Passivhaus vs. the UK approach – a non technical comparison of the different principles

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I've been working with Passivhaus for a year now, having previously worked with the UK approach of SAP and Building Regulations. The technical differences are interesting, but the subtle differences in principles are where we have the most potential to learn.

It's important to recognise their common ground, and by 'they' we are really talking about two different ways influencing the design of a building in order to reduce its energy use. We are not really talking about which is easier or harder, the Passivhaus standard is clearly more demanding, we are talking about different principles.

They both use a model to predict energy use, Passivhaus uses the Passivhaus Planning Package (PHPP), and the current UK approach uses SAP 2009. They also both have a set of targets against which compliance is judged – the Passivhaus standard and the Building Regulations Part L.

Rewarding good shape

For the UK approach, Part L relies on what is called a 'notional building' comparison. This sounds confusing, but is really very simple. It says that your building must be better thermally than if you built it using the energy efficiency standards of 2002 Part L. This effects basic design, because if you're only comparing your building with itself, nowhere are you comparing it to a building design that has fundamentally more efficient shape. Passivhaus on the other hand compares your building's energy use to a fixed target – the well known 15kWh per m^2 of useful floor area, per year. This pushes the design towards a more efficient allocation of heat loss area to useful floor area, better orientation and better consideration of the quantity of glazing.

This makes PHPP an invaluable tool at the initial design stage for optimising the design fundamentals, and the UK approach much less useful.

The UK approach certainly has its advantages, for example the 'notional building' model is a lot more forgiving of certain errors. If the SAP assessor enters extra wall area, it doesn't really matter in compliance terms because the notional house will have exactly the same amount of extra wall area – and thus both result and target move in parallel. Passivhaus in contrast has a fixed target and relies critically on the competence of the assessor.

The UK approach comes down to simply judging compliance, whereas Passivhaus and PHPP guide the whole design towards an efficient, low energy solution.

Considering Comfort

Another key difference in principles is found in the drivers behind Passivhaus and the UK approach. The Passivhaus driver is human comfort: cold draughts are eliminated and the cold radiant effect is minimised with a purpose. This purpose is to create an environment where a person can be warm and comfortable without compensating for a poor atmosphere by turning up the thermostat. The UK approach has nods toward comfort: a maximum air leakage rate, backstop U values and consideration of summer time overheating. However, if you want to roll back the air leakage and U values to backstops and compensate with solar PV you will still comply with building regulations, but comfort certainly won't be the priority.

Closing the design loop

An interesting difference has become apparent to us recently with the changes in the treatment of thermal bridges in the UK approach. Consideration of thermal bridges is absolutely essential in designing a low energy building so broadly I welcome the more robust treatment in the 2010 regulations.

However, again the difference in principles with Passivhaus is interesting. PHPP, the Passivhaus model, is based on external measurements of the building. These, being inherently larger, build in a margin into the standard calculation of heat loss. This has the effect of eliminating some of the academic 'thermal bridges' present in SAP such as normal wall corners – which are really just created by a geometric oddity rather than poor construction. The result with Passivhaus is that the architect can produce a 'thermally bridge free' design and no consultant ever needs to do a calculation. Thermally bridge free design can be verified by simple inspection of junction, using a rule of thumb. SAP conversely has fifteen different bridges (at my count) – all of which need to calculated or picked from a catalogue – and none of which can ever be thermally bridge free because SAP's internal measurements inherently underestimate heat loss.

The Passivhaus approach is to bring design back to the architect, who will aim to refine their details until they can be declared thermally bridge free by simple inspection. I fear that the UK approach will spawn a range of new professions and complexity – perpetuating the one way process of box ticking and checking familiar in current SAP assessments.

Compliance vs. low energy

In conclusion, as the UK approach is based on standardisation, it is no harder to pass the emission target in Newcastle than it is in Penzance, despite the significantly colder climate. Nor is it appreciably harder to pass a house with a convoluted thermal shell compared to a simple form. It is easy to see the advantage of such an approach, but it should not be confused for a route to low energy design – and the occasional anomalies it throws up make you wonder whether there must be a better way.

The fixed Fabric Energy Efficiency (FEE) standard (due to be implemented in 2013) is a step towards the principles of Passivhaus, and seems like a move in the right direction.

In the meantime understanding Passivhaus principles and learning how to use PHPP to assess your designs will certainly push you towards designing more comfortable and lower energy buildings – even if you don't achieve the full Passivhaus standard.

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WARM are an independent consultancy with the theoretical and practical understanding to bring pioneering low energy buildings from design to reality. WARM specialise in Teaching, Designing, Certifying & Testing to the Passivhaus standard, Peter Warm is endorsed by the Passivhaus Institut in Darmstadt as Passivhaus Certifier.

WARM was formally set up in January 2009 by father and daughter Peter Warm & Sally Godber. With the aim to design buildings that demonstrate real energy savings. The Passivhaus standard hit a chord with this ambition and quickly became the mainstay of their work.

Currently, the practice are working on a number of Passivhaus projects including the new build of several schools and social housing schemes, as well as the retrofit of existing housing.