

TIMBER FUTURES: THE BENEFITS OF TIMBER IN SUSTAINABLE DESIGN AND CONSTRUCTION



INTRODUCTION

Due to rising temperatures, worsening air and water pollution and unchecked levels of landfill waste, public concerns over climate change and the state of the environment are at an all-time high. In Australia, the design and construction industry is one of the highest contributors of waste and emissions year after year.¹ In 2018, the built environment was responsible for 40% of Australia's total waste levels.² In addition, the construction, operation and maintenance of buildings make up a quarter of the country's greenhouse gas emissions.³ As population numbers swell, the impact of construction on the natural environment is set to escalate.

Against this backdrop, the demand for sustainable building design is growing with designers and specifiers required to incorporate this new approach into all elements of construction, including material specification. To stay competitive while addressing the climate problem, practitioners need to make more informed choices when specifying building materials and find environmentally-friendly alternatives to less sustainable technologies. This includes accounting for the following factors during the specification process:

- embodied energy consumption;
- impact on the environment;
- impact on occupant health and wellbeing; and
- performance and aesthetic benefits.

In this whitepaper, we explore the growing demand for sustainability in contemporary design and examine the benefits of timber in creating long-lasting, eco-friendly buildings. In doing so, we highlight how specification of innovative, lightweight timber cladding can deliver elevated sustainability and efficiency values without compromising on durability, strength and style.





A GLOBAL PROBLEM: THE IMPORTANCE OF USING SUSTAINABLE BUILDING MATERIALS

Beyond Australia, the global construction sector is responsible for much of the world's natural resource consumption, waste and greenhouse gas emissions. Building construction consumes 30–50% of the planet's raw materials.⁴ Construction also generates massive amounts of waste with reports predicting an increase to 2.2 billion tonnes of global construction waste per year by 2025.⁴ According to the International Energy Agency, buildings and building construction are also accountable for approximately 36% of global final energy consumption and 40% of total CO₂ emissions (direct and indirect).⁶

The environmental impact of construction can be partly attributed to the continued use of polluting technologies such as steel and concrete. Among the commonly used materials in

construction, concrete and steel as well as brick are some of the highest contributors of embodied emissions.⁷ Other studies show cement and steel accounting for almost half of industrial emissions⁸ and a significant proportion of industrial water use.

In light of the public's growing environmental awareness, the construction industry is seeking ways to reduce its environmental impact. One approach is identifying sustainable alternatives to concrete, brick and steel that are suitable for a wide range of building types – from small residential dwellings to high-rise commercial skyscrapers. High quality, certified-sustainable timber and engineered timber products may provide a viable, long-term solution

DEVELOPMENTS IN SUSTAINABLE BUILDING DESIGN

The goal of sustainable design is to minimise negative environmental impacts at both the construction and use stages.⁹ A key component of sustainable design is using environmentally-friendly building materials whenever possible while also implementing measures to improve the health and wellbeing of occupants.

A sustainable approach to building design benefits occupants, the general public and the construction industry alike. Such benefits include:¹⁰

- reduced energy costs over the lifetime of a building;
- better use of natural resources (e.g. through reuse, recycling and responsible disposal);
- environmental protection outcomes; and
- improved occupant health and quality of life.

Developments in material technology have had a major impact on sustainable design. For example, Cross Laminated Timber (CLT), a next generation engineered wood product with enhanced structural properties, has opened up new architectural possibilities within the

commercial sector, including faster, more cost-effective carbon-neutral construction. The light weight of CLT decreases foundations loads and makes CLT panels easy to work with and erect at any height. Pre-manufactured CLT elements can also reduce construction timeframes, allow for more economical foundations and improve access for follow-on trades. Furthermore, building elements made of CLT can be combined with other materials such as glulam beams, enabling a high degree of design flexibility.

New mass engineered timber solutions, such as CLT, have been specifically engineered for maximum strength and portability.¹¹ Demonstrating its structural capabilities, CLT has been used in major high rise buildings in Australia, such as Forte Living in Victoria, the tallest residential timber building; the award-winning International House Living building in Barangaroo, Sydney; and 25 King St in Brisbane, which is the first, largest and tallest timber office. As it combines the inherent sustainability of timber with enhanced versatility and strength, CLT is considered by some commentators to be a viable solution that could permanently replace older polluting construction technologies.¹²

THE BENEFITS OF TIMBER

The emergence of timber and engineered timber products as a viable alternative to less environmentally-friendly building materials can be attributed to timber's ability to balance sustainability and performance. Below is an examination of timber under key specification and sustainability criteria.

Performance and aesthetics

Timber offers a timeless aesthetic that is popular in contemporary design, with a natural, warm and tactile look that is enhanced by a range of hues, textures and grains. Timber structures combine this visual appeal with high levels of acoustic, thermal and structural performance.

For example, plantation pine structural timber has a 20% higher strength to weight ratio than steel and is four to five times stronger than non-reinforced concrete in compression when using the same measure.¹³ As noted, engineered timber products offer even greater levels of structural performance. Some species are rot and termite resistant and can withstand harsh weather conditions over a long period of time. Timber is also an outstanding insulator and provides effective sound control, enhancing thermal and acoustic comfort in built environments.

While technically combustible, timber burns in a predictable way that enables designers to create fire resistant timber structures.¹⁴ Considering the complex fire safety requirements under the *National Construction Code*, designers and specifiers should prefer cladding products that have been adequately fire tested and suppliers who can offer expert advice as to the design of code-compliant timber building systems.

Embodied energy consumption

Timber products, including mass engineered solutions, have low levels of embodied energy. "Embodied energy" refers to the amount of energy consumed in producing materials for building construction.¹⁵ Embodied energy can be lowered by using local, natural and renewable materials that are long-lasting and recyclable.



Timber building products meet these criteria and are also less energy intensive to manufacture and use than other building materials. For example, aluminium requires approximately 170 MJ/kg in embodied energy (with no carbon sequestered) whereas kiln dried sawn hardwood requires 2.0 MJ/kg (with 0.5kg carbon sequestered),¹⁶ Research by the Forest & Wood Products Australia found that up to 25 tonnes of carbon per Australian home could be saved by choosing wood where possible.¹⁷ Timber is also lightweight and versatile, so it can be transported efficiently and incorporated into designs to be easily recovered, reused and/or recycled.¹⁸

Impact on the environment

Forests and timber products provide valuable carbon storage, absorbing greenhouse gas and locking it into the wood until it rots, decays or burns.¹⁹ This has the effect of reducing global emissions and mitigating the effects of climate change. The Forestry Corporation reports that the combined net annual carbon sequestration of sustainably-managed State forests and the timber products they produce is equivalent to 230,000 cars being taken off the road.²⁰

Timber building products have other notable environmental benefits. Timber is highly durable, with some hardwoods offering a service life of over 50 years and requiring minimal energy to maintain. It is also highly recyclable, non-toxic and biodegradable, meaning it can be broken down into materials that will not harm humans or the environment. Timber structures are thermally efficient and naturally insulating, reducing consumption of non-renewable energy.²¹ Sustainably-sourced timber is renewable and encourages the growth of managed forests which help with CO2 absorption across the globe and encourage local biodiversity.

Occupant health and wellbeing

A critical aspect of sustainable design is incorporating measures that improve occupant health and wellbeing. Timber excels in this area due to several factors. Timber building products improve indoor air quality by regulating humidity and are considered hypo-allergenic.²² Studies have also shown that there are psychological benefits derived from timber's natural calming appearance.²³ In the workplace, employees surrounded by wood have reported increased levels of productivity.²⁴

In general, designers and specifiers should seek building products with low volatile organic compound (VOC) content. Minimising VOC emissions is critical to a healthy indoor environment, which means specifying solutions that are free from or have minimal amounts of glues, resins and/or formaldehydes. Formaldehyde is particularly harmful and found in a range of building products.²⁵ Formaldehyde exposure can result in eye, nose and throat irritation, headaches and nausea as well as long-term effects such as cancer and impaired lung function.²⁶

Building materials containing silica can also pose a health risk. Such materials are not dangerous unless they are cut, generating silica dust that may be inhaled into the lungs. Exposure to silica dust increases the risk of lung cancer silicosis, kidney disease and chronic obstructive pulmonary disease.²⁷

Designers and specifiers should ensure that any products specified for a building project have zero or minimal VOC-content and do not contain silica. Leading timber products made from 100% natural materials fit this description and are safe for construction workers and occupants alike.



WEATHERTEX

Since 1939, Weathertex has been the cladding manufacturer preferred by builders, architects and designers all over the world. This Australian-owned company has employed over 150 local people for over half a century and offers a wide range of high quality timber cladding, weatherboards and architectural panels.

The Weathertex catalogue is supported by its expert customer service team, who have extensive technical knowledge and experience in relation to Weathertex products and Australia's complex regulatory environment.

With a better than zero carbon footprint, Weathertex's external timber cladding is ideal for today's environmentally-conscious market. Weathertex is endorsed under the Programme for the Endorsement of Forest Certification (PEFC), which promotes Sustainable Forest Management through independent third-party certification. The company also participates in the Living Future Institute Declare Label and Product Health Declaration initiatives, both of which aim to push the building materials industry towards healthier products and practices.

Weathertex Cladding, Panels and Weatherboards

Ideal for builders, architects and designers looking for high quality building solutions that are sustainable and environmentally-friendly, Weathertex cladding, panels and weatherboards are made from certified state forest or private hardwoods in Australia without any chemical additives. These solutions are third-party accredited, receiving a Global GreenTag Platinum certification with a GreenRate Level A for the Natural range and Gold Certification for primed flat cladding and wall panel sheets.

One of the most trusted brands in the industry, Weathertex products are Australian-made, 100% natural and contain no artificial glues or binders. These high quality cladding, panels and weatherboards are lightweight, strong and easy to use, making them a cost-effective, low energy alternative for a wide variety of residential and commercial applications. They are also guaranteed not to rot, split or crack for up to 25 years depending on the specific product, with low requirements for repainting and cleaning. These performance properties ensure Weathertex products increase the sustainability credentials of buildings whenever they are used.

The Weathertex range provides a range of styles, profiles and finishes to suit any project. The Natural cladding range is an unprimed board that offers the look of raw, undressed timber. Selflok and Primelok Weatherboards feature self-locking and fixing systems that result in clean, contemporary lines. Classic Weatherboards are available in a variety of surface finishes.

Panels such as Weathergroove and EcoWall combine improved performance and reliable structural bracing with a high degree of design versatility. EcoWall is robust and durable and features both vertical and horizontal express jointing. Suitable for homes or large commercial projects, EcoWall delivers exceptional strength while also being lightweight. It is compliant with Australian standards for external hardboard with large panels for quick and easy installation.

Weathertex products can be used internally and as an external wall cladding in bushfire attack levels up to and including BAL 19 construction. These products are available in a range of sizes and dimensions, a variety of colours and textures, and can be customised with a selection of high quality accessories.

REFERENCES

- ¹ Yu, Man, Thomas Wiedmann, Robert Crawford and Catriona Tait. "The Carbon Footprint of Australia's Construction Sector." *Procedia Engineering*, Vol. 180 (2017): 211-220.
- ² Diversified Communications Australia. "Zero to Hero: Waste in Our Construction and Demolition Industry." Australasian Waste & Recycling Expo. <https://awre.com.au/recycling/zero-hero-waste-construction-demolition-industry> (accessed 18 October 2019).
- ³ Martek, Igor and M Reza Hosseini. "Buildings produce 25% of Australia's emissions. What will it take to make them 'green' – and who'll pay?" *The Conversation*. <https://theconversation.com/buildings-produce-25-of-australias-emissions-what-will-it-take-to-make-them-green-and-wholl-pay-105652> (accessed 18 October 2019).
- ⁴ Victorian Government. "Building Materials: Building design for a sustainable future." City of Monash. <https://www.monash.vic.gov.au/files/content/public/about-us/council/agendas-minutes/27-january-2015/4.1-attachmente.pdf> (accessed 18 October 2019).
- ⁵ Slowey, Kim. "Report: Global construction waste will almost double by 2025." *Construction Dive*. <https://www.constructiondive.com/news/report-global-construction-waste-will-almost-double-by-2025/518874>
- ⁶ International Energy Agency. "Energy Efficiency: Buildings." IEA. <https://www.iea.org/topics/energyefficiency/buildings>
- ⁷ Teh, Soo Huey, Thomas Wiedmann, Judith Schinabeck and Stephen Moore. "Replacement scenarios for construction materials based on economy-wide hybrid LCA." *Procedia Engineering*, Vol. 180 (2017): 179-189.
- ⁸ Ibid.
- ⁹ United States Government. "Sustainable Design." US General Services Administration. <https://www.gsa.gov/real-estate/design-construction/design-excellence/sustainability/sustainable-design> (accessed 18 October 2019).
- ¹⁰ Ibid.
- ¹¹ Forest and Wood Products Australia Ltd. "Cross Laminated Timber (CLT)." *Wood Solutions*. <https://www.woodsolutions.com.au/wood-product-categories/Cross-Laminated-Timber-CLT> (accessed 18 October 2019).
- ¹² Block, India. "Cross-laminated-timber housing in east London offers "the future of low carbon construction." *Dezeen*. <https://www.dezeen.com/2017/11/01/worlds-largest-cross-laminated-timber-tower-dalston-works-waugh-thistleton-regal-developments-sustainable-london> (accessed 18 October 2019).
- ¹³ Timber Queensland. Benefits of Wood Fact Sheet 9: Construction Benefits —
- ¹⁴ Strength and Durability." Timber Queensland. http://www.timberqueensland.com.au/Docs/Benefits%20of%20Timber/Fact%20Sheets/Fact-sheet_09.pdf (accessed 18 October 2019).
- ¹⁵ Forest and Wood Products Australia Ltd. "Fire performance." *Wood Solutions*. <https://www.woodsolutions.com.au/articles/fire-performance> (accessed 18 October 2019).
- ¹⁶ Forest and Wood Products Australia Ltd. "Low embodied energy." *Wood Solutions*. <https://www.woodsolutions.com.au/articles/low-embodied-energy> (accessed 18 October 2019).
- ¹⁷ Australian Government. "Embodied energy." *YourHome*. <http://www.yourhome.gov.au/materials/embodied-energy>
- ¹⁸ Australian Government. "Forests, Wood and Australia's Carbon Balance." Forest and Wood Products Research and Development Corporation. <https://www.firewood.asn.au/images/downloads/forestswoodcarbonbalance.pdf> (accessed 18 October 2019).
- ¹⁹ Above n 15.
- ²⁰ Forest and Wood Products Australia Ltd. "Carbon storage." *Wood Solutions*. <https://www.woodsolutions.com.au/articles/carbon-storage> (accessed 18 October 2019).
- ²¹ Forestry Corporation of NSW. "Trees, timber and carbon storage." Forestry Corporation. <https://www.forestrycorporation.com.au/sustainability/carbon-and-forests> (accessed 18 October 2019).
- ²² Forest and Wood Products Australia Ltd. "Thermal performance." *Wood Solutions*. <https://www.woodsolutions.com.au/articles/thermal-performance> (accessed 18 October 2019).
- ²³ Timber Queensland. "Benefits of Woods Fact Sheet 2: Workplace and Health Benefits of Timber." Timber Queensland. http://www.timberqueensland.com.au/Docs/Benefits%20of%20Timber/Fact%20Sheets/Factsheet_02_NEw.pdf (accessed 18 October 2019).
- ²⁴ Ibid.
- ²⁵ Planet Ark. "Workplaces: Wellness + Wood = Productivity." *Make It Wood*. <https://makeitwood.org/healthandwellbeing/wellness-study> (accessed 18 October 2019).
- ²⁶ BNP Media. "Formaldehyde and Health Risks." *Adhesives & Sealants Industry*. <https://www.adhesivesmag.com/articles/92074-formaldehyde-and-health-risks> (accessed 18 October 2019).
- ²⁷ Ibid.
- ²⁸ Cancer Council Australia. "Silica dust." Cancer Council. <https://www.cancer.org.au/preventing-cancer/workplace-cancer/silica-dust.html> (accessed 18 October 2019).