

# Passive House – It's Happening Now in Australia

by Susan Morris

*(Part one of a two-part feature; second part will be featured in the September edition of BDAV News.)*

Buildings are responsible for 40% of energy use globally, with a large part of this attributed to the residential sector. Proven technologies and knowledge exist to reduce energy use by buildings. The Passive House Standard (translated from German 'Passivhaus') is one of these methodologies, and results in ultra low-energy buildings. The standard originated in Germany in 1991 and is used across Europe where there are now more than 20,000 examples. The concept is appropriate for all climates. Passive House buildings' individual characteristics are optimised for local climatic conditions. In hotter climates, more emphasis is placed on passive shading of windows to enable comfort in summer. Passive House buildings can be found in the United Kingdom, North and South America, Africa and Asia.

The Passive House Standard is not a regulation, but a methodology and certification system for creating very thermally-efficient buildings. Passive House design principles can be applied not only to the residential sector but also to commercial, industrial and public buildings. Passive House buildings allow for space heating and cooling-related energy savings of up to 90% compared with typical building stock and over 75% compared to average new builds.

Although Passive House buildings have been around internationally for 24 years, at last these super energy-efficient and thermally comfortable buildings are now appearing in Australia. In early 2014 there were no accredited Passive House buildings in Australia and now there are six. The first house to be certified, in Pages Flat, South Australia, is a partly underground house in a high bushfire-risk area, designed for a single family. The architect for this project was Max



*First certified Passive House - Pages Flat (South Australia) – Photo courtesy of Bernward Bücheler*

Pritchard and the Passive House designer was Passivhaus Australia, a South Australian firm managed by Bernward Bücheler.

In Canberra, a terrace house with roof garden in Kingston, by Industrious Design, was the next to be certified. Peter McKay, the building designer and owner of this house, describes his experience: "Building to the Passivhaus standard when there were none in Australia was quite challenging. They are different, but not that difficult, and certainly don't have to be 'high-tech'. The house has proven to be very comfortable, with low energy costs."



*Terrace house Kingston – Photos courtesy of Peter McKay*

Other Passive House-certified buildings include two freestanding family homes in Canberra built on neighbouring blocks, designed by architects Harley Truong and Andrew Verri, a single family house in Wonthaggi, known as Superpod, by Fiona McKenzie and a detached unit in Castlemaine, by CARBONlite design+build.

Details of these buildings can be found via the International Passive House Association database.

Another Passive House building, designed by Melbourne Design Studio, is ready for construction. Marc Bernstein-Hussmann was winner of the BDAV-10 Star Challenge in 2012.

"Inspired by the design competition, we set out to exceed the requirements of the NatHERS 10 Star. The aim was to create an energy-positive friendly family home, guided by European Passivhaus standards. Whilst this project started out as the '10 Star Challenge House', we have fully converted it to Passive House standards, so that it is now known as the 'MDS Quattro Passive Haus,'" says Bernstein-Hussmann.



*MDS Quattro Passive Haus by Melbourne Design Studio – Photo courtesy of Marc Bernstein-Hussmann*

To achieve the certification requirements for new Passive House buildings, the space heating demand must not be more than 15kWh/m<sup>2</sup> of living space per year, or alternatively the heating load must not exceed 10 W/m<sup>2</sup>. In situations (warmer climates) when active cooling is required to

ensure comfort in summer, the energy demand is also limited to 15kWh/(m<sup>2</sup>yr). The building must be tested with an independently administered pressure test (blower door test) to confirm the building has an air-tightness n50 value of less than 0.6 air changes per hour (ACH). The primary energy requirement for the total amount of domestic hot water, heating, cooling, auxiliary and household electricity must not exceed 120kWh/(m<sup>2</sup>yr). Energy-efficient equipment and appliances must be selected to achieve this target.

Passive House buildings show great diversity in aesthetics, size, construction methods and materials. The following five details enable buildings to achieve the Passive House standard:

1. Exceptionally high levels of thermal insulation;
2. Well-insulated window frames with double or triple low-e glazing;
3. Thermal bridge-free construction;
4. Air-tight building envelope;
5. Comfort mechanical ventilation, with highly efficient heat recovery.

These principles, together with good orientation, window shading and efficient design comprise a building that is very thermally comfortable and energy efficient. This high level of energy efficiency places

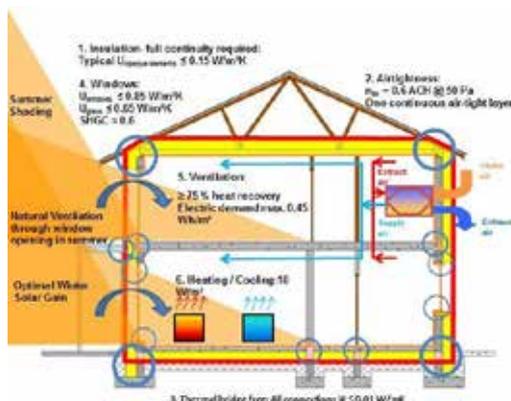
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Passive Houses at around 9+ stars when rated with NatHERs software.

What's remarkable about buildings designed to the Passive House standard is exceptional indoor air quality, resulting from the mechanical heat recovery ventilation system. Typically in Australia, as air-tightness increases in buildings, there is an increased risk of both condensation and poor indoor air quality. Europeans and North Americans are familiar with these issues and have created thermal bridge-free methodologies, and systems to ensure healthy buildings face none of these problems. Increasingly, Australian designers are tackling these issues with improved material specification and detailing, to avoid condensation and reduce thermal bridges.

We have high levels of asthma and allergies in Australia. Improved indoor air quality may help to control the asthma and allergies trigger. Pre-heated and pre-cooled filtered fresh air, to manage and control asthma and allergies, is an added benefit of the superior energy efficiency and thermal comfort of Passive House buildings.

Conventional HVAC systems take in a percentage of fresh air which then needs to be heated or cooled to a comfortable temperature. Mechanical ventilation with heat-recovery systems allows the outgoing air to warm or cool the incoming air, without any cross-contamination. Depending on the efficiency of the heat exchanger, over 90% of the heat from the exhaust air can be transferred to the intake air, bringing the incoming air almost up or down to room temperature.



Schematic showing ventilation and shading strategies for warmer climate Passive Houses- Image courtesy of Michael McCarthy

In low air-permeability houses, controlled ventilation is essential. Mechanical ventilation with heat recovery (MVHR) allows the recovery of heat from the stale, used air, transferring it to the incoming air – leading to reduced energy consumption and CO<sub>2</sub> emission reduction. MVHR Heat Systems have strict compliance requirements to meet Passive House standards. The system runs 24 hours a day to ensure fresh air is delivered into the airtight building. The systems are therefore required to be very energy efficient. Opening windows while the system is operating will greatly decrease energy efficiency.

However, depending on the design of the building and the MVHR system, it is possible to turn off the system and open windows and doors for natural ventilation when outdoor temperatures are moderate. There are many times of the year in Australia when temperatures outside are comfortable. Therefore, designing Passive Houses to work in 'natural ventilation' mode as well as in 'mechanical' mode is an appropriate design approach.

### How can building designers and tradespeople create Passive House buildings?

Up until 2014 it was necessary to leave Australia for specialist training in Passive House principles, software training, and to learn tradesperson skills. Last September international expert Michael McCarthy, of the Passive House Academy in Ireland, in conjunction with Box Hill Institute, delivered training in Melbourne to both designers and tradespeople.

There are now 27 accredited Passive House Designers and 9 Passive House Tradespeople in Australia.

Although physics and computations are required which seem daunting to some, the participants in the Designer course met the challenge with the average percentage score by the Melbourne group in October 2014 being the highest ever achieved by a Passive House Academy (PHA) exam group since the international exams began in 2009. The average score was 68.7%. Also, one student's official exam score of 87.1% was the highest score ever recorded globally by any PHA examinee since exams began in 2009.

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There was a 100% pass success rate from the November 2014 tradesperson class. Everyone that sat the exam achieved certification in both 'building envelope' and 'mechanical services'.

Demand for Passive House training is strong and Michael McCarthy is returning to Melbourne in September 2015 to offer both courses and the exams again.

The Certified Passive House Designer and Tradesperson courses afford participants with a wonderful opportunity to learn about the Passive House concept and how it can be applied in the Australian context. The courses are designed to cater for the needs of the industry and provide graduates who process the skills, knowledge and competencies to implement real world Passive House projects.

The Tradesperson course is a five-day programme aimed mainly, but not exclusively, at builders, contractors and tradespersons. The course allows participants to gain a full understanding of the theory and fundamental principles of the Passive House concept, covering all aspects of the construction process, including Building Envelope, Building Services and Quality Assurance procedures.

The Designer course is a nine-day course which focuses on the Passive House Design process. This course is mainly aimed at building designers, architects, engineers and other professionals involved in the building design process but again, not exclusively. The Passive House concept is rooted in building physics and this course covers all of the key formulae associated with energy losses and gains in buildings. Once the participant grasps the concepts from first principles, it becomes much easier to optimise the building design and energy balance for maximum energy efficiency and comfort in both the heating and cooling periods. The course will also include two days of tuition on the use of the Passive House Planning Package (PHPP). The participants will actively model a Passive House building in the Australian climate during this part of the course, giving them a first-hand insight into the climate-specific Passive House design process, and will pull together all of the theoretical learning from the rest of the course.

Michael McCarthy is convinced that "as we move towards more energy-conscious building design and

construction, this type of training will become a fundamental component of our education. By signing up to these courses, you are affording yourself the opportunity to move ahead of the curve and become an established player in the sector."

#### About the Author

Susan Morris is a teacher of the Advanced Diploma of Building Design (Architectural) at Box Hill Institute, Passive House Designer, architect and Fellow of the International Specialised Skills Institute. Susan's report "Improving Energy Efficient, Sustainable Building Design and Construction in Australia – Learning from Europe" can be accessed at <http://www.issinstitute.org.au/wp-content/media/2013/04/MORRIS-Report-LowRes.pdf>




**Passive House Designer/ Consultant Course:**  
**\$1,695 per person**  
 9 day Certified Passive House Designer/ Consultant course from Sept 21st to 25th inclusive (5 days: Mon - Fri) and from Sept 29th to Oct 2nd inclusive (4 days: Tues - Fri). Training materials are included within the course fee.  
 For more information and to enrol: <http://www.bhif.edu.au/courses/shortcourses/Pages/CPHD1.aspx>

**Passive House Designer/ Consultant Exam:**  
**\$450 per person**  
 The PHI shall issue the "Passive House Designer" or "Passive House Consultant" certificate after successful completion of the examination. The exam will be held on Oct 10th 2015.  
 For more information and to enrol: <http://www.bhif.edu.au/courses/shortcourses/Pages/CPHD2.aspx>

**Passive House Tradesperson Course:**  
**\$1,095 per person**  
 5 day Certified Passive House Tradesperson course from Sept 14th to 18th inclusive (5 days: Mon - Fri). Training materials are included within the course fee.  
 For more information and to enrol: <http://www.bhif.edu.au/courses/shortcourses/Pages/CPHT1.aspx>

**Passive House Tradesperson Exam:**  
**\$450 per person**  
 The PHI shall issue the "Passive House Tradesperson" certificate after successful completion of the examination. The exam will be held on November 7th, 2015  
 For more information and to enrol: <http://www.bhif.edu.au/courses/shortcourses/Pages/CPHT2.aspx>

## Historic Mentone Hotel Added to Victorian Heritage Register

The distinctive 1890 Mentone Hotel on Beach Road has been listed on the Victorian Heritage Register, ensuring any future changes to the building are carefully assessed to protect its character.

Victoria's Minister for Planning, Richard Wynne, said the Heritage Council of Victoria had recommended the hotel be added to the state's list of historically significant places and objects based on its architectural contribution to the Mentone area.

The 50 room two-storey sea front hotel was designed by Lowish, Moorhouse and Figgis. The Heritage Council of Victoria's assessment noted the building's exuberant and innovative design on the prominent waterfront site. The large hotel reflects the increased wealth and leisure time of Victorians during the 1880s boom period, and the striking Mentone Hotel is a rare survivor from this era.

Demand for accommodation and facilities for visitors in the area rose after the railway line to Mordialloc opened in 1881. The hotel opened

in 1890 and was renamed the Edgewater Beach Hotel in the 1950s, earning its nickname still used today, The Edgy.

The Heritage Council of Victoria assess each candidate for listing on their register based on its importance to the state's history and development. To be listed, the place or object must be found to meet the Council's criteria for assessment.

Changes to places on the Victorian Heritage Register requires a permit. Heritage protection for Victoria's significant buildings ensures their character is preserved as the state grows and evolves.

