

AGGRESSIVELY passive

A “passive house” design means you can step back and let your home do the work to keep you comfortable. This type of build is gaining momentum in Australia, favoured for its energy efficiency and consistent interior temperature. Come heatwave or wintry blast, it’ll be remarkably pleasant inside

WORDS CASSIE HAYWOOD

Sustainability is key for 21st century home design. Not only is it better for the planet, but an eco-friendly, “healthy” home can boost your mood and save you cash.

For decades Australian architects have been using a model known as “passive solar design”. This build type allows for improved efficiency and encourages design principles such as orientation, cross-flow ventilation and shading for effective application. Residents are still required to be “active” to maintain the benefits of this style, despite its name. Taking your home’s thermal comfort and efficiency up a notch is the “passivhaus” or “passive house” standard.

The concept of passive house has been around formally for almost 30 years, the first passive house being built in Germany in late 1991. With technology advancing (particularly in window and ventilation systems), the passive house construct has become a more accessible and effective option. The design and subsequent certification of a passive house is still relatively new in Australia, but is gaining momentum, with more architects, builders and homeowners making the change.

“The passive house approach focuses on a high-quality and well-insulated building envelope in order to create buildings with high levels of internal comfort,” says Daniel Wolkenberg, director of Poly Studio. “The main benefit of passive house construction is a highly energy-efficient house requiring only a small amount of energy for heating and cooling throughout

the year. Over the lifetime of the building, this results in a big reduction in operational carbon emissions and much lower energy bills.”

A passive house is created with five key elements: airtightness, thermal insulation, mechanical ventilation heat recovery, high-performance windows, and a construction without thermal bridges. Specifically, the certification for a passive house build requires strict maximum heating/cooling demands and airtightness of 0.6 air changes per hour at 50 Pascals of air pressure. Almost completely eliminating the air leakage of a building is a feature that differentiates passive houses from other constructs such as passive solar. Due to this, a certified passive house focuses not only on energy for cooling or heating (renewable or otherwise), but also maintaining an internal temperature of 20–25°C year-round in every room, come heatwave or winter chill.

SKIN DEEP DESIGN

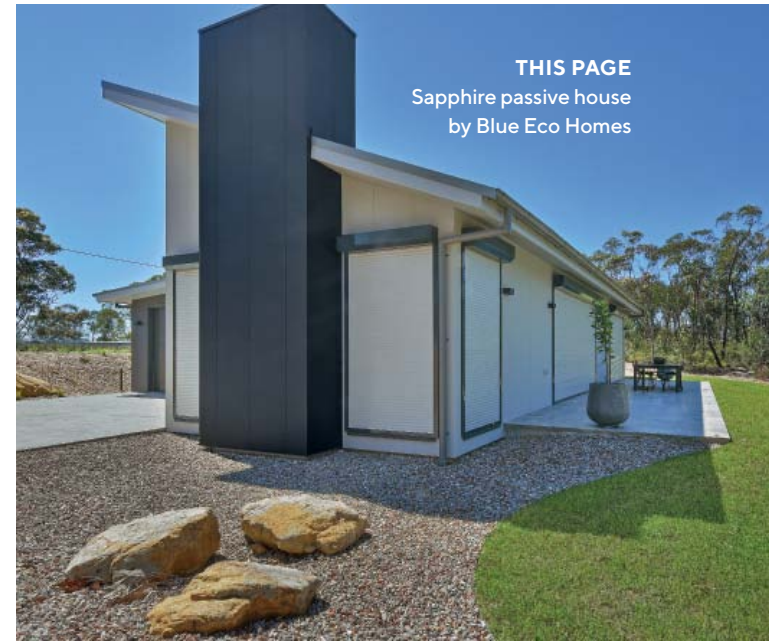
Andy Marlow is director of Envirotecture and board member of the Australian Passive House Association. He describes passive house as a “fabric first” approach. “By focusing on getting the external skin of the building (walls, roof, floors, windows, doors, shading) right, everything else can be easy. These are also the most expensive items to retrofit later.”

If you’re tossing up between passive solar design or a passive house, you’re already heading in the right direction. The benefits



THIS PAGE A House for All Seasons by Poly Studio. Photography by Tatjana Plitt





THIS PAGE
Sapphire passive house
by Blue Eco Homes



Paarhammer combination — fixed panes, tilt window for ventilation and lift-slide door for outside access



THERMAL BRIDGE
/'θɛ:m(ə)l brɪdʒ /

Sometimes known as a thermal highway. A path that heat can pass along, regardless of insulation. Thermal bridges are formed when the insulation layer is bypassed, allowing heat to be transferred through a wall, window, ceiling or floor.

are clear for any eco-friendly home, and with thoughtful design your home can be comfortable and beautiful. There are a few factors that particularly differentiate the two.

“Solar passive is based on orientation to the sun and cross ventilation. You’re required to ‘work’ the house to make it run effectively,” says Joe Mercieca, managing director of Blue Eco Homes. “For example, cross ventilation is only effective if windows are open and closed at appropriate times; when it’s too hot or too cold, no one likes their windows open. Heating or cooling in the home (and the money paid to run them) is lost through the windows being opened.”

Your lifestyle will dictate which type of build works better for you. “If you have a higher tolerance for temperature fluctuations and enjoy having your doors wide open for most of the year, regardless of what’s happening outside, then passive solar is probably best for you,” Andy points out. “If your tolerance for temperature fluctuations is more limited, bearing in mind tolerance decreases as we age, then maybe you need more control of your indoor environment.”

A passive house perk you may not expect is the reduction of noise, dust and even creepy crawlies in a home. There simply aren’t the same avenues for these things to enter a house. You also don’t have the guesswork of solar passive homes. “A certified passive house (CPH) is based on science and building physics to deliver a healthy indoor environment with ultimate



comfort — all while using very little energy,” Joe says. “It’s tried and tested to work well in hot and cold climates.”

Andy agrees, noting: “A CPH home works because of a rigorous design process and quality assurance process; passive solar design *may* work. Currently in Australia, no system in the residential sector actually verifies ‘as built’ performance. A CPH home can and generally does use 70 to 90 per cent less energy for heating or cooling than a standard home. CPH ensures you get what you paid for.”

THE PRICE IS RIGHT

A common misconception is that going sustainable costs you an arm, leg and a kidney — it simply isn’t true. While the figure varies between builders, Andy says if you’re building a custom-designed home, the construction cost premium is close to zero! Others in the industry estimate a small price tag, worthwhile for the long-term gain.

“From my experience there’s probably about a five to 10 per cent cost premium for incorporating passive house measures such as airtightness, improved insulation and high-performing windows,” Daniel explains. “However, by building to the passive house standard, heating and cooling systems can be much smaller, which helps to offset some of the additional cost. Depending on the size of the house, the energy savings are likely to be around \$1000 to \$2000 per year.”

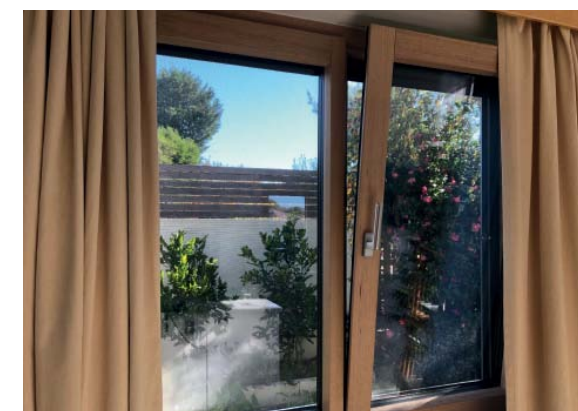
Even when it comes to building the home itself, increasing numbers of builders are equipped with the accreditation and attention to detail to meet the strict criteria. While it’s easier to build a new passive house than retrofit, the EnerPHit Certificate is the equivalent award for an existing home with the right adjustments.

“A passive house requires planning, science and testing throughout the build to ensure it works how it should,” Joe says. “You can’t ‘half build’ one of these homes. Going only part-way with a passive house will make issues worse. The additional airtightness without proper ventilation will cause unhealthy air quality within the building, leading to condensation, mould and health issues.”

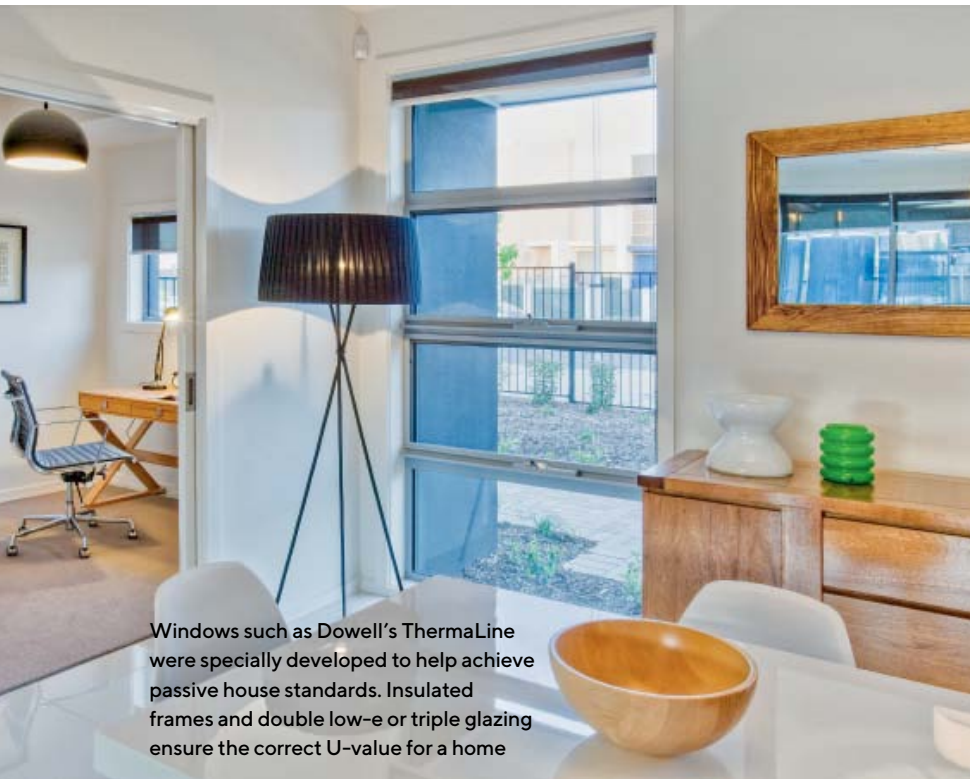
As in many areas, technology is progressing to create more eco-friendly options for the savvy homeowner. Efficient windows are an essential component in a sustainable space, and companies have more options suitable for an airtight home. Edith Paarhammer of Paarhammer Windows and Doors notes that windows are often the weakest link in a building envelope. “The whole window, including frame and glass, requires a low U-value (heat conductivity) ratings,” she says. “To meet these standards, glass should generally be double- or triple-glazed with one or two layers of low-E glass included. Multi-point hardware and seals,



Internal water tanks can add thermal mass to a building, helping the building work better — while looking good! Thornleigh House by Envirotecture.
Photography by Brandee Meier



LEFT Paarhammer tilt-&-turn window with frame internals in Victorian ash with clear low-VOC finish and aluminium cladding on the outside to reduce maintenance



Windows such as Dowell's ThermoLine were specially developed to help achieve passive house standards. Insulated frames and double low-e or triple glazing ensure the correct U-value for a home



ABOVE Pairing indoor window coverings with external products is ideal for those looking to improve their home's sustainability and energy consumption. The Luxaflex Evo MagnaTrack awning and Specta fibreglass sunscreen fabric eliminate up to 95 per cent of solar heat

BELOW Luxaflex Duette Architella shades feature a honeycomb-within-a-honeycomb cell structure that creates four fabric layers, trapping air and insulating the window



WHY PASSIVE HOUSE?

- Improved health, comfort and environmental impact
- Up to 90 per cent energy saving in the home
- Improved fresh indoor air 24/7 using a ventilation system throughout the house
- A reduced carbon footprint using less energy, sustainable materials, waste management onsite, energy-efficient appliances and water-efficient tapware
- Reduced auxiliary heating and cooling
- Maintained humidity to reduce exposure to mould and other toxins
- Energy positive with the addition of solar panels (i.e. the house uses less energy than it produces, charging a battery and sending the remainder to the grid)

Joe Mercieca



Freshwater House by Enviroecture.
Photography by Kayle Barton

as well as the correct installation of windows, is vital in achieving excellent energy efficiency."

There can sometimes be confusion over a window product's U-value, as the ratings differ from country to country. Australia often has comparable products to international sources, however, so you don't need to look far!

MATERIAL WORLD

The right insulation goes a long way in energy efficiency, as determined by the needs of your local climate. Tasmania will require a more heavy-duty material and thickness compared to sunny Cairns. Insulation solutions are becoming more versatile, with everything from HempCrete (airtight, fire- and mould-resistant and certified Net Zero) to Knauf Insulation's Earthwool (non-hydroscopic, non-combustible and rot-proof) made from recycled glass bottles.

Insulation needs to be thick enough, as well as continuous to create a passive house. The Australian Passive House Association explains that minimising thermal bridges means "keeping penetrations through the insulation to an absolute minimum, and if not avoidable then using materials that are less

conductive to heat (i.e. timber in place of metal) and/or incorporating thermal breaks (whereby a material that doesn't conduct heat well separates the two conductive elements). Otherwise your wonderfully insulated building will have a number of thermal highways that will cause increased energy consumption and increased condensation risk, affecting thermal comfort".

"Heat recovery ventilation systems are a crucial technology in passive house buildings," Daniel explains. "They provide fresh air to bedrooms and living spaces and extract air from wet areas. The warmth or cool of the air being exhausted is transferred to the fresh outside air, which preserves the internal air temperature. As they operate at low velocity, the system is very quiet and also doesn't require much energy to operate."

Another common misconception about a passive house is that you'll be living in an airtight box. "Contrary to some ill-informed opinions, you can still open your doors and windows in a passive house as often as you wish," Andy points out. "However, the question becomes 'do I need to?'. You won't need the fresh air (it comes from the ventilation system) but if it's a great day and you want to open up, go for it!" 🏡



Passive house by Logikhaus.
Photography by Tony Sheffield/
Highlife Magazine Southern Highlands