MODERN GREEN HOMES

Sanctuary

INSIDE ISSUE 38 20+ kitchen & bathroom designs; natural pools; all-electric solar homes; green roof guide; renovated Sydney semi; efficient appliances; design workshop Blue Mountains + more

SPECIAL

GREENER KITCHENS & BATHROOMS

WIN

A home battery storage system from Enphase

Offer open to Australian and New Zealand residents, details p87

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Cairns home adapted to the tropics

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Sanctuary

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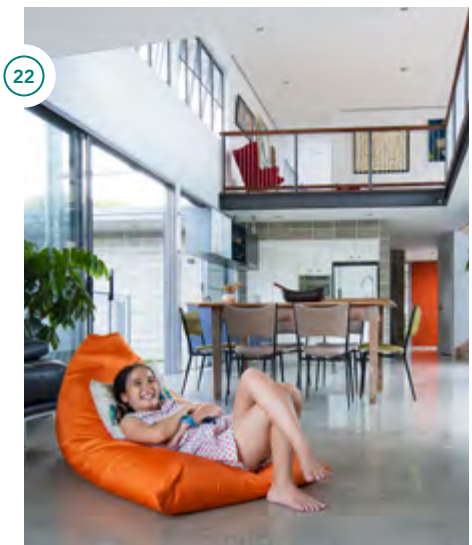

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ENPHASE.

Letter from the editor

—Issue 38

Kitchens and bathrooms are the most renovated parts of a home because they are among the most personal, reflecting something of our values and culture. They also need to be functional spaces, able to cater for the business of living, such as intense use and regular cleaning. In this *Sanctuary* we profile some of our favourite kitchens and bathrooms. Over 24 pages, we consider what it means to 'green' these spaces and explore different designs, new and recycled materials and practical cost-saving ideas (starts page 38). What the 20-plus projects in our special have in common is also what makes them so distinctive: they are thoughtfully customised and get the basics right when it comes to energy and water saving. We also bring you expert tips on efficient appliances (page 58) and show you ways to maintain surfaces without resorting to toxic chemicals (page 56). I'm sure you will find lots of ideas to inspire your own projects!

LIVING THE HIGH LIFE?

Apartment construction is outstripping single residential dwellings almost two to one in Australia's major cities, and the poor quality of many of these buildings is now daily news fodder. But we hear little about when urban density is done well, and even less about what apartment residents can do to improve the liveability of their buildings. In this issue's Design Matters, Anna Cumming shares stories of resident-led improvements, including energy action plans and living roofs (page 62). Two million people now live in multi-residential settings but consumer protections in this area are playing catch up, so we hope these case studies will encourage more owners and building managers to understand their rights and get active.

ALSO IN THIS ISSUE...

We visit four beautiful homes including the impressive passive solar extension on our cover which experiments with new materials (page 16), head outdoors to dip into the world of natural swimming pools (page 88) and help you get past first base when it comes to greening your roof (page 82). Design workshop returns this issue too, and architect Ian Sercombe provides design tweaks for a *Sanctuary* reader's strawbale house planned for the Blue Mountains. If you would like your project to be workshopped next, or have feedback or questions about anything else, please get in touch via email or social media.

Kulja Coulston

PS. Julian Bowker is the happy winner of our recent subscriber prize – a Daikin US7 super-efficient air conditioner. Subscriber prizes are open to subscribers and ATA members current at the time of the prize draw. Our new prize is an Enphase Home Energy Storage Solution; details page 87.

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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For all other States and Territories Ph Andrew on (02) 6734 6322 or go to www.runonsun.com.au

Products

01

WIFI WATERING SYSTEM

Home automation has entered the garden with a watering system that uses weather data to determine when to water. The Skydrop Controller connects to your home WiFi to predict upcoming showers, deluges or dry spells from real-time weather station data. The user splits the garden into zones and the Skydrop sets off each sprinkler when needed according to plant type, soil type, sprinkler type, shade and slope angle. Control it via the app on a smartphone or computer, or use the handheld screen to adjust the settings. Tell Skydrop about any water restrictions and it will automatically adjust watering days. The system will appeal to those with substantial gardens who want to cut their water use, or those who just want to water a bit smarter, with infrequent deep watering said to promote healthy root growth in plants. The Skydrop Controller is from Reece with an RRP of $438.90.

www.reece.com.au/irrigation/brands/skydrop

02

HOME VENTILATION VIA HEAT PUMP

A very well insulated home, or any home for that matter, can need help flushing out the stale air. The Duolix Max from Atlantic is a heat recovery ventilation system (HRV) that takes moisture-laden air from toilets, bathrooms and kitchens and replaces it with filtered fresh air ducted into bedrooms and living areas. In summer, it can subtly cool the home so that air conditioners get less of a workout. The main component is a very quiet heat exchanger that in winter swaps the heat from air drawn out to the fresh air coming in. In summer, the system can circulate the cool morning and evening air into living areas. This flow of air makes for a much healthier home. The Duolix Max costs up to $35 per m^2 for a fully installed system, less for parts only.

www.atlantics.com.au/home-ventillation-systems.html

03

MODULAR INDOOR GARDEN

There's no doubt that plants within a home, office or even an aged care facility can improve the health and wellbeing of those who live or work there. They clear the air of pollutants and even act as a bio-filter to capture VOCs. With this is mind, green living advocate and designer Joost Bakker has teamed with Schiavello to design an adaptable steel frame for plants. Vertical Garden is modular so that the greenery can be boosted when needed, and the flexible design gives the freedom to decorate shelves with potted plants, a herb garden, as well as books and other ornamental objects. The system is suited to the home, and can really benefit a school or healthcare setting where plants can have a therapeutic effect. Single 300mm columns can be purchased for $635 or $1300 for a 1164mm grid, and are available in heights of 1740mm, 2316mm or 2604mm.

www.schiavello.com/verticalgarden

04

EV CHARGE MANAGER FOR APARTMENTS

Electric vehicle charging is new territory in apartment blocks where there's a fine line between what's yours and what's communally owned. Residents might not want to subsidise a neighbour who charges their electric vehicle using common area power. Enter the E-Station Charge Star Manager, a sub-metering and access control system designed to work with charging stations in strata and body corporate properties. The charging station within the apartment block is connected to the Charge Star Network where all data about car charging sessions is captured and stored. This data is extracted from the network and emailed to the strata managers each month, who then bill the resident. The appeal for strata managers is that they have very little to organise other than billing, with E-Station managing user access cards and, of course, all the data. The management fee is $250 per station per year, and there is a one-off cost of $1990 for each networked charging station.

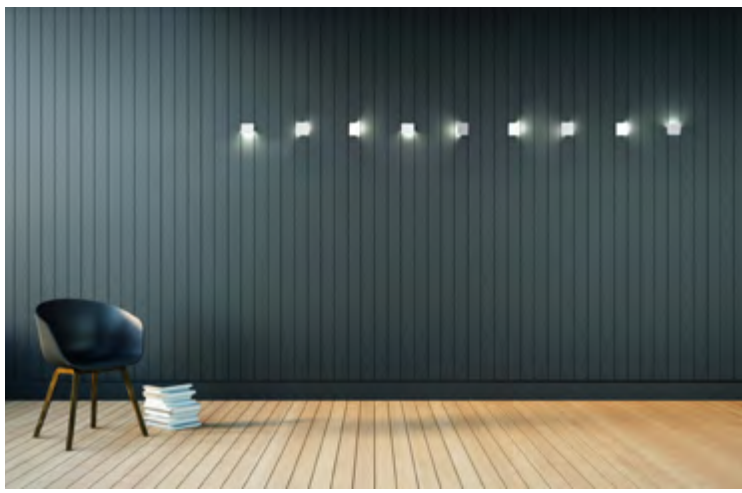
www.e-station.com.au/chargestarmanager

05

BRIGHT LIGHTS

Modern homes need adaptable systems, lights included. Brightgreen's new range of LED wall lights can be manipulated into various positions to illuminate different areas. The collection of four new designs features three universal adjustments that enable the fittings to move in and out and side to side so that light lovers can play with the effect and create new points of interest within the room. The hand-finished lights come in a choice of round or square or small or large and are cast from aluminium so can be recycled at the end of their life. The energy efficient LEDs range from 6W to 15W and 200 to 900 lumens depending on the fitting. Being wall-mounted also saves cutting a hole in the wall which can impact the home's thermal efficiency. The range includes the W200 SX Curve, the W900 SX Curve, the W200 SX Cube and the W900 SX Cube and prices start at $149.

www.brightgreen.com

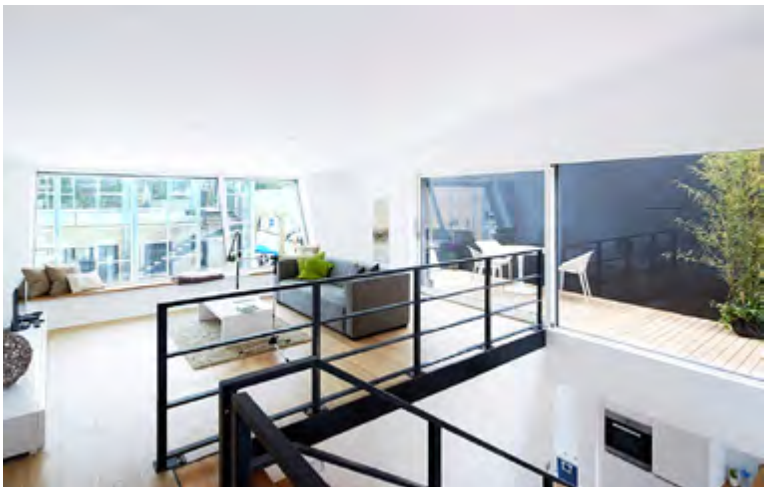


06

PAPEROCK PLY

We looked at Paperock in *Sanctuary 24*, a strong laminate material that works well as a kitchen benchtop. Now there's Paperock Ply, a lighter and cheaper option suited to kitchen cabinetry as well as furniture, signage and more. The Paperock component is the same as before, made from layer upon layer of recycled or sustainably-sourced paper which is then compressed, bonded with a resin and heat/pressure cured. The Ply option comprises a thin Paperock sheet laminated to both sides of exterior grade plywood made from FSC-certified, low formaldehyde Wisa Birch. Paperock should withstand most bumps and spills and last a while in the kitchen as it's impervious to water, and any marks can be sanded away. Paperock Ply costs between $149 and $289 per m^2 (ex GST), depending on the thickness of the plywood. Colours include black, brown, green and sand.

www.paperock.com.au



07

PHASE CHANGE PLASTERBOARD

Plasterboard doesn't usually rate as a material high in thermal mass. Add phase change materials (PCMs) to it though, and voila, plasterboard might be able to store and release heat much like a double-brick wall. Knauf Comfortboard is embedded with tiny polymer balls containing paraffin wax that melt and solidify depending on the temperature in the room. When the wax melts, it absorbs heat and stores it in the board, and when the temperature drops, the wax solidifies and releases that heat back into the room. Comfortboard is thin and light compared to other thermal mass so comes in handy if space is an issue, and can be used exactly like ordinary plasterboard, in the ceiling for instance, where most heat loss occurs. Comfortboard is made from industrial gypsum and recycled paper, with no VOCs emitted from the board or the PCMs. POA.

www.knaufplasterboard.com.au/comfortboard

08

COMPOST IN THE CITY

There are plenty of ways apartment dwellers can keep food waste out of landfill, even if they don't have a garden. One option is the Urban Composter City, the mini version of the original Urban Composter. The eight litre capacity bucket is designed with couples and small families in mind and fits tight spaces such as under the kitchen sink. The Urban Composter City uses anaerobic composting where the food scraps decompose slowly without oxygen. An accelerator spray containing fermented fruit extract helps the scraps break down faster. Simply cut the food into small pieces, spray and seal the lid. The system diverts food waste from landfill and can give plants valuable nutrients. Excess moisture can be drained every few days, diluted and fed to plants as a liquid fertiliser, and after six weeks the compost can be fed to yours or a friend's garden. Price is $49 or $65 with a starter kit.

www.urbancomposter.com.au/product/urban-composter-city

Reviews

—Books, websites, films 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

MICROSHELTERS: 59 CREATIVE CABINS, TINY HOUSES, TREE HOUSES, AND OTHER SMALL STRUCTURES

Derek Diedrickensen
Storey Publishing, 2015
$25

Surely *Microshelters* sets out to inspire the spread of tiny homes and structures around the world. The early chapters feature dozens of homes, tree houses and even playhouses across the United States, where the owners have shoehorned themselves and their limited belongings into cleverly designed tiny dwellings.

The practical how-to sections cover topics such as gathering tools, salvaging and budgeting, as well as six handy plans for small homes, cabins and even a wagon. The featured dwellings are a mix of DIY gems built from salvaged materials through to modern minimalist designs, with some of the best design fodder found in the Cabins section where dream homes live in majestic settings. Each structure features full-color photographs and insightful and fun commentary by the author. This is a great resource for the backyard builder, particularly those investigating granny flats or studios.

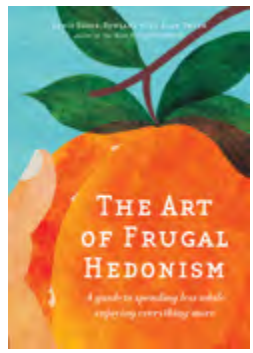
OPEN SOURCE ARCHITECTURE

Carlo Ratti with Matthew Claudel
Thames and Hudson, 2015
$23

These days anything can be open source, crowd-funded, or handed to the masses for online critique. It's an exciting time for architecture and also a challenging time for architects as they adapt to a more networked, collaborative and inclusive way inspired by 21st-century trends.

Open Source Architecture looks at the parameters around said architecture, as well as issues that pop up for architects, such as when collaboration turns to design by committee. It challenges the timeless way of designing, via the 'starchitect' approach, and asks if a paradigm shift to open source "could pump a collective vigor into architecture".

A key message is that the best ideas will rise to the top in an open source environment, which is great news for the sharing and realisation of environmentally sustainable design. This book is a fascinating read for architects or anyone interested in how new tools and approaches can shape and create the built environment.



THE ART OF FRUGAL HEDONISM: A GUIDE TO SPENDING LESS WHILE ENJOYING EVERYTHING MORE

Annie Raser-Rowland and Adam Grubb
Melliodora, October 2016
$25

This is a book to sit with for long periods and ponder, to dip into the ideas and then reflect on your own life and habits. *The Art of Frugal Hedonism* disects modern materialistic life down to the bare essentials for living and happiness. Follow the advice within and the obvious outcome is to save money. "Apply the lot, and you'll wake up one day and realise that you're happier, wealthier, fitter, and more in lust with life than you'd ever thought possible," say the authors.

The book looks at how simple household sustainability, such as avoiding waste or growing your own veg can be deeply satisfying and positive for a person's wellbeing. There's a lot more in this toolkit though, to help shift habits into action for living frugally, ethically and with more joy and freedom. The 50 or so topics include not thinking about money, indulging curiosity, working less and figuring out when you own enough.

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Lofty ideals

This modest extension showcases not only passive solar design but also well-researched eco-friendly materials, some of them still experimental.

WORDS Anna Cumming
PHOTOGRAPHY Hilary Bradford

WHEN AMANDA MARTIN AND MICHAEL Simon bought their inner-northern Melbourne home 13 years ago, it was with a low-impact lifestyle in mind: "It was a real compromise," says Amanda. "The blocks and houses around here are quite small, but we really wanted to live somewhere where we could easily ride bikes to shops, schools and parks." She describes the original 1929 house as a "depression Californian bungalow – smaller than usual and with no ornate plasterwork." Despite its cramped rooms and typical maze of services – kitchen, laundry, bathroom – tacked on at the back, the couple and their young daughter Georgie lived happily in the house for a decade before deciding to take on the renovation they had always planned.

Their brief to Sarah and Paul of Baker Drofenik Architects was to provide a light-filled new living space that would be comfortable with minimal active heating and cooling, to improve the connection with the family's beloved garden, and to create a breakaway space for their growing daughter. "It's a small site, and Amanda and Michael also wanted to fit a garage in, so there were space constraints," explains Sarah. "But the great thing about the block is that it's a 'peninsula': it's got streets on three sides, so it feels surrounded by trees and sky, not buildings."

Their design involved removing the small back rooms and building a new kitchen/dining/living room to the south, close to the western boundary to maximise back garden space. Clerestory windows to the north have eaves designed to block summer sun but admit winter sun deep into the room, where a concrete slab floor acts as thermal mass to help regulate the internal temperature. The windows are all double-glazed, and the large eastern windows are fitted with both external awnings to keep

Amanda and Michael's extension is clad in sustainably sourced white cypress shiplap board. Since this photo was taken, the east windows and glazed doors have been fitted with external awnings for shade and a pergola has been added over the deck. The lizard handle on the alternative entry door is from the Flying Anvil.

"We were originally planning reverse recycled-brick veneer for the southern wall for increased thermal mass, but in the end the budget didn't allow it," says Michael of the new living space. "As it turns out, because the room is really well sealed and insulated it performs really well."

The cement-free E-Crete concrete slab is one of the experimental products Amanda and Michael were keen to try. Softer than traditional concrete, it was given a gentle polish and sealed with a water-based finish, and so far is working well.

out morning sun in summer and thermally efficient internal honeycomb blinds for heat retention in winter. Although sliding glazed doors provide access to the deck and garden, the homeowners and their designers had the foresight to include a standard entry door off the deck too. “It’s to avoid having to raise or duck under the awning on the glass door to get in and out,” explains Michael. “And it’s sheltered from the north wind.”

Behind the extension is a small garage accessed from the street behind the property. In the retained part of the house, new timber double-glazed windows and heat pump powered hydronic heating panels were installed. An efficient wood heater in the tiny original lounge makes it a cosy second living room. Overhead, a large existing attic storage space has become a bedroom and getaway for Georgie. It was renovated and insulated and the fold-down access ladder was replaced with permanent stairs.

As self-described early adopters of sustainable technologies, Michael and Amanda already had water tanks connected to their toilet and washing machine, and a solar PV system oriented to the north, facing the street (for which they had to fight, as the house is covered by a council heritage overlay). They continued this philosophy with the renovation, taking on much of the materials research themselves. After detailed investigation, they settled on white cypress timber cladding as the most sustainable option for the extension. “It’s a species that doesn’t form nesting hollows,” says Michael. “Our timber came from New South Wales and Queensland, from areas that had been heavily cleared and regrown, and are now being selectively cleared to bring the forest back to a better state. It’s a by-product of active management of the forest.”

“Many of the products we chose are just emerging – we wanted to try them so we could talk about them, promote and encourage their use,” says Amanda. For the concrete slab they opted for E-Crete, a geopolymer concrete in which the cement component is replaced entirely with fly ash, a waste product of coal burning or steel production. This reduces the embodied energy of the concrete. “This product is still seen as experimental,” says Sarah, noting that Michael and Amanda's project was one of the first to use E-Crete for a polished slab. “But once industry catches up to the science, it will see a real reduction in greenhouse gas emissions.”

The E-Crete slab took longer to dry than standard concrete, and is a bit softer, meaning a super-polished Hiperfloor finish wasn’t an option. That didn’t worry Amanda and Michael, who prefer the matte effect of the light polish and water-based seal that the builder and floor polisher recommended. “We were warned about possible cracking with this material,” says Michael, “but it’s held up really well, even with the hydronic in-slab heating.”

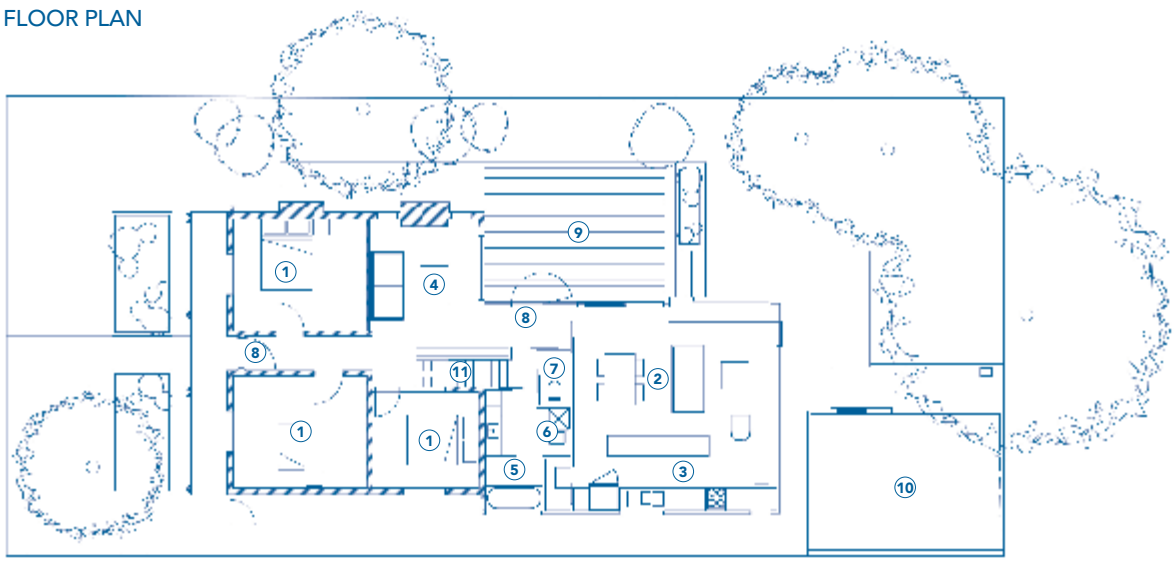
The couple’s preference for natural finishes is evident throughout their home, with soft colours, matte textures and plywood cabinetry (sustainably sourced Australian hoop pine ply, of course). The new living area is a lovely space to be in. “It’s particularly fantastic in winter, because you can sit at the south end and get a nice chunk of sun.” S

N

LEGEND

① Bedroom
② Living/dining
③ Kitchen
④ Lounge
⑤ Bathroom
⑥ Laundry
⑦ Toilet
⑧ Entry
⑨ Deck
⑩ Garage
⑪ Loft stair access (room not shown)

FLOOR PLAN



Brunswick House

—Specifications

Credits

DESIGNER
Baker Drofenik Architects Pty Ltd

BUILDER
Big Fish Constructions

PROJECT TYPE
Alteration and addition

PROJECT LOCATION
Brunswick, Victoria

COST
$370,000

SIZE
House 117 m²;
Attic 25 m²;
Land 377m²

BUILDING STAR RATING
6 Stars

Sustainable Features

HOT WATER
– Sanden CO2 Eco Heat Pump, 315L supplies hydronic heating and hot water.

RENEWABLE ENERGY
– 1kW system installed in 2008.

WATER SAVING
– Gater Pro Maxi100 Greywater diverter connected to laundry, shower and bath. Waste water transferred to a greywater pit and sewer in accordance with manufacturer's instructions and Australian Standards.
– 5000L rainwater tank and RainBank system provides water to toilets, washing machine and garden taps.

PASSIVE DESIGN / HEATING & COOLING
– Polished concrete slab for increased thermal mass
– The new south-facing room uses a bank of north-facing clerestory windows to obtain north light; the eave depth is designed to let in winter sun and shade the summer sun
– The clerestory windows are positioned to maximise solar access in winter for passive heating of the concrete slab
– Openable windows in the clerestory allow for hot air in summer to escape and assist cross ventilation
– Positioned ground floor windows for cross ventilation
– Ceiling fans increased air movement in summer
– After initial renovation, extra improvements include internal and external insulative and reflective blinds.

ACTIVE HEATING & COOLING
– In-slab hydronic heating to addition, hydronic panels to existing building, using Zenox stainless steel hot water/ hydronic circulation pumps and Sanden CO2 Eco Heat Pump
– Daikin 4.6kW air conditioner to attic
– Big Ass 'Haiku' ceiling fan
– Nectre Inbuilt LE wood heater installed in existing fireplace.

BUILDING MATERIALS
– E-Crete floor slab (cement-free, fly ash-based geopolymer slab)
– Kitchen and bathroom benches from Timber Revival; steel frame for kitchen cabinetry from The Flying Anvil
– Insulation: Kingspan Aircell blanket to roof and walls; Tontine R4.0 batts to ceilings; Bradford R2.7 batts to new external and internal wall cavities
– Cladding: Frenchams cypress rough sawn, vertical shiplap board
– Existing timber flooring was sanded and polished
– Joinery: plantation-sourced hoop pine plywood; recycled timber to island bench and bathroom vanity unit
– Decking: recycled spotted gum.

WINDOWS & GLAZING
– Double-glazed timber windows and doors from Elite Windows
– Casement and awning windows from Truth Hardware.

LIGHTING
– Existing LED lighting throughout, new lights from Big Ass fans.

PAINTS, FINISHES & FLOOR COVERINGS
– Livos Ardvos 266 Universal Wood Oil used on existing timber floors
– Quantam Aqua Oil to the external cladding
– Wattyl low-VOC, low-odour interior paints
– Wool carpet and underlay made from recycled material.

OTHER ESD FEATURES
– Vegetable garden and fruit trees, and extensive composting of food waste
– Secure bicycle parking.

The home's existing living room was rejuvenated with a new window onto the deck and garden and an efficient Nectre wood heater.

E-Crete™

E-Crete is a sustainable construction material alternative that utilises waste materials such as fly ash and slag from steel manufacturing as substitutes for traditional cement in concrete manufacturing.

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Tropical connection

Designed to provide ample shade, cooling breezes and a seamless connection to the outdoors, this Cairns home is perfectly adapted to the tropics.

WORDS Emma Scragg
PHOTOGRAPHY Nic Granleese

BEING OUTDOORS IN THE TROPICS IS A rich sensory experience replete with smells, sounds and the sensation of breezes moving across sweaty skin. And Stewart and Mahar knew they wanted their new home in Cairns to embrace this fully.

With work backgrounds in sociology and the environment, the design brief for their new home was clear: "A building that will work without air-conditioning; has a small enough footprint so it can be surrounded by garden on all sides; and will encourage household interaction," explains Stewart. They sought a design team who would embrace these ideas, and found common ground with Shaneen Fantin and Belinda Allwood of the emerging architecture practice POD.

Significant in choosing their building site was the age of their children (6 and 8 years). They wanted to be on a bus route, reach school without driving and be on the east side of the highway so the kids could get to the playground, beach and friends' houses on their own without crossing a busy road. "We felt something like this would allow them more independence earlier," says Stewart.

The result is a house that's skewed on the site to reduce heat gain from the east and west, as well as to enable views of the forest (a riparian corridor) and the mountains. It also gave more distance and privacy from neighbours and provided more usable garden spaces for food production and taller vegetation, which Stewart says is "important in reducing heat loads on the building".

Another part of the brief was that from the inside it would "feel like living on a verandah, not a house that has verandahs tacked on", recalls Shaneen. Not creating additional covered outdoor areas helped keep costs down, and was beneficial from the perspective of the building process and for ongoing maintenance. It also keeps the house open to views and daylight.

Downstairs is the hub of the family home with a cool, polished concrete floor, lofty ceilings and large screened openings on all sides. Along with the main living areas, a guestroom/study and accessible bathroom offer flexibility for guests and the family. The bedrooms are upstairs to keep the footprint small (just 30 per cent site cover) and to maximise the garden. While these areas have a less direct connection with the garden, they benefit from breezes and more elevated views. The children's rooms and the gallery space (which is used to exhibit Mahar's art collection) are separated from the main bedroom by a 'bridge' which, when the trees grow up, will give the sense of a canopy walk.

Stewart's appreciation of clean lines and raw finishes reflects a desire to minimise unnecessary material use (like tiles, render and paint); and where possible, they have chosen products readily available in the far north. Aesthetic interest is created by the rhythm of exposed framing and windows, weatherboards and blockwork. Architect Belinda Allwood is also a skilled cabinet and furniture maker, and the off-form concrete features are crafted and cast by her, using recycled pine pallets.

With lifelong experience of living in Far North Queensland, designers Belinda and Shaneen know firsthand what makes tropical buildings work. It was a no-brainer to use eaves to provide a shady hat and an

With large eaves and a stepped section to protect the lower level from the weather, this tropical home stays cool without air-conditioning. Materials that can be left with a raw finish, such as polycarbonate sheet and concrete blockwork, were chosen to minimise the use of paints and render.

A 'bridge' connects the upstairs bedrooms to the studio/gallery space, and allows for the large void that provides a sense of light and space to the living areas below; a reason why the house is dubbed the Big Small House.

By choosing to build a second level, 70% of the site was left for food production and indigenous planting. Windows are carefully positioned to capture cooling breezes, and when the house is opened up, it feels connected to the sky, treetops and surrounding mountains.

The kitchen features kauri pine benchtops and efficient appliances. Verandahs are intentionally missing to save on materials and space. Instead, the living and dining area is designed to act as a verandah, with large stackable doors opening to the garden.

insulated lightweight construction to avoid heat retention. They also incorporated a stepped section, well tested in the tropics, where the upper level is wider to give weather protection to the walls and windows below. The narrow footprint optimises airflow. “Casements were chosen as the predominant window type because they are not as expensive as louvres, but you can open them 100 per cent and control wind and rain direction,” said Shaneen. Screens to all openings, including the stacking sliding doors, provide secure and bug-free ventilation.

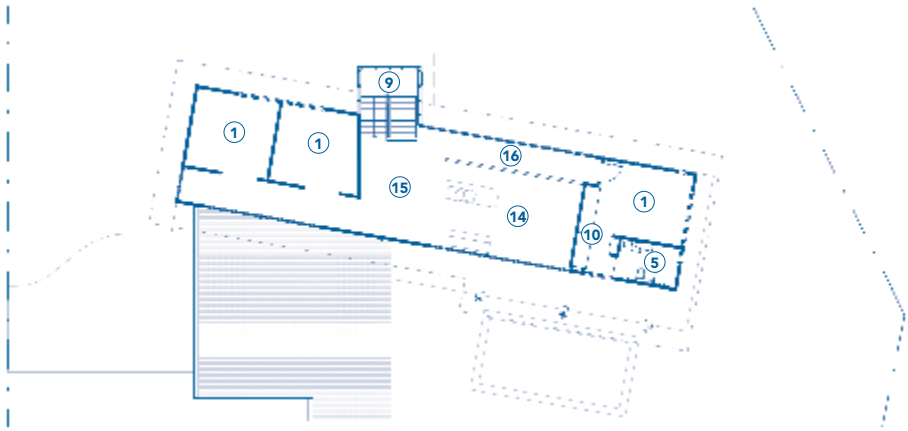
Once the family moved in, Stewart was able to plant vegetables in raised garden beds and endemic self-germinated trees and plants, along with some species from Shaneen’s nursery. With careful

Fondly referred to as 'the lantern', the stairwell is flooded with natural light through translucent polycarbonate sheeting. Plywood is used for the stairs and upper level, with a cool concrete slab used on the ground level.

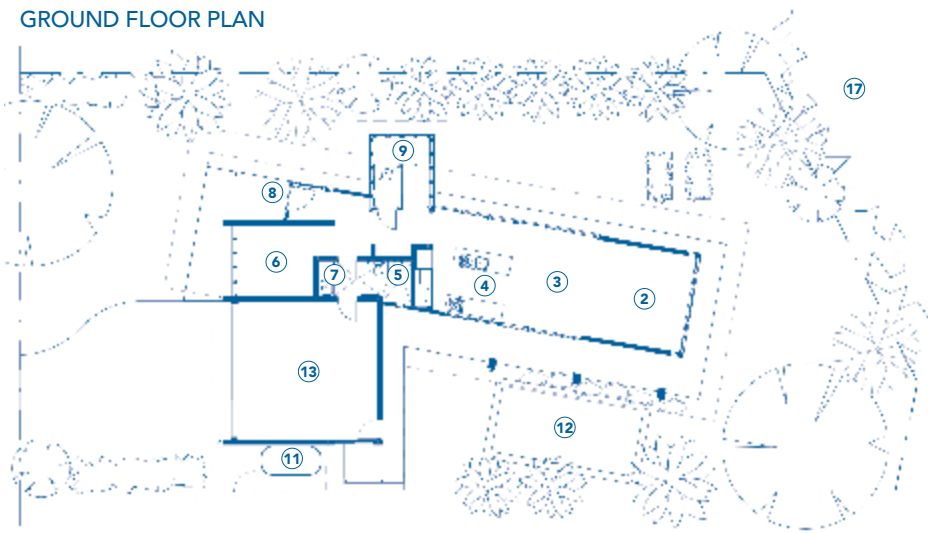
soil preparation, heavy mulching and appropriate plant selection, water use is minimised; a water conservation approach Stewart believes is more important than adding additional water storage.

Mahar and Stewart agree that their favourite aspect is the unobstructed connection of the garden to the house. “It is a joy to watch the garden throughout the day,” reflects Mahar. “I also appreciate the fact that when I’m inside the house, just a little tilt of my head takes me outside to the treetops and the mountains or up in the night sky. When the garden is mature enough, walking up and down the stairwell [the lantern] will be a treat ... to watch the play of daylight and shadows cast by the plants.” S

FIRST FLOOR PLAN



GROUND FLOOR PLAN



LEGEND

1. Bedroom
2. Living
3. Dining
4. Kitchen
5. Bathroom
6. Studio
7. Laundry
8. Entry
9. Stairs ('the lantern')
10. Store/Robe
11. Rainwater tank
12. Pool
13. Garage
14. Void
15. Gallery
16. Link ('bridge')
17. Riparian corridor

Big Small House

—Specifications

Credits

DESIGNER
POD (People Oriented Design)

BUILDER
Reilly Building Services

PROJECT TYPE
New build

PROJECT LOCATION
Palm Cove, Qld

COST
$600,000

SIZE
House 238 m²; Land 621 m²

BUILDING STAR RATING
6.5 Stars

Sustainable Features

HOT WATER
– Rheem heat pump 325L.

RENEWABLE ENERGY
– 2.4kW grid-connected solar system.

WATER SAVING
– 5000L Colorbond slimline rainwater tank, used for toilet flushing and garden irrigation
– Tapware 4-star WELS: including Teknobili Balance basin mixer, Posh Solus MkII 5F brass rail shower kit, Nobili Balance shower/bath mixer, Mizu Drift Gooseneck sink pullout.

PASSIVE DESIGN / HEATING & COOLING
– Orientation and siting maximise passive climatic performance, capturing breezes and providing shaded living and garden spaces throughout the day (also designed to capture views of the nearby mountains and the adjacent riparian corridor)
– The surrounding landscape becomes the outer filter and climate control for the house, providing additional privacy screening
– A central void and clerestory windows ventilate the spaces vertically, while the upstairs gallery and breezeway moves air throughout the length of the house
– Large areas of operable doors and windows maximise natural cross ventilation throughout the house.

ACTIVE HEATING & COOLING
– 1400mm diameter Airfusion Resort ceiling fans throughout, larger 2030mm fan in gallery space, from Beacon Lighting.

BUILDING MATERIALS
– Stack bond concrete blockwork
– Palram sunlite solar control twin wall polycarbonate sheet
– Polished concrete floor slab
– Timber and steel framed first storey structure
– Plantation radiata pine plywood sheet floor at upper level
– Hardies Old Style weatherboard cladding
– Off form concrete plinths, formwork made from recycled pallet pine
– Insulation 75mm Anticon blanket roof insulation
– All E0 MR MDF cabinetwork materials and locally sourced kauri pine benchtops in the kitchen.

WINDOWS & GLAZING
– Breezway Altair louvres
– Bradnams windows and doors: casements and awning hung windows to enable maximum ventilation and control weather; three-panel sliding stackable doors to ground floor.

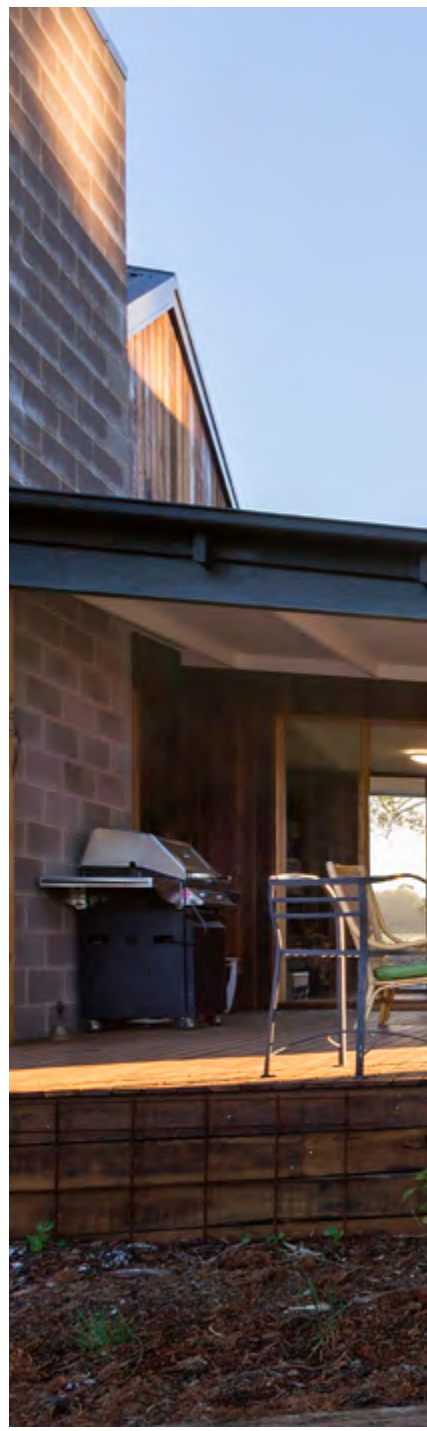
LIGHTING
– LED downlights and feature lighting.

PAINTS, FINISHES & FLOOR COVERINGS
– Low-VOC Dulux paint selection to walls and ceilings
– T&G plywood floor to upper level, Wattyl limewash with clear sealant
– Beaumont Tiles: Touchstone Nero DC-Porcelain used for floor and Sector Satin White rectified for walls.

OTHER ESD FEATURES
– More than 70% of the site is left for landscaping, food production and mineral water pool
– The landscape is predominantly native endemic and edible species, contributing to food security and acting as a continuation to the adjacent riparian corridor and vegetation conservation area
– Space saving decision to have no additional verandah, instead the living/dining space has been designed to feel, and act, like a verandah with large stackable sliding doors on both sides (4.2m wide), which also strengthens the connection with the garden
– Flexible/accessible design: fourth bedroom and study is accessible by visitors with a variety of ambulant needs and is on grade to the garage area. The hallway area outside the children's bedrooms is wide enough to be used as an additional play or study space, and the upstairs gallery area can also be used as an additional informal living space
– All-electric, energy-efficient kitchen appliances, including Scholtes 58L Pyro Oven 'S3 Range', Scholtes 60cm induction cooktop and Combi Oven, SMEG fully integrated dishdrawer, Delonghi front vent rangehood.

Tranquillity base

The owners of the Culvert House, on a rural block in country Victoria, didn't just want a sustainable and peaceful home for their retirement; they wanted to enjoy the journey.



WORDS Anna Cumming
PHOTOGRAPHY Chris Neylon

IAN AND PAM CORNTHWAITE ARE NOT new to house building, nor to sustainable homes: they designed and managed the build of a mud brick holiday house in Apollo Bay, and also spent five years living in the eco-friendly community development of Westwyck in Melbourne. So when it came to planning their retirement home, they had plenty of ideas. "We didn't just want a house; it was a project for us," says Pam. Ian agrees: "We had a lot of pretty strong opinions on what we wanted and didn't want. Mike Hill [co-founder of Westwyck] was an inspirational man, and living at Westwyck was a wonderful experience. We couldn't leave there and not try to build something as sustainable as possible."

Wanting to move out of the city but still be within easy reach to encourage visits from family and friends, the couple "drew a circle about an hour from Melbourne" and looked for a long time before finding the ideal block. They found it on the corner of a farmland subdivision just out of the small town of Trentham, 75km north-west of the city. With views to the north and west through mature gum trees and over the dam and paddocks of the remaining farm, it was possible to design a passive solar house that turns its back on the rest of the subdivision and feels remarkably 'off in the bush'. A disused railway line runs past the corner of the block, and a beautifully crafted old brick culvert was the inspiration for the house's name.

Ian and Pam found sustainable architects Maxa Design through *Sanctuary*. "We wanted to enjoy the journey, and part of that was working with like-minded, nice people," says Ian. "The team at Maxa were genuine, personable and enthusiastic, and we liked their work – we didn't even go to meet anyone else." Sven Maxa recalls that the couple had a very clear idea of the style they wanted: "They weren't prescriptive about anything aesthetic, but they knew how they wanted it to feel. We came out of the initial design meeting pretty much knowing exactly how the floor plan had to be, based on how the house needed to function and feel."

Maxa's design features two buildings with an entryway in between that Sven describes as "a hinge or a knuckle – a connecting joint between the two

A large grey ironbark deck tucked in the angle between pavilions provides a peaceful shady spot to lounge, without blocking winter sun to any of the living spaces. The house is clad with rough-sawn spotted gum, which will fade to grey as it weathers.

The house is orientated to look out through trees to farmland views to the north, ensuring privacy. "It was important that the house was elegant, rural, contextual," says designer Sven Maxa. "It had to fit with the site, look like it belonged."

Double-glazed sliding doors open from the living space onto a narrow deck to the north, and a western window looks across the main covered deck to views of established gum trees on the neighbouring farm. The room has a generous volume enhanced by the Victorian ash-lined cathedral ceiling. Found at a local second-hand dealer, the pendant lights were rescued from the renovation of the historic Port Melbourne courthouse and date from the 1920s. Ian and Pam had them rewired and fitted with LED globes.

The benchtops are Paperock, an Australian product made from layers of recycled paper bonded with phenolic resin and compressed. Ian and Pam chose it for its sustainability credentials, and are delighted with the look and feel. "It's so much warmer than stone. It doesn't mark easily, it's heat resistant and after 18 months the benchtops still look great and are easy to clean."

pavilions". The pavilions are offset to allow for views to the west from the living area and a generous covered deck tucked into the angle, where it doesn't block winter sun to any north windows.

The main part of the house contains the master bedroom with ensuite, a small second bedroom currently designated as the grandchildren's room, a study spot in the wide passage, and a generous open plan living room, dining and kitchen with timber-lined cathedral ceilings. It's long and narrow on an east-west axis, with plenty of northern glazing providing solar gain to all rooms in winter. The eave is appropriately designed to block the sun in summer when it's not wanted. Windows to the south were kept small for privacy, but are carefully located for cross ventilation. "Trentham's climate is particularly problematic for achieving a high star rating," explains Sven. "It can get very hot and dry in summer, and also gets very cold – it even snows. Especially when the budget is a bit tight, it's really important to honour basic passive design principles to get a good result."

Across the entryway is the studio – used variously for sewing and accommodating guests. Adjoining is a laundry and second bathroom. The layout makes it easy to close off parts of the house to reduce heating and cooling needs. "We would have liked in-slab hydronic heating, but it was cost-prohibitive," says Ian. "Instead we went with efficient Daikin split systems in the living room, main bedroom and studio, but we hardly need them. We find that the lower ceilings in the bedrooms and the sun coming in the windows works well for heating." They also have a wood heater in the living room.

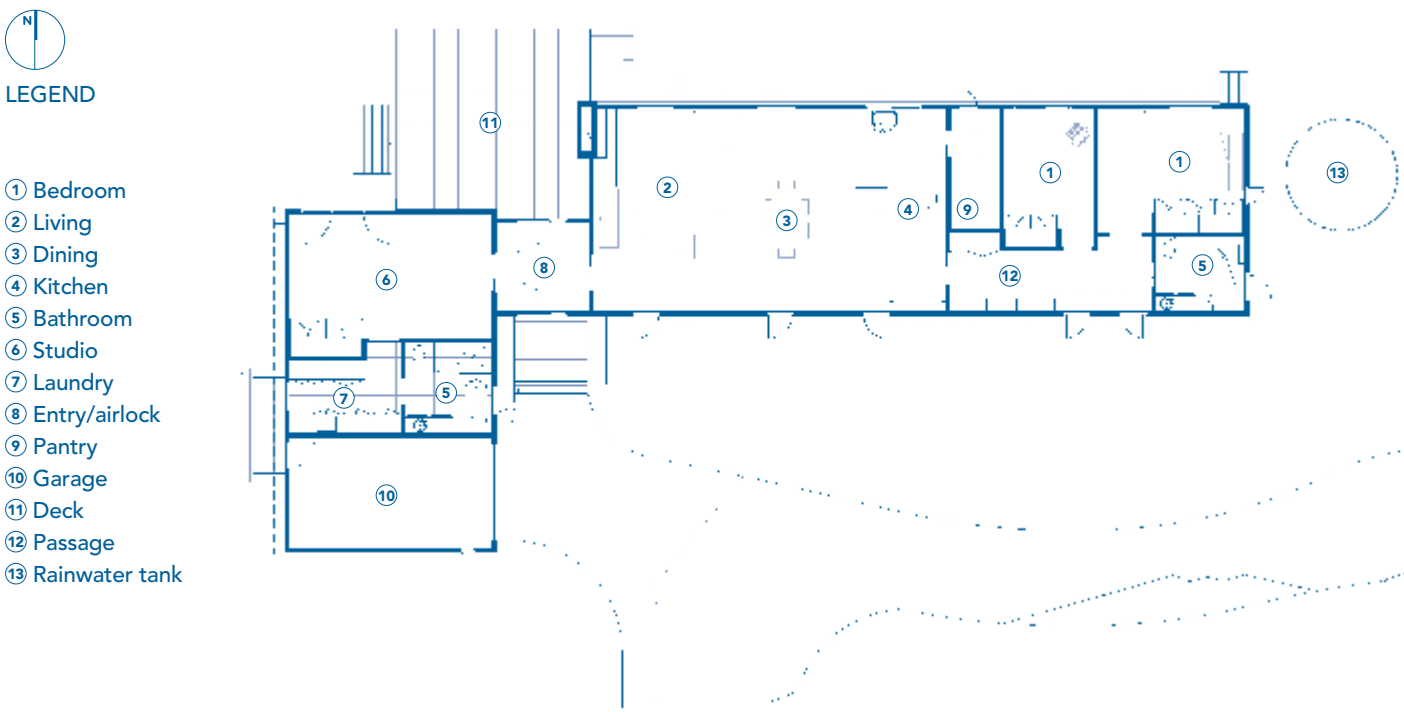
The house has a polished concrete floor throughout, and the walls are well-insulated timber frame with rough-sawn spotted gum shiplap cladding. "It will weather and fade to grey over time, and shouldn't need maintenance," says Ian. Other surfaces and colours have been carefully considered to be matte and muted, which when combined with the quiet setting, give the house a certain tranquillity. "At this stage of our lives, we're enjoying stillness and not having to be too busy," says Pam.

It's refreshing to hear how much Ian and Pam did enjoy the journey of creating the Culvert House. "As well as the great team at Maxa, we were lucky to have an excellent builder who, while not necessarily 'eco' as such, was very happy to do things the way we wanted them," says Pam. "Nothing at all went wrong with the build process."

"We had trusting relationships with the farmer whose land we bought, with our designers, and with our builder," adds Ian. "I don't think we'll build again, because we'd be lucky to have such a satisfying experience a second time!"

In its category, the Culvert House won Best Residential Design and a commendation for Best Environmentally Sustainable Design: Residential at the Building Designers Association of Victoria (BDAV) 2016 Awards, and also took out the award for Best Residential Design at the National Association of Building Designers (NABD) 2016 Awards.

FLOOR PLAN



Culvert House

—Specifications

Credits

DESIGNER
Maxa Design

BUILDER
Massina Building

PROJECT TYPE
New build

PROJECT LOCATION
Trentham, Victoria

COST
$500,000

SIZE
House 197 m²;
Land 9022 m²

BUILDING STAR RATING
6.3 Stars

Sustainable Features

HOT WATER
– Thermann evacuated tube solar hot water system with electric boost, 315L storage tank.

RENEWABLE ENERGY
– 3kW grid-connected photovoltaic array from EnviroShop; 12 Yingli solar panels; 12 Enphase Energy microinverters (average daily energy production 10.8kWh).

WATER SAVING
– 22,500L Tankworld steel tank and Davey RainBank with surface pump to supply house with all water needs. House is connected to mains town water (mandatory) and will automatically switch if necessary. NB: ATA's Tankulator (tankulator.ata.org.au) calculations predicted that a 10,000L tank would be suitable for complete self-sufficiency, but owners have oversized to account for dry periods
– WELS 4-star Swedia Klara stainless steel mixer taps for bathroom basins, laundry and kitchen
– Caroma Titan stainless steel range rated WELS 5- and 6-star used for bath and shower, supplied by Reece
– WELS 4-star Porcher toilet.

PASSIVE DESIGN / HEATING & COOLING
– House uses passive solar design principles, with a narrow north-south footprint to aid winter solar penetration and cross ventilation for this region; the long east-west footprint ensures all rooms benefit from this
– A covered deck is positioned to ensure the living areas are not shaded during winter
– Entry airlock minimises any heat losses and separates the studio from the main dwelling to minimise any heating/cooling requirements
– Northern eaves exclude summer sun but allow maximum north facing winter sun to enter home.

ACTIVE HEATING & COOLING
– 3 x Daikin Zena and L-Series split systems in the main bedroom, studio and living room, with a COP of 3.6 to 4.5
– Quadra Voyageur Grand Insert wood heater: 63% efficient, 2.0g/kg emissions, maximum average heat output burning hardwood 9.3kW
– Airfusion 142cm stainless steel ceiling fan used in conjunction with split system 'fan mode'.

BUILDING MATERIALS
– External cladding is rough-sawn spotted gum shiplap profile; decking is grey ironbark decking; internal ceiling lining is Victorian ash, from Kennedy's sustainable timber supply
– Insulation: Fletcher pink batts used for external and internal walls R2.5 and flat ceilings R6.0. Raked ceilings use 2 layers of R2.0 high performance Bradford gold ceiling batts and Anticon 55 foil backed blanket R1.3
– Polished concrete floors throughout (with exception of the tiled bathrooms).

WINDOWS & GLAZING
– Double-glazed FSC-certified hardwood window and sliding door frames with low-E glass supplied by Valley Windows, supplied with matching hardwood-framed aluminium mesh fly screens. BAL 19 compliant, U-value average 2.6, SHGC average 0.64.

LIGHTING
– Living room and studio pendant lights recycled from the former Port Melbourne courthouse (circa 1920), fitted with LED globes
– All other light fittings (internal & external) are LED in various fixtures supplied by Beacon Lighting.

PAINTS, FINISHES & FLOOR COVERINGS
– Cladding and decking finish: Quantum Quantec exterior wood preservative
– Haymes low-VOC paints used throughout the interior
– Victorian ash ceiling lining stained with Quantum Timbre Plus (in walnut).

KITCHEN AND BATHROOM
– High performance appliances including Miele induction cooktop and Schweigan rangehood (with externally mounted exhaust fan) from Evolve Appliances
– Paperock benchtops throughout
– Bamboo hand basins in all bathrooms
– Vented refrigerator cavity to maximise fridge efficiency (estimated 20% improvement).

OTHER ESD FEATURES
– Designed for an off-grid future, much consideration was given to the energy and thermal performance of this home, with the combination of wood heating and efficient electric appliances.

Recycled house

A Sydney semi is renovated using a palette of sustainably sourced materials and bricks and timber salvaged from the original house.

WORDS Rachael Bernstone
PHOTOGRAPHY Simon Whitbread

WHEN PAUL SHERIDAN AND PARTNER Kate chose to expand their semi-detached house in Sydney's inner west, their number one priority was to make the process and the outcome as sustainable as possible. They worked with architect Nick Bell – a long time friend and designer of their previous renovation, a new kitchen and adjacent outdoor deck – to determine the best way to achieve those goals.

"These clients are very 'green'," Nick Bell says. "Both of them are heavily involved in environmental issues in their jobs, so those concerns were a key part of the brief. Initially, it was not so much about energy or water conservation, but we started from first principles of trying to minimise the amount of materials we took off the site, not just to save money but to avoid throwing stuff in the bin."

From the outset, the team agreed to collect and reuse as much of the original building fabric as possible – bricks, sandstone and timber – as they prepared to knock down the rear room that blocked access to the backyard. The decision to leave the recently installed galley kitchen in situ and arrange the new rooms around it was another tick on the couple's mantra of 'reduce, reuse, recycle', although doing so added to the complexity of the process, as did an unanticipated move interstate.

"The back of the house was always problematic – it was pokey and dark," Paul explains. "Also, the site was long and narrow with a two-metre wide pathway on one side that wasn't being utilised. The second bedroom was just over two metres wide and it hadn't been touched since the 1880s when the house was built.

"We saw this renovation as a good way to address those issues, and a good opportunity to capitalise on increasing property values, but just as we signed the contract, Kate got a new job and we moved to Melbourne."

Undaunted, the couple pushed onwards with their plans which involved converting the former second bedroom into a flexible living space – a study or library, which opens to the newly landscaped back garden – and the addition of a new bedroom and ensuite above.

In a rather unconventional design move, this bedroom is accessed via a second staircase, so that the house now resembles a pair of two-storey pavilions arranged around a central social hub. Nick says that while the two-staircase plan doesn't necessarily suit traditional family setups, it's perfect for these owners, and, as it turns out, their tenants.

"Our tenants referred to the unusual plan as being like a pair of self-contained units that share a kitchen," Paul adds, "and we are looking forward to returning home to Sydney in the future, and welcoming friends and family to stay."

Rather than looking new and out of place, the rear pavilion blends in well thanks to its armour of recycled materials – bricks that the owners and extended family cleaned by hand one weekend, and timber that was repurposed for cladding. The upper bedroom is framed with shutters, windows and fixed walls that maintain privacy while offering views, cross ventilation and access to winter sun.

During the renovation, the owners also replaced the 70-year-old tiled roof with a new corrugated steel version, and installed insulation in all of the walls, roof and sub-floor, where previously there had been none. Going back to basics means the indoor temperature is stable and comfortable for most of the year, Paul says.

In another slightly unusual move, given Sydney's sub-tropical climate, there is no mechanical heating or ventilation at all, apart from ceiling fans that work in concert

Salvaged bricks and floorboards from the original house are embraced as features in the addition. The bricks were hand-cleaned and used for the living room floor; the mixed-species floorboards contrast beautifully with the custom windows and shutters. Functional outdoor storage allows the footprint to remain small, and porous landscaping retains stormwater onsite.

The shutters on these east-facing windows prevent summer overheating of the bedroom, but are easily opened from the inside to allow in winter sunlight.

Simple but effective, this pivoting window is used to create a new space. It also channels cooling breezes from the south west and allows natural light into the stairwell.

The galley kitchen opens up to the split-level addition with a striking curved ceiling, a feature the owners appreciate: "I love the curve ... the way it catches your eye and draws you toward the back of the house."

with a large remote-controlled skylight over the double-height central void. The skylight acts as a vertical heat chimney in summer, promoting good airflow from the older section at the front to the new addition at the rear.

Getting all of these strategies to work together on a tight inner urban site posed numerous design challenges, but by far the most problematic was the need to store recycled building materials, and have new materials delivered. The site doesn't offer rear lane access, and the builders also needed sufficient space to work outside. As a result, sequencing and project management required more careful oversight than a regular build, so Nick spent additional time on site, and the builder adopted the 'just-in-time' delivery method from the automotive manufacturing industry.

Having run some figures to determine whether the recycling of materials impacted on the bottom line, Nick concluded that the process of collecting, cleaning, storing and reusing materials was cost-neutral, but he says it was worth the effort for two reasons: firstly it limited the amount of waste that was sent to landfill, and secondly, the materials impart a sense of character to the new addition.

"I love the way the old timber floor boards came up in the cladding," Nick says. "The natural colour variations that we achieved were carefully composed: you could never create the same effect if you weren't using recycled materials. It would look contrived and terrible."

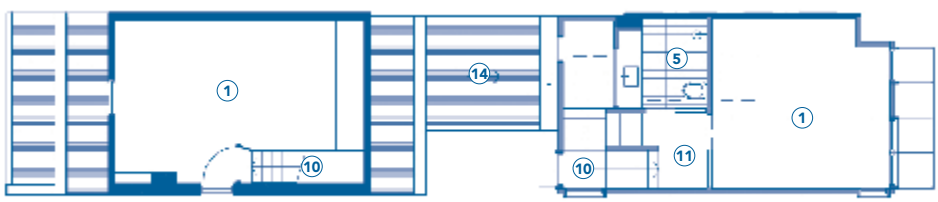
For Paul, who spent a few weeks living in the house at the end of the project before joining his wife in their new home, the renovation is full of unexpected delights. "We thought the house had a lot of natural light before, but it's even better now. But mostly I've been surprised by how much more space we have," he says. "The house feels longer and has hidden dimensions to it that I just didn't expect."

In short, this project surpassed the couple's expectations of what they might be able to achieve in a renovation: the house is now spacious without being ostentatious; it offers year-round comfort but uses very little energy; and their efforts to reuse materials paid off handsomely, to reduce construction waste and the need for new building products.

LEGEND

① Bedroom
② Living
③ Dining
④ Kitchen
⑤ Bathroom
⑥ Lounge
⑦ Laundry
⑧ Deck
⑨ Terrace
⑩ Stairs
⑪ Hall
⑫ Entry
⑬ Pivot window
⑭ Roof

FIRST FLOOR PLAN



GROUND FLOOR PLAN

Recycled House

—Specifications

Credits

DESIGNER
Nick Bell D&A

BUILDER
Direct Building Solutions

PROJECT TYPE
Rear addition

PROJECT LOCATION
Petersham, NSW

COST
$410,000

SIZE
House 105 m²; Land 150 m²

Natural light is brought into the first floor bathroom using skylights and an opaque window, which draws daylight from the hallway.

Sustainable Features

HOT WATER
– Reused existing gas instantaneous system.

RENEWABLE ENERGY
– 2.34kW photovoltaic solar array, including 9 x 260W Winaico panels, SMA SB2.5 V40 inverter, from Australia Wide Solar.

WATER SAVING
– Indigenous low-water use plants used in landscape design, by Craig Steen at Tranquillity
– 58 per cent of the rear garden built with porous surfaces to allow for planting and stormwater penetration
– Bathroom mixers are Caroma Liano Nexus WELS 6-star rating; shower Caroma Liano Nexus WELS 3-star rating.

PASSIVE DESIGN / HEATING & COOLING
– Natural light and cross ventilation is maximised by three Velux skylights located over the stairwell void, and in the bathroom and bedroom, electrically operated with rain sensors
– Cooling via cross ventilation through a centrally located stairwell and fan to master bedroom
– Reduced window sizes and external louvred shutters in the master bedroom are designed to provide privacy and shading to avoid overheating in summer. A canopy over the ground floor rear windows also provides shade
– The height of the addition was reduced to allow more natural light into the centre of the dwelling.

ACTIVE HEATING & COOLING
– Galaxy II ceiling fan in bedroom.

BUILDING MATERIALS
– Cladding: timber flooring salvaged from the original building has been reused as external cladding, and low-maintenance Scyon Stria cladding, a low-density mix made from local sand, Portland cement and cellulose
– 100 per cent wool Prestige carpet to bedroom, natural colour with no chemical dyes
– The floor in the addition is made from bricks salvaged from the original building cleaned by hand by the owner
– Insulation: CSR Bradford Acoustic Soundscreen R2.5 in walls, first floor ceiling R3 Bradford Gold Batts, ground floor ceiling R3.5 Bradford Gold Batts
– Roof: Colorbond custom orb
– Painted pine shutters fabricated by Evolution window system
– Recycled grey ironbark benchtops by Ample Interiors.

WINDOWS & GLAZING
– Timber-framed (and some aluminium-framed) sashless Aneeta Windows: FSC-certified, low-e glazing and draught proofing mechanism
– Three Velux electric skylights, with electric blockout functions.

LIGHTING
– LED lights from LPA and Inlite.

PAINTS, FINISHES & FLOOR COVERINGS
– Clear matte low-VOC sealer used on brick floors.

OTHER ESD FEATURES
– Existing landscaping elements such as timber sleepers were reused within the new landscaping and converted into new external furniture.

Greener kitchens & bathrooms

In this *Sanctuary* special, we feature over 20 inspiring kitchens and bathrooms that use beautiful, sustainable materials and showcase new ways to conserve energy and water.

Shades of green

DESIGN:
David Saunders,
S2 design

PROJECT TYPE:
Renovation

LOCATION:
St Kilda, Victoria

PHOTOGRAPHER:
Melanie Faith Dove

THE WATER, ENERGY, MATERIALS AND LANDSCAPING concepts used in this extensive restoration and addition to a heritage dwelling in St Kilda demonstrate a new approach to sustainable inner city living. Many common architectural elements are intentionally missing, including secondary finishes (such as paint) which have been minimised or eliminated completely by leaving durable construction materials in their natural 'as built' state. You won't find white porcelain, plasterboard or chrome either; instead, toilets, basins and tapware are stainless steel.

Home to sustainable architect David Saunders and his family, the house is thermally efficient and all materials are either salvaged from the original house, recycled, plantation-grown, zero-VOC or naturally occurring. Their home is largely self-reliant with 43,400 litres of rainwater stored in 4 tanks, and energy use is minimal due to the incorporation of solar PV, energy efficient appliances and lighting and sensible lifestyle practices. They also grow fruit and vegetables in the courtyards and 'roof farm'. Very little waste leaves the site due to careful recycling and extensive composting; grey water is diverted for reuse on gardens.

Images: (top left) Kitchen joinery is green-stained plantation plywood; (bottom left) the bathroom walls feature locally produced recycled plastic, a green wall planter and old-school cast iron bath; (top) David Saunders enjoys a cuppa in his naturally lit kitchen. Glazing is a combination of custom-fabricated, steel-framed double-glazed doors and windows and double-glazed, double-hung, sashless windows from Dayview Windows.

SUSTAINABLE FEATURES

APPLIANCES
- KWC Eve kitchen tap; Zip Sparkling Hydrotap
- Miele and Qasair kitchen appliances
- Liebherr refrigerator and freezer
- Stainless steel toilets from Britex, cisterns from GWA Bathrooms & Kitchens
- Linkware 'Elle' stainless steel bathroom fittings and fixtures
- Fantech bathroom / air-transfer fans.

MATERIALS
- Internal walls, ceilings and joinery are plantation plywood with Intergrain clear satin finish or recycled lining boards
- Benchtops stainless steel, granite and repurposed marble
- Shower walls, splashbacks and some external wall cladding made from locally produced Replas recycled plastic
- Elmich Versiwall 'green wall' planters
- Vintage, fully restored cast iron bath.

LIGHTING
- LED and compact fluorescent lamps
- Velux skylights plus windows, glass walls and glass floors allow natural light to flood the entire house. Additional daylighting via internal garden and courtyards.

OTHER FEATURES
- No air-conditioning required, natural cooling systems include cool humidified air naturally drawn up through the house via two internal 'rainforests' and air transfer system which draws cool air to the top level from the basement
- Solar PV and Apricus solar hot water system.

Warm & elegant

THIS KITCHEN WAS DESIGNED AND BUILT AS part of a house renovation which placed emphasis on energy efficiency and sustainability. The kitchen needed to be a healthy, practical work area for cooking with an aesthetic of homeliness.

The space speaks warmth and subtle elegance: the three sides of the kitchen revolve around the island bench, creating ease of workflow and space for more than one person at a time. The birch plywood doors and drawer fronts have a light coating of white-tinted Osmo Polyx oil to lighten the tone while allowing the plywood's grain to show through. The handles are simple cut-outs, creating ease of use and smooth lines.

DESIGN:
Select Custom Joinery in collaboration with Adhami Pender Architecture

PROJECT TYPE:
Kitchen renovation

LOCATION:
O'Connor, ACT

SUSTAINABLE FEATURES

APPLIANCES
- Miele products including: ovens, induction cooktop and dishwasher
- Liebherr fridge and freezer.

MATERIALS
- Island benchtop of recycled jarrah, retrieved from the old deck prior to the renovations
- Other benchtops of white Kashmir granite
- Cabinets/carcasses and shelving of sustainably sourced, durable birch plywood
- Timber doors of recycled jarrah with glass, other kitchen doors of birch plywood with cut-out handles
- Glass splashback.

PAINTS AND FINISHES
- Cabinetry finish is a tinted white Osmo Polyx oil and natural Osmo Polyx oil
- Marmoleum flooring made from linseed oil, pine rosins and wood flour.

LIGHTING
- LED downlights on either side of the rangehood as well as LEDs above the island bench
- Natural lighting from the side window as well as from the rest of the open-plan room.

OTHER FEATURES
- In-bench stainless steel compost bin situated in the granite bench with the sink near the window.

Pocket-sized house

THE KITCHEN IN THIS COMPACT THREE-level, 100-square-metre house takes flexible design to a new height. The steel-framed island bench has a retractable dining table; the fridge and freezer are tucked neatly under the bench; and, instead of the visual clutter of a rangehood, a Gaggenau downdraft extraction system is used to circulate air. Careful placement of double-glazed windows and plants, together with solar power and a mixed palette of materials, makes for an impressive renovation to this former shopfront. [See the full profile of this project in *Sanctuary* 30.]

DESIGN/BUILD:
Chris Clinton, Core Collective Architects

LOCATION:
Hobart, Tasmania

PHOTOGRAPHER:
Jasmin Latona

Chris fabricated the mould and cast the ensuite basin himself for the cost of a bag of concrete mix, sink waste outlet and mixer. The timber is recycled myrtle.

SUSTAINABLE FEATURES

APPLIANCES
- Fisher & Paykel DishDrawer 4.5-star WELS rated / 3.5-star energy rating
- Dorf Venus kitchen mixer – 5-star WELS
- Ariston electric oven
- Ariston gas cooktop
- Westinghouse 100l under-bench refrigerator (bar fridge)
- LG Express upright under-bench freezer
- Gaggenau downdraft extraction (recycled and customised)
- Power outlet in benchtop – Hafele power dock pop-up outlet.

MATERIALS
- Custom black mild steel folded benchtop
- Hafele heavy-duty drawer runners for slide out dining bench 212KTS
- Custom steel-framed island bench
- Recycled Tasmanian myrtle face.

PAINTS AND FINISHES
- Dulux Enviro 2 paints
- Livos Kunos floor finish over Tasmanian oak flooring and recycled myrtle joinery.

Straight from the garden

INTERIOR DESIGN:
Megan Norgate of Brave New Eco

PROJECT TYPE:
Renovated kitchen

LOCATION:
Northcote, Victoria

PHOTOGRAPHY:
Emma Byrnes

A HARD-WORKING KITCHEN IN A HOME WITH a permaculture garden in inner-urban Melbourne has been transformed for greater purpose and usability.

High-quality efficient appliances, no hard-to-clean surfaces or fiddly deep cupboards and everything the owners need within reach are the features of this kitchen renovation, in the same tiny, five-square-metre space as the original.

Designer Megan Norgate wanted to avoid a cold and minimalist outcome in an essentially cosy home, and instead merged functionality with an organic, homemade charm. One side of the kitchen became the utility bench with all the appliances. An induction cooktop, built-in oven, efficient 450mm-wide dishwasher and a tiny sink were included under a stainless benchtop making a junction between wet and hot areas. Stainless steel is also less likely to be damaged and easy to clean.

Terrazzo floor tiles give the splashback a natural feel and minimal grout reduces the amount of cleaning needed. A reclaimed blackbutt drying/shelving plate rack was made and thoughtfully designed for plates and cups to drip over the sink area; cut-outs from repurposed plastic bread crates were used to line the shelves.

A distinctive salvaged red box eucalypt branch acts as a vertical element for a floating shelf over the island bench, marrying the utilitarian with the organic. The walls were painted in Murobond paints and energy-efficient LED strip lighting is recessed under the open shelving.

SUSTAINABLE FEATURES

APPLIANCES
- Efficient 45cm Bosch dishwasher for small spaces
- Induction cooktop – no gas used in the kitchen.

MATERIALS
- Hand-made recycled blackbutt shelving/dish rack
- Post industrial waste terrazzo tiled splashback from Fibonacci Stone
- E0-rated laminate joinery
- Salvaged red box branch for structural support, air-dried and hand-whittled
- 100% recyclable stainless steel benchtop
- Dish rack drainage from recycled bread crates.

PAINTS, FINISHES AND FLOOR COVERINGS
- Tung oil timber sealants
- Walls in Murobond paints.

LIGHTING
- LED strip lighting.

OTHER FEATURES
- Tiny 5m^2 footprint
- Use of vertical space to support productive kitchen
- Wall-mounted dish drying/storage rack so drying dishes don't take up bench space.

Clever, cool food storage

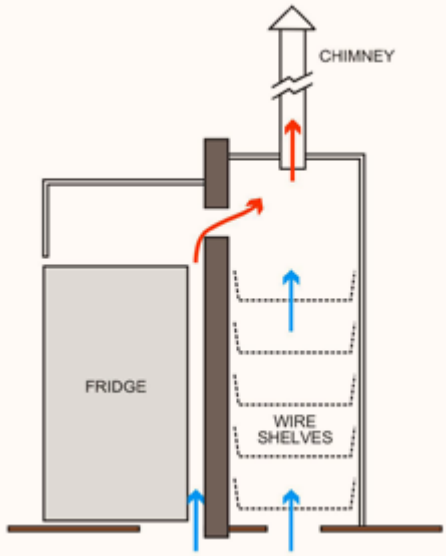
JAMES AND PRISCILLA'S NEW kitchen in inner-city Sydney makes use of a variety of sustainable materials and is fitted out with super energy efficient appliances. A large walk-in pantry was a priority, and tucked into one corner of it, directly behind the fridge, is a cool cupboard. Cooled by air drawn up from under the floor and vented through the roof, the cupboard's internal temperature can get as low as 12 degrees Celsius in winter and is always at least five degrees cooler than the ambient temperature. The cupboard is suitable for storing potatoes, eggs and other items that don't need full refrigeration. It's also good for drying herbs. The efficiency of the fridge is also improved using natural ventilation.

DESIGN:
James Robertson

PROJECT TYPE:
Renovation

CABINETMAKER:
Ian Thomson

LOCATION:
Lewisham, NSW



Larder revival

DESIGN:
Owner builder

PROJECT TYPE:
Larder and adjoining kitchen in new home

LOCATION:
Blampied, Victoria

PHOTOGRAPHY:
Mara Ripani

WITH A PASSION FOR SUSTAINABILITY AND permaculture, it was only natural that Mara Ripani and partner Ralf Pfleiderer would incorporate a larder into their light-earth home near Daylesford, Victoria.

Larders were commonplace in homes before the onset of refrigerators. By drawing in cool air, and excluding sunlight, these rooms are purposely designed to stay cool to facilitate long- and short-term food storage – but very few new homes these days make use of this electricity-free technology.

This larder faces south and a small window brings in natural light but not direct sunlight. It has a concrete pipe buried about half a metre below ground and extending 30 metres out towards the east. At the pipe entrance, trees have been planted to provide shade and a fine mesh prevents animals and birds from entering. The pipe draws air in and cools the air as it travels its length and enters the room via a grate in the floor – an outlet vent in the larder ceiling will create more draw.

The air temperature between the living areas and the larder is distinctly different. The walls of the larder are, like the walls of the house, made from light earth (straw mixed with a small portion of clay and water and packed into formwork). While the living areas of the house remain a constant warm 20 degrees Celsius, the larder is distinctly colder all year round. This is most noticeable in winter when the kitchen/living areas are heated.

The size of the larder is large to accommodate their future harvesting and preserving needs. And the plan is for the larder to be filled predominantly with home-grown produce.

SUSTAINABLE FEATURES

MATERIALS AND FINISHES
- Light-earth construction
- Concrete benchtop
- Pressed metal splashback
- Bamboo ply joinery
- Naturally cool larder for bulk food storage (shelving constructed using leftover materials from the build)
- Polished concrete floor
- Low-VOC finishes from Livos and Crommelin.

Antique reinvention

DESIGN:
Recycled Lane

LOCATION:
Brunswick, Victoria

A SALVAGED CZECH CUPBOARD (CIRCA 1880) WAS THE inspiration for this unique kitchen. Too large to use, the antique has been lovingly reinvented as kitchen cabinets, overhead cupboards, a baker's trolley and bookshelf. The hooks and intricate hinges that adorn panels on the island bench were also taken from the cupboard.

The kitchen carcass was purchased from Ikea. Three separate freestanding units are used to fit the space (purchased without the drawer fronts), and given a facelift using the material from the Czech cupboard. The island bench is a bespoke piece created for the space; all materials for this are recycled or reused from the cupboard; metal was used for the framework to complement the industrial aesthetic of the converted Brunswick home.

The savvy homeowners used eBay and the 'seconds' section of Ikea to source the workbench, induction cooktop, oven, sink and dishwasher.

A new life for old drawers

DESIGN:
David Waterworth and Kate Eve (owner)

BUILDER/JOINER:
David Waterworth, Against The Grain

PROJECT TYPE:
New kitchen from reused cabinets and reclaimed timber

LOCATION:
Heidelberg, Victoria

INSPIRED BY A SHOPFRONT CLAD IN old joinery that she saw on a trip to China, when it came time to install a new kitchen in her Melbourne home, Kate Eve enlisted the help of joiner David Waterworth to create a kitchen made from reclaimed drawers and doors of all kinds. David contributed some of his own drawers, and built the timber carcasses to fit the rest of Kate's collection, which included filing cabinet and index card drawers (some contributed by friends and family). Reclaimed timber was also used for wall shelving and for the pantry doors, and the benchtops are hardwood and salvaged granite. Lead image: Joseph Lombard.

Style and sustainability

WHAT A DIFFERENCE AN EXTENSION CAN MAKE to a home. The centrepiece of this renovation of a 1934 suburban house is a new kitchen and dining/living area that has brought it to life.

The extension, set back two metres from the original house and immersed in the surrounding garden, is a light-filled living space separated from the private space of the old home. Old and new are linked through a glass corridor.

Face cupboards in the kitchen have FSC-certified Tasmanian oak timber veneer sealed with natural oil free from VOCs, while the benchtops are oyster Caesarstone. The glass splashback hides a handy glass and spice cupboard.

Efficient electric appliances are used throughout in the kitchen, including a V-ZUG induction cooktop and Miele dishwasher. A highly efficient Stiebel Eltron heat pump supplies the hot water.

DESIGN:
Nadine Samaha of Level Architekture Konstrukt

PROJECT TYPE:
Extension and renovation

LOCATION:
Glen Iris, Victoria

PHOTOGRAPHY:
Matthew Mallett

SUSTAINABLE FEATURES

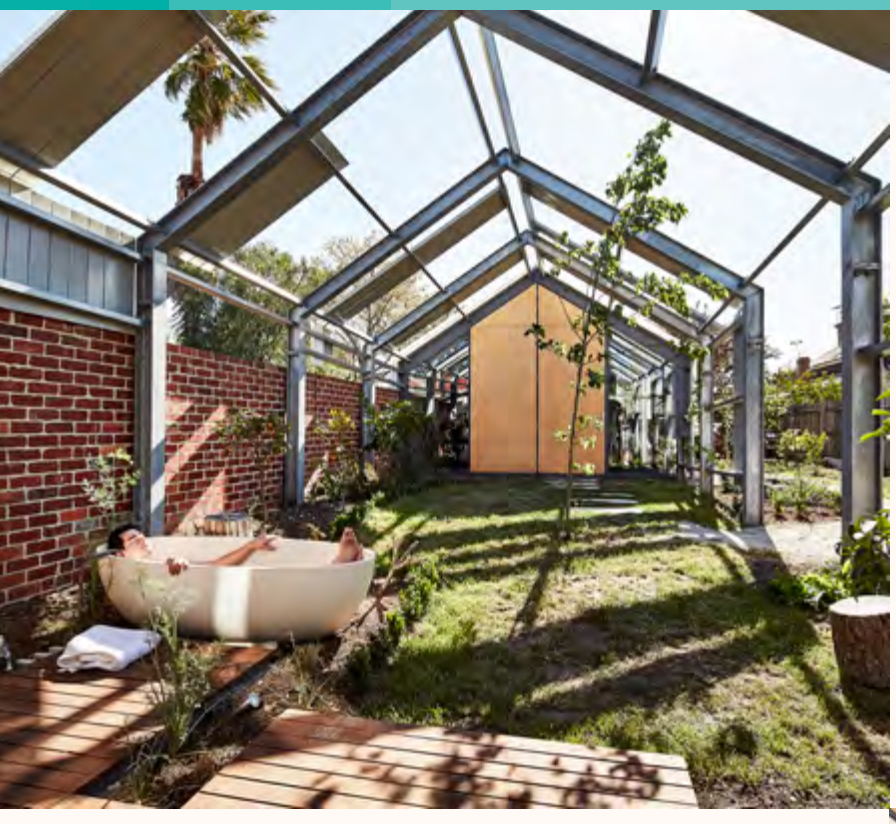
APPLIANCES
- V-ZUG induction cooktop and oven
- ZIP Elite square design tap with sub micron and sediment filters
- Tap Luz kitchen mixer Armando Vicario
- Fully integrated Electrolux fridge and separate freezer
- Qasair rangehood
- Miele dishwasher: energy rating 3.5, WELS water rating 4.5 stars
- Stiebel Eltron heat pump hot water system.

PAINTS AND FINISHES
- Allergy-free brief for materials and finishes
- All timber flooring and veneer cupboards were sealed with VOC-free WOCA natural oil.

MATERIALS
- Oyster Caesarstone benchtops
- Glass splashback
- Mix of recycled and Tasmanian oak timber flooring and panels for the ceiling was laid in the old and new extension from Britton Timbers, FSC-certified
- Tasmanian Oak Timber veneer on cupboard faces purchased form Timberwood Panels, FSC certified.

LIGHTING
- All lights are LEDs.

OTHER FEATURES
- Lowered section of the kitchen bench makes the preparation area accessible for children and wheelchair users
- Extension was set back from the original house by about 2 metres to create a garden where more light can penetrate and where residents can gain more enjoyment of the outdoors
- Graf Platin tank of 5000 litres installed underneath the grass in the backyard to collect rainwater for flushing toilets and watering the garden
- The whole house is insulated, with roofs reaching over R5
- Double glazing installed with low-e glass on the external layer and gap filled with argon gas to improve thermal performance
- All openings have blinds to reduce further summer heat gain and winter heat loss.



Alfresco bathing

DESIGN:
Andrew Maynard Architects

LOCATION:
Seddon, Victoria

THIS OUTDOOR BATHING AREA WAS DESIGNED and built at the request of the owners, as they had always loved the idea. Having a bath in the open yet private and sheltered from the elements was part of the overall brief for a 'ridiculously inside out' house, according to the designer. The bath has running hot and cold water, and after use the water filters throughout the garden to irrigate. The curved copper pipe, which forms the bath spout, was custom-made and comes up from the side of the deck. The bath itself is an Apaiser Seascapes bath, with base. Image: Peter Bennetts

Cedar tub

A LOVE OF JAPANESE DESIGN AND NATURE WAS PAIRED WITH a commitment to material experimentation and ESD practices in the renovation of this ensuite bathroom. By choosing a glass door, the residents have views of the sea from the shower and tub.

DESIGN:
The Design Commission

LOCATION:
South Coogee, NSW

BUILDER:
Life Structures

PHOTOGRAPHER:
Sharrin Rees

JOINERY:
Riteway Joinery

SUSTAINABLE FEATURES:

- Cedar bathtub made in Gembrook, Victoria, by The Japanese Bath Company; 'Isla' timber bath spout, from Wood Melbourne
- Timber flooring from managed forests, supplied by Mafi
- Toilet flushed with rainwater from on-site water tank
- Brodware taps and shower rose (5 star WELS rating), supplied by Cass Brothers
- 'Cradle to cradle' accredited floor and wall tiles by Mosa, supplied by Design Republic
- Benchtop made from Eco by Cosentino man-made stone – 75% recycled materials, 25% natural stone and eco resin, supplied by Royal Stone
- Reclaimed marble-based stone composite sink made by Apaiser; 'Mare' hand held shower on rail by Fantini, available through Rogerseller
- Energy efficient heat recovery ventilation by Stiebel Eltron, supplied by Heat Recovery Ventilation DVS Industries
- Solar hot water by Apricus.

Bathroom with a view

DESIGN:
Shane Thompson Architects

LOCATION:
Brookfield, Queensland

LOCATED ON A SEMI-RURAL SITE IN A LUSH VALLEY WEST OF Brisbane, this home is designed to maximise aspect and views from every room. The house harvests rainwater and uses water-efficient plumbing, zero- or low-VOC paint finishes and minimal plastics. The low-maintenance and accessible bathroom features a concrete-formed bath and bench, patterned tiles and spotted gum shutters. The house has a linear one-room wide plan and high ceilings to allow cross ventilation and natural daylighting, and all waste is treated on site. Image: Christopher Frederick Jones

Defined by tiles

DESIGN:
Day Bukh Architecture

LOCATION:
Randwick, NSW

PHOTOGRAPHER:
Katherine Lu

WITH SKYLIGHTS SET IN A CURVED CEILING, and three types of tiles, this bathroom is bold and dynamic. This is the main bathroom in a semi-detached house in Randwick that has been renovated to incorporate passive solar design. The home has high levels of insulation, uses sustainable timbers, efficient appliances and water saving devices. Rainwater is used in the bathroom and laundry.

BATHROOM FEATURES:

- Wall and ceiling Bisazza recycled glass mosaic; feature wall is handmade ceramic mural, in conjunction with owner Kiran Deol of Design Weaver and Bruce Rowe from Anchor Ceramics
- Parisi Onda bath
- Water-efficient taps including: Parisi Tondo wall-mounted shower; Zucchetti Pan mixers
- Anchor Ceramics basin and light pendants
- Stormtech floor waste outlet
- Solar Ark solar hot water with electric boost
- American walnut timber vanity stand and wall cabinet and mirror, joiner Aidan Morris
- Towel rack by Chris Colwell Design.

Steel and concrete simplicity

DESIGN:
Breathe Architecture

BUILDER:
Promena Projects and Ficus Constructions

LOCATION:
Surry Hills, NSW

PHOTOGRAPHY:
Katherine Lu

THIS KITCHEN AND BATHROOM, DESIGNED BY Breathe Architecture, form part of the renovation of a 100-year-old terrace house in inner-city Sydney. "For the owners, retaining much of the existing building was important, as was dematerialisation – stripping back, expressing and exposing," explain the designers. The existing aged facade was left untouched and old ceilings were pared back to reveal the true identity of the building. Any added materials were robust and humble, to ensure longevity.

In the kitchen, this meant concrete benchtops, brass and copper fittings, and blackbutt, melamine and mild steel for shelving and detailing. Materials chosen were of low embodied energy and sourced locally wherever possible, including Australian recycled timbers and locally manufactured brass door furniture and tapware. The kitchen and dining room are flooded with natural light via a triple-glazed, angled skylight. The courtyard is shaded by a vegetated pergola, and no active heating or cooling is needed inside.

The bathroom also employs the restrained palette of concrete, mild steel, timber and brass, with an inviting shower that can be opened to the elements by retracting its double-glazed roof. The reinforced concrete benchtop and planter box in the bathroom were custom made for the project. Lighting is hidden behind the mirror.

SUSTAINABLE FEATURES

KITCHEN

- Passive solar design; no active heating or cooling
- Double-glazed windows, triple-glazed skylight
- Raw brass gooseneck tapset (WELS 4-star) from Consolidated Brass
- Custom concrete benchtop with mild steel edge
- Copper double under-mount sink
- Blackbutt veneer banquette
- Custom mild steel overhead shelving
- 'Seta' square ceramic tiles from Classic Ceramics
- Brick facing tile in herringbone pattern from Robertson's Building Supplies
- Lighting is dimmable LED.

BATHROOM

- Roulette lever shower rose and tap set (WELS 3-star) from Consolidated Brass
- Exposed raw brass wall tap set (WELS 4-star) from Consolidated Brass
- Décor satin circular mirror from Viridian
- Cube 500 basin from Caroma
- Custom reinforced concrete benchtop and planter box
- Brick facing tile in herringbone pattern from Robertson's Building Supplies
- Blackbutt timber battens (from Urban Salvage) fixed to black fibre cement sheet
- Fosroc Renderoc finish to existing masonry walls from Parchem
- Double-glazed window over shower that opens to the sky.

Opening to light

INTERIOR DESIGN:
Megan Norgate of Brave New Eco

BUILDER:
Macasar Builders

PROJECT TYPE:
Renovation

PHOTOGRAPHY:
Emma Byrnes

HOW DO YOU RENOVATE A CALIFORNIAN bungalow to improve its thermal efficiency and make it brighter, more open and family-friendly?

Designer Megan Norgate of Brave New Eco went to work, revising the layout of the house, opening it up internally through the centre and adding a small extension. A central, dark bedroom was turned into a study/play area, which leads into the 32-square-metre extension containing a new kitchen, walk-in pantry, bathroom and dining room. The space opens to a large outdoor deck and pergola and feels wider and more expansive thanks to a high-pitched ceiling and deep window seat running along the north side.

A new living room was created and a space heater installed to zone the heating into the highly insulated extension. Recycled deco double doors were used in the lounge room so it could be closed when watching TV and a new sliding door with fluted glass put in to separate the extension from the original house.

The main bathroom was also renovated, made larger by extending into the hall space. The existing bathtub was reused and a soft pewter finish chosen for the tapware to avoid the use of chrome. Handmade fish-scale tiles were chosen for over the bath and an art deco drinks trolley was repurposed as a bathroom vanity.

SUSTAINABLE FEATURES

APPLIANCES & FITTINGS
- Induction cooktop
- Quality high-efficiency appliances
- Low-flow tapware and toilets.

MATERIALS
- Post-industrial waste composite benchtops by Create Stone
- Custom recycled messmate joinery and timber-battened island return
- Locally made hardwood kitchen handles
- Handmade ceramic tiles from Middle Earth Tiles
- Pewter finish Astra Walker tapware
- Recycled art deco drinks trolley repurposed for bathroom vanity
- Re-used an existing bathtub in new location.

LIGHTING
- LED strip lighting
- Locally made lighting fitting by Volkerhaug
- Refurbished mid-century copper and perspex pendant lights.

OTHER FEATURES
- 'Cool room' walk-in pantry for dry bulk food storage. A floor vent in the pantry runs through the concrete slab under the house to draw a continuous supply of air cooled by the slab
- Curved bench edge to soften and ease 'choke point' where kitchen entry meets door to north-facing decking
- Kitchen flows straight to decking and herb/salad gardens.

OTHER FEATURES
- Open shower to bath wet zone design to maximise usefulness of long narrow space
- Filled an existing doorway alcove with recycled timber shelving.

Corner shower

DESIGN:
David Boyle Architects

LOCATION:
Marrickville, NSW

OPENING OUT TO A PRIVATE CENTRAL COURTYARD, this bathroom, like the rest of the house, is curvaceous and playful with spaces. The home uses passive solar principles; high ceilings and windows are used strategically to bring in light and make even the small rooms feel spacious. Bathroom features include Inax Yohen Border tiles from Artedomus for the shower and Grey Encaustic tiles from Earp Brothers for the floor, Caroma Marc Newson wall faced toilet and bathroom and water efficient fittings. The pendant light is Castore 14 suspension from Artemide.
Image: Brett Boardman

Maintaining your kitchen and bathroom

WORDS

Bridget Gardner

You don't need to resort to toxic products to maintain the surfaces in your home.

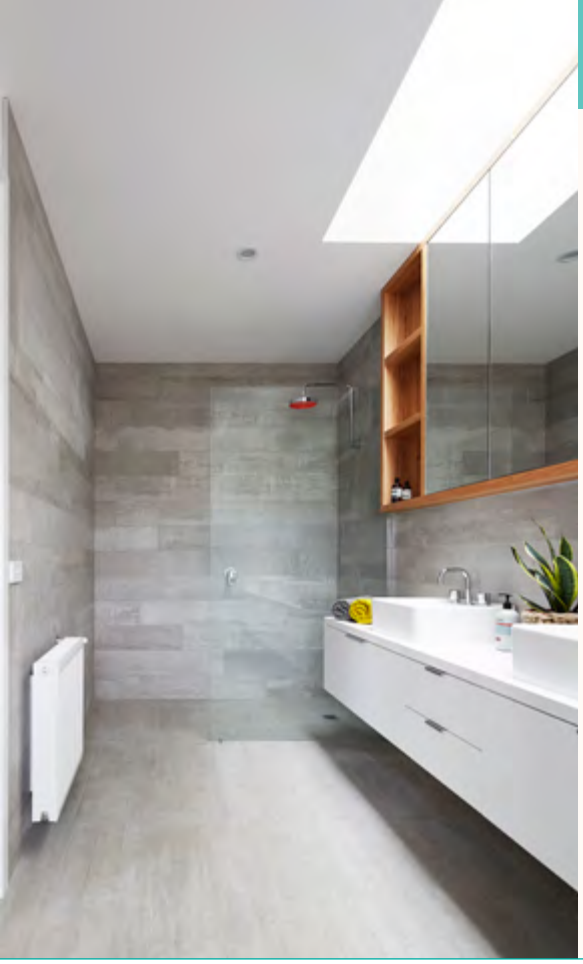
IT SEEMS THAT THE MORE LOVE AND money we pour into our beautiful homes, the higher our expectations are that we should keep them looking like the day they were built. Yet if there was ever a myth about modern kitchen and bathroom surfaces, it would be that they are easy to maintain.

Modern kitchen and bathroom surfaces generally fall into one of two categories: shiny, glazed and impervious surfaces that are easy to wipe clean but easily scratched and show every mark and smear; or natural, unsealed and textured surfaces that are harder to clean and easily stained, but generally more forgiving of surface dirt. While the approach to cleaning these surfaces is very different, you don't need two sets of cleaning products if you follow the three P's of green cleaning: prevention, preparation and process.

PREVENTION

Prevention really is the best cure for cleaning. Surfaces are most easily damaged via stains, scrubbing stuck-on grime, grit under shoes and furniture, and debris in your cleaning cloth. To prevent these problems, get into the habit of wiping and sweeping away messes as they occur. You then only need a full clean once a fortnight or before guests arrive!

For example, you can protect the surface and make cleaning easier, by applying a waxy coating (such as carnauba wax) to your stainless steel appliances and splashbacks and regularly oil wooden benches. After every shower, wiping the water from the



Source local

DESIGN:
Glow Building Design

LOCATION:
Trentham, Victoria

BUILDER:
Rick Egan

STAR RATING:
7.8 stars

WE LOVE THIS HOME AND featured it in full in *Sanctuary* 35. The entire build focused on locally sourced materials and services, and the bathroom is no exception. Image: Peter Clarke

SUSTAINABLE FEATURES:

- The electric hot water system is connected to a Sanden heat pump which runs the hydronic heating system
- Self-sufficient with rainwater; all waste treated on site
- Skylight used for natural daylighting
- Low water use appliances including Caroma dual flush toilet; WELS 4 Star Liano basin/mixer in bathroom.
- Tiles from Re-Use, salvaged concrete and marble reused from industrial demolitions
- Cabinets constructed by Evolve Interiors and Design using blackbutt veneers, some re-milled using Blackbutt found on site.

glass and tiles using a squeegee and from tap fittings with a microfibre glass cloth, will prevent mould and scale build-up.

PREPARATION

Investing in some quality equipment has three advantages: quality lasts longer, works better and can often replace the need for chemicals. Your shopping list could include: Quality microfibre cloths and mop; window squeegee; spray bottles; vacuum cleaners with HEPA filter; and steam cleaning equipment (especially if you have mould problems).

You also need plenty of recycled rags, toothbrushes and if possible flannelette nappies. Prevention strategies will only work if your cleaning tools are handy.

PROCESS

If the soiling is fresh, most surfaces can be cleaned with either microfibre and water, or a cloth or mop with a spot of detergent (or soap) in warm water. The cleaning process then depends on the surface.

Shiny surfaces: clean with a clean cloth then dry the surface using a clean flannelette rag or microfibre cloth, or a squeegee on windows, mirrors and shower glass.

Textured surfaces: use a tool that can get into the grooves, such as a toothbrush or a soft dishwashing brush, and lightly scrub in a circular motion.

Wooden surfaces: remove all dry dust first, then wipe with a clean damp cloth or mop.

Lacquered wood: add a dash of vinegar to the water to help it shine but make sure the cloth is damp, not wet.

Oiled wooden surfaces: clean with an oil-based product, such as the original oil, a mix of olive oil (2/3) and lemon juice (1/3), or grated soap in warm water, which leaves a waxy layer.

Follow my three P's of green cleaning and you can enjoy your beautiful sustainable home for years to come.

Bridget Gardner is green cleaning specialist and director of Fresh Green Clean: www.freshgreenclean.com.au

An antique is repurposed as a basin in David Saunders' characterful St Kilda home (full profile page 39).

Beyond the brand

appliances guide

Are you in the market for a new cooktop, fridge or smaller household appliance? With so much rubbish around, it's worth doing your homework to get value for money.

WORDS Lance Turner

APPLIANCE SELECTION CAN SEEM simple, but in fact can be a bit of an art form. There are a number of steps, the first of which is to list the requirements of the new appliance. For example, for a fridge you need to know the total volume required, as well as the individual volumes of fridge and freezer sections. You also need to know the maximum dimensions the fridge can be, allowing for the required airspace around it, the basic layout (freezer on top or bottom) and list the features it should have, such as should the freezer have drawers or shelves. And then there's how much you can spend on your new appliance.

ENERGY AND WATER CONSUMPTION

Probably most importantly, you need to consider energy consumption of the appliance. Over the life of an average appliance, the energy use and hence running costs can be considerable. Choosing an appliance based purely on initial purchase price, without considering ongoing running costs, can result in you paying more over its lifespan than if you had bought a more expensive but more efficient model.

Comparing energy consumption between appliances is simple, as many appliances such as fridges, dishwashers and washing machines are required to carry an energy ratings label. The label has two energy usage indicators: the star rating (the more stars, the more efficient the appliance) and the annual energy use in a typical situation (the lower the number, the less energy it uses).

Water consumption also influences energy consumption for appliances that use hot water such as dishwashers, so lower water use is better, provided it doesn't compromise the appliance's effectiveness. Appliances will generally have a water ratings label just like an energy rating and you can search www.waterrating.gov.au for the most water-efficient appliance.

RELIABILITY

An appliance isn't a bargain (and it won't be an environmentally sound purchase) if it only lasts a few years or requires regular repairs. It's worth doing research to see how generally reliable a model, range or brand is, and what sort of issues other owners have had with a particular appliance. Product review sites can help with this. Check out Choice, or another popular site is productreview.com.au, where you can type in a model number and see what others have to say about reliability and problems with that particular appliance. Not all appliances are listed, and very new models may have few or no reviews, but often there will be reviews for older, similar appliances that can guide you.

Of course, even the best appliances will have the occasional bad review. Production line manufacturing, even with the highest quality control, can result in a faulty appliance. Don't necessarily discount an appliance with one or two bad reviews when it has dozens of good ones.

QUALITY AND VALUE FOR MONEY

Another thing to consider is the quality of an appliance. While the general rule is that more expensive appliances are generally better quality than cheap ones, this rule doesn't always hold. There have been some expensive appliances that seemed like quality units, but have turned out to have poor efficiency, low reliability and high maintenance costs. The same applies at the other end of the market – cheap doesn't always mean unreliable and inefficient. If you do your research, you may be able to spend $1000 on your new washing machine and get similar efficiency, ease of use and reliability as a $4000 top-of-the line machine.

Generally, you will want your appliances to last for as long as possible, to provide the best financial and environmental outcomes, but many, if not most, appliances will need at least a small repair over their lifetime.

Whether induction or resistive element, a cooktop with a flat glass top will be much faster to clean, requiring less effort and little or no cleaning agents. Image: Emma Byrnes, see the full profile of this kitchen on page 42.

How much that repair costs depends on the availability and price of replacement parts, so check this. Some expensive appliances can have high spare parts prices and low-volume models may not have parts available. Big Warehouse Spares (bigwarehouse.com.au) is a good source of parts for those who want to avoid the repairer's mark-up.

RECYCLABILITY AND SUSTAINABILITY

When it comes to appliance recyclability, most people will have to use local facilities such as the local tip (or sometimes scrap metal dealers), most of which will take appliances for recycling, rather than landfill. However, some appliance manufacturers have recycling programs in place and may take your old appliance for recycling. Some appliance repairers and installers will also take old appliances and strip them for the good parts. Recycling options vary enormously from region to region, so check the RecyclingNearYou (recyclingnearyou.com.au/electrical) website for your local recycling options.

When it comes to sustainability of materials, most appliances of a particular category will contain similar quantities of similar materials – all fridges have steel or stainless steel cabinets, copper or aluminium coils and (usually polyurethane) foam for insulation, for instance. There are some areas where appliances will differ, such as the refrigerant used in a fridge, air conditioner or heat pump water heater. You may need to look at datasheets to glean this information, but for air conditioners and heat pump water heaters the refrigerant type is considered a selling point. Look for a refrigerant with a lower global warming potential (GWP). See: en.wikipedia.org/wiki/List_of_refrigerants for commonly available refrigerants and their GWP.

SPECIFIC APPLIANCES

In addition to the general considerations above, here are some points to consider when selecting specific appliances for your kitchen and bathroom.

DISHWASHERS

- Number of place settings – don't buy a large machine if there are only two of you – the temptation will be to run it part full.
- Machines that use less water also use less energy to heat that water, but there is a limit on how far you can reduce water use. Some machines with low water use don't wash well, so check reviews.
- If the racks and slides are cheap plastic, they may break easily, so look for an appliance with robust internals.
- Make sure the filter is easily cleaned – a filter that's hard to clean tends to get ignored, resulting in a less efficient machine and poor cleaning performance.

There are far fewer appliances in a bathroom compared to a kitchen, but radiant heat lamps and heated towel rails have the ability to use a lot of energy if they are not used correctly. Remember, it's not just the power rating of an appliance, but how long it runs for each day that determines its overall energy use. This bathroom from the Brunswick house featured on page 16, also houses the washing machine opposite the vanity. Image: Hilary Bradford

REFRIGERATORS

– Select a fridge that suits your needs – too small and it will forever be crammed too tight, resulting in uneven cooling; too large and it will use more energy than required.
– Make sure that door seals are low cost and easy to replace.
– Select a fridge with the most environmentally benign refrigerant that you can get, balancing other requirements.
– Avoid fancy options like icemakers in the door etc; they add cost and complexity and usually increase running costs.
– Always provide plenty of ventilation around the fridge, especially above – a fridge chimney to duct warm air away from the fridge can be built into fridge alcoves when doing renovations. [See a diagram of this on page 44.]

OVENS AND COOKTOPS

– Look for a well-insulated electric oven; gas ovens are likely to be less sustainable, particularly if you're using GreenPower or solar. Don't pay extra for features you won't use, such as rotisseries and the like. It's just more to break down and can compromise the oven insulation, increasing heat losses.
– If your oven needs are small, consider a combined microwave/convection oven. This reduces energy use and eliminates the materials required to make one of the ovens.
– It's hard to find ovens without digital controls, which can add to standby power. However, this is less of an issue nowadays as standby power of most appliances has greatly decreased; most draw less than one watt when not in use (a one-watt draw costs less than three dollars a year to run).
– Induction cooktops are efficient and allow fast cooking temperature adjustments. However, if your cooking needs are modest, a simple resistive element cooktop could be a good option – it's much cheaper, doesn't use much more electricity and will be much cheaper to repair.
– Whether induction or resistive element, fit a cooktop with a flat glass top. It will be much faster to clean, requiring less effort and little or no cleaning agents.

SMALL APPLIANCES

The first consideration for any small appliance is "Do I need this?" Always look for a model with a good reputation for longevity and reliability. Don't double up on appliances. For example, if you have a toaster-oven that toasts well, do you need a separate toaster? Eliminating excess appliances not only saves you up front, but gives you back more bench space.

Most of the cheaper small appliances are designed to be non-repairable, although parts are available for some models. Some manufacturers still make devices designed to be fixed. Dualit and Magimix are two examples, and while their appliances are expensive, they generally have a good reputation and most parts are available.

BATHROOM APPLIANCES

Radiant heat lamps can use considerable energy if used for long periods, so they should not be used for lighting. Look for a combined heat lamp/lighting system that has decent lights that provide the desired lighting levels, to eliminate the temptation to turn on the heat lamps for extra light.

Heated towel rails prevent towels becoming smelly from staying damp, but if run continuously can result in large energy use. A single small 100-watt towel rail will use 2.4kWh a day, or 16.8kWh per week. Over a six-month winter period it would use around 440kWh, or over $120 of electricity.

WARRANTIES

Regardless of the appliance, you want a good warranty. For appliances like fridges, warranties of five years or more are available, but, for small appliances, 12 to 24 months is more likely. A warranty can be an indication of a manufacturer's faith in its products, so it should be taken into account when selecting a brand/model.

Extended warranties, as offered by some of the large appliance chain stores, may sound like good insurance, but they can be expensive and may not cover all possible

This kitchen by Element Builders in Western Australia uses Paperock for kitchen joinery and recycled timber for benchtops and for the ceiling lining. Nice touches include the dining table on castors built by Michael Cicanese, easy-to-clean concrete floor and efficient light fittings and appliances. Image: Ruth&Me

faults. They can also be a waste of money if they cover only what you are already covered for under Australian consumer law. See Choice's extended warranty page at www.bit.ly/ACLEWI for more information.

MATERIALS SELECTION

There is a wide range of materials used in kitchens and bathrooms and it's not possible to cover them in depth in a short article. In general, look for materials with low toxicity, low or zero-VOCs and low embodied energy. Materials like ceramic tiles have a high-embodied energy, but also have a long service life and can be reused if removed carefully, so this should be taken into account when compared to other materials. For example, timber has a low embodied energy and is biodegradable, but if used in wet areas and for benchtops can have a short service life unless regularly maintained.

Materials that require little or no maintenance can have a lower environmental footprint than those that need regular maintenance. For example, polished stone needs little effort to keep it clean and looking nice, whereas wood needs regular oiling or refinishing. The cost of producing and applying those finishes needs to be included in the equation.

Look for locally produced materials if possible, provided they meet other environmental criteria. Stone quarried 50km away has a lot lower energy footprint than stone quarried and shipped from the other side of the planet.

Especially in wet areas, avoid materials like MDF, chipboard and similar compressed fibreboards for cabinet carcasses. Water quickly damages these sorts of materials unless they are specifically made for damp locations (most grades of compressed fibreboards are not) or have been properly sealed. More resilient materials include marine ply (available in low-VOC E0 versions) and composite materials such as Paperock. While these materials are more expensive initially, they will outlast cheaper materials such as chipboard.

Common ground

Building momentum for quality apartments

The liveability of apartment buildings has long been a blind spot for state governments but we're now finally seeing some change, writes Kulja Coulston, with case studies by Anna Cumming.

AT THE END OF LAST YEAR, THERE WERE A NUMBER OF government announcements that gave apartment sustainability advocate Christine Byrne reason to be optimistic. The NSW government released a draft strategy for public consultation which considers, among other things, improved standards for common areas and tenancies; and COAG agreed to fund the National Australian Built Environment Rating System (NABERS) to create a 6 Star energy rating tool for apartment building common areas.

"Five years ago, nobody thought about apartments, but all of a sudden there is momentum," says Christine, who established the not-for-profit organisation Green Strata to help owners corporations improve the sustainability of their buildings. "We know that mandatory energy efficiency disclosure changed the dynamics around sustainability in the commercial sector. Now, for the first time, the NSW climate change fund draft strategic plan mentions apartments and common property. I can't tell you how significant that is," she says.

Until now, apartment buildings have fallen through the cracks with regard to broader controls around environmental performance and thermal comfort. But with two million people now living in multi-residential settings in Australia, and many thousands of apartments in the construction pipeline, the concerns of this growing constituency can no longer be ignored. "Some buildings, especially the larger ones, are appallingly inefficient. Essentially, developers are shifting costs onto the future occupants of the apartments," says sustainability expert Alan Pears.

The newly minted Better Apartment Design Standards in Victoria become effective from March 2017 and aims to drive up apartment quality through encouraging natural ventilation, minimum solar access and even maximum cooling loads for apartments. "These initiatives are good, but there are so many buildings being built now that don't include the new features," says Alan, adding that governments should combine any planning scheme improvements with stronger regulations that empower owners corporation committees. "These committees play a financial role and are controlled by state governments and, as such, energy upgrades could be required as part of managing existing buildings."

IMPROVING EXISTING APARTMENT BUILDINGS

Although individual apartments are often small in size, the energy loads from common property areas can be significant, and these costs are passed on to owners through strata fees. "A lot of people don't believe they have the power to change their buildings, which is part of the problem. They don't know their rights," says Christine Byrne. "They buy an apartment and have no clue about the legislation or their liabilities, which means there are enormous possibilities here for education."

The City of Sydney's Smart Green Apartments program is the most progressive in the country when it comes to supporting residents to 'green' their buildings: participating buildings have achieved financial savings upwards of $23,000 per year. There is also good information on the Smart Blocks website to help residents 'tune up' their buildings, including how to engage owners who are not residents.

"It makes sense to prioritise energy efficiency projects by payback period in the first instance, and capital costs in the second," says Ethan Burns of Sustainability Now, who works with owners committees and strata corporations to design and implement energy savings. "The lowest hanging fruit for strata includes car park ventilation systems and lighting. But the best way to get an idea of specific opportunities for your building is to get an energy audit that provides a targeted, costed action plan."

Christine Byrne says there are additional flow-on benefits for buildings that prioritise environmental performance. "It imposes a management discipline as well. Looking at where money is being spent leads to better management of the building as a whole."

CASE STUDIES FOR APARTMENT BUILDING IMPROVEMENT

Even without government incentives and regulation, many owners committees are already reaping the benefits of investing in building improvements. Over the next eight pages, Anna Cumming shares some inspiring stories of resident action, including successes with low-rise 'six pack' apartments through to high-rise towers. She also looks at a couple of new-build strata developments that are getting it right from the start.

Grass is greener

PROJECT TYPE: Green roof retrofit
LOCATION: St Kilda East, Vic
STOREYS: 3 (low-rise)
APARTMENTS: 23
BUILT: 1951

SUSTAINABLE INITIATIVES:
– Retrofitted green roof: 646m^2 including decks, lawn, vegie planter boxes and over 470m^2 of native plants
– Water tanks
– Composting
– Bike racks

Westbury Street's green roof is providing a welcome focal point for residents, who share its upkeep and use it as a gathering space for barbecues, meetings and even movie nights. Images: Sonia Bednar

FROM THE STREET, THIS BLOCK OF FLATS IN MELBOURNE'S St Kilda East looks pretty similar to its neighbours. But head up the back stairs to the roof and a verdant surprise is in store.

In 2015, a 646-square-metre green roof was installed. Surrounded by the existing brickwork parapet, the green roof includes two lawn areas, planter boxes for vegies, washing lines, paths and three decks, but most of the space is given over to native plantings. "We wanted a self-sustaining ecosystem," explains Sonia Bednar, resident and Owners Corporation Committee chair. "The only non-natives are rosemary and lavender, to attract bees and assist biodiversity."

The green roof project began two years earlier, with an idea from Sonia's partner. They formed a Green Roof Committee and successfully applied for a $200,000 grant through a State Government program to assist community groups to improve the water cycle.

A structural assessment of the roof was carried out, and a heavy-duty waterproof and root-proof membrane was laid and fitted with a sensitive leak detection system that should mean remedying any future problem won't involve extensive excavation. Green roof contractor Fytogreen was employed to lay the substrate, install the watering system and choose and plant the grasses, groundcover and small shrubs that make up the rooftop park. The residents held working bees to help with the myriad smaller jobs like painting.

More than a year on, the garden is thriving. It absorbs rainwater and reduces stormwater runoff, and provides thermal insulation; in addition, it's proving hugely positive socially. "Before, we didn't have a [sense of] community because we didn't have a communal space. Now everybody's up there often," enthuses Sonia.

"Our rooftop was one big blinding white reflective surface, exposed to all the elements. It was not conducive to social gatherings. We used it to hang up our washing. The prospect of changing this into something we can enjoy and something that will benefit the environment was too good not to contemplate."

– Sonia Bednar, resident and owners committee chair

Getting it right from the start

PROJECT TYPE: New build
LOCATION: Perth, WA
DWELLINGS: 2 townhouses, 5 apartments
BUILT: completed 2016

SUSTAINABLE INITIATIVES:
– 9+ Star energy-efficient buildings featuring passive solar design, double glazing, rainwater storage, solar PV and solar hot water
– Intentional design to promote community:
  – Variety of housing types to suit a range of people
  – Shared BBQ, picnic area and gardens
  – Garages placed away from dwellings; front doors all open off shared green space
  – Shared bike storage

The Siding's three buildings contain two townhouses and five apartments, surrounded by shared gardens. As well as environmental sustainability, the development was designed with social sustainability and community firmly in mind.
Image: Daniel Carson

A roomy, shared bike store has space for around 20 bikes, and provides a good opportunity for residents to interact.
Image: Daniel Carson

In Perth, two couples keen to explore the possibility of living close to the city in a more sustainable, community-focused townhouse complex are onto their second small-scale strata development.

MARK AND ALANA DOWLEY AND HELMUTH AND EUGENIE Stockmann are the founders of The Green Swing, whose first project was Genesis, the 4-dwelling development in which they now all live. In 2013, planning started for The Siding, a development consisting of two townhouses and five apartments in three buildings surrounded by communal gardens and facilities. It's just been completed.

The dwellings are carefully designed for passive solar performance and energy efficiency (they are all 9+ Star), use sustainable materials, are all-electric, and are provided with solar PV, solar hot water, and rainwater collection. Perhaps what's most interesting about this development is its focus on social sustainability: it was intentionally designed to promote a sense of community. "The social aspect of strata developments is really important," says Eugenie. "We included a range of dwelling types – apartments and townhouses, different sizes, apartments on different floors – to suit a whole range of different people and diversify the resident mix."

While each dwelling has a private courtyard or balcony, there is also extensive shared open space, including lawns, gardens, vegie plots and a barbecue area. Garages are separated from the homes and residents walk through the shared gardens to their front doors. "We designed it to encourage community interaction," explains Eugenie. There's also a shared bike storage area with space for about 20 bikes – another place for a chat with your neighbour in passing. Even the letterboxes are deliberately all placed together, despite the two street frontages of the site.

"It's actually pretty simple," says Eugenie. "We do consciously keep our projects small. More than about ten apartments and it becomes harder to know your neighbours, and people lose that sense of community responsibility."

She also recommends people interested in embarking on a similar project look carefully at the standard strata rules and make changes to promote a sense of community. "Particularly with regard to gardens – the standard rules restrict what you can and can't do in common gardens. We recommend redrafting the rules to encourage ownership of common areas."

Engaging the experts

PROJECT TYPE: Building retrofit
LOCATION: Pyrmont, NSW
STOREYS: 10 (mid-rise)
APARTMENTS: 275
BUILT: 1999

SUSTAINABLE INITIATIVES:
– Converted common area lights to LEDs
– Movement sensors on fire stairs and rubbish chute room lights
– Data logger on water meter
– Plan to replace pool and spa gas water heaters with heat pump, and install solar hot water and PV on the roof terrace

SEVERAL YEARS AGO, THE OWNERS CORPORATION committee at Palladium Apartments decided to try to improve their complex's energy and water efficiency and reduce their bills. The first thing they did was to commission Ethan Burns, of Sustainability Now, to do an energy audit of the 275-apartment complex. "We asked Ethan to give us his recommendations prioritised in order of cost effectiveness," says Ron Shaw, resident and committee chair, "so it's easy to see a clear financial return."

The first thing they tackled was changing the lights in all the fire stairwells and the rubbish chute rooms to movement-activated LEDs; this initiative alone saved them around $2,000 on their monthly electricity bills – an impressive 20 per cent. They have just switched all corridor lights to LED, for an estimated further saving of $500 a month. Next, they'll upgrade the carpark lights.

Ron and the building manager, Rose Roddy, are not resting on their laurels though. They have just been awarded a $6,000 grant for feasibility studies looking at swapping their pool and spa gas water heaters for a more efficient heat pump, and at installing solar PV on two unused roof terraces to help supply their common area electricity needs. They are also considering a solar hot water system on the roof of a barbecue area conveniently close to the pool.

Because of the original design of the buildings, some upgrades have proved unfeasible at Palladium. "We have tried really hard to understand the building, and what we can and can't do," says Ron. Rose agrees: "Ask what's in your building, and what you can realistically tackle," she recommends.

"It's great to have independent audit reports. You get different people on committees for different reasons, and it's good to have a neutral report."

– Rose Roddy, building manager

Commissioning a comprehensive sustainability audit was the first step in Palladium Apartments' mission to improve energy and water efficiency and lower bills.

A decade of dedication

PROJECT TYPE: Energy efficiency retrofits
LOCATION: Melbourne, Vic
STOREYS: 36 (high-rise)
APARTMENTS: 87
BUILT: 1999

SUSTAINABLE INITIATIVES:
– Electricity use reduction: installation of variable speed drives on cooling towers and water pumps; replacement of lighting with efficient LEDs; movement sensors in stairwells
– Sprinkler tests changed from weekly to monthly to reduce water consumption
– Well-supported recycling scheme
– Electric vehicle charging stations coming soon

Lighting and cooling system upgrades cut Republic Tower's common area electricity consumption by nearly half over 10 years, saving thousands of dollars a year.

THE 36-STOREY REPUBLIC TOWER ON THE CORNER OF Queen and La Trobe Streets was one of the first high-rise residential apartment buildings in Melbourne. It houses 87 apartments.

Since 2006 the Owners Corporation Committee and Facility Manager John Pfeiffer have pursued a step-by-step program to reduce the building's electricity usage. "We started with the low-hanging fruit," says John. "First we removed one of the fluorescent tubes in each of the double tube light fixtures in the carparks. That cost nothing."

Last year, the remaining tubes were switched to LEDs, the final step in the conversion of common area lighting to efficient LEDs that also saw 212 halogen downlights replaced and movement sensors added to stairwell lights. "The fire escape stair lights used to be on all the time, which was just crazy," says Peter Harris, resident and owners committee member.

As well as the lighting upgrades, significant energy savings were achieved by the installation of variable speed drives (VSDs) on the air conditioning system's cooling tower motors, and on the water pumps. "Before, the motors were either off, or on and working at 100 per cent; now the VSDs sense the capacity needed and run the motors at the optimal speed," explains John. "It uses less power, and also extends the life of the motors."

As a result of their efforts, electricity consumption has fallen by a huge 40 per cent over 10 years. Last year John approached the building's electricity retailer and was able to negotiate a reduction in the 'peak demand' component of their bill to reflect the permanent reduction in consumption – a move which will save the owners corporation an extra $3,000 each year.

Their next step is likely to be infrastructure to enable interested residents to have electric vehicle charging stations in their parking spaces.

"Taking on these projects hasn't been that difficult – we have just demonstrated to the committee that we can save money over time by spending some money."

– Peter Harris, apartment owner and Owners Corporation Committee member

Pioneering shared solar

PROJECT TYPE: Building retrofit
LOCATION: Fitzroy North, Vic
STOREYS: 3 (low-rise)
APARTMENTS: 92
BUILT: 1998

SUSTAINABLE INITIATIVES:
– Rooftop solar powering the building's common area lighting and pool pump
– LED lighting in common areas; sensors on garage lights
– Trial underway for 'behind-the-meter' distribution of solar electricity to individual apartments

THE LOW-RISE BUILDINGS OF NICHOLSON GARDENS SIT around a large, treed garden with a communal pool. About five years ago, apartment owner Miriam Robinson was instrumental in kickstarting the complex's solar project. "I used to watch the sun shining on the roofs and think, someone should do something with that," she says. Taking the idea to an owners corporation committee meeting, she got a warm response and a project group was formed.

There was plenty of space for solar panels on their rooftops, but on their solar consultant's advice they elected to break the project into stages and start small, to ensure a short payback time and make it easier to get the committee's support.

"We swapped all our common area lights for LEDs, installed sensors on the garage lights, and upgraded our pool pump," Miriam says, "and installed 16 solar panels – that's 4kW – enough to cover our daytime energy use in common areas." All that cost them $25,000, and has reduced their annual communal energy bill by $7,000, meaning a payback time of under four years.

Phase two is to offer solar power to individual apartments. After investigating an 'embedded network' (or micro-grid) and finding the regulatory requirements quite onerous and the up-front costs too high, the committee is now working with Melbourne startup Allume Energy to trial the company's 'behind-the-meter' distributive technology. "Our system allows residents to share the output of a solar system on a simple pay-for-power model," explains Cameron Knox of Allume. "They keep their existing meters and grid power supply agreements with retailers; we supply them with the solar electricity generated on the complex's own roof at a rate 30 to 50 per cent lower than the retail price."

One big advantage of Allume's system is that the low setup cost (at Nicholson Gardens, about a third of the cost of an embedded network) and simple hardware requirements mean that there's no need for all or even most of the apartments to sign up for the system to be financially viable, and residents can easily opt in or out at any time. "It's very scalable," says Miriam. "We'll start with enough solar panels for as many apartments as are interested, and plan to add more as needed." A one-month technical trial involving three apartments has just been successfully completed; all being well, the committee and Allume plan to have the system rolled out across the complex by mid-year. It will be the first of its kind in Australia.

Nicholas Hill and Cameron Knox from Allume Energy with Miriam Robinson, Chair of Nicholson Gardens owners committee. Image: Allume Energy

Miriam encourages others to get stuck into sustainability projects in their buildings: "You need someone to lead the project who is a bit goal orientated, who really wants to make it happen. Also, it has to make sense financially. And finding the right technical people to help is crucial – start with your local council for advice."

Building the ‘missing middle’

PROJECT TYPE: New build
LOCATION: White Gum Valley, WA
APARTMENTS: 3
BUILT: 2016

SUSTAINABLE INITIATIVES:
– Compact apartments
– Passive solar design, high energy efficiency, double-glazed windows, solar PV with battery storage, rainwater harvesting (plumbed to toilets and laundries)
– Accommodation of 3 to 6 adults in a location allowing easy pedestrian access to shops, parks and other facilities

The development’s location on the White Gum Valley estate, within easy reach of many services and close to central Fremantle, is an important part of fulfilling the brief of targeting the needs of ‘Generation Y’. Architect David Barr’s design omits fencing to promote engagement with the street and the rest of the estate. Planter boxes loosely define the property’s boundary: “They will be used for herbs and vegies – looked after by the residents but open to all.” Images: Robert Frith

Clad in Colorbond for its durability and low maintenance requirement, the Gen Y House is actually a compact complex of three strata-titled apartments.

This compact three-unit development on a very small lot near Fremantle focuses on balancing community, sustainability and affordability.

AT A GLANCE, THE GEN Y HOUSE IN THE WHITE GUM VALLEY estate a stone's throw from central Fremantle is just that: a two-storey house. In fact, it's a cleverly designed three-apartment strata complex specifically designed to "reconceptualise what is achievable when community, sustainability and cost are prioritised equally," as its designer David Barr explains. It was the winning entry in Landcorp's Generation Y competition, which called for an affordable housing solution accommodating 3 to 6 adults on a single 250-square-metre residential lot.

"We studied a variety of requirements in depth," says David. "We aimed for a balance: delightful spaces to live in that were still attainable for someone buying for the first time."

To keep costs down, David and his team opted to keep the apartments small: at 44 to 50 square metres each, they have a combined internal area that is less than the average Australian home. Each has its own kitchen, bathroom and laundry as well as a generous private courtyard or balcony; they also have access to shared outdoor space. "We compensated for the smaller interior spaces with larger windows, visual connections to the outdoors, and carefully planned layout," says David. "And the location has its own compensations: the White Gum Valley estate offers parks and it's an easy bike ride from Fremantle."

Other cost-saving measures included choosing pre-finished materials that wouldn't require maintenance, such as Colorbond cladding on the exterior, melamine for cabinetry, and prefabricated roof panels. The kitchens and bathrooms in the three apartments are identical, to take advantage of economies of scale. "There wasn't one magic solution, rather a number of things that all helped to minimise tradespeople's time on site and keep the cost down," David explains.

Sustainability was never compromised, though. All apartments have access to northern light and cross ventilation; the complex has 10,000 litres of rainwater storage that is plumbed to the laundries and toilets, and share a 9kW solar PV system with battery storage. David and his team had a life cycle analysis of the building completed using the Etools software, and determined that it would have a 98 per cent reduction in operational carbon footprint over its life compared with a standard home.

The layout of the three apartments allows for northern sun access and cross ventilation to each, and they all have their own private outdoor space.

The Gen Y House was completed in December 2016 and is currently open to the public for tours before the apartments are put on the market this autumn. Once it's occupied, Landcorp is planning to run a 'living laboratory' project, monitoring energy and water use and interviewing residents about the experience of living there, and sharing the results.

David is very pleased with the finished project especially as the building is meeting needs beyond the brief. "It's had a lot of interest from baby boomers wanting to downsize, and it's also good for intergenerational living. It addresses the 'missing middle': a housing type in between single housing and large multi-residential developments."

Saving on strata levies

PROJECT TYPE: Building retrofit, solar installation
LOCATION: Kensington, NSW
STOREYS: 5-9 (mid-rise)
APARTMENTS: 164
BUILT: completed 2006

SUSTAINABLE INITIATIVES:
– 27.5kW solar system installed to provide common area electricity
– Converted common area lights to LED
– Movement sensors on fire stairs and garage lights
– Switched off pool heating

The residents of Capella's 164 apartments are benefitting from lighting upgrades and a large solar system; bill savings have meant no rise in strata levies for three years. The solar had a longer payback period so was installed after all of the other initiatives were implemented.

"Without a doubt, it's worth hiring a consultant and getting an energy audit done. When such fantastic cost savings are available, why not?"

– Deborah Chowns, caretaker

CAPELLA APARTMENTS IN KENSINGTON, A SHORT TRIP south of Sydney's CBD, is made up of five blocks surrounding a large shared park with a lap pool. Completed in 2006, the complex houses 164 apartments, and these days the roof boasts a 128-panel, 27.5kW solar system, completed in two stages (17.5 kW + 10 kW), approximately 12 months apart.

"It was installed in two stages in 2015 and 2016, and powers the common area lights and plant – lifts, ventilation and so on," says Deborah Chowns, caretaker at Capella. She explains that the system cost was about $70,000, and was paid for with the help of a government rebate of around $20,000.

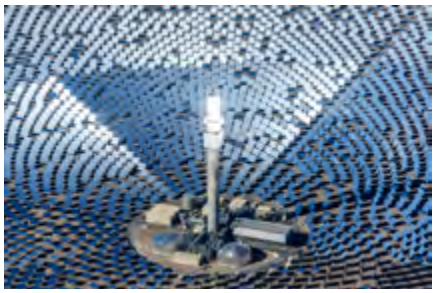
Prior to installing the solar, the Owners Corporation also replaced all the common area lights with LEDs, with movement sensors on the garage and fire stair lights and push button timer switches in the 30 garbage rooms. They plan to change their corridor lights to movement sensors too, so that they automatically dim to 20 per cent when there's nobody around. "There's virtually not an old halogen or fluorescent light left in the place," says Deborah with satisfaction. They also made the decision to switch off the heating for the outside lap pool, as it doesn't see enough use to make heating it sensible.

In four years, their initiatives have seen Capella's annual electricity bills fall from about $120,000 to $70,000. "A big part of my job is to look closely at budgets," she says. "Strata levies are high in Sydney's eastern suburbs, and used to go up automatically every year. But with the bill savings we've made, we've held off raising the levy for maybe three years now."

ATA UPDATE

ALTERNATIVE TECHNOLOGY ASSOCIATION – www.ata.org.au

ATA NEWS



100% RENEWABLE GRID IS POSSIBLE

A fully renewable electricity grid would provide long-term economic, climate and social benefits for Australia, according to a new discussion paper by the ATA. The ATA's *100% Renewable Energy Grid – Feasible?* concluded that a 100% renewable grid will be reliable and stable, as long as it uses an appropriate mix of renewable generation sources, energy storage and upgraded infrastructure.

To read the discussion paper go to: www.ata.org.au/news

COMMUNITY ENERGY CONGRESS 2017

The Community Energy Congress is the premier event on Australia's community energy calendar. Congress 2017 will be held at Melbourne Town Hall on 27-28th February 2017. The event will bring together over 500 people from community energy groups, renewable energy developers, policy makers, network companies, retailers, councils, NGOs and regulators, and more. The ATA is a proud co-organiser of the congress.

To register go to: c4ce.net.au/congress

ATA SHOP – SHOP.ATA.ORG.AU

BECOME AN ATA MEMBER

Have *Sanctuary* delivered to your door, access all the *Sanctuary* back issues online for free and get access to ATA's independent sustainability advice service by becoming an ATA member. You will also be supporting ATA's research and advocacy for a sustainable Australia. Join before 21 April 2017 and you will be in the running to win an Enphase Home Energy Solution (home battery system) valued at up to $7000.

shop.ata.org.au/product-category/ata-memberships

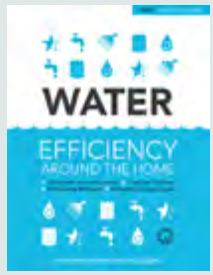
RENEW 138

This issue of *ReNew* looks in detail at roofing materials and roof design, including green roofs, as well as external shading options for windows. It also looks at vertical gardens as a way of getting greenery into small spaces, and reusing building materials creatively in the garden. Also 100% renewables for Australia, an EV owner's insights into charging, DIY wicking beds, islands leading the way in sustainability and much more!

Price: $8.95 for print version or PDF.
shop.ata.org.au/shop/renew-issue-138

KIRI LOW-FLOW SHOWERHEAD

Don't forget when you are renovating your bathroom to install a water and energy efficent showerhead. The Kiri low-flow showerhead provides a great shower with a flow rate of less than 4.5 litres per minute, saving water and the energy used to heat it. Designed for optimum water droplet size and pressure to give you a pleasurable showering experience. Price: $132.35 ($112.50 for ATA members) shop.ata.org.au/shop/kiri-satinjet-ultra-low-flow-showerhead-rose-mount



WATER EFFICIENCY AROUND THE HOME

The ATA's *Water Efficiency Around the Home* e-book is loaded with information to help you save and store water throughout the home and garden. Includes a rainwater tank buyers guide, water-saving toilets, how to keep your rainwater clean, smart water monitoring, plumbing best practice, water features and greywater systems. Help save water this summer and learn useful tips for DIY projects.

Price: free to download for ATA members, $5 for non-members: shop.ata.org.au/shop/water-efficiency-ebooklet

ATA

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, sign up to ATA updates online at **www.ata.org.au**.

Optimise your solar

WORDS

Mick Harris

There are now over 1.6 million solar power systems sitting atop Australian roofs, but do you know if yours is working properly? ATA founder and solar PV pioneer Mick Harris helps you find out.

SOLAR PANELS NEED VERY LITTLE MAINTENANCE. THIS IS great, but can mean they are taken for granted and problems can go unnoticed even when they significantly reduce the benefit you get from the solar system.

Some companies claim that around half of all solar systems are not performing to capacity. This sounds alarming, but probably includes a wide range of cases from complete disconnections through to panels affected by dirt, which will fix itself with the next heavy rain.

The more serious cases are relatively rare, but can impact your bill significantly. Australian households often pay around $2000 per year for electricity, which many have managed to halve by adding solar. Households still on the high feed-in tariffs can gain an additional benefit of several thousand dollars per year.

There are two easy ways to see if your system is working: check your electricity bill and your solar inverter.

YOUR ELECTRICITY BILL

Your bill can show whether or not your solar system is working: if there is no export showing on your bill there may be a problem. Often your panels generate more electricity than you're using, for example when you're not home during the day. The excess electricity is automatically fed in to your local electricity grid, earning you money. Your bill will show this feed-in as a separate item, see Figure 1. (The rare exception is if your local grid can't cope with your excess, so the local electricity distributor has required your solar installer to add a device blocking all feed-in.)

YOUR SOLAR INVERTER

The solar inverter is a 'box' that takes electricity from the panels and feeds it to your switchboard. It's often located on the wall near the switchboard at the front of the house or it might be in the garage or at the side of the house. They come in a range of colours – red, blue, grey and off-white are all common.

Most have a few lights and a small LCD screen on the front. The screen will generally tell you the power being produced at that moment, measured in watts (W) or kilowatts (kW). Most of them have a button that you press to scroll through other information. If the inverter is showing a strange message instead, it's likely your solar system is inoperative (refer to the ATA's Solar FAQ for some examples of error messages: www.ata.org.au/news/solar-frequently-asked-questions). Inverters work quite hard and like any electronic equipment do not live forever; 10 years is a reasonable lifespan. Inverters shut down at night.

IS IT GENERATING AS MUCH AS IT SHOULD BE?

When your system was installed, it was rated to generate a number of kilowatts of power. You'll find this on the quote and other paperwork, but if that's not available it can be tricky to work out the system's rated power. Each panel's rated power is on its label, but of course they are on your roof! As a rough guide, recently installed systems have 3 to 4 panels per kilowatt of rated power. For example, if you have 16 new-ish solar panels, your system's total rated power is probably 4 to 5 kilowatts. Panels have increased in size and power – most systems installed before 2010 needed about 5 to 6 panels per rated kilowatt.

If your home is well insulated and well sealed, like this house designed by Jerry Wolveridge featured in *Sanctuary* 17, it may be worthwhile to run your reverse cycle air conditioner during a sunny day, leaving the living spaces comfortable well into the night. Image: Derek Swalwell

Don't be surprised if your inverter is reporting less than your system's total power, as this was rated under laboratory test conditions of bright, direct sunlight and cool air. Such conditions are rare in the real world. For example, if you checked your north-facing solar system at midday on a clear, sunny day, the inverter might report 80 per cent of the system's rated power, however if it's generating only 50 per cent or less for a few clear days in a row there is likely to be a problem.

Many solar system panels are organised in two separate groups (or 'strings'). If your system is generating only half what it should, perhaps one group has become disconnected.

COMPARING WITH THE NEIGHBOURS

One way to check your system's performance is to compare it against a similar system nearby. A good measure is the total energy your system generated on a particular day, measured in kilowatt-hours (kWh). Most inverters report this number, often under a heading such as 'e-day'. It's best to check daily energy near dusk, when the inverter is still operating but there's very little generation to come.

Many solar enthusiasts have computers continually monitoring their generation and uploading it to a free community website called pvoutput.org. On this site you can search for a solar system within say 20km of your postcode, and see how much energy they generated yesterday in kWh (see the ATA Solar FAQs for details on how to find this).

For example, if your inverter reported that yesterday your north-facing 3kW solar system generated 12.1 kWh of energy. And someone in the next suburb has a 4kW system (also north-facing) that generated 16.3 kWh yesterday. Allowing for the fact that their solar system is bigger, the two systems performed similarly. If you find that your solar system is performing much worse than comparable systems, there may be something wrong.

POSSIBLE CAUSES OF UNDER-PERFORMANCE

Most people with panels on a decent tilt (say greater than 10 degrees) find the panels self-clean in the rain. However this does vary with microclimate. If dirt, bird droppings, moss or other materials build up on the panels to the extent that they reduce the system performance, panels can be washed down with water with the help of a soft broom if required. Do not use detergents. It is best to avoid climbing on a roof for safety reasons; many companies offer panel-cleaning services.

A small amount of shade can have a big effect on performance. As well as the obvious trees, watch out for antennas, power lines and creeping vines. Shade may occur only at certain times, for example winter afternoons.

If your system especially underperforms on hot summer days, your inverter could be overheating. Ensure the heat sinks (fins) on the back or top of the inverter are clean and nothing is stored on top of the inverter. If it's mounted on a sunny wall, you could consider installing an awning to give it some shade.

Panel quality failures are more serious problems, such as 'yellowing laminate' and 'micro-cracks' (also known as 'snail trails'). In cases like these, try to get the panels replaced under warranty. →

There are two easy ways to see if your system is working: check your electricity bill and your solar inverter.

SITE INSPECTIONS

A number of companies offer on-site solar inspection services. If you were happy with the original installer, ask them to come back and do the service. If not, you could look online for someone who specialises in this or for a local company willing to do a service.

Some companies are charging around $400. This is too much, I would suggest $200 to $250 is more reasonable. It is worth asking if the service provider uses their own electricians. If they sub-contract the quality of the service could be less, as the contractor may want to rush in and out as quickly as possible. Even if your system is performing well, it's a good idea to get your system professionally checked periodically, perhaps every five years. This would include checking electrical connections and panel mounting.

ONLINE MONITORING

There are some companies offering remote monitoring services for your solar power system. These will probably give a handy program or app that gives you statistics or charts, and perhaps automatically alert you if they detect that the performance has suddenly dropped. Identifying the cause of the problem is trickier. Some services claim they can diagnose some faults from their distinctive effect on patterns of solar generation, but to really understand the cause and fix it you'll still need a site inspection. Many solar installers can add remote monitoring at the time of install.

OPTIMISING YOUR SOLAR BILL SAVINGS

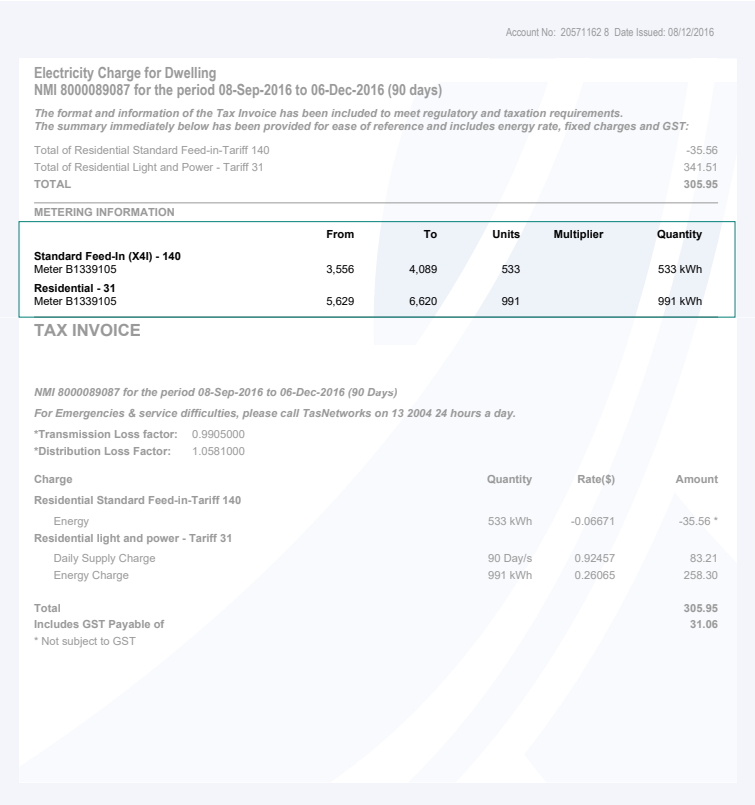
Unless you have a feed-in tariff greater than your retail cost of buying electricity from the grid, solar electricity gives the best savings when it powers your appliances directly. So if practical, run your energy-intensive appliances during the daytime. For example, hot water uses a lot of energy, so you could use an electric hot water system (or a heat pump) running on a timer from 11am to 5pm. Water pumping is another prime candidate, for example irrigation or pool filtration.

If your home is well insulated and well sealed, it may be worthwhile to run your reverse cycle air conditioner during a sunny day, leaving the living spaces comfortable well into the night. The ATA has an independent advice service to help households optimise their systems in this way.

Batteries can also save your excess solar for use in the evening. For more information on batteries and if they are right for you, see recent articles "Just add batteries?" and "How green is my solar" in issue 137 of *ReNew* and "Should you quit the grid?" in *Sanctuary* 37.

REPAIRS AND UPGRADES

In the worst case, a failed or underperforming system may need to be repaired. The solar industry is developing quickly, so in practice it can be hard to repair, replace and upgrade systems because the original panels are no longer available. Also the replacement inverter has to be compatible with the panels. In recent years, safety standards for solar systems have increased, so a solar installer repairing or upgrading your system should take it up to current electrical standards. This may be expensive in some cases.



Account No: 20571162 8 Date Issued: 08/12/2016

Electricity Charge for Dwelling
NMI 8000089087 for the period 08-Sep-2016 to 06-Dec-2016 (90 days)

The format and information of the Tax Invoice has been included to meet regulatory and taxation requirements.
The summary immediately below has been provided for ease of reference and includes energy rate, fixed charges and GST:

Total of Residential Standard Feed-in-Tariff 140	-35.56
Total of Residential Light and Power - Tariff 31	341.51
TOTAL	305.95

METERING INFORMATION

	From	To	Units	Multiplier	Quantity
Standard Feed-In (X4I) - 140 Meter B1339105	3,556	4,089	533		533 kWh
Residential - 31 Meter B1339105	5,629	6,620	991		991 kWh

TAX INVOICE

NMI 8000089087 for the period 08-Sep-2016 to 06-Dec-2016 (90 Days)
For Emergencies & service difficulties, please call TasNetworks on 13 2004 24 hours a day.

*Transmission Loss factor: 0.9905000
*Distribution Loss Factor: 1.0581000

Charge	Quantity	Rate($)	Amount
Residential Standard Feed-in-Tariff 140			
Energy	533 kWh	-0.06671	-35.56 *
Residential light and power - Tariff 31			
Daily Supply Charge	90 Day/s	0.92457	83.21
Energy Charge	991 kWh	0.26065	258.30
Total			**305.95**
Includes GST Payable of			**31.06**

* Not subject to GST

Figure 1. Your electricity bill can show whether or not your solar system is working: if there's no export showing on your bill then there may be a problem.

Finally, if you have a good feed-in tariff, upgrading your system could result in you losing your attractive feed-in tariff as repairs are only permitted to replace 'like for like'.

In some cases, repairing a system can cost more than the cost of the original system. This is particularly common where the system was very cheap in the first place. The old adage 'you get what you pay for' applies here.

Solar is a wonderful thing. About 10 years ago a 100-watt solar panel cost about $1000. Today the same panel would cost around $100 which is a massive change. With prices now so low, don't hesitate if you have a system that is hard to repair: buy a new one and bask in the joy of making your own power and paying less to energy companies.

Mick Harris is director of one of Victoria's leading sustainability retailers EnviroGroup/Environment Shop. He is also the founder of the Alternative Technology Association (*Sanctuary's* publisher) where he continues to provide independent technical advice to ATA members and supporters.

How to avoid common sustainable design mistakes

Making mistakes in a building project can cost time and money, and leave you well short of the energy-efficient home you planned for. Verity Campbell asks four experienced designers about their top tips for avoiding the most common pitfalls.

BUILDING OR RENOVATING A HOME CAN BE STRESSFUL. There are many things that can, and do, go wrong: subterranean 'surprises' when the first sod is turned, challenges getting the design through planning regulations, and budget and time blowouts, to name a few.

Aiming for a green home adds another layer of difficulty, so here are some tips from the experts to help you achieve a smoother, more enjoyable and stress-free project.

SIMONE SCHENKEL

The first step to getting it right is finding the right team to work with, says Simone from Gruen Eco Design. You need to separate those claiming sustainable design knowledge from those who actually have it. "If a designer or architect says 'we're going to put in a rainwater tank and solar hot water and have a six-star house,' that's already a good indication they don't know what they're talking about," she says. And if they tell you that all you need is the legal minimum requirement for insulation, you know they're not aiming for best practice. You need an architect or designer who knows everything there is to know about passive solar design.

Another thing to look out for is cost cutting. "When you have a limited budget, you sometimes have to be innovative or more involved in the whole process if you want to build a really energy efficient house." This means being involved in sourcing materials, including checking from the outset how amenable the builder is to using salvaged materials or to get your preferred companies (third parties) involved in the construction. It might also mean overseeing the window company to get your new highly energy efficient double-glazed windows installed properly to guarantee their performance. "Some builders are a bit hesitant about this when it comes to their insurance and their warranties."

Simone recommends you make sure insulation and gap sealing is done properly during the build, to ensure that the performance you're paying for and expecting is the performance you'll receive. She says you should insist insulation be checked onsite, and audited if possible. "I would recommend engaging specialist insulation contractors – a third party – to install and certify the insulation."

SID THOO

Sid Thoo from Sid Thoo Architects says it can help to choose a builder who has a portfolio of sustainable homes. "However, this is no guarantee in itself," he cautions. "I was once involved in a project where the builder appeared to have a strong history, but it turned out it was the business partner, who had left, who actually had the experience." And, he advises, don't overlook the younger generation of builders who are passionate about building more sustainably, even though they may not have much experience.

Sid also suggests homeowners ask "pointy" questions of prospective architects or designers in those early meetings. Questions like: "How will you manage construction waste on site? Will you spend the time to get multiple quotes? Do you know about more sustainable options or selections?"

When putting together the design brief, Sid recommends homeowners identify priorities and must-haves, and budget accordingly. His tip is to create two lists: "One that contains things you absolutely must have in the project (that you aren't prepared to compromise on), and a wishlist of things you would really like to have, in order of priority, but can live without."

For the essential items, get cost estimates and prices as soon as possible and clearly identify what brand, size, model et cetera you want, to ensure these are factored into the construction cost estimates. "If any budget issues come up (and they often do), knowing that these items have been allowed for helps to ensure they don't get left out.

"Don't assume anything: it has to be specified/identified/noted, or it will be missed!" says Sid. Your architect or building designer will create construction specifications that list all the finishes, materials, fixtures and fittings you want to include in the build.

"I would recommend engaging specialist, third party insulation contractors to install and certify the insulation."

- Simone Schenkel

You need to make sure these specifications are comprehensive. "There are many standard or 'off the shelf' specifications in use by industry, but when it comes to sustainability and water and energy efficiency inclusions, you'll really have to write your own to make sure you get exactly what you want."

PENNY GUILD

Guild Architects' Penny Guild says it's important people understand the difference between thermal mass and insulation to help them choose the right architect or designer to work with and to ensure they end up with a home that is thermally comfortable year round.

Penny gives examples of homeowners who have lived in Victorian brick homes, remembering how cool they stay in summer. "They think that's the brick acting as an insulator, whereas it's actually the brick acting as thermal mass (and once it heats up it will take a long time to cool down)," she says. The confusion is completely understandable, though: "When I'm tutoring, I see architecture students struggle with the difference between mass and insulation, and I think a lot of architects don't fully understand the difference either."

People need to be aware that requesting a brick house with lots of concrete and expecting it to be thermally comfortable year round can be challenging. "You've got to be thoughtful about where the mass is and whether it can be exposed to sun or other passive heating source in winter particularly. And if you've got mass, it's got to be insulated on the external side," she adds. And don't forget that in cooler climates, heating is the larger part of the energy load on your house: too much glass on a cold night is going to "suck all the heat out of the room".

Penny also advises homeowners to think about how, where or even if they will use timber. "Everyone loves the look of timber," she says, "but you have to understand how much maintenance timber requires." Clear finishes on exposed external walls require refinishing at least every year, if not more often. The orientation of your wall will also affect how much maintenance it will need, she says. This means the building will weather differently – and even if you opt for a low maintenance, natural finish that greys over time, you're still going to get uneven weathering. "Anywhere there's an eave is going to weather differently to walls without eaves."

"Timber sourcing is a really interesting one, too," she adds. "It's really hard to source sustainable hardwood timber in Australia. Every timber supplier says their timber is 'sustainably sourced' and there's a lot of greenwash." Penny recommends people consider opting for other timber products such as recycled timber, finger-jointed Australian-grown plantation pine, or composite and reconstituted products that ensure every part of the tree is used.

SVEN MAXA

Sven from Maxa Design says homeowners should look out for the hidden costs of using recycled and reclaimed materials. "It seems like a great idea – which it is – to use reclaimed and recycled materials in a project, but homeowners need to be aware that using these materials can increase labour costs." Laying recycled bricks takes more time and mortar; reclaiming floorboards is a painstaking process of removal plank by plank, then removing nails and preparing the boards for relaying.

If you're an owner builder, says Sven, you can source, clean and stack recycled materials for your projects – and save on labour costs that way. Or a good half measure, he suggests, is to purchase reclaimed or recycled materials ready for use. "There's not a huge supply, but they're ready to go," he says.

Sven also recommends homeowners make sure they look into minimum allowable house sizes when moving into estates or borrowing from banks. "Sometimes you can't build a house less than a certain size (large!) in an estate and a bank won't loan you money for a new build unless it meets the banks expectations on size and cost."

He also recommends homeowners and their designers make proper allowances for sustainable technology from the earliest stages of design. "There's no use deciding on a 10kW solar panel system if you haven't allocated the roof area or right roof aspect in the design," he says. Just as there's no use wanting a blackwater waste treatment system if you haven't given due consideration to access on the site. "It's important when you're meeting prospective designers for the first time that you're asking these questions, and looking for their experience in these areas," says Sven.

He also suggests homeowners look to the future when planning their build or renovation. "We advocate for a fabric-first approach. Forget the interior finishes to a degree and invest in a great quality build with the best windows you can afford. You can renovate a home over time but, realistically, you are never going to redo that fabric. Build it once with really good integrity and you've got great bones to build on into the future."

Verity Campbell is a communications consultant, freelance writer and trainer with extensive experience working with architectural and design firms.

Design workshop: Passive solar strawbale

Details

PROJECT TYPE
New build

LOCATION
Wentworth Falls, NSW

LAND SIZE
2800m²

PROPOSED HOUSE SIZE
175m²

BAL (BUSHFIRE ATTACK LEVEL):
BAL-29

BUDGET
$350-400,000

The Brief

- Comfortable, energy-efficient, passive solar family home
- Allow space for food-producing permaculture garden
- Sustainable, low maintenance materials, ideally able to be recycled or composted at the end of a long life
- Design to minimise chance of loss in bushfire

Leaving their busy city lives behind them, Lisa and Shawn are planning an energy-efficient strawbale home and productive permaculture garden on their newly purchased block in the Blue Mountains. Architect Ian Sercombe responds with some design tweaks to maximise garden space and tie the house and garden together with efficient circulation paths.

NAMED AFTER ONE OF THE LEADERS of the 1813 expedition to find a way across the Blue Mountains into the unknown interior of New South Wales, Wentworth Falls is a quiet town 100km west of Sydney, surrounded by waterfalls and scenic lookouts. Looking for a change of pace, Sydney professionals Lisa and Shawn recently bought a tranquil bush block here. "The Blue Mountains is a stunning part of the world, without the crowds, traffic and noise of Sydney, yet it's close enough to family and friends still in the city," says Shawn.

The couple already spend most of their weekends escaping the city, and are keen advocates of permaculture, suburban food gardens and living sustainably. "We chose our block for its size, its flat and north-facing nature, quiet location, and access to potential [local] employment opportunities. We prioritised these attributes to help keep building costs down and allow for a passive solar design, as well as being helpful for a future food-producing permaculture garden," they explain.

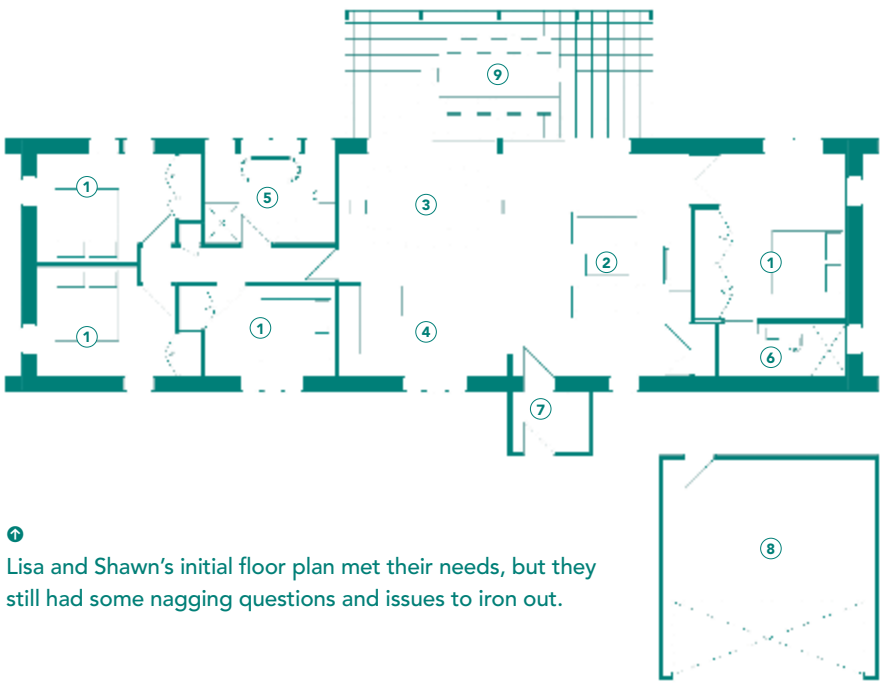
Working together with an architect, Shawn and Lisa have designed a simple rectangular home for their bush site, running east-west to maximise north sun to as many rooms as possible. Although it will have four bedrooms (to accommodate visiting friends and family on weekends, and possibly children in the future), it will be relatively modest in size at 175 square metres.

A steel frame will be infilled with strawbale, for its low embodied energy, renewable nature and compostability at end of life; a polished concrete slab floor will provide thermal mass; and the roof black Colorbond: "We believe it will add warmth, and understand that the mountains require more heating than cooling," Shawn says. They plan to install a heat pump for hot water and some sort of eco-friendly wastewater treatment system as there is no sewer connection available.

With some questions still left to iron out, we've asked Ian Sercombe, an architect specialising in energy-efficient design, rammed earth and low toxicity materials, to comment on Lisa and Shawn's proposed design and help them achieve their planned "comfortable, energy-efficient and environmentally considered family home".

Lisa and Shawn's 2800 sqm block in the Blue Mountains is level and treed, with a Bushfire Attack Level of 29 (medium). They bought it "for its size, its flat and north-facing nature, quiet location, and access to potential employment opportunities".

ORIGINAL FLOOR PLAN



Lisa and Shawn's initial floor plan met their needs, but they still had some nagging questions and issues to iron out.

N

LEGEND

1. Bedroom
2. Living
3. Dining
4. Kitchen
5. Bathroom
6. Ensuite
7. Entry
8. Garage
9. Terrace

IAN'S RESPONSE

The clients have a sound brief focused on energy efficiency and clearly understand passive solar design and have researched the local council's development control plan and requirements regarding bushfire to come up with an effective plan. And the floor plan looks to have addressed the client's brief and budget well. However, this being a design 'workshop', my response offers an alternative solution, particularly taking into account other factors such as the requirement for a large vegetable garden and circulation paths in and around the home.

ORIENTATION

Like the original response, I have organised the primary living spaces to the north, as well as the master bedroom. The block lends itself to creating an east-west plan, maximising the possibility for getting direct winter sunlight into the living spaces as well as making the most of the views to the north of the site. A pergola to the north with a deciduous vine will assist in minimising summer heat gain.

FLOOR PLAN

I have pulled the dwelling as close to the street as possible to maximise the backyard and garden area. The carport, with large storage area, is placed adjacent the covered entry, making it easy to get shopping or kids out in a covered space and into the house under cover. I like a carport as they tend not to get used as store rooms that result in the cars being parked on the driveway. This means the cars are always in the shade or out of the rain.

To the north of the carport is a covered patio area. This area would house storage for garden and chook needs, and washing machine and a table and chairs. There would be a servery bench off the kitchen window. Having this area directly connected to the carport makes it easy to move sacks of chook feed, organic fertilisers or tools between car and storage area. If the clients plan to sell their produce one day, it's easy to get it into a vehicle from here.

The kitchen is placed to the north and serves as the hub of the home. It connects to the entry, dining and living spaces, covered patio, pergola to the north and the permaculture gardens. With so much time spent in kitchens this location makes it convenient to orchestrate the day's events, supervise kids in the north yard and easily access the zone 1 herbs and vegetables for each meal.

Bedroom 4 is located close to the entry to conveniently serve as either a study or guest room.

FLOORPLAN

With the east-west orientation it's easy to get natural direct winter sun to the primary living spaces. With the block being quite large even the south facing windows will receive plenty of natural daylighting. Windows to the east and west have been minimised to mitigate summer heat gain, but exist to improve cross ventilation through the spaces.

BUILDING FABRIC

The clients are keen to use strawbale. This is an excellent choice for the Blue Mountains area. The high insulation it provides, combined with the thermal mass in its finishing will make for a very comfortable home. It's important to provide plenty of protection to the walls due to the possibility of intense rainfall. The floor would be a ground coupled concrete slab serving as a solid area of thermal mass.

GLAZING

Double glazing in this climate is most valuable. I would recommend using double glazing throughout, which will complement the straw bale wall construction. Ideally the window frames would be hardwood or a thermally broken aluminium frame. Using double glazing should be a priority over other 'luxuries' in this climate.

ENERGY

Using a gable roof form, there is plenty of room for a solar PV system. The size of it and the metering would be determined based on the amount of time the clients spend at home throughout the day. It may be worth considering a hybrid system with batteries.

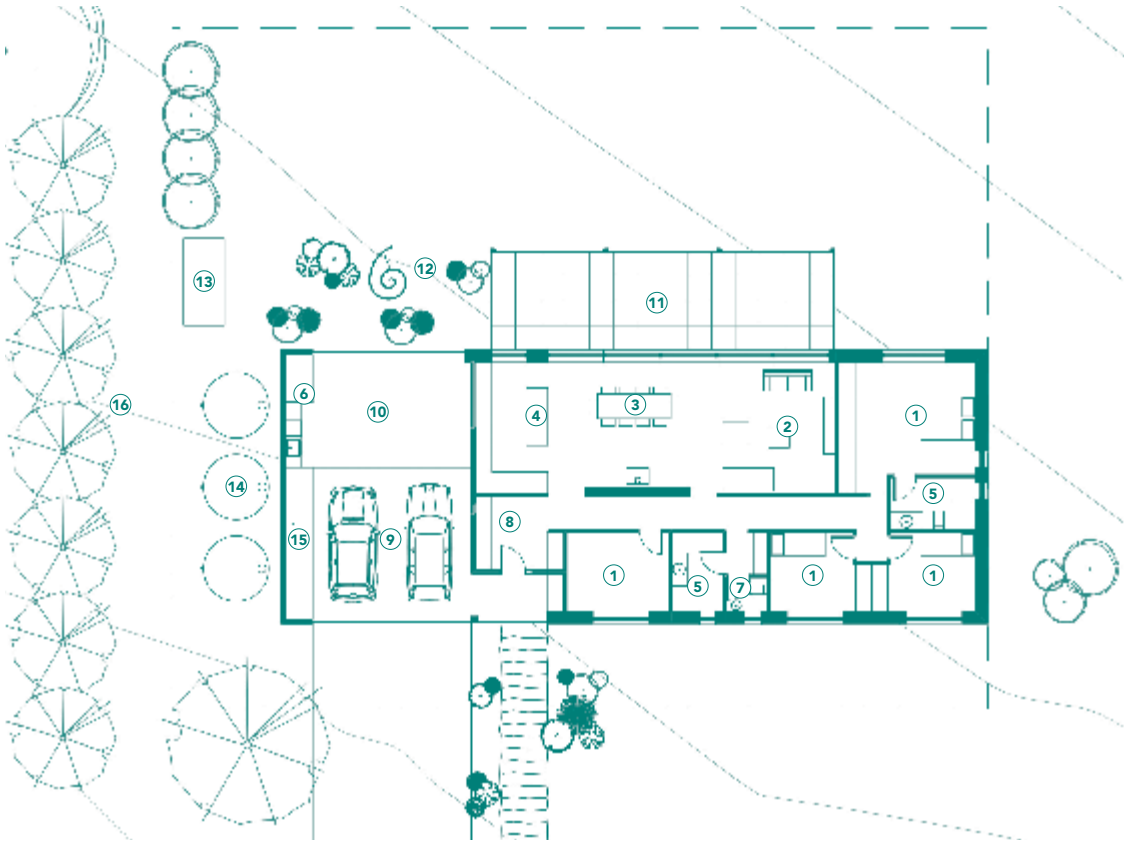
INSULATION

With the external walls being strawbale, insulation is covered. The roof/ceiling should be insulated with natural batts at about R4.0. The slab edges should also be insulated.

HEATING AND COOLING

Having a steady source of timber around the property, a centrally located woodburning heater would work well. It should be located in front of a high mass wall. I would also recommend a model with a small oven underneath and area on top to cook. This provides an opportunity to boil water, make soups or bake bread or pizzas while burning fuel for warmth.

ALTERNATIVE FLOOR PLAN



LEGEND

① Bedroom
② Living
③ Dining
④ Kitchen
⑤ Bathroom
⑥ Laundry
⑦ Toilet
⑧ Entry
⑨ Carport
⑩ Utility space
⑪ Terrace with pergola
⑫ Garden
⑬ Chookpen
⑭ Water tanks
⑮ Store
⑯ Fire retardant trees

With the home being well oriented and with a highly insulated external fabric, additional heating requirements to the wood fire would be minimal. My preference is socks and a jumper for additional warmth; however, Lisa and Shawn might consider in-slab heating if the budget can accommodate it. For cooling it would be worth considering ceiling fans.

HOT WATER

The roof is perfectly oriented to accommodate a solar hot water service. Combining this with an electric booster will assist in reducing water heating costs. When installing, it's worth having a booster switch located near the kitchen so the boost is only used during extended periods with no sun.

WATER AND GARDEN

Lisa and Shawn have advised they will be constructing a permaculture garden. I have placed this to the north, private side of the dwelling. Zone 1 would ideally be close to the kitchen and covered patio area, making it easy to access basic herbs and vegetables as well as collect eggs daily.

I've proposed water tanks along the western end of the dwelling. This means both sides of the gable roof can drain directly to the tanks without the need for charged lines. With a water pump also being located next to the tanks it's a sufficient distance from the main living and sleeping areas to minimise noise.

Ian Sercombe is Principal of an architectural practice specialising in energy-efficient architectural solutions for residential and small commercial projects.
www.isarchitect.com.au

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Green roofs

GETTING PAST FIRST BASE

Many green roofs don't get past being a 'good idea', but with some knowledge and planning you can follow through on your desire to green up high, writes Dick Clarke.

WORDS Dick Clarke

GREEN ROOFS ARE PLACES WHERE nature can thrive in spaces we don't usually use for any other purpose. And they are rightfully catching on around the world as more people recognise the benefits of bringing living greenery into what would otherwise be hard environments. But too few residential green roof projects get further than the drawing board, and often because of avoidable obstacles encountered in the design and planning process.

Before we get into the 'hows' of green roofs, it's important to first consider the many good reasons to include one at home.

WE NEED MORE URBAN GREENERY

Traditionally, increasing density has come at the expense of nature but this need not be the case. There is space to recreate natural systems between, on the sides of, and on top of our buildings. There can be many drivers for this, including government policy.

In Singapore, the government set a target of 50 per cent tree cover in what many people think of as a small island covered in high-rise. Their 2003 master plan *A City in a Garden* set the framework that is evident today, where the population has nearly doubled since the 1980s, yet the total green cover grew from 36 to 47 per cent. With over 90 per cent of Australians now living in towns and cities (and New Zealand isn't far behind that percentage), we're starting to think along these lines with the 202020 Vision that aims for 20 per cent more urban green space by the end of this decade.

Improved building performance

It is intensely interesting when buildings engage with plant life externally and internally. And green exteriors help to cool buildings too, so it's an obvious strategy to wrap as much of the exterior as we can in suitable plant life.

This works by reducing the direct solar gain, by both the shading from foliage and the presence of the soil or planting medium. The shading provided by the foliage reduces the direct solar gain to the materials below, and it stands to reason that the more foliage, the greater the effect. So turf will have less of a shading effect than shrubs and trees. The extra insulation provided by soil or planting medium will also vary according to depth. Earth-covered houses, where the soil is a metre or more deep, are legend for their year-round stable temperatures, yet even a non-soil, lightweight planting medium will have a beneficial effect.

A recent report in the *Environment Design Guide* (environmentdesignguide.com.au) showed shallow extensive green roofs could reduce heat transfer and provide a saving for cooling – up to 37 per cent annual heating and cooling energy saving in Perth and 10 per cent savings in Melbourne. The very act of transpiration and photosynthesis uses energy, which is coming from sunlight, so it stands to reason that a living green roof will absorb and use more solar energy than an otherwise identical fake one.

Psychological & emotional benefits

Introducing greenery into our immediate surroundings has a hugely beneficial counter-effect, improving mental and physical health, raising workplace productivity, and leading to a better understanding of our place in the web of life. It is consistent with and complementary to biophilic design – where the very forms and features of the building are designed to mimic or respond to nature. Passive solar design is the most fundamental expression of biophilic design, and green roofs (and walls) fit hand in glove with it. Thankfully planners, architects and developers are getting in on it too.

OVERCOMING OBSTACLES

Despite the benefits, there are any number of reasons why green roofs fail to happen, especially for residential buildings, even when a green roof is the most appropriate design solution. →

Completed last year, these award-winning townhouses in Angel Street, Newtown, NSW, were built by Steele Associates to incorporate native, low maintenance green roofs for thermal and acoustic insulation. Among other energy- and water-saving features, each house has extensive window shading, solar power, energy monitoring and 8000 litres of rainwater for irrigation, flushing and washing.

Planning issues

Planners often advise against approving greenery on otherwise hard dry buildings. The reason is that in the past, poor technical design and lack of ongoing management have resulted in greenery dying, hanging limp and brown, and not having the desired effect at all. However, in my experience these cases are few, and the risk is now low thanks to a wider and deeper understanding of how to design for ease of maintenance, and the ready availability of on-demand irrigation systems.

Even though green roofs contribute to the greening of urban spaces, most planning controls do not recognise them as 'landscaped area' unless there is natural soil of one metre depth or more. This means 'extensive' green roofs with a thin layer of growing media (up to 200mm deep) are excluded despite providing a lot of benefits, and only some 'intensive' green roofs (soil over 200mm deep) are able to take full advantage of the planning rules; this is a reason why we do not see as much greenery as say in Singapore.

Things are changing (very) slowly. Greenstar is now awarding a point for a green roof and some local governments are starting to recognise the benefits of green roofs storing significant amounts of water, which reduces run-off entering sewer systems and waterways.

Technical considerations

We now have lightweight planting media and integrated irrigation systems available virtually off the shelf, which means we no longer need to consider green roofs as part of 'massive structures'. It is quite possible to have saturated roof mass loads of less than 120kg per square metre when mature, which lightweight structures can easily accommodate. The waterproofing and associated detailing is very straightforward, yet may be seen as an obstacle by builders and tradies, affecting cost.

Lightweight planting media need constant irrigation, although at low rates. Providing the infrastructure for this is straightforward, but on some sites providing the necessary stored rainwater may not be and should be considered at the earliest concept design stage. The *Growing Green Guide* can be downloaded for free and can help you iron out any concerns.

Costs

There is no doubt that green roofs cost more than a conventional tile or metal roof, and this is the most common reason green roof projects do not proceed. Incredibly, waterproofing issues are still the most common building fault and cause for consumer complaint in Australia, whether in bathrooms or balconies, and the last thing anyone would want is a planted roof failure. Therefore, most builders take the waterproofing seriously, but also see it as a major cost centre. Good planning and design can overcome these issues: a green roof arguably protects the waterproof membrane. And inexpensive leak detection systems are available to manage risks.

The cost of the planting material and irrigation equipment must also be considered early on in the budgeting.

Ongoing management

It's a fact that commercial and and multi-residential buildings are managed better than the average house, because they have a professional manager whose job it is to see that all systems are functioning and maintained. Single residential buildings generally rely on the owner or occupier, with ad hoc results. The fear of failure, or the worry about the time and cost involved in looking after a green roof, puts some people off. This is also part of the reason some planners are reluctant to support applications that contain small-scale green roofs. There are many gardeners and companies that offer great maintenance services, but with automated irrigation and appropriate soil and plant selections management problems can be averted (see Elke Haege's article on page 85).

Renovation difficulties

It is good to look for opportunities to green buildings any time anything is done to them. Although existing buildings can be structurally augmented to accommodate a green roof, we have seen several cases where an owner is keen to incorporate a green roof in their renovation, only to be thwarted by the limitations of the existing structure (even for extensive green roofs that can be relatively lightweight). Retaining the existing structure, and thus reducing cost and material consumption and waste is the main reason to renovate rather than rebuild. Therefore this may be an unavoidable obstacle and, while frustrating, we should remember that not everything is possible for every site!

FUTURE IS GREEN

As we move towards medium and high density living, it is increasingly important to bring living nature with us. One of the best examples is in Milan, Italy. Two residential towers designed Stefano Boeri, which he calls a 'vertical forest', contain as many trees as one hectare of forest. There are a mixture of large and small trees, with 5,000 shrubs and 11,000 floral plants, and the design team claim these will absorb dust in the air, helping to clean the city's air. "This is a kind of biological architecture that refuses to adopt a strictly technological and mechanical approach to environmental sustainability," says Boeri Studio. Central Park in Sydney is an Australian example of this kind of larger-scale living architecture.

Green roofs are what we need to see more of, along with green walls and planted balconies, and tree-lined boulevards. The future will be 'green' in all senses of the word, and no builder, developer, or planner, or government should try to convince you it should be any other way. Ⓢ

Dick Clarke is principal of Envirotecture, a sustainable building design firm in Sydney.

Image: Rhiannon Slatter

Gardening up high

We're learning more all the time about what plants can thrive, and survive, on rooftops. Elke Haege shares the latest research on your best soil and plant options for living roofs.

WORDS Elke Haege

TO SURVIVE THE HARSH CONDITIONS of rooftop landscapes, certain plants have special adaptations, but it is also critical we provide plants with the right soil and water conditions.

Success or failure with a rooftop garden will most likely come down to your choice of soil and the availability of water. Evapotranspiration (water loss) of plants on windy, sunny rooftops can quickly dry plants out. Soil acts as a buffer and rooftop irrigation is essential.

IRRIGATION

I recommend drip (under the surface) irrigation so that the water penetrates down into the soil and encourages deeper rooting by plants. As an aside: consider collecting rainwater that falls on other sections of your rooftop for irrigation – is there space on your rooftop for a water tank? [Bearing in mind the structural support needed for a full tank.]

SOIL VOLUME

The right soil and soil depth will give you a successful landscape (more plant growth, healthier plants, less disease, less plant death, more resilience and tastier produce). This is because plant roots use soil to breathe air, take up water and anchor themselves. A larger volume of the soil provides the nutrients and minerals your plants can tap into which is vitally important on a harsh, windy rooftop.

SOIL TYPE

For rooftop soils you need to consider the topsoil as well as the subsoil (the next layer down). For topsoil, specify E1 (rooftop 'A' Horizon) and for subsoil specify E2 (rooftop 'B' Horizon). Reputable soil supply companies will be able to supply you with these soil types. Make sure you ask for a certificate or letter stating that

The green roof is fitted with a sensitive leak detection system to help avoid extensive excavation if a problem emerges. Green roof contractor Fytogreen was employed to lay the substrate, install the watering system and select and plant the grasses, groundcover and small shrubs that make up the rooftop park. This apartment retrofit project is featured in full on page 63. Images: Sonia Bednar

what is going to be supplied to you meets these specifications. Check that the soil weight meets the parameters of your rooftop. Compliant E1 and E2 soil media are <2400kg/m^3 (2.4kg/L) saturated density (for more detail on this, see *Soils for Landscape Development*, published by CSIRO).

SOIL DEPTH

A good rule of thumb for soil depth on rooftops is to have 300mm as the E1 ('A' Horizon) and 300mm minimum as the E2 ('B' Horizon) for groundcovers and small shrubs. For screen planting, increase the 'B' Horizon to 500mm. For small-medium tree planting, increase the 'B' Horizon to 800mm to give 1.1 m total depth.

TREE ANCHORS

Where taller trees or windy sites are involved, tree anchors may be necessary, it is however important not to penetrate the waterproofing layer when installing these.

MULCH

Mulch helps prevent soil from drying out and provides nutrients as it slowly breaks down. One thing to consider is the amount of wind on your rooftop and if this will send lightweight mulch over the edge. If this is the case, consider larger diameter mulch, such as pine bark. Whichever mulch, make sure it complies with Australian Standard AS4454.

FERTILISING

Given the potentially limited soil volume and the fact your plants don't have natural ground from which to draw trace elements and other nutrients, fertilising is important. Slow release fertiliser with a supplementary liquid fertiliser in spring through to autumn will assist. I have a worm farm on my rooftop and am able to liquid fertilise regularly as well as use the castings and reduce my degradable waste. You may also need to top up the soil yearly due to slumping.

SHADE PLANTS, TREES AND SCREEN PLANTS (SHEPHERDING)

Screen plants or larger plants can help protect and shade smaller plants, like a windbreak in a paddock. Consider: sacred bamboo, lilly pilly, grevillea, citrus trees, kunzea, banksia, dwarf magnolias and dwarf eucalypts.

Climbers on a pergola can also have a good screen/shade effect. Consider: wisteria, grape, flame vine and bougainvillea

BRINGING LIFE TO THE ROOFTOP

Birds will soon find your rooftop if you provide food and shelter (and water) for them. Most pollinator insects will likely find your rooftop, as long as the journey to get there isn't too exposed or too high. As a rule of thumb, greater than five storeys (from what I have observed) means fewer pollinators.

WINDY ROOFTOPS

When planting out a windy rooftop consider: groundcovers such as native fan flower, daisies, salvia, convolvulus, star jasmine, pelargonium, geranium and pigface; or low shrubs like rosemary, grevillea, coastal rosemary, large leaf jade, kangaroo paw, hakea, tea tree, lavender, bird of paradise. You can also select edibles including oregano, marjoram, flat leaf parsley, cherry tomatoes, thyme and sage.

MORE INFO

Have a chat with your local nursery to find out what plants do well in your area. Experiment and have fun with your rooftop/balcony planting.

Elke Haege is a landscape architect and consulting arborist, and co-author of *Soils for Landscape Development: Selection, Specification and Verification*, CSIRO Publishing. She's been involved in a research project with Arup and Ecosystem Architecture where they have designed a working case study called VSU (Vertical Sustainable Urbanism).

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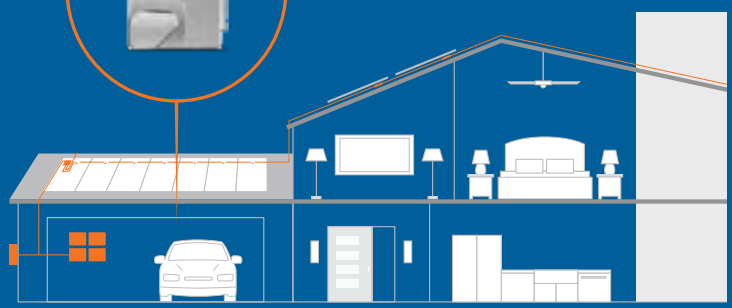

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Natural pools

Natural pools are designed to minimise the environmental impact of backyard bathing, and are aesthetically beautiful too. With hundreds of these systems now installed in Australia, we find out how they work.

WORDS Kulja Coulston

SWIMMING POOLS CAN GET A BAD rap when it comes to sustainability, notwithstanding their benefits for recreation and health. Their ongoing energy and water use can be immense, even for pools that are used sporadically.

But a growing number of households are changing this equation by installing chemical-free natural pools that use filtering systems that mimic nature. Rather than using chlorine to kill everything in the pool (except the swimmers!), a sustainable water quality is achieved by creating a balanced ecosystem.

Frances Cosway has included a natural pool in the garden of her sustainable home in Hampton, Victoria. "I always refer to it as our water feature that you can swim in," says Frances. "It's like swimming in a lake. There are tadpoles in there at the moment and dragonflies everywhere."

The pool is nestled in a thriving native garden and in the natural setting looks like it's always been there. Large boulders are used to form the pool edge, and water lilies and other aquatic plants grow out into the swimming space. The rounded pool shell itself is concrete with a layer of fine, sand-like pebble mix to blend in with the rocks. Rather than artificial blue, the crystal clear water is jewel-green. "The kids love swimming in it. For me, it is aesthetically beautiful all year round," says Frances, but emphasises that it's not for everyone. "A lot of people prefer blue pools that look very structured."

Frances and her partner opened their home for Sustainable House Day 2016 and the pool generated enormous interest. "As soon as you say it has no chlorine, people instantly assume it's salt treated. Most visitors were not aware that you can get a pool with natural water without chlorine or salt."

The term 'natural pool' can describe two different but not mutually exclusive concepts. It generally refers to pools with chemical-free 'living' water. The pool may resemble a pond or look just like a regular pool with a concrete or polypropylene shell, pool tiles and decks; either way, the water is alive and can have a water quality equal to or better than a mountain stream. Less commonly, the term is applied to chemically treated pools that blend in with the surrounding landscape.

Landscape designer Sam Cox, a proponent of naturalistic landscaping, has used both approaches. "What I've always wanted to do is bring the garden right in around the pool. With chemical pools we always had to have a buffer zone. We couldn't bring the plants too close as the splashing would damage the plants," he says. "With natural water, we can bring the plants right into the swimming space."

HOW NATURAL POOLS WORK

The science behind natural pools is well developed. Water is purified using a biological filter and fine filtration in combination with sophisticated hydraulic design, where water is moved constantly and circulated thoroughly. A 'biofilm' of beneficial bacteria lives in the biofilter (and parts of the pool before cleaning), and breaks down any organic matter using nitrification; plants then take up the resultant nitrate in competition with algae.

The constant flow and circulation of water maintains oxygen in the system and appropriate hydraulic design will avoid warm or stagnant patches developing. Good design will also focus heavily on maximising daily water pumping efficiencies: through evaporation these pools will lose a similar amount of water as a conventional pool, but generally use less energy per litre of water pumped.

→

"With natural pools we can bring plants right into the swimming space."

- Landscaper Sam Cox

This natural pool at Frances Cosway's home in Hampton, Victoria, was designed by Sam Cox to look like a natural landscape. The pool itself was built by Natural Swimming Pools Australia: "When we're down there it just feels like we're in a completely different space," says Frances. "We use the pool all year – just not for swimming all year." Photo: Matthew Mallett, image supplied by White Pebble Interiors

Natural pools can be of any size, shape and depth, as long as the design allows the entire volume of water to pass through fine filtration and the biological filter. Creating a stable system is essential but can be tricky – there must be sufficient surface area for the microorganisms to live on (gravel for example) compared to water volume. "Like with a greywater system, we are emulating nature in some way. It's about getting the balance right between water volume and how often it's circulated through the system," explains Sam Cox.

Sam has incorporated dozens of natural ponds, and now pools, into his landscapes over the past 20 years, and says it's important to prioritise client education in order to set realistic expectations. "I grew up in the country where you swim in rivers and dams and lakes, so your expectation is very different compared to growing up swimming in urban swimming pools," he says. "We had one client who thought he wanted a natural pool with natural water but then realised through the process that he was uncomfortable with it. The water in his pool was glass-clear and clean – but there were fragments of algal dust around the edges and he couldn't make that shift."

DESIGN

Depending on how much space is available, a one- or two-pool system can be used: one is the swimming pool; a second is the biological pool and comprises gravel and plants (also known as the 'regeneration zone').

Jeff Knox from River Water Pools in Albury has designed his own two-pool system. His pool has several edges where, using gravity, the water overflows down through pipework to the fine filtration, before travelling through additional pipes to the bottom of the biofilter gravel bed, where it then rises up through the gravel to be pumped back into the pool. "I've used this system for 11 years and the water quality is very clear and good enough to drink," he says. "The fine filtered up-flow gravel biofilter method means my water has a very low nutrient level and the gravel filter has never blocked because the water passes through the fine filter first." Avoiding what a common problem in these systems.

For smaller urban spaces, compact European systems are available. Wayne Zwar of Natural Swimming Pools Australia has built 25 pools in Australia and is part of an international network using the BIOTOP 'living water' filtration system. The filters in these systems are generally tucked under a deck and perform the function of a biological filter without the need for an additional pool.

"Natural pools have been in Europe for over 30 years and we are accessing a lot of knowledge about them. There is a lot of specific equipment required to make these work in a backyard including a fantastic 'biobox' which means we don't need huge gravel beds or plant areas." Costs start at $80,000, but the ongoing costs are negligible. "The bulk of the cost is in the system we import from Austria. There's obviously no ongoing cost for chemicals. The energy use for the pump is low, as we use a 12 volt German pump which is very efficient."

POOL CONVERSIONS AND DIY

It is possible to build your own natural pool or convert an existing pool into a natural pool, but you need to check if yours is suitable first. A number of different companies offer conversion kits to help with this, each using a different system and method.

But be aware that design tips available online may not be directly applicable for your site or climate. In Australia, pools need to be designed to cope with rapid temperature rises through the day and 40-plus degree temperatures in summer.

With an infrastructure investment upwards of $40,000 for DIY, it's risky if you don't understand what you're doing

This natural pool in Talgarno, Victoria, uses plants for aesthetics, and a BIOTOP filter is tucked under the deck: "Algae is not a dirty word for us – we need a form of biofilm for the system to work. We can get natural pools to the point where they are low-maintenance and crystal clear," says Wayne Zwar. Image: Natural Swimming Pools Australia

The water in landscaper Sam Cox's reflection pond is clear and clean, and can be used for swimming: "A formalised pond or reflection pool used to be just for aesthetics, there was always that separation," he says. "Now there's an opportunity to have that, and use it too." Image: Lisa Hatfield

or why you are doing it, according to Jeff Knox. "I have had enquiries from natural pool owners whose pools will not function properly, because the design was flawed from the beginning."

Existing dams can be converted to natural pools, but their location is usually far from ideal – natural pools should never be positioned in spots that receive nutrient-rich surface water runoff.

For those just wanting to make the most of an existing swimming pool, converting it to a natural pool is one option, but there is also a movement in Australia (led by Ku-Ring-Gai council in New South Wales) to convert disused pools into ponds. If the water quality is maintained to a high level, these can also be used for swimming.

All swimming pools need to be built to Australian Standards and you should check with your council before construction. Increasingly local governments are not making a distinction between 'pools' and 'ponds', if the depth is greater than 300mm and they are located next to a house.

MAINTENANCE

Like any system, maintenance is crucial but how much you need to do will depend on the type of system you have, and the desired water quality. As a rule of thumb, over a 24-hour period, the entire body of water will pass through the filters. Water levels can be topped up from the mains or onsite water storage.

Compared to conventional pools, natural pool maintenance is more about time than money. In warmer months, plant and algal growth is at its most prolific, and regular cleaning of filters, vacuuming and other maintenance is required. In cooler months, skimming leaves and general upkeep is still needed. Exceptionally low E.coli readings are possible in a well-designed system, as long as ducks are kept out of the water!

Natural pools can be heated to extend the swimming period. Frances Cosway's pool is geared up for heating, but so far her family hasn't taken advantage and instead uses the pool aesthetically in cooler months: "We use the pool all year – just not for swimming all year."

CREATING AN ECOSYSTEM

While the original desire to swim in chemical-free water came from those with chlorine allergies, people wanting to return something to the environment are now embracing them. "Nature loves these pools," enthuses Jeff Knox.

"What you are creating in your backyard is a small oasis," says Wayne Zwar. "Instead of chopping trees down to put the pool in or paving metres of terracotta around it – by putting one of these in you're building a mini ecosystem. You're encouraging nature, not destroying it – from tiny insects right up the food chain to swallows (with the exception of mosquitos which don't like moving water)."

He adds that this technology is so well accepted overseas that local authorities in England, Europe and the US are now building public pools using natural filtration.

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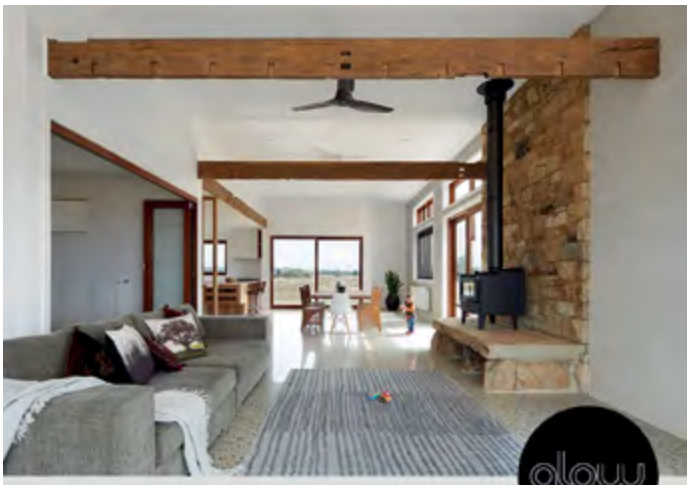

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Ask our experts

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

Tim Adams is principal of F2 Design, a sustainable building design firm based in Melbourne and on Victoria's Surf Coast.
Mick Harris is director of EnviroGroup/Environment Shop and technical adviser to ATA members and supporters.
Dick Clarke is principal of Envirotecture, a sustainable building design firm in Sydney.

Q – Why does a home that is 100m² get the same or similar star rating to that of houses that I have seen that are up to 500m²? And do you see a place for a rating system where smaller homes are rewarded or given a better rating than larger ones as they will more than likely use less energy over the course of years? – *Ben*

A –There is an area adjustment factor built into the NatHERS software. It is a parabolic curve which gives a big boost to small dwellings, then tapers off to zero at 200sqm at which point it starts to apply a penalty score. Consequently, it is much harder to get a 6 Star compliance score for a 500 m2 house than for a 50 m2 apartment.
That said, the system is not perfect and a 300m2, 6 Star house will use close to twice as much energy as a 150m2, 6 Star house even if the air conditioning appliances used have the same COP (coefficient of performance). Conversely, you still need to consider appliance energy efficiency as there are no provisions built into the Star rating – a smaller house could end up using more energy than a larger house with more efficient appliances. – *Tim Adams*

Q – We are looking to buy bathroom vanity units. The units we are considering are manufactured in China. We were told that they are made of MDF-type particle board. Our concern is whether we have to be worried about formaldehyde gas emissions. Would you be able to advise about this problem? – *David*

A – You are right to be concerned. Particle board uses a range of glues in its manufacture and can off-gas a range of VOCs including formaldehyde. MDF also releases very fine dust particles that when inhaled can lead to health problems. While the latter is not a problem to the end user (unless you need to re-cut it), it is a problem for the workers who make it. MDF is being banned in Europe.

You may find you have to buy your kitchen components in Australia if you want to be sure you have minimised VOCs. There are a number of online resources that could help you with alternatives to MDF: Ecospecifier (www.ecospecifier.com.au) has an eco priority guide for kitchens, and the blog at www.mychemicalfreehouse.net is also good for ideas. – *Mick Harris*

Q – We're planning a home for the Wimmera district (western Victoria) and realise that our initial proposal to have limestone external walls then insulation then gyprock prevents walls being used as thermal mass. We are therefore considering other construction methods, incorporating internal stone walls. How would we determine how much thermal mass storage we should have in our location? For internal walls to act as thermal mass, do they have to be either solar exposed or heated by another source (e.g. slow combustion fire)? If yes, we are wondering why there is such an emphasis on reverse brick veneer construction, as in most house plans the southern internal walls will not be solar exposed. And is there any way of quantifying the benefits of thermal mass? – *Anne*

A – A general microclimate design response should work as long as it is typical Wimmera flat country. The variables that come into play when people live in the house have far more effect than whether or not you have a cubic metre more or less thermal mass.

Therefore I would suggest that you aim for as many high mass internal walls as possible, and run your design through simulation software like AccuRate or BERS Pro. Then add a high mass floor and see what difference it makes. You can have hardwood flooring laid over high mass – either engineered timber stuck down to concrete, or traditional tongue and groove flooring laid on battens with grout screed between battens (so the boards touch the grout) all on a concrete slab.

Reverse brick veneer should have direct or indirect solar gain (or another heat source) if the winter period is long and/or cold enough for it to provide benefit. If there is no solar gain, it will still provide passive cooling.

Yes, the walls will need to be solar exposed or heated by another source –but keep in mind that the software runs on certain occupant behaviour assumptions, which are statistically generalised. How you live in the house will make all the difference. – *Dick Clarke*

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