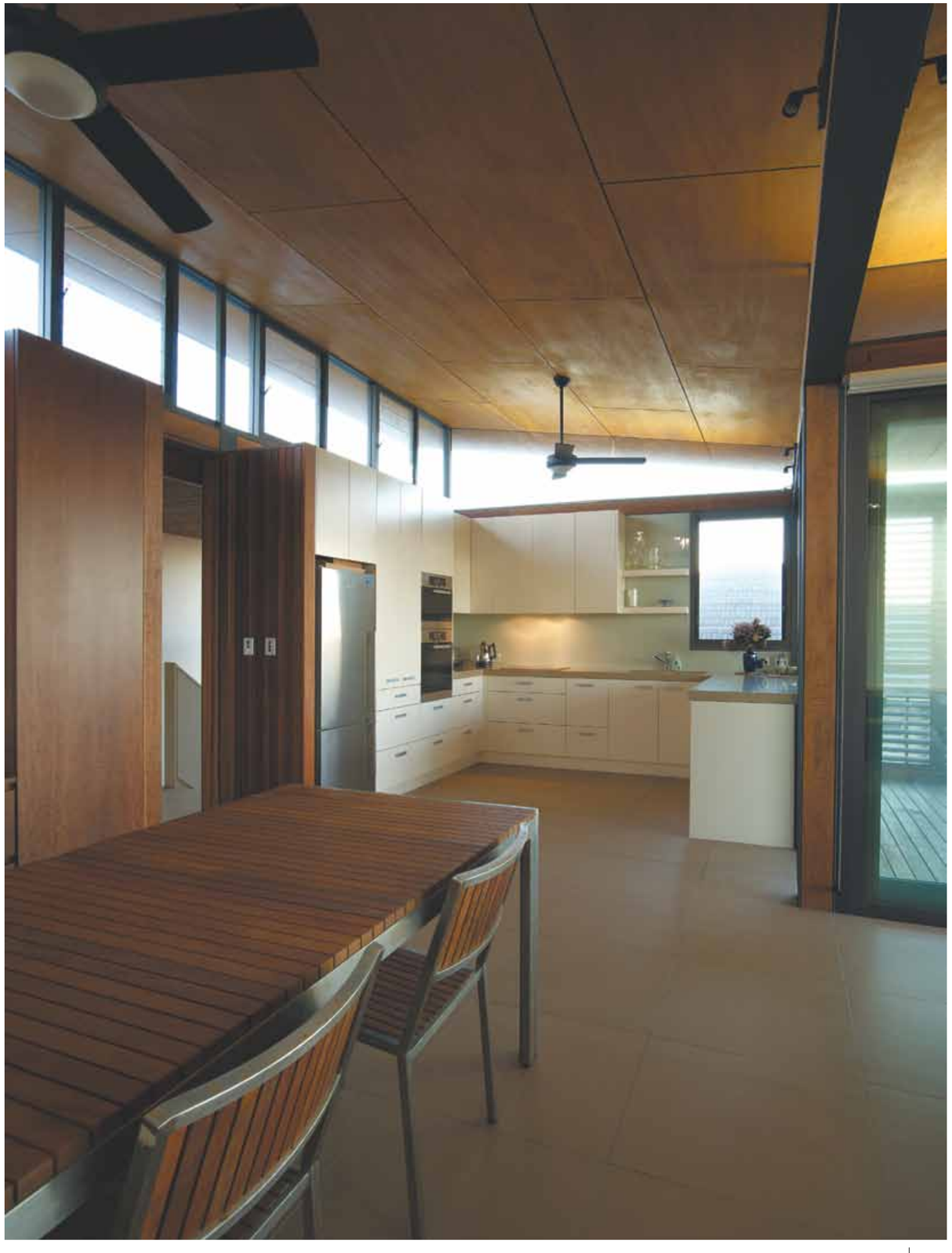
Choi says it was "a pleasure and huge resource" to work with Graeme as "a lot of architects work with good principles and best practice but there is generally not much post-occupancy research done".

Graeme has installed an eight-channel data recorder which will measure performance information including outside air temperature, solar radiation, the temperature of the passively-warmed sunroom, the temperature of the main living area, the level of water in the water tank, the amount of energy generated from the solar panels and the temperature in the domestic hot water tank.

"Graeme's ongoing measurements will provide operational information that he will make available to others who wish to make their home more sustainable," says Choi.

Visitors to the Jessup/Elkan home are intrigued by the radio-linked readout in the living room which provides a continual record of daily and monthly electricity generation.

"It is a source of continual satisfaction to see how in summer we are generating – and being paid for – electrical power output to the grid," says Graeme. "This feature is of great interest to our many visitors as they can see solar energy in action." **The 1.4kW array of solar panels have been found to generate about 50 per cent of the home's electricity needs in summer and about 25 per cent in winter.**



The two bathrooms are fed entirely by tank water

Bathroom exterior: louvred windows are positioned to provide good cross ventilation

With the whole house connected to a 15,000-litre rainwater tank and pump, "we shower using our own rainwater and heat from the sun," says Graeme. "The water lathers beautifully – what more could you want?"

"On the deck we can sit in the sun listening to our solar-powered waterfall as it cascades down the slope in the landscaped native garden."

A year's measurements determined that the tanks contributed 99 per cent of the home's water needs.

Domestic hot water is provided by a conventional solar hot water installation using an instantaneous gas water heater to bring the water up to the required temperature on less sunny days. Graeme and Barbara usually have the gas heater switched off in the summer.

Cooling in the house is provided by a well-designed air flow and ventilation system comprising of generous openings on all four sides of the house, high-level clerestory windows to enable the escape of warm air and induce airflow at times of no wind. The only active system comprises seven reversible ceiling-mounted fans.

General lighting is provided by efficient compact fluorescent lights and localised reading lights avoid the need for a high level of general background lighting.

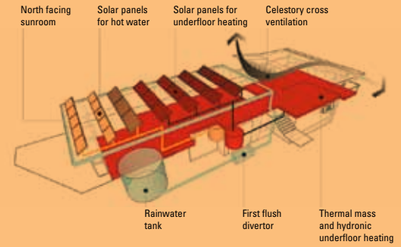
Audio and TV appliances in the lounge are connected to a separate power circuit so a single switch can ensure they are completely turned off when not in use. This helps to minimise standby energy use.

Barbara Elkan says the concept she and Graeme visualised has been realised in this superbly designed but "natural" house.

Mona Vale residence

Designer **Choi Ropiha Architects** www.choiropiha.com
Builder Graybuilt Pty Ltd
Location Mona Vale, NSW
Project type New home

Photography Brett Boardman



Sustainable features

HOT WATER SYSTEM

- Edwards solar hot water. 300L stainless steel tank coupled to two Rheem copper solar collectors. Supplementary heating by a Rinnai instantaneous gas heater. $8000 installed, after rebate

RENEWABLE ENERGY

- 1.4 kW grid-connected solar PV, sized for upgrade to 3.0 kW. $12,000 after rebate
- Renewable energy offsets from Climate Friendly to offset emissions from grid supply

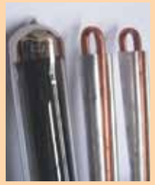
WATER SAVING

- 15,000L rainwater tank with Onga water pump with manual changeover to town water when necessary
- In-ground first flush diverters – 300L capacity to ensure clean water supply
- Tank water to whole of house except kitchen cold water
- Water-efficient plumbing to reduce water consumption
- Pre-plumbed for use of greywater for flushing the toilets (to be installed)
- Coastal native landscaping to avoid watering
- Low-flow AAA-rated showerheads
- AAA-rated Caroma Smartflush 4.5L/3L dual flush toilets

PASSIVE HEATING & COOLING

- House ‘zoned’ to 3 separate areas: sunroom at back; bedrooms and hallway; living area at front. Assists in retention of heat in winter
- Reverse brick veneer construction to dormitory area
- Walls and ceiling insulated with R3 polyester batts
- Window and deck adjustable shutters
- Generous eaves to provide shading
- Tiled concrete slab floor for thermal mass
- Windows positioned to provide good cross ventilation regardless of wind direction
- Limited window area on the west wall, preventing excessive heat gain in summer
- Large windows in north-facing sunroom with adjustable awning and tiled concrete floor for passive solar
- High-level clerestory windows in the southern pavilion provide solar gain, ventilation and natural lighting to front living area
- Bedrooms cross ventilated via fanlight windows above doors

ACTIVE HEATING & COOLING



- Solar-powered hydronic space heating to the living area – kitchen, dining, and lounge. System comprises 6m^2 Suntrap evacuated U-tube solar collectors (suntrap.net.au); 500L hot water storage tank; 2 x Grundfoss water circulating pumps. Graeme: “U-tube solar collectors are relatively low profile, which fits in with the flat roof design of the house. Most evacuated tube panels are quite long; the advantage with the U-tube collector is that they will operate on their side, so they won’t interfere with the neighbours’ views.”

  Cost: around $20,000

- Auxiliary space heating provided by a high-efficiency Cannon Fitzroy power-flue gas heater

BUILDING MATERIALS

- External cladding is indigenous plantation spotted gum wood panelling to the front pavilion, Shadowclad radiata pine eco cladding to the rear section

WINDOWS & GLAZING

- Comfort Plus laminated glazing to all windows and doors

LIGHTING

- Low-energy compact fluorescent lighting

WASTE TREATMENT

- Organic waste composting and worm farm

OTHER SUSTAINABLE FEATURES

- Audio-visual appliances in the lounge are connected to a separate power circuit so a single switch can ensure they are completely turned off when not in use

Sanctuary talks to John Maitland

Adelaide-based John Maitland of Energy Architecture is one of the country's most awarded environmental architects. He tells Sanctuary a little of what makes him tick.

Why did you get into architecture?

My father recognised in me an organised and creative mind, and suggested architecture. It appeared to be a less academic option compared to other courses and related to areas I enjoyed, so I went along with his suggestion. It wasn't until final year that it dawned on me that I wasn't just "going to school", that architecture was in me, and with that realisation I began to flourish academically.

Why did you make the move to environmental architecture?

I paid attention to sunshine and shade in my buildings, of course, but it wasn't until the early 80s that I became conscious of, and seriously concerned about, the broader impacts of built form decisions on the environment. **By the early 90s I had developed my business around core aims toward sustainability** and renamed my practice Energy Architecture.

John's work on the Aldinga Arts EcoVillage has included designing this house, profiled in *Sanctuary* 3

How do you feel about the current state of architecture in Australia?

There is a groundswell of interest in sustainable architecture, reflected in the emergence of different architectural forms, but the unfortunate reality is still with the project home builders. There is nothing to show real steps toward better housing. Brick veneer abounds.

The design and construction of John's own cutting-edge home renovation, Ada St, was recorded in a documentary, *21 Ada Street Sustainable House Documentary.* It's available from his website, www.energyarchitecture.com.au

What are some of the things you've done lately?

I'm proud of my work with the Aldinga Arts EcoVillage. It has set a new benchmark in South Australia for larger scale housing development, and become a learning model for sustainability. The developers wanted knowledge about building systems, design thinking and community structures that enable a direction toward sustainable development. And I have learned about the principles of strong economic development, without which any worthwhile plan can go awry. The dollar factor has a way of modifying the best of intentions when it comes to sustainable development.

I'm also excited by a new project-home business I have developed called "Next – Your Sustainable Home". It's a range of off-the-plan energy and water efficient homes, some of which are preformed factory built. This initiative is encouraging builders to take on ways to build energy efficiently and economically. They see that they can use existing standard systems and technologies, combining them in more effective ways tied to natural energy and air flows. **The exciting thing is that "Next" homes are accessible to a greater number of people than one-off designs.** Through Next I'm influencing and interacting with more young people, and I believe that they are redefining current boundaries and defining their future.

More information

www.energyarchitecture.com.au
www.aldinga-artsecovillage.com.au
www.nextyourehome.com.au

"Next" is a range of off-the-plan energy and water efficient homes, some of which are preformed factory built

Batchelor pad

The $178,000 house that looks a million bucks

by Rachael Bernstone

The house features timber decking and covered transitional spaces that blur the lines between inside and out

Shade from the surrounding garden helps keep the house cool year round

When Darryl Butler and Graeme Cheater did the rounds of architects in Darwin to discuss their plans for a low-budget house, they could find only one who was willing to take them on. It had everything to do with the budget: $150,000 to build a new house in Batchelor, 100km south of the city.

It was at the offices of the Architects Studio where a previously unknown local connection sealed the deal. Architect and heritage consultant Peter Fletcher had a photograph of the Wesleyan Methodist church on his office wall. Built in 1897, and one of Darwin's oldest surviving buildings, the church was restored and moved to the city's Botanic Gardens in 2000. "See that baby in the photograph, that's me," said Graeme to his surprised partner and the architect. Graeme's father, a builder, had worked on the church many years previously.

Having appointed Peter as their architect, Darryl and Graeme suggested he could help them convert a shed into their new residence. When that proved too costly, Peter offered to design a back-to-basics home to suit their lifestyle, influenced by the historic church and early Territory homesteads. These pioneer structures were built with steel frames to resist termites, corrugated steel walls and roofs, which were easy to transport, and wide overhangs and shutters to keep the sun out and let breezes in.

"In the 19th century, houses were built by lay people, not builders or architects, who came up with ideas because of the extremes of climate here, and they lived reasonably comfortably in what

Advantages of steel in Top End construction
Termite-proof, minimal heat retention, allows single-skin construction and minimal use of other materials (plaster, glass, paint etc). Extensive local steel fabrication expertise. Light weight of materials minimises transportation costs and site disruption.

> The polycarbonate panels under the roofline mean that light comes in all around the top of the walls, so there is always beautiful light inside

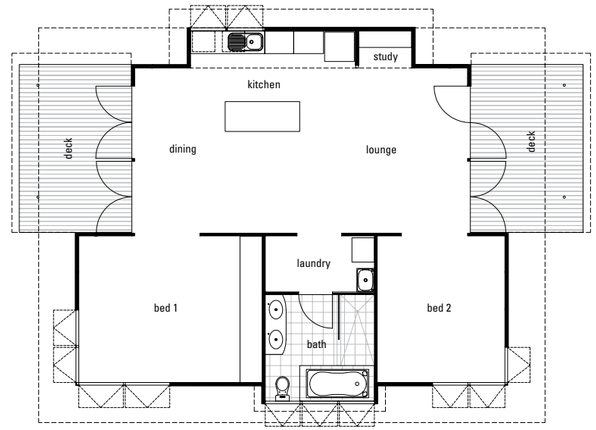
The concrete slab floor is always in full shade, creating a cool haven from the daytime heat

is essentially a hostile environment," Peter says. "They had limited materials but they were innovative in the way they cooled their houses, through the use of open planning and operable walls or wall shutters, so that they effectively became pavilions rather than houses."

Peter's design for Darryl and Graeme consists of a steel frame and single skin construction – corrugated Colorbond steel and polycarbonate panels form the outside walls and the interiors are left unlined – making the house straightforward and inexpensive to build.

The absence of glass or windows – Suntuf polycarbonate shutters in various shades of translucency feature in every room – also helped to keep costs down. **During daylight hours, artificial lighting is not required because over 60 per cent of the external walls are clad in Suntuf, ensuring even light distribution throughout.**

"I'm a minimalist in the sense that I try to reduce the amount of materials back to an absolute minimum to achieve the job," Peter says. "That produces a more environmentally friendly result because, in this case, we used half the materials that a typical house would require, which translates to savings in both production and transport of



Awning shutters allow walls to remain open, even during tropical downpours

building products, as well as significant cost savings for the clients."

With only two bedrooms and open living spaces leading to generous decks, the plan is both economical and in harmony with its climate. As long-term Top End residents, Darryl and Graeme were aware of the advantages of open planning and cross flow as an alternative to airconditioning. Big on entertaining, they also required covered transitional spaces to outdoor entertaining areas, in order to accommodate the movement of groups of people.

"These spaces also provided wall and door openings during the wet season so that cross flow is not restricted," he adds. "Similarly, awning shutters allow walls to remain open, even during tropical downpours."

Sited among established foliage – an earlier house on the site burnt down in the 1970s but its garden remained – the house is shaded by huge frangipani and custard apple trees and other tropical plants.

"The openness of the design means that everywhere you stand in the house, you can see out to the garden," Darryl says. "And the polycarbonate panels under the roofline mean that light comes in

Industrial chic: The kitchen is fitted out with benches and cabinets from an auto parts catalogue!

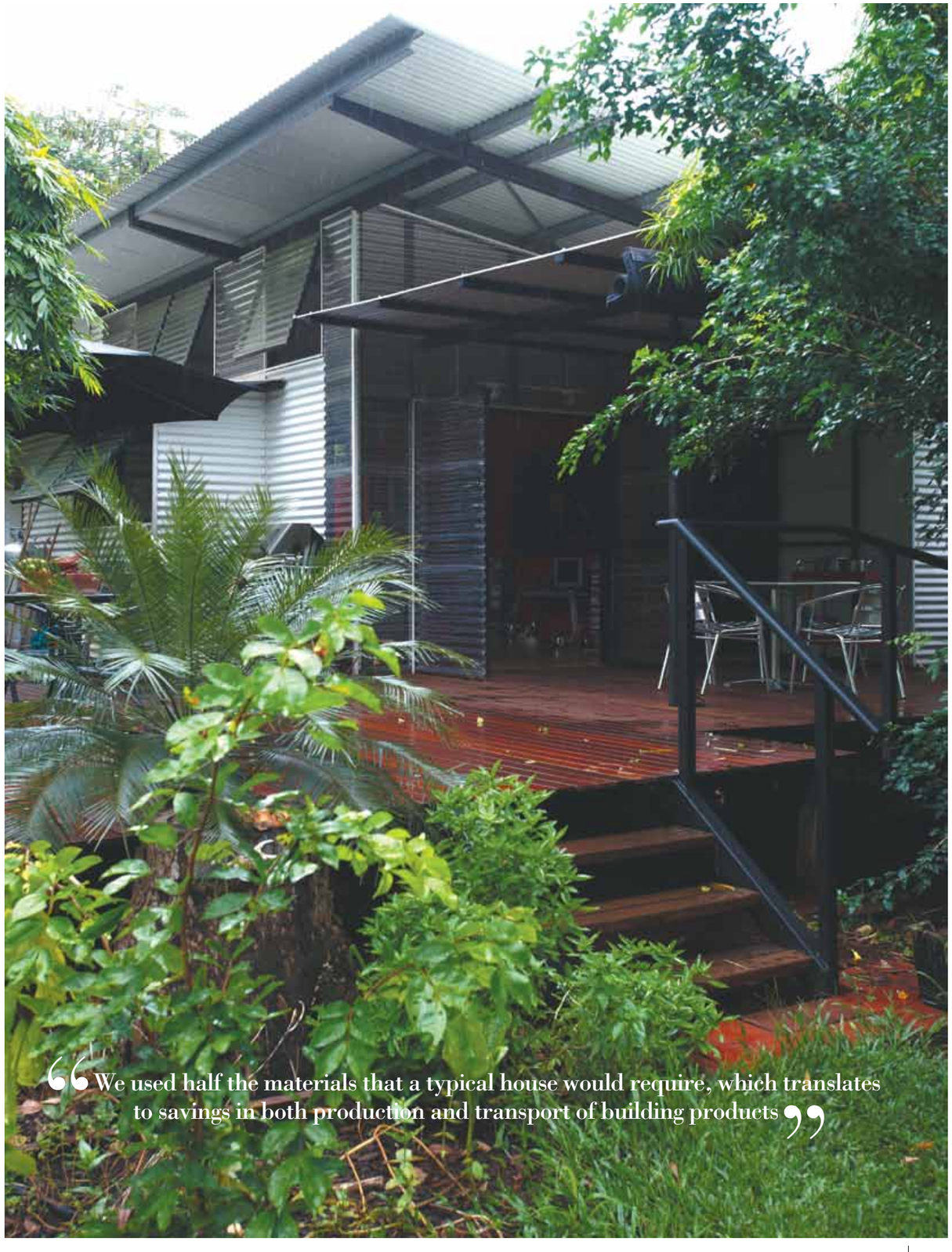
all around the top of the walls, so there is always beautiful light inside."

Darryl and Graeme's decision to eschew a traditional kitchen in favour of two kits of steel cabinets they spotted in a Repco catalogue saved on hefty joinery. The red and silver cupboards, drawers and moveable benches translated to an 85% cost saving compared to a conventional kitchen fit out costs and contributed to the industrial aesthetic of their interiors.

"We mostly cook outside unless it's raining," Darryl explains. "We don't have a stove inside, but we have a barbecue on the deck and we use a camping stove with a butane cylinder if we need a hotplate. I like to bake and so I cook cakes in the convection microwave, and I've recently started experimenting with baking bread in the barbecue."

The simplicity of the architecture is very much in keeping with Darryl and Graeme's lifestyle: they don't overly value their possessions but value being attuned to their environment. "We made a conscious choice to not allow things like security screens, to compromise what we wanted for our living space which was to be open and integrated seamlessly with the garden."

"We will never aircondition this place," Darryl



"We used half the materials that a typical house would require, which translates to savings in both production and transport of building products"

High-level polycarbonate transparent cladding brings light into every room, while deep eaves ensure no direct sunlight penetrates. Light without heat

adds. **"When the sun goes down, and the temperature drops at night, the house cools immediately thanks to the single skin.** During the day, the ambient temperature inside is the same as outside, but we have shade from the roof and breezes running across the house that make it cooler inside. In the build-up, around October and November, when the outside temperature can be 38 degrees, it gets a bit warm, but the sun never touches the slab so the concrete floor stays cool, and at night the temperature drops very quickly to comfortable levels."

Although the cost of the house – $178,000 – was higher than the clients' initial budget, most of the increases resulted from changes they requested during the design and construction phases, and they are happy with the final outcome. "We really like what Peter has done for us," Darryl says. "We have a house that we really love living in, and although it's quite idiosyncratic, people who come here to visit immediately see how well it works with this climate. It might not be everyone's cup of tea, but we are not precious about anything and it works for us."

Batchelor Pad

Designer The Architects Studio/Mode Design Corporation
www.architectsstudio.com.au
Builder Tranzbuild NT
Location Batchelor, NT
Project type New building
Cost $178,000
Photography David Silva, Silva Photographics

Sustainable features

PASSIVE HEATING & COOLING

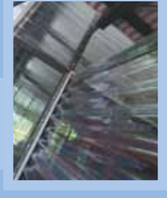
- Clear-finished concrete floors for thermal mass
- Air-Cell Retroshield thermo-cellular reflective insulation in ceiling
- Unrestricted cross-ventilation via shutters and French doors
- High level exhaust shutters to accelerate cross-ventilation and expel hot air
- Deep eaves, shade walls and shutters
- Orientated to capture year-round prevailing breezes
- Shade and cooling micro-climate from established garden setting

ACTIVE HEATING & COOLING

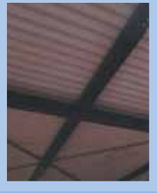
- Ceiling fans (infrequently used)

WINDOWS & GLAZING

- No glass. Instead transparent Suntuf polycarbonate wall cladding by Burnside Plastics



BUILDING MATERIALS



- Single-skin steel Bluescope Lysaght
- Custom Orb walls and ceiling
- Lightweight rectangular hollow sections (RHS) steel frame
- No internal wall linings
- Minimal materials content for smaller ecological footprint

LIGHTING

- Low-energy light fittings throughout

OTHER SUSTAINABLE FEATURES

- Ground-level, as opposed to elevated, building, to allow access by older persons or persons with a disability
- Sited to allow expansion via functional areas connected to new 'pods' with covered breezeways