

opposite

Double-glazed timber joinery from Germany works with modern detailing.

The elements of Passive Design

Architect **Darren Jessop** worked closely with the owners of this Auckland home to create the first certified Passive House in Australasia, meeting an exacting set of international standards.

photography **Simon Devitt**





above
Sunny open plan living space captures and retains heat in the cooler months.

opposite
Electric sliding shutters over the bedroom windows are designed to control heat in summer.

Our design for this four-bedroom home in east Auckland began typically enough. We had worked through three sketch design options with the client and had settled on one that met the budget and maximised the use of the long narrow site from a sun and space point of view.

At this point, our Canadian-American client started asking deeper questions. He was particularly interested in specifications for heating and cooling and was visibly disappointed with the low thermal insulation standards of New Zealand homes, plus the lack of guidelines for their design and performance. Our client began an extensive research journey to discover a suitable standard and technologies to support it. We needed to find one that we could adapt to our local construction methods that would also create the performance that our client required from his home.

Our client opted for the internationally recognised Passive House model first developed in Germany in the 1980s. Research shows that energy consumption in Passive Houses is about 80% lower than in conventional buildings. They combine high-levels of comfort with low energy consumption using high thermal insulation and heat recovery systems.

Informed by this model, we based our construction on five basic design elements:

1. Clever compact design that optimises the use of natural resources for comfort.
2. High insulation to ensure the house stays warm once heated and remains cool in summer.
3. No thermal bridging so that the inside of the house isn't affected by the exterior conditions.
4. Air-tight construction for optimal control of the ventilation system.
5. Consistent air circulation for a continual supply of fresh air at perfect living temperatures.

This was modelled at the design stage using software developed in Germany.

Breaking thermal bridges

Thermal bridging occurs where heat is transferred between the floor slab and the ground. This commonly occurs at corners, connections, windows and where insulation is interrupted. It leads to about 10–15% of heat loss in traditional buildings. So thermal bridge-free construction covers everything from windows and internal steel beams not touching the timber framing, to insulating the footings and having the concrete slabs sit on high-density polystyrene.

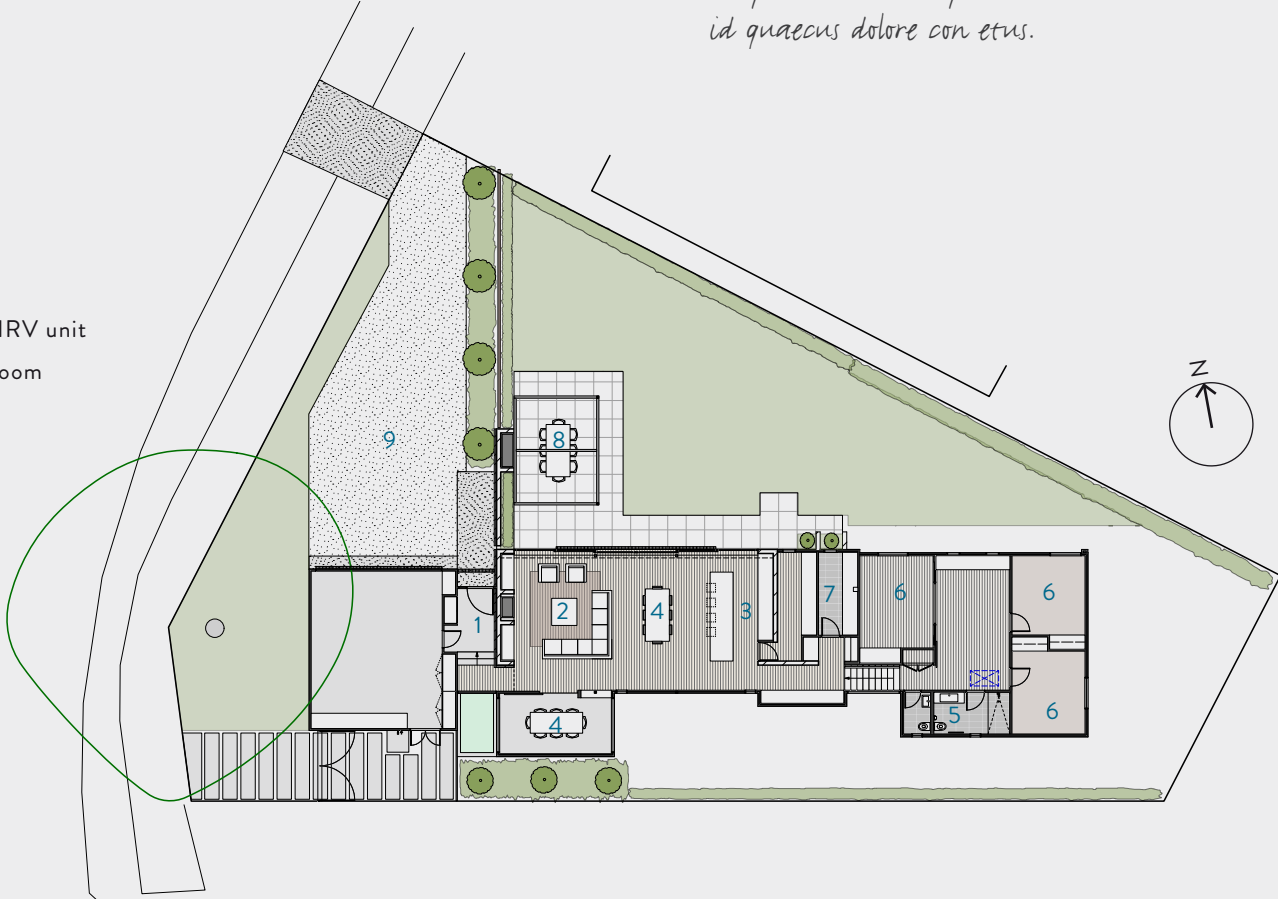
High quality buildings with low energy running costs require little power from the grid. It's even possible to feed some power back if the house is not in full use.



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Passive house

- 1 Entry
- 2 Living
- 3 Kitchen
- 4 Dining
- 5 Bathroom
- 6 Bedroom
- 7 Laundry/HRV unit
- 8 Outdoor room
- 9 Drive



Vene venderes cus ut et aligendam, Vidita vent voluptame odio tempos alit, te.Voloraec tiusdae si id quaecus dolore con etus.

Occupiers of a passive home built to these standards can expect a monthly power bill of around \$40.

Air-tightness and circulation

A blower fan was fitted to the front door and the owner monitored pressure in and out of the house for about a month. As part of his commitment to the project, he spent many nights walking the structure with infrared and ultrasound devices looking for leaks. Being airtight, the home requires fresh air to be circulated to ensure that it's a healthy living environment. The heat-recovery ventilation system (HRVS) plays an important role in this. As well as providing clean air that is free of pollen, dust and moisture, it provides almost all of the heating required for the house due to the combination of passive heating from the sun, heat recovered from the system and heat loss reduction measures across windows and other structural elements.

An efficient HRVS was imported from Germany. This takes stale, warm air from parts of the house like the kitchen, bathrooms and laundry and passes it through the heat-recovery unit in the laundry. The old air is discharged whilst heat is harvested and retained. The system then pulls in fresh air from outside, passes it over the heat recovery system which is 85% efficient, and distributes it to areas needing heating. Cooling is achieved in a similar way, all activated by a computer system.

Drawing cost comparisons vs conventional New Zealand construction

At completion of the project, we estimated that creating a home that meets the passive home standards defined by the German model adds around 10–12% to the build costs. However the occupiers will recoup much more than this amount if they live in the house over its life, whilst enjoying a warm, comfortable and healthy home.

Passive Houses provide the optimal living temperatures in every room all year round (between 20 and 25°C) with constant fresh air. The cost of running the HRVS unit is about the same as running a 100W light bulb. Occupiers of a passive home built to these standards can expect a monthly power bill of around \$40, which constitutes a convincing argument in favour of this route. In fact, in the first month in the home (late winter/early spring) the clients' electricity bill was \$42.

The house has been certified by MoSART in Ireland, an approved passive house certifier. The client was instrumental in the research and testing phase, and together we achieved a great result in spite of the lack of local examples. ●

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