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www.passivhaustrust.org.uk
01 INTRODUCTION

Many older homes are outdated and no longer fit for 21st-century living. Uninsulated and poorly ventilated buildings result in hard to heat homes that may suffer from damp and mould issues. Ever-rising fuel bills result in some residents being unable to afford to heat their homes to the World Health Organisation (WHO) recommendation of 18°C. Poor quality living conditions can exacerbate residents ill health and cold homes are becoming as big a killer as deaths associated with smoking & alcohol abuse.

Two further concerns for social housing providers, already facing budget cuts, are tackling fuel poverty and building maintenance & durability. Passivhaus is proven to deliver on all these fronts. All of this whilst delivering significantly reduced carbon emissions.

The announcement of a new Future Homes Standard from 2025 will at least halve the energy use of new build property by 2030 with ‘the highest levels of energy-efficiency.’ Get a head start by building compliant homes now. Those who have already delivered Passivhaus schemes have reported significantly reduced rent arrears and shorter void periods, which has substantial impact on long-term viability.

This guide highlights significant synergies between the priorities of social housing providers and the multi-faceted benefits of successfully building and delivering Passivhaus homes. The aim is to explain why social housing providers should be aiming for Passivhaus and how to successfully implement the Standard.
WHAT IS PASSIVHAUS?
High quality, well designed housing which addresses issues of fuel poverty and residents’ health while also reducing rental voids and maintenance costs may sound like an impossible dream. Passivhaus is a whole house approach with clear measured targets focused on high quality construction, healthy indoor environments & low fuel bills.

KEY CONCEPTS

WHOLE HOUSE APPROACH
Passivhaus incorporates several factors that are interconnected and must be considered in conjunction to deliver optimum buildings, from ventilation & heating strategies to daylight & risks of overheating. With Passivhaus you know what outcomes you are being promised, and the design tool, Passivhaus Planning Package (PHPP), enables accurate predictions.

INDEPENDENT QUALITY ASSURANCE
There is integrity in the clarity and simplicity of the Standards defined performance requirements. Certification provides a robust quality assurance process, carried out by an independent party, that guarantees certainty of performance. If someone claims a building is a Passivhaus then they are claiming that it meets ALL the strict energy & comfort requirements. Verifiable under Trading Standards, the paper, Claiming the Passivhaus Standard, clarifies this.

HIGH QUALITY FABRIC & WINDOWS
Quality is inherent in Passivhaus buildings because attention to detail & buildings built with care are essential to deliver performance promises. A fabric-first approach maximises performance of the building materials. High quality products & components put together with meticulous detail lead to a durable & resilient building that requires less maintenance.
MYTH-BUSTING

- You CAN open the windows, but with controlled ventilation that provides drastically improved air quality you may not want or need to.

- It IS suitable for many climates, with certified schemes in hot & arid conditions in Australia, to wet & cold conditions in Canada, and even a Passivhaus research station in Antarctica.

- It DOES use a ventilation system that is extremely energy-efficient, quiet & costs little to run.

- Build costs CAN fit any budget. Exeter City Council have delivered schemes for the same price as a home built to Building Regulation standards.

CONTROLLED VENTILATION WITH HEAT RECOVERY

Minimal heat is required to keep homes at optimal temperatures as Passivhaus uses heat sources including the sun, appliances and even occupants themselves. The ventilation system helps circulate any heat evenly, simultaneously providing constant fresh air removing odours & filtering out pollutants.

OPTIMAL COMFORT

A Passivhaus is designed for its specific location. PHPP considers different climate zones and contains UK specific weather data for calculations. This helps create designs that work with their surroundings, optimising window placement for solar gains in winter to help heat the building and providing adequate shading in summer to keep cool.

KEY STATS

- Passivhaus typically use 90% less energy for heating compared to a conventional building.

- More than 65,000 buildings certified across the globe.

- Largest UK certified multi-home Passivhaus development in Norwich has 100+ homes & is 100% social housing.

- The 1st Passivhaus prototype built in Germany in 1992 is still performing well today.

- A variety of non-domestic UK Passivhaus examples include schools, offices, archives, & leisure centre.

- Not just for newbuild - the Passivhaus retrofit standard has slightly relaxed targets to consider complexities & constraints of existing buildings.

- Suitable for all tenures including rented & shared ownership.

- New classes Passivhaus Plus & Premium take into consideration energy generation from renewable sources.
BUSINESS AS USUAL IS RISKY BUSINESS!

Passivhaus may seem too costly or high-risk for those who have never built one before, but business as usual also involves its own risks such as non-performance, overheating & the need to upgrade to meet future zero carbon targets. Continuing with the current norm could be riskier than striving for Passivhaus.

⚠️ POOR QUALITY

What is the cost of cold damp homes that are expensive to heat? Ventilation is also often a problem in non-Passivhaus homes.

Under-performing buildings cause several problems ranging from unaffordable energy bills to serious long-term health effects for those living in them – particularly the elderly and children. This often leads to more residents’ complaints, and increased rent arrears. Better quality housing could save the NHS £1.4 billion in first year treatment costs alone.

Over-heating is also becoming a key issue in non-Passivhaus buildings due to increasingly extreme weather, with hotter temperatures more frequent in the UK.
PERFORMANCE GAP
Passivhaus buildings do not suffer from a performance gap. The average home is likely to use around 40% more energy than predicted, with heating demand sometimes 2 to 3 times greater. Much of this is due to lack of quality control on site, failing to ensure high quality construction and that the right materials are used in the right places. Clear evidence proves that actual energy performance of newbuild homes does not match the design.

The rigorous Passivhaus quality assurance process ensures that what is designed is what gets built and the actual energy performance is, on average, exactly as predicted by the design stage modelling.

COSTLY UPGRADES
The rush to provide homes in a hurry can mistakenly rank quantity over quality, placing social housing providers under pressure to deliver volume. It is not uncommon for new builds to suffer from defects and require substantial upgrades within 5-10 years. Aiming for lower standards than Passivhaus without a rigorous compliance process can be more costly in the long-term.

Invest in quality and value now to save on costly repairs later - The 2019 report, UK housing: Fit for the future?, highlights the average home would require an additional upfront cost of £5k to achieve close to Passivhaus standards. Whereas subsequent retrofit costs & remedial work may cost up to £26,500 per home.

Table 1.1. Costs of designing in measures for a new home at the outset, relative to trying to achieve the same outcomes later

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cost (£) - new build</th>
<th>Cost (£) - retrofit (equivalent outcome)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building a home with an air source heat pump and ultra-high levels of fabric efficiency (equivalent to a space heat demand of 15 kWh/m²/yr)</td>
<td>4,800</td>
<td>26,300</td>
</tr>
<tr>
<td>Passive cooling measures package</td>
<td>2,300</td>
<td>9,200</td>
</tr>
<tr>
<td>Water efficiency package of measures</td>
<td>300</td>
<td>3,300</td>
</tr>
<tr>
<td>Flood resilience and resistance package</td>
<td>1,500</td>
<td>3,100</td>
</tr>
</tbody>
</table>
The low gas bill means that my children will get Christmas presents this year, and if it carries on like this, we might be able to have a family holiday next year.

Wimbish Resident, Hastoe Group

REDUCED RENT ARREARS
Thanks to drastically reduced energy bills, residents can afford to live comfortably which leads to improved customer experience, fewer complaints, and reduced rent arrears. In addition, void periods where homes are unoccupied are lowered, which maximises annual rental income. Savings are made on lower void management & re-let costs, also avoiding legal costs. This has a significant impact on long-term viability.

Read the Sustainable Homes report, Touching the Voids, on how investment in energy efficiency can help to deliver a financial boost for social landlords.
AFORDABILITY

Heating demand, compared to existing homes, can be reduced by 90% which translates into very low fuel bills - a great way for social housing providers to guarantee affordable homes and eliminate fuel poverty.

Saving on energy bills improves quality of life and means more spending money for residents, which is put back into the local economy. A resident at One Manchester’s Erneley Close said “before my flat was freezing. I was spending about £15 per week on heating and even using fan heaters to get the temperature up. Since moving back in I’ve only used the heating once. It’s really taken the pressure off, knowing we won’t be spending an arm and a leg on keeping the house warm, day in, day out.”

HEALTHY HOMES

The lack of draughts, cold spots, mould and condensation create comfortable temperatures and clean fresh internal environments in both winter and summer, particularly beneficial for more vulnerable residents.

Continuous clean fresh air provided by the ventilation system (Mechanical Ventilation with Heat Recovery) provides excellent indoor air quality and Passivhaus residents have reported it has helped alleviate allergies such as hay fever, and respiratory problems associated with air pollution and mould.

Thanks to high-quality construction & triple glazing, a Passivhaus creates a peaceful sound-proof environment so there are fewer resident complaints on noise issues, and they can be confidently built next to loud busy roads.
LOW MAINTENANCE
A report from the Passivhaus Institute proves that efficiency pays - confirming the durability of high quality Passivhaus products & materials. Increasing the component life saves on costly repairs and replacement. Ventilation filters are the only additional maintenance requirements in a Passivhaus. Lower maintenance increases the longevity and usability of assets.

HIGH QUALITY & DURABLE
Passivhaus projects are proven to perform, on average, exactly as modelled and have over 25 years’ worth of research & data with 65,000 certified buildings around the globe. Invest in a high-quality building fabric rather than technologies that will need maintenance & replacement.

Exact calculations are part of the Passivhaus process and are modelled in the Passivhaus Planning Package (PHPP). This helps eradicate shortfalls in performance and creates resilient buildings with lower maintenance.
FLEXIBILITY
Passivhaus offers incredible design flexibility and is open to any construction methodology. All the projects featured in this booklet are certified Passivhaus schemes. From towering concrete blocks to detached rural cottages, the standard can be applied to a range of applications, building typologies, and construction methods. This allows for buildability to be tailored to skills & craftmanship already existing within the local area.

Passivhaus employs good building physics requiring nothing more than a competent Passivhaus designer/consultant working with a quality conscious builder, and of course a client with the ambition to do it! The certification process then ensures high performance.

Passivhaus is a good way of building because it both helps with fuel poverty and is aligned with the Council’s climate change agenda through carbon emissions reduction.

Andrew Turnbull, Senior housing development officer, Norwich City Council

FUTURE-PROOFING
Emerging threats of air pollution and compliance with carbon targets are a growing concern. According to the latest International Parliamentary Committee for Climate Change’s (IPCC) report, we need to build net zero energy-efficient houses by 2030 to avoid catastrophic climate breakdown.

This message is being reflected in many new regional policies going beyond building regulations, and most recently with the chancellor’s announcement of a new Future Homes Standard from 2025 which will at least halve the energy use of new build property by 2030 through ‘the highest levels of energy-efficiency’

As investigated in our report ‘Passivhaus, the route to Zero Carbon?’ better building fabric performance is imperative to meeting zero carbon targets, and Passivhaus coupled with a small amount of renewables can achieve this.
MINIMISING COSTS
Innovation costs associated with early Passivhaus projects are now reducing as the methodology has become more widely adopted. By 2019 we had seen significant growth of UK certified Passivhaus homes, there is a growing body of expertise, and Passivhaus components can be sourced more easily.

New PHT costs & benefits guidance includes three case studies from Exeter, Norwich, and Cornwall to show how designs can be optimised to reduce costs. Simple measures that can help mitigate costs are listed here:

OPTIMISED DESIGN
Passivhaus does not come with a style book; it’s completely down to the design team. It’s important that design is optimised where possible, such as orientation to maximise solar gains, thermally efficient massing, scale & form, and simple detailing. A building’s shape can have huge financial implications - Terraces are more efficient than detached homes, as are multi-storey buildings compared to low rise bungalows. Complexity is possible, but also more costly.
SIMPLE IS BEST
Contrary to many myths, a Passivhaus does not dictate a complex structure or specialist materials – it is flexible in construction methodology. If the structure is simple, ‘buildable’ and uses familiar materials then there is more chance of cost-effective success. Pre-fabrication & off-site solutions may provide better quality & programme certainty. Service penetrations must be carried out carefully, and a well-planned programme with considered sequencing can prove vital.

Learn more tips on ‘how to build a Passivhaus’ with the Trust’s rules of thumb guidance document.

EARLIER IS BETTER
The earlier a commitment is made to the Passivhaus standard, the less costly and the more likely it will be successful. Ideally, some input should be sought from a Passivhaus designer or consultant before a planning application is submitted, because factors decided at this stage can strongly influence the energy performance and cost. These include the form, complexity, orientation, materials and glazing design. Whilst there is no specific requirement on any of these factors, good early choices will create an easier path to optimise costs.

Thoroughly developing a detailed design needs to be considered at a much earlier stage and manage value-engineering & specification changes after the final design is signed off. A Passivhaus designer should explore the performance implications of various design choices as the design develops. However, this needs to be done from the start and not post planning to keep costs in check.
GETTING CONTRACTORS ON BOARD

Finding the right team at the right price can be difficult. A Passivhaus advisor can help assess the competency of the project team against buildability of the design, previous Passivhaus experience, and appropriate pricing.

COLLABORATION IS KEY

If contractors or consultants are unfamiliar with Passivhaus, this may result in added premiums for ‘new or innovative’ contract requirements. Improving contractor understanding of risks, including how they could be shared or minimised, can assist in reducing premiums.

Early contractor engagement can assist in this regard. Learn more on how to mitigate risks through different procurement routes by watching a video on procuring Passivhaus.

Passivhaus Procurement
https://vimeo.com/198064774
WORK WITH A TEAM THAT ‘GET IT’
Everyone involved needs to get on board and understand the key Passivhaus concepts or be willing to learn. Whilst contractors & consultants with previous experience clearly offer an advantage, what is more important is that the contractor has a culture of quality. Lots of advice is available to show builders how it’s done, and we have seen several successful projects from first time Passivhaus teams who have ‘bought-in’ to the concept.

PASSIVHAUS EXPERIENCE
Passivhaus needs to be considered from concept through to completion. There is an argument for continuity within the design team, where solutions considered at early stage design are maintained during the development of the technical design and during inspection of the work on site, with any changes from the design logged and re-modelled.

Airtightness, along with attention to detail, is often the biggest challenge for contractors new to delivering Passivhaus and maintaining the integrity of the air barrier can seem a high-risk element to deliver. It is important to ensure that these matters are understood by the contractor and that processes are in place to monitor and report on such critical issues.

Although experience is the best recommendation, a Certified Passivhaus Tradesperson qualification indicates the holder understands Passivhaus, which can be a useful starting point.
MINIMISING RISKS

QUALITY CONTROL
Remove uncertainty by aiming for certification, which provides a crucial quality control system, requiring the contractor to provide evidence, photographs and signed statements of all the critical areas that affect Passivhaus performance. These documents are submitted to an independent Certifier who will examine and ensure that the building will deliver performance before issuing an appropriate certificate. Design stage approvals are available from most certifiers, whilst independent testing ensures measured targets are met.

"Quality control on site is where Passivhaus really excels. What we are doing at Goldsmith Street is bringing Passivhaus to the mass market. The stigma of extra cost can be driven down by volume and experience."
Geoff Hales, Senior contracts manager, RG Carter.

EDUCATION
Appropriate training and education for site staff, such as toolbox talks or product demonstrations is invaluable, as is retaining an inspection process, (either a retained architect or Clerk of Works or both) which will help to pick up issues as work proceeds.
AIM HIGH
When dealing with tight performance margins, value-engineering & tweaks in specification can have significantly detrimental effects. Throughout the design, the Passivhaus designer should regularly update the PHPP calculations and report back to the team. It’s advisable to aim for a better performance early on to allow margins for error and accommodate design changes. Clearly outline roles, responsibilities, and accountability for delivery of key Passivhaus targets.

Client Checklist
- Consider a specialist procurement framework such as EXEseed framework or fabric first framework.
- Ideally, appoint at least one advisor with experience of previous Passivhaus schemes.
- Engage with contractors early and treat them as key team members.
- Prioritise value not cost and employ cost consultants to get the figures right from the start.

HANDOVER & MAINTENANCE
Help occupants understand their new home. A planned familiarisation session explaining how to use the ventilation system delivered a fortnight or so after residents have moved in has been found to be more effective than attempting something on ‘moving in’ day.

Ensure your organisation is equipped to manage Passivhaus homes. Some internal instruction for maintenance and call centre staff can be valuable in diagnosing the correct response to Passivhaus issues. Consider post occupation evaluation, (POE). The information gained can support the methodology, inform board reports and educate and inform your future Passivhaus schemes.
04  NEXT STEPS

FIND AN ADVISOR
Grow your networks & hear directly from those that are already implementing the Standard. Learn from their key success factors & how to avoid common mistakes. Take a look at our map of UK Passivhaus professionals who may be able to help and there are several key events throughout the year:
- Regional Passivhaus Social events.
- UK Passivhaus Conference
- International Passivhaus Open Days
- Contact us about client advice

VISIT A PASSIVHAUS
Get out and visit as many as you can. The best way to really understand the comfort is to experience & feel it yourself. Site visits offer you a chance to speak to occupants and those involved with delivering the building. Several large-scale residential Passivhaus developments have been built across the nation. If you are trying something new and can’t find what you are looking for, in the UK, look further afield... It’s an international standard!
On-site Passivhaus training for residents wishing to work in construction may be valuable for regeneration projects.

Online training is available on the fundamental concepts. If you are looking for something more detailed to develop a comprehensive skill-set in-house, check relevant courses on our events & training pages.

BUILD A PROTOTYPE

Many have trialled a prototype on a small proportion of a larger development before rolling out the Standard at a larger scale. Don't give up before you start! Over 50 social landlords have already completed a Passivhaus scheme; check online a list of Local Authorities & Housing Associations who have delivered Passivhaus homes.