World Conference on Timber Engineering Oslo 2023

INVESTING IN MASS TIMBER CONSTRUCTION IN AUSTRALIA: THE CLEAN ENERGY FINANCE CORPORATION TIMBER BUILDING PROGRAM

Christina Wijeratne[1] and Paolo Lavisci[2]

ABSTRACT: The built environment must play a significant role in achieving Australia's decarbonisation objectives. Whilst energy efficiency measures and renewable energy sources helping to address the operating emissions of Australia's built environment have gained significant traction, the embodied carbon in the materials used in construction is becoming an increasingly important component of the built environment's carbon emissions profile. Where application is appropriate, mass timber provides a lower embodied carbon alternative to conventional construction materials. The Clean Energy Finance Corporation (CEFC) Timber Building Program, launched in February 2022, offers AUD 300 million in debt financing to encourage greater use of mass timber in construction. The CEFC Timber Building Program looks to increase the use of mass timber in Australia, to achieve direct carbon savings through individual projects and drive demand for mass timber products in Australia. It also aims to enable increased exposure and capacity building for construction professionals and help to influence the broader market through providing demonstration value. The Timber Building Program highlights the unique and broad impact potential of targeted, purpose-driven financing.

KEYWORDS: Debt program, timber funding, embodied carbon, financing

1 INTRODUCTION

The Clean Energy Finance Corporation (CEFC) is Australia's 'green bank' with a 10-year track record of investing to reduce emissions across the economy, working with co-investors, business, industry, and government to deliver on Australia's ambitions to reach net zero emissions by 2050. In February 2022, the CEFC launched an AUD 300 million Timber Building Program, aimed at accelerating the use of mass timber construction in Australia, with the provision of tailored debt finance to eligible projects.

2 THE AUSTRALIAN CONTEXT

Australia produces approximately four-and-a-half times the world average per-capita CO_2 emissions, at over 14 tonnes in 2021 [1]. This is on par with the United States, and more than double that of the European Union [2]. With the building and construction sector accounting for 39 per cent of global emissions, [3] the built environment has a significant role to play in reaching net zero targets in Australia and globally.

2.1 THE EMBODIED CARBON CHALLENGE

Efforts to decarbonise the built environment have traditionally focused on operating emissions. As improvements to operational energy become common industry practice and net zero commitments become more mainstream, the market's attention is turning to the embodied carbon of materials used to build. According to the Green Building Council of Australia (GBCA), in 2019 operating emissions contributed 84 per cent of Australia's built environment emissions, with the remaining 16 per cent contributed through embodied carbon. Without intervention, and as the electricity grid continues to decarbonise, by 2050, this is expected to shift, with embodied carbon projected to contribute 85 per cent of Australia's built environment emissions [4].

The embodied carbon emissions of the materials used in Australia is 30–50 million tonnes of CO_2 emissions per year, which is approximately five to 10 per cent of national greenhouse gas emissions [5]. The economic value of the construction materials sector is approximately AUD 65 billion, contributing roughly three per cent of Australia's GDP [6]. The CEFC industry report *'Australian buildings and infrastructure: Opportunities for cutting embodied carbon'* (herein referred to as the '*Embodied Carbon Report'*) found that, depending on the initiatives and low carbon products utilised, it is possible to achieve embodied carbon savings of between three and 18 per cent whilst reducing materials costs by between 0.3 and three per cent [7].

2.2 THE ROLE OF MASS TIMBER

Conventional building materials such as concrete and steel are traditionally made by highly carbon intensive processes. Comparatively, the carbon emitted during the processes of making mass timber is much lower [8]

[1] Christina Wijeratne, Clean Energy Finance Corporation, Australia, christina.wijeratne@cefc.com.au
[2] Paolo Lavisci, FWPA, Australia, paolo.lavisci@woodsolutions.com.au

Furthermore, with sustainable timber production and improved building dis-assembly practices, mass timber has the ability to maintain substantial amounts of sequestered carbon [9]. The *Embodied Carbon Report* found that the embodied carbon emissions of a mass timber building can be up to approximately 75 per cent less compared to a conventional concrete and/or steel counterpart on a per square meter basis [10].

2.3 THE MASS TIMBER INDUSTRY

The use of mass timber construction materials in Australia lags that of more mature markets such as North America and Europe. Whilst Australian forests and plantations sequester, and wood products store, approximately 57 million tonnes of CO_2, equal to approximately 10 per cent of the total greenhouse gases emitted in Australia [11], Australia has a limited domestic supply chain, with only a handful of onshore mass timber manufacturers.

Australia's commercial building sector is highly competitive and has adopted efficiencies such as the use of precast concrete and steel. However, the market has not widely adopted the use of mass timber, with one important impediment being structural and fire engineering standards which, until the NCC 2016 revision, did not allow the use of mass timber in structures above three storeys within a 'Deemed-to-Satisfy' provision. This necessitated a 'performance solutions' approach requiring additional design time, costs, and greater approval risk.

The residential building sector is highly fragmented, largely comprised of many smaller scale builders. Australian residential buildings up to three storeys in height are typically built with reference to the largely prescriptive AS1684 standard, rather than seeking greater performance outcomes through the performance-based AS1720 (noting this provisions for GLT and LVL, but not for CLT) or through the reference to other standards such as the Eurocode 5. Thus, the residential building sector typically lags the commercial building sector in sustainability outcomes and progress.

The use of mass timber in medium-to-large scale construction is further limited due to the cost savings of reduced labour and build times often not being factored into project feasibility analyses, thus not considered to offset the often higher upfront costs of mass timber (on a 'bill of quantities' basis) compared with traditional construction materials in Australia. Further, limited builder experience constructing with mass timber, and resistance from lenders and insurers to support off-site prefabrication, pose additional hurdles to broader uptake.

While constructing with mass timber offers many benefits compared with traditional construction approaches, including the ability to achieve embodied carbon savings, increased productivity through shorter construction times, lower physical impacts to site surrounds from the construction process, and improved site safety, the adoption and growth in use of mass timber construction approaches seen in North America and Europe have not yet been achieved in Australia.

2.4 ENABLERS OF CHANGE

Driving change in the Australian mass timber market requires a broad and collaborative cross-sectorial approach. There are several initiatives currently underway which seek to address the barriers to the uptake of mass timber in Australia, including:

- Regulation: building standards have a significant impact on material selection and construction techniques. The National Construction Code (NCC) has been progressively updated in 2016 and 2019 to include positive changes in support of the use of mass timber in mid-rise construction (up to 25 meters in height) [12]
- Disclosure: the measurement of embodied carbon and collection of such data unlocks the ability to benchmark and drive higher standards. Rating tools play an important role in providing consistency and fostering positive behavioural changes in the market. The GBCA has launched a *Responsible Products Framework* which sets embodied carbon targets for buildings seeking high ratings [13], and the National Australian Built Environment Rating System (NABERS) is creating a framework for measuring, benchmarking, and certifying emissions from construction and building materials [14]. Some Australian states are using policy levers to introduce embodied emissions measurement and reporting requirements across residential and commercial developments [15].
- Industry partnership: industry collaboration between relevant stakeholders can enable a consistent understanding of economy-wide hurdles and provide a feedback loop to policy and regulation. The Materials and Embodied Carbon Leaders' Alliance (MECLA) is a collaborative thinktank which has attracted over 100 industry partners with a collective decarbonisation vision, including the CEFC [16].
- Education: technical knowledge building is required to increase building professionals' comfort and confidence in using novel construction materials and techniques. Forest & Wood Products Australia Limited (FWPA) is a not-for-profit company that, through its WoodSolutions program, provides integrated services to the Australian forest and wood products industry, the construction industry, and the broader community.
- Supportive capital: capital is necessary to influence progress across the economy. Supporting projects demonstrating the benefits of mass timber construction can support the development of the domestic market in a myriad of ways. The CEFC is providing financing in support of the use of mass timber through its targeted Timber Building Program.

2.5 FOREST AND WOOD PRODUCTS AUSTRALIA

FWPA has the mission of investing in effective and relevant research and development designed to grow the

market for forest and wood products, increase productivity and profitability across the value chain and ensure positive environmental and social outcomes. An example of FWPA's work in this area is its investment in fire testing and collection of engineering evidence to support the evolution of the NCC. The NCC 2016 revision introduced Deemed-to-Satisfy provisions for using timber structures in buildings up to 25 meters effective height.

In 2010, FWPA launched WoodSolutions, an industry initiative designed to provide independent, non-proprietary information about timber and wood products to professionals and companies involved in project development, design and construction in the built environment.

In 2011, the Grattan Institute, an independent Australia public policy organisation, quantified the growing gap between housing supply and demand and suggested that multi-residential timber framed construction was an innovative technique that would contribute favourably to the supply of housing [17]. In response to the new and growing demand for support in relation to multi-storey timber framed construction, WoodSolutions launched the Midrise Advisory Program (MAP), involving 22 industry and institutional partners.

MAP helped to build the mass timber knowledge base of developers, builders, architects, engineers, building surveyors, and quantity surveyors, supporting building professionals and decision makers in their designs, procurement, and construction activities. MAP demonstrated the benefits of wood-based construction using multiple free-access tools such as case studies, seminars, project-specific meetings and feasibility analyses, site visits, a demonstration building, a help desk, engineering software and design guides. An example of this is the *Cost Engineering of Mid-rise Timber Buildings* technical design guide which uses data from several mid-rise timber projects in Australia and overseas to quantify the cost savings associated with the use of timber structures, and provides guidance on how to appropriately capture their value proposition in activities related to the design, procurement and installation of mid-rise wood structures in Australia [18].

The primary target of the MAP was to support the use of timber in 'significant' projects. This was accomplished by supporting key decision-makers in developing their understanding of mass timber products and their complementarity within an optimised design. The 30 projects which were completed, started, or fully confirmed within the MAP's activity term (2016-2022) used approximately 53,000 cubic meters of structural wood products, as well as additional ancillary products and services. This represents approximately three per cent of the projects considered to have the potential of being developed using timber. Most of the projects supported by the MAP featured a significant design quality combining aesthetics, performance, cost efficiency, and quick delivery, reflecting the benefits of timber and enabling the successful introduction of the materials to major players in the market.

WoodSolutions has become well known and trusted as a provider of reliable educational tools for timber design and construction, supporting the development of new professional and technical competencies, with the organisation's website being one of the world's most visited in the field of timber information and education (with 1.9 million overall visits in 2022, as measured by Google Analytics). WoodSolutions' Technical Design Guides and Environmental Product Declarations, which are all free for public download from their website are frequently used as the de-facto industry standard, being referenced in design specifications and tender documents. As the number of contacts and projects grows, awareness of the benefits of timber is increasing in Australia. Many professional associations involved in construction (including developers, builders, architects, engineers, building surveyors, and quantity surveyors) have collaborated with WoodSolutions to develop their associates' awareness of the value proposition of timber structures in the market.

3 CEFC TIMBER BUILDING PROGRAM

An AUD 300 million Timber Building Program was established by the CEFC and launched in 2022 as part of its broader strategic focus on reducing embodied carbon as an essential component of a low emissions economy. The Timber Building Program is a novel approach to addressing the issue of upfront embodied carbon in the commercial construction context, using tailored finance solutions to support the increased adoption of mass timber in construction.

3.1 CLEAN ENERGY FINANCE CORPORATION

The CEFC is a specialist investor at the centre of efforts to help deliver on Australia's ambitions for a thriving, low emissions future. With a strong investment track record, it is committed to accelerating Australia's transition to net zero emissions by 2050. In addressing some of Australia's toughest emissions challenges, the CEFC invests to fill market gaps, collaborating with investors, innovators and industry leaders to spur substantial new investment where it will have the greatest impact.

CEFC lifetime investment commitments to 31 December 2022 were AUD 11.7 billion. Together with institutional investors, business, industry and cleantech innovators, the CEFC catalysed AUD 42.8 billion in investment in Australia's low emissions economy, with each dollar of CEFC capital leveraging an additional $2.62 from the private sector. In investing on behalf of the Australian Government, the CEFC has a strong commitment to deliver a positive return for taxpayers across its portfolio. The CEFC has a flexible approach to investment, which recognises the needs of an evolving market. CEFC financial products and structures, including debt and equity, are shaped to help drive private sector investment across a diverse range of activities.

In recognising the urgent nature of the emissions challenge, the CEFC has focused investment origination

activities, prioritising emissions challenges across the wider Australian economy. These include backing the clean energy system of the future, where Australia requires significant new investment to support a substantial uplift in renewable energy generation, storage and grid transmission project. The CEFC also invests in in low emissions solutions in property, infrastructure, industry, natural capital and resources, which can deliver benefits across the economy, from lower energy consumption to alternative approaches to production, reducing demand on the energy network and abating carbon emissions. In tapping into new investment models and opportunities the CEFC develops new financial markets and products, builds investor confidence and crafts tailored and innovative investment solutions for new and emerging industries.

3.2 THE ROLE OF CEFC FINANCE

Capital is a powerful tool able to influence technology, innovation, and growth across the economy. Finance can impact all aspects of the transition to net zero emissions, including through supporting utility-scale renewable energy, major infrastructure and real estate projects, innovative climate technologies, and broader debt capital market approaches.

By operating across all sectors of the economy, the CEFC mobilises capital to support both the supply of, and demand for, renewable energy, energy efficiency, and low emissions technologies. A strong governance approach helps ensure intended commercial and emissions outcomes are achieved across the portfolio. As well as direct carbon abatement impacts, investments have demonstration value, showcasing commercially viable solutions with key learnings leveraged and shared to influence and educate the broader market.

The CEFC is an active investor across the property sector. This extends from commercial office, retail and industrial segments through to alternative and emerging asset classes, including student housing, retirement living and residential markets. The CEFC also invests across the capital stack, using debt and equity instruments. CEFC cornerstone investments in new property funds continue to demonstrate the positive link between financial returns and Environmental, Social, and Governance outcomes. In order to optimise emissions performance and achieve long-term sustainability targets, the CEFC operates as a 'patient' investor, recognising there are opportunities to reduce emissions across the investment lifecycle, from the development approval process to design, procurement and construction, then finally into operations, as well as the need to address the emission of existing building stock and support circular economy principles. At 31 December 2022, the CEFC have made lifetime investment commitments of AUD 2.1 billion across the property sector.

In Australia, building with mass timber generally proves more expensive than conventional concrete and steel approaches, especially as the cost savings of reduced labour requirements and build times are often not factored into project feasibility analyses. An additional barrier relates to lack of awareness, with many contractors and developers not familiar with mass timber, and a perception of increased risk in relation to durability, fire resistance, and building code compliance. These factors present challenges to developers committing to the use of mass timber and being able to source investment and finance for mass timber projects.

The CEFC Timber Building Program has been designed to support an increase in mass timber projects in Australia, to provide direct exposure and capacity building for construction professionals involved in individual projects, as well as influencing the broader market through providing demonstration value and concerted knowledge sharing. As more projects utilise mass timber in construction, more data will be generated to combat myths around durability, fire resistance, and costs. Such data can also help guide policy, building standards, and rating tools to recognise the full benefits of mass timber, including its role in addressing the embodied carbon challenge. Supporting demand for mass timber products may also aid in the development of local supply chains. The Timber Building Program aims to drive demand to support these integral market enabling approaches.

3.3 CEFC PROGRAM PARAMETERS

The CEFC Timber Building Program is a tailored debt program designed to attract projects that are incorporating the material use of mass timber to achieve significant embodied carbon outcomes. Finance is bespoke and tailored to best suit each individual transaction and borrower. Funding can be project-specific senior secured property finance, or portfolio-level corporate debt secured by a pool of assets. The CEFC can offer fixed or floating interest rates, and can lend as sole financier, or alongside co-financiers in syndicated or club structures. Investments are made at commercial returns and financing packages are structured to optimise sustainability outcomes on a risk-adjusted basis. Governance is guided by the *Clean Energy Finance Corporation Act 2012* (the CEFC Act) and CEFC policies and guidelines.

Opportunities are evaluated on a case-by-case basis and with consideration of the overall commercial and carbon outcomes and initiatives. The program is sector agnostic, open to developments including commercial offices, retail, industrial, healthcare, education, multi-residential apartments, retirement living, aged care, hotel, and student accommodation, as mass timber can have a role to play across all asset types. The Timber Building Program is seeking to support scalable projects that drive strong demonstration value, and where possible, draw in third-party capital to optimise the program reach. The Timber Building Program has an Australian focus as per the objectives of the CEFC Act.

All projects must use low carbon mass timber products during the construction phase to achieve material embodied carbon outcomes and use appropriately sourced and accredited timber materials.

3.4 CEFC PROGRAM IMPACT

The CEFC Timber Building Program is anticipated to be a multi-year scheme, acknowledging that through-cycle investment certainty is necessary to drive the momentum required to achieve broader adoption of mass timber construction approaches in the Australian market. This also reflects the CEFC early engagement model required to ensure sponsor and project alignment with required carbon and impact outcomes; the necessary project and financial due diligence, approval, and documentation processes; and ultimately the financing and project construction timelines.

The CEFC February, 2022 launch of the Timber Building Program was positively received by the market, attracting a significant level of responses from property companies and developers, positive support from industry groups and the Australian government, and considerable attention from the respected and specialist media outlets.

3.5 FIRST PROGRAM INVESTMENT

The CEFC successfully executed on its first finance package under the Timber Building Program in September 2022, with its involvement in T3 Collingwood. T3 Collingwood is the first Australian addition to the Hines 'T3' global portfolio, a Timber, Transit, and Technology-oriented development methodology which is centred upon sustainable design, efficiency, and profitability, supporting the delivery of credible decarbonisation pathways. T3 Collingwood, a 15-storey prime-grade office tower in the inner-city Melbourne suburb of Collingwood, aims to deliver a dual emissions reduction impact – cutting embodied carbon levels by as much as 40 per cent during the construction phase and, once operational, targeting market-leading net zero emissions.

The hybrid construction approach used to build what will be one of Melbourne's tallest hybrid timber buildings will feature a glue laminated timber (GLT) post and beam structure with cross-laminated timber (CLT) flooring starting from the sixth level, on top of five reinforced concrete podium levels. Timber will be sustainably sourced from two specialist local mass timber manufacturers, with Xlam Australia supplying the CLT and Australian Sustainable Hardwoods supplying the GLT. T3 Collingwood will use approximately 4,000 cubic metres of mass timber components for the structural frame, storing approximately 3,000 tonnes of CO_2.

Hines Australia Managing Director Simon Nasa noted:

> 'Mass-timber construction is an important step in driving a sustainable future for the built environment we live and work in. Not only is timber a completely renewable resource, but timber offices are also biophilic in creating a more natural working environment for tenants and their staff. This results in increased productivity and better mental health outcomes, helping to create the people-friendly live-work-play communities that Hines is known for' [19].

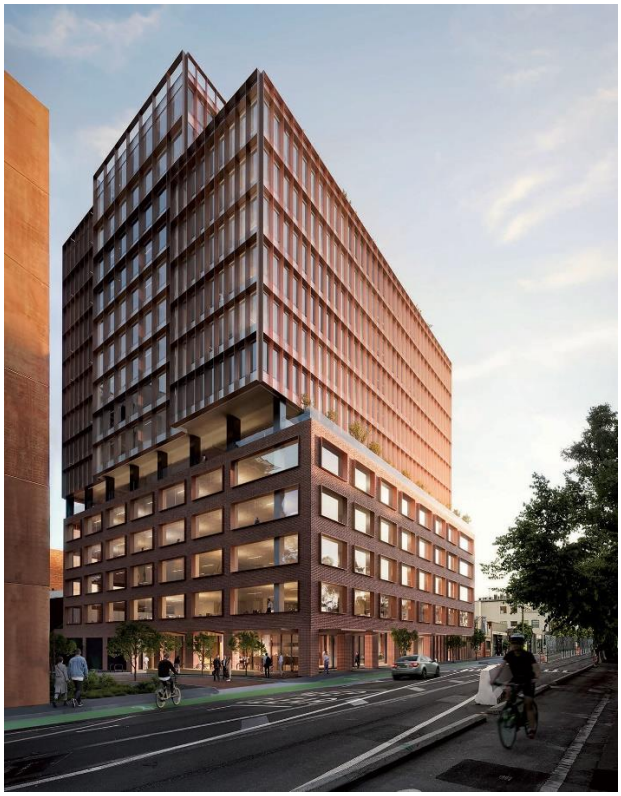

Figure 1: *External façade architectural rendering of T3 Collingwood*

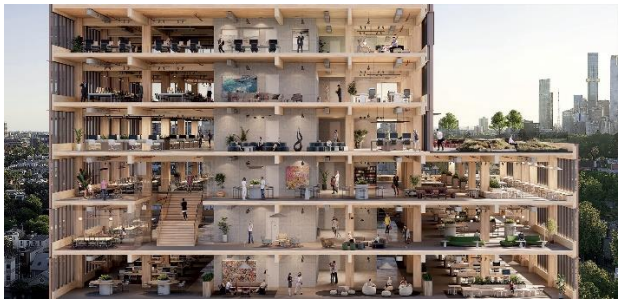

Figure 2: *Cross section architectural rendering of T3 Collingwood*

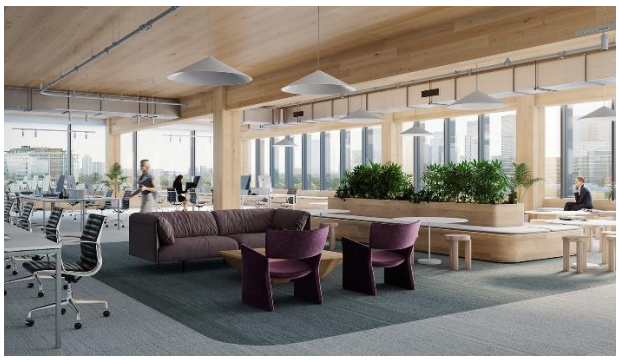

Figure 3: *Internal architectural rendering of T3 Collingwood*

T3 Collingwood was supported from its early concept stage by the WoodSolutions MAP through an established collaboration with the architects, engineers, program manager, and builder.

As one of the world's largest privately held real estate investors and managers [20], and with a global T3 portfolio, the Hines development of T3 Collingwood signals the readiness and investable nature of Australia's mass timber construction market.

T3 Collingwood aims to achieve significant carbon abatement outcomes, as well as create demand for Australian domestic mass timber, and encourage owners, developers, architects, engineers, and builders to use mass timber where appropriate as an alternative to conventional construction materials such as concrete and steel.

Learnings in relation to fire resistance and code compliance are expected to help inform regulatory approaches; embodied carbon measurement and outcomes can contribute to rating tool developments; and the project will help demonstrate the investable nature of mass timber buildings to the broader finance market, driving the adoption of larger-scale capital programs.

Through the Timber Building Program, the CEFC is encouraged to see interest from parties across the spectrum, from significant developers such as Hines, through to mid-market and private market participants, signifying the scale of the investable mass timber market, and the opportunity to educate and influence building professionals across the economy. The Timber Building Program aims to support more projects achieving strong emissions savings and broader positive market impacts.

4 CONCLUSIONS

The CEFC plays a unqiue role in supporting Australia's economy-wide decarbonisation ambitions. Embodied carbon is becoming an increasingly important challenge in the decarbonisation of the built environment, and as a low carbon alternative to traditional construction materials, where applicable, mass timber has a key role to play in addressing the challenge. The adoption of mass timber construction approaches in Australia faces multiple impediments, including from a lack of awareness across construction, development, investment, and finance industries, leading to perceptions of increased risk and cost. The CEFC has found that in the Australian context, working with early adopters can create significant behavioural change and shift key market drivers. The CEFC Timber Building Program looks to achieve direct carbon savings from investee projects, drive demand and increase the use of mass timber in Australia to provide direct exposure and capacity building for construction professionals, and to influence the broader market through demonstration value. Learnings from an increased number of projects can help to combat myths; guide policy, building standards, and rating tools; and aid in the development of local supply chains, highlighting the unique and broad impact of purpose-driven financing in accelerating emissions reduction.

REFERENCES

[1] Ritchie H., Roser M., Rosado P.: CO_2 and Greenhouse Gas Emissions. Our World in Data, 2020.

[2] Ritchie H., Roser M., Rosado P.: CO_2 and Greenhouse Gas Emissions. Our World in Data, 2020.

[3] IEA: Global Status Report for Buildings and Construction 2019. IEA, Paris, 2019.

[4] GBCA, thinkstep-anz: Embodied Carbon and Embodied Energy in Australia's Buildings. Green Building Council Australia and thinkstep-anz, 2021.

[5] Clean Energy Finance Corporation: Australian buildings and infrastructure: Opportunities for cutting embodied carbon. Clean Energy Finance Corporation, 2021.

[6] Clean Energy Finance Corporation: Australian buildings and infrastructure: Opportunities for cutting embodied carbon. Clean Energy Finance Corporation, 2021.

[7] Clean Energy Finance Corporation: Australian buildings and infrastructure: Opportunities for cutting embodied carbon. Clean Energy Finance Corporation, 2021.

[8] Hough, R.: Rethinking Timber Buildings Seven Perspectives on the Use of Timber in Building Design and Construction. ARUP, London, 2019.

[9] Clean Energy Finance Corporation: Australian buildings and infrastructure: Opportunities for cutting embodied carbon. Clean Energy Finance Corporation, 2021.

[10] Clean Energy Finance Corporation: Australian buildings and infrastructure: Opportunities for cutting embodied carbon. Clean Energy Finance Corporation, 2021.

[11] Department of Industry, Science, Energy and Resources: National Greenhouse Gas Inventory Quarterly Update: March 2021. Department of Industry, Science, Energy and Resources, 2021.

[12] England, P., Bennetts, I.: Fire Safety Design of Mid-rise Timber Buildings. WoodSolutions, Melbourne 2016.

[13] Chapa, J., Cornell, T., Barbov, N., Bezzina, E., Wouters, T.: Driving responsible products in the built environment – Changes to Green Star Buildings and our strategy for the future. Green Building Council of Australia, 2021.

[14] Vickers, J., Sullivan, N., Davies, A., Kogileru, T., Wouters, T.: Embodied Emissions Technical Report. NABERS, 2022.

[15] NSW Department of Planning and Environment: Sustainable Buildings SEPP Overview. NSW Department of Planning and Environment, 2022.

[16] Materials and Embodied Carbon Leaders Alliance: MECLA Partners, https://mecla.org.au/partners, accessed Feb. 2023.

[17] Kelly, J-F., Breadon, P., Reichl, J. Getting the housing we want. Grattan Institute, Melbourne, 2011.

[18] Ritche, L., Lavisci, P., Carter, N., Kennedy, T.: Cost Engineering of Mid-rise Timber Buildings. WoodSolutions, Melbourne, 2019.
[19] Clean Energy Finance Corporation: Landmark T3 Collingwood kickstarts CEFC Timber Building Program. https://www.cefc.com.au/media/media-release/landmark-t3-collingwood-kickstarts-cefc-timber-building-program/, accessed Feb. 2023.
[20] Hines: About Hines, https://www.hines.com, accessed Feb. 2023.