Passivhaus in Practice

Lessons Learned & Future Direction for Scotland

CIBSE Scotland

PASSIVHAUS in PRACTICE

future direction for Scotland

Sarah Lewis, Co-Director UK Passivhaus Trust

13th May 2026

Passivhaus Trust - Introduction

Leadership in the UK for the adoption of the Passivhaus standard and methodology

Promote Passivhaus to reduce energy use and carbon emissions from buildings in the UK

Promote Passivhaus to provide high standards of comfort and building health

Passivhaus - origins

> “I was working as a physicist. I read that the construction industry had experimented with adding insulation to new buildings and that energy consumption had failed to reduce.
>
> This offended me – it was counter to the basic laws of physics. I knew that they must be doing something wrong. So I made it my mission to find out what, and to establish what was needed to do it right”
>
> - Wolfgang Feist

Which sectors can use Passivhaus?

What is Passivhaus – one inclusive standard

Bicester Eco Business Centre

Agar Grove

Trafalgar Way, Mixed Use

Harris Academy Sutton, Secondary

Klinikum Frankfurt Höchst

St Sidwell's Leisure Centre

What is Passivhaus – social housing

Carrowbreck Meadow, Broadland DC

Cunningham House, Shettleston Housing Assoc.

Goldsmith Street, Norwich City Council

Primrose Park, Plymouth City Council

Sarn Passivhaus, Powys Council

Rayne Park, Norwich City Council

What is Passivhaus - quality retrofit

Erneley Close, One Manchester Housing

Niddrie Road, Southside Housing Assoc.

Wilmcote House, Portsmouth City Council

Renfrewshire Council's roll-out

Cedar Court, Queens Cross Housing Assco.

What is Passivhaus

A comfort and health standard

A route to net zero

An energy standard

A quality standard

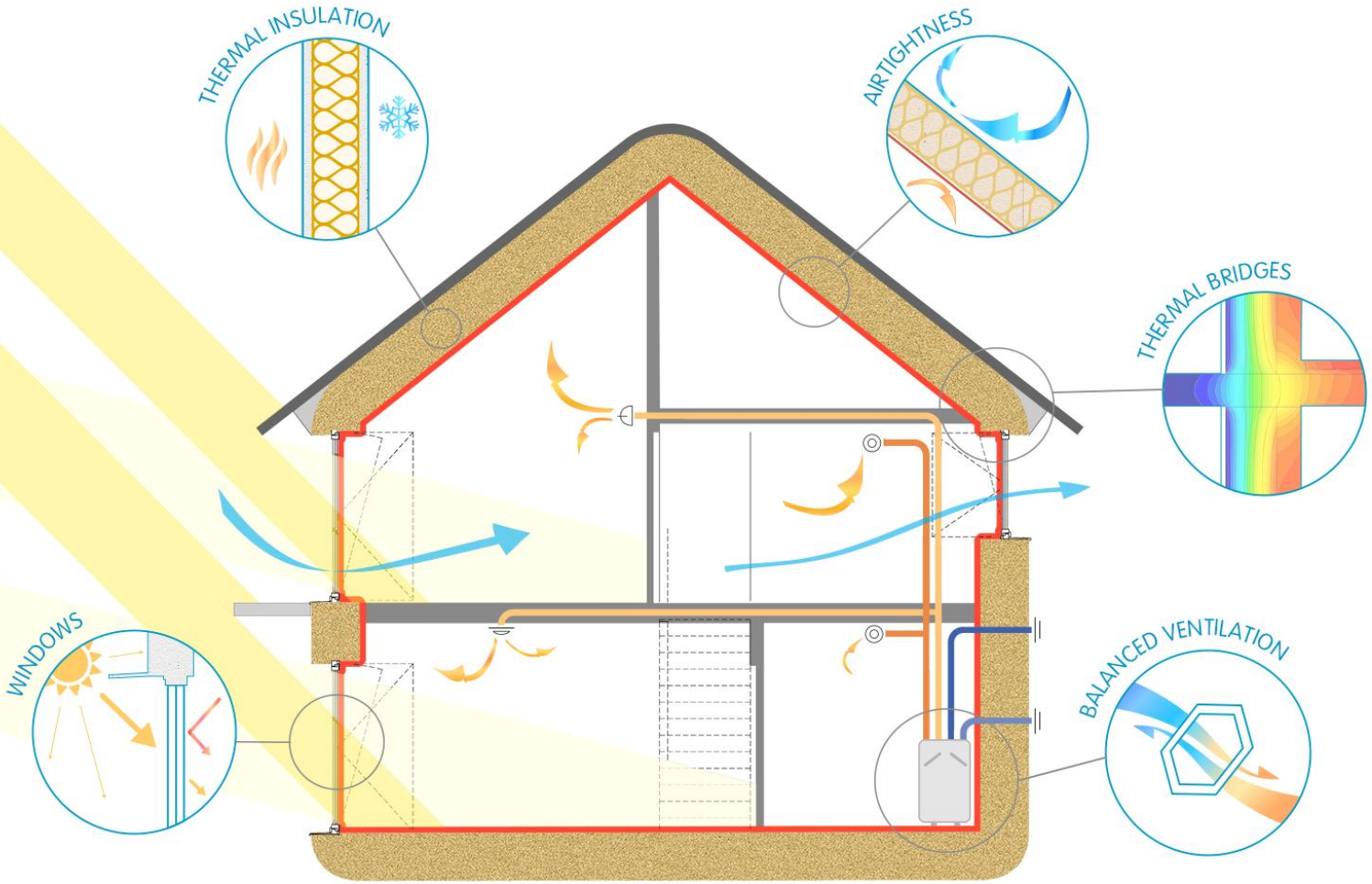
What is Passivhaus – 8 Principles

3 Principles of approach

What is Passivhaus – 8 Principles

5 Building

Principles

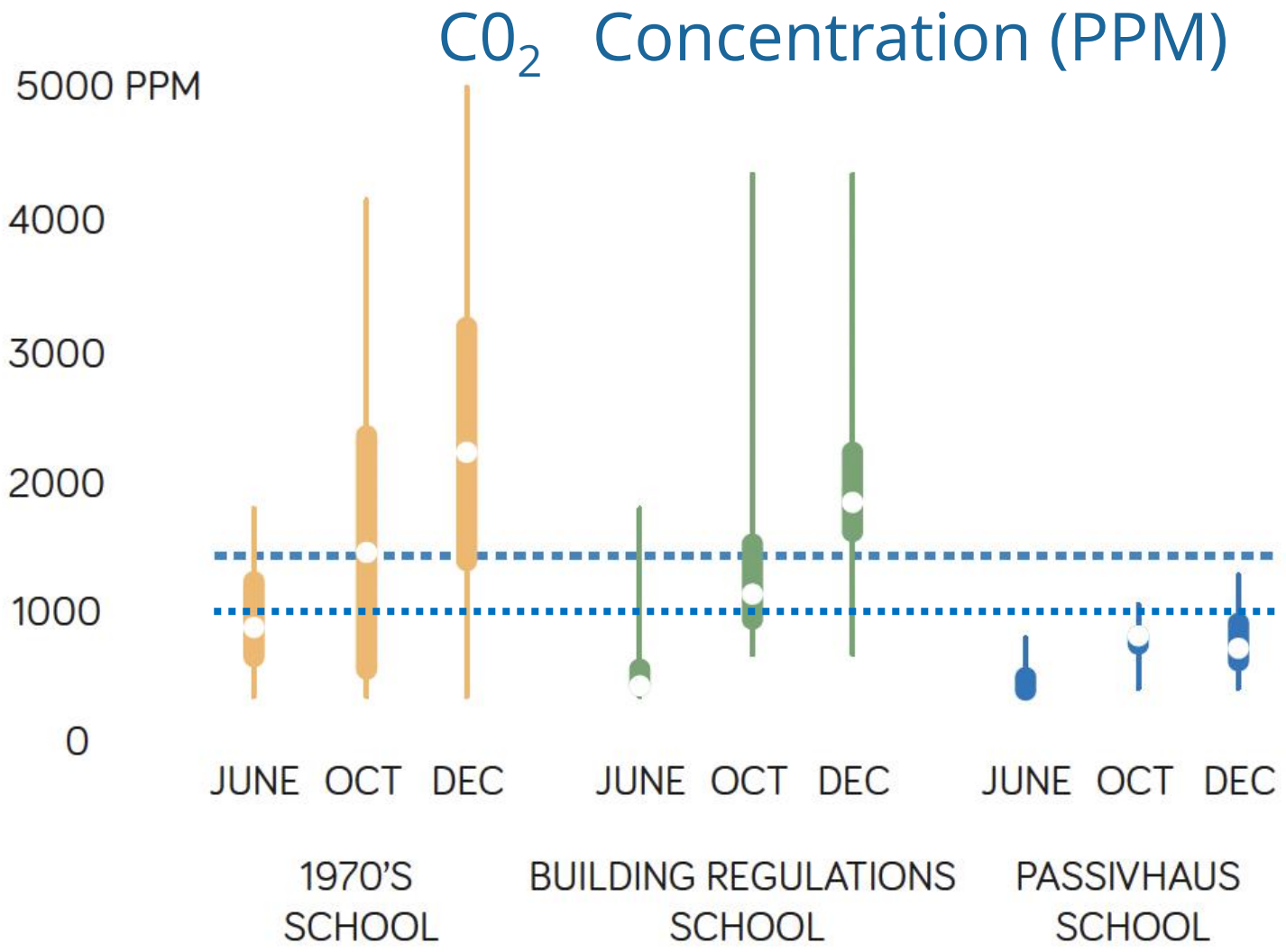


What is Passivhaus – Performance in use

A Passivhaus building is:

- The right temperature, steady in both winter and summer, and free of draughts
- High in indoor air quality, with a constant supply of tempered fresh air
- Cheap to run, with very low energy bills
- Robust and well-built.

Passivhaus Health



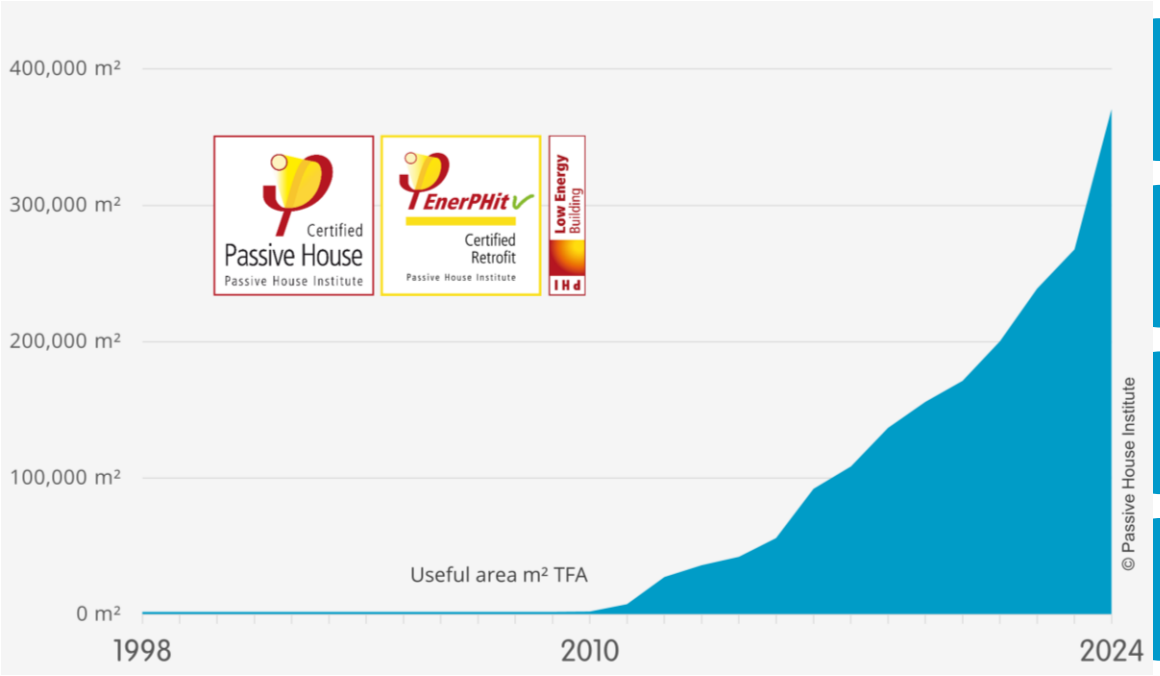
Data source: Architype

People Performance

1. 13% reduction in absenteeism
2. £23,000 reduction in energy bills

Interserve, Watermead Business Park in Leicestershire

UK Passivhaus Uptake – 1%



> 470
GB CERTIFIED PROJECTS

> 2200
GB CERTIFIED DWELLINGS

370,600 m²
TFA CERTIFIED

> 8000
UNITS IN DEVELOPMENT

UK Passivhaus Uptake - SFT

Demonstrating Progress with Impact

SFT OUTCOMES 2023

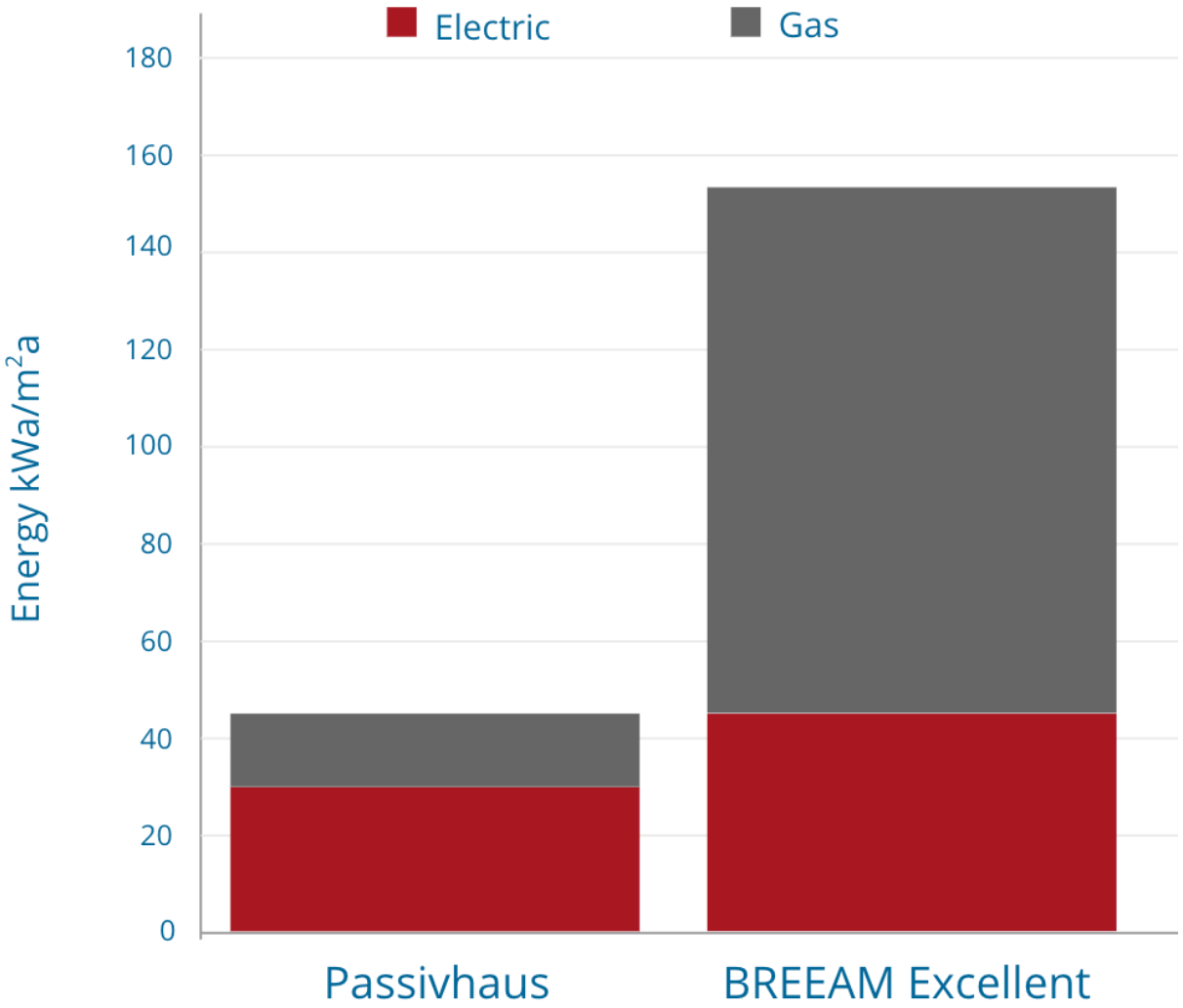
SCOTTISH FUTURES TRUST

Outcomes based approach for new schools sees councils embrace Passivhaus to help meet energy targets and secure funding

The Performance Gap

"The City of Edinburgh Council has adopted certified Passivhaus as a proven approach. It provides clarity around design and construction expectations, thereby ensuring building performance and user comfort expectations are delivered."

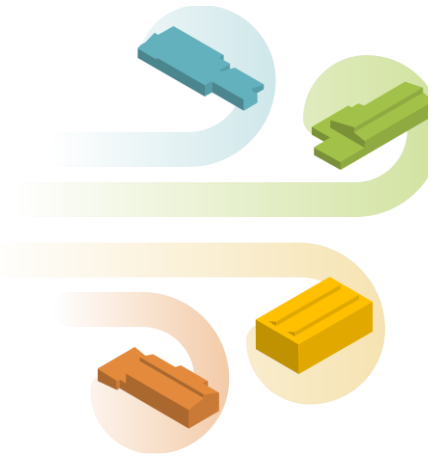
Patrick Brown, Head of Capital Programme Team, City of Edinburgh Council



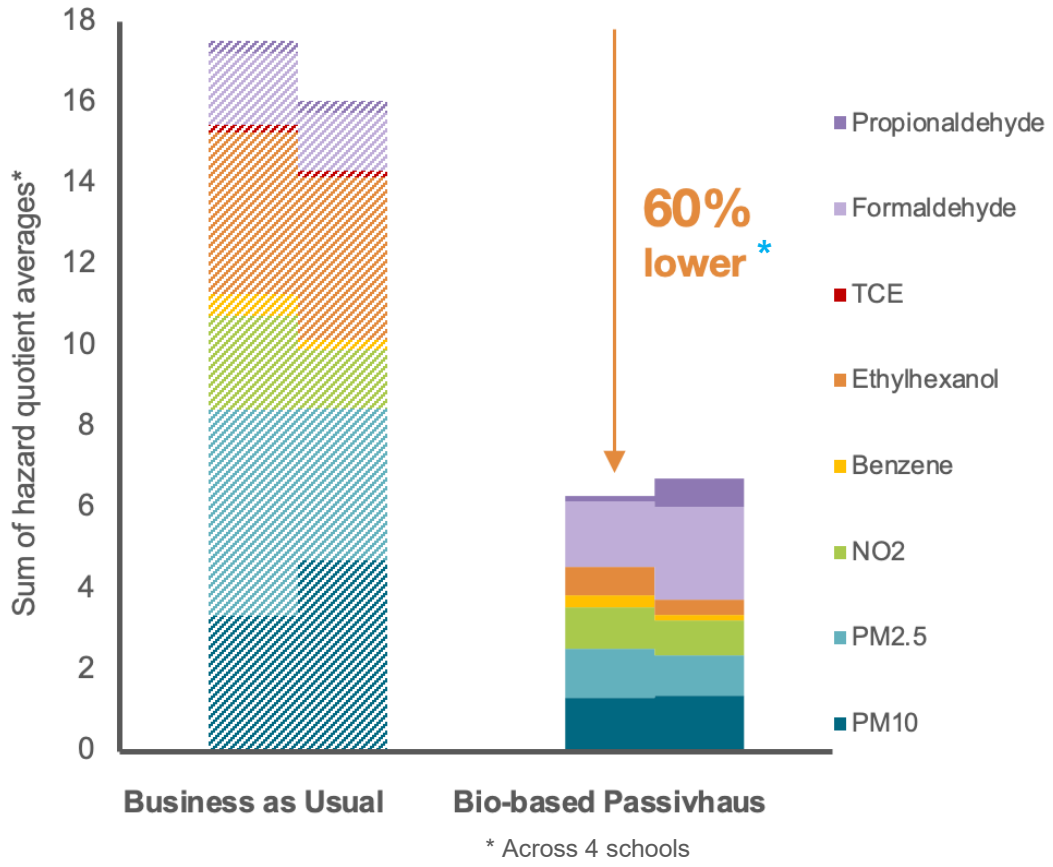
Whole health benefits – Science led outcomes

*Architype Passivhaus schools have **Volatile Organic Compound (VOC)** levels 40-60% **lower** than industry standard schools**

Whole health benefits – Science led outcomes

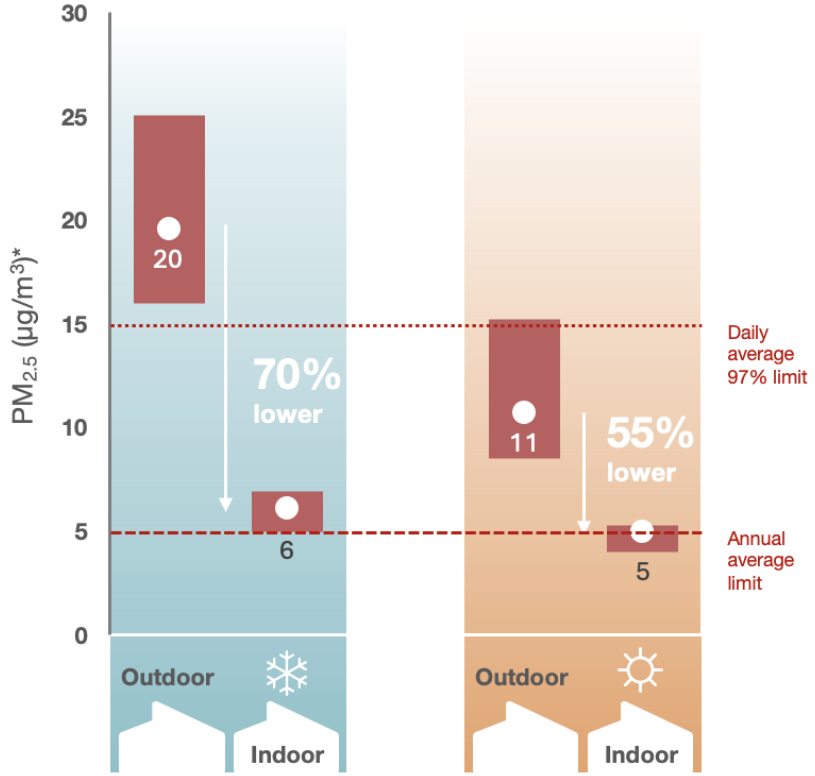


Radically reduced hazardous exposure



* Across 4 schools

Radically reduced external pollutants



*Daily average concentration aggregation, occupied hours

ARCHITYPE/PERFORM+

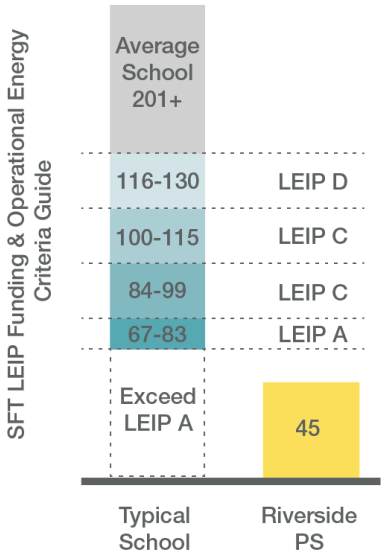
Riverside Primary

ARCHITYPE/PERFORM+

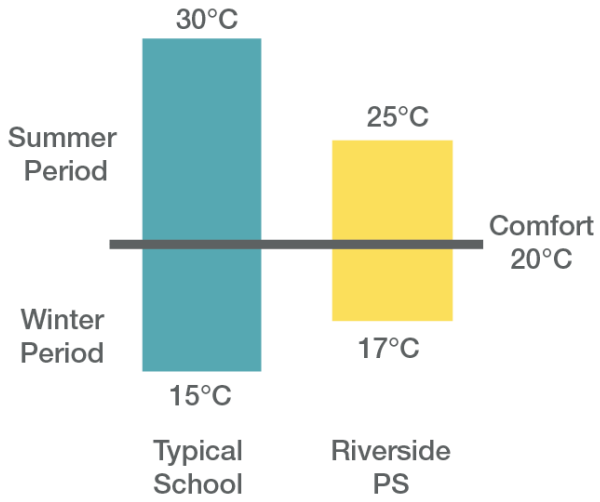
Image – David Barbour

Riverside Primary

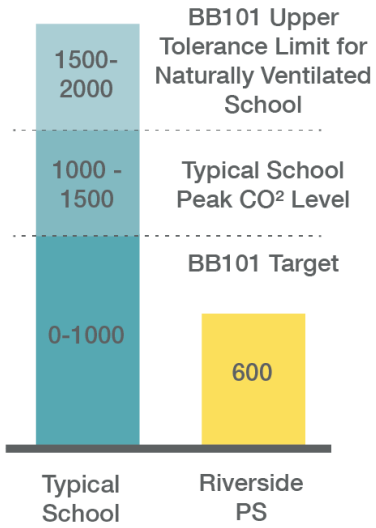
Operational Energy kWh/m2/a



Internal Temperature °C



Average Air Quality CO^2 Level ppm

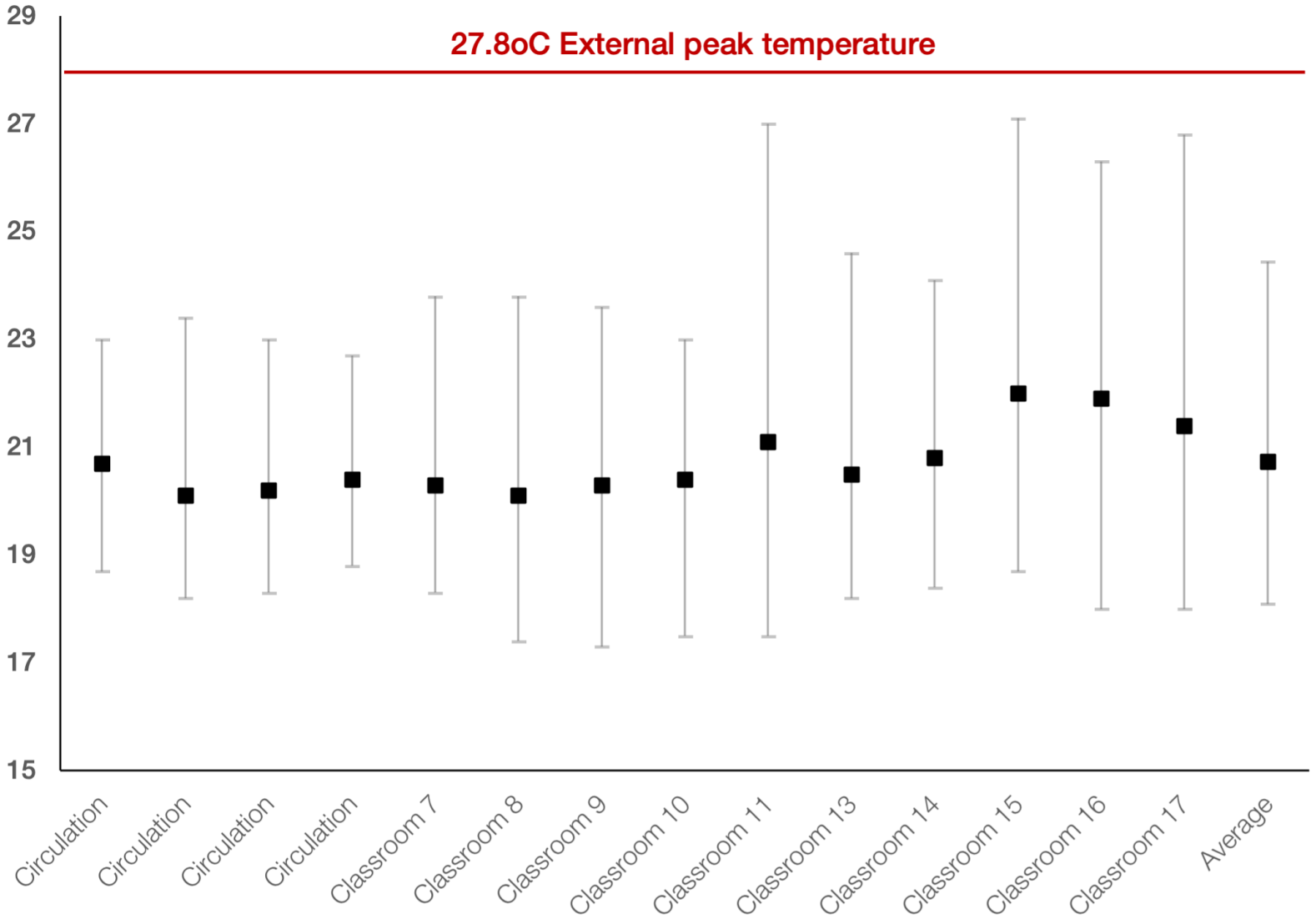


ARCHITYPE

Riverside Primary

Overheating mitigation

- September 2024 heat wave in Perth Scotland
- Comfort maintained
- Coolest building within education estate



Woodmill High School & St Columbas RC HS

- The largest Passivhaus Certified education campus in the world

- Operational Energy Savings in first year £433,392

UK Passivhaus Uptake – National policies

National

Scotland commits to Passivhaus Equivalency

TAI ARY CYD

23

Social Housing Providers signed up to Welsh Govt Pattern Book

5

Councils who had adopted PH/ related higher standards

100

social housing providers have delivered Passivhaus sites

Passivhaus Trust – Scottish Equivalent

Citizens Assembly

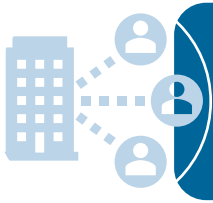
2020 –
23 June 2021

MSP Private Members Bill

30th August 2021 –
engagement with PHT

Parliament – Scottish Passivhaus Equivalent

15th December 2022

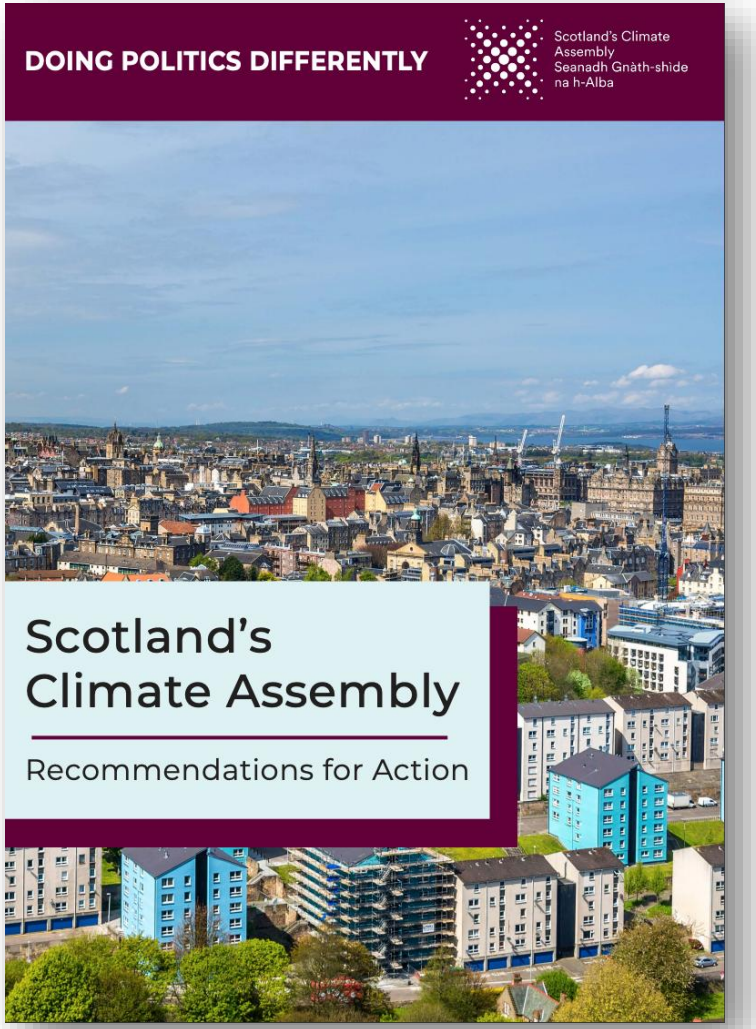


Development & Support for Standard

now

Citizens Assembly

- A citizens’ assembly is a group of people who are brought together to learn, discuss and reach conclusions
- Scotland's Climate Assembly is a citizens' assembly held from 2020 – 2021
- How Scotland should tackle the climate crisis in an effective and fair way.
- 97% voted in favour of the Passivhaus or Scottish equivalent standard for new build projects in Scotland



Parliament – Scottish Passivhaus Equivalent

10th Jan 2023

“make subordinate legislation within two years to introduce new minimum environmental design standards for all new build housing to meet a Scottish equivalent to the Passivhaus standard”

UK PH Uptake – Scotland deemed to satisfy

Energy Standards Review WG Consensus – Nov 2024

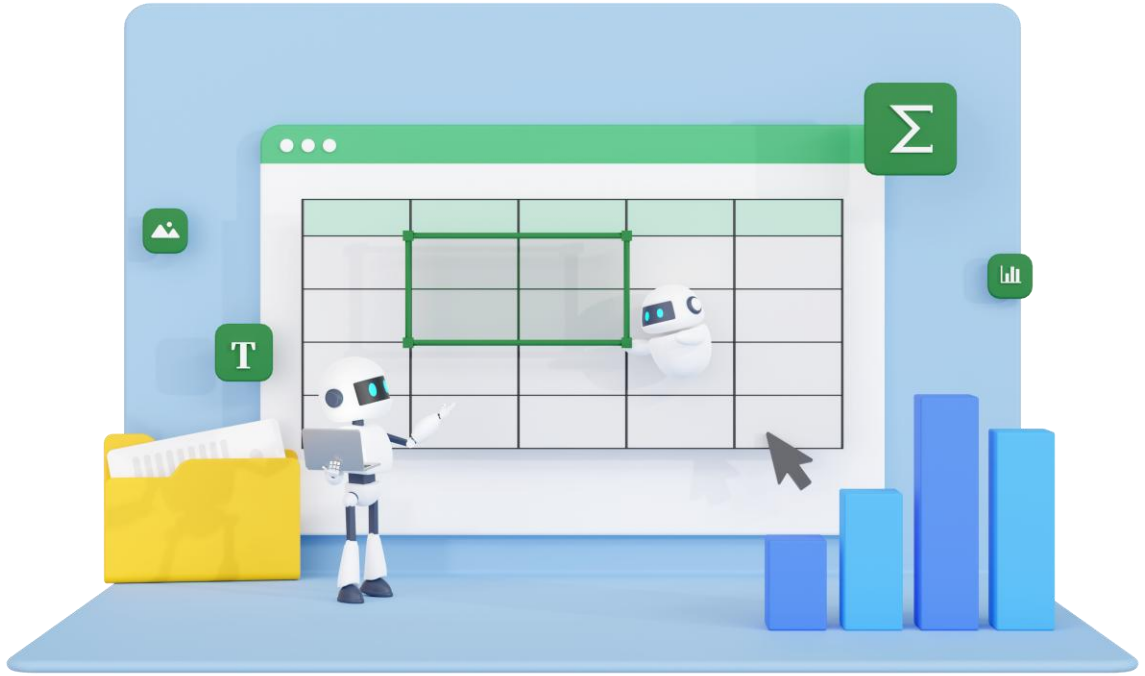
- supports the proposal for fully Certified Passivhaus to be '**deemed to satisfy**' key elements of Part 6.1 and Part 3.14.

- recognise that this would avoid the need for the unnecessary cost of duplication of modelling, for those clients wishing to adopt full Passivhaus and therefore encourage its uptake within Scotland.

UK PH Uptake – Scotland PHPP

With 30 years of development & in-use testing on 60K + projects:

- International benchmarking
- Independent auditing of Certification
- POE – UK Universities, on energy, comfort and health on over 100 UK projects



UK PH Uptake – Absolute Metrics

Absolute Target – eg 60mpg

Encourages optimised performance, because:

- you design & optimise the car to achieve target mpg
- the user knows if the car is achieving that mpg
- Government can set higher targets overtime and measure actual progress over time

Notional Method – eg 20%

Undermines performance, because:

- you can create a really inefficient design and easily achieve compliance with the 'notional' reduction but result in a car that is using way more fuel than it should
- which the user has no benchmark to compare to
- Government has no way to measure progress over time

Why Passivhaus - Benefits

Building Performance

Climate Emergency

Health & Wellbeing

People Performance

Financial

Social

Why Passivhaus – Quality & Comfort

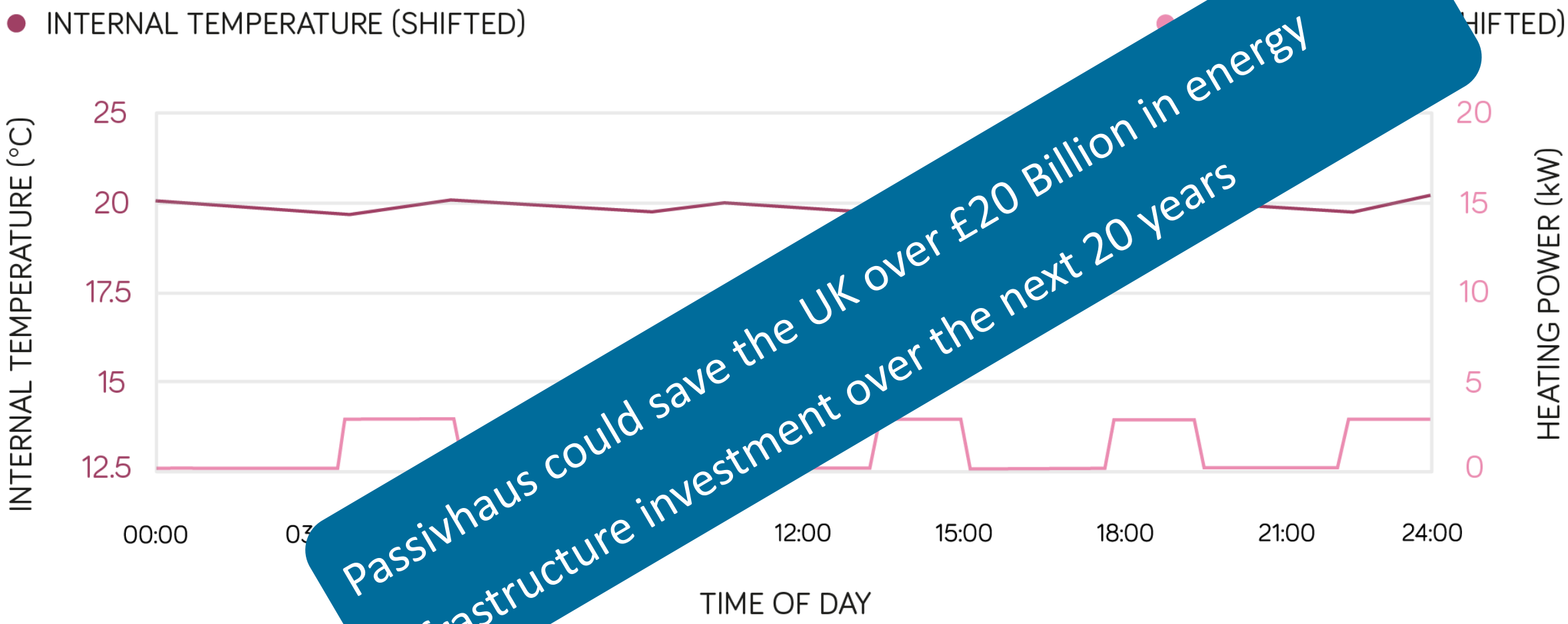
"The air quality in the house is amazing… we all now have amazingly wonderful sleeps at night which we believe is due to the air quality. The consistent temperature in this house is perfect."

Resident, Carrowbreck Meadow

"It's great in the cold weather– my new home is cosy and warm and I don't have to worry about heating costs any more as I rarely use it. I really like living here, the bungalows are brilliant!"

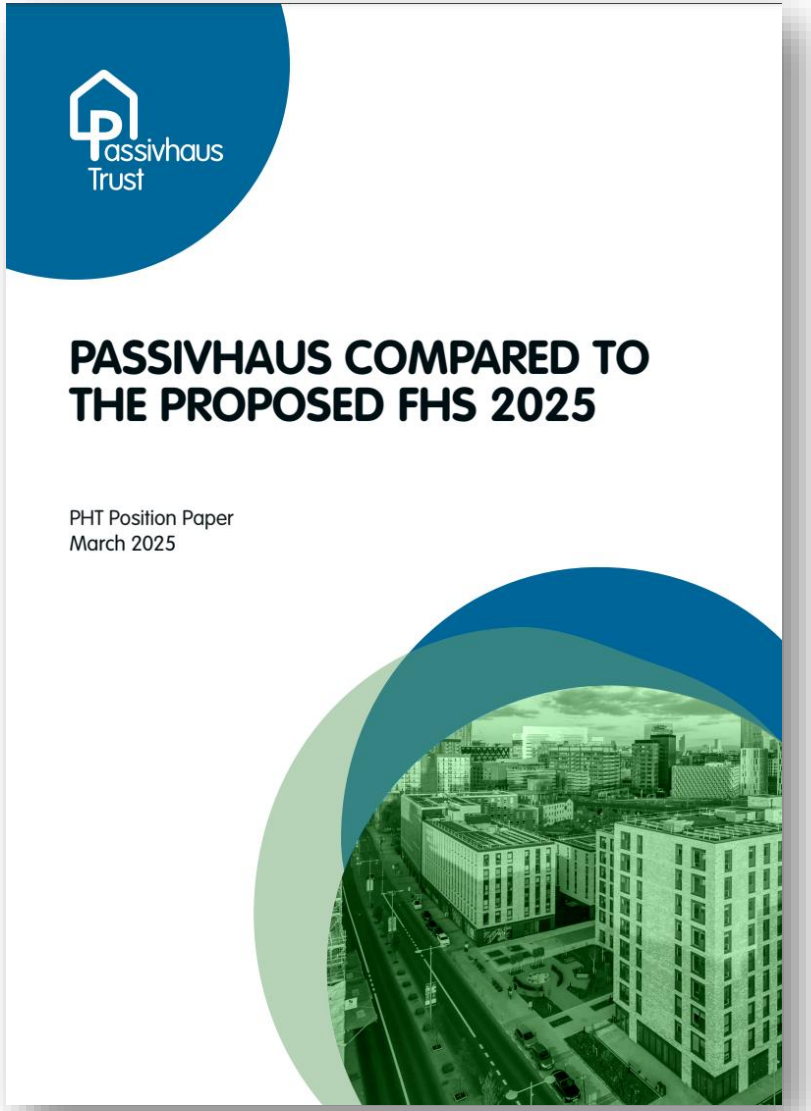
Resident, Racecourse Estate

Why Passivhaus – supports NZ transition



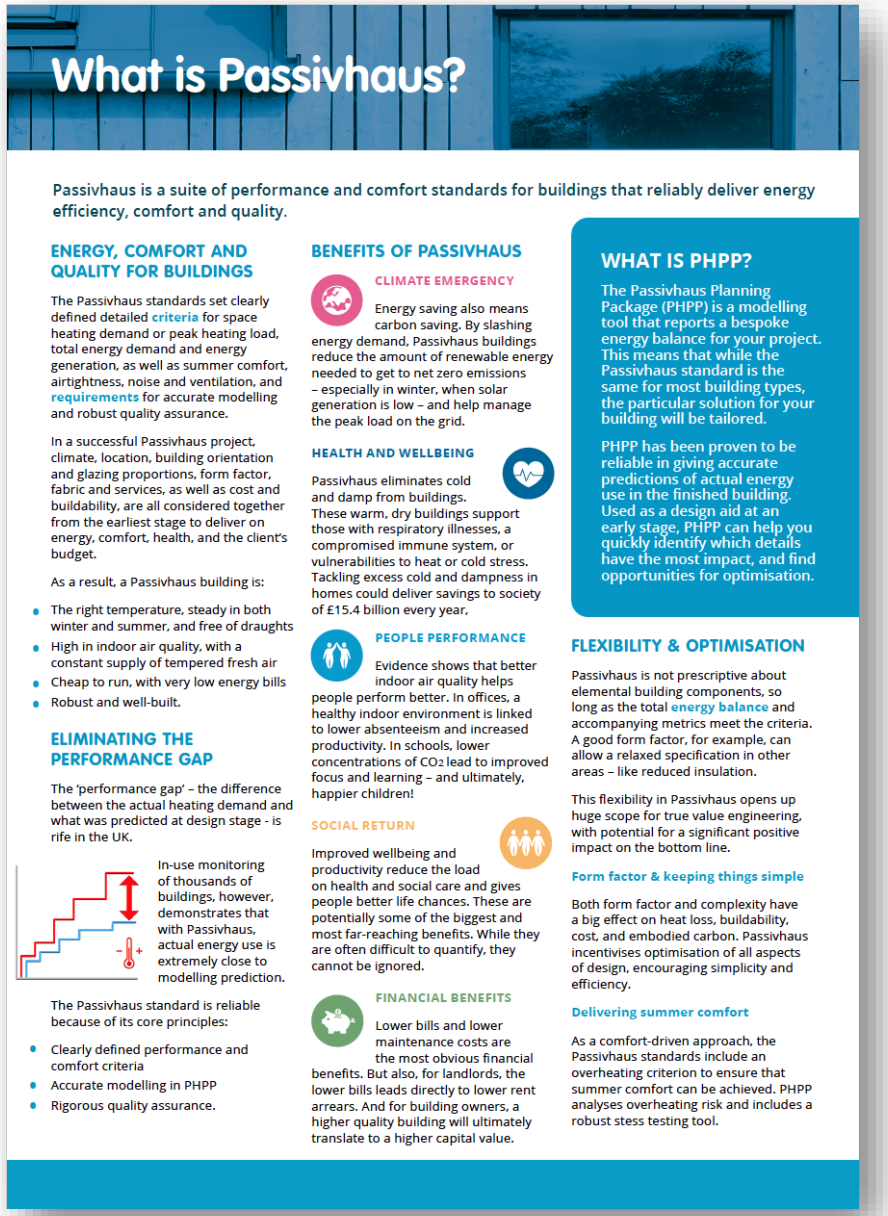
Passivhaus could save the UK over £20 Billion in energy infrastructure investment over the next 20 years

UK Passivhaus & FHS - benefits



	FHS 2025 PV	FHS 2025 no PV	Passivhaus Classic
TARGETS / LIMITS			
Energy use intensity	x	x	√
On site energy generation	√	x	x
Space heating demand	x	x	√
Cooling demand	x	x	√
ENERGY SUPPLY			
Low energy bills	√*	x	√
Lowest peak demand on the grid	x	x	√
COMFORT			
Summer comfort	?	?	√
Winter comfort	?	?	√
Good internal air quality	?	?	√
Protection against condensation and mould	?	?	√
Better quality components	x	x	√

What is Passivhaus?



What is Passivhaus?

Passivhaus is a suite of performance and comfort standards for buildings that reliably deliver energy efficiency, comfort and quality.

ENERGY, COMFORT AND QUALITY FOR BUILDINGS

The Passivhaus standards set clearly defined detailed **criteria** for space heating demand or peak heating load, total energy demand and energy generation, as well as summer comfort, airtightness, noise and ventilation, and **requirements** for accurate modelling and robust quality assurance.

In a successful Passivhaus project, climate, location, building orientation and glazing proportions, form factor, fabric and services, as well as cost and buildability, are all considered together from the earliest stage to deliver on energy, comfort, health, and the client's budget.

As a result, a Passivhaus building is:

- The right temperature, steady in both winter and summer, and free of draughts
- High in indoor air quality, with a constant supply of tempered fresh air
- Cheap to run, with very low energy bills
- Robust and well-built.

ELIMINATING THE PERFORMANCE GAP

The 'performance gap' – the difference between the actual heating demand and what was predicted at design stage - is rife in the UK.

In-use monitoring of thousands of buildings, however, demonstrates that with Passivhaus, actual energy use is extremely close to modelling prediction.

The Passivhaus standard is reliable because of its core principles:

- Clearly defined performance and comfort criteria
- Accurate modelling in PHPP
- Rigorous quality assurance.

BENEFITS OF PASSIVHAUS

CLIMATE EMERGENCY

Energy saving also means carbon saving. By slashing energy demand, Passivhaus buildings reduce the amount of renewable energy needed to get to net zero emissions – especially in winter, when solar generation is low – and help manage the peak load on the grid.

HEALTH AND WELLBEING

Passivhaus eliminates cold and damp from buildings. These warm, dry buildings support those with respiratory illnesses, a compromised immune system, or vulnerabilities to heat or cold stress. Tackling excess cold and dampness in homes could deliver savings to society of £15.4 billion every year,

PEOPLE PERFORMANCE

Evidence shows that better indoor air quality helps people perform better. In offices, a healthy indoor environment is linked to lower absenteeism and increased productivity. In schools, lower concentrations of CO_2 lead to improved focus and learning – and ultimately, happier children!

SOCIAL RETURN

Improved wellbeing and productivity reduce the load on health and social care and gives people better life chances. These are potentially some of the biggest and most far-reaching benefits. While they are often difficult to quantify, they cannot be ignored.

FINANCIAL BENEFITS

Lower bills and lower maintenance costs are the most obvious financial benefits. But also, for landlords, the lower bills leads directly to lower rent arrears. And for building owners, a higher quality building will ultimately translate to a higher capital value.

WHAT IS PHPP?

The Passivhaus Planning Package (PHPP) is a modelling tool that reports a bespoke energy balance for your project. This means that while the Passivhaus standard is the same for most building types, the particular solution for your building will be tailored.

PHPP has been proven to be reliable in giving accurate predictions of actual energy use in the finished building. Used as a design aid at an early stage, PHPP can help you quickly identify which details have the most impact, and find opportunities for optimisation.

FLEXIBILITY & OPTIMISATION

Passivhaus is not prescriptive about elemental building components, so long as the total **energy balance** and accompanying metrics meet the criteria. A good form factor, for example, can allow a relaxed specification in other areas – like reduced insulation.

This flexibility in Passivhaus opens up huge scope for true value engineering, with potential for a significant positive impact on the bottom line.

Form factor & keeping things simple

Both form factor and complexity have a big effect on heat loss, buildability, cost, and embodied carbon. Passivhaus incentivises optimisation of all aspects of design, encouraging simplicity and efficiency.

Delivering summer comfort

As a comfort-driven approach, the Passivhaus standards include an overheating criterion to ensure that summer comfort can be achieved. PHPP analyses overheating risk and includes a robust stess testing tool.

PASSIVHAUS i

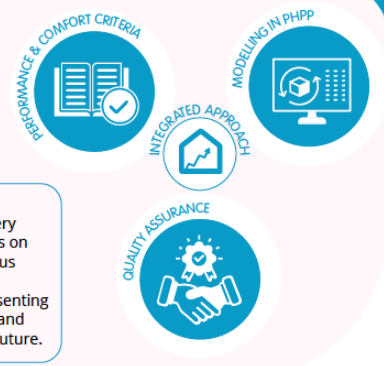
The Passivhaus Principles

Passivhaus Trust

Passivhaus buildings are based on fundamental principles that must form part of an integrated approach to reliably deliver exceptional energy efficiency, comfort, and durability. There are three core principles of approach and five building principles that support successful outcomes.

PRINCIPLES OF APPROACH

The three core principles of approach are detailed performance and comfort criteria, accurate performance modelling in PHPP, and rigorous quality assurance across design, construction, and commissioning. Together, these principles enable Passivhaus buildings to not only meet theoretical energy standards but also deliver on their real-world performance, comfort, and durability.



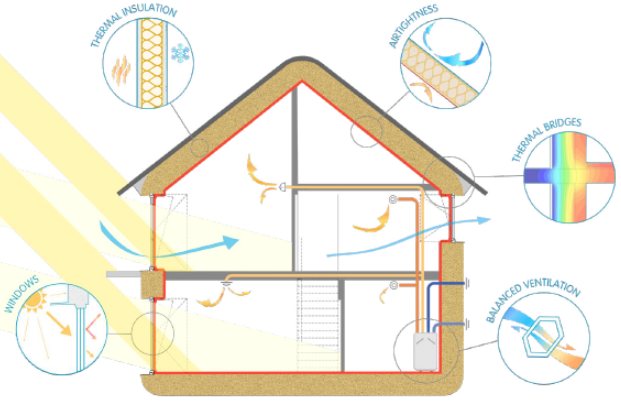
Clearly defined and detailed **performance and comfort criteria** which are underpinned by a strong and proven evidence base.

Quality assurance is delivered through careful verification at every stage, so that the building delivers on its performance targets. Passivhaus Certification is independent and impartial, with the Certifier representing the best interests of the building and building owners, now and in the future.

Every Passivhaus project must be modelled using the **Passivhaus Planning Package (PHPP)** for precise energy balance calculations and comfort assessments. It's both an invaluable design aid and a powerful tool for value engineering.

BUILDING PRINCIPLES

By following these principles of approach, each Passivhaus building will have a project-specific solution which optimises the five key building principles:



High performance **insulation** which is optimised for comfort, energy demand and the climate zone.

Continuous, high performance **airtight** layer to minimise heat loss, eliminate draughts and maximise fabric longevity.

Thermal bridges minimised to prevent cold spots and mould.

High performance **window** specification & shading to provide optimum comfort and efficiency in summer and winter.

Quiet and efficient mechanical **ventilation** with heat recovery (MVHR) delivering high indoor air quality.

These eight principles together form the foundation of the Passivhaus approach, enabling buildings to achieve the highest levels of efficiency, comfort, and durability.

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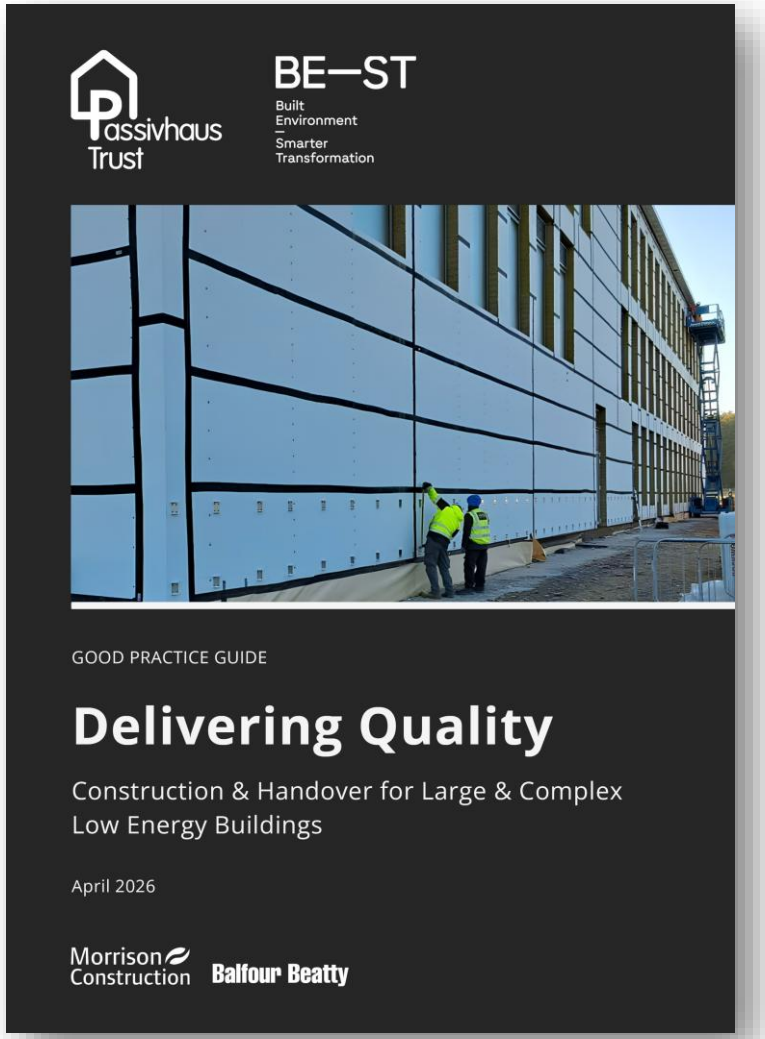
New Publications – April 2026



Download the good practice guide

Format of paper

Programme

Principles

The construction programme is the project's roadmap. It integrates procurement, design, statutory approvals, training, construction activities, testing and commissioning. A construction programme is not merely a scheduling tool. It is a quality control mechanism, and without an up-to-date, dynamically managed programme, it is nearly impossible to consistently deliver quality on site.

Common issues

Issue	Cause	Effect
Insufficient design time	Inadequate time allocation for subcontractor design work	Delays in procurement and disruption of site activities
Unclear or unprogrammed tasks	Poor engagement and lack of a collaborative approach.	Out of sequence works, increasing risk of remedial work and compromised quality
Compressed inspection periods	Inadequate time allocation for quality to be built in and checks applied.	Sub-standard work missed, covered up or left unresolved, with negative impact on building performance

Practical guidance

This paper does not aim to provide a full guide to construction planning – rather, it focuses on the principles that most influence quality outcomes.

Pre-construction programme

A well-considered pre-construction programme should aim to complete the majority of RIBA Stage 4 activities before site mobilisation, including confirmation that the design is capable of achieving the necessary certification requirements. This sets the foundation for success by reducing uncertainty and embedding quality drivers early. Key considerations include:

Procurement: Break down work packages clearly and align them with the procurement schedule. The procurement schedule contains key information such as:

- design information release dates
- periods for review
- periods for the collation of tender documentation
- tender period
- timescales for the review and final placing of sub-contract orders.

Programme summary checklist

Pre-construction

- [ ] Aim to complete majority of RIBA stage 4 activities before site mobilisation
- [ ] Engage with supply chain to confirm lead-in times and install durations
- [ ] Include key quality testing and hold points
- [ ] Develop airtightness strategy and integrate into programme

On-site

- [ ] Create weekly rolling plans for key activities
- [ ] Use visual tools for clarity of understanding
- [ ] Base plans on real discussions with sub-contractors

Case study – Procurement through collaboration

Context

For Highland Council's new Nairn Academy project, designed to achieve Passivhaus 'Classic' Certification, Architects and Passivhaus Designers Reiach & Hall worked with the Council, Balfour Beatty and the design team to develop a technical solution that utilised a design for manufacture approach utilising large scale composite panels.

Fig. 8: Nairn Academy render, Reiach and Hall Architects

Issue to be resolved

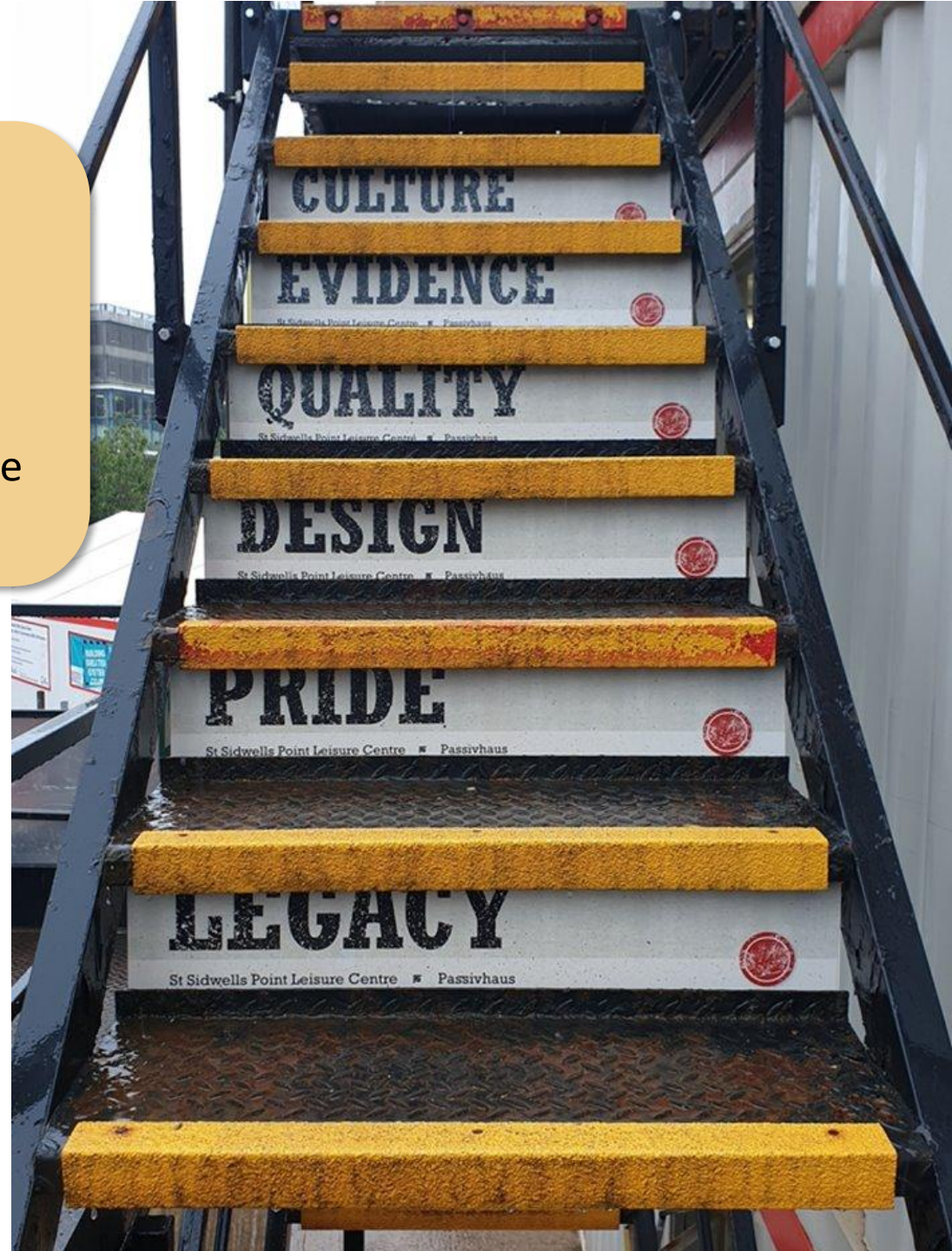
A key issue was how to ensure a high level of airtightness and thermal continuity could be achieved with the chosen envelope solution. The use of composite cladding panels is more traditionally used in large 'shed' type structures and had not readily been utilised on Passivhaus projects.

Intervention/ solution

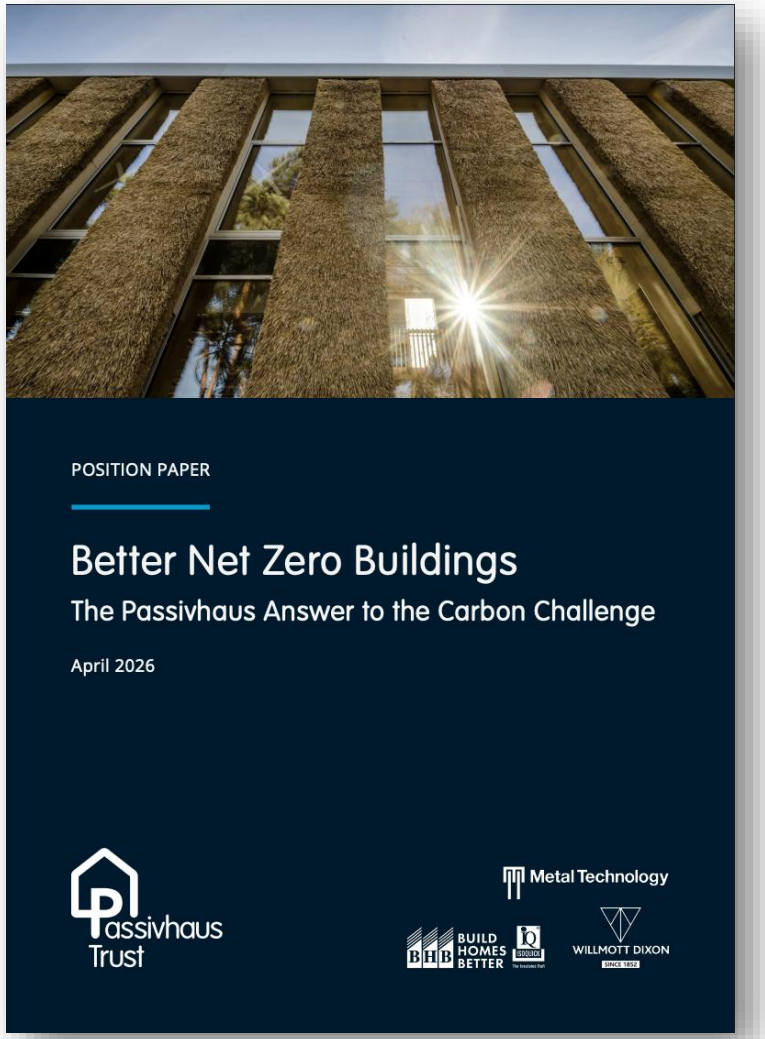
Details were reviewed and developed to 'Construction' level through intense weekly Technical Design Review Workshops involving the design team, Balfour Beatty and key envelope sub-contractors. This included review of the design solutions, installation responsibilities and construction sequencing.

The culture of quality

Quality starts with culture, and culture is shaped by the environment we create. The way we manage our workplaces signals the standards we expect and how we value our people



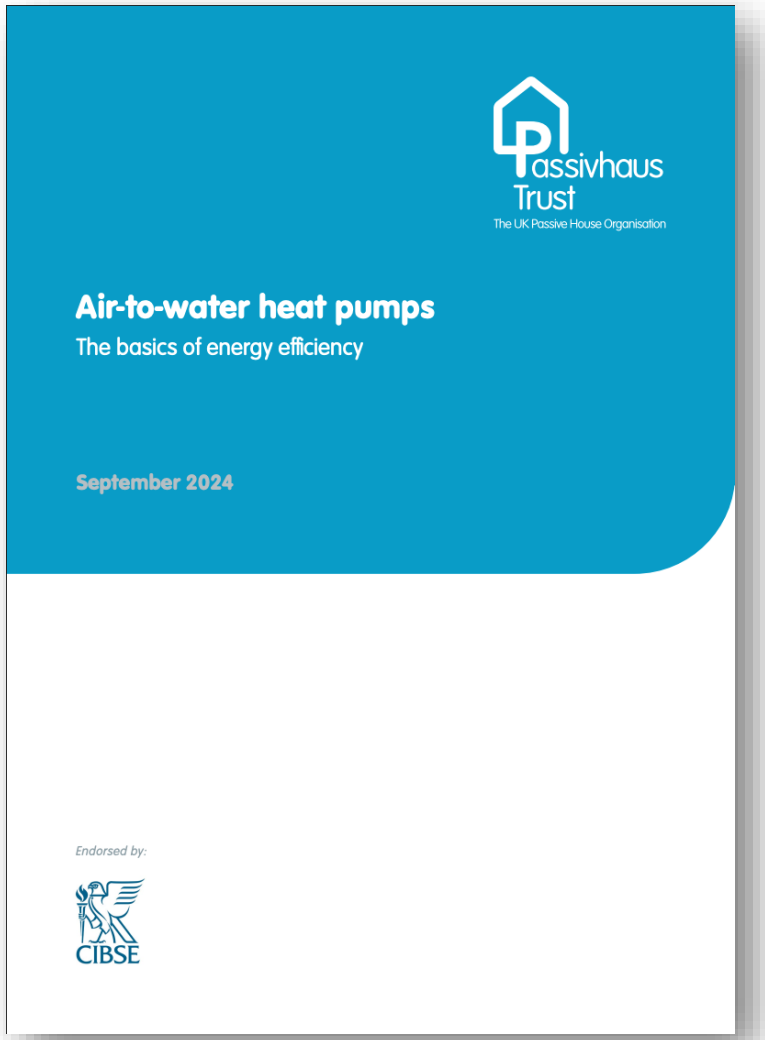
New Publications – April 2026



Passivhaus is deemed-to-satisfy certain Practical Completion “on track” requirements

Download the position paper

CIBSE & PHT Collaborations



Coming Soon….
Active Cooling Good Practice Guide

GET INVOLVED WITH THE TRUST!

Become a PHT member

Join a global community driving the adoption of the Passivhaus standard in the UK.

Call for Conference papers

Are you working on cutting edge Passivhaus developments? Submit your latest innovation or research.

Client Clubs, Open Days, & Passifest

Discover our range of new and exciting events happening throughout the year.

02
PHI CREDIT POINTS

UP NEXT!

Passivhaus retrofit school insights: Clients, carbon and collaboration

13:00 - 14:30 | 20 May | online

Scaling up Passivhaus retrofit

Component method for residential Passivhaus retrofit

Cost, payback and innovative funding models

Estate wide Passivhaus retrofit tools in use

02 PHI CREDIT POINTS

13:00 - 14:30 | 15 Apr | online

Passivhaus retrofit schools insights: Clients, carbon and collaboration

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King's College London: Component method for complex Passivhaus retrofits

02 PHI CREDIT POINTS

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