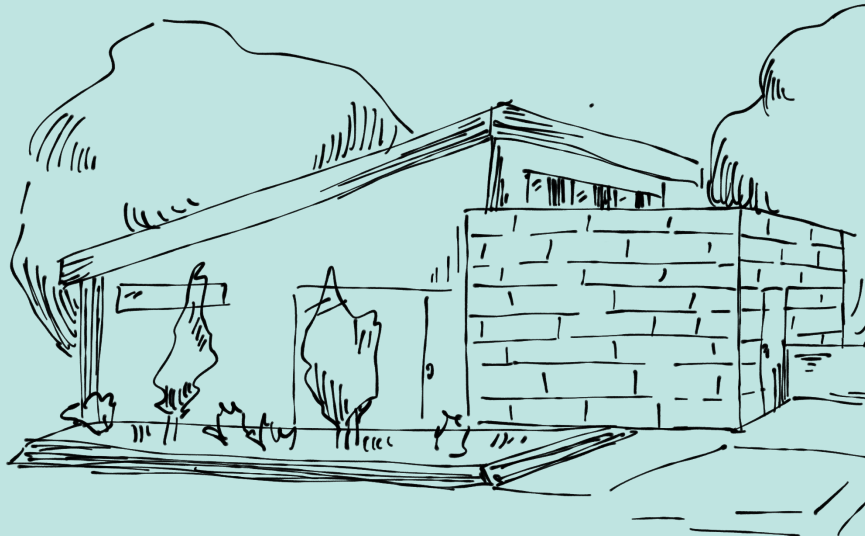


Greenheart's introduction to Passivhaus



Passivhaus is the most widely recognised international energy and comfort standard for buildings, with a rigorous assessment and commissioning system. It's effectively the best standard to work with, which is why we use it as a starting point in our projects.

Benefits

The benefits of Passivhaus go further than Energy efficiency – Passivhaus principles put occupant wellbeing front and centre to ensure a supremely comfortable and healthy living environment, with steady interior temperatures and fresh air supply.

Anyone who's experienced Passivhaus buildings will notice how comfortable they are. We often don't realise how poorly traditional houses perform until we experience the constant temperature and fresh air of a Passivhaus.

How is it assessed?

The care required to achieve the required airtightness and thermal-bridge free construction demands attention to detail and a very high level of quality overall.

For new-build projects there are three Passivhaus classes (Classic, Plus and Premium) and for the refurbishment of existing buildings there are two classes (Enerphit, or Enerphit by component). With just a handful of Passivhaus Plus new-builds currently in the UK, we're incredibly proud that one of them is ours.

Compliance is primarily determined by reaching a very low level of energy consumption for space heating (Specific annual heat demand); this is somewhere in the region of ten times lower than a standard build (although no direct comparison is possible because of different methods).

Other Passivhaus certification criteria are calculated using the Passive House Planning Package (PHPP) modelling software, and include:

- **Primary energy:** Overall building energy consumption accounting for the energy source/fuel type mustn't exceed a maximum level
- **Renewable energy generation:** this applies to PH Plus, and premium only*
- **Airtightness:** This figure must be below 0.6 air changes/hr under 50pascals of pressure for new builds
- **Overheating risk:** This must be limited to a maximum number of days a year when the PHPP model shows the interior temperature exceeding going above 25°C.

Passivhaus design principles

Passivhaus principles can be applied to the design of any type of building, in any kind of climate; irrespective of project type, for the most efficient and economical solutions, the designer should always consider Passivhaus from the very beginning.

First and foremost, a building designed with Passivhaus principles in mind should consider:

- **Orientation:** in relation to the sun-path and the building's position on the site.
- **The size and position of glazed elements:** windows should be designed for daylight and view, but the heat they let in and out is fundamental to the Passivhaus model. Windows and glazed doors typically lose more heat by conduction than an equivalent area of wall or roof, but the heat they bring in from the sun plays a significant part in the heat balance.
- **Efficiency of the form:** this looks at form factor (or the ratio of external surface area to useful floor area) and the likelihood of thermal bridges at junctions (bits of the building that stick out, bolt on or overhang).

Once those key factors have been considered, the design should address:

- **Building envelope:** Looking at Uvalues (which measure how effectively the various elements of a building fabric are at preventing heat from transmitting between the inside and the outside of a building) and continuity of the insulation layer.
- **Airtightness:** Identifying a clear strategy to prevent uncontrolled ventilation (draughts). The choice of materials (such as membranes, tapes and sealants), detailing and the position of an airtight 'layer' within the building envelope all play a role in this.
- **Solar gain and shading:** Considering in more detail the effect of windows and glazed doors, along with the risk of overheating and mitigation through shading.
- **Thermal bridges:** Minimising conduction of heat through junctions in the construction.
- **Fresh air supply:** Using highly efficient mechanical ventilation with heat-recovery. and Purge ventilation through windows.

Common misconceptions about Passivhaus

- **There's no heating:** A Passivhaus in a cold climate will require some heating.
- **The windows need to be tiny:** It's not that simple - while large windows lose more heat, they also provide more heat from the sun. The fact is that whatever the size, windows must be of a very high specification and carefully designed.
- **The windows must be fixed and stay closed:** Occupants can and should open windows when needed! For example, being able to rapidly ventilate at night is a key part of managing the overheating risk, and when outside air is warm enough we all want open windows. What's important to understand is that when the air outside is cold, opening windows isn't necessary to provide the fresh air we require.
- **They look boring:** Nobody wants a building form devoid of character; elegant simplicity works and has architectural merit in its own right. And more complex forms can be made to conform, though some may deem the Uvalues and types of insulation needed to offset the consequent surface area and cold bridges to be prohibitively expensive.
- **They must measure 21° throughout the building at all times:** 21° is a design benchmark used to ensure consistency in the modelling. Occupants have full control over the temperature, based on what they consider comfortable. Passivhaus works on the premise that temperatures should be fairly consistent throughout the building, but in reality many people prefer bedrooms to be cooler than living rooms or bathrooms, and that's not a problem.

Our approach

The Passivhaus Planning Package (PHPP) is the standard Passivhaus modelling software and takes the form of an Excel workbook that overlays a complex set of background calculations with a user-friendly interface. We have a certified Passivhaus consultant in-house who can provide PHPP modelling, where options can be tried and assessed for their effect on the building's performance along with their relative build costs. With the designers and builders under one roof, Greenheart is uniquely positioned to offer that comparison.

For early stage design work, we use DesignPH (a 'plugin' for the popular 3D modelling software SketchUp) to rapidly assess whether a scheme is heading in the right direction and whether one design concept out-performs another.

Once completed, the PHPP model and supporting design information is passed on to an independent certifier for validation, oversight during construction and sign off.

To certify or not to certify?

A building needn't have Passivhaus certification to benefit from the Passivhaus approach. Modelling can be an effective design tool for any building where energy use is a key consideration. With over 20 years' passivhaus experience, all Greenheart buildings incorporate passivhaus principles to some degree, and many do achieve official Passivhaus certification.

Other standards, like AECB and 'Low energy building', have some merit but in our experience are most often invoked when Passivhaus is out of reach for a given design.

Whilst some are huge advocates of Passivhaus certification, others argue that certification represents an unnecessary cost and that too much significance is placed on 'in-use' energy.

Embodied CO2 (the energy used in the production and movement of materials) and use of natural, low toxicity or ethically sourced materials (ethically produced materials with low toxicity), are equally important when considering green building as a whole, especially as the energy grid becomes cleaner and greener - and neither of these are Passivhaus criteria.

Implementing Passivhaus principles as part of the design process and pursuing Passivhaus certification are two separate things. While the decision whether or not to certify is a subjective one that each of our clients decide based on their specific situation, the objective fact is that Passivhaus is a very useful, effective methodology which offers some of the tools we need to do be part of the climate solution and its widening recognition increases the value associated with its badge.

At Greenheart we have the capacity and skills in-house to provide Passivhaus design and modelling services, and our buildings typically exceed the levels of airtightness and general quality required to pass the test. So, if you're considering a sustainable build project and want the peace of mind of working with an experienced Passivhaus design and build company, do get in touch. Whether you're looking for a partner to guide you through the process from conception to completion, or to work with your passivhaus architect and take on the construction side of things, we're just a call away.