

LCH 13

Ymateb gan : Ymddiriedolaeth Passivhaus
Evidence from : Passivhaus Trust

1. Introduction

This response from the Passivhaus Trust highlights how housing built to the Passivhaus standard can play an important role in Wales' low carbon transition. The skills and technologies used to achieve this level of performance are already well established and proven in the UK and across the world

2. The role of housing (and Passivhaus!) in Wales' low carbon transition

Housing has a key role to play in any low carbon transition. Obviously, the performance of the existing stock is the most important factor, as it is responsible for approximately 25% of CO2 emissions across the UK. However, improving new homes is also important, so that they no longer contribute to the problem and future retrofitting will no longer be needed.

Passivhaus is one way of achieving these highly efficient homes in Wales. Passivhaus buildings use very little energy for heating and cooling, while providing a high level of occupant comfort. They are built with meticulous attention to detail and rigorous design and construction according to principles developed by the Passivhaus Institute in Germany, and can be certified through an exacting quality assurance process.

The Passivhaus New Build standard is set at 15 kWh/m².a for heating energy demand and Passivhaus buildings typically achieve this performance in reality. New homes built to current Building Regulations i.e. Part L 2013 might typically achieve heating energy demand of approximately 60-80 kWh/m².a in practice. Passivhaus homes will therefore consume less than 25% of the heat energy for a typical new build home or, looked at the other way, will use 75% less heat energy than a typical new build home. This can make an important contribution to Wales' low carbon transition.

3. The development and availability of skills and technology for highly efficient housing

There are two major challenges presently facing the Welsh housing industry:

1. The Welsh Government's commitment that all new buildings be 'Nearly Zero Energy' by 2020 (1).

2. Evidence that many new low energy buildings are not performing as well as they are designed to (2) in terms of three importance aspects:
 - energy use
 - ventilation and indoor air quality
 - thermal comfort and overheating

It is no longer enough to use a standard building design and construction process, with bolted-on energy supply solutions. Research into the real performance of buildings has revealed serious problems with this approach. A significant 'performance gap' has been identified with many new buildings, relating to evidence that they are using more energy than expected, whilst also experiencing problems with both indoor air quality and overheating (3).

Passivhaus offers a cost-effective, quality assured alternative to the standard approach, and it has been shown to deliver the required levels of performance on a consistent basis (4).

Passivhaus is a very low energy standard, that offers the skills and technology necessary to deliver highly energy efficient homes. It was developed to close the performance gap and ensure the delivery of good indoor air quality and consistent thermal comfort throughout the year by using an advanced calculation tool (PHPP) and providing an approach that is quality assured throughout. This ensures that Passivhaus buildings really deliver reduced greatly energy use, good indoor air quality and comfortable temperatures throughout the year.

Recent research carried out by Bath University demonstrated that there is 'no evidence of a performance gap in certified Passivhaus homes in the UK' (5). Space heating and overheating were monitored in Passivhaus dwellings.

'the homes are, on average, performing better than the design prediction of 15 kWh/m²/year and the performance gap seen in other dwellings, where more energy is being used for space heating, is not being seen in these certified Passivhaus dwellings.'(5)

By considering improved performance in terms of the whole building and the processes throughout, and bringing these together into a design tool – the Passivhaus Planning Package (PHPP) – the Passivhaus approach simplifies the work needed to deliver a real high quality, healthy, comfortable, low energy building. In addition, a Passivhaus building that is designed to respond to the climate, and is well insulated and ventilated, provides protection from summer overheating as well as winter cold. All these factors ensure that a Passivhaus building will deliver a high quality internal environment that will support and enhance the health and well-being of the building's occupants, while using very little energy.

With the first Passivhaus building built in 1991, over 65,000 buildings have been designed, built and tested to this standard worldwide (6). In the UK more than 150 projects, encompassing over 800 units, have been certified Passivhaus, some of which are in Wales (7).

The Passivhaus Trust is the official organisation for Passivhaus in the UK. The Passivhaus Trust members map (8) shows the location of many practitioners with a range of expertise and experience in Passivhaus design and construction, around the UK. These include architects, designers, consultants, builders, engineers, product suppliers and manufacturers, clients and academics. There is also an active programme of education and training events throughout the year,

culminating in an Annual Conference. There is therefore a sufficient supply chain for the delivery of Passivhaus homes in Wales.

4. Improving the energy efficiency of the existing housing stock

, Passivhaus also has a role to play in improving the efficiency of the existing housing stock. The Passive House Institute has developed the EnerPHit – ‘Quality-Approved Energy Retrofit with Passive House Components’ Certificate. This involves the same measures of improved insulation, thermal bridges and airtightness, as well as use of high quality windows and whole house ventilation with heat recovery. These measures can achieve energy savings of 75 to 90% (9).

Application of this standard in the UK is at an early stage, with three large tower-block projects (Manchester, Glasgow and Portsmouth) and about 10 small-scale (individual home) projects. Experience so far suggests that Passivhaus retrofit might be useful and cost-effective on the large-scale schemes, but too onerous on individual dwellings, unless a complete refurbishment is being undertaken anyway.

5. Delivering affordable energy efficient housing at scale

Passivhaus can provide one option for delivering affordable, energy efficient housing at scale. Results from some of the first Passivhaus social housing units built in the UK have demonstrated some interesting results, both in terms of capital costs (10) and in terms of running costs (11). However the capital costs of these early projects include additional costs for innovation, which should reduce over time. This research is currently being updated, and the interim findings are presented below, although the report won't be available for at least six months:

- a. Capital Costs – there can be an additional capital cost for Passivhaus homes, if everything else (design standards) is kept the same. If however, the design is adjusted to be more efficient for Passivhaus (orientation, windows etc) then it is possible to achieve the Passivhaus standard at no extra cost. This has been achieved by Exeter City Council on their latest two schemes, because they set their brief to achieve this, and adjusted the designs accordingly.
- b. Operational costs – there will be a significant saving in energy costs for occupants of a Passivhaus home. Average annual heating bills can be approximately £150 for a typical 2 bed terrace, although this obviously depends on the lifestyle and behavior of the occupants. In Exeter, they have found that some tenants have not needed to use their heating at all for several years. Additionally, the experience of Hastoe Housing is that they achieve lower voids and lower rent areas (almost zero in both cases) for Passivhaus homes because the comfort and cost benefits are so great that tenants don't want to risk losing their property.

Delivery of Passivhaus at scale is already happening on a number of large-scale housing projects such as Camden Council's [Agar Grove](#) (400+ units) and [multiple sites in Norwich](#) (400+ units)

6. Barriers to delivering transformative change

We have been doing some work to find out how to encourage Local Authorities and Housing Associations to adopt Passivhaus on their own housing schemes.

http://www.passivhaustrust.org.uk/competitions_and_campaigns/passivhaus-for-local-authorities/

Current barriers that they have identified include:

1. Increased capital costs compared to existing building regulations & no facility for sharing cost savings from operational/ asset management budgets to cover uplift in capital cost budgets
2. Lack of expertise about procurement of high performance homes in the client organisations
3. Risk aversion (and hence risk pricing) among contractors when bidding to build higher performance homes

Introducing tighter regulations would remove most of these barriers, as there would be a level playing field set at a higher standard, so clients and contractors would both come up to speed and there would no longer be a cost differential.

7. Does Wales have the requisite skills to facilitate the change required

Not at the moment. In particular, housing clients will need additional support in order to make the transition to procurement of higher-performing homes such as Passivhaus, either by seeking specialist advice from the representative UK organisations – such as the Passivhaus Trust – and/or by provision of a dedicated procurement support hub/ facility to assist them.

Once the Regulations change, then the supply chain should be able to quickly bring itself up to speed about the changes needed to achieve successful delivery, and there are plenty of facilities to support them in the delivery of Passivhaus, although similar facilities may not exist for other approaches.

8. What changes are needed to Building Regulations to achieve NZEB and beyond.

We particularly support the following changes:

1. Higher standards of fabric energy efficiency – ideally including an absolute target in kWh/m²/yr
2. A flexible carbon reduction target but with a minimum fabric energy efficiency backstop
3. Qualitative risk assessment for overheating, followed by quantitative risk assessment where needed
4. Measured ventilation rates as a proxy for good indoor air quality
5. EITHER Performance in-use data for a percentage of projects OR External review of predicted performance

9. Examples of good practice in Wales (and beyond).

There are numerous examples of Passivhaus homes in the UK (see [here](#)) and many more across Europe and worldwide.

Several of these projects are in Wales – for example in [Ebbw Vale](#) and [Swansea](#). Indeed the UK's first ever Passivhaus building was built in Wales see [here](#). There are also several other Passivhaus trial schemes being developed through the Welsh Housing Innovation Programme.

References

1. Written Response by the Welsh Government to the report of the Environment and Sustainability Committee entitled A Smarter Energy Future for Wales
<http://senedd.assembly.wales/documents/s57872/Welsh%20Government%20Response.pdf>
2. Zero Carbon Hub work on the performance gap
<http://www.zerocarbonhub.org/current-projects/performance-gap>
3. Zero Carbon Hub, Carbon Compliance for Tomorrow's New Homes: a review of the modeling tool and assumptions – Topic 4 Closing the gap between designed and built performance, NHBC Foundation, Aug 2010
4. Feist W, Peper S, Gorg M, CEPHEUS Final Technical Report, Passivhaus Institut, Enercity & Energieinstitut Vorarlberg, July 2001
5. The Passivhaus Trust - *The performance of Passivhaus in new construction: Post occupancy evaluation of certified Passivhaus dwellings in the UK: Early Results (July 2017)*
http://www.howtopassivhaus.org.uk/sites/default/files/The%20performance%20of%20Passivhaus%20in%20new%20construction_July%202017%20V2_0.pdf?
6. The Passivhaus Trust website
<http://www.passivhaustrust.org.uk>
7. Passivhaus Trust Project Gallery
<http://www.passivhaustrust.org.uk/projects/>
8. Map of Passivhaus Trust members (<http://www.passivhaustrust.org.uk/members/map/>)
9. Passipedia -Details of the Enerphit standard
<https://passipedia.org/certification/enerphit>
10. Passivhaus Trust & AECOM Passivhaus capital cost research project (January 2015)
<http://www.passivhaustrust.org.uk/UserFiles/File/Passivhaus%20Capital%20Cost%20Research%20Project%20-%20Passivhaus%20Trust,%20January%202015.pdf>
11. Encraft Technical Insight: Whole-life costs of a Passivhaus:
Sensitivities of whole-life cost analysis for domestic Passivhaus buildings (February 2014)
<http://www.encraft.co.uk/wp-content/uploads/2014/02/Technical-Insight-February-2014-Whole-life-Costs-of-a-Passivhaus.pdf>