MODERN GREEN HOMES

Sanctuary

ISSUE 56

SUSTAINABLE HOUSE DAY SPECIAL

DEEP DIVES: Building & design | Retrofitting
Building materials | Climate resilient design

Best and fairest

Australia's eco homes on show

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PLUS

Flood-resilient design genius
Tiles from recycled glass and fabric
Targeted retrofits for comfort
Urban homesteading trailblazers

WIN

An Earthworker-Reclaim heat pump hot water system worth $5,000 from the Earthworker Energy Manufacturing Cooperative

Offer open to Australian residents. Details page 80


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Stepping it up

LOCATION Strathfield South, NSW • **WORDS** Rebecca Gross • **PHOTOGRAPHY** Petri Kurkaa

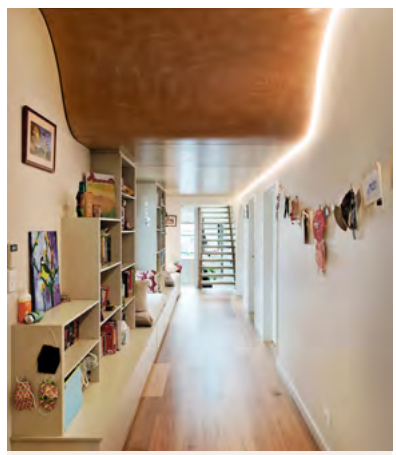
This high-performing Sydney home employs a site-specific design that breaks out of the typical Passive House box while still achieving the energy efficiency and renewable energy requirements.

Passive Houses can have a tendency to be cubic or boxy in shape, as the simpler the building form and the lower the surface-area-to-volume ratio, the easier it is to achieve the required airtightness and energy efficiency. However, it doesn't have to be this way. A recently completed Passive House Plus in the Sydney suburb of Strathfield South takes a different form, as the challenging block called for a solution that was 'outside the box'.

↖←
Matthew and May's house is designed to sit comfortably in its suburban setting. It features two green roofs: a small one over the front porch for extra greenery and decoration, and a larger one in the centre of the plan providing a pleasant outlook from the main bedroom.

The clients, May and Matthew, bought the block in 2009. The house was cold, lacked space, light and storage, and needed structural work. They initially planned to renovate, but after speaking to architect Andy Marlow at Envirotecture it became clear a knockdown and rebuild was the best way forward as the existing house required more work than was cost-effective. By building a new house, the couple could achieve their brief for a sustainable, energy-efficient house that would suit them and their two young children well into the future.

Site conditions made a standard passive solar design difficult: the street is to the north where a large tree obstructs solar access to the front of the house, and the block slopes downward from the street with a two-storey house to the west. In response, the Envirotecture team initially opted for a solution combining passive solar design with Passive House principles. This first design included single- and double-storey sections, green roofs and a central courtyard, but when the building was costed higher than anticipated, Andy developed a second design more typical of the compact Passive House box. "It was cheaper, but not enough for us to forgo how much we loved the original design. If we had to spend a lot of money, we



At a glance

- Certified Passive House Plus on a tricky site
- Two green roofs and a central courtyard
- All-electric home
- 10kW solar PV system generates more energy than the family consumes

Opening for Sustainable House Day 2021. For more:

sustainablehouseday.com/passivcourtyard

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The living area is in a double-height space at the rear of the house; a high north-facing window admits ample sunlight.

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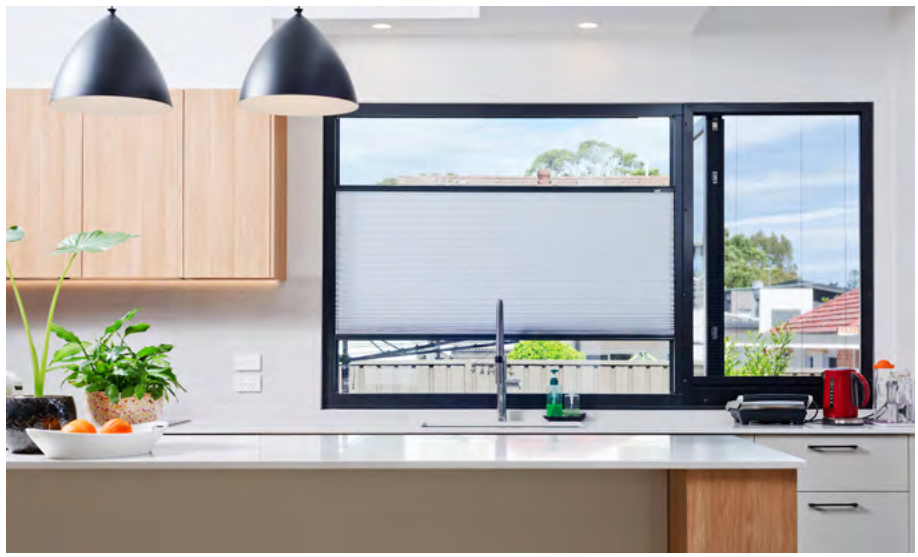
The house is all-electric, with induction for cooking.



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A blackbutt screen between the dining and living areas provides partial separation of the spaces without blocking light and airflow.

decided we might as well get something we really loved and so we went with the first design," says May.

The front of the house is single storey with a gabled roof that fits with the vernacular of the streetscape. The challenge was then to get sun into the back of the house. To achieve this, a flat green roof and a side courtyard are in the centre of the plan, so that light can enter the two-storey rear volume.

Internally, the garage, two children's bedrooms and study are in the front of the house beneath the gabled roof, and the laundry and bathroom are beneath the flat green roof. The living area is in a double-height space at the rear, with the dining and kitchen adjacent. An open staircase ascends to the main bedroom, walk-in robe and ensuite (with Japanese bathtub) upstairs.

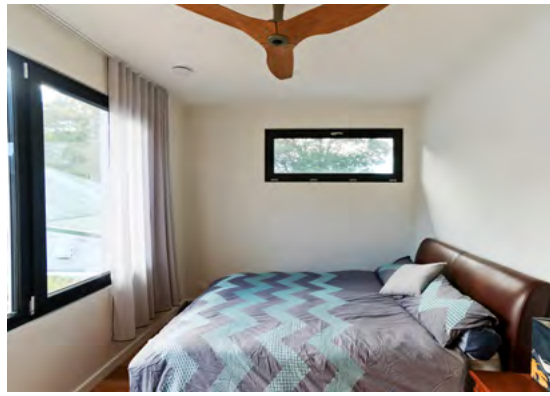
The double-height ceiling and a high-level triangular window opening onto the green roof work together to bring light and a greater sense of space into the living area, while a glazed sliding door to the courtyard allows light to enter the dining area and kitchen. The open treads of the staircase also allow a view through to the backyard, and a window at the top of the stairs provides a sky view.

The house is all timber framed, including the structure supporting the green roof. Inside, an inspired design feature is the elegant curved timber ceiling in the hallway, which serves several purposes. It enhances the arrival experience into and through the house,

provides a seamless transition between the front and central sections with their different roof structures, and hides the ductwork for the mechanical ventilation with heat recovery that delivers filtered air to every room. And with joinery for storage and seating, the hallway has become a favourite place for Matthew and May's children to read, and a convenient place to sit and put on shoes.

The building meets the requirements of Passive House Plus because it generates at least as much renewable energy as the residents consume, thanks to rigorous design and a 10-kilowatt solar array; May and Matthew are yet to pay a utility bill. "We knew we had to get the design right, or it would be impossible or very expensive to fix. We thought to invest in the important things, like triple glazing, that are going to last for a long time, and save where we could on other things such as fixtures and fittings," says May. "That's the approach we took to the project and every dollar has been worth it."

While the house breaks with the conventional compact shape of a Passive House, its more complex and site-specific design achieves the energy efficiency and renewable energy requirements. "It's not a simple geometry and there is lots of external surface compared to volume, which is not very Passive House, but demonstrates that with this approach, if you're careful and creative you can do anything," says Andy.



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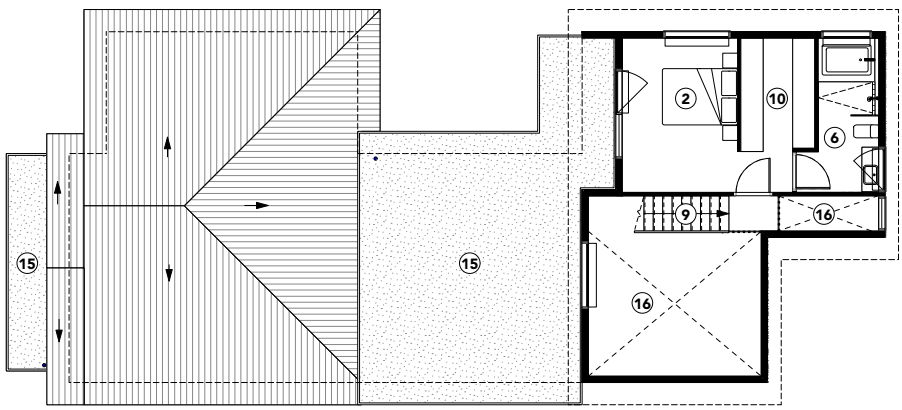
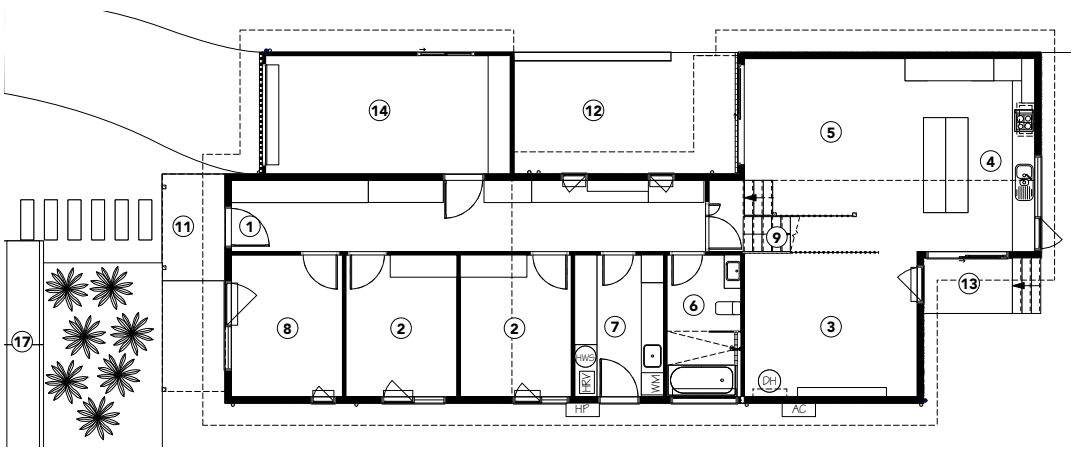
Efficient ceiling fans are installed in all bedrooms and living spaces.

FIRST FLOOR PLAN



GROUND FLOOR PLAN



LEGEND

1. Entry
2. Bedroom
3. Living
4. Kitchen
5. Dining
6. Bathroom
7. Laundry
8. Study
9. Stairs
10. Walk-in robe
11. Porch
12. Courtyard
13. Deck
14. Garage
15. Green roof
16. Void
17. Planter boxes

HOUSE SPECIFICATIONS

HOT WATER
- Sanden 315L heat pump hot water system

RENEWABLE ENERGY
- 10kW solar PV system with Sunpower Maxeon 3 400W panels and SMA Sunny Tripower inverter from Sydney Solar

WATER SAVING
- 2 x 1,750L pre-cast concrete rainwater tanks from Landscape Tanks, plumbed to garden taps and toilets
- Water-efficient (WELS 4-6 star) taps and showerheads
- Taps and showerhead in main bathroom reused from original house

PASSIVE DESIGN, HEATING & COOLING
- Block not optimal for passive solar performance (north to street and a slope down from the street) led to a solution combining passive solar design elements and Passive House design
- Certified Passive House Plus: treated floor area 164.3m^2; airtightness 0.5 ACH50; heating demand 13kWh/m^{2}a; cooling & dehumidification demand 14kWh/m^{2}a; renewable primary energy (PER) demand 40kWh/m^{2}a
- Eastern courtyard allows sunlight into rear section of house
- Great cross ventilation through house
- Double-height void to rear section for sunlight and breeze penetration
- Ground-connected concrete slab for thermal mass (with insulated edges)
- High-performing windows, excellent insulation and airtight, thermal bridge-free construction
- Eaves sized to block direct sun in summer while admitting winter sun

ACTIVE HEATING, COOLING & VENTILATION
- Sabiana ENY-SP-280 mechanical ventilation with heat recovery (MVHR) system supplied by Logikhaus
- Mitsubishi Electric 5kW reverse-cycle air conditioner in living room
- BigAss Fans Haiku ceiling fans in bedrooms, study and living room

BUILDING MATERIALS
- 90mm timber frame construction with oriented strand board (OSB) for bracing; OSB made from thinning of FSC/PEFC-certified pine plantations
- Weathertex cladding
- Boral Envisia (reduced cement content) concrete slab with insulated edges
- Roof: VersiClad Corrolink structural insulated panels (SIPs), R3.8
- Proctor Wraptite SA building wrap
- Insulation: 50mm polyisocyanurate (PIR) panels to external walls (R2.76); Autex SoundSolution batts to internal walls (R2); 25mm extruded polystyrene (XPS) to slab edge
- Floors: Topdeck Flooring Wooden-Land Classic engineered timber flooring in blackbutt (FSC-certified)
- Blackbutt joinery, stairs and hallway ceiling

WINDOWS & GLAZING
- Logikhaus uPVC-framed triple-glazed windows and sliding doors (U-value approx 1)

LIGHTING
- LED lights throughout

PAINTS, FINISHES & FLOOR COVERINGS
- Dulux envirO2 low-VOC interior paint
- Dulux Weathershield exterior paint
- Taubmans water-based enamel (low-VOC) to interior trims
- AQUAPRO 8270 Advance 2K Floor Finish (low-VOC) to stairs

OTHER ESD FEATURES
- All-electric house
- Two green roofs for extra insulation and a pleasant green outlook

DESIGNER
Envirotecture

BUILDER
Distinct Building Services

PROJECT TYPE
New build

LOCATION
Strathfield South, NSW

COST
Approx $1.1 million
(see Insights)

SIZE
House 174.5m^2
Garage 21.6m^2
Land 446m^2

ENERGY RATING
Certified Passive House Plus

ENERGY ASSESSOR
Envirotecture

INSIGHTS
"Price is a funny thing. The build contract price was $945,000, and the kitchen, joinery, fees and so on added the rest (be careful to check what's included when comparing prices). This house was relatively expensive because it's not simple geometry; there's lots of external surface compared to volume, which is not traditional for Passive House but proves that Passive House can do anything. Also, the two green roofs are lovely but were not a cost-focused decision!"

Andy Marlow, architect