

MODERN GREEN HOMES

ISSUE 45

# Sanctuary

The experimental issue: designs that play with shape, budget, site and style



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# Forest friendly

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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.

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**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.



Protected mountain ash trees made thermal mass and solar panels unviable, leading the design team to opt for the Passive House standard. External stairs and platforms are used to connect the north-facing living areas to the steeply sloped backyard.



The house is all-electric, with induction for cooking. Flooring is engineered board from Wild River Timber.




shows the level of detail that Allan went to in his construction of the house.”

The couple recently added a reverse-cycle air conditioner to boost the temperature to 20 degrees if required, but find they only need to do this after they’ve been away for a few days. Allan notes that their winter energy costs were under \$6.90 per day. Adds Ann, “with the house being completely sealed and with triple-glazed windows, I have no idea what the temperature is outside.” Key to the building’s ability to retain warmth is the generous application of insulation, with R6.0 batts in the floor, walls and roof.

In terms of an aesthetic, Ann had wanted a house that would be “something different, that we could pleasantly live in but that also blends into the environment.” Having mentioned that she admired curved roofs and soft building shapes, Maxa’s preliminary design was of a black, rounded building, inspired by a fallen log on the property. Says Ann, “I thought it was pretty out there – but I loved it!”

The curved roof and walls, clad in corrugated iron for its flexibility and BAL compliance, and supported by steel sub-floor framing, elegantly frame the compact 8m by 25m single-floor plan. The rounded structure is as functional as it is visually striking. Falling leaves and branches simply slide onto the ground rather than accumulating on the roof – a critical consideration in a bushfire zone.

Having lived in the house for a year now, Ann is delighted with it. “It’s lovely. We wanted to create something we could put our energy into and enjoy, and it’s been working really well for us.” The experience of being an owner-builder has been gratifying, too. “Allan had the technical knowledge, and with Sven the two of them were able to work out what to try. We have all learned from this.” 



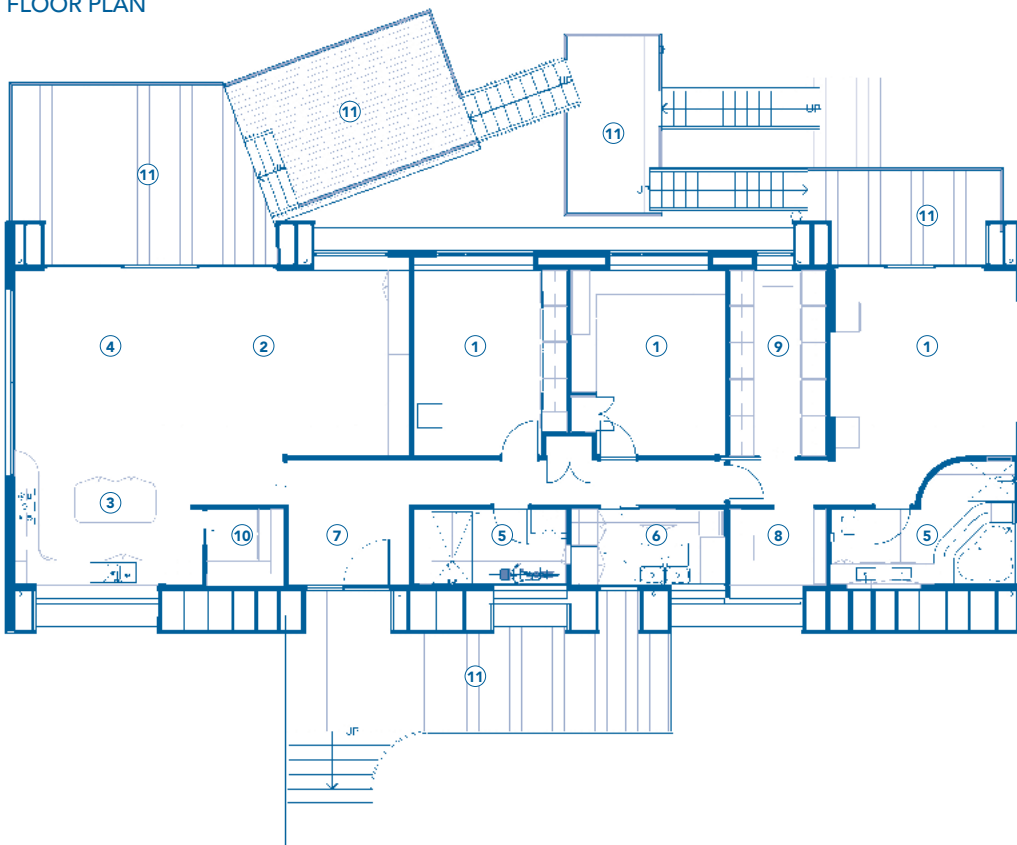
The main bedroom has tree views to the east and north. All windows and glazed doors are triple glazed for thermal performance, with 6mm toughened glass to meet BAL 29 requirements.



The 'magic box', housed in the laundry and coupled with a heat pump for hot water, provides heating, cooling and heat recovery ventilation and is a key part of the home's Passive House design.



FLOOR PLAN



LEGEND

- ① Bedroom
- ② Living
- ③ Kitchen
- ④ Dining
- ⑤ Bathroom
- ⑥ Laundry
- ⑦ Entry
- ⑧ Study
- ⑨ WIR
- ⑩ Pantry
- ⑪ Deck

# Kallista House

## —Specifications

### Credits

#### DESIGNER

Maxa Design

#### BUILDER

Owner-builder

#### PROJECT TYPE

New build

#### PROJECT LOCATION

Kallista, VIC

#### SIZE

House 200 m<sup>2</sup>;  
Land 6124 m<sup>2</sup>

#### BUILDING STAR RATING

7.4 Stars; designed to  
Passive House principles

#### ENERGY RATER

Matthew Graham, Graham  
Energy

#### BUSHFIRE ATTACK LEVEL

BAL 29

### Sustainable Features

#### HOT WATER

– Nilan Compact P (Nilan Denmark) ‘magic box’ – an all-in-one 3kW heating/cooling/heat recovery ventilation/hot water service. This includes the coupled 2.2kW Panasonic heat pump.

#### WATER SAVING

– 2 x 10,000L rainwater tanks (Statewide Water Tanks) with Grundfos CMB-SP 5.5 pump  
– Tanks are connected together to allow the secondary tank to overflow into the primary tank; manual changeover valves can switch between the tanks and mains  
– Stormwater runoff distributed across the block and kept on the surface to minimise risk of landslip.

#### PASSIVE DESIGN / HEATING & COOLING

– Passive solar design principles followed, including northern orientation of the building, optimised window sizes and placement, super-insulation, although thermal mass has been limited due to the elevated design and risk of land slip, so a flexible structure was required  
– Passive House design and construction principles adopted, including completion of the Passive House Planning Package (PHPP) to show compliance with the performance standards. Interestingly, the PHPP requires shading of vegetation to be included – a

major consideration on this site – whereas the NatHERS assessment specifically excludes this  
– Super-insulated walls, roof and floor sections including: floor and curved section of outer wall in cellulose fibre (treated recycled paper) to R6 or greater; walls R6 Knauf Earthwool Batts; roof R6 Knauf Earthwool batts  
– Pro-Clima Extasana external smart ‘wind-tight’ membrane to the full perimeter of the building  
– North-eastern windows have Roma blinds (Laros Technologies) on the exterior that are remotely operated  
– Solar panels were not an option due to the density of mountain ash trees; the trees act as an insulating blanket from high summer temperatures and frost.

#### ACTIVE HEATING & COOLING

– Nilan Compact P (Nilan Denmark) – 3kW reverse-cycle compressor in line with the heat recovery ventilation system. Each room has supply and exhaust registers to improve flow rates and system performance. Backup by an independent Panasonic 2.2kW split system inverter heat pump when required  
– Underfloor is warmed by ductwork due to convection in the underfloor cavity which is sealed and insulated.

#### BUILDING MATERIALS

– Steel sub-floor framing and

curved timber laminated veneer lumber (LVL) roof and floor truss rib cage to the length of the building from Lube Engineering/Timber Imagineering  
– Corrugated iron cladding from Mack Bros on all external surfaces – rolled to the specified radius for walls and roof  
– Extasana external membrane from Laros Technologies  
– Floor is engineered board by Wild River Timber.

#### WINDOWS & GLAZING

– Triple-glazed Doepfner composite window and door frames with 400mm solid base panel and 6mm toughened glass for BAL29 compliance, from Laros Technologies.

#### LIGHTING

– All LED pendant fixtures to remove the need for holes in ceiling and insulation.

#### OTHER ESD FEATURES

– Worm farm wastewater treatment system by A&A Worm Farm includes a primary and secondary treatment tank connected to a 15 cubic metre sand filter connected to 600 square metres of soakage area fed by dripper lines  
– All electric home, including a Westinghouse induction cooktop (very fast)  
– 8 trees were removed for construction and these were relocated at a cost of \$10,000 under the revegetation scheme at a farm in Little River.