Certified Passive Houses in New Zealand– a position paper

PASSIVEHOUSEINSTITUTE
NEW ZEALAND

What is a Certified Passive House?

A Certified Passive House follows a strict, scientific process to predict the performance of buildings quite accurately at the design stage. This results in buildings that truly shelter occupants, providing them with a constant supply of fresh air, and a comfortable indoor environment at very low running cost. The way a Certified Passive House meets the performance targets is not defined. Certified Passive Houses have been built with every construction type known to humankind, from straw bale self-builds to prefabricated solid construction and everything in between. While they differ significantly in appearance and typology, they all perform within a narrow band of indicators for indoor environmental quality. Certified Passive Houses have been erected in all climate zones, from very cold to very hot. Naturally, the way Certified Passive House performance targets are met will vary with the climate they are built in. With New Zealand's overwhelmingly temperate climate, the targets are far easier met than in countries with climate extremes.

The Passive House standard is often confused with “passive solar” concepts that were popularised in the 1970s. While Passive Houses utilise solar heat gains to the extent possible, they avoid common passive solar shortfalls: poor comfort conditions at times, and insufficient regard for good indoor air quality. Furthermore, passive solar homes heavily rely on occupant intervention, like proper window operation, for reasonable performance, whereas in a Certified Passive House the thermal envelope does all the work, allowing the occupants to passively enjoy a comfortable and healthy building.

Anyone who wants to may call their project a Passive House, as “Passive House” is not a patent protected term or trademark. This will not necessarily entail the benefits of a Certified Passive House though, as the quality assurance process is an integral part of the parcel. The attributes we are discussing in the following are therefore exclusively validated by Certified Passive Houses.

A Certified Passive House, in the words of Johnston & Siddall (2016), “does what it says on the tin”. It closes the frequently reported gap between the design aspirations and the performance of buildings in use. All building types can be certified as Passive Houses, and overseas we find for example Certified Passive House schools, museums, supermarkets, offices, universities and even prisons. However, for this paper, we will focus on residential Certified Passive Houses.

Certified Passive Houses in New Zealand

The first Certified Passive House in New Zealand was built in 2012 in Glendowie, Auckland. At the time of writing, there were 19 Certified Passive Houses in New Zealand registered in the international database. The authors know of a similar number of Passive Houses that are in the process of becoming certified. Currently, all Certified Passive House buildings in New Zealand are detached, single family homes, town-houses, apartments and social buildings are however in the pipeline at the time of writing.

Certified Passive House professionals (designer, consultants and tradespersons) are available country-wide. While there is no requirement to use certified professionals when designing or building Certified Passive Houses, certified professionals are specifically trained to deliver the required quality cost-effectively.

Status of housing in New Zealand

The unhealthy and inefficient standard of the existing building stock in New Zealand is well documented. Recent BRANZ research found visible mould in nearly half of all houses surveyed. The quality of housing is one of a number of unequally distributed social determinants (wealth and education for example are others) that are known to drive health outcomes (Howden-Chapman et al., 2004; Krieger and Higgins, 2002). Cold and damp indoor environments are widespread in New Zealand homes, and large proportions of the population do not have the ability to change these. A quarter of New Zealand's households are estimated to be in fuel poverty, which is considered to be a factor in the country's high rate of excess winter mortality (16%) (Davie et al., 2007) and excess winter hospitalisations (8%) (Howden-Chapman et al., 2012).

There are however some indications that houses built to more recent iterations of the Building Code are still not healthy or energy-efficient places to live. For example, 45% of interviewees (n=177) living in new houses in New Zealand reported dissatisfaction with the level of comfort (Page, 2007). In the thermal comfort starved situations that prevail in many New Zealand houses, achieving a thermally comfortable indoor situation in homes will thus impact heavily on energy consumption, if the energy efficiency of houses remains unchanged. The indoor environmental quality of new homes was furthermore found to be lacking, when put to the test (Rosemeier, 2014) This does not surprise, as it is impossible to safeguard good outcomes for indoor environmental quality of houses with the Building Code toolkit.

Why is “being better” than Building Code requirements or scoring in rating schemes not the answer?

Neither the Building Code nor rating scheme processes allow for robust ways to verify the performance of buildings. Meeting a threshold on paper, using unproven and un-verifiable methods, is not a pathway to advancing building performance. Furthermore, without a feedback loop, it is impossible to learn from experience or engage in continuous improvement. The thresholds of the Building Code are a secondary problem. The methods do not allow a validation of results. A gradual improvement on this basis is impossible.

What is the relevance of the performance of new houses with regard to overall housing performance?

As most buildings are already built, requirements for new homes will not have an immediate impact on the overall performance of houses in New Zealand. Yet, new houses lock-in the performance for the next century, and better performing new houses will eventually lift the expectations for all housing, and enable by then tried and tested techniques to be transferred to existing buildings. EnerPhit is the Passive House certification scheme for retrofits. It is well used in Europe, but there are currently no certified projects in New Zealand.

Will requiring Passive House performance amplify housing unaffordability?

From the outset, it has to be stressed that housing affordability is overwhelmingly determined by land prices, followed by the characteristics of building element surfaces. Yet, designing and building a better performing house will cost slightly more than a house of the same geometry at the same location with identical surfaces. It is however doubtful if the latter will meet the purpose of the Building Act 2004. As outlined in section 3 of the Act, its purpose is to ensure that people can use buildings safely and without endangering their health. Moreover, according to the Building Act, buildings are even required to have attributes that contribute to the health and well-being of their occupants.

The main components for building better performing houses are inexpensive, and additional material cost can often be compensated by using a smarter design approach. Certified Passive Houses in New Zealand have been built for reasonable square meter rates. A limited number of components, namely highly efficient windows and ventilation systems, currently incur a cost premium due to the low volumes of their usage. Cost for these components are however steadily falling overseas.

Economic advantages of Certified Passive Houses are immediately evident if the total cost of home ownership over 20 years is considered. But again: this comparison only works if the reference case is a home that contributes to the health and well-being of its occupants. As retrofitting a substandard home to reach a good level of indoor environmental quality at a later stage is often prohibitively expensive, getting it right the first time is paramount also from an economic perspective.

The road to closing the performance gap for houses

Any attempt at raising the performance of houses needs to start with changing the methods of the Building Code; only then does an incremental increase in performance requirements make any sense. Modelling and consequently predicting the performance of houses as accurately as feasible within economic constraints needs to be a mandatory step. Certified Passive Houses are modelled with good accuracy using an inexpensive spreadsheet tool. Currently, the largest part of the effort of modelling high-performance houses relates to sourcing the relevant data of materials and products. Mandatory labelling requirements for building products would significantly reduce the modelling time-frame. Naturally, the design optimisation has to be coupled with checks of the as-

built performance with thorough documentation, producer statements regarding the performance of relevant items, and physical tests on site.

Next, concrete and easily measurable benchmarks for performance pertaining to indoor environmental quality need to be set in the Building Code (temperature and humidity ranges, as well as indicators for the quality of indoor air, e.g. CO_2).

To close the feedback loop, post-occupancy evaluations are necessary for a percentage of new buildings, to ascertain what worked and what did not. Evaluations should include health indicators (indoor air quality, temperature and humidity), as well as energy consumption figures.

These changes need to go hand-in-hand with an initiative to educate about housing performance and how it is achieved. This should be aimed at all building professionals, consenting authorities, mortgage providers and the general public.

To enable economies of scale for high-performance products during a transition phase, incentives for the usage of these products should be available. These should however never be percentage based, as empirically, this increases cost, but rather be either a fixed amount or reduced interest for the amount needed to finance extra cost. In any case, there should be clearly defined and demonstrated performance requirements for any funds received.

Lastly, publicly funded demonstration projects, for example low-cost social housing to Certified Passive House standard, will help with disseminating skills of designing and building high-performance houses, while simultaneously providing healthy housing options where they are needed most.

About PHINZ

We are an Incorporated Charitable Trust with the following aims:

To advance education through:

- Educating the building industry and members of the public about improved energy efficiency in New Zealand buildings;
- Promoting the Passive House Standard
- Researching the performance of built Certified Passive Houses in New Zealand and making such research publicly available;
- Researching the New Zealand housing industry in order to promote energy efficient building options;
- Providing a platform for the building sector to gain knowledge of highly energy efficient buildings;
- Educating building professionals and lay persons about Certified Passive Houses.

To benefit the community by:

- Improving public health and well-being and relieving fuel poverty of the people of New Zealand through the promotion of healthy and highly energy efficient homes and public buildings;
- Working with the public sector of New Zealand to improve the energy efficiency of New Zealand homes and public buildings.

To learn more about the Passive House Institute visit www.phinz.org.nz

Passive House Institute New Zealand

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PO BOX 11766, Wellington 6142

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