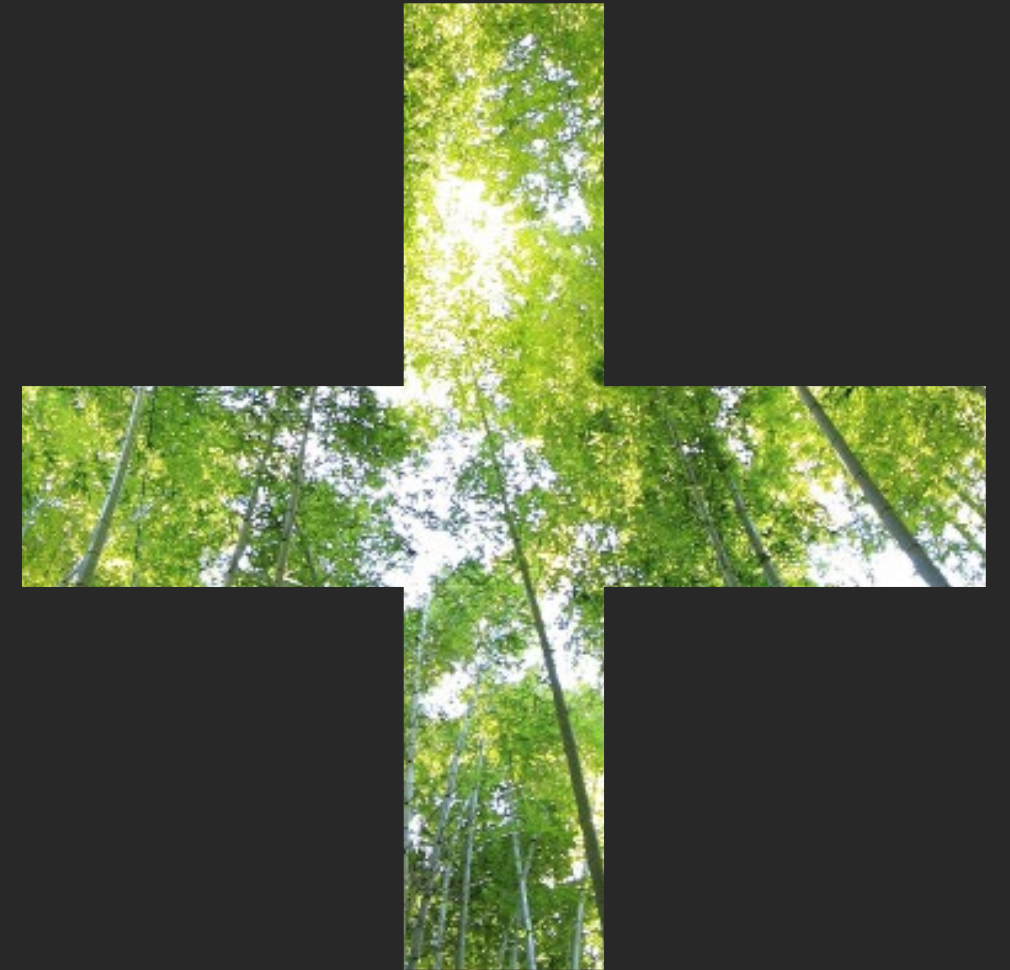


Our guide to

# DESIGN-LED PASSIVHAUS



HABITAT+

architects | designers | creators





# BUILDINGS DESIGNED BETTER.

Carefully crafted, creatively  
sustainable design.  
Exceptional service.

From design-led, boundary pushing Passivhaus, to creatively re-imagining existing buildings and communities, our projects are individually crafted to exceed each client's individual brief.

Habitat+ Architects was created from a desire to design better buildings and spaces which have a positive impact on the lives of those using them, whilst minimising their environmental impact. We believe that great design comes from passion and care, integrating knowledge, experience and innovation.

We strive to give each and every project exceptional consideration to ensure that the outcome exceeds expectations and has a positive impact through design and sustainability on the environment into which it is placed.

**We design better buildings.**

HABITAT+  
architects | designers | creators



A photograph of a dining room. In the foreground, a large, light-colored wooden table with a thick top and a bench sits on a tiled floor. The table has a rustic, handcrafted appearance. Behind the table, several wooden chairs with curved backs are visible. A potted plant sits on the table. In the background, a kitchen area is visible with white cabinets, a dark countertop, and a bar stool. A framed picture of a Highland cow hangs on the stone wall to the left. The overall atmosphere is warm and modern.

# DESIGN-LED PASSIVHAUS.

Do you want a building with zero or minimal energy bills which also looks and feels amazing?

While many Passivhaus buildings are simple in form and design, we believe in pushing the boundaries to achieve the high standard in exciting, carefully crafted buildings. We move away from the formulaic to test new forms and architecturally strong shapes which are informed by their context. In short, our Passivhaus buildings have that 'wow-factor' as well as excelling in every element of design.

Passivhaus is suitable for every building type. With our design-led Passivhaus, achieving low energy compliance doesn't mean having to compromise other elements of the design. We have used design-led Passivhaus to create exciting designs in locations with difficult planning constraints, such as Conservation Areas, while challenging the limitations of modular construction methods to help bring these designs to life.



“Our site was beautiful but challenging and we were aiming for a highly sustainable, contemporary home. We found Tim and Tom both creative and practically supportive in overcoming the challenges, to achieve a beautiful design and an enjoyable experience for us.”

Dr Frank Ainscow and Dr Kerry Mashford OBE





# WOW FACTOR.

Our **design-led Passivhaus** buildings are imaginative, exciting buildings which result in a higher quality of life and minimal running costs.

Anchorage Passivhaus, Wyre Piddle



# PASSIVHAUS?

## LOW ENERGY BUILDINGS THAT FEEL AMAZING

Passivhaus is an internationally recognised comfort and energy building standard which uses passive, low-tech techniques to drastically reduce, or eliminate the need for space heating. Its formula includes significant levels of insulation, high air-tightness, triple glazing, minimal thermal bridges and mechanical ventilation and heat recovery to provide an exceptionally healthy and comfortable indoor environment with low running costs.

“Passivhaus does indeed minimise energy demand, but it delivers much more, including health and well-being of occupants; our ability to meet climate targets; construction quality; and commercial benefits to owners, employers and lenders, to name just some.”

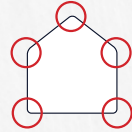
## KEY PRINCIPLES



High level of continuous insulation to the building perimeter.



An continuous, extremely air tight fabric.



Reduced thermal bridges (weak spots).



Triple glazed windows.



Efficient background ventilation with heat recover (MVHR).

## WHAT ARE THE BENEFITS OF PASSIVHAUS?

### BUILDING PERFORMANCE

- Low energy demand
- Reduces performance gap
- High levels of comfort
- Effective and healthy ventilation
- Higher performance building components
- Better site QA procedures resulting in better construction quality
- Lower risk of building fabric damage
- Resilient and future-proofed buildings

### CLIMATE EMERGENCY

- Lower carbon emissions
- Lowers peak demand
- Lowers the overall requirement for renewable energy
- More economical to save energy than to generate it
- Gives us the best chance of achieving net zero in buildings
- Enables decarbonisation without increasing fuel bills
- Robust in the face of short-term extremes and longer-term climate changes
- Ability to support demand response
- Lower cooling requirement in a future warmer climate

### HEALTH & WELLBEING

- Eliminates cold homes – and associated health impacts
- Guarantees good levels of ventilation – essential for health
- Reduces internal pollutants such as VOCs
- Deals with internal humidity - eliminates condensation and mould
- Improves quality of life for people with chronic illness or disabilities
- Protects against external air pollutants
- Reduces risk of airborne infection
- Reduces the impact of external noise

### FINANCIAL

- Lower energy bills
- Rental - fewer and shorter void periods
- Reduces the extent and depth of fuel poverty
- Higher capital value 5-7%
- Lower maintenance costs
- Lower management costs
- Ability to access cheaper time of day tariffs
- Lower whole life costs
- Lower borrowing costs / Green mortgages
- Ability to access cheaper green finance
- Holds value in the event of future carbon or efficiency legislation
- Lower risk of defects litigation
- Lower risk of repetitive damage due to quality issues

### PEOPLE PERFORMANCE

- Reduced absenteeism
- Improved productivity
- Improved learning outcomes
- Attract and retain staff

### SOCIAL

- Improved health & wellbeing of communities
- Reduced demand on health and social services
- Improved learning outcomes for children
- Economic stimulus of construction
- Upskilling of the construction workforce
- Clear statement of intent for transition to a net zero economy
- Demonstrates compliance with social value policies and targets
- Aligns with several UN Sustainable Development Goals





# WON'T PASSIVHAUS RESTRICT THE DESIGN?

Passivhaus is a performance standard relating to comfort and energy efficiency. How this is applied to a brief and site is in the hands of the designer. There are numerous examples of the standard being applied as a formula, leaving the end product without the wow-factor, but we believe in using the Passivhaus standard to achieve comfortable, low energy design without compromising design. That's why we call it **design-led Passivhaus**.

We've integrated cantilevers and angled shapes. We increase glazing where you will get benefit from connecting with the landscape but compensate to ensure the building doesn't overheat.

How Passivhaus is applied is entirely in the gift of the designer, which is why with us you know we will make sure your building has a physical and emotional wow-factor.

# STUFFY? NOT AT ALL.

Conventional buildings can sometimes feel stuffy because the CO<sup>2</sup> level is too high, requiring occupants to open the windows, but in a Passivhaus, the ventilation system supplies the interior with constant fresh air preventing this issue. Passivhaus buildings are better insulated and much more airtight than regular builds. However, thanks to the ventilation system expelling stale indoor air and replacing it with fresh air from outside, they remain excess moisture and mould free. This, together with the comfortable interior temperatures that the heat recovery system and quality building envelope maintain means that excellent air quality is guaranteed!

**“People who live in energy efficient homes have been found to be in better health, with improved mental wellbeing, reduced contact with the health service and reduced absence from school or work.”**

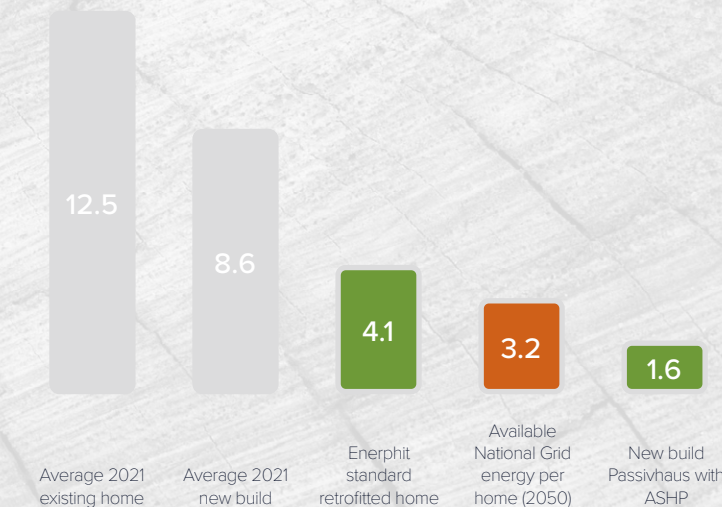
# MYTH BUSTING.

## AREN'T NEW BUILD HOUSES ENERGY EFFICIENT ALREADY?

Most new build houses are built to satisfy current building regulations, which are fairly basic standards and can be easily exceeded. New build houses often suffer from significant 'performance gap' (the different in energy and comfort performance between what

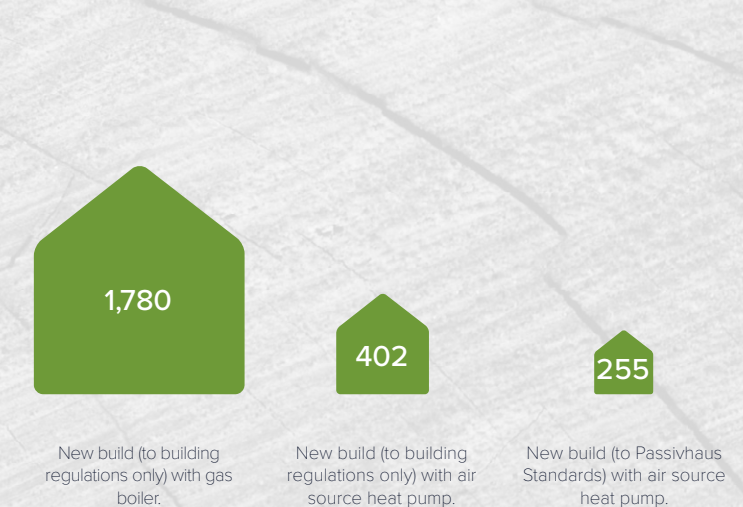
is designed and the real world situation) due to poor quality workmanship and a lack of post design analysis and testing. What's more, the energy which the National Grid anticipates it will be able to deliver in 2050 is far short of a new-build energy demand.

Heating and Hot Water Demand of UK Homes MWh/year



Graph courtesy of Passivhaus Benefits December 2021 by Passivhaus Trust, page 18, Figure 5.

Cumulative CO<sub>2</sub> operational emissions from 2021-2025 (tonnes)



Information courtesy of Passivhaus Benefits December 2021 by Passivhaus Trust, page 18, Figure 5.



# LET'S TALK ABOUT COST.

Passivhaus adds value. Great design is priceless.

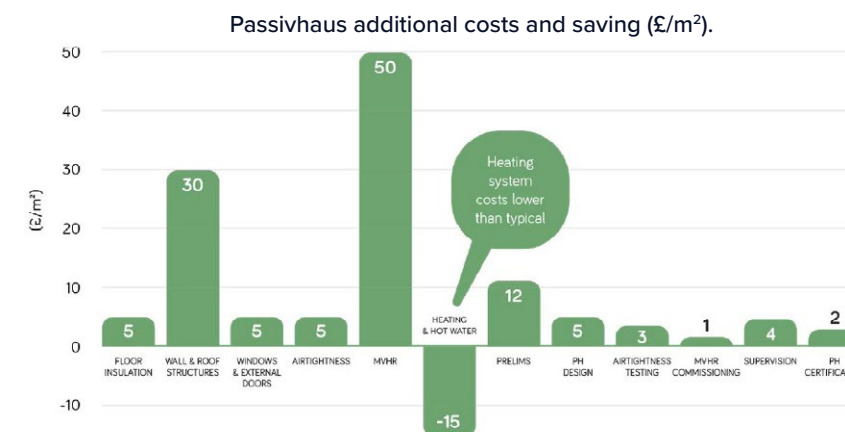
## PASSIVHAUS IS EXPENSIVE RIGHT? It's all relative.

Project to project delivery varies, but according to the Passivhaus Trust a Passivhaus will typically be **8%** greater in capital cost to deliver than the same building built to meet only the standards of building regulations. However, these additional costs result in a far superior quality product, with a higher capital value (demonstrated to be **5-7%**), lower running costs and lower maintenance costs, not to mention occupant health and well-being.

The capital cost of the structure is generally similar, with additional costs coming through the requirement for a mechanical ventilation heat recovery

system and triple glazing. Savings will be made through a significantly downsized heating system as a traditional centralised heating system with radiators is not required. Significantly, this cost is also offset against significantly reduced lifetime running costs, with the Passivhaus Trust research indicating that the payback period may be as little as **8 years**.

Good design on the other hand doesn't cost anything more than that of the designer themselves. This is where we help you maximise the benefits and experience of living in numerous, unquantifiable ways.



Graph courtesy of Passivhaus Benefits December 2021 by Passivhaus Trust, page 39, Figure 11. Information from Passivhaus Construction Costs, Passivhaus Trust, October 2019.



# NET ZERO THE EXTRA MILE

'Net-zero' refers to a building's operational energy. If a building is net-zero, then it produces as much energy as it consumes, and therefore has no ongoing environmental impact (other than maintenance).

The Passivhaus standard in the UK requires space heating of less than 15kWh/m<sup>2</sup>/yr, (while the Enerphit standard allows 25) and a primary energy demand of less than 60kWh/m<sup>2</sup>/yr. By achieving this you are

already going a long way towards achieving a building which is 'net zero' in its operational energy.

Supplementing this with renewable energy sources such as solar panels or a heat pump coupled with battery storage is a good way to remove your dependency on imported energy from the National Grid, giving protection from price inflation, unreliability and potentially fuel poverty over the building's lifetime.

**“Our house has been designed so well. It fits our lifestyle and has created an amazing space to live in. The views through the amazing windows make us feel so connected to the surrounding landscape. It has exceeded all our hopes and expectations.”**

Mr and Mrs Fowler





# A RAY OF SUNSHINE.

Our design-led Passivhaus buildings ensure that we bring light into our buildings, making them feel light, spacious and airy, while ensuring that we're connecting the occupants with the aspect and external landscape. This, combined with the healthy internal environment are ideal for ensuring wellbeing.

At the same time a key element of the Passivhaus standard is maximising winter solar gain - free heat energy from the sun absorbed through mostly south-facing glazing in the winter. Careful design balances this gain with avoiding summer overheating through the same windows during the warmer months.

Where possible, this glazing will correlate with the building's aspect - the direction which the building faces. An ideal site would be south-facing but if that's not possible then we can design around this, complementing the site conditions.

When considering a deep-retrofit of an existing building - the Passivhaus Enerphit standard - then the criteria are slightly more relaxed as it recognises that you can't control orientation and have to work with what you've got. This is where we can bring a design to life, as working with existing characteristics can provide wonderful opportunities.





# THE LITTLE DETAILS.

To achieve the Passivhaus Standard and ensuring that the quality of the design shines through, careful attention to detail is paramount. Minimising thermal bridges and airtightness (bits where heat can leak out of the building) have to be meticulously designed and constructed. These need to be planned from early in the project.

We design every detail and junction, from the way an external wall connects to the roof, to how the air tightness membrane interacts with structure at difficult junctions so that it isn't compromised. As our designs push the boundaries of Passivhaus, we consider this vital to ensure that the visions can be realised and that problems which are easy to avoid never materialise.

Image courtesy of Intello.





# A BALANCING ACT.

WE WORK CLOSELY WITH YOU AND THE CONTRACTOR THROUGHOUT THE PROJECT TO AVOID A PERFORMANCE GAP AND DESIGN EROSION.

**Performance gap** - the difference between predicted performance and real world performance - is a significant risk for any building. The average UK building will consume 40% more energy than how it was designed, generally through poor workmanship and bad planning. Passivhaus not only requires a greater amount of care and attention to detail, but is also rigorously checked and tested to ensure the designed performance is achieved in reality.

Quality can also suffer through **design erosion** when poor communication leads to bad decisions reducing the quality of the project. We work closely with the design team and the contractors ensure that the details are not only deliverable, but are instigated on site. We provide clear information to ensure that the design and project goals are understood by the whole team ensuring that the final building can be delivered as designed creating a low energy, functional, emotionally moving and beautiful and provides ultimate value.

“From the monitoring of thousands of built Passivhaus buildings, energy use on average is extremely close to the amount that the modelling predicts. In an average new home, by contrast, heating demand can be 60% more than forecast using modelling.”

The Passivhaus Trust







**Our knowledge  
and experience of  
Passivhaus systems  
means we know  
the best way to  
bring YOUR  
design to life.**

There are pre-certified, modular or component Passivhaus systems available, such as Beattie Passive frame or Kingspan TEK SIPs, which, when applied to the right design, will help meet Passivhaus standards.

Our relationships with companies, such as Beattie Passive, mean we understand how far we can push the design boundaries to maximise the benefit, without adding significant cost.

We let our experience drive the solution, choosing the most suitable construction methods for the design. A certified Passivhaus construction system maybe perfect, or we can create a bespoke solution to realise your design goals. Pushing boundaries with the budget in mind is what we do best.

Whatever solution is used, we will make sure it is best suited for you.



# FREQUENTLY ASKED QUESTIONS

## **Why is Passivhaus a sustainable approach?**

Passivhaus isn't necessarily the best approach for you, but we believe that it's a fantastic low-tech, low-energy standard. Its strength is in the simplicity, and Passivhaus buildings benefit from vastly reduced energy bills and comfortable, healthy indoor environments.

## **I want a sustainable building, but not necessarily Passivhaus.**

Passivhaus isn't the only method of being sustainable. Any of the principles can be applied to any building to help minimise energy use. We seek to make all of our buildings well-designed and low energy, but there are many ways to do this and we won't force you down a particular route, but instead find out what is important to you.

## **Why should I use you to design my Passivhaus?**

We carefully craft our Passivhaus buildings so that they not only meet the required standard for certification, but also have 'wow-factor'. We believe that the standard doesn't need to come at the expense of good design, and this is a philosophy we apply throughout. We call it design-led Passivhaus.

We have good relationships with certified contractors and manufacturers who make pre-certified systems, helping you to achieve your goals in the most cost-effective and stress-free manner. We're also familiar with the common pitfalls which can hit your budget and compromise the project, helping you avoid these and saving you money.

Our co-founder Tom Locke is also a Certified Passive House Designer, recognised by the Passivhaus Trust as having substantial knowledge and expertise in the principles and delivery of low energy and Passivhaus buildings.

## **Is the standard only for new homes?**

Passivhaus is a standard for new buildings, however its sister standard - Enerphit - is designed to work with existing buildings undergoing deep retrofit. It has slightly more relaxed standards to account for unchangeable factors such as orientation, but is still designed to create low-energy, comfortable buildings and is something we can help you with.

## **What does living in a Passivhaus feel like?**

Passivhaus is a sealed box system, meaning that heat doesn't leak out of the building. Fresh air is therefore provided mechanically, filtered to maintain the quality. This means that your indoor environment is healthy, pollutant-free and comfortable all year around, regardless of outside conditions. However the buildings are still designed so that windows can open so that you have control over the environment when you want.

## **Is Passivhaus the same as net zero?**

Net zero is a concept whereby a building doesn't consume more energy than it produces. Like the word 'fitness', there are many definitions of this. Passivhaus is one way of working towards net-zero by significantly reducing the energy demand,

and when combining some renewable energy generation such as solar panels, it can achieve net zero. If certain criteria are met, this is known as Passivhaus Plus.

## **Is Passivhaus only for houses?**

Absolutely not. There are numerous commercial public and private buildings constructed to the Passivhaus standard. The application is a little different which reflects the ways the buildings are used, but the principles, which are simple can be universally applied.

## **How involved are you with the project delivery?**

We appreciate that each client is different and every project is unique, so we can tailor our service to fit your needs, being involved as much or as little as you want. All of our project service options include the highest quality of design, with 3D computer imagery and exceptional service included, with more information on our 'getting started' web page. If you need us to, we will be with you every step of the way. If not we're always only a phone call away.

## **Aren't new build houses already really efficient?**

Sadly not, this is a common misconception. New build houses are built only to current building regulations, which are standards which are fairly basic and can be easily exceeded. New build houses also suffer from significant 'performance gap' (the difference in energy performance between what is designed and the real world situation) due to poor quality workmanship and lax



**THANK YOU**

HABITAT+

architects | designers | creators

[www.habitatplus.co.uk](http://www.habitatplus.co.uk)

[hello@habitatplus.co.uk](mailto:hello@habitatplus.co.uk)