MODERN GREEN HOMES

Sanctuary

ISSUE 45

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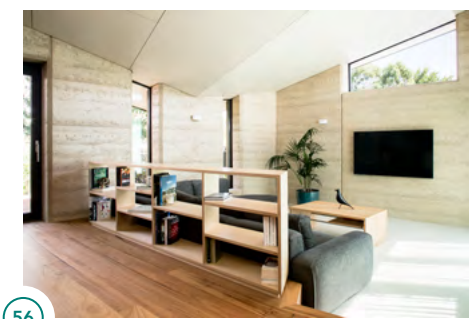

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Forest friendly

Discover how a surprisingly curvilinear home in Victoria's Dandenong Ranges achieved a 7.4 Star rating without heavy lifting from either rooftop solar or thermal mass.

WORDS Fiona Negrin **PHOTOGRAPHY** Chris Neylon

WHEN ALLAN AND ANN RETURNED TO Victoria after 30 years in NSW they wanted a project to sink their teeth into. Passionate about owner-building a comfortable and sustainable home for their retirement, they purchased a 6000-square-metre block in leafy Kallista, and contracted Maxa Design to collaborate with them on the house design. But, as planning requirements and site constraints kicked in, it became clear that some of the most dependable tools in the ESD toolkit weren't going to be effective.

Maxa Design explains that the steep slope of the block limited the ground space available for building and required the house to be "elevated off the ground. Thermal mass would cause problems for us structurally and it would have brought massive engineering costs."

Meanwhile, the large trees on the site, including mountain ash and grey gum, blocked solar access. Ann and Allan were keen to preserve the regal trees and, moreover, they were protected by local laws. It became clear that rooftop solar would not have a place in the build. "Obviously, if we could have put solar panels on, we absolutely would have," says Maxa Design, "but it wouldn't have done any good."

With limited scope for thermal mass and no role for rooftop solar, the designers, Allan and Ann started looking at other options. Enter Passive House: a rigorous design process that sets a certifiable standard for a building's thermal comfort and air quality. In the freezing environments of northern Europe where the 'Passivhaus' methodology originated, an airtight building that leaks no heat makes a lot of sense. "Kallista is cold, too!" laughs Sven Maxa of Maxa Design. "From a passive solar design perspective, when you've got limited solar gains you really need to contain the heat generated by ovens, people and equipment. Passive House is the perfect solution for this kind of environment."

In a tightly sealed building envelope, "bringing in fresh air becomes critical," says Maxa Design. "You have to have a ventilation system." After poring over databases of Passive House-accredited components, Allan and the designer tracked down a compact system by Danish company Nilan that integrates ventilation with heating, cooling and (via a coupled Panasonic heat pump) hot water. "We call it the magic box. It's an interesting system and we believe it's the first of its kind in Australia in a domestic building," says Maxa Design, acknowledging that in this sense "it's very much a trial".

Allan, who was an engineer by profession, was heavily involved in installing the Nilan Compact P and tweaking it to suit his and Ann's needs. He left the underfloor ductwork uninsulated so the floor surface would gain some heat over winter. He also soundproofed the unit to ensure the motor was inaudible and installed a supply and exhaust valve in every room. The designers explain, "You can design a building where you just supply [fresh air] to living rooms and bedrooms and just exhaust [stale air] out of the kitchen and bathrooms. It's a technicality, but it

Inspired by the shape of a fallen log on Allan and Ann's Dandenong Ranges property, the house's curves are clad in corrugated iron for its flexibility and BAL compliance. As an added bonus, falling leaves and branches simply slide off, a plus in this bushfire-prone setting.

About face

This mountain home demonstrates how you can achieve thermal comfort and energy efficiency despite being oriented to the east and unaided by thermal mass.

WORDS Rebecca Gross
PHOTOGRAPHY Barton Taylor

HOUSES TYPICALLY FACE NORTH TO maximise passive solar design, but not all sites are oriented this way. L-House, located in Linden in the Blue Mountains, faces east to expansive views of the bush and city, and therefore required an alternative approach to creating a thermally comfortable house. With high-performance insulation and glazing, a low window-to-wall ratio and evenly distributed skylights, L-House, designed by Alexander Symes Architect (ASA), stays warm in winter and cool in summer while embracing the eastern view.

The clients, Anthea and Ian, moved into a draughty one-bedroom house on the property in 2007. “It was not designed or built for the mountains and was like living in a block of Swiss cheese,” Anthea says. In addition to their cottage, another pavilion served as a guest house and there were footings for a third pavilion, intended to become the main house. Anthea and Ian approached ASA to design a more functional and comfortable house. Done with suffering through cold winters, their chief priority was comfort.

Ian and Anthea originally wanted to maintain the two existing pavilions and create a new dwelling to the east to capture the view. “It felt like this approach wasn’t respecting the site, and the modern building would block the guest pavilion,” Alex says. Instead ASA designed an L-shaped house that retained and linked the existing structures, reusing the forms, services and structures, where possible, to reduce waste and cost. “Anthea and Ian bought the house because they love the landscape. By not building another house, it reduced the footprint of the house on the site, providing more opportunity to appreciate the environment, as well as recycling existing materials and upgrading poor performing dwellings,” Alex explains.

Stripping the pavilions back to their structure and building around them, ASA took a hierarchical approach to materials. Materials remained in situ, where possible; for example, the existing framework. Stripped materials such as the cladding were reused, if possible. This material now lines the soffit on the underside of the

Anthea and Ian’s reimagined house faces east to make the most of bush and city views. High-performance insulation and glazing and a low window-to-wall ratio helps ensure good thermal comfort.

Rising from the earth

Traditional local materials and an innovative spiral design with a green roof combine to offer a simple, sustainable lifestyle for this tree-changing family in Japan.

WORDS Anna Cumming
PHOTOGRAPHY Kaori Ichikawa

SOME 20 YEARS AGO, I SPENT TIME living in Japan and studying its art and traditional architecture, with its emphasis on simplicity of design, lightweight timber construction, natural materials, and master handcrafting. Modern residential architecture in Japan (as elsewhere) has largely moved towards the utilitarian, urbanised and mass produced, so when the Spiral Garden House came to my attention, I was intrigued. It combines traditional materials and construction techniques with a surprising design that is a radical departure from traditional architectural styles, producing a striking-looking and high-performing home.

The house is a product of its location and the family who commissioned it. On the island of Awaji, in Japan's Seto Inland Sea some 70km south-west of Osaka, the long-established fishing and farming community has been joined recently by a growing population relocating from urban centres, looking for a slower-paced lifestyle closer to nature. Kazuhiro Watari, his wife Ayumi and their two children are part of this new community, which has established a currency-free sharing economy, a forest kindergarten and a 'free schooling' cooperative. →

Homeowners Kazuhiro and Ayumi Watari asked for a house for their 986-square-metre site, with the basic elements for living, that they could complete little by little on their own. Over the next year they plan to plant a garden on the twisting roof that gives Spiral Garden House its name, and build swales and drainage ponds that radiate out from the house to handle excess rainfall.

Mind the gaps:
Passive House from the inside


WORDS
Dick Clarke & Andy Marlow

Certified Passive House is gaining traction in Australia, especially with sustainable designers and builders. But why are people embracing a voluntary building standard, and what does it offer that passive solar design does not?

Dick Clarke is a building designer with over 30 years experience and proprietor of Envirotecture. Andy Marlow is an architect, urban designer and Certified Passive House designer. He is a director of Envirotecture and a volunteer board member of the Australian Passive House Association.

PASSIVE HOUSE LOOKS LIKE IT COULD BE 'THE NEXT BIG thing' in Australia. While it's a relatively new idea here, it's been around in Europe for a couple of decades. Originating in Germany in 1992 where it is known as 'Passivhaus', it has proved to be a very useful means of getting buildings of all types (not just residential) to provide high quality, low energy indoor environments.

Contrary to popular misconceptions, it is not enforced sealing up of the building where windows and doors are never opened. On the contrary, you can live in a Passive House in the usual way, opening doors when the weather is nice, closing up when too hot or too cold. The difference is that when you close the house, it really is closed, and it looks after the indoor environment to a very high standard of health and comfort.

ABOUT PASSIVE HOUSE

Certified Passive House (often known by its abbreviation CPH) is a voluntary standard for constructing buildings that deliver a healthy indoor environment that is comfortable in temperature and humidity, while using very little energy. It is known as a 'fabric first' approach, that is, by getting the skin of the building right, everything else falls easily into place.

Passive House was chosen over traditional energy-efficient design for this 8.7 Star renovation in Bellbrae, Victoria, due to the limited ability to incorporate thermal mass into the existing lightweight construction. Builders APHI Projects says the house achieved 0.96 air changes per hour (ACH) at 50Pa, which complies with the EnerPHit retrofit standard. The house has been extensively insulated and sealed, and fitted with triple-glazed Doepfner windows, a Sanden heat pump, heat recovery ventilation and solar PV.

The technical definition is a building that can achieve thermal comfort by heating or cooling only the fresh air required to maintain a healthy indoor air quality. This is modelled in detail before construction begins using the PHPP (Passive House Planning Package) software that has been developed since the late 1980s.

The standard has expanded rapidly to cover a wide range of building types, including new builds and renovations, high-rise apartments, schools, offices, hotels, swimming pools and a police station. There are currently over 60,000 Passive House buildings around the world. In Australia and New Zealand there are several dozen completed to date, with dozens more on the drawing board.

Passive House is founded on five principles, with performance levels that set upper limits on energy use and air leakage. Heating demand is limited to 15kWh/m^2/year. Humidity must stay below 12g/kg of air (around 65 per cent relative humidity at 25 degrees Celsius) for at least 80 per cent of the year, and temperatures of more than 25 degrees are capped to 10 per cent of the year, if no mechanical cooling is used. Mechanical cooling must still operate within the same allowable energy limits as heating.

FIVE PASSIVE HOUSE FOUNDATIONAL PRINCIPLES

1. Appropriate insulation

The amount of insulation varies depending on the climate zone. A house in Dunedin, NZ, would need more than a building in Sydney, which would need more than a dwelling in Broome. It's worth noting that in many climate zones a Passive House does not need much more insulation than a code-compliant building.

2. No uncontrolled air leakage

Airtight construction ensures that only fresh filtered air enters your home. Certified Passive House requires the air leakage to be tested near completion of the building, and it must be below 0.6 air changes per hour (ACH, measured at 50 Pascals pressure) in order to receive certification. Or for renovation projects using the official EnerPHit retrofit standard it needs to be 1.0 ACH. This is the single biggest challenge for many tradespeople: how to work with airtight materials, and how to ensure nobody stuffs it up during construction!

Airtightness is as beneficial in keeping heat out as keeping it in. The lack of holes also helps keep out other unwanted visitors too (cockroaches, vermin, snakes). It is achieving airtightness that leads to the need for a mechanical ventilation system if a build up of CO_2 and other toxins is to be avoided.

3. Mechanical heat recovery ventilation (MHRV)

An MHRV system continually draws filtered outdoor air into living spaces and bedrooms and exhausts stale air from bathrooms and kitchens, and the outgoing air transfers its energy to the incoming air without the two air streams mixing. This delivers fresh, tempered air to the home without paying the energy penalty of opening a window.

These systems use very little energy as they move relatively small volumes of air, and so there is no perceptible draught. In warmer climates, an energy recovery ventilation (ERV) system can do the same with the addition of humidity balance. Heat recovery has proven to be an efficient, healthy choice with its low volumes (no draughts or noise), low energy and in-built filters.

On the verge

Public meets private in that space between front fences and the road, which makes verge gardens a contested but exciting frontier for sustainable landscape design.

WORDS Simon Pawley, Sustainable Outdoors

COUNCIL-OWNED VERGES HAVE traditionally been treated as the unloved and unsightly bit of grass that development forgot. Sometimes, depending on the council, they also become an additional unwanted mowing nuisance to the adjacent homeowner. However, residents are now reclaiming these areas to create beautiful natural oases instead.

I've been specialising in verge garden conversions for the past 15 years. And in more recent times I've noticed verge gardens have been gaining in popularity, whether that's to reintroduce corridors of nature into our urban areas or to use spaces with fantastic potential that would otherwise be wasted. Wherever progressive councils have embraced verge gardens and relaxed their regulations, native gardens are getting the edge over lawn. I'm seeing this all across the country, and very much so in my hometown of Perth.

COMMUNITY BENEFITS

Green infrastructure, such as verge gardens, strengthen a community's sustainability and resilience. Council regulations that give residents more incentive and freedom to reclaim and be creative with their verges open up more opportunities for neighbours to connect with each other. Verge gardens become an extension of your liveable area, increasing your time reconnecting with nature and socialising in your own street.

You can always tell when an area has a strong community base by looking at how well loved their verges are. And, no, I don't mean wealthier suburbs with council-maintained lawn verges. I'm talking

about nature strips that have been planted lovingly with cuttings from a friend and tended with care. Verges that proudly display personal touches like feature logs or rocks, or a pathway that meanders through to a bench seat where you can take a rest under a tree. These are areas that you love walking home through because it's lively with people enjoying the outdoors; plus it's full of interesting features and plants that are attractive to look at. These places make you feel welcomed and safe.

Naturally, areas with a strong sense of community will attract more people to move there, thus increasing the value of the area. Therefore, it's no surprise that verge gardens are becoming increasingly popular with councils and residents.

OTHER BENEFITS

Environmental advantages

Lawns in the wrong position can require copious amounts of water to maintain their lush greenery. The average Western Australian household uses about 240kL of water per year (or more than 650L per day) with over 40 per cent of that water used outside the home. Lawns are known to consume a large chunk of this which makes reducing lawn areas an easy way to reduce the use of water and also the need for a lawnmower.

Verge gardens also have a positive effect on reducing summer temperatures. On a very hot summer day, you'll notice that sitting under a tree is always cooler than sitting under a gazebo. This is due to the cooling effect of moisture evaporating from the plant's leaves. In the same way, verge gardens help to reduce the urban heat island effect by increasing the amount of plants and green spaces in developed areas. Surrounding your house with plants creates a microclimate that helps cool things down, therefore reducing energy use for summer cooling. With our carbon-intensive electricity grid, reducing energy use means reducing the amount of CO_2 emissions we generate.

Habitat creation

Gardens provide shelter and food for other fauna, so they will attract all kinds of insects and animals including those that are ecologically beneficial such as bees, spiders and lizards. There are nectar-producing plants that are very good at attracting native birds and butterflies and other plants that produce seeds for wildlife. The more verges that are linked together, the larger the created migration corridors for these species through our urban areas. Pretty soon you will have a verge that is full of life and vibrancy!

Okay, this verge landscaping is elaborate by any standard! But what it demonstrates is that when a community is on board and supportive, often-neglected grassy nature strips can be transformed into diverse habitats for all to enjoy.