



Passive house vs passive solar design

By **Mark Fielding** of Ecotect Ltd

New Zealand has seen a lot of new developments in the last few years from people in the architectural and building community, many of whom seem to be getting on the green bandwagon – and about time too!

One particular green building subject, the so-called passive house (or Passivhaus) movement is growing with intensity and is fast becoming the catch cry of best practice standard for residential building design in New Zealand. Many people have heard about the passive house movement and most believe it to be the highest standard for energy efficiency house design – and it certainly is – regardless of whether it is needed.

WHAT IS A 'PASSIVE HOUSE'?

Passive house is a building methodology that combines technology, design and components. It was developed in Northern Europe

to provide comfortable energy-efficient homes to shelter people from the very cold winters in those regions. It has spread to North America and the UK where in such countries I too would be looking seriously at building my own house in such a way – if I could afford it.

In temperate New Zealand though, even Central Otago (where it seems to be popular), are our winters anywhere close to the extremes of those continental countries in high northern latitudes?

KEY FEATURES

Some of the main features of passive houses are:

- Airtight houses, with a sealed building envelope that is pressure tested.
- Non-opening or minimal opening windows with triple glazed timber or uPVC frames imported from Europe or China.



HARNESS

*the wind and sun to reduce your power bills for ever.
Combine both wind and solar for the best future results.*

Call Tony Today: **021 434 394**
tony@futureenergy.nz www.futureenergy.nz

*Tony Pearson is recognised nationally as a leader in this field, with installations all around the country and this has been proven by him winning the SEANZ Best Installation four times.

**future
energy**
wind & solar specialists

- Internal heat recovery ventilation (HRV) machines, also imported from Europe and costing up to \$20,000 plus installation costs. Each room gets an air duct from a central pump unit.
 - Ultra-insulation in all building elements.
 - Passive solar design principles (passive solar gain)
- For other aspects, see Wikipedia: en.wikipedia.org/wiki/Passive_house

MARKETING A DESIGN METHOD

How has this relatively new design method gained such popularity so quickly? Is money being spent on marketing the passive house system? Are there profits to be made from selling certain products that are included in this building design method? Why do we now have passive house accredited designers and architects in New Zealand?

Our local architects and designers are already trained and experienced in designing energy efficient buildings in New Zealand, and this knowledge is available to anyone wanting a new house built, for the cost of an architect's fee – or even from a free search on the BRANZ 'Level' website: www.level.org.nz.

DRAWBACKS OF THE PASSIVE HOUSE

Personally I would rather open a window for fresh air, certainly carefully in very cold weather.

Add to that the maintenance, filter cleaning and eventual breakdown of the HRV machine – how can such a thing being included in a 'passive' house? Surely this is an 'active' system – and how healthy is it? Haven't we been warned about the potential for harmful bacteria in ducted air conditioning systems? Health is a main tenet of the New Zealand Building Act.

New Zealand's building industry tried some airtight building envelope ideas in the 1980s, using aluminium foil backed linings and foil vapour barriers in our skillion ceilings. The results were less than ideal, and the finding of that 'experiment' was that it was better to let our building envelopes breathe moisture vapour.

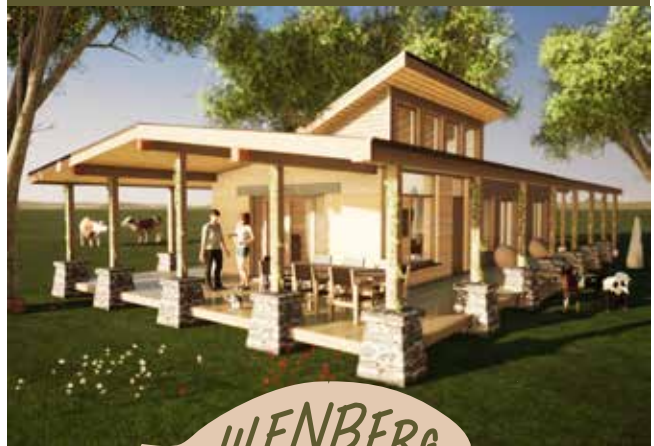
Opposite and top right: The Baden house. Built in 2009, this two-storey four-bedroom passive solar home is compact (no passage ways), and features a double height main space with mezzanine floor, all irradiated with double height solar glazing. Thermal mass is provided by the exposed concrete floor on the ground level, and by at least one face of exposed black polished concrete block wall in every main room in the house. Sunshade devices were designed for the summer shading of the lower storey glazing as the high eaves would not do this at that level. The shade sail is for shading the deck in summer only. Though not the cheapest house, with structural two-storey honed and coloured concrete block walls, it's a good example of using more than just a concrete slab floor for thermal mass where there is a very large area of north glazing.

Photos: Open2view-RE/MAX Elite, Nelson



Above: Interior of the Baden house – main living space

Build, renovate and finish your home with clay, plant fibre and other natural materials for your own personal wellbeing and the health of the planet.



Martin Ulenberg ANZIA Registered Architect
Focusing on ecologically sensitive design and specialising in earthen and natural materials.
ulenberg.co.nz

Sustainable Architecture * Passive Solar Design
* Adobe - Natural Timber - Straw *
* Solabode - Affordable Eco Homes *

Mark Fielding
P: 03 546 8760
M: 021 158 5024
E: mark@ecotect.co.nz

ecotect *
www.ecotect.co.nz



carboNZero



ISO 14064-1 • certified organisation

Too many Kiwi homes are damp and unhealthy...

Visit pyroclassic.co.nz to learn how
the only clean air approved wood fire
with a **genuine overnight burn** can **dry**
your home to make it **warmer** and **healthier**.

Pricing Starts From
\$3,199
Packages Also Available





Above: The Cooke house: Eave design that allows all available winter sunshine to enter through full-height north glazing. Photos: Mark Fielding

HIGH TECH AND HIGH COST

So why has the so-called passive house method become almost a New Zealand benchmark standard? Our building research institute BRANZ has also questioned the value of passive house tech in New Zealand – see: www.buildmagazine.org.nz/index.php/articles/show/passive-house-or-passivhaus

Even before covid-19, there has been a call for affordable and energy efficient homes for ordinary New Zealanders, now even more so. Passive house tech surely costs money, but is that money wisely spent? High performance, simple passive solar designed homes, can be built for a lot less. They provide superior comfort and healthy air quality using carefully designed solar glazing matched with thermal mass, controlled roof overhangs and natural ventilation.

CLIMATE CHANGE AND THE LOCAL ECONOMY

I also question the passive house cost to our planet, in terms of carbon emissions and the cost to our local economy, which misses out from all that money spent overseas on imported materials and components, when we have a perfectly good building material and component industry here employing our own people.

There are other aspects used too, SIPs panels (structural insulated panels) are a common element in a passive house. A great idea – but most are made from imported oriented timber strand board and polystyrene, assembled in a sandwich in China, before being shipped to New Zealand. Why are we not making such SIPs panels here from plywood (made in three local factories), and polystyrene (made in at least one factory in each main island)?

PASSIVE SOLAR GAIN

Passive houses do use a bit of my all-time favourite passive solar gain but they don't seem to give it much of a high priority. Possibly because in Northern Europe, the centres that have the highest number of winter sunshine hours, have fewer than New Zealand's lowest sunshine hours region. With such little winter sunshine, it is no wonder they don't rely so much on passive solar gain to heat their homes.



Above: Interior main space in the Cooke house at midday in mid-winter: solar gain through full-height north glazing irradiating thermal mass floor, with north-facing skylights irradiating the adobe thermal mass wall. The small radiant log burner is used for backup heating only.

DESIGN FOR THE SUN: NZ STYLE

New Zealand on the other hand has an abundance of winter sunshine hours, even in the cloudiest regions, and enough to use simple direct-gain passive solar design techniques to great effect. Even the government thinks so, because in 1982, the then Ministry of Energy commissioned a group of local architects (university lecturers) and other experts to adapt a United States passive solar design method to the four main New Zealand climate conditions. One of the group was passive solar architect Dave Bruer, brought in from the USA, who had helped develop second generation solar house design methods in his home country.



Above: The Lewis house, Tawa. A compact, affordable house using passive solar design. This photo shows the sunshine angle on the longest day, with eaves completely controlling solar admittance.



Above: This house makes the most of full sun on the north glazing, with veranda awnings to control the sun in summer. Skylight windows admit light into the airy interior. Photos: Mark Fielding

That work resulted in a thick design manual with all the design tools required – and a series of designers’ seminars throughout the country to teach the methods. That manual was called *Design for the Sun* and I still use it today, nearly 40 years later. It’s been around a lot longer in New Zealand than passive house tech and it was developed specifically for every region in New Zealand. You don’t hear much about simple passive solar design – perhaps because there is nothing to sell – just good design principles for the New Zealand climate.

DIRECT-GAIN PASSIVE SOLAR FEATURES


Simple direct-gain passive solar homes are characterised by the following:

- House faces to the sun (north in New Zealand), most windows on the north side, with sills at floor level, and hardly any glazing on the south side
- Thermal mass: fully insulated concrete slab floor exposed to the sun; dark colour for better heat absorption
- Full depth insulation in roof and walls; minimise thermal bridges

- North roof overhang designed to fully admit beneficial winter sunshine and exclude undesirable summer sunshine
- High-level windows to vent excess hot air in winter (yes it gets warm!)
- Modest sized floor plans with minimal breaks from a simple rectangle
- No moving parts – natural ventilation rather than mechanised ducting
- Costs no more than a well-designed comfortable house
- Built using conventional trade-friendly methods (so tradies don’t add ‘fear’ costs)
- Provides better than 60% higher thermal performance than a fully code compliant standard house built in New Zealand (based on BRANZ ALF4 heat-loss calculations).

COMFORTABLE, AFFORDABLE, LOCAL

Houses using passive solar design are the true ‘passive’ houses – **passive** means there is nothing to do, except maybe draw the curtains at night, **solar** means the sun is involved, providing a massive amount of free energy in winter on a daily basis (up to 1kW per hour for every square metre of north-facing glass) and **design** means it is not by accident.

Very little additional heating is required and then only after 2–3 days of cloudy winter weather. They are safe, super comfortable, modest affordable homes that use local materials and built by local tradespeople and suppliers. 

Mark Fielding is the director of Nelson-based Ecotect Ltd and Solabode Ltd. He designs affordable eco homes for clients all over New Zealand: www.ecotect.co.nz

More info

- www.ecotect.co.nz/_downloads/passive_solar_design.pdf
- www.ecotect.co.nz/PDF/eecapsfs.pdf



Above: North-facing full-height glazing with eave design admitting all winter sunshine – plus clerestory windows, also with eave control, admitting full winter sunshine to rear interior spaces.