

Solar Passive in a cooler climate

2014



Scope of works

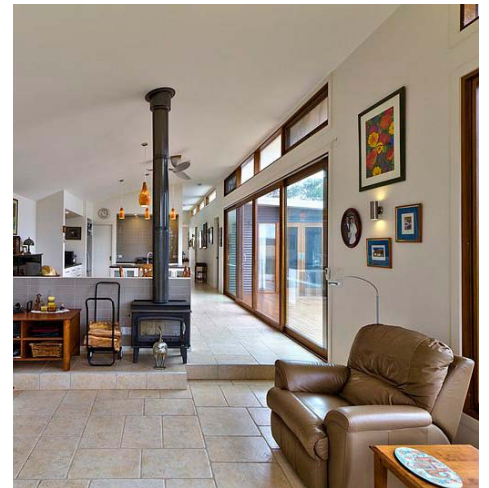
This project came to us originally as an Architect supervised Tender. The specification had very detailed requirements regarding the design for the building. Sustainability in construction methods and materials was a chief focus for the Architect. Energy efficiency was a significant driving force for the Owners who wanted a home with low energy inputs and the ease of living associated with that. The Clients developed the concept with their Architects, a design practice specialising in sustainable architecture. The completed design offered an outstanding energy rating of 7.7 Stars.

The Clients have previously lived in rural Queensland. The shift into the temperate environment of Stanley is designed to progress them into the next stage of their lives. The local area offered a climate that appealed to their sense of seasons passing. Stanley is slightly isolated but remains close to the larger township of Beechworth and the regional centres of Wangaratta and Albury-Wodonga. Access to health and infrastructure services was important to them but equally so the opportunity to live in a rural area of great physical beauty.

In making the shift there was a strong desire to keep a sense of privacy as well as the ease of living in a well designed and thermally efficient home. The site is elevated with sloping land to the North and East, on a Lane that only attracts local and traffic offered the advantages they sought in regards to privacy. The ability to make good use of the Northern aspect completed the picture for them.

The end result has been an architecturally interesting home, well suited to its aspect and environment. The completed house has a level of functionality and thermal efficiency that means the Owners comfort and lifestyle is catered for in a home that complements its surrounds and achieves low levels of energy consumption.

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In the Clients own words;

We have lived happily and comfortably in our new home for more than six months now. We are pleased with its design, construction and thermal performance. Our satisfaction owes a great deal to the skill, hard work and open communication of Lachie and his team. (We) would not hesitate to recommend them to any prospective clients.

Design and construction features

This is an outstanding example of an energy efficient design that has been achieved without sacrificing contemporary standards of finish and aesthetic design.

The 7.7 Star thermal performance rating can only be achieved with attention to the detail of the thermal performance features including sealing and insulating the House thoroughly.

The total list of energy efficient and sustainable design features is impressive:

- Solar passive design using northern aspect for best effect.
- Insulated concrete slab with R.1.0 polystyrene sheet extending under the slab.
- Feature Timber Doors and Windows to External openings, double glazed for thermal performance
- Ceramic tiles in North facing living areas for thermal mass properties.
- Rolled Steel Universal Beams to create the distinctive roof line.
- LVL timber beams for larger spans in Garage and Carport
- The Warped roof connecting the carport to the house is a very non-conventional roof design. With two parallel beams connecting the structures at 4 different levels, the framing, roof cladding and flashing of this unique feature was quite challenging and has been executed very well.
- Complete sealing of wall fabrics against openings, proprietary seals for doors and windows to allow for maximum control of air movement
- An off-grid power supply, produced by a 2.94 kilowatt installation of 12 x245W photovoltaic panels generate the electric power supply for the House. The brief to the installer (SunReal of Wangaratta) was to provide about 6.5kWh per day in Winter. It is backed up by batteries and a diesel generator which has only run for 38 hours in the first nine months of occupation including the whole of Winter. Our Clients have achieved independence in their energy needs.

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- Cross flow ventilation – windows and doors on North and South faces allow cross-flow ventilation for cooling with proprietary seals that prevent heat loss when closed.
- High awning windows, operated by electric winders, that assist with venting hot air very effectively
- A variety of wall fabrics, using external finishes over an insulated frame covered with a breather membrane.
- No recessed down lights of any type in the internal ceilings of the house to ensure a well-sealed envelope and no gaps in insulation
- The building is located on a rural property and is not connected to town water. The home owners are reliant on collecting rain water to meet their needs within the house. In order to harvest as much water as possible a 100,000 litre tank was installed on site to collect rainwater
- Smart Flo gutters that maximise the amount and cleanliness of water reaching storage tanks and reduces the bushfire risk
- Gardens water need will be met using a local water bore supply as well as recovered water from a worm farm installed to treat sewage from the house
- Metal Dynamics wood fired Stove, providing a secondary energy source for Hot water supply and heating in Winter.
- A fresh air Breather pipe was provided to a precise location adjacent to the Wood Heater. Through this strategic vent, fresh air is supplied to the Heater, something very important in a very well-sealed environment.
- Custom Kitchen, Laundry and Bathroom joinery design using a blend of natural and contemporary finishes

Benefits to end user

Custom designing a new home, using passive design principles, takes advantage of the climate that surrounds us. Australians often design homes that focus on resisting the environment around us, meaning we consume energy in constructing and running these buildings. Intelligent thermal design reverses that trend.

Homes like this one that use solar passive design can significantly reduce the need for additional heating or cooling, which, according to 'Your Home', accounts for about 40 per cent (or more in some climates) of energy use in the average Australian home.

This house offers its owners a substantial range of benefits;

- Smaller, smarter floor plan that reduced construction prices and ultimately uses less energy to maintain a comfortable lifestyle
- Execution of solar passive design that effectively ensures thermal comfort
- Thermal efficiency that requires simpler heating and cooling systems
- Water harvesting and efficiency that ensures sustainability in the long term
- Two heat sources for the hot water service that ensures constant supply year round.
- Lighting design and smaller floor plan that requires fewer light fittings
- Low maintenance materials that reduce long term costs to the home owners
- Stand alone power system that delivers economical power and a sense of independence.
- Sewage treatment system that recycles water for a second use,

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Choice and use of materials

A significant amount of care was taken in choosing cost effective materials that would enhance the design thermally. Aesthetic feature internally and externally was also important and has been successfully executed to a very high standard.

Attention to the bushfire risk led to a number of preventative measures being applied;

- Cladding is all non-combustible Fibre reinforced cement sheet or corrugated steel.
- All joints in the external surface material of walls are sealed or overlapped
- Vents in external walls are screened with mesh
- Window and door fly screens are aluminium mesh with a 2mm aperture
- Windows and external glazed doors are made of Vic Ash (listed in Paragraph E2, Appendix E of AS3959-2009) with glazing that complies with section 6.5.2 and section 6.5.3 of AS3959-2009
- Steel garage door is fitted with nylon brush in contact with the door, as per section 6.5.5 of AS3959-2009
- Decking material is Silver Top Ash, a bushfire-resisting timber

The Curved main roof, achieved using a steel portal frame, provides an outstanding feature without being overwhelming. Rolled steel Universal Beams and steel columns create the structural skeleton of the house. Our attention to quality was demonstrated by the rejection of inferior product supplied originally. We subsequently sourced material of the correct standard, at our own cost.

The Double glazed Timber windows and door frames were all painted prior to installation and sealed into the frames. Door and window locations create ease of ventilation, air conditioning and functionality.

Porcelain floor tiling accessible to northern sun in winter throughout the living areas boosts the effectiveness of the thermal mass of the slab

The House uses an 'A&A' Worm farm for sewage treatment. The associated Vent pipe is often an unsightly feature of these units and placement options are limited. We were able to facilitate the location of this large uPVC pipe discreetly placed against the House framing, reducing its visual impact. Recovered water is diverted to a dedicated irrigation system for use in the garden.

The elevated deck area to the North and East, featuring Radially Sawn Silvertop Ash 'New Deck' as a sustainable, durable and cost effective alternative to Merbau. The decking has been completed with an eye to the detailing of the deck joints and edges.

Slide valve controls in the stormwater pipes provide for flexibility in rain water harvesting and ensures the 'under flood' stormwater system can be drained, enhancing water quality.

Consideration of Wall fabric design to minimise heat gain in Summer and heat loss in Winter. The combination of BGC Duragroove sheet and Colorbond Corrugated iron provides a low maintenance solution without adding thermal mass externally.

LVL timber beams for larger spans in Garage and Carport

Smart-Flo spout system for cleaner water and reduced maintenance. This system is designed to reduce Bushfire risk as debris is shed naturally from the spouting.

Lighting – selection of LED lighting to maximise efficiency and reduce electricity use.

High quality bulk insulation batts to Walls and Ceilings

Extensive use of Plantation grown pine, chosen specifically as a renewable resource that locks up Carbon. Timber used is not chemically treated to reduce potential chemical toxicity



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