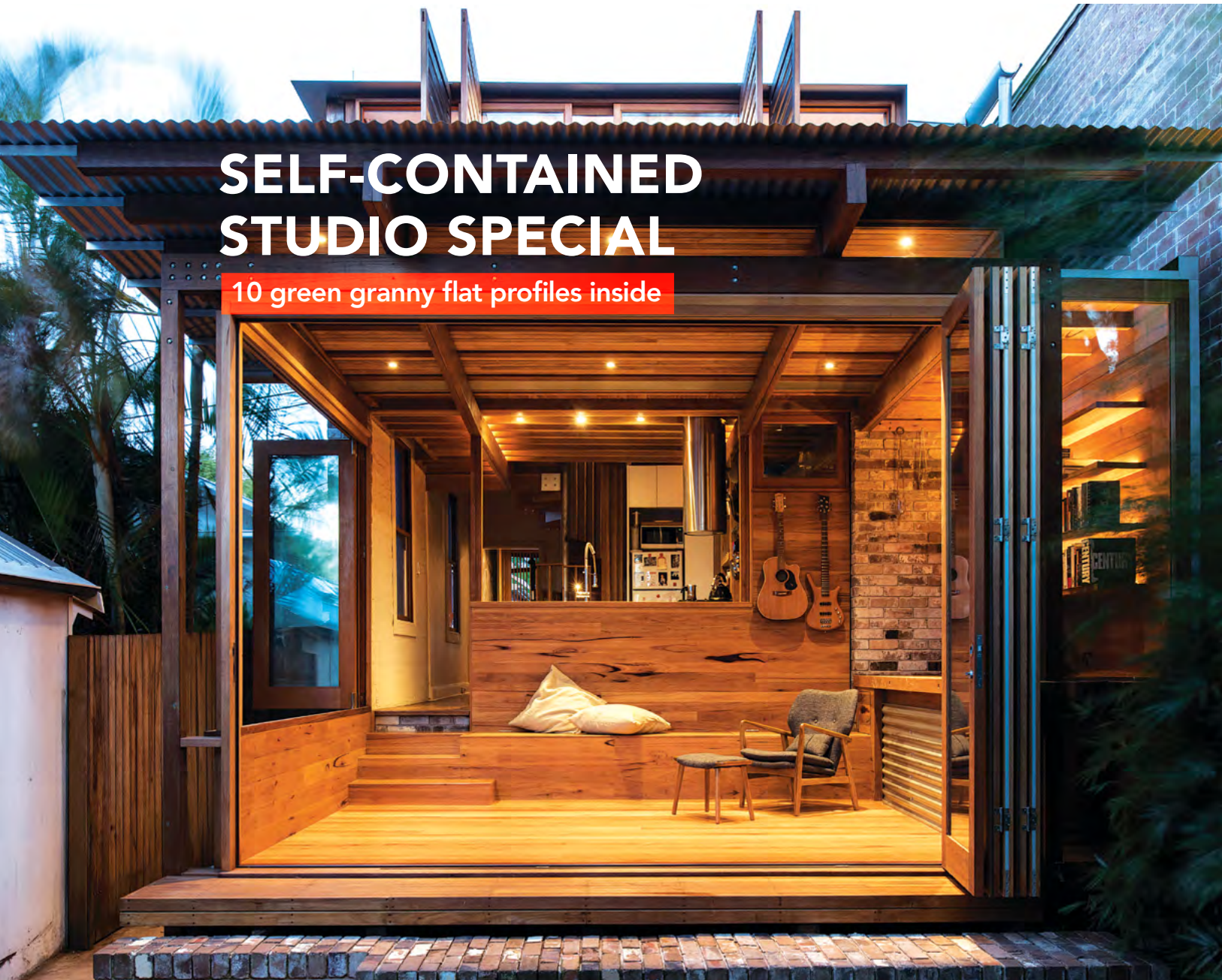
MODERN GREEN HOMES

Sanctuary

INSIDE ISSUE 35 Hydronic heating; skylights; birdscaped gardens; design for cold climates; green home ideas & products; renovating on a tight site; tiny backyard studios

SELF-CONTAINED STUDIO SPECIAL

10 green granny flat profiles inside



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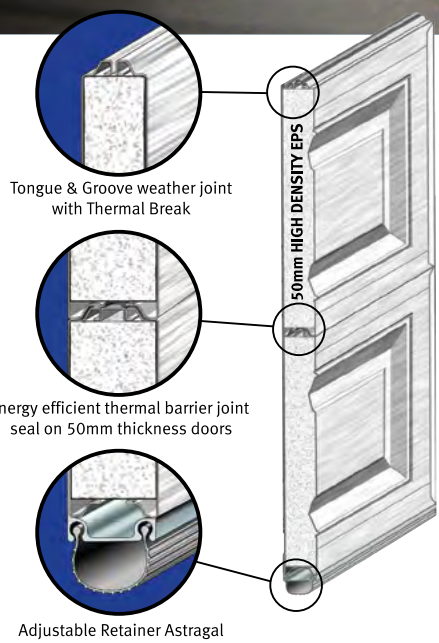

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Sanctuary

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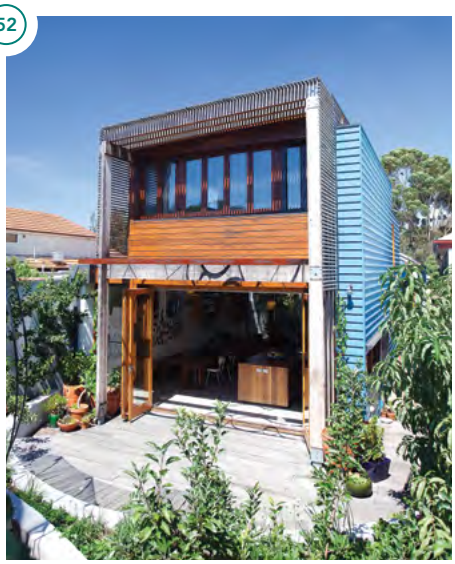

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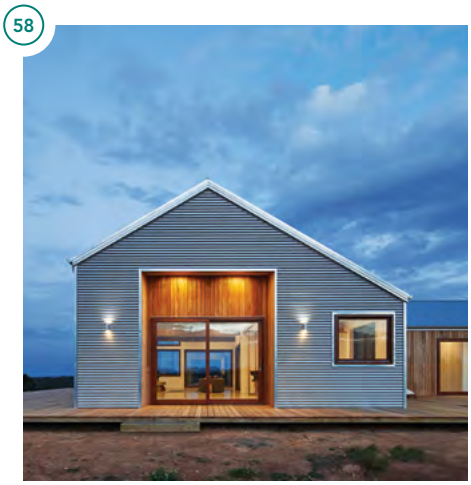

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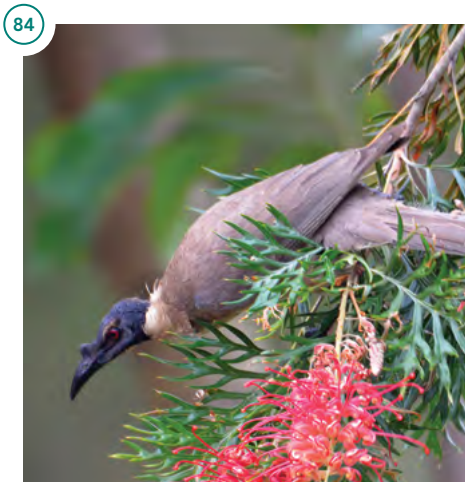

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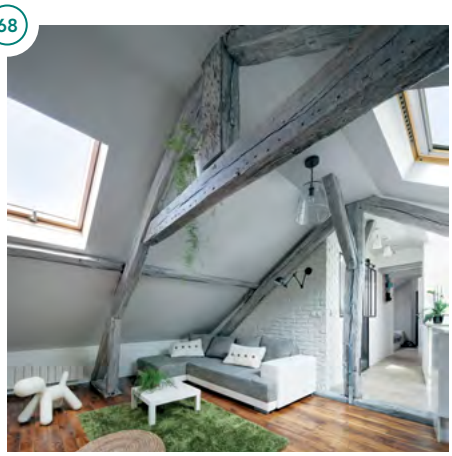

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Letter from the editor

—Issue 35

GREENING OUR CITIES ONE BACKYARD AT A TIME

Well-built, well-designed small spaces are, in many ways, more valuable than larger ones. They are more efficient with materials, require less energy to run, are easier to clean and have a chance of being located within cooee of everything else you do.

While suburbs continue to sprawl to make room for new houses and people, attitudes to small homes are changing – and so are the planning laws. Granny flats are being rebadged as 'small secondary dwellings' and many people are building them for home offices, downsizing in retirement, accommodation for old friends, rental income and more. In this issue of *Sanctuary* we unpack the trend and examine the exciting possibilities for small secondary dwellings as affordable housing and the opportunities for sustainable design to transform the push for urban infill. As part of this special feature, we profile 10 architecturally designed secondary dwellings that are making our suburbs more flexible – it is impressive indeed to see what can happen when high design is applied to the once-humble granny flat. And in lieu of an overarching affordable housing strategy for Australia, I would urge policymakers to note the successes here – grassroots ingenuity is leading the way.

ALSO IN THIS ISSUE...

Rachael Bernstone explores what happens when the Japanese 'Sukiya' style is applied to a semi-detached terrace in inner-west Sydney. Sarah Coles looks at creating habitat for birds and we feature inner-city renovations that make the most of tight sites. We head to the bush to look inside a rammed earth farmhouse in Margaret River and a stunning home high in the Great Dividing Range in Trentham, Victoria. This time of year many people are looking for ways to bring light and heat into homes, so we compare hydronic heating with reverse-cycle air conditioning to help you keep warm this winter, and check out the latest in 'daylighting' technologies.

This is my first *Sanctuary* as editor and I have already benefited from the immense knowledge and wisdom in our community of readers, past editors and contributors. I thank everyone for making me feel so welcome, and hope you enjoy reading this issue as much as I have enjoyed making it.

Kulja Coulston

sanctuary@ata.org.au | sanctuarymagazine.org.au

Congratulations to David Shlager from Clovelly, NSW, the happy winner of our Australian Ethical $5000 managed fund subscriber prize. David and his wife are "travelling down the road of engineering a full off-grid existence" with the help of *Sanctuary* and the ATA and he said this prize will make their dream a little more achievable.

Sanctuary is published by the Alternative Technology Association (ATA), a not-for-profit environmental organisation promoting renewable energy, sustainable building and water conservation since 1980. ATA's advisory service, advocacy, research and publications aid over 6000 members Australia wide.

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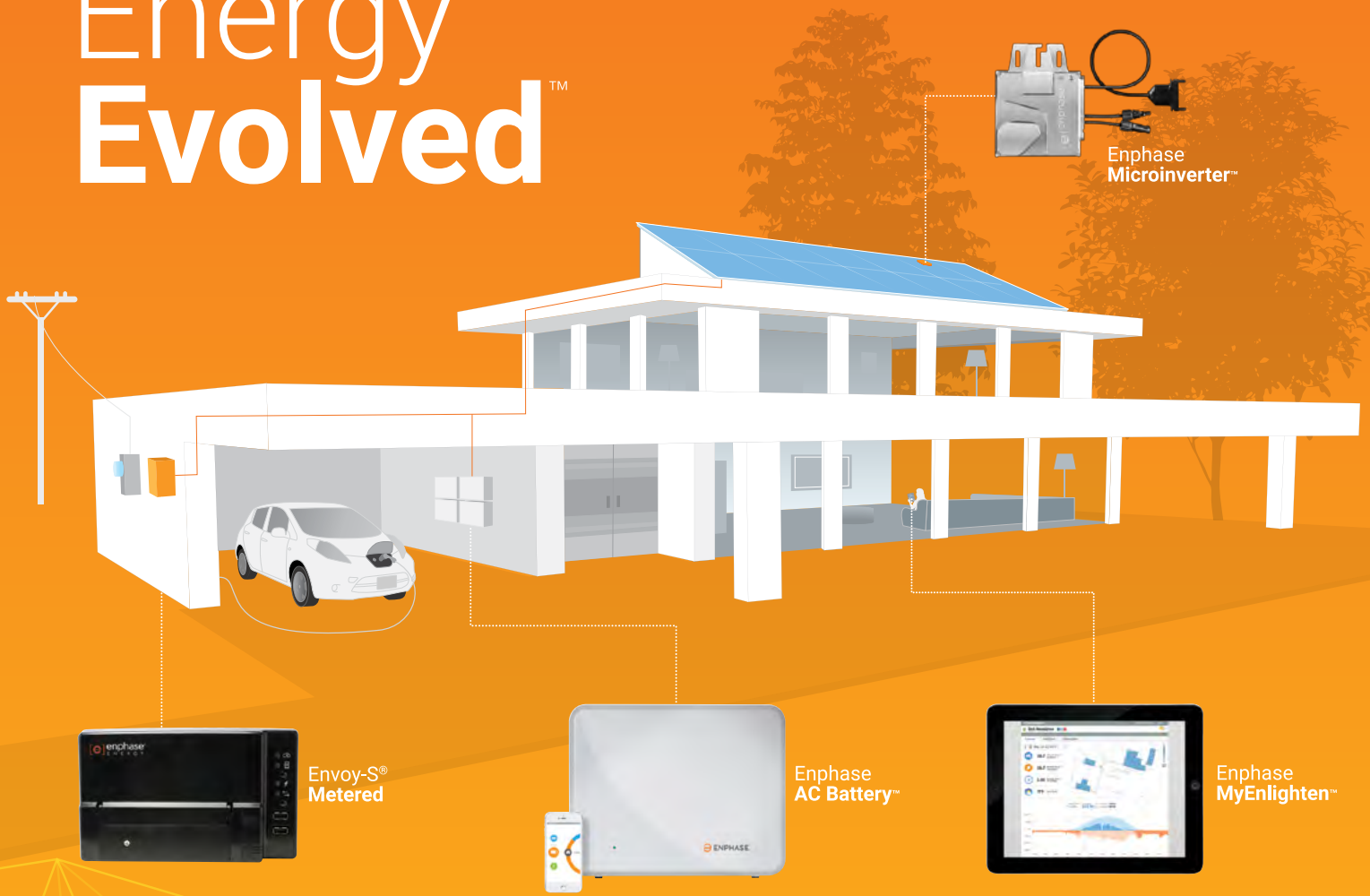

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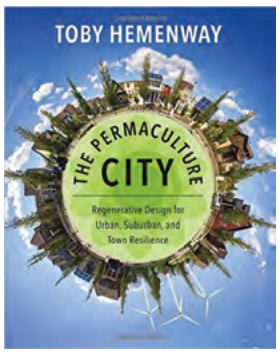
Reviews

—Books, websites and other interesting stuff

If you have recommendations for films, books, smartphone apps, blogs, websites or anything else you think would be of interest we'd love to hear from you. Email us at sanctuary@ata.org.au

BOOKS



THE PERMACULTURE CITY

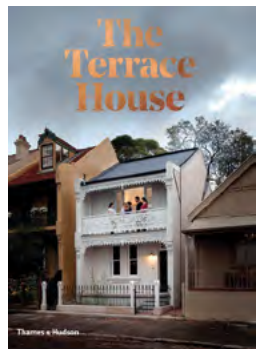
Toby Hemenway
Chelsea Green Publishing
$39.99 (AUS)

Chelsea Green publishes fantastic books about organic gardening, permaculture, ecology, DIY, and sustainability. *The Permaculture City: Regenerative Design for Urban, Suburban, and Town Resilience* (2015) by Toby Hemenway is no exception. It documents the rise of new approaches and thinking when it comes to permaculture designers and practitioners. And given that nearly 90 per cent of Australians live in urban areas and urban density is on the rise, *The Permaculture City* is relevant and timely. The main thrust of the book is to explain why urban permaculture is more than just 'gardening in the city'. It begins with an overview of cities from the perspective of whole-systems permaculture and includes chapters on design, techniques for home gardening, community gardening strategies and water efficiency. 'Energy Solutions for Homes and Communities' is a lively chapter for the sustainable home owner or builder. Permaculture has exploded in recent years. Hemenway writes, "After 30 years we're starting to know what we're doing"; a fact articulated by this book.

KIYONORI KIKUTAKE: BETWEEN LAND AND SEA

Edited by Ken Tadashi Oshima
Lars Müller Publisher
$50.00 (US)

Although obscure to many, Kiyonori Kikutake (1928-2011) is renowned for his involvement in the Metabolist movement – a post-war Japanese architectural movement that fused ideas on architecture with those of biology. Metabolists wished to move beyond the modernist idea of 'form follows function' and in this book instead emphasises "the potential of space to continually adapt to changing functions in a way that is dynamic, seemingly biological, akin to a living organism". This book is based on an exhibition of Kikutake's work, and the exquisite volume contains essays about his life, extracts of his writings, and profiles of his projects under the headings 'Land' and 'Sea.' The designs and models of his work included in *Between Land and Sea* are a wonder to behold. Kikutake was well ahead of his time. After witnessing the devastation of WWII, he proposed that traditional agriculture couldn't feed the city, and envisioned Marine Cities as centres for aquaculture, "producing and processing food from the sea, as well as harvesting energy from the ocean currents".



THE TERRACE HOUSE: REIMAGINED FOR THE AUSTRALIAN WAY OF LIFE

Edited by Cameron Bruhn and Katelin Butler
$70.00 (AUS)

With many well-designed buildings, floor plans and beautiful images, this book would be of interest to those in the throes of planning a new home or addition. The editors Katelin Butler and Cameron Bruhn are well known and active in the Australian housing industry, and the quality of houses profiled in this weighty 250+ page book is high. While the majority of the profiled projects don't have a sustainability focus, some designers will be familiar to *Sanctuary* readers, such as Andrew Maynard Architects, Benn + Penna Architecture and Tribe Studio. The book is also filled with interesting facts: "The format of the terrace house, as we know it today, resulted from the Great Fire of London in 1666 [and] a resolve to develop new construction patterns that would inhibit fire spread."

WEBSITES

BUY ME ONCE

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Buy Me Once is a website that only stocks products built to last a lifetime. After spending a year investigating why consumers buy cheap products which rapidly break, the website's mission is to "throw away our throwaway culture", and the producers have weeded through thousands of products to identify a range which hold manufacturers' guarantees for quality. Currently, the majority of products on the site are available only to shoppers in the UK and US, but it is a good resource for identifying which brands in the Australian and New Zealand markets are durable, such as Le Creuset cooking pots or Timberland boots. Up for a challenge? *Buy Me Once* is running a competition for a little black dress that lasts a lifetime.

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THE PLANTHUNTER

www.theplanthunter.com.au

The botanist's equivalent of Brainpickings – the Planthunter is a monthly online magazine about plants. Founded by landscape designer Georgina Reid, who also contributes regularly to *The Design Files*, each issue takes a different theme such as 'Medicine', 'Design' and 'Money', and three to five new stories are published each week. The magazine publishes stunning images and is broad in its scope, with articles at the intersection of botany, design, culture, art and the environment. Categories include gardens, art and design, people, harvest, botanica and how-to. With nearly 500 articles you can spend hours on this glorious website.

PODCASTS

99% INVISIBLE

www.99percentinvisible.org

Produced by Roman Mars.

99% Invisible is a podcast that began as a joint project between a public radio station and the American Institute of Architects. Early on, it had a design and architecture focus, but now, more than 200 episodes in, the podcast spans the genres of infrastructure, cities, objects, sounds, visuals, technology and history. With immaculate production, this is great radio to listen to while you re-tile the bathroom or weed the vegie patch. Subscribe to this podcast via iTunes or your favourite podcast player.

In the post

Write to us! We welcome letters on any subject, whether it be something you have read in *Sanctuary*, an experience you've had as part of the green design or build process, or a great idea you would like to share.

Please limit letters to 200 words. We can't guarantee we will publish all letters received and letters published may be edited for appropriateness, clarity and length. Email letters to sanctuary@ata.org.au with your name, city and state you live in.

We are building in a high termite area in Euroa, Victoria, and are looking at using H2 or H3 timber in the frame to help with this problem – but the possible toxicity concerns us. From my research, some of the chemicals used in these timber treatments could be considered toxic by the consumer, even if not admitted by the manufacturer. How can I find out what each timber manufacturer uses to treat their H2 and H3 timbers? And along the same lines what is known about boron treated timber?

– *Wendy*

From your email I think you already understand that H2/H3 refer to the hazard level, not the treatment type. You can find the six main hazard levels for treated timber here: www.timber.net.au. On this website you will also find technical advice and a number of Australian timbers that are naturally resistant to termites. (My personal preference would be for cypress pine but only because it smells so good when you're cutting it. It also has a lovely grain if you were to use it for floorboards!)

It's probably obvious, but I'd definitely avoid strong chemicals in a house frame, like copper chrome arsenate (CCA). This and creosote are also pretty toxic if burnt.

Blue pine treated with synthetic pyrethroid is a good option. I'd also consider a steel frame, rammed earth or other naturally inedible material if termites are that much of a problem.

Boron/borate is common for killing ants but having your whole house frame impregnated by the chemical would lead to a much greater level of potential exposure. Some boron-based compounds are toxic to us as well as to ants. When choosing a specific product you would need to know exactly what they are using. If you do find the chemical name you can look it up on: www.sciencelab.com to find the material safety data sheet (MSDS).

– *Doug Rolfe*

I've been looking at a lot of open layout house designs lately for my dream home and have noticed that the doors and windows open right up, giving a desirable open space feel. But, there is no sign of flyscreens! I have worked and lived up and down the east coast of Australia and I have found mossies to be very annoying and a serious health risk. How do they keep flies and mossies out of the open house?

– *Alex, Wollongong*

The answer is, they don't! Or more precisely, most of the lovely houses featured in glossy architectural publications do not end up being used the way the designer intended. Also, in some respects they are often non-compliant with building codes – how many staircases have you seen in books with no handrail? Often flyscreens are installed after the event – and after the photo shoot – because it is impractical to live without them. But not always!

In Sydney, I am told by entomologist friends that there are 22 species of mosquito, but only two of those will usually enter houses. The surroundings are also important, in terms of dampness and mosquito habitat, as is elevation above ground. Mossies typically hang around at less than 2m elevation. Case in point is my own home on Sydney's Northern Beaches: it's very well vegetated, has a very healthy mossie population (from the mossie's point of view) in the back garden, yet because my deck is 1.5m above ground, a mossie coil of some kind is usually sufficient to keep them at bay, and the living area remains unscreened because so few actually come inside. If it was at ground level that may be a different story.

But to screen a wide opening such as bifold or stacking sliders, a vertical roll type screen is a good option, that is, it has a vertical roll at one or both ends, sliding horizontally. There are several brands on the market, some may be more robust long term than others, such as the Centor screen we have used very successfully on a number of such projects.

– Dick Clarke. [Two house profiles in this issue also feature door units with inbuilt screens, pages 46 and 52 – Ed].

Share your ideas, inspirations and examples of energy-efficient solutions and sustainable designs on Instagram @sanctuarymag, our Facebook page www.facebook.com/SanctuaryMagazine and on Twitter @Sanctuarymag






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ENERGY EFFICIENT & ENVIRONMENTALLY SUSTAINABLE BUILDING DESIGN

A modern townhouse

By subdividing a large site in Melbourne's middle suburbs to allow for two 7.7 Star townhouses, architect Marie Carrel has bought some financial security, and created additional housing close to employment and transport.

WORDS Verity Campbell
PHOTOGRAPHY Ben Wrigley

Urban infill: The generous 645 square metre site is redeveloped to accommodate two 7.7 Star townhouses, each with space for parking, productive gardens and trees. Access to the smaller rear dwelling is to the side of Marie's home.

GIVE A DESIGNER A BLANK CANVAS and let's see what they do. Marie Carrel of Planet Architecture took her canvas, in Melbourne's leafy eastern middle suburbs, in a direction designed to secure her better work-life balance and financial freedom.

Instead of opting for a single dwelling on the generous 645 square metre site, Marie decided on dual occupancy with a largish 7.7 Star dwelling at the front (featured here) and a smaller townhouse slated for the block's rear. She wanted to maximise the site – "we need more urban density because most of us like to live closer to town" – and create a good financial foundation for the future, while producing quality, sustainable architecture. "Dabbling in property development is a very exciting project for me."

Marie has nimbly solved the particular solar and privacy challenges of this east-west property. The home literally opens to the sun. With lofty ceilings, the combined living, dining, and kitchen spills onto a generous north-facing deck. This is Marie's favourite part of the home and it's easy to see why. "The high ceiling (three metres) gives that extra height where it's needed, while the bedrooms upstairs with 2.4 metre high ceilings keep mossies within reach," she laughs. "This home is all about air and light."

Sun is shaded from the thermal mass of the tiled concrete slab during summer, yet reaches almost to the southern reaches of the room in winter. The house is also designed to maximise through breezes. A south-facing casement window glanced

Double-glazed concertina doors open the living and dining rooms to a secluded outdoor entertainment area. The plant wall provides colour, and helps maintain healthy indoor air quality, and the recycled timber wall was reclaimed from the demolition of the old house.

through a peephole perforation in the staircase wall sends fresh air straight down into the lounge area. This window also ventilates the whole upper floor, Marie says.

As a building designer Marie likes to specify materials and products she's personally used – so that she can vouch for their performance – but this project has enabled her to expand her repertoire by trying out new products she has specified on other jobs but never lived with herself. Take the induction cooktop, or the oversized bi-folds and retractable fly-screen (4.6 metre span by 2.7 metre height), or her beloved hydronic heating. "This is the first time," she asserts, "since leaving France 27 years ago that I feel like I'm there. Because thermally it's been a shock to live in freezing houses here and in the States [where she lived before]. In the middle of winter it's just so cosy."

The key to the hydronic's success, says Marie, is its insulating layer. Traditional hydronic heating, she explains, heats the entire slab, the footings, and the surrounding ground if it's not insulated. But even if it is insulated, heating an entire slab takes time and energy. This system, she explains, is much more efficient because it includes Poly Underfoot insulation over the concrete slab. This layer keeps the heating coils separate from the slab

The house is designed to maximise through breezes. A south-facing casement window sends fresh air into the lounge area.

The light-filled kitchen makes the most of north sun, with smaller windows positioned to the east and west. The in-slab hydronic heating system in the living spaces is insulated to reduce losses and lag.

Heat rises! The rooms upstairs require no additional heating due to the combination of passive solar design and in-slab hydronic heating on the ground floor.

Marie uses vivid colours in combination with concrete and timber to create a sense of space in smaller rooms. All bathroom fittings are 5 star WELS, and the toilets and laundry are supplied with rainwater.

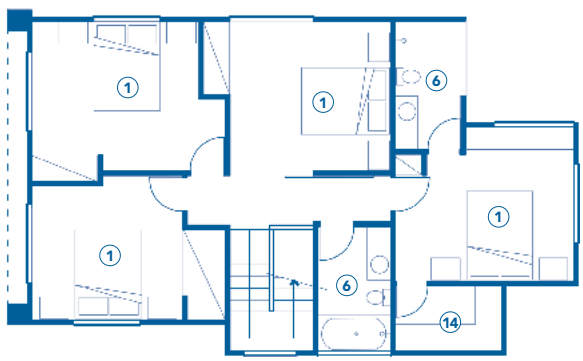
below – to reduce heat loss – and embeds them into a thinner, 100mm 'screed' slab poured on top. The coils heat this slab and the room beyond, saving time and energy. "The screed being thinner is also more responsive to thermostatic changes so you won't be sweating in the middle of the day in spring and autumn," adds Marie.

"Depending on the day," she says, "the heater comes on about 6:30am and heats until about 10am, and then it goes off until the next morning. This system, combined with the passive performance of the thermal mass of the floor, insulation, and double glazing, keeps the house around 16 degrees at night during winter, and about 21 degrees during the day." It's so efficient, she adds, that there's no need for upstairs heating. "Three out of the four rooms upstairs are facing north and heat rises so they keep warmer in winter anyway."

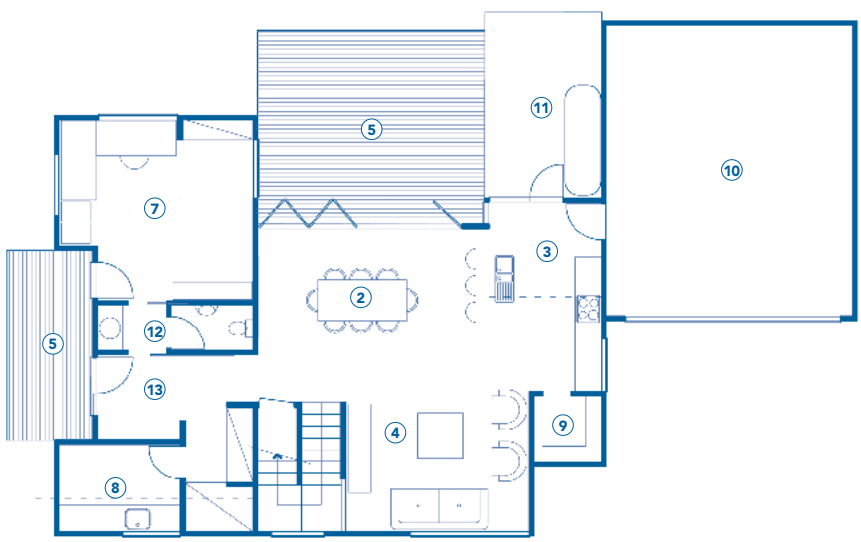
Marie estimates this type of hydronic heating adds about $80 per square metre to the hydronic heating install, depending on what slab finish you opt for. But "you have to spend more money as an investment to make sure you spend less later in running costs," she says.

Alongside warmth, light is another trademark of this home. "I'd like everyone to have a house that's bright and light," says Marie. "Once you've lived in a bright and light house there's no return. There's an energy that is brought by the sun that nothing else can bring."

FIRST FLOOR PLAN



GROUND FLOOR PLAN



LEGEND

1. Bedroom
2. Dining
3. Kitchen
4. Lounge
5. Deck
6. Bathroom
7. Study
8. Laundry
9. Pantry
10. Garage
11. Patio
12. Toilet
13. Entry
14. Robe

A modern townhouse

—Specifications

Credits

DESIGN
Marie Carrel

BUILDER
Eastwood Property

STRUCTURAL ENGINEERING
Coulthard Shim Pty Ltd

PROJECT TYPE
New build

PROJECT LOCATION
Melbourne, Victoria

COST
$530,000

SIZE
Lot 1
Land: 288 sqm
House: 217 sqm (includes 39 sqm garage)

Lot 2
Land: 217 sqm
House: Yet to be developed with a single storey, 2 bedroom house + study.

Balance of total: 645 sqm block including common land with driveway

BUILDING STAR RATING
7.7 Stars

Sustainable Features

HOT WATER
- Reused gas storage tank from demolished house, to be replaced at end of life with a high efficiency Sanden heat pump.

RENEWABLE ENERGY
- 100% accredited GreenPower due to low average daily energy use of 5.7kWh/day.

WATER SAVING
- All taps are 5 star WELS rated
- Caroma Profile toilet which allows hand washing with the clean water that enters the cistern once the toilet has been flushed
- 2510L slimline rainwater tank fitted with Onga pump and Davey Rainbank water controller. Rainwater supplies toilets, laundry and garden taps
- Bosch front-loader washing machine, 4-star energy and water rating.

PASSIVE DESIGN
- All habitable rooms (bar one bedroom) face north, with bathroom, stairs, entry, laundry, pantry facing south
- Insulated concrete slab for thermal mass
- All windows and glazed doors on the north side are fitted with eaves to prevent slab overheating in summer
- Insulation: walls R2.5 high density (HD) Knauf Earthwool batts; ceiling R6.0 Knauf Earthwool batts and Aircell insulation membrane
- Cross ventilation via south opening windows.

ACTIVE HEATING & COOLING
- Hydronic heating: pipes sit in a special cement screed above the structural concrete slab, with Poly Underfoot foam insulation inbetween – ensuring footings are not heated. Boiler: Sime super-efficient condensing gas boiler
- Lucci-Air ceiling fan in the study and master bedroom.

BUILDING MATERIALS
- Plantation pine wall and roof frame
- Colorbond roof in Surfmist, MiniOrb steel cladding in Basalt and James Hardie Axon and Matrix Cladding
- Modwood (made from recycled wood and plastic) balcony balustrade
- Recycled internal wall timber lining boards (many reclaimed floorboards from demolished house, balance was obtained from recycler)
- Finger-jointed plantation pine architraves and skirting boards, solid plantation pine shelving, Low-VOC Ardex range of glues and sealants.

WINDOWS & GLAZING
- Double-glazed Victorian ash windows from Premier Doors and Windows, with 14mm gap and argon filled cavity
- Low-e glazing to west-facing windows
- Rubber draught-proofing seals to all windows and doors.

LIGHTING
- LED lighting throughout.

PAINTS, FINISHES & FLOOR COVERINGS
- Low-VOC Wattyl interior design paints to interior walls
- Wattyl interior design water-based enamel paints; Wattyl Solaguard externally
- Signorino floor tiles throughout ground floor and bathrooms; laminate floor upstairs.

OTHER ESD FEATURES
- Vegie patch in the front garden
- Urban infill, replacing one dilapidated residence with two energy-efficient residences, while retaining open space.

The house is designed for the climate and features technologies including solar hot water and photovoltaics, rainwater collection and waste water treatment systems.

Country spread

Living in the country may seem charming and idyllic to some, but Pamela O'Reilly endured many climatic extremes before building a modern farmhouse near Margaret River.

WORDS Rachael Bernstone
PHOTOGRAPHY Douglas Mark Black

WHEN PAMELA O'REILLY AND HER late husband bought a property near Margaret River more than two decades ago, they took up residence in a former Group Settlement house built by pioneer farmers in the 1930s, and dreamed of running cattle and growing grapes. "It was built to English standards and was facing the wrong way," Pamela recalls. "The house wasn't insulated so it was stinking hot in summer and freezing cold in winter. After Terry passed away, I spent more than 20 years living there."

Pamela shelved their plan to grow grapes and continued raising beef cattle instead, calling on her son Paul, who lives next door, and daughter Jennifer, who lives in Margaret River, to help run the business. Three years ago, after decades of driving back and forth to Perth, Pamela decided to embrace country life full-time. She commissioned Paul, who is also an architect and lives in a home he designed and built for himself, to design her a modern farmhouse.

"Paul had a free run with the design," Pamela says. "Apart from saying that I didn't want a skillion roof and that I did want a traditional farmhouse verandah, I trusted him completely."

Taking into account his mother's wishes, Paul divided the house into two parts – both with pitched roofs and timber cladding, to resemble traditional barns –

Placed at a right angle to the bedroom wing so it faces north, the open plan living room contains kitchen, dining and sitting areas, with a covered outdoor room at the eastern end.

Picture windows – one with an inviting window seat and open shelving – frame views of the garden and farmland beyond, while banks of sliding glass doors allow breezes to enter for cross ventilation.

separated by a flat-roof section. It contains the main entry and a combined study and guest room.

"Essentially I split the house into two pavilions, and located the bedrooms on the southern side to face paddock views to the east, with a traditional verandah providing shaded spaces off that wing," Paul says. To the right of the main entry, the bedroom wing boasts a wide hallway with a rustic aesthetic, thanks to the rough-hewn recycled Oregon front door, which segments a long rammed earth wall. Formed and compacted in place, the rammed earth works in concert with concrete floors in the living area to provide thermal mass.

Placed at a right angle to the bedroom wing so it faces north, the open plan living room contains kitchen, dining and sitting areas, with a covered outdoor room at the eastern end. Two picture windows – one with an inviting window seat, the other surrounded with open shelving – frame views of the garden and farmland beyond, while banks of sliding glass doors allow breezes to enter for cross ventilation.

Outside, Pamela has nurtured a thriving series of garden rooms from a once bare paddock, battling grasshoppers, weevils and long spells without rain. She's always been a keen horticulturist but had never started a garden from scratch before, and admits the prospect was slightly daunting. "I found it easier to tackle once Paul laid out a series of winding paths with large granite borders, and plant beds and raised vegetable boxes," she says.

→

The house is divided into two parts, each with pitched roofs and timber cladding to resemble traditional barns. The garden is wild and luxuriant and has distinctive themes: a thicket is designed to attract wrens, and under the verandah there is a perfumed garden with gardenias and gingers.

The rammed earth wall stretches through the house and works in concert with concrete floors in the living area to provide thermal mass.

The bed packs away into the wall in the combined study and guest room.

Despite being just two years old, and therefore "still in its infancy", the garden is wild and luxuriant with a riot of coloured flowers that attract bees and native birds. Distinctive themes outline separate zones: a perfumed garden with gardenias and gingers nestles below the verandah; bushy natives occupy the western side between the carport and front door; a thicket designed to attract wrens sits just beyond the kitchen garden; an orchard marks the outer edge; and several ponds and water features are dotted throughout.

Nowadays, Pamela spends most of her time outdoors – tending cattle and the garden – but she loves to retreat into the house, which is much more comfortable and inviting than the Group Settlement house she occupied for so long. "This house never gets hot, even if it's 40 degrees outside," Pamela says. "And it doesn't get cold in winter because it's facing the right way. Also, my bedroom has louvres on three sides, carefully placed in the corners so as not to spoil the view, so I can capture breezes from all directions."

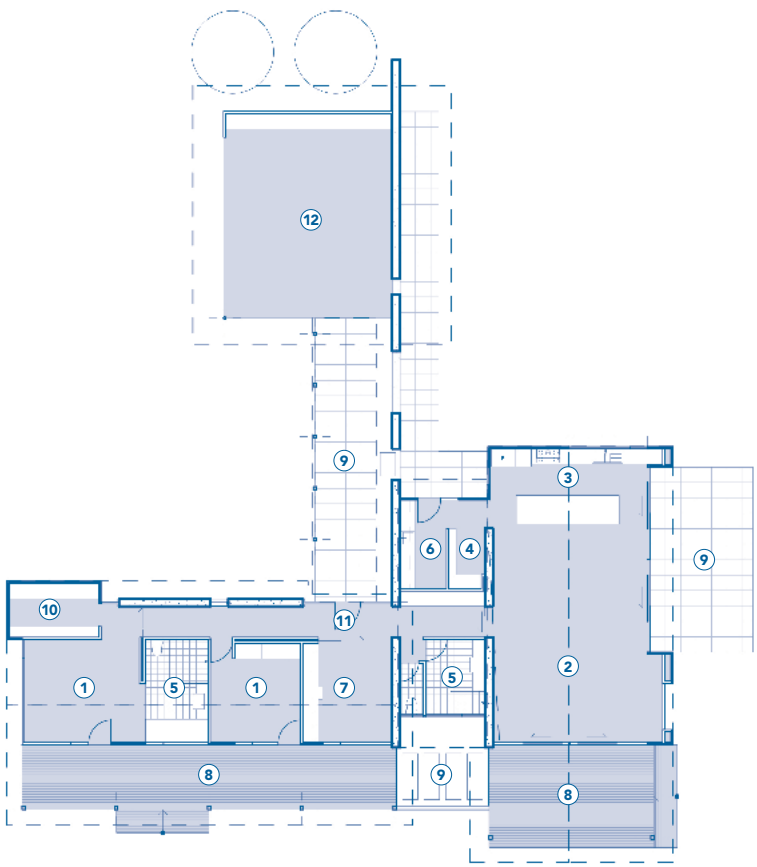
The new house is easier and more efficient to run too, thanks to a host of sustainable design features including solar hot water and photovoltaics, rainwater collection and waste water treatment systems, a slow combustion fire that uses fallen timber collected from the property, and ceiling fans throughout.

"We used eTool to conduct a life cycle assessment rating in the design stage of the project, which both informed and reinforced a number of decisions on material and product selections, so that we could ensure a low carbon footprint," Paul says. "The house received an overall gold rating with a platinum rating for operational carbon. It's not a common assessment but it's more useful and in-depth than star ratings."

With its rough surfaces that hint at the former life of the recycled timber and bricks used in the build, and a spectacular location that makes the most of the climate and views, Pamela couldn't be happier in her new abode, which she likens to permanent camping. "I wanted a house that felt like being outside, but which was sheltered from the elements," she says.

"We are a bit bushy," she adds. "We like the space, the air, and don't like being too close to neighbours. In Perth, we had a 600 square metre block whereas here we have 330 acres [133 hectares]. It's quite hard work but I wouldn't have anything different."

FLOOR PLAN



N

LEGEND

1. Bedroom
2. Living/dining
3. Kitchen
4. Pantry
5. Bathroom
6. Laundry
7. Study
8. Deck
9. Paving
10. Robe
11. Entry
12. Carport

Farm House

—Specifications

Credits

DESIGN
Archterra Architects, Principal Paul O'Reilly

BUILDER
Terra Castle Constructions

ENGINEERING
Margaret River Structural Engineering

PROJECT TYPE
New build

PROJECT LOCATION
Margaret River, Western Australia

SIZE
Land 65 hectares; house 185 sqm

BUILDING STAR RATING
eTool life cycle assessment gold rating

Sustainable Features

HOT WATER
– Apricus 30 evacuated tube 315L solar hot water system with electric boost.

RENEWABLE ENERGY
– 2.5kW grid-connected solar photovoltaic system with SMA inverter.

WATER SAVING
– Four 25,000L aquaplate galvanised steel tanks used for drinking, washing and cooking (no town water services)
– Wastewater (black and grey) is recycled onto the garden with a Taylex aerobic treatment system.

PASSIVE DESIGN
– Concrete floor slab for thermal mass to living areas
– North-facing windows to main living areas with eaves overhang to exclude the summer sun
– Cross flow ventilation with louvre windows on the windward side and larger openings (sliding doors) on the leeward side to create a pressure differential.

ACTIVE HEATING & COOLING
– Masport wood fireplace with wood sourced from fallen trees on the property
– Hunter Pacific Concept ceiling fans.

BUILDING MATERIALS
– Zincalume custom orb and Trimdek profiled steel cladding and roofing
– Woodform Architectural spotted gum cladding
– 300mm thick rammed earth walls are a mix of ironstone gravel and limestone, locally sourced
– Insulation: Wool Store R1.8 foil bonded sheep's wool roofing blanket, R3.5 Autex Greenstuff recycled content polyester ceiling batts, R2 Autex Greenstuff recycled content polyester wall batts to internal and external framing, R2.6 Foilboard Ultra 20 foil bonded EPS foam board on 20mm air cavity batten to external walls
– Plantation pine stud frame
– Big River Timbers spotted gum floorboards
– Recycled jarrah decking
– Recycled jarrah verandah posts and external exposed timber framing
– Recycled clay brick paving.

WINDOWS & GLAZING
– Sunergy clear low-e glass in AWS aluminium frames anodised dark bronze by Aspired Aluminium and Glass
– Breezway Altair louvre windows.

LIGHTING
– Brightgreen D900 Cube 16W.

PAINTS, FINISHES & FLOOR COVERINGS
– Trowel finish concrete slab with Enviropro Endure water-based clear finish
– Timber flooring finished with Livos Universal wood oil
– Decking finished with Organoil decking oil and left to naturally weather grey
– Timber cladding oiled with Cutek CD 50 and left to weather naturally
– Spotted gum veneer cabinetry finished with water-based polyurethane
– Plasterboard finished with Wattyl ID low-VOC acrylic paint
– Doors and frames finished with Wattyl Aquatrim water-based enamel.

"Paul had a free run with the design – apart from saying that I didn't want a skillion roof and that I did want a traditional farmhouse verandah, I trusted him completely."

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DAIKIN Sanctuary MODERN GREEN HOMES ATA

Japanese lessons

A small house doesn't have to feel cramped, as architect James Pedersen demonstrates with this home for his growing family in Sydney's inner west.

WORDS Rachael Bernstone
PHOTOGRAPHY Thilo Pulch

AS AN ARCHITECT HIMSELF, JAMES Pedersen is adept at finding the right balance between maximising functional spaces and keeping renovation costs down. So, when he set about extending his family home, he wanted to practise what he preaches.

James and his wife Libby purchased the one-bedroom semi-detached cottage in 2010 and since then they've added two children to their family. Both James and Libby work from home, so they needed more space, but only a little bit more.

Inspired by Japan's Sukiya houses – a collection of individual 'boxes' that relate to surrounding gardens, rather than a box-like structure divided into rooms – James opted to add just two rooms: a master bedroom upstairs, and a verandah at the back, while upgrading the kitchen and bathroom in place. After a few years of living in the renovated house with their young daughter, James realised that the new verandah wasn't working as he'd envisaged. In 2015, he decided to enclose the space by installing windows and doors, thereby creating a second living room that overlooks the garden.

By adding just 39 square metres to this diminutive dwelling, James created a series of flexible spaces that can be used for sleeping, working and relaxing, offering the same multi-purpose functionality that many Japanese houses provide. "I aim to integrate the requirements of people – the occupants – and place, the existing building and its environmental conditions, with as little intervention as possible," James says.

"While it may be tempting to knock down half the house when renovating, that's usually not the most efficient way to proceed," he adds. "As an example, I try to keep existing structure but minimise circulation spaces, because every square metre of circulation that you can eliminate saves about $3500 in building costs. My designs combine both economic and ecological benefits."

As both designer and owner-builder on this project, James was able to test several new architectural ideas, and he's been pleased with the results so far. A 2000 litre water tank in the second living room adds thermal mass to that space, thanks to its

The rear living area was first built as a deck, but has been enclosed with double-glazed windows and doors which fold away to create an indoor-outdoor living space.

A 2000 litre water tank located in the rear living space acts as a heat sink in summer, and in winter it receives direct sun to help passively heat the home.

northern and western outlook. In summer the tank performs as heat sink to extract heat from the room, and in winter, when the water temperature hovers around 15 degrees Celsius (or slightly higher when the sun directly hits the metal skin) it passively heats the room.

"Years ago I worked for a clever bloke who experimented with trombe walls, and he built his own house in concrete with water vats in the walls," James recalls. "Water has better heat retention properties than sandstone or concrete, so it made sense to put our water tank to good use."

Another resourceful idea is the space-saving spiral staircase: timber treads cantilever from a central pole to keep the ground clear beneath. "Originally I planned to put kitchen joinery underneath the treads, but when it was installed I loved the sense of space, so I left it open," says James.

In keeping with many Japanese buildings, this home has a wonderful hand-made quality, and James credits project builders and long-time friends Matthew Adams and Wade Machuca for helping to achieve that outcome. "We made many of the fixed windows ourselves, so we minimised the materials needed by setting the glass straight into the building's structural frame," James says. "We also site-welded the stair, made the kitchen benches and desks upstairs, and all the outdoor shutters upstairs.

"The handmade-ness of the build was certainly an experiment," he says. "The stairs and shutters would have been much more expensive if we'd had them manufactured off-site." For the three months that James worked on the initial build, he paid himself a labourers' wage, but didn't factor in the cost of his design fees, thereby minimising the overall project cost.

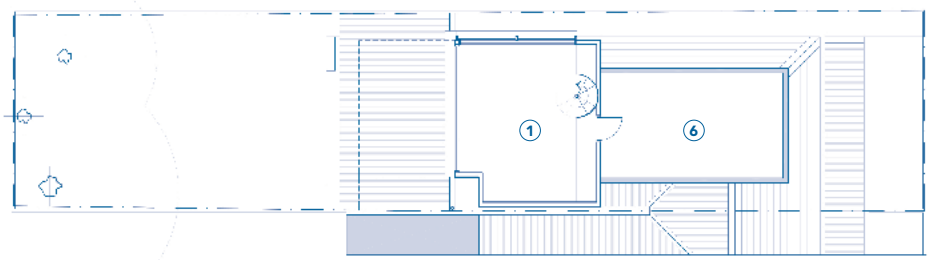
So are James and his family content in this modest Japanese-inspired house in Sydney's inner suburbs? "So far, so good," James says. "Libby works downstairs in the new living space with a laptop, and I work upstairs at a desk. We may need a third bedroom once our second child is a bit older, but we'll have to wait and see.

"By adding just two extra rooms, we've made all the difference," he says. "The house did feel a little bit claustrophobic before, but now there's freedom about how we use the spaces and thanks to the garden views, it doesn't feel enclosed."

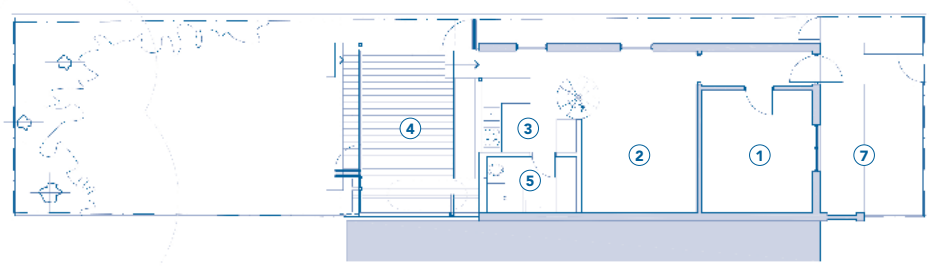
By keeping the scale small, and building kitchen benches, fixed windows and shutters themselves, James and Libby were able to keep costs down.

The space-saving spiral staircase was built onsite: timber treads cantilever from a central pole and allows the floor to remain clear beneath.

FIRST FLOOR PLAN



GROUND FLOOR PLAN



LEGEND

1. Bedroom
2. Living
3. Kitchen
4. Dining/living
5. Bathroom/laundry
6. Attic
7. Deck

Pedersen house

—Specifications

Credits

DESIGN
Pedersen Architecture

BUILDER
Owner-builder

PROJECT TYPE
Renovation

PROJECT LOCATION
Tempe, NSW

COST
$252,000

SIZE
House: 93 sqm
(39 sqm additions)
Land: 162 sqm

Sustainable Features

HOT WATER
– 220L Everhot gas boosted solar hot water system.

RENEWABLE ENERGY
– Energy Australia 100% GreenPower.

WATER SAVING
– Flambe kitchen mixer by Armando Vicario, 5-star WELS
– Arq bathroom basin mixer by Roger Seller, 6-star WELS
– Laufen Pro A wall-hung toilet pan, 4-star WELS
– Oxygene sink mixer to laundry, 5-star WELS.

PASSIVE DESIGN
– Protected north-northeasterly to west-north-westerly glazing to maximise winter sunlight and summer afternoon cooling breezes
– The north-north-easterly facade is protected by projecting eaves. The west north-westerly facade is protected by external operable western red cedar shutters on the first floor, and eaves and surrounding tree cover on the ground floor
– Internal rainwater tank to provide thermal mass to the interior. In summer the tank acts as a heat sink to extract heat from the space, and in winter it will retain a similar temperature to that of the ground temperature, which normally sits at around 13 degrees Celsius – warmer than average air temperature. In addition, the tank is located so as to receive direct winter sunlight which elevates its temperature and stores some heat.

BUILDING MATERIALS
– Boral blackbutt hardwood, with Australian Forestry Standard Chain of Custody certification
– Plantation pine studwork
– Western red cedar shutters
– Lysaght zincalume external cladding
– CSR Bradford reflective foil laminate blanket insulation
– GreenStuf polyester bulk insulation
– Kingspan Air-Cell Insulbreak.

WINDOWS & GLAZING
– Western red cedar framed double-glazed door and window units, from Doorsmart.

LIGHTING
– SAL 12V LED strip lighting and recessed downlighting.

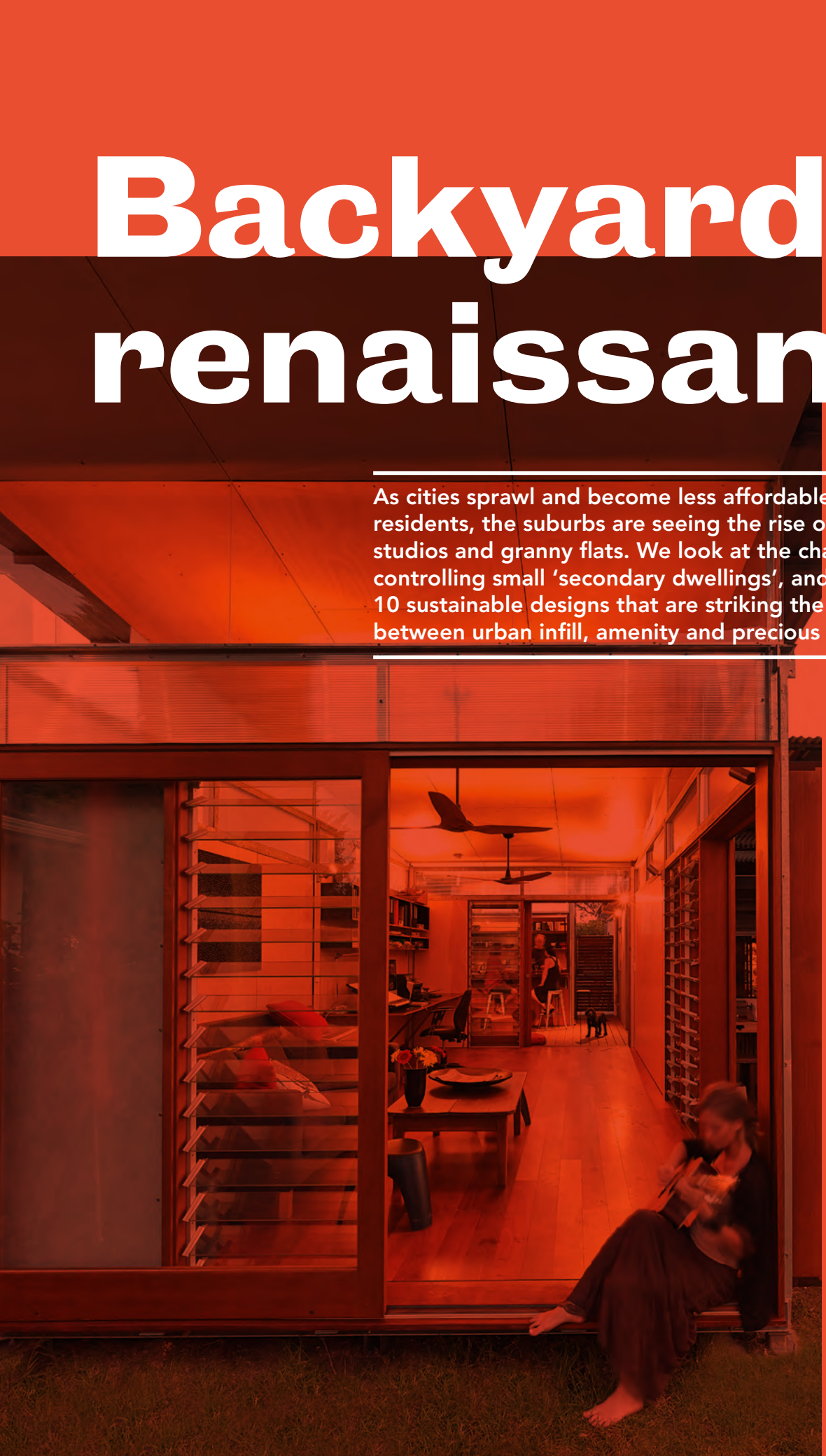
PAINTS, FINISHES & FLOOR COVERINGS
– Organoil hard burnishing oil to interior timbers
– Low-VOC Intergrain Ultradeck Natural to exterior timbers
– Wattyl low-VOC interior paints.

OTHER ESD FEATURES
– No active heating or cooling
– The old brickwork sourced from the original house was cleaned and reused in the back step and walls. Old hardwood decking was reused to line the ceiling of the new rear living room
– Spatial efficiency, minimal intervention and preservation of existing building fabric – the addition is quite small and the total floor area of new work is 39 square metres, resulting in a 93-square-metre two-bedroom house.

Each room in this 93-square-metre house has multi-purpose functionality. The upstairs master bedroom doubles as a treetop home office.

Backyard renaissance

As cities sprawl and become less affordable for many residents, the suburbs are seeing the rise of self-contained studios and granny flats. We look at the changing regulations controlling small 'secondary dwellings', and feature 10 sustainable designs that are striking the right balance between urban infill, amenity and precious urban vegetation.



WORDS Kulja Coulston
PHOTO Michael Nicholson

"Amenity for all is where the design comes in and bad design can make it not work at all."

With its own access and garden, this 60-square-metre secondary dwelling in Coogee, NSW, is an example of how clever sustainable design is making use of neglected suburban spaces for housing. Design: TAKT, Image: Shantanu Starick

BEST KNOWN FOR THEIR SUSTAINABLE public buildings, high-profile architects Kerry and Lindsay Clare have recently completed a self-contained backyard studio for clients in Burleigh Heads. "Another space was required for visiting grandparents and other family members," says Lindsay Clare of the brief for a striking passive-solar designed 'granny flat' set among the trees.

There is a boom in granny flat construction underway in Australia and Clare Design is just one of a growing list of architectural firms that have taken on smaller-scale projects. "As suburban life is a little bit less affordable and less desirable for some ... to be able to have more family accommodation on your property just makes sense."

Unlike subdivision and strata developments, granny flats (also known as small secondary dwellings) must be on the same title as the primary residence. There are three main types – backyard bungalows, 'Fonzie' flats above garages, and connected separate units.

Getting approval for a granny flat has traditionally been tough in Australia. Without a planning permit, they were permissible only if they were removable and occupied by a dependent relative; and renting them out for income was generally illegal. Planning schemes vary a great deal across Australia, but the rules for these dwellings have tended to result in cheap, low-quality portable buildings.

Now things are changing. Rents and median house prices have been soaring for a decade and urban lifestyles are adapting: young people and old are now more willing to trade off a large house and yard for a better location. Over the past six years, many local and state governments have rethought the role granny flats can play in alleviating housing supply pressures in established suburbs.

Allowing "granny-less" granny flats has made a difference, according to City of Fremantle councillor Rachel Pemberton. "A lot of people are priced out. It effects young people and I have had a lot of conversations with older people and they are interested in downsizing but there is nowhere for them to go," she says. "We want to allow people to age in place, as well as creating some more affordable housing."

Western Australia changed its granny flat laws in 2013 to allow 70-square-metre permanent secondary dwellings to be built without a planning permit on single house lots over 450 square metres; and for them to be income-generating. Fremantle was first to amend its laws in WA, and councillor Pemberton is leading the charge to bring about 'tiny' subdivisions in future: "It's no secret that we have the biggest houses on the planet and among the most expensive – so there is a correlation there that we are also seeking to address. The current R-codes and zoning can actually create very negative impacts on our communities."

The ACT, NT and NSW have all made similar amendments to laws governing granny flats, and parts of Queensland and Tasmania now treat secondary dwellings more favourably in residential codes.

Of all the states, the NSW State Environmental Planning Policy (Affordable Rental Housing) 2009 has resulted in the largest upswing in secondary dwelling construction, most likely due to Sydney's notorious house prices. That policy allows fast-track approvals with no planning permits for 60-square-metre secondary dwellings on land sizes larger than

Built first as a music room, this heavily insulated studio in Northcote, Victoria, is now used as a home office and spare room for guests. The positioning of the studio allows for easy connection to the main house, but it can also be private with a separate side access. Design: Statkus, Image: Matthew Mallet

450 square metres. The land must remain one principal dwelling but the unit can be used to generate rental income. These changes have led to a three-fold increase in granny flat construction since 2010 – almost 5000 secondary dwellings were approved in that state last year alone.

In contrast, South Australia and Victoria have seen no change and no boom. Ironically, Victoria introduced the first as-of-right dual occupancy laws in the 1980s but its granny flat laws are now the most restrictive in the country. They allow only 'dependent person's units' without a permit. "Victoria is very much lagging on this," says Sally Wills, a sustainable builder and affordable housing advocate who's been agitating for change. "Our current dependent person's unit rules don't allow use by family and friends – you have to be a dependent person and when that dependency relationship doesn't exist anymore you have to remove the building. It's crazy."

She believes Victoria should adopt the NSW approach to encourage homeowners to build small secondary dwellings on appropriate sites. "The more little houses that are built, particularly in our middle suburbs where there is lots of land and the infrastructure is already there, the jobs are there and the public transport is there, I think the better," says Sally Wills. "Queensland has adopted this approach in a couple of jurisdictions and I imagine it will sweep through the whole state. The ACT has had the laws for quite a while, and they actually now allow 70 to 90 square metre dwellings to enable two-bedroom houses, as that was where the gap was with the rental scenario."

Increasing urban density isn't universally supported, and won't be appropriate for all sites. There is real concern about the loss of suburban greenery and backyard cricket games. And there are fears backyard dwellings could introduce traffic and transient residents, or offer a shortcut to development. But considering the forces of multi-residential projects and subdivision, small secondary dwellings can offer an affordable and lower-impact way to evolve the suburbs. Good design is fundamental to success.

"The challenge is to make sure the new accommodation doesn't detract or impact on the original accommodation or the neighbours," says Kerry Clare. "Amenity for all is where the design comes in – and bad design can make it not work at all. Councils need to consider the footprint of all these new buildings because we don't want to lose the tree canopy and open space. They're the lungs of the city."

Sally Wills sees potential for small-scale infill housing to raise the bar for design and performance. "I'm actually suggesting they should be 7 Star energy rated. If we're going to have a mini boom on small dwellings we should make them as energy efficient as possible – and there is already provision in the NatHERS program to give a bit of a bonus to small houses."

Whatever the economic drivers, granny flats are an irresistible challenge for many sustainable architects. Below, we feature 10 examples of projects that have got it right through good design.

Self-contained studio profiles by:
Sasha Shtargot and Kulja Coulston

DESIGN/BUILD
Clare Design
Clare Build

LOCATION
Burleigh Heads, QLD

SIZE
98 sqm (total floor)

COST
$2500 – $3000 per sqm

MATERIALS
Zinc-coated steel, laminated timber and viridian glass

PURPOSE
Multigenerational living

PHOTOGRAPHY
Peter Hyatt

Box pavilion

This two-storey 'box' pavilion is located six metres behind a 1950s Gold Coast beach shack on a narrow 400-square-metre site. Built to allow for contemporary intergenerational living, the granny flat also protects the once-exposed backyard from overlooking. Each level in the granny flat has its own bathroom, and a studio space that can be 'sub-divided' with sliding screens to become a living space or bedroom.

It is built from light-weight materials and connected to the main house by a roofed deck. To enable privacy between living spaces, the deck has battened doors to allow the main house to be screened off, or opened up to allow family members to come together if they wish to. The concept of the extended-family house – where grandparents, married children and grandchildren can cohabitate – was an exciting part of this project for renowned architects Kerry and Lindsay Clare: "The benefits are environmental with the better use of resources, its cost effectiveness and better social outcomes from increased density and mutual family support."

The flat is oriented on the site to optimise passive heating and cooling. The careful placement of louvred windows ensures the spaces enjoy balanced sub-tropical light, and the design cleverly uses pivot windows and doors to allow for the channelling of breezes through the house as part of its ventilation strategy. These openings also contain flyscreens (essential to keep the mossies out), and the mechanisms allow for them to become secure double-hung windows while still allowing for controlled airflow.

Copper House

This 60-square-metre secondary dwelling on a narrow lot in Coogee replaced the original fibro shack. Designed for flexible use into the future and conceived by Takt, the building is designed as three boxes which step down the slope.

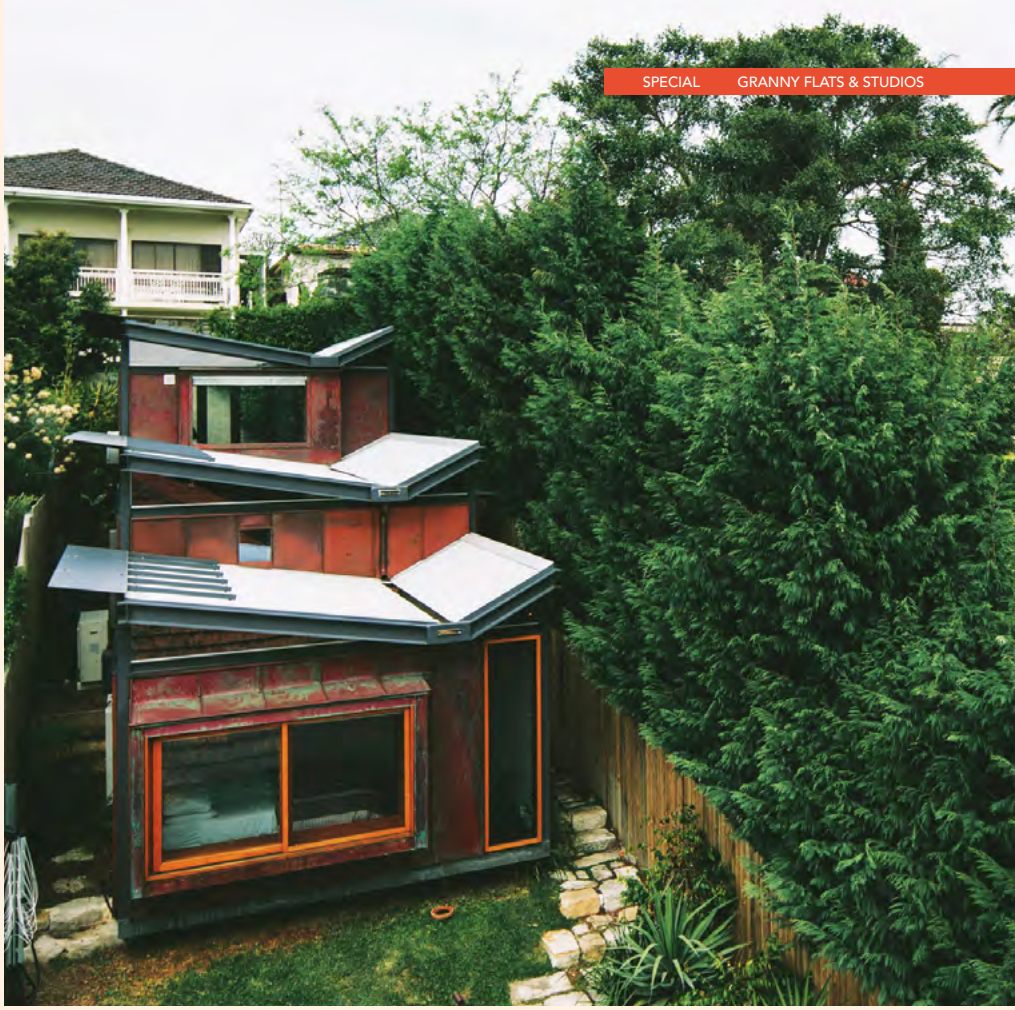
Brent Dunn of Takt said the brief was for a building that was 'rich yet calming', and made the most of the steep site. "All construction is restrained to a 600mm grid for both materials economy and rhythm, and connection to the earth is given particular consideration. Sandstone from the original foundations has been repurposed for landscape steps."

A butterfly roof invites winter sun and provides seclusion from neighbours; and a dark concrete slab and panels of artist canvas for internal walls create a tactile interior. The steel-framed building is clad in copper, which was chosen to age gracefully in a coastal environment – it has already developed a patina.

It can be used as a permanent home, granny flat, rental or boutique B&B. It has two bedrooms, a bathroom, living space and windows which can be opened to take in breezes and views of the sky.

Takt's interest in small-footprint buildings began with their own backyard office, which generated a lot of interest. TAKT aims for 'inherent sustainability' in its projects: small, well constructed and built to last. The company is now developing a modular version of the design, which can be extended if required.

"Small purpose-built spaces can be a wonderful activator of residential neighbourhoods. A lot of household properties sit empty throughout the day while occupants are at work," says Brent. He said his experience showed people were willing to invest more per square metre for something smaller and more flexible. "Once they have a dedicated space, people start to realise they can do things at home in these smaller buildings. It opens up possibilities – to develop an idea or hobby into a whole new life working from home."



DESIGN
TAKT Studio for Architecture

BUILDER
Mark Loader

LOCATION
Coogee, NSW

SIZE
60 sqm

COST
$5000 per sqm

MATERIALS
Steel frame, copper

PURPOSE
Rental/retreat

PHOTOGRAPHY
Shantanu Starick

DESIGN
Sue Harper, Troppo Architects (Byron Bay)

BUILD
Mooney Constructions

LOCATION
Northern Beaches, Sydney

SIZE
60 sqm

COST
$3000 per sqm

MATERIALS
Barestone and Ecoply cladding, hemp insulation, hoop-pine ply walls, bluegum and grey ironbark floors

PURPOSE
Flexible space, home office, teenage/guest retreat, rental

PHOTOGRAPHY
Michael Nicholson

Flat-pack studio

This pre-fab, flat-packed modular studio is the creation of Sue Harper, now of Troppo Architects in Byron Bay, and is similar to the firm's Love Shack. When the granny flat laws changed in New South Wales she saw the opportunity to not only create a granny flat that performed better than the portable homes of old, but to create a living space that was more "flexible and fun" using materials that were environmentally sensitive.

This dwelling is located to the side of the main house, and access is via a separate set of stairs. It has one studio bedroom/living space, plus an adjoining laundry, bathroom and kitchen. "When not rented out, the laundry doubles as a breakfast bar and in the evenings it is a great spot for BBQs and drinks – it becomes the centre of the house for most of the day," says Sue. "During the week you can pull out the drawing board and use it as a studio, or close it up and use it as accommodation for friends and family, and then there's Airbnb."

The building arrives like a Meccano set, is easily assembled and disassembled and can be added to over time. "You can take the windows out – ours started with ply shutters until we could afford to put timber-framed glass doors in." Although it looks lightweight, the building is heavily insulated within the floor and ceiling. It has a timber floor, a plywood layer beneath, an air gap, a hemp insulation layer and fibre cement under-lining. "It's quite dense and can achieve quite high star ratings," says Sue. "We adapted one for Wagga where there is a huge variety in temperatures, and the client only warms it a few days each year. That one had low-e glass up high and double glazing for all the lower doors."

DESIGN/BUILD
Day Bukh Architects

LOCATION
Annandale, NSW

SIZE
55 sqm

COST
$4000 per sqm (approx)

STAR RATING
7.5 Star

MATERIALS
Zincalume, FSC tallowwood and pine

PURPOSE
Retirement

PHOTOGRAPHY
Katherine Lu

Downsizing in Annandale

This 55-square-metre, one-bedroom granny flat at Annandale in Sydney was constructed as a secondary dwelling for the owners of the main house. Designed by Day Bukh and built as part of a renovation with an overall cost of $220,000 (including appliances), it carries a 7.5 Star rating and has a host of environmental features in keeping with the owners' philosophy. The roof is Bluescope zincalume metal and the exterior walls are treated pine with 20mm foilboard insulation with an R3.2 rating.

The hardwood timber flooring is FSC-certified Australian tallowwood. There is insulation in the ceiling and the floor and windows are low e-glazing with frames of western red cedar. All lights in the granny flat are LEDs.

There is an instantaneous gas unit for water heating, while an energy efficient reverse-cycle air conditioner and a stand-alone gas heater have been installed for space heating. Renewable energy comes in the form of six 200W solar panels on the roof, while for water saving there are rainwater tanks with a 2000-litre capacity that feed the laundry and top up the main house's swimming pool. Overflow is connected to the main house's tanks.

The house owners plan to move into their backyard residence in four years time, and rent out the main dwelling as part of a gradual retirement. This will allow them to remain in their community while downsizing and at the same time secure an income during retirement.

Russel Lea 'Fonzie' Flat

DESIGN/BUILD
Ben Giles

LOCATION
Inner urban Sydney

SIZE
60 sqm

MATERIALS
Spandek and timber structure

PURPOSE
Flexible living space

PHOTOGRAPHY
Andy Baker

This 60-square-metre building in the back yard of a house at Russell Lea in Sydney's inner west had to meet two criteria: it was to be visually attractive and a useful living space. Architect Ben Giles wanted to create as small a footprint as possible to maximise the overall amount of landscaping and garden. The result was a structure that would take up the block's full width, but be just one room wide, with a combined living, dining room and kitchen downstairs and a loft-style bedroom on the second floor. The extra height creates a feeling of space. The walls and roof of the building are clad in pre-finished and profiled Lysaght Spandek, chosen for its durability and to keep costs down. The interior is cleverly designed to maximise the sense of space, with the kitchen recessed into a wall, bathroom located behind it and all spaces connected with the bedroom upstairs.

The two-storey section – which occupies the northern part of the block to minimise shading over a neighbour's property – plays a functional role too. It creates a thermal stack effect so that heat travels upwards and can be ventilated out via louvred windows on both sides at the highest point. Combined with the concrete slab main floor, insulated timber-framed walls and roof, and adjustable external blinds, the building has many inexpensive passive solar design features. The whole project, including demolition, landscaping, and the new structure cost $280,000. [See the full project feature in *Sanctuary* 16.]

Music studio and study

DESIGN
Statkus Architecture

LOCATION
Northcote, VIC

SIZE
34 sqm

COST
$2700 per sqm

MATERIALS
Recycled brick, oriented strand board, expanded polystyrene, karri hardwood

PURPOSE
Home office, music studio, guest bedroom, children's play area

PHOTOGRAPHY
Matthew Mallet

'Functionality and flexibility' were the watchwords for this studio at the back of a home in the inner Melbourne suburb of Northcote. The owners wanted a multi-purpose space that could be used as a professional music studio, reception room, guest bedroom, study and family room. Statkus Architecture was asked to design a building that worked on a number of functional levels while connecting to and enhancing the existing house.

Recycled Northcote red bricks were used on two walls for high thermal mass and cement-rendered EPS cladding used on the other two, creating a fanning effect on the yard facing the facade. There is sustainable plantation karri hardwood decking connecting to the main house, all windows are double glazed and timber framed, and all lights are energy efficient.

The studio floor is on a timber sub floor frame (on concrete stumps) with oriented strand board flooring. The underside of the floor is insulated with acoustic and thermal insulation as are the walls and ceiling.

Due to the orientation of the studio, it doesn't need artificial cooling – just heating in winter. The occupants use an electric plug-in space heater, but with the high thermal mass and small spaces, it doesn't take much energy to heat up and keep warm.

DESIGN/BUILD
PTMA Architecture

LOCATION
Brisbane, QLD

SIZE
35 sqm

COST
$2000 per sqm (approx)

STAR RATING
7.5 Star

MATERIALS
Strawbale, recycled timber

PURPOSE
Rental, guests, Airbnb

PHOTOGRAPHY
Fotomedia

CARINA HEIGHTS GRANNY FLAT

A stand-out feature of this granny flat at Carina Heights, a south-east suburb of Brisbane, is a distinctive strawbale wall that the owners settled upon after consulting with Peter McArdle of Gold Coast firm PTMA Architecture.

Facing due west, the large wall shields the 35-square-metre granny flat from the harsh Queensland sun. Standing clear of the building, it vents hot air into a court space rather than inside. It also provides a privacy buffer from the neighbours and the occupants in the main house.

The straw is rendered, providing a softer form than a similar rendered blockwork wall while reducing the embodied energy in the material of the wall and significantly improving the performance.

To suit the owners' budget and to be true to sustainability principles, the granny flat was designed to be small but of a high standard. The owners have finished the interior of the space to create a warm feel for guests, family and friends. The smaller size significantly reduced the new materials used in the build, and the energy needed to heat or cool if they were ever to use air conditioning.

The granny flat collects rainwater, includes recycled timber and Ecoply in the joinery (kitchenette and bench seat) and low-VOC finishes. The design incorporates significant cross ventilation with windows to all walls, ceiling fans, and insulation to comply with the current requirements for 6 Star construction.

DESIGN/BUILD
Jeremy Salmon

LOCATION
West End, QLD

SIZE
66 sqm + carport and deck

COST
$2600 per sqm (approx)

STAR RATING
6 Star

MATERIALS
Timber frame, fibre cement, strip timber flooring

PURPOSE
Family accommodation

PHOTOGRAPHY
Mark Crocker

WEST END GRANNY FLAT

This secondary dwelling in West End in Brisbane was built for the ageing parents of one of the owners of the main house. The flat's area is 66 square metres and there is also a 10-square-metre deck and 18-square-metre carport. It carries a 6 Star energy efficiency rating and the whole project was built for $250,000 (including all works).

Designed by architect Jeremy Salmon, it incorporates timber framing, fibre cement cladding, strip timber flooring and a metal roof. The building was carefully orientated both for climatic appropriateness and to enhance private living environments for the residents of the flat, the existing house and the neighbours. Effective space was maximised by allowing the bedroom area to combine with the living area, but it can be closed off if required for privacy.

The loft bedroom is accessed externally so that it can be an overflow room for either the house or the flat and achieve a good level of separation without additional corridor space. Materials and structural system were kept simple and straightforward, while excavation for the build was minimal. Though currently not wheelchair accessible, Jeremy says the dwelling can be adapted with little fuss if needed in the future. The house and granny flat are on a small lot but have good-sized garden areas for both sets of occupants.

DESIGN
Nic Brunsdon

LOCATION
South Fremantle, WA

SIZE
17 sqm

COST
$2000 per sqm (approx)

MATERIALS
Zincalume cladding, reclaimed timber, cold formed steel sub-frame

PURPOSE
Transportable permanent residence

TINY HOUSE FREO

At just 17 square metres, this pocket-sized home in Fremantle's suburbs is colourful and compact. With clever storage, a high ceiling, roof window and separate living spaces, it provides enough space for a couple and their young baby. The designer, Western Australian architect Nic Brunsdon, says fitting two bedrooms, a kitchen, bathroom, study, living and dining into 17 square metres was no small feat. "It makes you pay attention to what's important in all aspects of design, construction and living. It's philosophical as much as structural. Every pocket becomes an opportunity. We utilised spaces under the stair treads and depressions in the structural frame."

The house is off-grid and transportable, and uses recycled timber and Zincalume for cladding. It has a solar PV and battery storage system, a composting toilet and the option of rainwater or town water. While currently parked in a South Fremantle backyard it could easily put down permanent foundations. "I think this is symptomatic of a larger push, through necessity, to inhabit the underutilised areas of our urban environments. Backyards are obviously one," says Nic. "As we start to re-value our cities, the creep inwards puts value on these neglected tracts. Homeowners unwittingly become land-bankers. Unlocking these parcels is the goal."

DESIGN
Saturday Studio

LOCATION
Manly, NSW

SIZE
60 sqm

COST
$1400 per sqm (approx)

STAR RATING
6.5 Star

MATERIALS
Timber stud frame, Ritek roof panels, Weathertex cladding

PURPOSE
Rental

CORRIE ROAD GRANNY FLAT

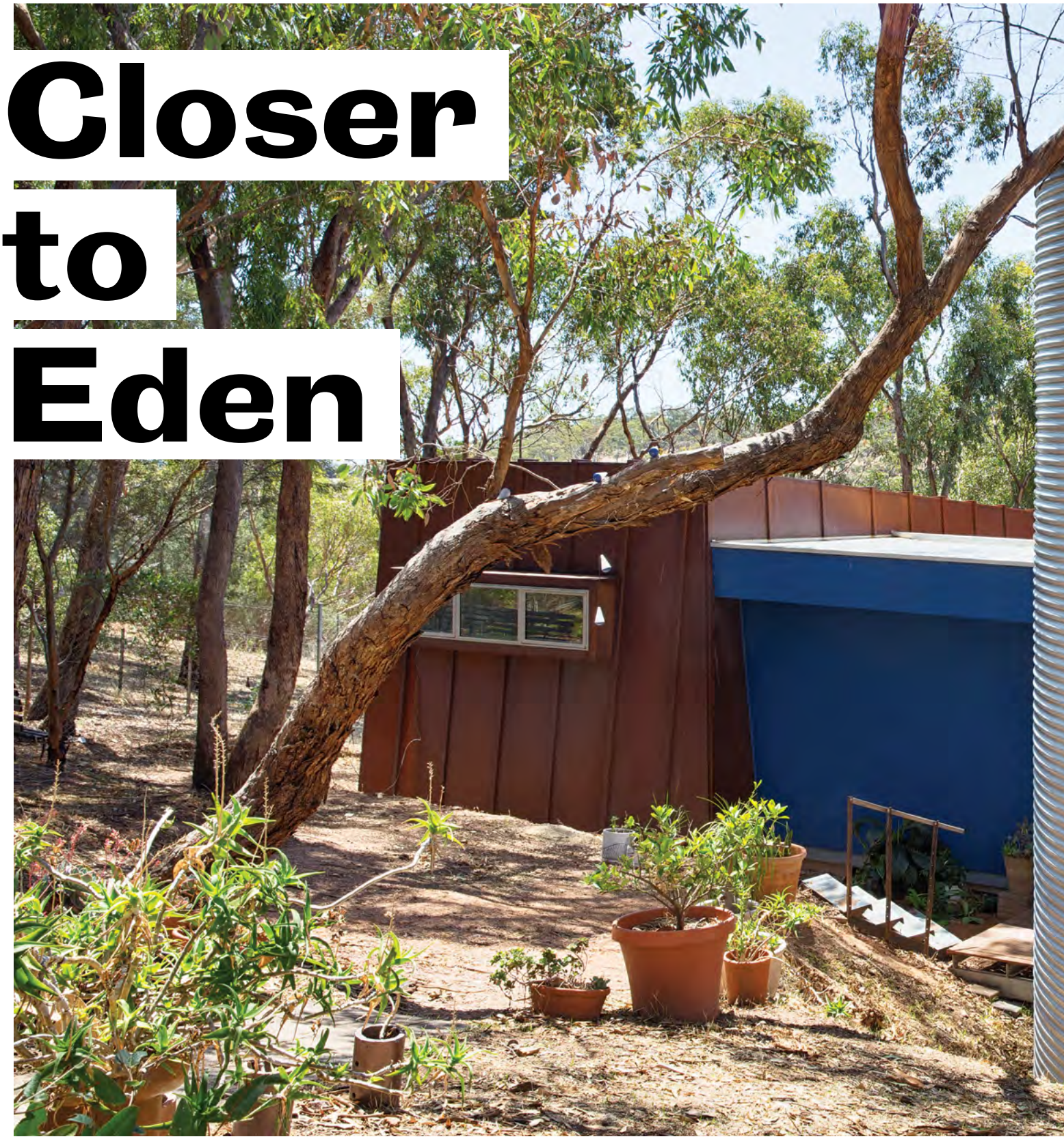
When Nick Richter of design firm Saturday Studio and his partner bought a large block of land at North Manly, they decided to subdivide it into two lots, front and rear, and build a house and granny flat on each lot. The front house has a granny flat facing the street above the garage of the house, while the granny flat at the rear house is integral to the primary structure of that house.

Each granny flat of 60 square metres was built simultaneously with its house, and cost about $80,000.

Sustainable features include a timber stud frame, Ritek roof panels (structural insulated panel system), Weathertex cladding with locally produced and sustainably logged blackbutt timber battens, spotted gum decking and aluminium windows. There is a polished concrete floor in the rear granny flat and a vinyl floor in the front one. The benchtops are made by Paperock.

From a design point of view, Nick doesn't think of the buildings as mere 'granny flats': "The front one is a small free-standing cottage with a very comfortable, large lounge room that can seat six people and not feel crowded. It has a full-size kitchen, a complete internal laundry, a bathroom with a striking curved wall and glass roof, and two double bedrooms with built-ins. It has its own street address, letterbox and front gate and a comfortable deck with architectural screen."

Closer to Eden



Rather than being bulldozed, this striking and ambitious yet badly performing house in Adelaide's Eden Hills has been reconfigured and extended to provide better flow and connect it to its bush setting.

New pop-out windows bring much-needed light and ventilation to the round 'silos' of the original house. The choice of bright colours, straight lines and different metal cladding for the new parts of the house provides contrast with the existing structure and reflects architect John Maitland's view of the project as "a long-term connection of disparate elements… like in a human relationship."

WORDS Anna Cumming
PHOTOGRAPHY Keiren Macdonald, Snapme Media Group

THE FIRST TIME CATH AND GEORGE walked down the long drive of their unusual house in the Adelaide Hills, "we just thought, 'wow'." Tucked below them on a steep bush block, the house was a statement in glass and curved corrugated iron and looked north through flowering gums over the Watiparinga Reserve and Viaduct Creek, with a view of the Adelaide plains beyond.

But despite the enviable site and its unique design, the house had issues: "It was hot, airless and the layout wasn't terribly functional," explains Cath. They fell in love with it, but they also took pity on it. "We thought, if we don't buy it, someone else might just push it over."

Built in the 1980s by a recently graduated architect as his own home, the original house was an ambitious two-storey steel and glass cube with round 'silos' at three of its corners. Reminiscent of the classic Aussie water tank, it was striking but impractical. "I like a house to know where it is," says homeowner Cath. "but it wasn't connected to the outdoors. There was only one [external] door – dodgy from a bushfire

The original house had no eaves, and only one external door. Fixed metal shade structures over the two large north-facing windows now help regulate internal temperatures, and the living room opens onto a generous deck with steps down to the sloped garden. The new main bedroom features one angled side wall and a large window that opens onto the bushland view.

point of view – and no deck or balcony. The living room was in one of the silos, none of which had any windows."

With two rapidly growing children, Cath and George needed more space: a new main bedroom, and a guest room for frequent interstate visitors. "We also wanted to improve the flow of the house, and do what we could with shading, insulation and cross ventilation to improve the heat management."

Cath and George enlisted John Maitland of Energy Architecture to tackle the renovation after visiting John's own house one Sustainable House Day. John designed a new master bedroom with ensuite to the west, squeezed in a clever cantilevered study/guest room almost on the boundary to the east, opened up and reconfigured the lower level layout, and installed horizontal fixed shading over the huge north-facing windows. The living room was moved to the north to take advantage of the view, and now opens onto a new deck wrapped around the north side of the house. Upstairs, the two bedrooms and small secondary living space are largely unchanged, except for banks of louvres for ventilation and blinds for shading. With most of the non-curved walls made up of glass, replacing it all with double glazing was cost prohibitive, so John opted instead for installing "very efficient heat pump air conditioning"; newly available small-gauge ducting helped make the installation discreet.

Crucially, windows were added to the silos to bring in light and much-needed ventilation; they have deep brightly coloured box frames that provide shading and solve the geometric problem of installing flat windows in a curved surface. The splash of colour is deliberate: "I wanted the mode of the architecture to be distinct from the original," explains John, of the alterations and additions. "I wanted to honour what the [original architect] had done, the very pretty aesthetic of it, so I chose colour, orthogonal shapes and horizontal forms, to contrast with the existing silver, round, vertical."

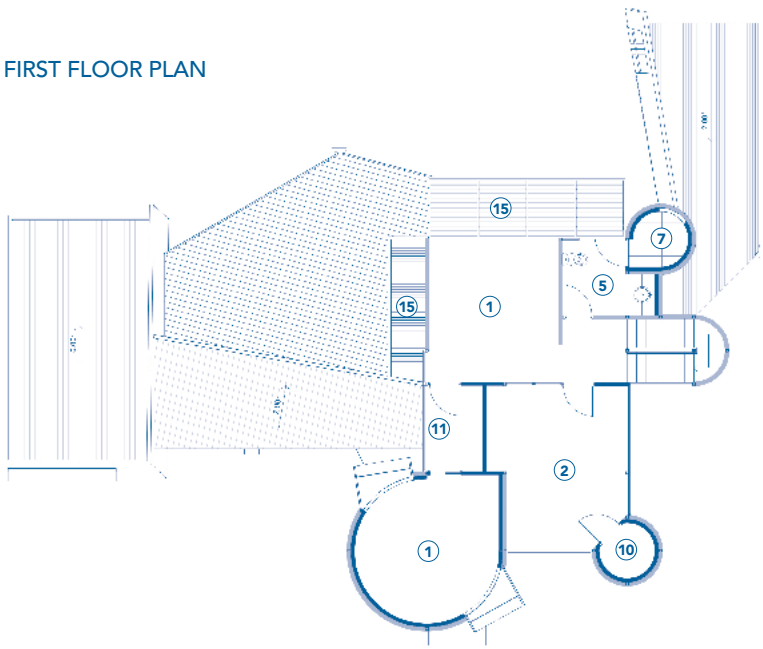
The extension, housing the new main bedroom and its ensuite and walk-in robe, is in the form of a cube, tilted to follow the slope of the land. One side wall also slopes away from the perpendicular, providing an interesting interior element (and a furnishing challenge!). To the north, a concertina floor-to-ceiling window can be opened right up to bring the sounds and scents of the bush inside; a roll-away insect screen keeps airborne visitors out and is surprisingly visually unobtrusive. On the sides seen most, the box is clad with Corten steel that will weather to a rusty patina. It was chosen for its texture and colour, and to echo the metal finish of the existing house without matching it. John included a generous vent space behind the cladding to regulate heat transmission into the room.

The study/guest room extension is also clad in Corten. Wedge-shaped to fit the space available, it hovers over the steep slope at the north-east corner of the house. Cath credits John with the inspiration: "I thought that corner was a full stop. It was John's idea to put the guest room out there," she says. It's accessed through the

downstairs bathroom – with two other bathrooms in the house, this arrangement isn't a problem for a room that's not occupied full-time. The room's small balcony puts visitors right amongst the trees, with clusters of cream-coloured gum blossoms almost close enough to touch.

The bankruptcy of their first builder made for a longer than anticipated build, but the family was able to move into their much improved home in November 2015. Already they are loving it. "We recognise that in many ways starting from scratch would have had many benefits, both thermal and financial," reflects Cath, "but this would have ignored that sense of fun and place that drew us to the initial house. More importantly, we couldn't bear to waste a house that still had a good few years in it."

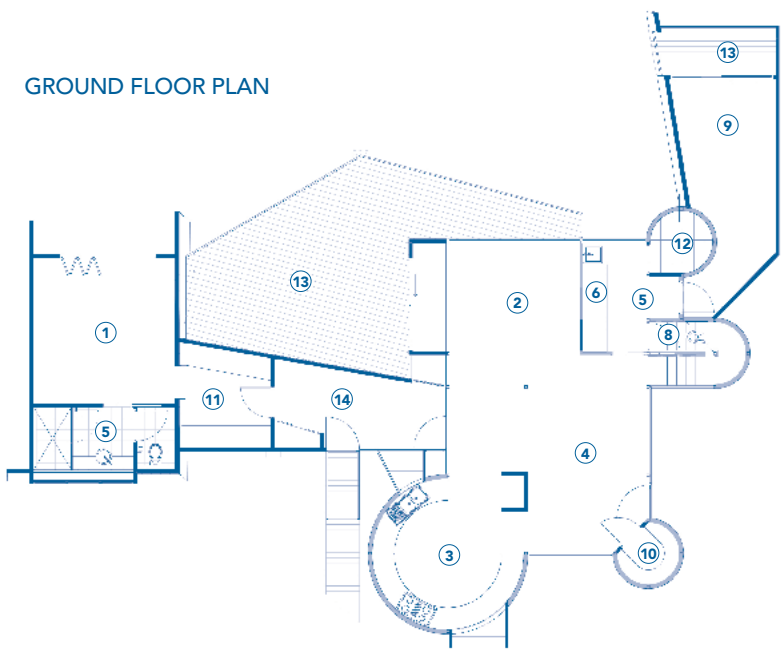
FIRST FLOOR PLAN



LEGEND

① Bedroom
② Living
③ Kitchen
④ Dining
⑤ Bathroom
⑥ Laundry
⑦ Shower
⑧ Toilet
⑨ Study
⑩ Storage
⑪ Robe
⑫ Bath
⑬ Deck
⑭ Entry
⑮ Eaves

GROUND FLOOR PLAN



Eden Hills

—Specifications

Credits

DESIGN
John Maitland & Daniel Manno

BUILDER
Adelaide Prestige Homes

PROJECT TYPE
Renovation and addition

PROJECT LOCATION
Eden Hills, Adelaide

COST
$610,000

SIZE
Land: 2760 sqm
House: 255 sqm

BUILDING STAR RATING
6 Star

Sustainable Features

HOT WATER
– Retained the existing solar hot water system: Edwards solar system. Manual electric boost
– Hot water pipes in the addition are insulated.

RENEWABLE ENERGY
– 2kW solar photovoltaic system, soon to be installed.

WATER SAVING
– Ri-Industries 22,000L underground rainwater tank plumbed to whole of house except kitchen
– Ri-Industries 2000L retention tank with Fielders first flush system, slow discharge to landscaping.

PASSIVE DESIGN
– Extensions oriented north for maximum solar gains; fixed metal shade devices added to existing window frames and external shading devices to northern living room windows
– Light-coloured roofing to lower heat loads
– Edmonds roof ventilator – TurboVentura
– Raven door seals throughout.

BUILDING MATERIALS
– Insulation: CSR Bradford hi-performance R5.0-6.0 ceiling batts, CSR Bradford Soundscreen Plus R2.5 to walls, Enviroseal wall wrap to external walls and Thermotec reflective unsulation and foam double layer to roof
– Walls: Onesteel Corten steel 3mm; James Hardie rendered fibre cement 9mm; Fielders Colorbond custom orb metal sheeting
– Roof Fielders Colorbond Klip-Lok 700 roof sheeting.

WINDOWS & GLAZING
– Trend aluminium-framed, natural anodised, double-glazed windows throughout new addition
– Full width flyscreen in the main bedroom by Freedom Screens.

LIGHTING
– Clipsal LED light fittings throughout.

PAINTS, FINISHES & FLOOR COVERINGS
– Dulux Weathershield acrylic to walls, eaves and fascias
– Deck oil is Livos, plant-based
– Sikkens clear finish to timber elements
– Universal Tiles porcelain tiles to ground floor living/utility areas
– Carpets to bedrooms and upstairs living are sisal natural fibre.

OTHER ESD FEATURES
– Home office so Cath can work from home and avoid commuting
– Low water garden – the garden currently comprises three raised vegie beds, which are being converted to wicking beds, and an assortment of local and or other hardy plants. No watering system is required
– On the lower side of the site similar water management work is underway, with indigenous grasses and shrubs.

The position now occupied by the living room used to be closed off as the main bedroom. "My favourite thing is watching the changing light on the hill across the gully," says homeowner Cath, "and being able to do it from the couch, or the deck – I used to have to sit on the edge of my bed for that view."

ATA update

—Alternative Technology Association: www.ata.org.au

The ATA, publisher of *Sanctuary* magazine, is a not-for-profit organisation that exists to enable, represent and inspire people to live sustainably in their homes and communities. Stay up-to-date with ATA news, subscribe to the ATA enewsletter online at www.ata.org.au

ATA NEWS

ATA'S GAS PREFERENCES SURVEY

Consumers are less likely to choose a gas appliance than they were five to 10 years ago, according to a survey by the ATA. Among the findings of the *Gas Preferences Survey*, a significant share of gas users are making plans to switch appliances away from gas. Only 34% of respondents who replaced their hot water system in the past 12 months continue to rely mainly on gas for heating water.

www.ata.org.au/news/consumers-support-cost-reflective-pricing

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Are you thinking about going solar but don't know where to start? Andrew Reddaway, ATA's energy analyst, answers basic questions about solar power for people who are looking to have solar installed on their roof or need general information. Once you get started, ATA has plenty of additional resources to help guide you along the process.

Visit: www.ata.org.au/news/solar-frequently-asked-questions

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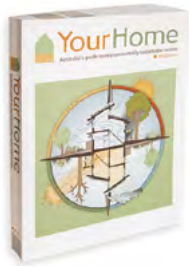

YOUR HOME UPDATED

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Family hub

Located on a tight site and a busy cycleway, this classic weatherboard has been artfully renovated to meet the needs of an active and creative family, and to provide every room with a garden view.

WORDS Verity Campbell
PHOTOGRAPHY David Johns

This single-fronted weatherboard extends to a second floor at the back. The renewed north-facing garden has been transformed by landscape architect Fiona Harrison into curved terraces of densely planted vegetable gardens and vine-draped fences. "Tight urban sites don't need to be restrictive in terms of how much garden or access to outdoor space a family can enjoy."

BOASTING IDEAL PASSIVE SOLAR possibilities through its north-facing backyard, this single-fronted weatherboard in Brunswick, inner Melbourne, was far from reaching its potential. "Almost unliveable" describe the owners of their family home. "The thermal performance was appalling – you almost couldn't enter the home when it was over 33 degrees!"

The family of four enlisted Sarah and Paul from Baker Drofenik, architects specialising in challenging inner city sites and thermal insubordination. The team set to work righting the many wrongs of the existing home and 'DIY' extension. They used high-spec products – including a 4.9kW solar power system and 6500 litres of rainwater storage – and passive design principles. "A house renovation like this comes out of a combination of the owners' vision and willingness to open up, close down, respond to breezes and sun, be thermally efficient, and also be a reflection of the owners' personal beliefs," explain the architects.

From the street a custom-made weatherproof 'box' houses the family's cargo bike so that it can be wheeled in the side gate and stored securely. Corten steel drops the structure out of sight behind foliage. Entry to the home for those arriving on two wheels, rather than three, is up the side path, with plentiful undercover bike storage through a grapevine-draped 'green tunnel'. "Tight urban sites don't need to be restrictive in terms of how much garden or access to outdoor space a family can enjoy," explains Sarah. "In fact the under-utilised inbetween spaces can add to the vitality of the internal spaces, offering solar access,

possibilities for ventilation and alternative garden views. The east boundary green tunnel could be a banal side access way and bike storage area, but with the owners' use of plants the side access is transformed into a beautiful transition space."

For foot arrivals, the front door reveals a long hallway through the old part of the home – barely touched in the renovation – past a bedroom, then a bathroom and concealed laundry where the new works begin. The glimpse through the bathroom to the leafy greenery of the bike lane is a favourite feature of the home for its owners, as is the fully tiled walk-in shower, doing away with "step and rickety plastic base".

Past the bathroom, the hallway opens to a "central pivot space" to the first-floor staircase and new living/dining room. "This space, which would essentially be just a corridor," says Sarah, "is redefined as a central hub to the house providing a lively space for family activities and expression and a dense amount of storage for books, games, display of photos and family memorabilia.

Over the staircase, a small operable skylight admits light and vents heat. The two upstairs bedrooms have horizontal windows to the east for ventilation and morning light and slot grills to reduce glare. A series of casement windows to the north and south fine-tune cross ventilation. "The windows open individually so they can be adjusted," says Paul. During summer evenings the windows, with flyscreens, remain open; during winter a single window remains open for fresh air.

Downstairs, the open plan kitchen, dining, and living room expands to the north and south with bi-fold doors and full width flyscreens. Overhead lights were passed over for floor lamps, sourced by the architects, that can be moved around the space with floor-mounted power points. A custom-made Mark Tuckey table, large wall-hung circular shelves, a room length inbuilt storage bench, and particularly the dark timber-panelled ceiling and walls, make this room a welcome departure from 'white and bright'. The room is cool, moody and nuanced. "It feels like a ship has landed on the back of an old house," laughs the owner. "We love the timber. It's just beautiful to look at."

Initial concerns about the concrete slab in the room being cold and "kind of

The open plan kitchen, dining, and living room expand to the north and south with bi-fold doors and full width flyscreens. With large wall-hung circular shelves from Clock-It Cabinets, a room-length inbuilt storage bench and dark timber-panelling, the room is cool, moody and nuanced. "It feels like a ship has landed on the back of an old house," laugh the owners."We love the timber. It's just beautiful to look at."

The back steel screen was purpose designed by the architect and built by steel fabricator Peter Drofenik. Over time, summer shade will be provided by grapevines.

The under-utilised inbetween spaces can add to the vitality of the internal spaces, offering solar access, possibilities for ventilation and alternative garden views. The external timber sliding shutters shade the kitchen from west sun and are operated manually from inside.

A Corten steel bike storage box sits behind foliage out of sight of the road. And although a relatively small site, there is enough roof space for a 4.9kW solar energy system and solar water heater. The east boundary could be a banal side access way and bike storage area, but with the owners' use of plants it is transformed into a beautiful transition space.

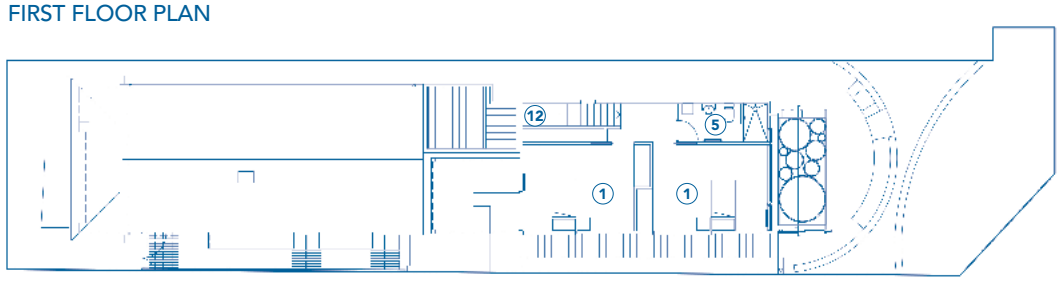
industrial" were alleviated through the architects' specification of a stippled inlay, the hydronic heating and solar gain through that ideal northern aspect.

Outside, the renewed north-facing garden has been transformed by landscape architect Fiona Harrison into curved terraces of densely planted vegetable gardens and vine-draped fences. Fiona's intervention here adds another layer of complexity to the site, say the architects, building on the clients' vision. "We found the collaborative approach invigorating and helped us push our design along directions we may not otherwise have investigated. This resulted in a house that we believe not only represents our core philosophies but also the owners'." S

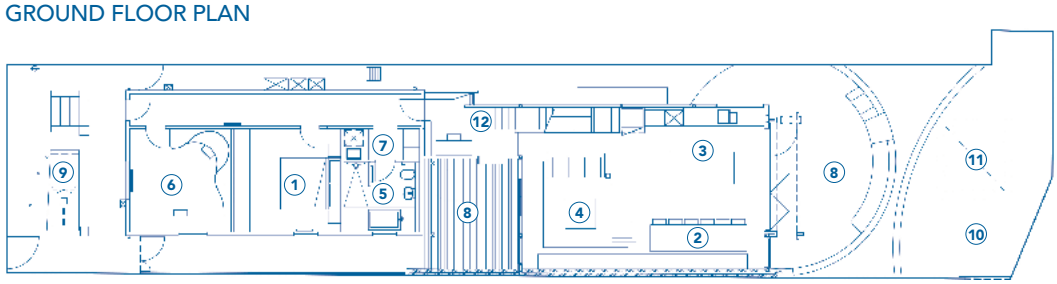
LEGEND

1. Bedroom
2. Dining
3. Kitchen
4. Lounge
5. Bathroom
6. Study
7. Laundry
8. Outdoor living
9. Bike storage
10. Garden
11. Rainwater (in ground)
12. Staircase

FIRST FLOOR PLAN



GROUND FLOOR PLAN



Brunswick house

—Specifications

Credits

DESIGN
Baker Drofenik Architects

BUILDER
Gande Constructions

PROJECT TYPE
Alteration and addition

PROJECT LOCATION
Brunswick, VIC

COST
$450,000

SIZE
Land: 306 sqm
Ground floor: 127 sqm
First floor: 46 sqm
Courtyard: 16 sqm

Sustainable Features

HOT WATER
– 315L gas-boosted Rinnai Sunmaster solar hot water system.

RENEWABLE ENERGY
– 4.9kW grid-interactive solar photovoltaic system, SMA 5000TL Sunny Boy inverter, installed by Going Solar.

WATER SAVING
– Hoss Boss on demand hot water recirculation pump
– Nylex Greywater Diverta, to reuse water from first floor shower into the back garden via sub soil irrigation
– 6500L Graf Carat underground rainwater tank for garden, toilets, washing machine and garden taps; Onga Dominator pump with mains water switch function.

Positioned above the striking recycled timber staircase, a small operable skylight brings in light and vents heat.

PASSIVE DESIGN
– North-facing concrete slab for thermal mass
– Solid brick wall to east for thermal mass
– The timber batten screen to the north provides some shading, the steel circular structure is for a deciduous vine to grow over in the warmer months.

ACTIVE HEATING & COOLING
– In-slab hydronic heating with gas boiler and hydronic panel heaters to areas with timber floors; Zenitherm hydronic panels and heated towel rails.

BUILDING MATERIALS
– Insulation: Kingspan Air-Cell blanket to roof and walls, polyester bulk insulation in ceiling R3.5, min R1.5 to floor space and R1.5 to walls; fixed 20mm battens over insulation for cladding and to provide an additional air gap
– External cladding: pre-primed and painted timber weatherboards; Woodform Architectural spotted gum cladding (Australian Forestry Standards)
– Pergolas and rear shade structure: Durapost and Durabeam white cypress (FSC Certified) from Laminated Timber Supplies
– Internal timber lining boards: Recycled Reds from Delta Timber
– Cabinets: spotted gum solid and veneer (kitchen area); silver wattle (bedrooms); kitchen laminate Abet Laminati – from Concept Cabinets.

WINDOWS & GLAZING
– All windows and external glazed doors are solid timber, double glazed by Miris Windows
– Casement opening windows from Truth Hardware
– Large Centor track concertina door with integrated concealed sliding flyscreen
– Stained glass window repaired by Dr Leadlight
– External timber sliding screens (operated manually from inside) for shading, designed by the architect and constructed by the builder
– Luxaflex Duette thermally efficient window furnishing fabrics.

LIGHTING
– LED wall, ceiling and outdoor lights
– Warm-white fluorescent tube in the kitchen.

PAINTS, FINISHES & FLOOR COVERINGS
– All paints and finishes recommended by the Green Painters Association, including low-VOC Wattyl ID
– Internal concrete floor HiperFloor finish (no applied finish – polished until sheen level is achieved).

OTHER ESD FEATURES
– As much material as possible was salvaged from the original house and reused
– Purpose-built Corten steel lockable cargo bike storage box
– Extensive food garden including fruit trees
– The rear fences were made out of a reclaimed feature worm wood from Yarra Timber purpose designed by the architect and built by the builder.

Big sky views

Constructed from locally sourced materials and designed in the style of a traditional worker's shed, this new family home in Trentham is comfortable, thermally efficient and provides views in all directions.

The location of the house on the 40-acre block was carefully selected to have views of town and the mountains: "We love sitting out on the deck and watching the big sky. The fabulous time for us is late afternoon, early evening, as the sun's setting and the clouds are rolling past Mount Macedon and the surrounding countryside."

WORDS Fiona Negrin
PHOTOGRAPHY Peter Clarke

THE AWARD-WINNING 700HAUS IS home to Kane, Lea and their young family in picturesque Trentham, high in the Great Dividing Range about an hour's drive north-west of Melbourne. Named for the number of metres the house sits above sea level, 700Haus confidently unites a striking, minimalist aesthetic with a rigorous attention to thermal efficiency, making it an exemplar of good residential design for a sub-alpine climate.

The 40-acre Trentham block was vacant when the couple purchased it in 2010. Serendipitously, they met Tim Ellis, principal at Glow Building Design, at an Alternative Technology Association 'Speed date a sustainability expert' event. Kane recalls "turning up with photos of our block and saying, 'we're looking for somebody that can help us build our dream.' We spoke to a few architects there and we both felt that Tim was in tune with what we wanted to do, and he was the right person for us."

Their brief was to build a house that fits in with the landscape and reflects the region's history, using a minimal range of materials, locally sourced where possible. Tim designed a contemporary, elegant take on a working shed. True to the couple's intention to use few materials, the house's exterior uses only three: timber, steel and stone, including corrugated iron cladding, locally quarried stone for the chimney, and blackbutt timber from local native plantation forests for the deck.

The house needed to have low ongoing energy use and be able to withstand the sub-alpine conditions of the region. The couple also wanted to take advantage of fine views out to the Macedon Ranges and Trentham township, which meant a straightforward northern orientation wasn't going to work. Tim's team "went back and forth between thermal rating software and 3D modelling software" to model every element of the design – plugging in CSIRO data and contour points to find the right spot for the house; modelling shadows to check how much light would hit the concrete slab; testing window locations to frame a desired view. The 3D modelling was indispensable in "bringing things to life," says Kane, and together with the thermal rating software, ensured 700Haus achieved dual outcomes of postcard-perfect views from every window plus thermal efficiency.

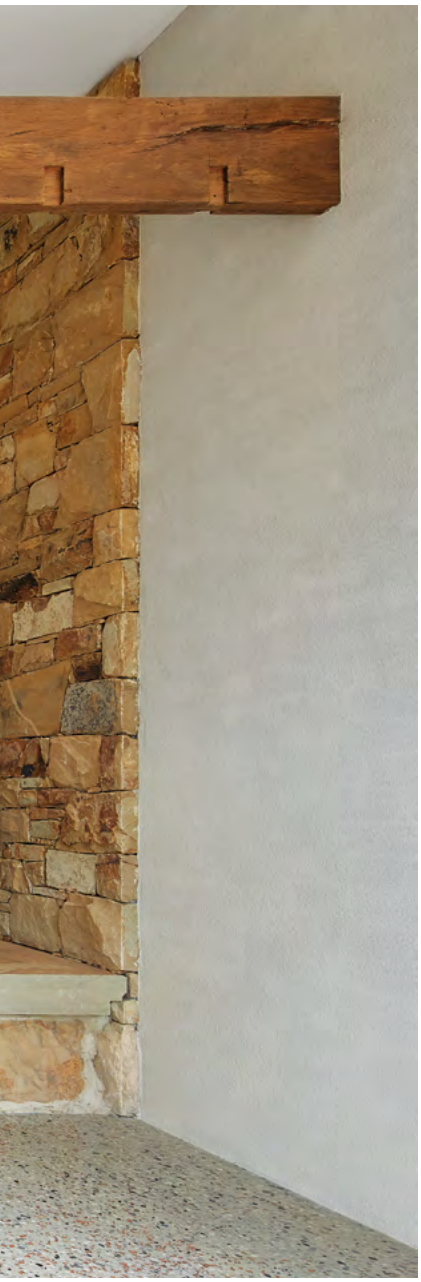
The quality of thermal efficiency, as important as a gorgeous view though not as visible, is attributable in part to the house's double stud timber walls.

→

Sourcing materials locally was an important design criterion for this house – the timber beams were reclaimed from an old schoolhouse, and the chimney rock was sourced from the nearby town of Castlemaine.

Moving from inside the house to the outside, Kane says, "you have a layer of plaster, then a stud wall; we then have an air gap, another stud wall, and then the finishing on the outside. So what we actually have is very, very heavily insulated walls with two layers of R2.5 insulation." Combined with double- and triple-glazed windows and R6 insulation in the ceiling cavity, the house is exceptionally well insulated from the weather.

700Haus' I-shaped floor plan has the main living area in the northern end, where thermal mass from the polished concrete slab floor and stone hearth (actually a fully rendered brick wall, built by a local stonemason from locally quarried stone) captures the daytime sun and slowly releases warmth to the rest of the house through the day. On exceptionally cold days the family gets a heat boost from the wood fire or hydronic panels connected to a heat pump. But even "with just a minimal wood fire on, our coldest day last year was minus six and we could walk around inside the house in shorts and a T-shirt", says Kane. "The house has performed above expectation." →



The 7.8 Star home is passively heated and cooled – the polished concrete slab in the north-facing, open plan kitchen and meals area helps keep internal room temperatures constant. Benchtops and cabinetry were milled from blackbutt found on site.

The master bedroom has three small, south-facing windows and double-glazed doors to the west which provide sunset views, but are protected by awnings to exclude direct summer sun.

Although construction was completed in just five months (Kane and Tim credit the builder, Rick Egan from Kyneton, for his can-do attitude) the house is still a work in progress. Fixed louvres are yet to be built on the north-west side of the house to block the summer sun but admit winter light. A large corrugated iron and timber work shed is in the throes of construction; it will house farming machinery as well as a solar array that will effectively allow the family to live off-grid. And there's native trees and vegetation to plant. But this is tinkering at the edges; the home is built and the family is delighted with it.

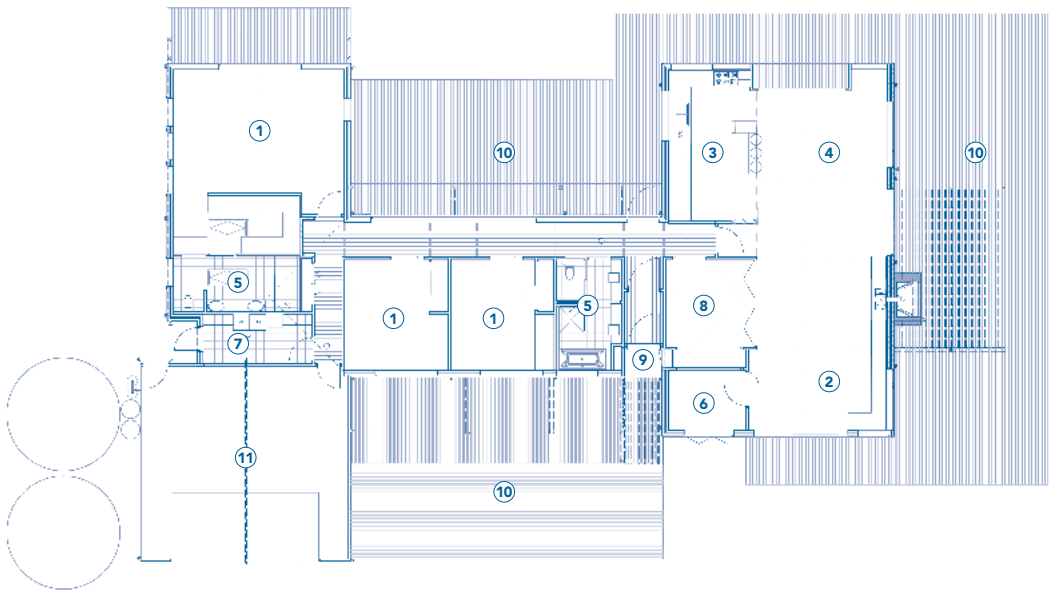
When asked about their favourite aspect of the house, Kane responds, "It's a really easy answer: we love sitting out on the deck and watching the big sky. The fabulous time for us is late afternoon, early evening, as the sun's setting and the clouds are rolling past Mount Macedon and the surrounding countryside. It's magic, and it makes it all worthwhile."

Sliding barn-style doors in the hallway suit the style of this contemporary farmhouse, and allow for more flexible furniture placements in the bedrooms.

LEGEND

1. Bedroom
2. Living
3. Kitchen
4. Dining
5. Bathroom
6. Study
7. Laundry
8. Playroom
9. Entry/airlock
10. Deck
11. Garage

FLOOR PLAN



700Haus

—Specifications

Credits

DESIGN
Glow Building Design

BUILDER
Rick Egan

ENGINEER
Coulthard-Shim Engineering

PROJECT TYPE
New build

PROJECT LOCATION
Trentham, Victoria

SIZE
House: 253 sqm
Land: 157,595 sqm
Garage 49 sqm

BUILDING STAR RATING
7.8 Stars

Sustainable Features

HOT WATER
– The electric hot water system, located in garage to assist insulation of the unit, is connected to the heat pump.

RENEWABLE ENERGY
– The house is currently grid connected, but the owners are monitoring energy use to assist sizing the solar system to be installed to the northern aspect of shed, with the potential to include battery storage.

WATER SAVING
– Self-sufficient with water; house located in one of Victoria's highest rainfall areas
– 62,000L Pioneer Tanks made of local BlueScope steel; includes 10,000L firefighting allowance; there is also a dam
– Gabled roof designed for efficient rainwater catchment, and to reduce problems with ember attack in the case of a bushfire
– Rainwater collected through a wet system to the house, with UPVC downpipes to allow hydrostatic pressure to fill tanks
– Water-efficient appliances including Caroma dual flush toilet; WELS 4-star Liano basin/mixer in bathroom.

PASSIVE DESIGN
– Reverse brick veneer allows for thermal mass to balance interior temperature
– Polished concrete insulated slab with northern aspect, for additional thermal mass
– Awnings pitched to allow winter sun penetration, and exclude direct summer sun
– Battened air gap to corrugated steel reduces heat transfer; additional external air barriers and insulation to roofing to reduce thermal differentiation and avoid condensation.

ACTIVE HEATING & COOLING
– Haiku fan from Big Ass Fans, with winter mode
– Sanden heat pump hydronic heating, designed to be run on PV electricity.

BUILDING MATERIALS
– Walls and roof: BlueScope Lysaght corrugated galvanised steel cladding
– Caesarstone 'Pure White' and blackbutt benchtop – the timber found on site and cut and polished at nearby mill
– Double-stud walls to allow additional insulation to be installed
– Timber frame-plantation pine prefabricated locally by Bendigo Truss to allow off-cuts to be re-used in factory setting.
– Insulation: Knauf Earthwool 2xR2.5 for walls; breathable, reflective wrap insulation; ceiling R6 plus R1.5 blanket wrap to top chord of rafters (also to decrease the risk of condensation problems)
– Timber beams reclaimed from an old schoolhouse; honed fire-resistant blackbutt timber and radially sawn blackbutt, sourced locally from Timber Search in Woodend
– Cabinets constructed by Evolve Interiors and Design using blackbutt veneers, some re-milled using blackbutt found on site
– Local Castlemaine rock for chimney, built by WJ Jones & Sons Stonemason
– Bathroom tiles from Re-Use, salvaged concrete and marble re-used from industrial contexts/buildings
– Untreated Victorian ash barn-style internal doors from Binq, (Australian Forestry Standards).

WINDOWS & GLAZING
– Double- and triple-glazed timber framed Victorian ash windows throughout (AFS); windows include a range of tilt turn and powered venting high awning windows, supplied by Binq.

LIGHTING
– 7 watt LED lighting throughout, with individual switches to enable lighting of smaller zones; dimmers installed
– LED floodlighting externally.

PAINTS, FINISHES & FLOOR COVERINGS
– Wattyl low-VOC paints
– Local woollen carpets – made from 100% wool Cavalier Bremworth
– Recycled blackbutt on battens over slab in hallway
– Polished slab: 32MPa.

OTHER ESD FEATURES
– Use of local products and trades
– Efficient appliances used throughout, including 900mm freestanding electric oven, Ilve appliances; refrigerator from Electrolux is locally produced
– Revegetation: 270 eucalypts and acacias planted thus far
– On completion of the shed, the PV system will be installed
– All waste treated on site.

Stay warm this winter with efficient heating

WORDS

Lance Turner

Lance Turner is the Alternative Technology Association's technical editor, and a columnist in *Sanctuary's* sister magazine *ReNew*.

Heating can be responsible for a large proportion of a home's energy use, but can make all the difference when it comes to winter comfort. We investigate the quality and costs of some efficient options, including hydronic heating systems and reverse-cycle air conditioners.

No matter how well designed your house is for passive thermal performance, in most of Australia and New Zealand you will probably need some added winter heating. But what heating system is best and most energy efficient for your home?

Although there are countless versions of gas- and electric-fuelled space heaters on the market, we are looking at two of the more efficient choices that you could consider: hydronic heating which uses radiators and in-slab immersed piping; and reverse-cycle refrigerated air conditioning, a form of heat pump technology.

HYDRONIC HEATING

Hydronic radiator systems consist of a heat source (boiler), one or more pipe circuits with heated water flowing through them, and radiators to emit warmth into the room. Some more complex hydronic systems have multiple zones, so you can choose to heat only part of the house, reducing energy use.

These systems have a number of advantages over other forms of heating. Hydronic systems emit heat either underfoot or close to floor level, which gives the feeling of warmth with lower ambient room temperatures than with space heating. This is because emitting heat at a lower level without the need for forced air movement (fans), the radiant convectors (radiators) avoid the cooling effect of airflows produced by heating such as reverse-cycle air conditioners or ducted gas furnace systems. Hydronic systems are also flexible: some boilers provide domestic hot water, eliminating the need for a separate water heater.

Disadvantages of hydronic systems include the initial installation cost. A complete system can easily cost $10,000 or more, depending on the boiler, the number of circuits and type of radiator. However, prices have dropped over time as hydronic heating becomes more popular and recent technology in boilers and pipe systems make it more affordable.

For a new build, and with a concrete slab floor, in-slab immersed hydronic floor coils can be laid with multiple circuits to provide perhaps the ultimate in comfort and operating costs, but you need to carefully consider the way these systems are controlled and insulated, to overcome potential heat lag from the heat bank in the floor mass. A system using wall or skirting radiators allows you to turn the heating on and off at will, and get heat within a minute or so.

WHICH FUEL?

There are a range of options. Reticulated natural gas enables a gas-fired boiler to be used, but alternatives are solid fuels such as timber and manufactured pellets, solar energy, ground-sourced heat pump and air-to-water heat pump technology. Electric (non-heat pump) boilers and LPG-fuelled systems probably should be avoided unless there is no other choice available.

Solar systems have roof-mounted collectors that provide a proportion of the water heating, with instantaneous gas, heat pump or solid fuel heat sources used as a backup. Bear in mind though, heating is required at times of the year where there is the least solar input, and the water storage capacity required can be large, up to 1000 litres or more.

Heat pumps use a refrigeration system to extract heat from the outside air (or the ground or a body of water such as a dam) and concentrate it into the water tank [see box]. Even air that feels cold to us can contain a lot of usable heat, although the colder the ambient air, the lower the overall available heat capacity.

If no other fuel source is available or you have a low-cost source of solid fuel, such as fallen timber on a large property, solid fuel boilers can also be used to provide hydronic heating.

Arguably, the most greenhouse-friendly and lowest cost to run system would be a high-efficiency heat pump combined with a suitably sized photovoltaic array, although these systems are rare.

REVERSE-CYCLE AIR CONDITIONING

An energy-efficient heating alternative to a hydronic system is the room-mounted or central ducted system reverse-cycle air conditioner, also known as a heat pump. These systems use refrigeration principles and a reversing valve to heat (or cool) the air in your home. Unlike relatively inefficient resistive electric heaters that turn energy from one form (electricity) into another (heat), reverse-cycle systems use electrically powered compressors to move heat from one place to another; they use a lot less energy to produce the same amount of heat.

The efficiency of reverse-cycle systems is given by a coefficient of performance (COP). This is a ratio of the heat moved to the electrical energy input. As an example, if your heat pump uses 1kWh of electricity to move 4kWh of heat from outdoors to inside your home, then it has a COP of 4. The actual running COP depends on numerous factors, including the temperature differential between outdoors and indoors, the refrigerant and compressor type used, and overall system design.

These days, reverse-cycle air conditioners are mainly individual room or 'split systems'; the indoor air-handling unit and outdoor compressor unit are separated and linked by high-pressure hoses. The split system has several advantageous features—the air handling unit is quite compact, they only need a couple of small holes in the wall, floor or roof for piping and cabling, and the compressor is outside. →

Split system reverse-cycle air conditioners are compact and simple to operate and modern units generally have high operating efficiencies.

As well as in-slab systems, there's a vast array of radiators available for hydronic heating systems, from the traditional standing radiators to towel rails, bench seats, skirting boards, mirror surrounds and even decorative wall art. Image: Caleido

WHAT'S CHEAPER, HYDRONIC OR REVERSE-CYCLE?

It can be difficult to compare the two approaches. A single efficient reverse-cycle air conditioner will certainly be cheaper to run than a whole-of-house hydronic system. Even if you install several reverse-cycle air conditioners to allow you to heat the whole house, you are probably unlikely to run them all at once, and so your running costs may also be lower. However, a well-zoned hydronic system can be cost effective.

One advantage of reverse-cycle air conditioning is that you can start small, by installing a single unit, and then add more as the budget allows. With a hydronic system you really need to buy a boiler and ancillary equipment sized to suit the entire heating requirements of the home. With a reverse-cycle air conditioner, you also get cooling without having to buy a separate system. However, a whole-of-home reverse-cycle air conditioning system purchased just for its heating ability will cost more than a whole-of-house hydronic system.

Running costs will depend on many factors including the size of the system and its efficiency, so be sure to consider the size of the system and look at the efficiency data, whether for a hydronic system or a reverse-cycle air conditioner. For a given level of heat loss in a home, a system with higher COP will use less energy to maintain required temperatures.

A primary factor determining running costs is the thermal efficiency of the house. Remember, the better insulated the home, the less energy needed to heat and cool it, and the smaller, and therefore cheaper, the heating system you need to install. This means that you need to take all the usual efficiency measures, such as insulating ceilings and walls (and under floors if possible), sealing draughts, and insulating windows with either double glazing, curtains and pelmets, or both. In short, spend some money on energy efficiency measures up front and you will save on heating in both the long and short term.

COMFORT AND OTHER CONSIDERATIONS

Many other factors come into operating costs. Forced air systems of all descriptions do tend to dry the air within the conditioned space, which has a cooling effect of approximately three degrees Celsius, as you lose perspiration off your skin to your surrounds. This happens to a lesser extent with hydronic heating. As discussed earlier, hydronic systems tend to feel much more comfortable at lower temperatures than reverse-cycle air conditioners, as the radiant heat is at floor level and there is no cooling effect from air movement or reduction in relative humidity.

With heat pump hydronics, you might be able to access a cheaper off-peak tariff to heat the water, at least for part of the day. This will depend on your system's design and your energy company's tariff usage requirements. There are also opportunities to source electricity from renewable sources, rather than coal-fired power. If you have excess photovoltaic-generated electricity, you could use this to offset some of the running costs for heat-pump hydronic systems and reverse-cycle air conditioners. It's important to note, though, that heating systems are most needed in winter when there are lower solar radiation (insolation) levels. An oversized solar system can help to some extent, but the savings are likely to be small. A battery could power the system at night, but currently the bill savings won't offset the battery cost.

As for gas-fuelled systems, given that gas prices are now tied to international prices, the future costs of running a gas boiler can be difficult to predict. There's also the issue that natural gas is non-renewable and becoming dirtier as more is sourced from fracking and coal seams.

Each home's situation is different, so you need to evaluate the economics of the systems, based on your own particular circumstances. Ⓢ

FOR MORE INFORMATION:

Lance Turner's efficient heating systems buyers guide is available in 'Stay warm this winter: a heating buyers guide' in *ReNew* 135, and includes comprehensive tables listing specifications for hydronic boilers, hydronic heating systems and the most efficient reverse-cycle air conditioners available in Australia and New Zealand.

FURTHER READING:

'Hydronic heating product review' in *Sanctuary* 27.
'Winter comfort: not just a heater choice' in *ReNew* 127; 'A tale of two heaters: gas vs electric' in *ReNew* 133; 'Are we still cooking with gas?', ATA report at www.bit.ly/CAP_GAS and in *ReNew* 130.

HEAT PUMP BASICS

Reverse-cycle air conditioners, often called heat pumps, use a refrigeration system to move heat from one place to another, concentrating it (raising the temperature) in the process. Air-source heat pumps extract heat from the outside air and concentrate it into usable heat, which might be used to heat a room directly or to heat water in a hydronic system.

A variation is the ground-source heat pump, which instead extracts heat from the ground (or a body of water if available). The advantage to this is that the ground is a more stable source of heat and is usually at a higher temperature than ambient air in winter, so system efficiency can be higher. However, given Australia's mild winters, the greater cost of installing a ground-source heat pump (due to the requirement of boring many deep holes or digging deep trenches) may be hard to justify.

Heat pumps use a closed system that contains a liquid with a low boiling point, called the refrigerant. A compressor adds energy to the refrigerant as well as increasing the pressure, forming a superheated vapour. This enters a set of coils known as the condenser where the vapour forms back into a liquid, giving up some of its heat energy in the process. It then flows through an expansion valve where the pressure is abruptly reduced, causing some of the refrigerant to form a vapour. It then flows into another coil called the evaporator where it absorbs heat, flows back to the compressor and the cycle repeats.

In a cooling-only air conditioner, or a fridge or freezer, the evaporator is inside the house or fridge cabinet and the condenser is outside. This is why the back of the fridge gets warm. In a heating-only heat pump, such as some hydronic systems, the condenser is inside (in the storage tank) and the evaporator outside.

In a reverse-cycle system, the system uses a reversing valve and so the inside cooling coils can be either evaporator for cooling or condenser for heating. The same applies for the outdoor coils. This applies not only to reverse-cycle air conditioners, but also to hydronic systems that can heat and cool.

Daylight your home

WORDS

Dick Clarke

Roof windows are most suited to applications where you want to enhance amenity, such as views of the sky or surrounding vegetation. Image: Velux

When investigating a skylight for your home, the first question to consider is whether you need sunlight or just light. With the advent of solar-powered LED technologies you can now bring 'daylight' into your home or apartment without compromising the building envelope – but if you want the real thing, there are several energy-rated skylights on the market. Dick Clarke explains.

I have been playing around with skylights for nearly 40 years and have tried just about every trick to get daylight into dark places.

In the 1970s I built double glazed skylights before Velux was heard of, and long before WERS (Window Energy Rating Scheme) had been conceived. In the 1980s I built 'tetrahedroid lightshafts' (a term invented to describe their weird geometry). In the 1990s I tried flexible reflective shafts descending two storeys. In the 2000s I used a photovoltaic panel to directly drive LED lights to create virtual daylight. These have all become commercially available– except the tetrahedroid shaft which is still unique!

You can now buy just about any kind of skylight you can imagine to daylight your home. Skylights are of course just one method for doing this – atriums, lanterns or clerestory windows are others, but they are a whole other facet of bringing natural light into your home that must be considered at concept stage, and cannot be easily retrofitted. This article focuses on skylight applications, and the advantages of commonly available products which can be used to daylight your house.

DAYLIGHTING

Introducing natural light into buildings – or daylighting – has long been recognised as extremely beneficial to human wellbeing. It also reduces demand for artificial lighting, which can reduce running costs and emissions. For this reason, daylighting is recognised by the Green Building Council's Green Star rating scheme, and also by the even more rigorous Living Building Challenge, and by most other environmental design tools, including BASIX in New South Wales.

Skylights have come a long way since the inefficient single-skin acrylic-domed skylights which came in either clear or translucent. They leaked masses of heat – both in and out – and in residential applications this issue was always a problem. These skylights are now penalised in all energy rating schemes, and have virtually disappeared from residential use, and rightly so.

The important considerations when assessing the quality of a skylight are the same as for windows: solar radiant heat gain (SHGC) and conducted heat flows (insulation value, expressed as conductivity in the U value).

WERS covers skylights but not all available products have been rated, however this scheme is still very useful for finding the most thermally efficient products. See www.wers.net/werscontent/skylight-products and *Your Home* for more information on how heat flows through glass.

ROOF WINDOWS

The roof window is a type of skylight that is most suited to applications where you want to enhance amenity, such as views of the sky or surrounding vegetation, or introduce windows into a loft. But as in all things, it's a question of balance. For all their wonderful benefits, it's a frustrating fact that every roof window will bleed heat at a higher rate than even a moderately insulated roof and ceiling, no matter how efficient it is. To avoid compromising the comfort and performance of your home, you need to plan and size roof windows carefully.

Rated roof windows

The great leap forward in roof windows came when European products appeared with double glazing and insulated timber frames. These are now the default choice, with common brands like Velux and Fakro being the most recognisable; local manufacturer Skydome also has a similar range of WERS-rated roof windows that perform equally well.

Each comes in a variety of operational modes: fixed and top hinged, remote or manual control, with some having the option of low-volume ventilation to allow air exchange in cold conditions. →

The advantages of tubular skylights are twofold: they can be located in slightly awkward and tight spaces where a conventional roof window or its shaft could never fit; and they cause very little heat gain or heat loss. Image: Velux

They also come with a selection of reflective and block-out blinds – essential in summer. The key to their performance is the way the softwood frame is profiled to act as both insulator and to assist in sealing. They are clad externally in aluminium for longevity and weather protection.

Sizing and orientation

The size and number of skylights in a space must be considered carefully. A good rule of thumb: a well-positioned skylight need not be more than two to four per cent of a room's floor area to provide effective sunlight; 10 per cent is certainly way too much.

Orientation also needs careful planning. South-facing roof windows bring in lovely reflected light, but if the geometry is incorrect, may also bring in direct summer midday sun – not delightful at all. Alternatively, a steeply sloping north-facing roof may provide great low winter sun while keeping most high summer sun at bay. Roof windows are really only recommended in non-tropical Australasia: southern Australia and all of New Zealand.

Installation

Depending on the room and ceiling configuration, the roof window will require some sort of shaft between it and the ceiling. Raked ceilings have small parallel shafts that are easily constructed and are unobtrusive. Flat ceilings require careful thought, especially if you want the skylight to fan its direct sunlight across the room. If retrofitting, the building's structure must also be considered. If you make the shaft too large, the volume may convect too much warm air out in winter, making the room feel cooler, and especially if the skylight itself is excessively large.

TUBULAR SKYLIGHTS

Tubular skylights are very effective at delivering abundant light through a relatively small opening, between 200mm and 400mm in diameter. They may use an angular selective clear dome on the roof to optimise the low winter sun angles. The tubes are either flexible foil or solid polished stainless steel, the latter having higher reflectivity. These skylights spread light evenly through the room using ceiling diffusers; the most efficient diffusers are the Fresnel lens type, which can be circular or square.

Advantages and applications

The advantages of tubular skylights are twofold: they can be located in slightly awkward and tight spaces where a conventional roof window or its shaft could never fit; and they cause very little heat gain or heat loss.

LED daylighting – using solar technology and LEDs – is a versatile option for getting virtual daylight into difficult spaces. Image: www.solarskylight.com.au

They can be used safely in the tropics, and can also have lights installed inside the tube, so that the same fitting is used for daylighting and night light. Some can be coupled with exhaust fans.

Controlling the light

Tubular skylights found their niche initially lighting minor rooms and utility spaces. I fitted one in my teenage son's bedroom to encourage him to arise a little earlier than noon each day. It certainly worked! But I soon discovered that he put a towel over the roof dome to preserve a snoozy dimness. You can get controllable dimmers, but don't tell your teenagers.

The larger, high efficiency tubes and square diffusers have also found a place in living and work areas. We have a Solatube DS190 with angular selective roof dome and a large Fresnel lens diffuser which gives wonderful light to our drawing office.

LED DAYLIGHTING – PV+LED DIRECT DRIVE

Sometimes referred to as LED or virtual 'skylights', these systems are solving all sorts of problems that used to be too hard or too expensive using a skylight. These 'daylighting' systems mimic skylights using two technologies which are now mature - photovoltaics (solar generated electricity) and LEDs, which are now both at a low point on the cost curve.

How they work

They are conceptually very simple, they use: a PV panel on roof, cable to carry extra-low voltage DC current to lights (usually via a smart driver), and light fittings on the ceiling which operate once the sun rises. Downstairs can be literally two or three storeys and many metres away, making this a versatile option for getting virtual daylight into difficult spaces. Though as in all things, check the quality and warranty before you buy.

Bedrooms can get extra light this way (but note bedrooms still need an external window to meet building codes) and they can be switched off if the teenager really needs their beauty sleep.

Effectiveness

I installed a Redilite 64 watt system powering three LED lights – and was very impressed with the brightness. Even without direct sun on the PV panel, these lights are very effective. And when the sun climbs above the treeline in the morning they really hit their stride – it is simply amazing. We now issue sunglasses to people before they enter the kitchen. Yet there is no heat gain or loss, because there is no hole in the roof compromising the building envelope.

→

Roof windows are an excellent way to introduce daylight and views into a loft, and comply with building codes which require bedrooms to have external windows. Image: Fakro

Light range

You can specify any colour light you like with LEDs, so it's important to plan the desired effect. If you want to fool yourself (in the nicest possible way) that you are enjoying daylight, then 4000 to 4500K (Kelvin) is the ideal colour range: it is a good approximation of sunlight, and suits our circadian rhythms. If you choose warm white (2700 to 3000K) then you will feel like it's night time, and that can be confusing during the day. A dilemma may arise if you use the same fittings for day and night lighting – something I tend not to do, I'd rather have two simpler sets of lights. Many LED fittings now have adjustable colour temperatures, but this appears not to have entered the off-the-shelf market for this type of product as yet.

Remember LED systems do not provide real daylight. If it's exposure to the sun's rays that is required you will need a skylight.

REMOTE DAYLIGHT VIA FIBRE-OPTICS

There is a 'best of both worlds' product available in Europe from Parans. A sunlight collector is located somewhere suitable on the roof, and fibre-optic cables are run to any location deep within the building, where a distributor spreads the sunlight out at the desired intensity. The cost of the components – especially the optic fibre – is not insignificant, and as yet there is no distributor in Australia. Current exchange rates would place this at the top of the price pile, but it appears to be the only practical way to provide real sunlight to spaces with no other chance of receiving natural light, so for some houses it could be quite viable.

WHICH TO CHOOSE?

At the end of the day, it's horses for courses and the sun shines on them all. Making the right choice will depend on a range of factors, including whether you need sunlight or just light. But whichever type you choose, it has to be designed and installed correctly to give the best result.

It is important to use products that meet all components of the relevant standards, such as AS/NZ-4285-2007. Reputable manufacturers of skylights are members of the Skylight Industry Association and can be found here: www.siai.com.au. WERS ratings for skylights are also very important, and details can be found here: www.wers.net/werscontent/skylight-products.

Photovoltaic solar LED equipment needs to meet a different set of standards since they are not skylights and no roof penetrations or thermal transfer is involved. They instead use a combination of an extra-low voltage (ELV) photovoltaic panel, wiring and lighting. ELV products can be installed by a 'competent person', but there can be safety issues, so best to follow the manufacturer's instructions carefully, and as with all consumer goods, check the warranty.

Daylight your home today

For natural daylighting advice always use an SIA Member, ***they're the experts***

The Skylight Industry Association Inc. (SIA) is the industry's Peak Body and is a member of the Australian Fenestration Rating Council.

It represents manufacturers, suppliers, resellers and installers to Australian Standards AS4285 & AS3959, with the NCC and the National Energy Rating Scheme WERSfS.

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Details

PROJECT TYPE
Renovation, owner-builder

LOCATION
Barwon Heads, VIC

LAND SIZE
590 sqm

CURRENT HOUSE SIZE
84 sqm, 40 sqm garage

PROPOSED HOUSE SIZE
181 sqm, 23 sqm garage

BUDGET
$200,000

The Brief

- Keep the footprint small to maximise the garden and outdoor living spaces and, where possible, retain or build around existing mature fruit trees
- Energy-efficient, passive solar design that makes use of the sea breeze for natural ventilation and cooling
- Natural light to all living spaces
- Provision for solar PV and water tanks
- Avoid hallways or enlarge them to provide a secondary function, such as a rumpus/study area
- Remove asbestos cladding and roofing materials, and replace with materials that fit with the character of the street
- Three modest bedrooms, with a separate guest room for weekend visitors.

There is nothing romantic about asbestos cladding and dingy kitchens. But when deciding whether or not to demolish their fibro beach shack, Lucien Hoare and Jess Davis chose to keep as much of their new home's old-school charm as possible. With a modest budget to work with, Tim Sonogan, from Sonogan Design in nearby Torquay, responds with a flexible design that pours light into the living spaces.

WITH A VIEW TO HAVING A LIFESTYLE that focussed more on outdoor living, Lucien and Jess made the move from an inner city apartment in 2014, not long after their son was born. "Neither of us need or want a large house so living in a small space was ideal – but growing vegetables in pots has its limitations," says Jess.

After renting in the area for six months, they found what they were looking for in Barwon Heads: a coastal block with a small house and large garden, and a town with a village feel, where they could access trains to Melbourne, walk to shops, schools and parks. It wasn't until they moved in that they realised they had bought one of the last original beach houses in the area. "Our neighbours were relieved to find out we planned to live here permanently and keep the garden. Around here most of the old places have been knocked down – people are rebuilding right to the boundaries."

The rundown 1960s fibro shack met their relatively small budget, but the trade-off was that the house, rear bungalow and gardens needed substantial work. "To make it liveable, we needed to replace the floors and paint the house internally," says Lucien. "We also removed close to 10 tonnes of concrete and furniture from the gardens."

After spending their first year establishing the native and food gardens, and coordinating a new routine for parenting, commuting and working from home, they are now ready to work on the house. After researching materials and designs, they are clear they want to keep the house small – and will renovate rather than demolish. Jess explains: "It doesn't make sense to knock it down if we can meet all our needs by improving it."

In fact, they would like to keep the renovation within the footprint of the existing house, rumpus and garage to retain as much outdoor and garden space as possible. However, they concede some extension may be necessary to create a house with three bedrooms, open living spaces and a larger kitchen, without resorting to a second storey.

Currently, the property is dominated by the carport and garage along the west boundary, which adds very little to the living space and serves only as storage. The site has existing mature fruit trees, which they would prefer to build around rather than remove. But they do wish to remove the asbestos cladding and roof from the site, and replace them with materials that suit the existing streetscape, which is majority zinc corrugated roof and weatherboard cladding.

While they are constrained by the site, Jess and Lucien want to have natural light throughout, and as far as possible passively heat and cool the house by taking advantage of the sea breeze. They are also committed to installing solar PV and water tanks.

They have both been owner-builders before – Jess constructed her own backyard studio, and Lucien managed a commercial office redevelopment – and intend to be owner-builders with this renovation and addition, calling in help where necessary. →

Jess and Lucien purchased one of the last classic beach shacks in the area, and want to renovate it to be as comfortable and energy-efficient as possible: "Our neighbours were relieved to find out we planned to live here permanently and keep the garden. Around here most of the old places have been knocked down – people are rebuilding right to the boundaries."

ORIGINAL PLANS

FLOOR PLAN

LEGEND

① Bedroom
② Living
③ Kitchen
④ Bathroom
⑤ Rumpus/shed
⑥ Laundry
⑦ Study
⑧ Rear bungalow
⑨ Deck
⑩ Garage
⑪ Garden shed

The existing house is 85 sqm, plus outbuildings including the 40 sqm garage, rumpus and laundry.

TIM'S RESPONSE

Jess and Lucien have purchased this property in beautiful Barwon Heads having now met all of their lifestyle and social needs. With both of them commuting for part of the week, they have selected their site well near the shops and the Barwon River, providing them with the ability, when they are at home, to walk everywhere.

If this were a blank slate, I would recommend two storeys, with reverse living, keeping the footprint small but maximising passive elements. But with the owner requirement to retain part of the existing 'fibro shack' – which is understandable to reduce cost and waste to maintain neighbourhood character – creating sun-drenched habitable spaces is their next and most important need.

They both have a great understanding of passive design and how their home should work for them, and their brief is on point with their modest budget.

ORIENTATION

Designing a home on an east/west block with an existing building and established northern street frontage is one of the most challenging of all environmentally conscious designs. In this case there is little room to extend into the highly sought after northern area of the site.

The way around this common issue is to create natural lighting to the southern habitable areas via high windows.

FACADE

Half of the facade will be 'sunken' to create a nice sense of covered entry, however the existing facade and roofline presence will be retained to keep some history and beachy 'feel' that is so prominent to Ocean Grove and Barwon Heads living.

FLOORPLAN

Carefully reconfiguring a floor plan when considering renovations and additions is important because, like everything else, design evolves over time. Like many homes of this era, little attention was paid to the climate during its design and construction.

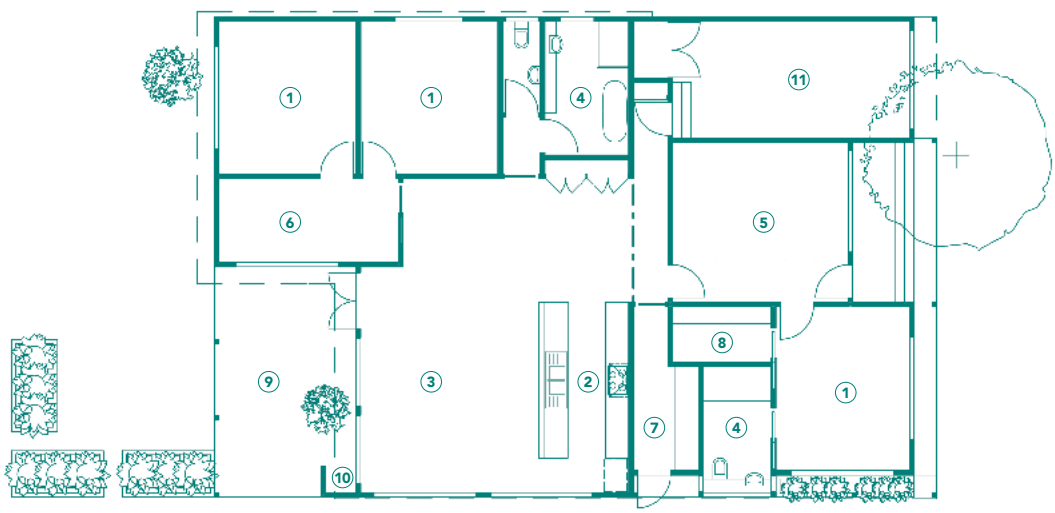
The garage will remain to the west to reduce solar heat gain throughout the summer. The existing front rooms, though, will be re-assigned as the rest of the building footprint increases into open plan living and dining, while allowing space down the eastern boundary for access and wall gardens.

In their brief, Lucien and Jess emphasised they wanted to maximise outdoor living and garden space; the new floorplan extends 204 sqm, including the garage, with 88 sqm extra required to meet their needs.

PROPOSED PLANS

In their brief, Lucien and Jess emphasised they wanted to maximise outdoor living and garden space, and avoid hallways or enlarge them to provide a secondary function. The new floor plan has flexible living spaces, including an entry that could easily be repurposed as a study or bedroom.

PROPOSED FLOOR PLAN



LEGEND

1. Bedroom
2. Kitchen
3. Living/dining
4. Bathroom
5. Study/entry/bedroom
6. Rumpus
7. Laundry
8. Robe
9. Outdoor living
10. Outdoor shower
11. Garage

Where possible, they want to retain or build around any existing mature fruit trees, which are located at the rear of the existing deck and laundry.

NATURAL LIGHT

Clerestory windows transitioning into a cathedral ceiling give the south-facing living area lots of natural lighting and a sense of size. Ideally, these windows are operable to allow for great stack ventilation and purging of the house on warmer days.

The main amenities and bedrooms are situated to the west, leaving the living area to garner morning sunlight. I understand the owners' requirement to open up the living area into the garden to the south. Realistically though, this area will be damp and uncomfortable for eight months of the year, so I am suggesting larger east windows, and view-capturing windows to the south only.

CLADDING

Recycled timber would be optimal as cladding, but requires maintenance. Zincalume roofing, Colorbond trims and composite weatherboard wall cladding (made from recycled materials it requires little maintenance and no painting) will set the home well in the tree lined streetscape and around the neighbouring buildings. Retaining the existing scale of the front facade will keep the house's integrity.

GLAZING

Double glazing in this climate is valuable, and there are many different glazing options they could consider. I would recommend double-glazing throughout, and the possibility of triple glazing to the southern glazed elements, which will somewhat counteract the lack of northern exposure, ensuring minimal heat/cooling transfer.

ENERGY

There is sufficient roof space and direct sunlight exposure to the rear bungalow roof to install a large solar PV system. Given that they will both be working and parenting at home for part of the week using daytime (on peak) power, they could make savings using the solar power before feeding any excess to the grid.

INSULATION

With the replacement of roof and wall cladding, this generates the perfect chance to fit out the home with insulation and bring the home up to a current standard. In this part of Australia (assuming a 90 mm wall frame) natural recycled batts with maximum R value would be appropriate.

HEATING/COOLING AND HOT WATER

With this design, indoor temperature changes will be minimal, but a low-energy hydronic heating and cooling system will help reduce any temperature fluctuations. Solar hot water with electric boosting would reduce water heating costs.

WATER AND GARDEN

Two large water tanks to the rear of the property (sized for the average rainfall and usage) will provide water to the toilets, laundry/washing machine and gardens. A greywater system will provide that extra water requirement, as the owners are avid gardeners.

KITCHEN, BATHROOM & LAUNDRY

Currently, the kitchen is very basic. The new kitchen will be positioned just below the clerestory windows to allow the dining and living area maximum natural lighting.

By reducing the amount of new materials and introducing recycled materials where possible, they could bring the cost down – the cradle to cradle approach or, at the very least, low embodied energy, is important with any material choice. →

Due to site constraints, there is limited potential to build to the front (north). This view from the north-east shows the light-capturing east windows and the clerestory north-facing windows which will pour light into the backyard-facing living space.

Wet areas to the south would be optimal to allow north aspects for living, but due to the living-to-backyard transition requirement, I recommend the main bathroom be located to the west side to act as a thermal break. With frequent weekend visitors the reality, having a separate ensuite bathroom will allow some private space.

Positioning the laundry with an external door works for a number of reasons: it gives easy access to the Hill's hoist, but also allows people to enter without tracking sand through the whole house.

GROWTH AND FLEXIBILITY

Many old beach houses in Barwon Heads were built to house multiple families holidaying together and this site is no different. By renovating the rear bungalow and connecting it with pathways to the house, there is potential for this home to become a site appropriate for multi-generational living, with teenage children or older family members living out the back, and also cater for holiday makers.

As they both commute and work flexibly from home, the floor plan lends itself to this requirement – the entry, rumpus or bungalow could easily be used as sun-filled home offices or additional bedrooms for a larger family.

The desire to keep the renovation to a single storey will ensure a good internal/external transition, but will prove harder to control heating and cooling. On the plus side, minimising the building footprint, where possible, allows external space for children and visitors to play and socialise.

The owners prefer smaller spaces, and do not particularly like 'unused' space, such as foyers or hallways. The entry access has been designed in a way that a fourth bedroom can be easily made with an internal timber framed wall. Ⓢ

Tim Sonogan is the principal of Sonogan Design, a building design and drafting practice located in the Victorian beachside town of Torquay. Sonogan Design can take you through the building process of your new home, extension or renovation.

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More affordable and more sustainable?

WORDS

Sarah Robertson

The latest research shows that green homes can improve housing affordability over the life of a building with little or no additional upfront costs – so why does sustainable design not rate in the affordability debate?

Housing affordability has been the topic *du jour* in the Australian media and politics of late. Yet while discussion has focused on negative gearing and the inhibitive upfront costs of home ownership, broader conceptions of affordability remain in the background. The role of sustainable design in creating more affordable homes and communities has barely been mentioned.

However, there are many in the housing industry calling for broader conceptions of affordability. In 2009, the Australian Institute of Architects released an affordable housing policy that supported the Victorian Council of Social Service's suggestion that what we need is 'affordable living', not just 'affordable housing'. Affordable living takes into account the indirect costs of living such as accessing employment areas, expenditure on utilities, the costs of adaptable housing and sustainable design.

Several years later, upfront costs continue to frame affordability debates. The fact that discussion and debate all too often pitches affordability against sustainability frustrates Dr Trivess Moore, research fellow at RMIT University's Centre for Urban Research. His research into the through-life costs of building 6 and 8 Star homes validates what sustainable designers have said for years: the higher upfront capital investment required to build a home with passive design at its core does pay off. "My modelling, and work by others, is showing that when you consider through-life affordability, any additional upfront costs [of sustainable design] should pay themselves back pretty quickly if you have good, clever

design and suitable technologies," Moore says.

This is a sentiment reiterated by building designer Luke Middleton of Eme Design. Designing homes more efficiently and flexibly with smaller building footprints is central to making housing more affordable. For Middleton, using space more efficiently is a key element often overlooked. It is partly about changing client expectations of how much space they really need, he says. Research into greenhouse gas emissions supports the impact of house size in achieving environmental sustainability – smaller houses and stringent building codes significantly reduce CO_2 emissions from new buildings.

Another element of the sustainability and affordability debate is housing type. No longer is the quarter acre block with a detached or semi-detached dwelling necessarily the dream. Apartments are increasingly seen as a more affordable option for those who want to live within relative proximity to the CBDs of major cities. Across Australia, about 80,000 apartments are expected to be built in 2016, with Melbourne, Sydney and Brisbane leading the construction charge. Yet, as apartment blocks rise from the dust of inner urban infill sites, the quality of the housing proposed and currently under construction is under review.

The Nightingale Model (designer-led, multi-residential housing) is one development approach with a stated aim of delivering better quality, sustainable and more affordable homes for Melbourne residents. At a planning committee hearing earlier this year, architect Jeremy McLeod of Breathe Architecture pitched his

An 8 Star modular home in Canberra, designed by Light House Architecture and Science, uses an efficient floor plan to reduce the home's overall size and cost, and is an example of a house that is affordable to build and affordable to live in. Image: Rodrigo Vargas

This 8 Star energy-rated home in the ACT is designed to maximise views of the garden; the north-facing dining area flows into the backyard via a generous deck. Image: Rodrigo Vargas

case for why the Nightingale I project should be built as designed. "Affordability, how do we do that and how do we bring that to the residents of Moreland?" Smarter and more sustainable design, minimal car parking, 17kW of solar power, solar hot water and capped returns for investors were important parts of his answer.

However, apartment living is not considered a viable option for everyone. Based on feedback from potential purchasers, Six Degrees has incorporated three-bedroom apartments into their Nightingale II development. They are not affordable in the traditional sense but they are more affordable, says Six Degrees director James Legge. The experience of residents at Nightingale's little sister supports this. McLeod explains the biggest utility cost The Commons residents have is their internet use [read more on this project in *Sanctuary* 33].

Meeting the challenge of Australia's housing affordability crisis is no small task. The housing experts, designers and providers who are working towards solutions know that good design, including environmentally sustainable design, is central, not opposed to the affordability agenda. The challenge is that custom designed buildings are often more expensive than off-the-shelf solutions. Yet sustainable design doesn't have to cost more. Dr Moore and his colleagues asked housing industry professionals in Victoria,

South Australia and New South Wales about the costs and benefits of well-designed homes. Their responses were telling: while it might cost between zero and five per cent more to build an apartment with improved thermal performance, passive solar orientation and visual amenity, the value of these aspects, which are not typically incorporated into cost-benefit analyses, was perceived as completely worthwhile.

For Moore, Middleton and others, sustainability and affordability aren't mutually exclusive goals. It's not about adding extra, but thinking more carefully about the design of homes, designing in flexibility and incorporating technologies that can offset the rising costs of energy, water and other services.

"Sustainability has got a bad rap in terms of cost because of ill-considered designs," Middleton says, adding that transparency about embodied and operating energy is important. "We need more good precedents out there to say, this is the hero and this is the reason why."

Sarah Robertson is a writer and researcher based in Melbourne. Her PhD, based at RMIT University, is looking at the role of environmentally sustainable residential design and urban community projects in shaping sustainable cities and citizens.

Jenny Edwards, a Director and Scientist at Light House Architecture & Science, tests houses to help people tailor their renovation or retrofit budgets for maximum benefit. Here, she provides some tips to keep your costs down without compromising on good design.

Affordability and sustainability fit together perfectly! Through excellent design – use of natural light, connection to outdoors, smart integrated storage – a small footprint home can feel as big as, and function better than, homes with much larger floor areas.

To make a new home more sustainable:

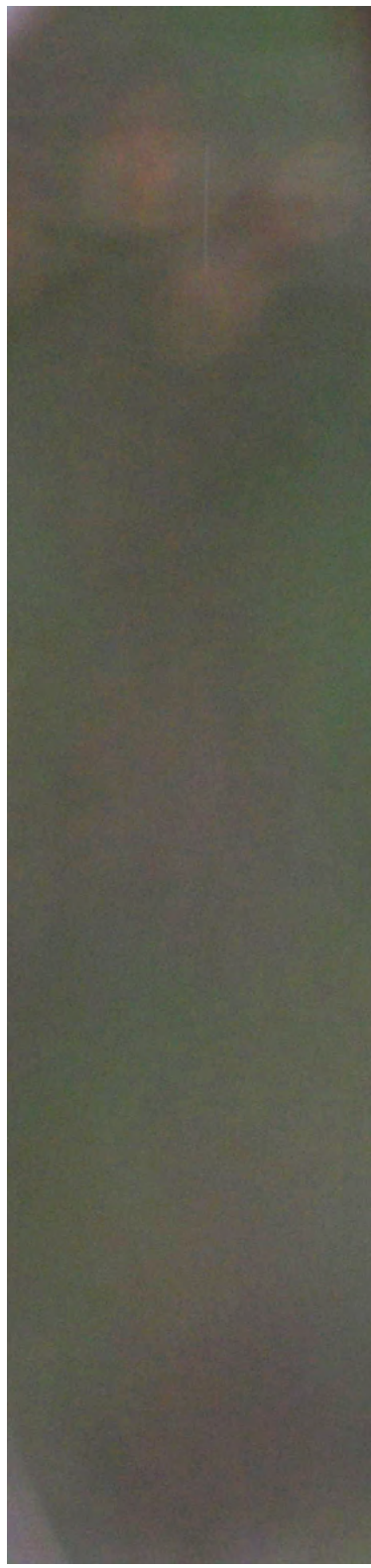
The quality of the building envelope is vital. Insulate and draught seal. Do both of these things, as one without the other just doesn't make sense.

Minimise your floor area through excellent design with no dead spaces – maximise space efficiency and functionality.

Think hard about how you want to live, what functions you want your home to be able to perform and design to achieve this brief without excess. The smaller the footprint the lower the upfront costs and embodied energy. The smaller the footprint the lower the running costs.

Gimme shelter

Designing outdoor spaces to attract birds is a wonderful way to conserve, create and reconnect habitat. Sarah Coles speaks to Bev Debrincat from the Habitat Network about the best ways to birdscape your garden.



WORDS Sarah Coles
PHOTOGRAPHY Damien Cook

THERE IS NO BETTER SOUND TO wake up to than the complex notes of a magpie's warble. But as bird habitats are compromised by urban sprawl and rural development, this simple pleasure is becoming far less common. Several species of birds are now extinct in Australia, and the endangered, vulnerable and threatened lists continue to grow. Thankfully, all is not lost – you can design the outdoor area of your home and community with birds in mind.

In his book *Where Song Began: Australia's birds and how they changed the world*, Tim Low writes, "the bird life of Australia and its sister island New Guinea is 'the most distinct and different' in the world." Australia has 989 recorded bird species, of which 45 per cent are endemic, but some of our unique birds are disappearing; 23 species have become extinct since 1788, and many more are under threat.

The Habitat Network aims to reconnect isolated populations of small native birds, pollinators and other native animals by educating gardeners to include native plants in their backyards, and through work with local councils and Landcare groups to conserve bird habitats and create habitat corridors. Bev Debrincat from the Habitat Network says, "A lot of people can remember having fairy wrens and firetails in their gardens. Now they are not seeing those birds anymore."

Habitat loss is the culprit. "Our houses are getting bigger, the amount of garden space is getting smaller and people are going for neat and tidy gardens," she says. "There's no native plants, no habitats, no biodiversity in our back gardens."

Where habitat was once continuous, it is

Nectar-loving birds, such as this noisy friarbird (*Philemon corniculatus*) of the honeyeater family, are attracted to blossoming native plants such as the banksia, grevillea and kangaroo paw.

The red-capped plover (*Charadrius ruficapillus*) is distributed widely throughout Australia, but unfortunately has poor breeding success due their nests being on the ground. Conservation efforts for this bird are focussed on protecting nests and educating beach users and dog walkers.

now fragmented by development including bare paddocks and car parks. Sometimes the trees remain, but the undergrowth or shrubs are cleared which makes the area uninhabitable for small bird species that require those types of environments. "We encourage bushcare groups and councils to look after bushland areas and to thicken up those edges with native habitat," says Bev. She adds that while national tree planting schemes are important they often result in habitat that lacks "the right structure for small birds". The Habitat Network wants people to either plant densely from the outset or return to undertake subsequent plantings.

Many birds that hunt over large areas are under threat, as they require unbroken areas of habitat, which is increasingly rare. When movement between different habitats is difficult, a situation called 'the island effect' occurs. Bev gives an example: "The female fairy wrens get forced out to find a mate. They have to find a population other than their family group to mate with so they have to be able to travel far enough to find more fairy wrens."

Protecting birds is not all about feel-good altruism: birds are good for gardens – they aid pollination, keep insect numbers under control, they till the soil and their droppings can be a natural fertiliser. They are visually spectacular and birdcalls are fantastic.

CREATING HABITAT IN YOUR GARDEN

There are steps you can take to birdscape your garden.

Diversity is key: Create layers of vegetation with different types of plants. Different birds like a diversity of strata, some like grasses, others shrubs, and some prefer trees. Smaller birds need plants such as spiky leaved melaleuca, vines and densely planted areas, as they nest in low and middle storey vegetation. When designing your garden, also include bare ground, because birds like to take dust baths to rid themselves of mites, and they eat grit and worms to aid digestion.

Consider water, food and shelter: You can simply install a birdbath or a pond. Nectar-loving birds are attracted to blossoming native plants such as the banksia, grevillea and kangaroo paw. Larger birds, such as parrots, prefer to eat fruit and the seeds of wattle and bottlebrushes. Many native plants have tube-shaped flowers that honeyeaters enjoy. (There is a symbiotic relationship at play when a honeyeater plunges its beak into a flower – the bird is accessing food and the plant is being pollinated.)

Consider planting low ground covers to create microclimates, and install open grassy areas that attract the insects birds like to eat. These grassy areas need to be near enough to a densely planted area so that the birds can escape if a cat or a larger, territorial bird such as a magpie should appear. Also select tall grasses for your garden to offer finches and wrens protection from predators. Shrubs will provide perches where birds can sit and wait for prey.

Things to avoid: It's important that you don't feed birds with birdseed or your leftover sandwich crusts, because feeding encourages larger, aggressive birds to dominate the area. It can also upset their digestion and replace the need to source their own food. Avoid using pesticides and insecticides in your garden as birds like to eat insects, and nasty chemicals travel up the food chain.

Whether you're working in your own backyard, or in the wider community, preservation of bird habitats pays off in the end. Bev was excited to recently discover superb fairy-wrens nesting in an unlikely habitat island beside a 24/7 bridge construction project, dense suburban development and busy traffic.

MORE INFO

Birds In Backyards is an Australian research, education and conservation program focusing on the birds that live where people live: birdsinbackyards.net

Where Song Began: Australia's birds and how they changed the world, Tim Low (2014).

The Habitat Network has many resources for creating small bird habitats: habitatnetwork.org

The State of Australia's Birds report series tracks trends in bird populations and their health: birdlife.org.au

Feral: Searching for Enchantment on the Frontiers of Rewilding, George Monbiot (2013).

Birdscaping Australian Gardens: Using Native Plants to Attract Birds to Your Garden, George Adam (2015).

Many landscape firms integrate biodiversity into design projects by working with ecologists to plan urban spaces. Large-scale projects, such as this one by Australian Ecosystems in Carrum south-east of Melbourne, benefit birds by restoring and linking habitat corridors.
Image: Sandy Scheltema

Products

01
ZCELL BATTERY

With more households projected to adopt battery-connected solar PV systems, demand for energy storage batteries is expected to surge, giving rise to concerns about the environmental impact of more lithium-ion batteries ending up in waste. (According to the Australian Battery Recycling Initiative, 8000 tonnes of lithium-ion batteries are thrown out every year). Redflow, an Australian company, has developed a battery that has good options for refurbishment or recycling at end-of-life and doesn't use lithium. The ZCell is a 'flow battery' and has different characteristics to other household batteries. It is made with a reusable liquid electrolyte component that can be cleaned and reused, and offers full usage of battery capacity (100% depth of discharge), and high tolerance of temperature extremes and periods of disuse. The efficiency of the battery over a full cycle is 80 per cent compared to approximately 90 per cent for lithium batteries. The ZCell stores 10kWh of electricity and the battery stack has a 10-year warranty. Available from mid 2016. RRP $17,500 to $19,500 (depending on installer), and includes the battery enclosure, inverter/charger and installation.

www.zcell.com

02
CREATIVE COMMONS LEAN DESK

Opendesk is an open-source furniture design website where you either download a design file and do it yourself or request quotations from local businesses that can make and deliver the finished furniture to you. The website is global but there are dozens of Australian businesses listed on the site. There is a fee to access the platform, for users and designers, and many designs are available at little or no cost. The technology you need to produce furniture from the platform is a CNC machine (like a computer-driven drill/router that carves shapes out of wood). The Lean Desk (pictured above) is a four-person workstation, made from birch plywood, which is the basic material required for each product on the site. Opendesk estimates the RRP of a constructed Lean Desk to an Australian buyer would range between $1930 to $2570, depending on the builder.

www.opendesk.cc/lean/desk

03
VELUX SOLAR-POWERED SKYLIGHT (VSS)

Velux has launched a solar-powered version of its remote controlled electrically operated skylight. The VSS features a solar panel that recharges the concealed battery-operated control system. The skylight has a low profile on the roofline and has an inbuilt rain sensor that automatically closes the skylight when rain is detected. The interior features a white painted frame and sash with aluminium capping on the exterior. It is double glazed and blocks approximately 80 per cent of heat. It has a special outer coating that reduces the need for cleaning. It includes insect screen and flashings for corrugated iron or tile roofs. RRP from $2053.

www.velux.com.au

04
ACCESS LADDERS

With the rise of the tiny house movement and a shift towards smaller dwellings, ladders are in high demand so people can reach mezzanine levels or access storage more easily. Access Ladders is a Brisbane manufacturer which custom builds and offers a range of ready-made ladders that can be shipped Australia wide. Ladders are available in a range of materials including aluminium and plantation pine, and are supplied with castor wheels and rails. RRP approx $700 timber, $800 folding aluminium and $900 to $1050 for deluxe sliding aluminium models.

www.accessladders.com.au

05

RETROFIT DOUBLE GLAZING

Compared to single glazing, double-glazing offers the benefits of improved insulation, lower energy costs and noise reduction. But if a your home's existing single-pane window frames are still in good condition you may not wish to replace the whole unit as part of a sustainable renovation. Thermawood Retro-fit is a dry glazing system for double glazing existing windows and doors. The system is designed to fit any wooden joinery and offers the benefit of preserving the original aesthetic of the home. The process involves the removal of the existing window glass and the replacement with a high-performance sealed insulating glass unit. If the windows are timber framed it is modified in-situ, if aluminium, it is provided with a set of frame adaptors and opening sashes are replaced. This is a New Zealand product that is now available in Australia.

www.thermawood.co.nz

06

PAARHAMMER BUILDERS RANGE

Paarhammer has just launched a Builders Range of reduced-cost timber windows and doors. *Sanctuary* readers will be familiar with the company's pre-painted custom windows – this new range is supplied in domestic window sizes, sanded and ready for painting. A number of styles are available, including European-style tilt and turn windows, fixed windows, French doors, bi-fold doors and lift-slide doors. The timber is plantation-grown Victorian ash. The windows and doors are double glazed with 16mm argon-filled airgap, and the multi-point German hardware combines with special seals to achieve low U-values. Paarhammer windows and doors are accredited under the Window Energy Rating Scheme (WERS). Price on application.

www.paarhammer.com.au

07

FRANKIE PENDANT LAMP

The Frankie Pendant is made from American Ash timber arms and a felt panel shade made from recycled plastic bottles. The panel fabric is stabilised to resist colour fading and moisture damage and is non-allergenic. This is a modular lighting design, allowing for just a single pendant lamp or a more complicated lighting set-up. An extension module allows the pendant to be extended lengthways in half-metre increments, and a corner module allows the lighting system to go around corners. The faceted shape of the recycled polyester felt shade helps to reduce ambient noise in the environment. RRP from $523 plus shipping.

www.designtree.co.nz

08

RECYCLED-WASTE ROOF TILES

Authentic Roof is a Brisbane-based company that distributes roofing manufactured by Canadian company Crowes Building Products. Crowes manufactures roof slate from auto industry waste such as bumper bars, tyres, trim and interiors that might otherwise end up in landfill. The company reports the tiles are safe to use with rainwater tanks and no harmful chemicals or colour coating is used during the manufacturing process; the product also meets the Australian Standard for roofing and water collection. Available in black or grey and three shapes, the imitation slate is made using eight different moulds so it has the varied appearance of natural, quarried slate with the benefit of being stronger. The tiles are UV resistant, flame-retardant, do not fade and have a 50 year warranty. RRP $78 (plus GST) per square metre. Ridge capping is $25 (plus GST) per linear metre. Australia wide delivery. Delivery fees apply.

www.authenticroofaustralia.com.au

Ask our experts

Dick

Your design, product and specification questions answered by our expert columnists.

Dick Clarke is principal of Envirotecture, a sustainable building design firm in Sydney and Redland Bay, Queensland.

Q—Can you please provide some advice on polystyrene cladding over brick veneer? I have a 1970s brick veneer house and have been looking into the thermal inertia advantages of cladding it. But which sort (in particular which density, and whether unsealed, or presealed on one side or on both sides), and whether battening the brick is necessary or will a 'glue and screw' direct to the brick be fine? I'm getting conflicting advice from suppliers and builders. One supplier here in South Australia says they've never heard of anyone fixing their panels to the outside of brick veneer, but I know it can be done.

– Peter, SA

A— The short answer is yes you can get some improvement, but some risks have to be managed, although you might get a better overall result if you just insulate the wall cavity. Insulating the exterior of brick veneer will definitely improve the thermal performance of the building, but a number of qualifying factors need to be considered first, and then the fixing method. Locking the thermal mass of the brick skin off from the outside world, and allowing it to regulate internal temperature, is the goal here. But locking it off is not easy, and the cavity acts as an insulator, depriving the interior of the big benefit of direct exposure that reverse brick veneer provides.

First, is there sufficient boundary clearance to add wall thickness without falling foul of either the local planning codes or the National Construction Code's fire separation rules?

Then, is the house slab-on-ground (SOG), or raised timber floor (RTF)? The difference here triggers two separate factors: condensation management and termite protection. Condensation risk will be minimised in RTF because the subfloor air is linked to roofspace by the wall cavity: as the roofspace heats up, and assuming the usual unsarked roof tiles, air leaves the roofspace via a zillion little gaps, replaced by cooler air drawn up through the wall cavity from the subfloor. This aids in drying the subfloor and the wall cavity, although it will slightly cool the building in winter unless the wall cavity is insulated – but my assumption is that it is uninsulated, and hence this whole line of enquiry. So it would be good to limit the draught but not stop it entirely, or better, to control it seasonally. This is a whole story in itself, so let's get back to the main plot here.

The material and system also needs consideration. The most common conventional system is to apply 40mm to 50mm of expanded polystyrene (EPS) foam with a skim coat of acrylic render on the surface, coloured and textured to taste. EPS is deservedly falling out of favour, and the better system suppliers have alternatives like polyurethane (PUR) or polyisocyanurate (PIR) foams. At the very least, extruded polystyrene (XPS) is better than EPS, which has production issues, site waste escape issues, and recyclability issues. As yet there are no organic materials that form part of a proprietary system, but they will surely come, with hemp being in the early stages of research now as one example.

The method of application is not critical as long as it stays on! Creating a secondary cavity behind the foam adds a wee bit of insulation, but it would not be needed as a condensation channel if the foam is doing its job of being a high-level insulator and waterproof. The level of insulation required will vary with climate zone, but you may as well go for R2 as a minimum if you're going to do it at all, and much higher R values are quite achievable.

But therein lies a leaky story – the edges. Every window and door reveal, and the top and bottom of the wall will leak heat in and out, and if there are lot of openings this might be a significant portion of the whole. The bottom of the wall is especially important because you probably cannot take this material down to ground, for warranty and termite reasons.

All of which leads me back to the point that it may be a lot more effective to just insulate the wall cavity with a spray-in foam like Icynene – you get better air tightness around openings, no leakage top and bottom, but potential condensation problems if there is no internal air exchange. Unless you are a very pro-active occupant, a heat recovery air exchange unit may be a very good investment.

However (and you have to love the exceptions to the exceptions to the rules!) if you insulate externally and resolve all of the detailing issues at openings and perimeter, and then remove the air cavity so that the brick is exposed to the interior, *then* it may be worth the hassle. How can this be done? By exposing the studs (as timber, or wrapped in timber or plasterboard etc) such that you have a series of recesses in the wall that go back to the brickwork. This is a very individual thing, and would need careful thought so it complemented the design concept of each space.

– Dick

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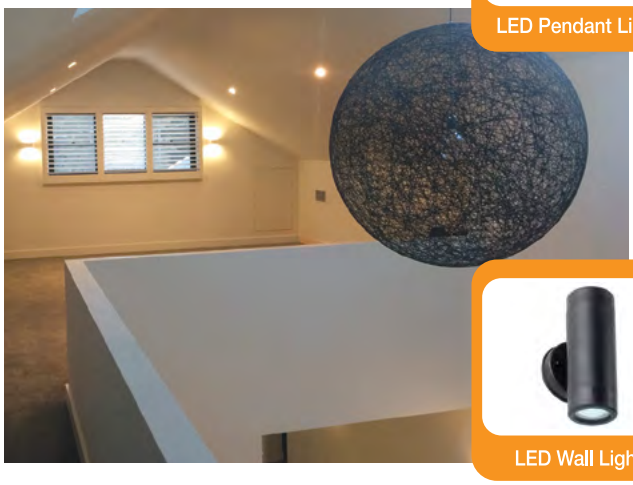


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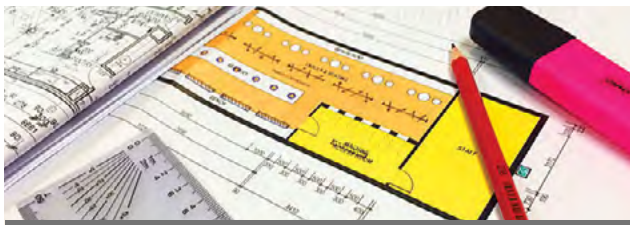

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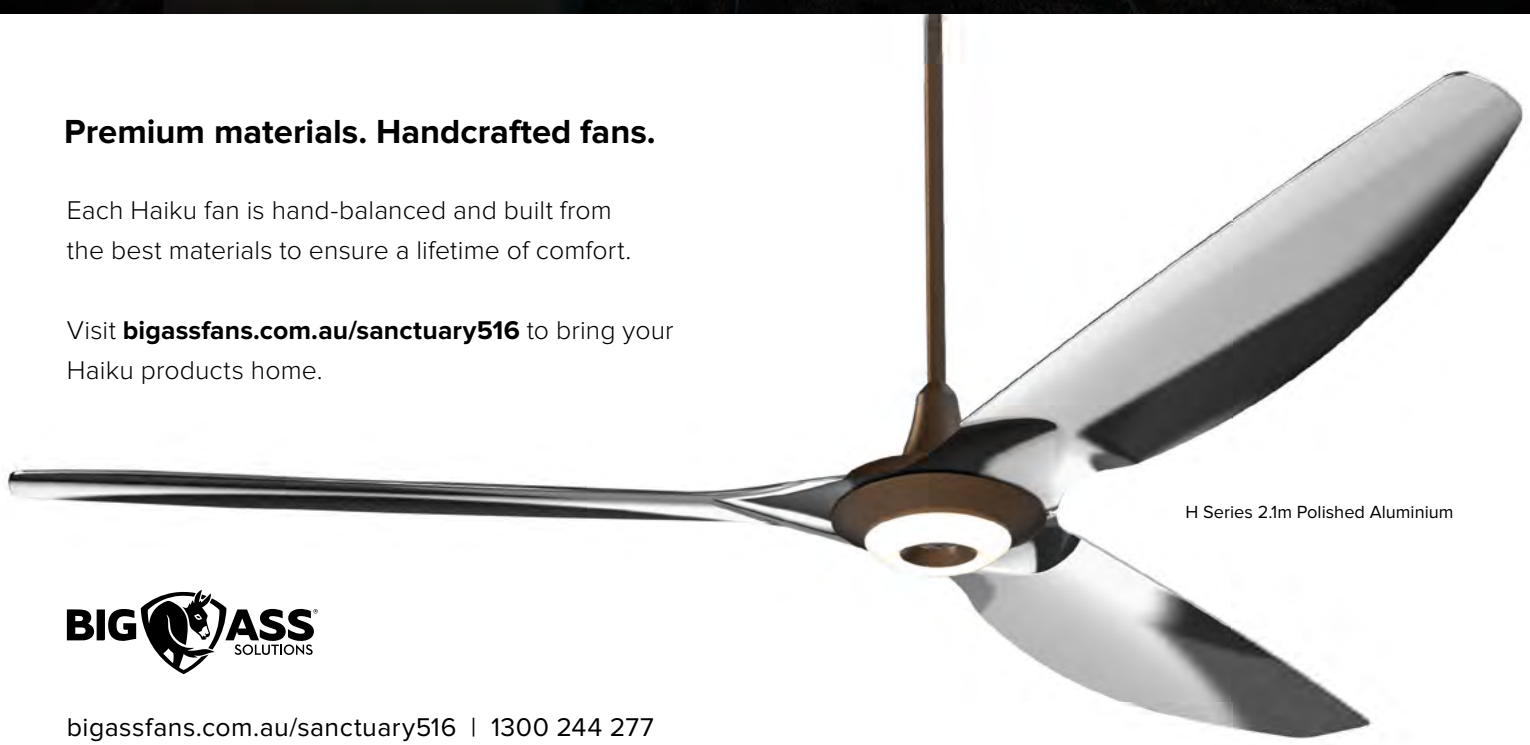

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