

A large, stylized outline of a house with a gabled roof, rendered in black and white, set against a solid blue background. The outline is thick and has a white inner border.

# **THE PASSIVHAUS PLAYBOOK**



# Foreword

We're proud to help bring this Passivhaus Playbook to the Australian sector and beyond, and hope that it supports the acceleration of Passivhaus uptake.

The Passivhaus standard is not just an iteration on business as usual, and it doesn't deliver just an evolutionary outcome. As a junior engineer, when I first became aware of Passivhaus, and the benefits it could deliver, my main question was simply "shouldn't every building be like this?". Across my career, I've since visited dozens of Passivhaus buildings the world over, listened to and learned from leaders internationally in the sector, enjoyed working on over 200 buildings of various typologies aspiring to the standard and even (and most excitingly for me) built my own home to the standard. Those who have lived or worked in a Passivhaus building can attest – this is not just another standard. This is a standard that has been extensively tested and delivers delight to occupants, and social, economic and environmental benefit in spades, with robust results.

At last report, there are at least 120,000 buildings around the world. There are developers, entire cities and even regions where Passivhaus is the minimum expected standard for buildings. We wanted to know why there weren't more in Australia, and, specifically, what could we do to unlock the standard for our own developments. How could we develop a process for a technically feasible, buildable, cost effective Passivhaus approach?

We are very excited to deliver this Playbook in support of project teams working to do the same. Even where the Playbook process revealed nothing ground-breaking, it clearly tests and articulates a process that can be emulated and this is where the value lies. We are proud to have developed this work and grateful to the insights provided by our collaborators, including many of DV's internal staff, Introba, Built and Wilde & Woollard. We have drawn on the collective knowledge of many, many decades in the design and construction sector and across thousands of projects, of all types and levels of ambition. We tested what we knew in a new paradigm, for a vastly different outcome. Thank you all for your willingness to share this with the world.

In particular we thank Introba for their guidance through this process, and for working to put together this Playbook. We hope it is a useful catalyst for Passivhaus in Australia.

**Clare Parry**

**Director of Sustainability  
Development Victoria**

On behalf of the Australian Passivhaus Association (APA), I want to express my deep gratitude and congratulations on the launch of this Playbook.

This publication represents an important milestone for the Australian property sector – the ambition to scale the delivery of Passivhaus (PH) developments as a way to achieve climate goals, increase climate resilience and support the health and quality life of those living in our cities.

To date, PH has predominantly been a focus of the private sector, however DV has shown incredible leadership through their commitment to exploring ways to scale PH through the public sector, as well as their transparency in sharing the learnings with the industry.

Since APA was founded just ten years ago in 2013, we are privileged to witness the exponential growth of the Passivhaus marketplace and our association alike. The association is experiencing 20% growth year on year, our engagement increased by 48% in 2023, 100s of professionals are becoming PH certified every year, PH projects of all types and scales are coming to market and PH projects are being recognised as setting the golden standard in many award programs around the Nation.

We are fast heading towards a critical tipping point in our ability to scale the PH Standard in Australia. This Playbook will play a critical role in facilitating this and providing practical advice to navigate the process. It is now a reality that Australians can expect buildings that perform as intended.

A special thank you to the whole team at Development Victoria and Introba for your generosity in sharing insights, the time and effort that you have put into collating them into this succinct and highly useful playbook. Lastly, I would like to thank you for inviting me to represent APA in the early engagement workshops which underpinned the beginnings of this Playbook.

**Kate Nason**

**Chair  
Australian Passivhaus Association**

# Acknowledgements

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Kate Nason – Chair, APA

*We acknowledge the Traditional Owners of the Land on which we live and work and recognise their continued connection to Country. We pay our respect to their elders, past and present and extend that respect to all Aboriginal and Torres Strait Islander people.*

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**This page:**

Glenroy Community Hub  
Architects: DesignInc  
PH Consultant: WSP Australia  
Certifier: Grün Consulting  
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# Introduction

The Passivhaus standard has recently enjoyed a groundswell of interest and attention. In a world requiring tangible solutions to complex challenges – such as climate change, energy poverty and health crises – the underpinning focus of Passivhaus on absolute performance metrics has positioned the standard as an effective part of the solution.

Various jurisdictions worldwide have adopted Passivhaus as a yardstick for high-performance standards. For example, in 2017, the Vancouver City Council adopted Passivhaus as one option to demonstrate compliance with its rezoning policy. In the same year, the Province of British Columbia enacted the ‘BC Energy Step Code’, which uses Passivhaus performance as the benchmark for ‘Step 5’ in its goal for constructing net zero buildings by 2032. More recently, in early 2023, Scotland announced that all new homes must meet Passivhaus standards from 2024.

Closer to home, Australia has yet to see Passivhaus nominated in statutory frameworks, but the tide is changing. Rather than wait for the regulatory environment to set benchmarks, the private sector is exploring Passivhaus as an opportunity to deliver greater value in user experience, environmental impact and operating costs. This pursuit has shifted the industry from predominantly focusing on single-family homes to delivering Passivhaus at scale, with examples including the Glenroy Community Hub, Gillies Hall and Woodside Building for Technology and Design.

But it’s not only the private sector with ambitions for high performance. This Playbook is the result of a collaboration between Development Victoria (DV), the Victorian Government’s development arm, and Introba, a sustainability-led building services consultancy. DV engaged the Introba team to develop a “technically feasible, buildable, cost-effective Passivhaus approach” process. While the original intent of the collaboration was never to create industry guidance, the engagement outcomes were compelling. DV and Introba decided that the Passivhaus Playbook could contribute to greater confidence and success in increasing the benefits of Passivhaus performance across the market.

While there are elements of the Playbook that are Australia-centric, we believe it has the potential to inspire and guide the pursuit of Passivhaus in other locations around the world.

# Developing the Playbook

Passivhaus is a concept that is often suggested during design but ultimately ends up on the cutting room floor. Even with experienced consultants at the table, technical solutions are identified, and buildability challenges are resolved, but far too often at a level of investment that is seen to be too much for the project to bear.

So, to develop a 'technically viable, buildable and cost-effective Passivhaus approach', the team knew at the outset that a business-as-usual approach wouldn't work.

This is where Regenerative Practice became a catalyst for a new approach.

Regenerative thinking uses an appreciation for living systems to shift outcomes from the degenerative – which focuses on 'how to minimise harm' – to the regenerative – which focuses on 'what good looks like'. By recognising the development landscape as a series of nested systems, it is possible to uncover potential that would otherwise remain obscured, allowing project teams to provoke positive change at the most effective intervention points.

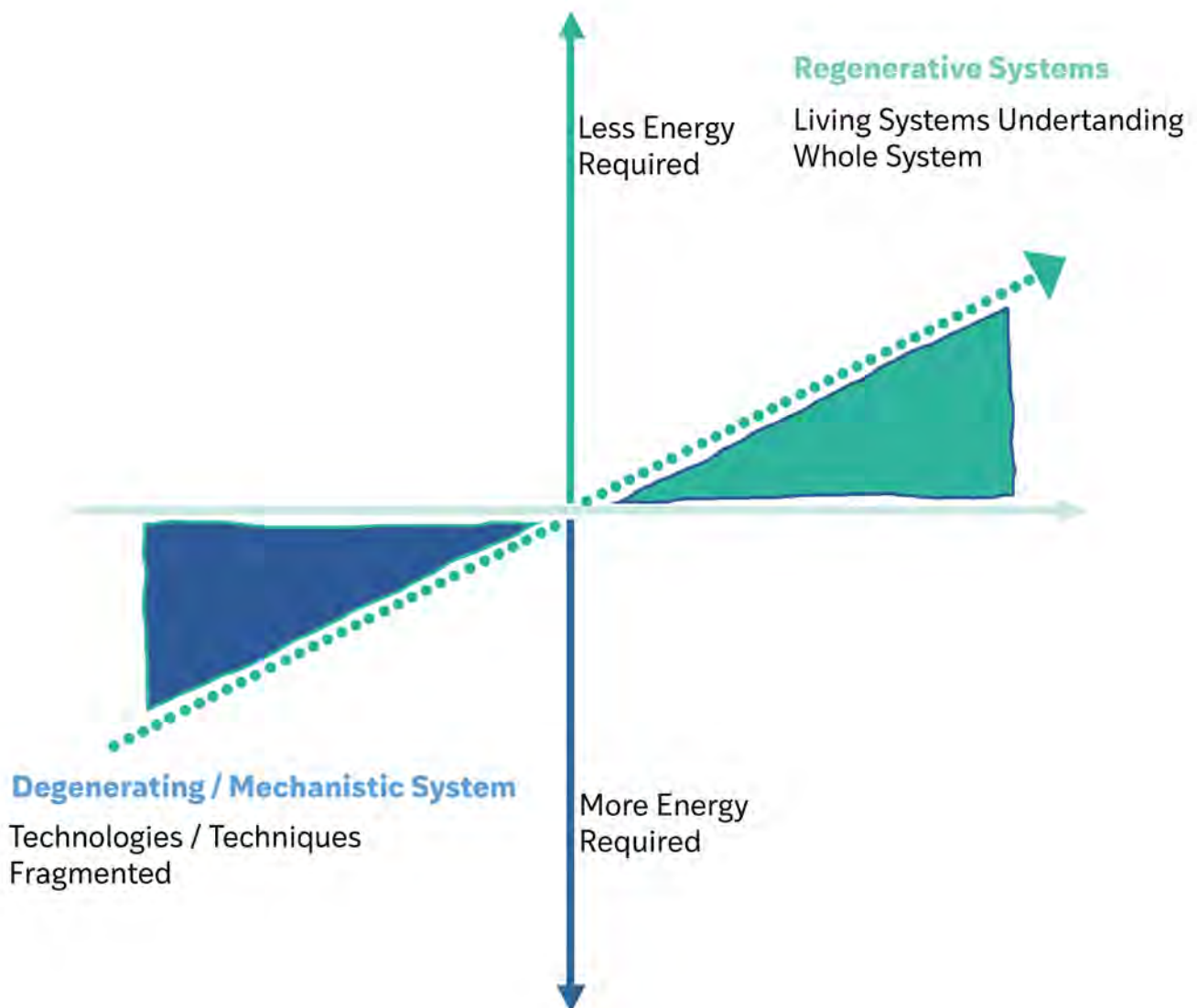
To embed this approach, Introba facilitated a series of multi-disciplinary workshops with key design disciplines, including façade, building services, fire, construction, development and cost specialists. The team explored Passivhaus on a pilot project nominated by Development Victoria – a multi-unit residential building of approximately 250 apartments.

A cornerstone of the workshops was a mindset shift from 'problem' to 'potential'. By focusing their efforts on imaging and articulating the look and feel of the ideal Passivhaus approach, the team could experiment with the fundamental systems as wholes, uninhibited by the usual roadblocks that often cause ambitious ideas to come unstuck.

The team considered the project life cycle, from ideation to implementation, creating a nine-step pathway that covers everything from funding to design coordination, from supply chain to storytelling. Once a clear picture of the proposed pathway was determined, dedicated buildability and cost workshops were conducted to investigate the construction and financial aspects of the playbook.

Read on for the Passivhaus Playbook.





**Conventional Practice**

"One step better than breaking the law"

**Green**

Relative Improvement (LEED, G8 Tool, Green Globe, etc.)

**Sustainable**

Neutral "100% less bad" (McDonald)

**Restorative**

Humans DOING THINGS TO nature assisting the evolution of Sub-Systems

**Regenerative**

Humans (Hominids) PARTICIPATING AS Nature Co-evolution of the Whole System

Above: Trajectory of Environmentally Responsible Design adapted from Regenes Group Diagram, 2020



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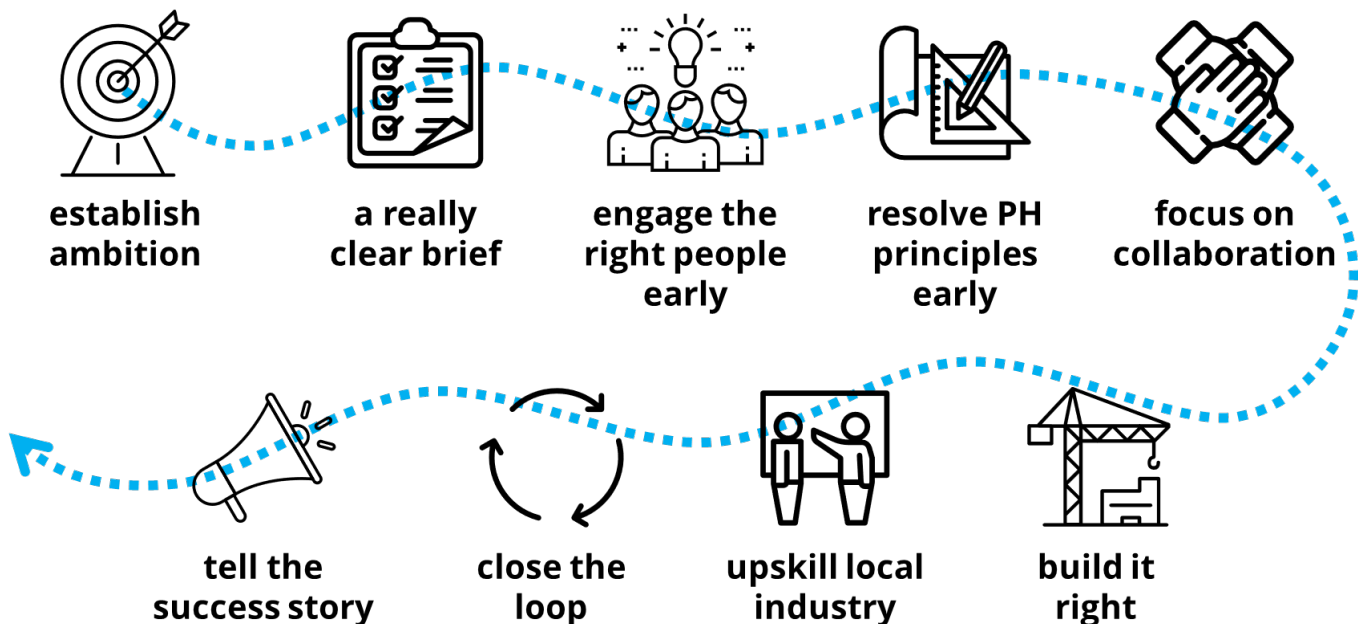
Clayton Community Centre  
PH Consultant: Peel Passive House Consulting  
ME Designer: Introba  
Certifier: MEAD Energy + Architectural Design LDT  
© Catherine Chan

# The Passivhaus Playbook

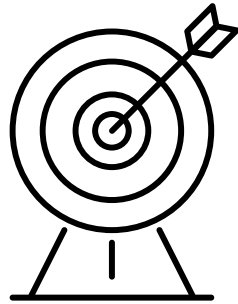
The nine steps of the Passivhaus Playbook are summarised diagrammatically on the right. Further detail regarding each step can be found on the following pages, including key actions and a description of the potential that each step unlocks.

The Playbook is intended to be seen as a cyclic process, beginning with the alignment of stakeholders via a clearly articulated investment case through to generously sharing project stories with the wider industry. Importantly, this sharing provides a catalyst for future projects, both within and outside the stakeholder group of the project at hand.

The Playbook is also intended to involve everyone associated with project delivery – investor, developer, designers, consultants, builders, supply chain and end users. Each has a role to play in achieving a successful outcome, so the earlier the team can find alignment, the better.



# Step 1



## Establish ambition

Any ambitious goal is at risk if stakeholder values and expectations are not aligned upfront. A clear value proposition should be used to align stakeholders, a step which is particularly important for an organisation's first few Passivhaus projects, where a strong investment case will be critical.

### Key actions

- Develop a clear value proposition for Passivhaus delivery – the WHY
- Internal alignment of PH drivers and value, which may include not only financial value but also social value
- Include all stakeholders, incl. councils etc



*This step unlocks the ability for the project budget to be developed with Passivhaus embedded, reducing the risk of diminishing ambition as the project progresses*





# Step 2



## A really clear brief

The project brief needs to nominate Passivhaus certification as an objective and allow for additional early phase resolution of Passivhaus principles. This adjustment will likely extend the design program, particularly in the early phases, and require additional design scope compared to a business-as-usual brief.

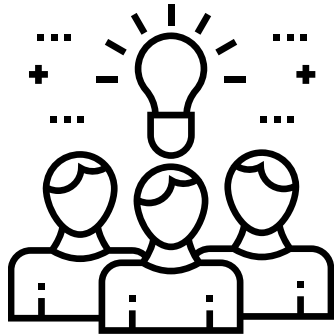
### Key actions

- Specific Passivhaus outcomes and objectives need to be clear, e.g. Is formal certification to be pursued and which verification process will be pursued?
- Adjust the design programme to facilitate additional coordinate activities. For large-scale developments, this may mean an extension of Concept Design by up to 12 weeks.
- Evaluate tenders on the basis of the bidders' understanding of the Passivhaus objectives and important of early coordination



*This step enables the alignment of the whole design team and stakeholder group in relation to the performance objectives of the project*

# Step 3



## Engage the right people early

Engage a broader team from day one to allow Passivhaus feasibility to be tested and early design decisions to be made with an understanding of the Passivhaus implications. Consider the early engagement of contractor advice, for example, through an early contractor involvement (ECI) phase. This is key to controlling buildability and cost, especially when dealing with Passivhaus-specific supply chains and subcontractors.

### Key actions

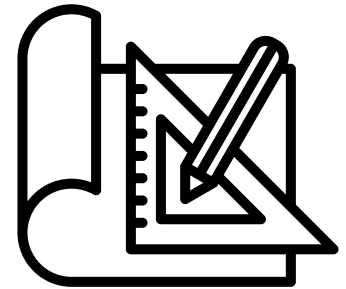
- Engage a specialist Passivhaus consultant, fire engineer and building surveyor early
- Nominate that the following team members have demonstrable Passivhaus experience: architect, Passivhaus specialist, building services engineer, structural engineer, quantity surveyor
- Engage contractor during the Concept Design phase with a clear brief to undertake buildability and procurement analysis. Ideally, engage a contractor with experience delivering buildings with Passivhaus performance outcomes



*This step unlocks the provision of specialist advice when it's needed most – when design flexibility is at its greatest and cost implications and design changes are minimised*



# Step 4



## Resolve PH principles early

Focus on developing a feasible Passivhaus solution before committing to planning so that key 'pain points' are resolved. These may include general massing arrangements, key construction details, glazing ratio and wall constructions.

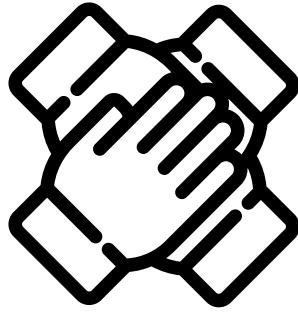
### Key actions

- During concept design, identify opportunities to simplify the design in pursuit of elegant rather than complex Passivhaus solutions
- Resolve building form rationalisation, window-to-wall ratio, construction methodology and key construction detailing, all supported by Passivhaus planning package (PHPP) modelling
- Develop a cost model that is specific and robust, with as much elemental costing as possible



*This step unlocks the ability to streamline subsequent design phases, with major Passivhaus challenges resolved early. This will help to minimise cost impacts and complex design solutions as the design progresses*

# Step 5



## Focus on collaboration

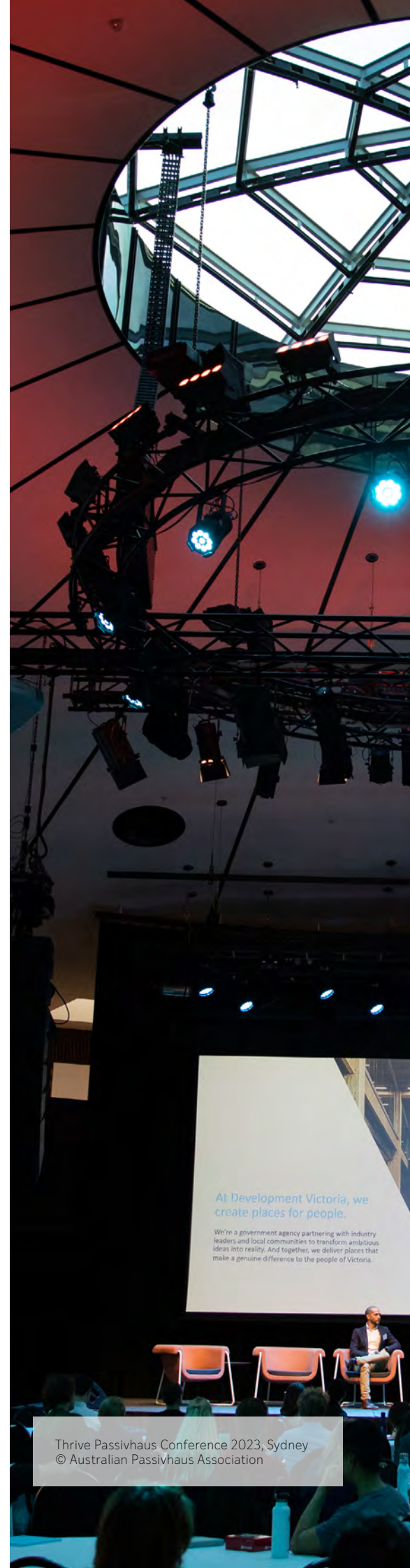
Working in silos is unlikely to lead to sufficient resolution of Passivhaus challenges. Establishing a program of integrated design workshops focused on Passivhaus coordination will allow the whole design team to understand their role better. Fostering a safe learning environment for Passivhaus newcomers will increase agency and build capacity quicker.

### Key actions

- Passivhaus specialist scope to include facilitation of consultant team and contractor onboarding
- Develop design programme to include regular Passivhaus workshops facilitated by the Passivhaus specialist – aim for fortnightly during concept design and monthly from schematic design through to construction documentation
- Create a safe learning environment to build capacity in Passivhaus newcomers



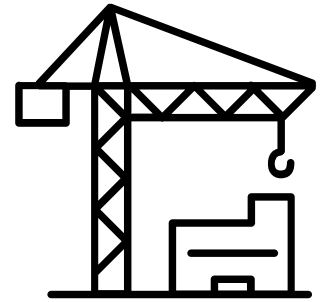
*This step unlocks a collaborative design environment where individuals are aligned with a common purpose and objective*







# Step 6



## Build it right

These steps involve extra diligence in tender and construction documentation, a construction process supported by appropriate skills and training, and a specialist consultant team involvement onsite during construction. These approaches are intended to avoid ambiguity in performance objectives, scope gaps in tender submissions and poor construction practices.

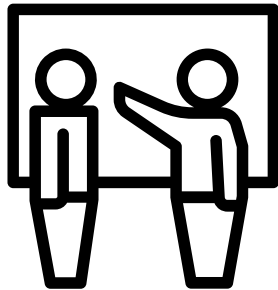
### Key actions

- Develop ‘watertight’ tender documents by allowing two weeks for the Passivhaus specialist to review construction documentation prior to finalisation
- Contractor and trades to undertake Passivhaus inductions and training if not completed previously
- Contractor to create ‘induction process’ for all sub-trades to communicate key objectives and any specific requirements such as reporting/rectification process for any penetrations to air barriers
- Consultant team to stay engaged through the construction phase to provide specialist advice
- Engage a specialist Passivhaus consultant in a peer review capacity, particularly if contractor is new to Passivhaus
- The construction manager is specifically focused on Passivhaus aspects of construction
- Nominate champions within the construction team to take ownership of specific elements, such as air tightness



*This step unlocks a level of confidence during the construction process in delivering the requisite level of performance for a Passivhaus*

# Step 7



## Upskill local industry

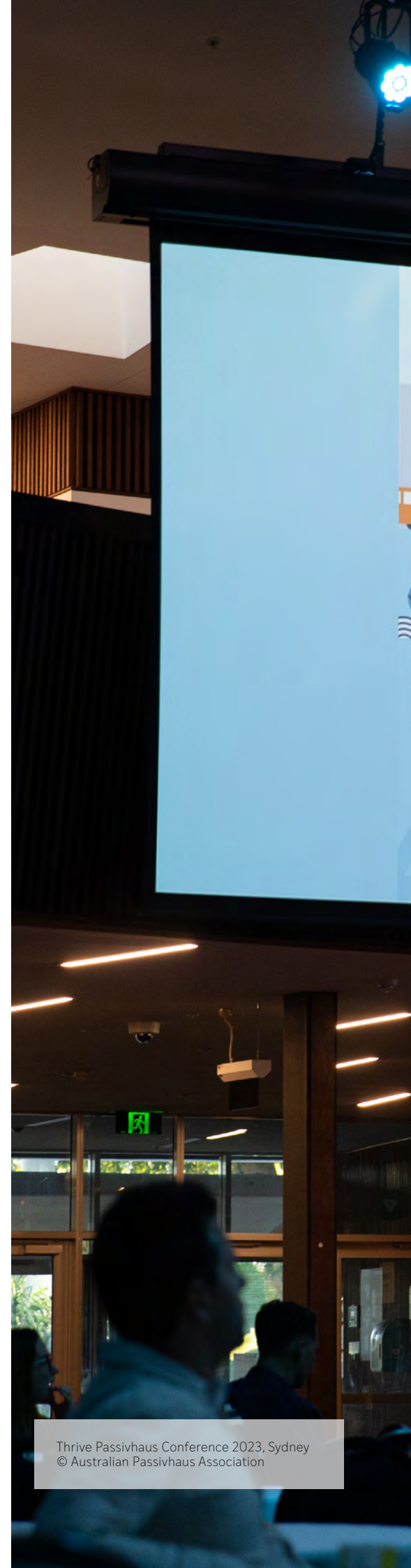
Due to the limited local Passivhaus supply chain, including trained contractors, procurement options are likely to be impacted. Each project, however, is an opportunity to contribute to growth and upskilling in the supply chain through advocacy and market demand signals. Putting this effort into early projects will improve procurement options and reduce costs on future projects.

### Key actions

- Build supply chain and relationships from early in the design process, with particular focus on locally fabricated windows and doors that meet Passivhaus performance requirements
- Encourage local supply chain to have products certified as official Passivhaus Components through the Passivhaus Institute (PHI)
- Include Passivhaus training and experience as an evaluation criteria for consultant team engagement and contractor selection

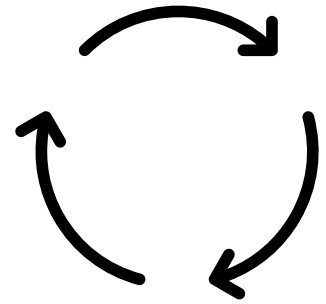


*This step unlocks future capacity and capability across the supply chain, building economies of scale in the market*





# Step 8



## Close the loop

Passivhaus buildings are designed to maintain healthy and habitable spaces. Measuring operational data provides an opportunity to address performance issues early. It also contributes to an evidence base of successful Passivhaus environments. Also, engage with occupants to gather qualitative feedback. Then close the loop by using and sharing gathered information for future business cases and design processes.

### Key actions

- Invite owners/tenants to participate in feedback and provide incentives for their engagement
- Embed sensor and feedback technology into the Building Management System to capture energy and Indoor Environmental Quality data
- Make learnings available to development and design teams embarking on similar projects



*This step unlocks a better understanding of the development's actual performance, providing valuable insights for commissioning and operation as well as future projects*

# Step 9



## Tell the success story

Ensure project successes are used to promote Passivhaus understanding in the industry, including cost and health benefits. Remember to be transparent – generously share what worked as well as what didn't work – challenges can be just as valuable as wins.

### Key actions

- Establish an advocacy and education program from design through to operation
- Tell the success stories generously, including those that feel like failures at first
- Be transparent with capital cost and performance data
- Engage the community at large – including end users – not just Passivhaus practitioners
- Engage with your regional Passivhaus institutes and communities. For example, the Australian Passivhaus Association offers an excellent range of knowledge sharing platforms such as the Project Database, Webinar sessions, Annual conferences and publications.



*This step unlocks future capacity and capability across the supply chain, building economies of scale in the market*



# Shaping the Playbook

## WORKSHOP

**Notes (DB)** Mission: "Develop a process for a technically feasible, buildable, cost effective Passive House approach"

Describe the ideal process for achieving our objective:

- The project meetings are a safe environment for learning, admitting gaps, etc.
- Masterplanning and massing exercise is informed by PH principles to maximise opportunities
- There is an acknowledgement that an efficient PH may not conform to existing expectations (of app materiality, quantity of glass, balconies) - CHALL
- The process explores familiar (BAU) materials, m
- ... feels like it's just another bu

**Notes (MS)** Mission: "Develop a process for a technically feasible, buildable, cost effective Passive House approach"

Describe the ideal process for achieving our objective:

- e.g. The consultant team is fully aligned and clear on the PH objectives of the project

**Pre Design**

- Internal alignment within DV
- Site selection for building orientation
- Discuss with Council how the planning requirements can help PH and if there flexibility with Council for the planning envelope if a better outcome is demonstrated
- Passive house designer involved with site selection
- Optimisation of the envelope
- Have a passive house consultant involved at business case stage
- Educated enough to deliver a brief that includes the cost and value of PH
- Commit to PH early - PH not as a design option
- Resolve key principles early
- "Bring the heavy lifting forward"

**Design**

- Facade consultant will be involved pre-design
- ECI pre-planning with cost input (straight up or Managing smart) (can have a long embairment process if builders are swapped)
- ECI during later design stages
- Development plan sets out height massing and set backs
- Planning application will include PH design
- Longer concept design phase
- Engineers and PH designers involved

**Notes (MS)** Mission: "Develop a process for a technically feasible, buildable, cost effective Passive House approach"

Describe the ideal process for achieving our objective:

- A really well articulated brief with specific outcomes and objectives
- Enough time and money to do the job
- Clear expectations at each stage
- ECI to include PH experience
- PH included in weighted evaluation process
- Have market knowledge on purchasers and consider trends
- Have a good education and marketing strategy

**Post occupancy**

- BMS that can capture performance
- Close the loop with tangible feedback (financial data)
- Tell the success story project. Consultant brief to include this process
- Detailed BIM model used for maintenance and monitoring. Consultant brief to include this process
- Work in a option for occupant engagement
- Build and app that feedback data to occupants

DEVELOPMENT VICTORIA 22



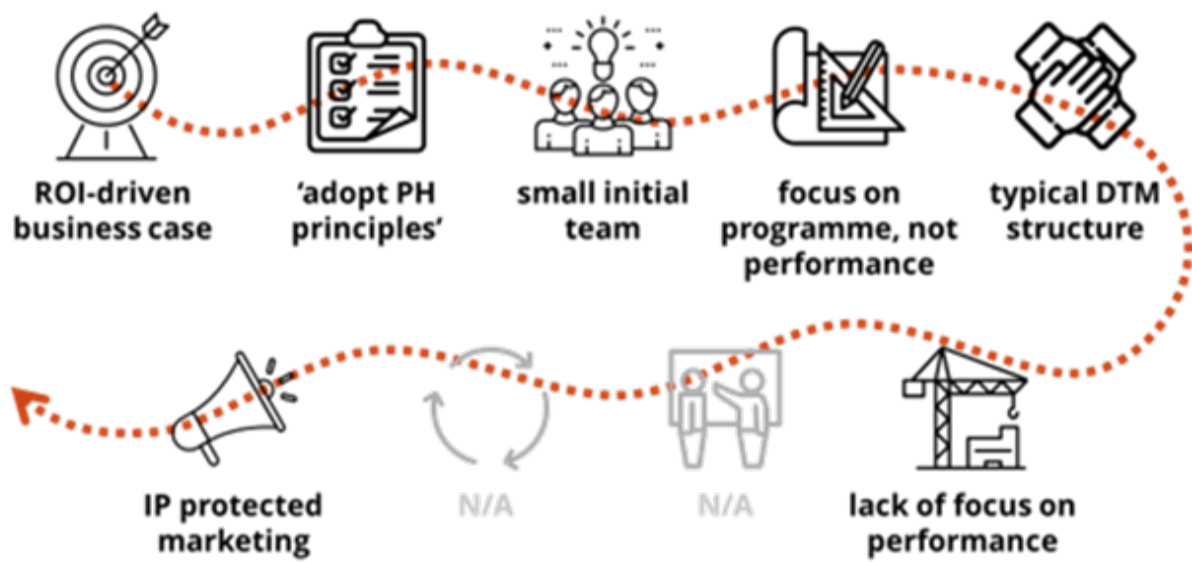
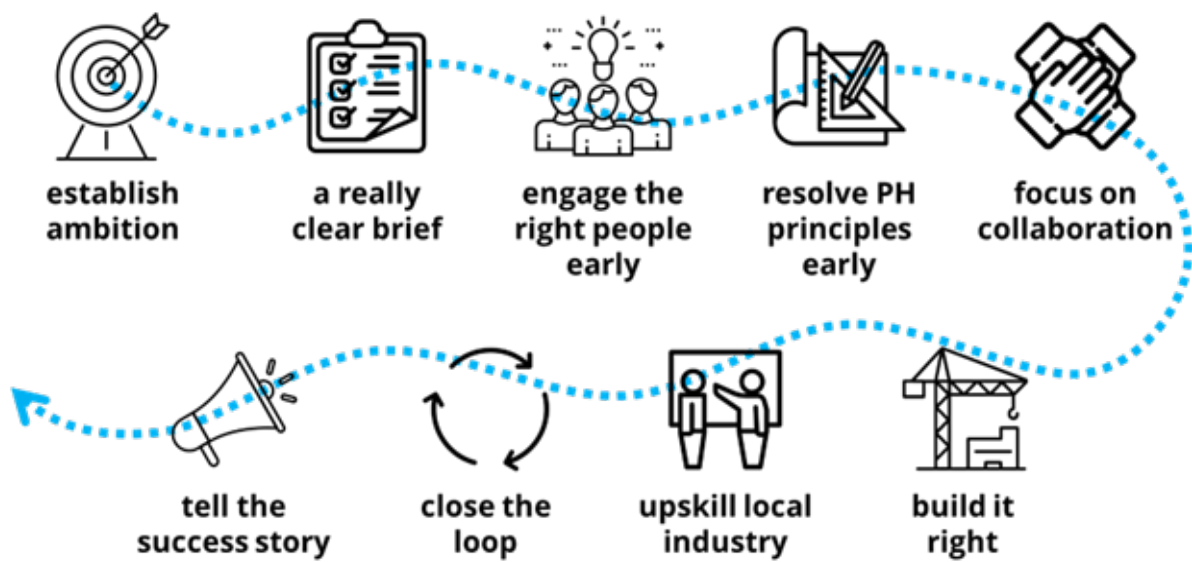
# Bridging the Gap from BAU

By developing the Playbook, the team were able to reflect on what currently constitutes 'Business As Usual' (BAU), as a direct comparison to the process required to deliver a Passivhaus project. This is incredibly important for teams looking to adopt the Passivhaus standard, as it identifies the gaps that need to be addressed in pursuit of the desired outcome.

Project teams should regularly map these gaps – perhaps yearly – as some aspects will likely change over time. For example, as the adoption of Passivhaus increases, so will the supply chain's maturation.

The BAU mapping illustrated here represents the context during which the Passivhaus Playbook was developed – the Australian market in early 2022. The team's review highlighted the following challenges:

1. The typical focus during business case development is direct financial return, which misses the opportunity to develop a more holistic view of value creation, including health, reputational and longer-term returns.
2. Many technical briefs reference terms such as 'passive design', 'fabric first' and even 'Passivhaus principles', but few are clear in their ambition to pursue Passivhaus in earnest
3. Most projects enlist a small core team of consultants early on – this means specialist advice regarding the feasibility of Passivhaus is not available until many fundamental design decisions have already been made
4. Early design phases, such as concept design, are often squeezed in the project programme, offering little opportunity for the design team to resolve key performance challenges
5. Design team meetings are often conducted as a reporting exercise, with each discipline providing updates in isolation – this misses an opportunity for collaborative problem-solving and capacity-building
6. Construction tendering typically focuses on cost and programme efficiencies rather than focusing on performance outcomes
7. Very few projects will engage the wider industry to upskill, educate and inspire as part of a contribution beyond the project boundary
8. Very few projects allow for a contractual continuation beyond handover, missing an opportunity to truly understand performance in operation, rectify underperformance and bring insights to bear on subsequent projects
9. Success stories tend to be marketed without transparency, protecting intellectual property rather than contributing to wider industry progress beyond organisational and project boundaries



# Cost & Value

As mentioned earlier, the pilot project used by Introba and Development Victoria was a multi-unit residential development with approximately 250 apartments. To explore the “cost-effective” objective, the team engaged Wilde & Woollard and Built to estimate the itemised capital cost uplift and savings based on the proposed pathway. Introba calculated estimated operational costs for both base building and apartment energy use.

The cost data indicates an overall uplift of 2.8% against a baseline capital cost. This is far below the reported uplift of 20-30% when the Passivhaus standard is applied to a project without an integrated planning, design and delivery approach. This outcome highlights the potential financial value in adopting the Passivhaus Playbook.

For the pilot project, the majority of cost uplift is associated with construction items such as thermal breaks, insulation and heat recovery ventilation. Professional fees are also significantly uplifted due to the early engagement of specialist advice and extended design scope. However, these increases are partly subsidised through several cost-saving opportunities, including modular façade panels and glazing and air conditioning equipment rationalisation.

The operational cost analysis focused on energy use and compared three performance scenarios – a benchmark ‘business-as-usual’ apartment, an 8-Star NatHERS development and a Passivhaus apartment. The results indicate that the apartment occupant could halve their energy costs, saving approximately \$700 per year compared to the baseline. When accounting for maintenance costs (replacing the MVHR filter), this saving reduces to approximately \$550 per year and equates to approximately \$15,000 over 20 years based on 3% CPI.



## Capital Cost

Construction Cost	COST excl. GST
Thermally broken balconies	+\$861,300
Isolation of basement carpark	+\$615,348
Insulation of terraces	+\$298,900
Modular façade ('mega-panels')	-\$736,440
Facade glazing rationalisation	-\$331,398
Heat recovery ventilation	+\$2,436,000
Reduced air-conditioning size	-\$348,000
<b>Sub-total</b>	<b>+\$2,795,710</b>
<b>Professional Fees</b>	
Extended Design Scope	+\$982,880
Early Contactor Engagement (ECI)	+\$160,000
Construction oversight	+\$202,920
<b>Sub-total</b>	<b>+\$1,345,800</b>
<b>Cost Summary</b>	
<b>Total Additional Capital Cost</b>	<b>+\$4,141,510</b>
<b>Capital cost per apartment</b>	<b>+\$16,241</b>
<b>Variance from current budget</b>	<b>+2.8%</b>

## Operational Cost

**\$700**

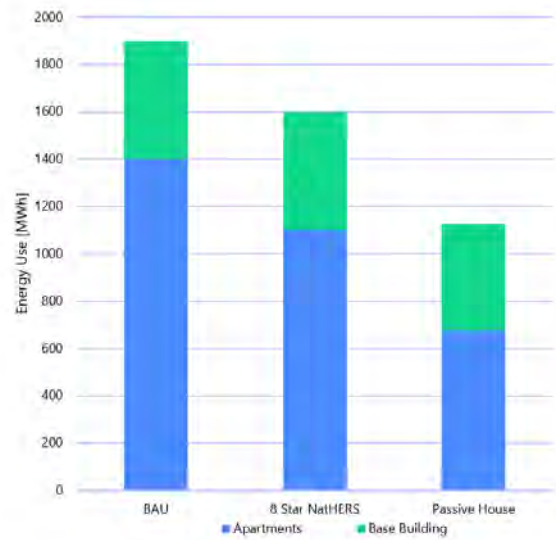
Annual energy saving per apartment

**\$550**

Net annual saving per apartment

**\$15,000**

Net saving over 20 years (CPI 3%)



Disclaimer: It is important to note that cost information presented in this Playbook indicates the market characteristics at the time of estimation and represents the building typology of the pilot project. Nevertheless, the magnitude of both capital cost uplift and operational savings is in alignment with other Passivhaus cost studies.

When assessing the cost impact of any ambitious or high-performance goal, it is important that the value proposition isn't restricted to financial return. Passivhaus buildings in particular, offer a wide range of benefits that should be considered during the first step of the Playbook. Below is a summary of the benefits to the developer/operator and apartment owner that was developed as part of the pilot project.

## Value to developer/owner

### Proven

Passivhaus is science based, a tried and tested method for delivering ultra-low energy buildings.

### Marketing

Passivhaus buildings can be marketed as genuinely sustainable with guaranteed reduction in energy bills and improved indoor comfort. It is an internationally recognised performance standard, allowing marketing efforts to transcend the location of the project.

### Planning

Passivhaus exceeds local planning requirements and demonstrates to authorities that the building will meet and exceed emissions reduction, energy efficiency, resilience and health and wellbeing objectives.

### Climate Action

Delivering Passivhaus projects aligns with many organisational sustainability strategies for delivering energy-efficient, low-carbon buildings, and contributes to achieving Net Zero Carbon commitments.

### Assurance

Passivhaus-certified buildings are likely to have fewer variations, delays, callbacks and warranty claims because of the level of documentation and the mandatory quality assurance process.

### Financial Return

Passivhaus certified buildings have lower operating costs and high-quality components. As the market becomes more educated about sustainable buildings, the demand for Passivhaus buildings will grow, and developers will attract a premium for Passivhaus apartments.

## Value to developer/operator

### Energy Bills

Due to heating and cooling energy requirements being around 90% lower than a conventional apartment as well as high-efficiency lighting and appliances, overall energy bills are reduced by around 50% for apartment owners.

### Health

High indoor air quality due to a continuous supply of filtered fresh air, which also controls moisture to prevent mould growth.

### Comfort

Through high-performance walls, windows and solar shading, temperatures are stable regardless of weather conditions.

### Quiet

With high insulation walls and well-sealed windows, Passivhaus buildings cut out most exterior noise, which is particularly important for urban environments.

### Resilient

Passivhaus buildings remain habitable for longer during events such as power outages and heatwaves.

### Finance

Passivhaus buildings can qualify for reduced interest rates on borrowing.



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# Key Challenges

In developing the Passivhaus Playbook, the project team conducted two workshops focused specifically on buildability and supply chain challenges. A number of key challenges were highlighted relating to building form, envelope and systems. This section of the Playbook provides suggested approaches to these challenges. While not exhaustive, we believe the considerations will help design teams navigate some of the most significant issues in implementing Passivhaus at scale.

## Form

### SOLAR EXPOSURE

In some climates where Passivhaus is building momentum, solar radiation can be a significant environmental load to manage. Solar exposure can become a challenge when other drivers, such as development envelopes, make it difficult to design a passive building form.

Consider rationalising glazing to minimise the quantity of transmitted solar radiation first. If external shading is necessary, consider designing a prefabricated façade solution with integrated shading to avoid significant onsite installation costs and programme impacts.

### STEPPED MAPPING

A common approach to massing involves stepped volumes, often driven by planning requirements associated with daylight access and overshadowing. This approach provides the benefit of terrace amenity but introduces complexity in wall-roof junctions that need to be considered from an insulation and air tightness perspective.

The traditional approach to insulating the underside of terrace slabs introduces a significant thermal bridge at the wall-roof junction. Consider an 'inverted roof' construction with insulation running over the terrace slab with pavers and finishes above.

### BALCONIES

A common design feature, particularly in residential developments, balconies provide abundant amenity and are typically created as an extension of the internal floor slab. This approach results in a significant thermal bridge.

There are several options for review when considering balcony treatment, including using 'winter gardens' in lieu of external balconies, creating a separate external steel structure, cast-in thermally broken slabs, and communal terraces in lieu of individual balconies.

### BASEMENTS

Unconditioned basement spaces, such as carparks, will be excluded from the building's thermal envelope. These spaces will often feature typically uninsulated columns, resulting in a thermal bridge between the carpark and conditioned space above.

Consider insulating basement columns to minimise thermal bridging. It may be possible to insulate only the top 50% of each column, but the design team should test this rationalisation.

## Envelope

### WALL CONSTRUCTION

Stick-built and curtain wall facades are often utilised in traditional building construction. These approaches typically fall short of the thermal insulation and air tightness demands of a Passivhaus.

Consider using prefabricated façade panels with integrated windows, doors, non-combustible insulation, air/vapour barriers and thermally broken rain screens/shading. Production in a controlled environment can improve air tightness compared to onsite fabrication. Consider procurement programme implications.

### SUPPLY CHAIN

In some countries, locally sourced Passivhaus-certified windows and doors are unavailable.

Consider rationalising fenestration area to enable double glazing in lieu of triple glazing, while balancing daylight and views. If timber or uPVC products are inappropriate (e.g. due to combustibility), engage with local supply chain to source thermally broken aluminium products with equivalent Passivhaus performance.

### BUILDING ENTRANCES

In typical buildings of scale, entrances often feature sliding doors, revolving doors and lifts that penetrate the thermal boundary (e.g. to service basements). These features all increase the difficulty of achieving Passivhaus air tightness requirements.

Consider entrance doors with positive pressure air seals as well as airlocks at entrances (both above grade and at basement lifts). Ensure any building lifts are selected and the shaft sized to avoid the requirement for a ventilation opening at roof level (which may require a performance solution depending on local codes and standards). Include lift shafts and lobbies within thermal envelope and air tightness boundary as it is extremely difficult to ensure lift doors are airtight.

### AIR TIGHTNESS TESTING

The high level of air tightness in Passivhaus projects requires physical testing and often results in remedial sealing and alterations. If testing is completed after internal finishes are installed, this may result in costly invasive works.

Manage the project programme to enable an air tightness specialist to be engaged to undertake testing prior to internal finishes being installed. Include hold points for several tests throughout construction as a risk management strategy.

## Systems

### HEAT RECOVERY VENTILATION

Passivhaus projects require heat recovery ventilation as a prerequisite. This is not Business As Usual and requires coordination with design teams to establish the most appropriate strategy.

Consider using PHI pre-certified ventilation units to streamline the certification process and avoid penalisation in the PHEP calculation. Carefully consider the merits of centralised and decentralised ventilation depending on the building typology and spatial implications. Ensure sufficient space for insulating ductwork.

### AIR CONDITIONING

The significant reduction in heating and cooling loads within a Passivhaus building offers advantages that can be leveraged if a considered approach is adopted.

Ensure air conditioning systems are “right-sized” rather than based rules of thumb. The resulting reduction in air conditioning equipment will enable a cost rationalisation that should be leveraged elsewhere in the project. Adopt holistic thermal comfort strategies, such as the use of ceiling fans.

### KITCHEN EXHAUST

In multi-unit residential buildings, kitchen exhaust hoods typically discharge through façade with make-up air from adjacent spaces. This arrangement is not in alignment with a Passivhaus approach to ventilation.

For these applications, it may be necessary to seek a performance solution with the relevant building authority early in the project. A potential approach is to provide general exhaust from the kitchen to the heat recovery unit alongside a recirculating exhaust hood with integrated grease removal. Note induction cooking is required.

### PLUG LOAD ENERGY

As Passivhaus considers total energy use – including appliances – it is important to consider all contributors to energy use.

Develop a schedule of plug loads for the specific building use. This may include appliances in a residential building or medical equipment in a healthcare setting. For each plug load category, explore opportunities to rationalise energy demand through efficiency measures and careful selection and specification. Consider the integration of onsite renewable energy generation.



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# Conclusion

The Passivhaus Playbook isn't rocket science. In fact, most of the individual steps may seem very familiar, perhaps even obvious. But far too often, particularly on projects of scale, there is a lack of commitment to these steps, and the project falls back to the traditional methods of planning, design and delivery.

Whether you are an investor, developer or designer, we hope there's something here for you. Take a look through the Playbook steps and identify what's within your sphere of control and what's within your sphere of influence. These are your levers.

If nothing else, we hope the Playbook provides a quick reference for your next project. We hope it serves as a reminder that there are many opportunities to tweak our approach to projects. And if we are intentional about these steps right from the outset, we have an opportunity to deliver something special, something truly high-performing, with very little impact on the bottom line.

## Where to get more help

For further information, reach out to your local Passivhaus institute.

A list of global organisations can be found on the [International Passive House Association](#) website.

The [Australian Passivhaus Association](#) is one such organisation, providing a wealth of useful resources including a list of certified Passivhaus builders and designers, project examples and publications.

