STEPS TOWARDS A

GREENER FUTURE

Progress Towards Net-Zero
Opportunities to tackle climate change and reduce future greenhouse gas emissions in the built environment using low carbon emission building materials and construction practices.

GIPPSLAND FORESTRY HUB
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Department of Agriculture, Fisheries and Forestry

The Australian National Housing Accord is the biggest housing initiative of our generation it could also have the biggest environmental benefit as well – with the right policy directions.

It's not just about 'More Housing – including social housing – it's about doing this and getting a better environmental outcome!'

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July 2024

wood products victoria

Executive Summary

Australia has committed to reducing greenhouse gas emissions by 43% below 2005 levels by 2030 under the 2015 Paris Agreement, and the Australian Federal Government is developing the *Net Zero 2050 Plan* [1] which will establish the pathways for transition to a net zero economy including in the built environment.

The Australian Federal Government has also proposed a major residential building program under the 2022 National Housing Accord, setting an aspirational target to deliver 1.2 million new, well-located homes over the next 5 years.

Australian state governments are also committed to these targets and are implementing respective policies, plans, and programs with this aim.

It is recognised that 'more building', means 'more emissions', but it is also acknowledged that reducing carbon emissions in the built environment will be fundamental in Australia reaching its net zero target.

The critical emission sources in the building and construction sector are the burning of fossil fuels for energy, and use of carbon-intensive materials and processes. Carbon emissions released before the building is occupied (upfront carbon) are expected, without intervention, to go from 16% to 85% of the built environment's total carbon footprint by 2050 [2].

Forests and wood products are a natural and renewable resource which can help to address this building carbon footprint issue, as timber products;

- are a low carbon emission building material,
- uniquely lock away and store carbon for the life of the product, and
- can deliver high onsite productivity and low emission offsite prefabrication construction system efficiencies.

This has been recognised internationally at COP28 (6 Dec 2024) where a coalition of 17 countries, including Australia, endorsed the I*nitiative for Greening Construction with Sustainable Wood* [3].

This report provides considerations and recommendations focussed on tackling climate change and reducing future greenhouse gas (GHG) emissions in the built environment, using low carbon emission building materials and construction practices, across four themes for action – government policy, voluntary initiatives, wood products industry, and education of wood's value.

Summary of Recommendations

Government Policy

R1.1 Adopt a national/state framework for measuring embodied carbon and create a national embodied carbon database for building products & materials.

R1.2 Support the introduction of embodied carbon targets into the National Construction Code (NCC) and set state embodied carbon targets.

R1.3 Implement mandatory life cycle carbon calculation and reporting.

R1.4 Introduce embodied carbon reduction requirements for government buildings & projects.

R1.5 Recognise and incentivise the uptake of low embodied carbon materials and construction practices.

R1.6 Foster the growth and availability of cost-effective low emissions Australian building materials.

Voluntary Initiatives

R2.1 Incentivise and support the use of voluntary rating mechanisms such as NABERS Embodied Carbon and Green Star rating tools.

R2.2 Inform and support Environmentally Sustainable Development (ESD) planning policies and material recommendations.

R2.3 Incentivise the recognition metric for low carbon emissions AND stored carbon.

R2.4 Provide incentives to achieve low carbon thresholds.

R2.5 Support manufacturing sectors to transition and to develop EPDs.

R2.6 Pursue incentives to encourage new plantation establishment.

Wood Products Industry

R3.1 Reduce/eliminate the use of fossil carbon through the life cycle.

R3.2 Certification of all plantations and production forests.

R3.3 Develop more prefabricated timber solutions.

R3.4 Continue to develop and update Environmental Product Declarations (EPDs) for Wood Products.

R3.5 Utilise captured and reused timber ‘waste’ from both construction and demolition.

R3.6 Work collectively locally and globally to advance bio-based building solutions.

Education of Wood’s Value

R4.1 Responsible sourcing – what it is, why it is critical to net zero.

R4.2 Stored biogenic carbon – what it is, why it is valuable, how to get the data.

R4.3 Best uses of timber to reduce embodied carbon (including lightweighting and enabling adaptive reuse).

R4.4 Carbon literacy for the whole value chain.

R4.5 How to maintain the value of timber (and the carbon stored in it) throughout its whole lifespan.

Context

The Australian federal and state governments have set aspirational targets around 2 important policy areas:

- Climate Change and Emissions Reduction - *Net-Zero by 2050*, and
- National Housing Delivery – 1.2 million new, well-located homes over 5 years from 2024 – *National Housing Accord 2022*.

These 2 aspirations are intrinsically linked - increased construction will inevitably mean greater emissions, unless we build differently with agreed and focussed net zero goals.

A focus on embodied carbon impacts and the increased use of low carbon emission building materials and construction practices provides a paradigm shift on traditional practices, and a positive solution in delivering significant carbon reduction climate change benefits at the local, state, national and global levels.

To achieve this requires an understanding of

- the number of buildings to be constructed,
- what materials might, or could be used, in their construction,
- the embodied carbon emissions associated with the materials, over the lifecycle of the building, and
- the most efficient, high productivity, and low emission, prefabrication and construction systems and methods available.

It also requires government policies, targets and procurement measures that include a focus on:

- embodied carbon emission reduction and acknowledging and encouraging the benefits of using low carbon emission building materials and construction practices, and
- delivering quality, high performing buildings across the residential and commercial sectors, and particularly in new social housing projects.

The dwellings we all live in, are often overlooked in the drive for sustainability improvements, and this report offers a pathway to help the residential construction sector to adopt more climate-responsible, embodied carbon emission reducing building practices. The positive benefits of timber construction materials and systems are also presented.

1.2 Million New Homes in 5 Years – Australia's National Housing Accord Aspirations

The Australian Federal Government's aspirational national target, under the *National Housing Accord 2022* [4] (as amended 2023) of delivering a total of 1.2 million new, well-located homes over 5 years – July 2024 to June 2029 has been recognised for its 'positive ambitiousness'; and state government departments, and the building construction supply chain sector, are all actively investigating and considering if, and how, this target might be realistically delivered throughout Australia.

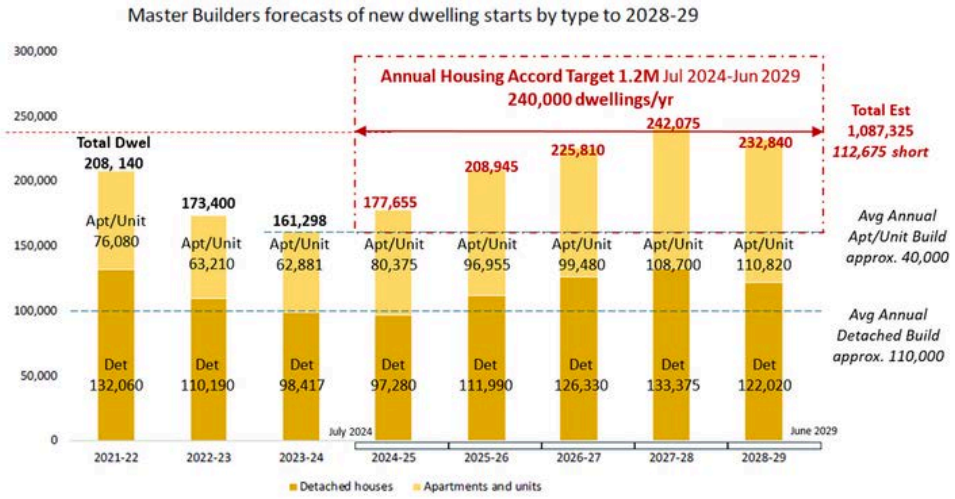
1.2 million new homes over 5 years means a need for 240,000 new dwellings built annually – which effectively is an additional 80,000 dwellings a year nationally.

Master Builders Australia projected forecasts (at April 2024 [5]) of likely dwelling starts out to 2029 clearly reveal that there will be a need for a mix of new detached dwellings and apartment units.

How these new dwellings are constructed, and the materials used, will be extremely important in regards to their climate change impact.

Wood products can be used as the primary structural / construction material in many of these new dwellings to enable a reduction in GHG emission impacts:

- lightweight framing for detached dwellings and low rise buildings
- mass timber solutions for mid-rise apartment buildings.



Engineered Wood Construction

Wood is the most ancient and yet modern of materials

Today 'engineered wood' is the focus for building and construction applications – all manufactured and graded to standard: sawn softwood – machine graded pine (MGP), laminated veneer lumber (LVL), glued laminated timber (GLT), cross laminated timber (CLT), oriented strand board (OSB), timber I-beams, roof and floor trusses, frames, plywood and particleboard [6].

Engineered wood products are used extensively in building Australian homes using various forms of construction methods, including onsite stick-built frames, prefabricated wall frames and roof trusses, elemental offsite prefabrication, and fully completed modular or volumetric systems.

Wood is also currently a very popular solution in non-residential construction – multi-residential (both low-rise and mid-rise), hotels, offices, schools, aged care, hospitals in particular; recognised for its wide availability, material workability, lightweight nature, carbon storage, speed of construction, as well as its biophilic and wellness benefits [7].

In these projects innovative timber solutions abound, particularly in the area of system prefabrication and offsite construction that provide significant onsite low emission construction solutions.

Embodied Carbon and Low Carbon Building Materials

Embodied carbon refers to GHG emissions associated with the materials and construction processes throughout the whole life cycle of an asset (i.e. material extraction, transport, manufacture, construction, use (and replacement), demolition and end-of-life).

Upfront carbon refers to the emissions associated with a building material's life cycle analysis (LCA) stages of production (A1-A3), Transport to site (A4) and construction (A5) - before a building is used as defined by the International standard ISO14025 and EN 15978. These are key sources of embodied carbon and are 'frontloaded', unlike annual operating emissions (B6) or end-of-life emissions (C1-C4), which occur later and/or gradually over time.

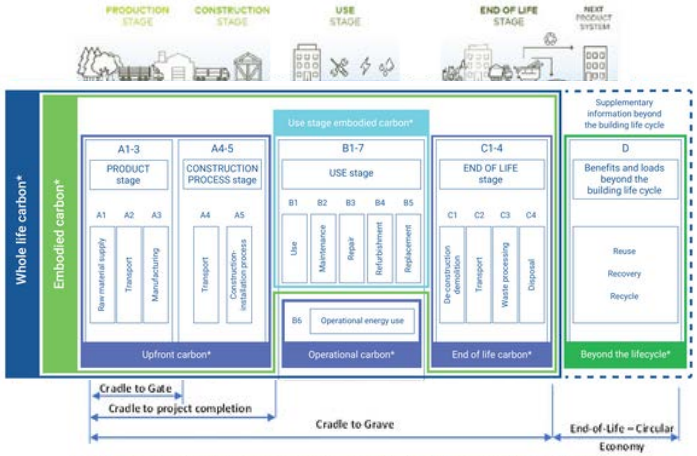


Figure 1: Terminology used in this report cross-referenced to terms and lifecycle stages defined in EN 15978

A key tenet of all built environment related embodied carbon policies and voluntary initiatives is the concept of increasing the use of low embodied carbon emission building materials and low emission construction practices.

Wood products have a very low carbon emission profile - 1m3 of kiln-dried dressed softwood has a cradle to gate fossil fuel emissions value (GWP fossil[i]) of 157kgCO2-e/m3 (LCA Stages A1-A3).

For a functionally equivalent 90x45mm kiln-dried softwood stud the GWPfossil= 0.64 kgCO2-e/m, five times less than a 90x40mm 0.75mm BMT steel[1] framed stud at 18.3 kgCO2-e/m2 or 3.11 kgCO2-e/m

Data source EPD Australasia: FWPA Softwood Timber and BlueScope – TRUECORE® Steel

[i] *For EN15804 carbon sequestered in product is reported as a negative value in module A1-A3. Carbon in product assumed to be emitted at end-of-life and reported in module C. Essentially biogenic sequestration = emissions [at end-of-life]. Carbon reporting requires that biogenic sequestration/ emissions are reported separately from fossil emissions*

Bio-based Products – Natural Carbon Stores

Bio-based products such as wood are also 'naturally' unique because wood products store carbon for the life of the product. **Carbon in wood is good.**

Stored or sequestered carbon is chemically bound in bio-based materials like trees. Trees absorb CO2 from the atmosphere and lock it away for life. It is a natural form of carbon capture use storage (CCUS [9]) - utilisation and storage as old as the planet.

Trees are very effective at capturing CO2 - its carbon content makes up approx. 50% of the dry weight of wood. According to the EPD[8] 1m3 of kiln-dried dressed softwood effectively has a cradle to gate net GWP emissions value of -718kgCO2-eq (allowing for a net biogenic sequestration of -875 kg CO2-eq GWP-biogenic, and 157kgCO2-eq GWP fossil emissions [i]).

While this (biogenic) carbon storage is temporary, the carbon in timber can be preserved for decades, centuries, even millennia – The Temple of the Flourishing Law Pagoda (Hōryū-ji) in Nara Japan, is 5 storeys tall, 32.45 meters, and analysis reveals the timbers used were felled in the year 594 (1,430 years ago). Note; some rating tools and standards currently do not recognise or allow the stored carbon in timber to be considered.

Timber products at the end of their first life can also be repurposed by direct reuse or recycle and remanufacture.

Even if timber ends up in a landfill, if there is no oxygen to cause full decomposition, Australian research [10] has shown that only a small proportion will be lost, the majority of the carbon will remain stored in perpetuity.

This creates a virtuous cycle when forests are sustainably managed and certified of - planting, growth, harvesting, replanting, and extracted wood use – then repeat. **A natural CCUS option for the built environment to help store carbon 'today' as we seek more complete decarbonisation solutions for the future.**

Forests are a major component of the global carbon cycle due to the ongoing absorption of carbon dioxide (CO2) during forest growth.

Using the solar energy of the sun, through the process of photosynthesis, trees break down atmospheric CO2, releasing the Oxygen (O2) that we breathe and storing the Carbon (C) in the woody mass of the tree, leaves or needles, roots, and surrounding soil. Wood products continue to store this carbon for the life of the product (or further lives if recycled) until the sequestered carbon is finally released back into the atmosphere by fire or decay.

The importance of wood products, from sustainably managed forests, as a natural, renewable and carbon sequestering, climate change positive material is well recognised and accepted globally.

ZERO-CARBON-READY BUILDINGS

Zero-carbon-ready buildings are buildings that can operate in a low emissions economy.

The International Energy Agency defines them as:

"A ZERO-CARBON-READY BUILDING IS HIGHLY ENERGY-EFFICIENT AND EITHER USES RENEWABLE ENERGY DIRECTLY, OR USES AN ENERGY SUPPLY (E.G. ELECTRICITY OR DISTRICT HEATING) THAT WILL BE FULLY DECARBONISED BY 2050."

Together with a decarbonised grid, zero-carbon-ready buildings deliver the end goal of a decarbonised built environment and feature a number of characteristics:

- High efficiency, high performance
- Fossil fuel free and fully electric
- Powered by renewable electricity
- Grid responsive
- Offset with nature
- Low embodied carbon

REDUCE

Built with lower upfront emissions

Built using materials with significantly lower embodied carbon. Emissions are reduced during construction.

Highly efficient

All buildings and infrastructure are energy efficient. Reduces stresses in the grid.

Walkable and livable

Transport emissions are reduced by good urban design, promotion of active transport, and low carbon options.

Grid responsive

Buildings that interact with the grid, including demand response and allowance for electric vehicles.

ELIMINATE

Fossil fuel-free

Buildings do not use fossil fuels for heating, hot water, cooking and onsite energy generation.

Powered by renewables

All energy used in buildings comes from 100% onsite or offsite renewable sources.

COMPENSATE

Offset with nature

The balance of emissions are compensated or neutralised through investments in high-integrity, nature-based carbon offsets.

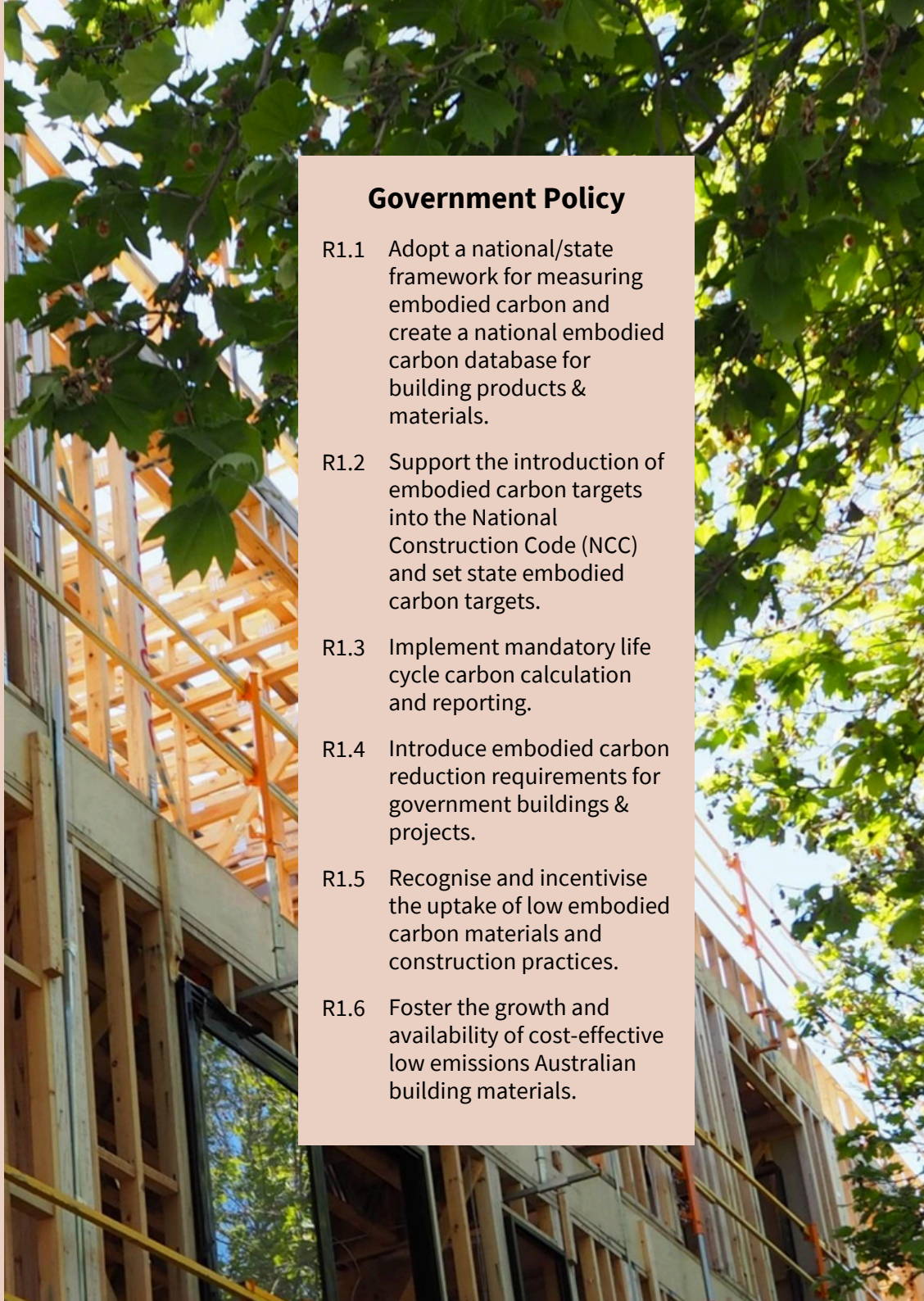
Source: Every Building Counts – 2023 Edition, GBCA

Built with lower upfront emissions

Built using materials with significantly lower embodied carbon. Emissions are reduced during construction.

Recommendations – Theme 1 Government Policy

Recognising the benefits of low embodied carbon emission wood products, provides an easy solution in assisting with the troubling problem of reducing climate change impacts.



Government Policy

R1.1	Adopt a national/state framework for measuring embodied carbon and create a national embodied carbon database for building products & materials.
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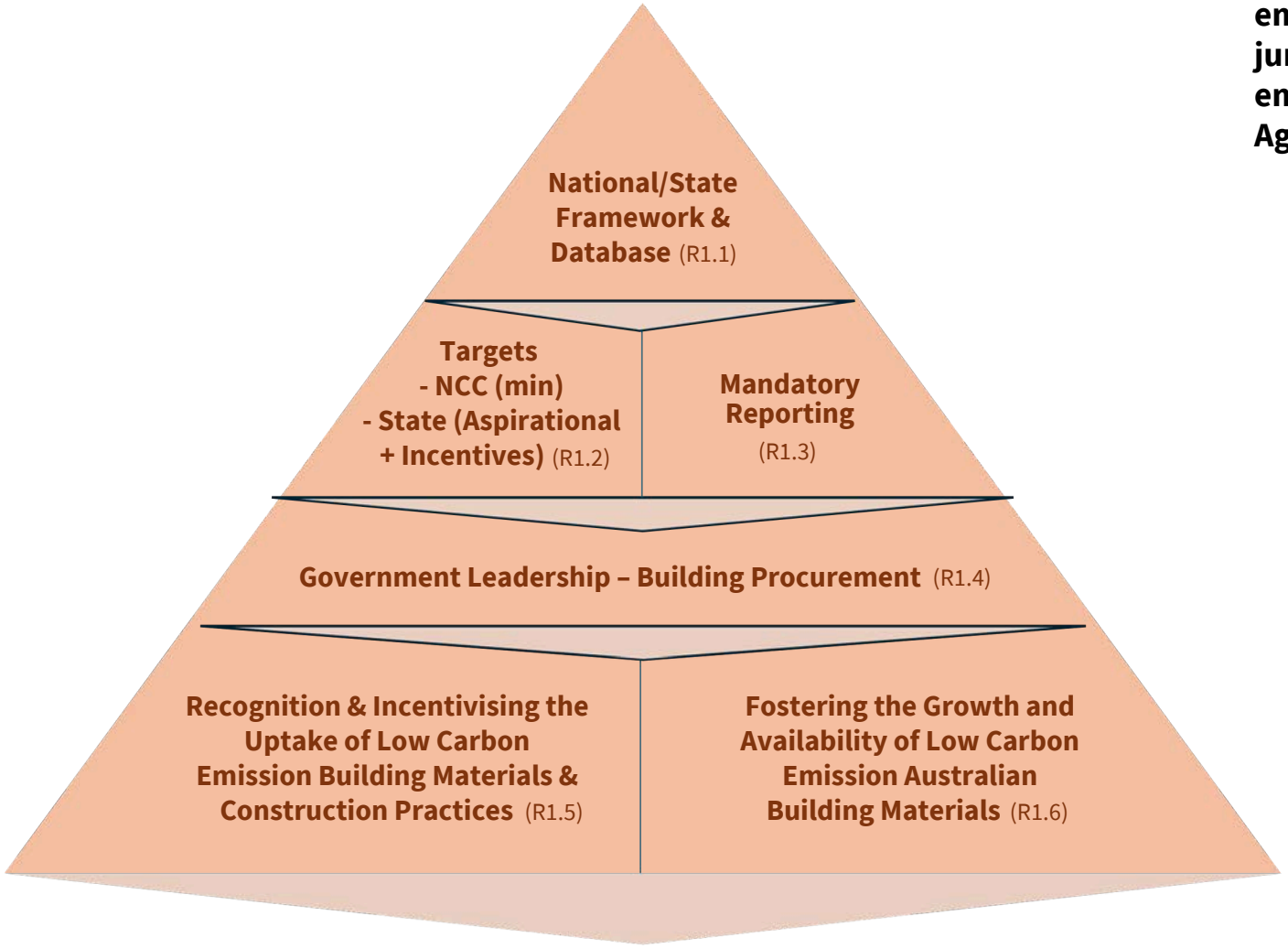
R1.4	Introduce embodied carbon reduction requirements for government buildings & projects.
R1.5	Recognise and incentivise the uptake of low embodied carbon materials and construction practices.
R1.6	Foster the growth and availability of cost-effective low emissions Australian building materials.

Recommendation Overview



Addressing embodied carbon as part of emission cuts is critical if all Australian jurisdictions are to successfully cut GHG emissions in line with the Paris Agreement trajectory [11]

- Collaboration within government and with industry is key to the accelerated development of the required policy frameworks. Industry has demonstrated its willingness to engage and collaborate.
- There are a range of policies and programs required to assist our industry and economy to decarbonise.
- Clearly there is a role for government intervention through procurement. Government is the largest lever to enable change to occur directly through its procurement tendering requirements and specifications.
- Governments can also enable and fast-track change to occur through industry policy including support and encouragement for industries seeking to decarbonise, and those looking to drive new and innovative materials into the market.

Conclusion: MECLA 2023 Best Practice Policy Development – International Review of Policies and Programs for Low Emissions Building Materials

R1.1 Adopt a National / State Framework for Measuring Embodied Carbon and Create a National Embodied Carbon Database for Building Products & Materials

Government Policy

Frameworks

ISSUE

Australia must achieve net zero emissions in line with the *Paris Agreement*, and **action in the built environment will be critical in achieving this**. However, there is currently a major gap in government policy around embodied carbon emissions in the built environment that needs to be rectified – **a clear layered policy pathway is urgently needed.**

Australia also has no accepted framework, or aggregated publicly available dataset of emissions factors, for measuring embodied carbon in the building and construction sector in an accurate, repeatable, and trusted way.

Hence there is also a need for:

- Ä an agreed national structure and approach to measure, verify and compare embodied emissions in new buildings and major refurbishments, and
- a publicly available national agreed database of process based LCA/EPD carbon emission factors for building and construction sector products and processes.

SOLUTION

Government needs to endorse an agreed national / state framework to measure, verify and compare embodied carbon emissions in new building projects, and major refurbishments. This will be essential to allow building owners and investors to set robust and measurable targets for reducing embodied emissions in buildings. A seminal ASBEC issues paper [12] (June 2024) provides some key recommendations on what is needed (box opposite).

The NSW Government is currently taking the lead, as part of the NABERS program developing, with the engagement from industry, a National Standard for Embodied Carbon in Australian Buildings [13] and also an agreed Dataset of Emission Factors for Building Products; including conservative default values for products that do not currently have published environmental product declarations (EPDs). Once it is completed, all states and territories should adopt it nationally, integrate it into construction regulation, and apply it to government projects.

The Victorian Government is still to deliver a formal strategy on embodied emissions however the recent recommendations by Infrastructure Victoria include an Overarching Principle (2) that Victoria should align approaches with other government and industry best practice, and Recommendation 2 that Victoria should implement the same carbon measurement approach as NSW [14].

Australian Sustainable Built Environment Council | **ASBEC**

To be successful, Australian governments need to:

- → Scale and deepen the work of NABERS' upfront embodied carbon measurement methodology.
- → Support the supply chain to deliver better products and services.
- → Support the value chain to deliver better design and construction outcomes.
- → Adapt embodied carbon policy for the needs of different segments and sectors.

What we need:

- → Short-, medium- and long-term sectoral decarbonisation strategies for the built environment that holistically address embodied carbon using the whole reduction hierarchy.
- → A pathway that considers Australia's layered policy landscape and most efficiently and effectively regulates embodied carbon in this complex environment.

Decarbonisation of upfront carbon emissions is not an event, but a long-term process. The strategies put in place need to be transparent, clear, and communicated in advance. This will allow industry to make progress now, rather than being overwhelmed with solving every problem at once.

The time is now for a comprehensive policy suite.

R1.2 Support the Introduction of Embodied Carbon Targets into the NCC and Set State Embodied Carbon Targets

Government Policy

Targets

ISSUE

The NCC is Australia's primary set of technical design and construction provisions for buildings.

The NCC2022 includes 7-Star 'minimum energy' performance standards for operational emissions using NatHERS for residential dwellings, and NABERS for non-residential buildings – it does not however currently set any targets for embodied emissions.

As buildings electrify and the grid decarbonises, operational emissions will be less significant, and embodied emissions will become the greatest source of GHGs. Without intervention, embodied emissions are expected to rise from 16% to 85% of the built environment's total carbon footprint by 2050 [15].

Federal and state Governments need to set targets for embodied emissions utilising the NCC framework or their state variation provisions.

Some leading industry sectors are already voluntarily taking action to reduce embodied emissions, still minimum NCC standards will assist to formalise this requirement and ensure all of industry involvement.

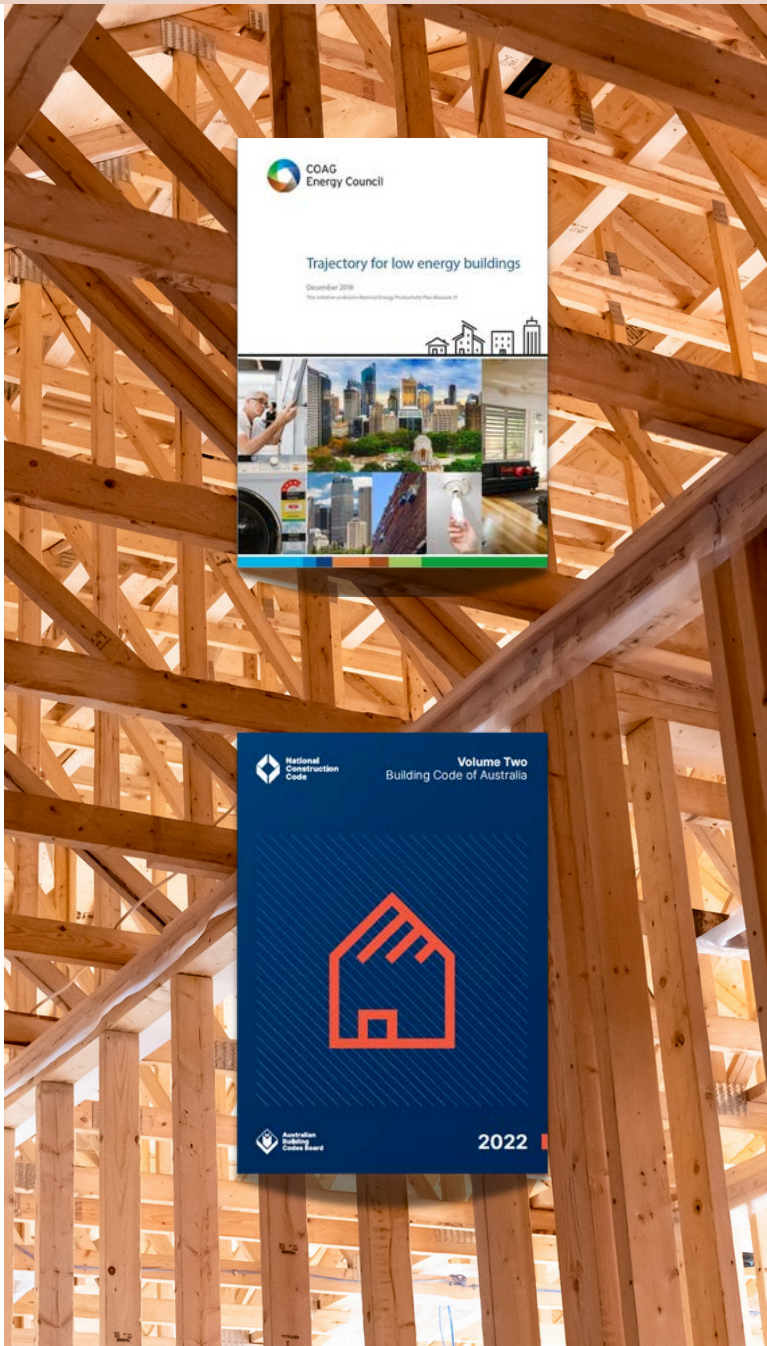
SOLUTION

The NCC provides a formal framework for delivering minimum operational energy efficiency provisions operational emissions reductions in new buildings and major refurbishments. This code and its framework should be utilised to deliver similar outcomes for setting appropriate minimum embodied carbon targets.

The Federal Government, and states and territories, should introduce minimum requirements for reporting and reducing embodied carbon into the NCC update in 2028, or before this if possible.

The Energy and Climate Change Ministerial Council has agreed to the Department of Climate Change, Energy, Environment and Water (DCCEEW) providing an update of the 2019 *Trajectory for Low Energy Buildings* by the end of 2024, with the aim of supporting the delivery of a low energy, net zero emissions residential and commercial building sector by 2050. This update should set a clear plan for the introduction of embodied carbon targets into the 2028 NCC. This will provide clarity of upcoming changes to allow the full building and construction design, supply chain and regulating sectors to adjust their programs, building designs, construction approaches, and supply chains accordingly.

Recognising that state governments often introduce requirements outside of the NCC, or as variations to the NCC, it is recommended that the Victorian Government look at introducing some aspirational challenging, but achievable, embodied emission targets for government buildings & projects. Different target levels could be recognised by access to different incentives - ie grants, funding, green-loans, regulatory and planning considerations, promotion, etc.



R1.3 Implement Mandatory Embodied Carbon Emission Measurement and Reporting

Government Policy

Reporting

ISSUE

‘That which is measured improves. That which is measured and reported improves exponentially.’

Very little Australian data currently exists on the embodied emissions impact of all the different building types (residential, multi-residential townhouses and apartments, offices, schools, etc.), the products they use, and the ways they might be constructed.

We all need to clearly understand now the ‘impacts of how we build’, so that future strategies and policies, and building designs can be introduced to minimise upfront carbon and full building life cycle impacts.

SOLUTION

Require all new building projects to calculate and record their carbon emissions using a standardised method that distinguishes between embodied and operational carbon.

Having a calculation and reporting requirement develops familiarity with the methodology and establishes the path for future regulatory requirements. It also collects data that can be used to set the future regulatory limits.

NSW under its new SEPP policy [16] has introduced required measurement and reporting of ‘embodied emissions’ for all building types to help capture valuable data to inform future policy – for the residential sector though the new *BASIX Materials Index* and for non-residential building through a new *NABERS Embodied Emissions Materials Form*.

It is recommended that the Victorian Government also introduce a similar mandatory measurement and reporting requirement for residential and non-residential buildings. With Victoria’s additional data, added to NSW’s, this would cover over half of Australia’s annual building volume – a hugely valuable resource with which to assist in developing future policy directions under the NCC.

For the residential sector, this should be an Embodied Emissions Materials Impact assessment requirement, as NSW is doing, as part of the current NCC2022 NatHERS 7-Star provisions – all the information needed is already supplied under the NatHERS Energy Raters evaluation process to allow the assessment to be undertaken (in fact the AccuRate Software has had an *Embodied CO2 Emissions Module* included since 2010; the carbon emission data simply requires updating, which should be done using the new EPD based NABERS *Dataset of Emission Factors for Building Products* and the EPD database of emissions factors that will be published at the same time).

For the non-residential sector, the new NABERS Embodied Emissions Materials process should be adopted.

NATIONWIDE HOUSE ENERGY RATING SCHEME®

NABERS

R1.4 Introduce Embodied Carbon Reduction Requirements for Government Buildings & Projects

Government Policy

Procurement

ISSUE

MECLA's 2023 investigation – *Best Practice Policy Development – International Review of Policies and Programs for Low Emissions Building Materials* [11] – clearly recognised the importance of government policy as a **'Driver of change'** and 'Procurement policies that reward and require embodied carbon reductions through low emission construction materials and practices.'

Federal, state and territory governments can and should use their considerable building demand and usage to drive improvements in embodied emissions.

By setting measurable targets that call for greater levels of ambition from industry to promote embodied carbon, and by adding embodied emission reduction criteria and low embodied emission product usage and construction requirements to public tenders, governments can drive large-scale change.

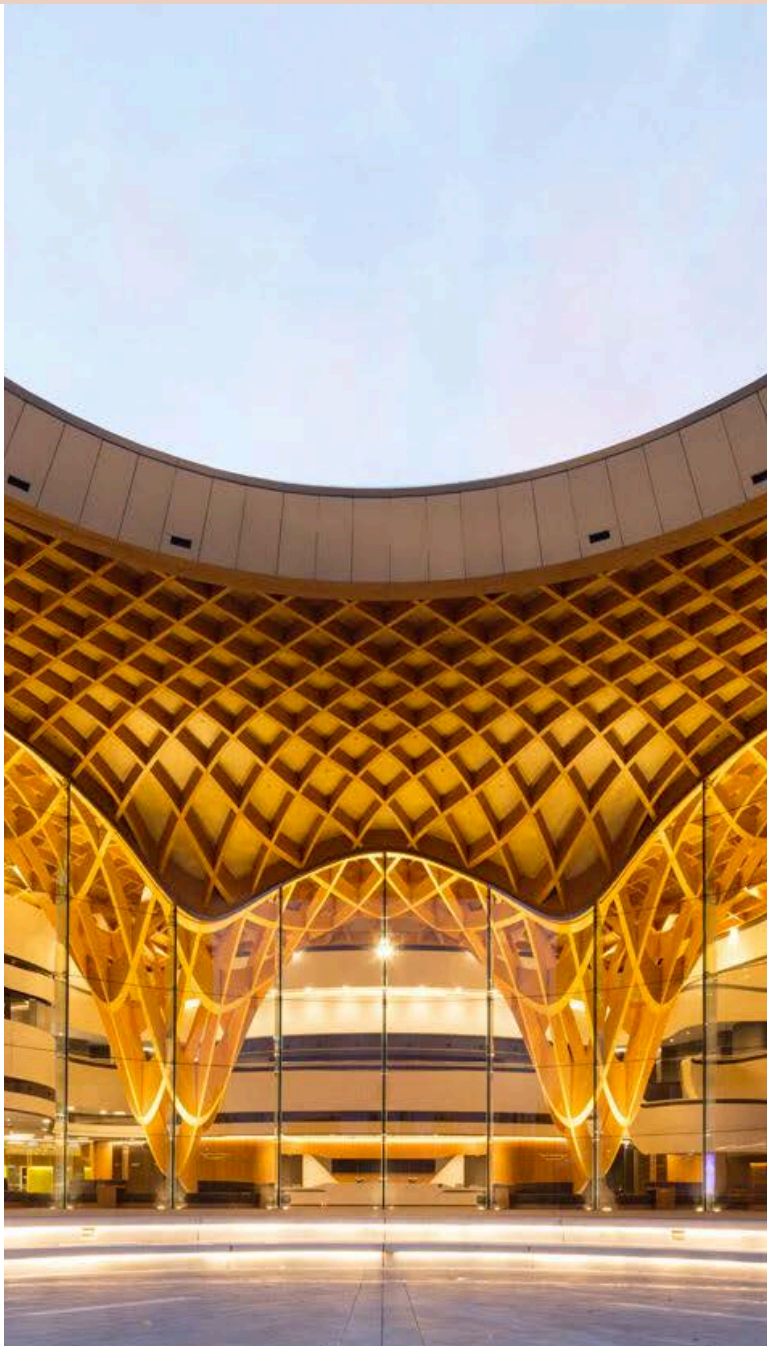
Design briefs for procurement should include carbon in addition to the traditional constraints of time, cost, and quality.

SOLUTION

The *Every Building Counts 2023* [17] report recommends that 'The Federal and State and Territory Governments should commit to reducing their own embodied carbon footprint over time to achieve net zero by 2050 or before. Measures could involve minimum standards for new buildings and fitouts, and targets to increase them over time. This will contribute to developing skills and expertise in the market and reduce the cost of low-carbon materials through economies of scale. There are also many shared benefits to be unlocked by pooling resources and research and sharing information between the property and infrastructure sectors.'

A recent CEFC report [18] in terms of government procurement has suggested the following:

- Encourage the mainstream use of low embodied materials and products through access to and provision of grants, funding, and advisory services.
- Establish tendering criteria that evaluate, reward, and drive low carbon product/material selection.
- Mandate provision of EPDs/embodied carbon declarations on all high carbon intensity building products and materials.
- Mandate that embodied carbon is measured and reported.
- Set embodied carbon targets in project briefs.
- Increase the rate of embodied carbon reduction to be achieved by tenderers.
- Align across government departments to create consistency.



Bunjil Place, Melb
Mass timber (GLT)

R1.5 Recognise and Incentivise the Uptake of Low Embodied Carbon Materials and Construction Practices

Government Policy

Materials & Systems

ISSUE

Fundamental to reducing the embodied emissions impacts in the built environment is the increased use of low embodied carbon building materials and construction practices; however, whilst federal, state and territory governments might recognise this fact, they do not currently actively incentivise it.

Clear recognition and incentives are needed to encourage property developers, builders, building professionals, materials manufacturers, and suppliers to expand the availability, procurement and use of low embodied carbon emission products.

There is also a need for more offsite prefabrication supply capacity, that offers lower embodied impact construction solutions, and greater onsite construction productivity for builders – particularly to try and assist in meeting the Federal Government's 1.2 million new homes aspiration over the next 5 years under the *National Housing Accord 2022.*

SOLUTION

Federal state and territory governments can take action to improve embodied carbon outcomes through the use of incentives. These could include the following:

- Direct financial incentives, grant-access, green-loans, tax offsets or planning incentives for building and property organisations undertaking embodied carbon reduction on their projects.
- Mandating policies that;
    - maximise structural timber construction product use, particularly in social and affordable housing applications (lightweight framing and mass timber) – would provide significant additional CO2 stored
    - require social housing to be the highest quality of sustainable residential construction – timber-framed-passive house construction – thereby significantly minimising the future energy use costs for the social housing residents (refer Gillies Hall Case Study [19] – the first Passive House CLT housing accommodation in Australia)
    - improve 'home resilience' by requiring raised timber floor construction (particularly for flood prone areas or on significantly sloping sites)
    - support and incentivise offsite construction – particularly high onsite productivity, offsite prefabricated 'Elemental Solutions' through Australia's extensive existing frame and truss sector network for homes and low-rise construction projects, and offsite manufactured mass timber systems for mid-rise apartment construction.

Gilles Hall, Melb Mass timber (CLT) Passive House

Flood prone zones and sloping sites.

Offsite prefabrication solutions.

R1.6 Foster the Growth and Availability of Cost-Effective Low Emissions Australian Building Materials

Government Policy

Growth & Availability

ISSUE

The *Every Building Counts 2023* report [16] notes:

> The need for more low embodied carbon materials in the construction sector is crucial to action on climate change. Traditional high-carbon materials contribute significantly to greenhouse gas emissions. Failing to embrace sustainable alternatives will lead to increasing emissions at a time when all efforts should be directed to mitigation. Transitioning to low embodied carbon materials is essential to achieve climate targets and build a resilient future. Prioritising the availability and affordability of these materials will encourage their uptake by the built environment.

It is a scientific fact that renewable materials including wood products, and other bio-based materials like bamboo and hemp, provides possibilities for capturing and storing carbon sequestered during growth. New plantation establishment for future building products can also make a very significant immediate and ongoing (new tree growth) and long-term (carbon sequestration in soil and products) contribution to decarbonisation efforts. A natural CCUS option for the built environment to help store carbon 'today' as we seek more complete decarbonisation solutions for the future.

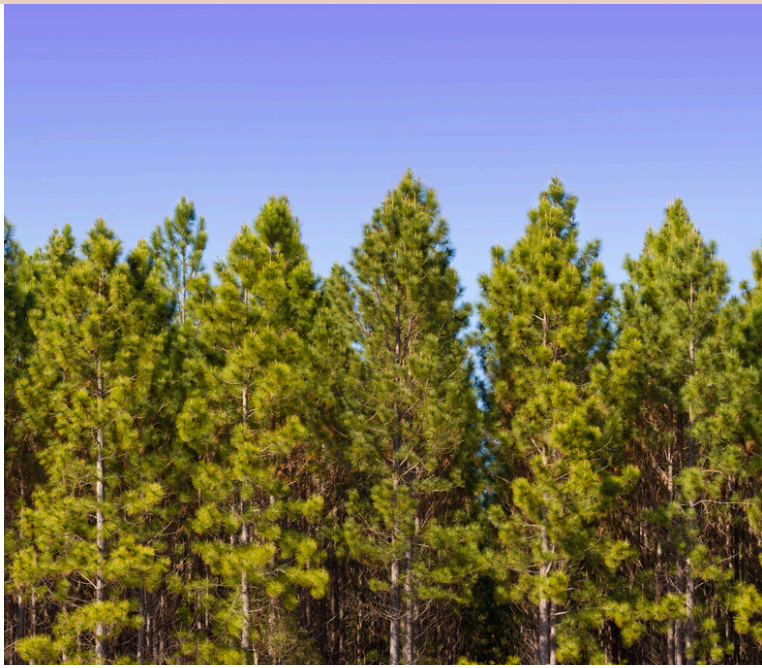
In addition to the carbon sequestration abilities of bio-based materials, the related embodied carbon impacts are generally less than other alternative more carbon-intensive materials.

SOLUTION

Governments can play a crucial role in fostering the market's growth for low embodied carbon materials.

Governments can:

- Incentivise the initial establishment of more softwood and hardwood plantations for building products, and state and territory governments can directly invest in planation establishment or make available state governed public land for this important use.
- Promote research and development initiatives to advance the availability and affordability of low carbon emission building materials. Through these measures, governments can drive the transition towards a lower embodied carbon-built environment.
- Test alternative low embodied carbon materials in government projects and adopt performance-based standards.
- Implement supportive policies, such as incentivising the use of these materials in construction projects.
- Provide financial assistance or tax offsets to manufacturers.

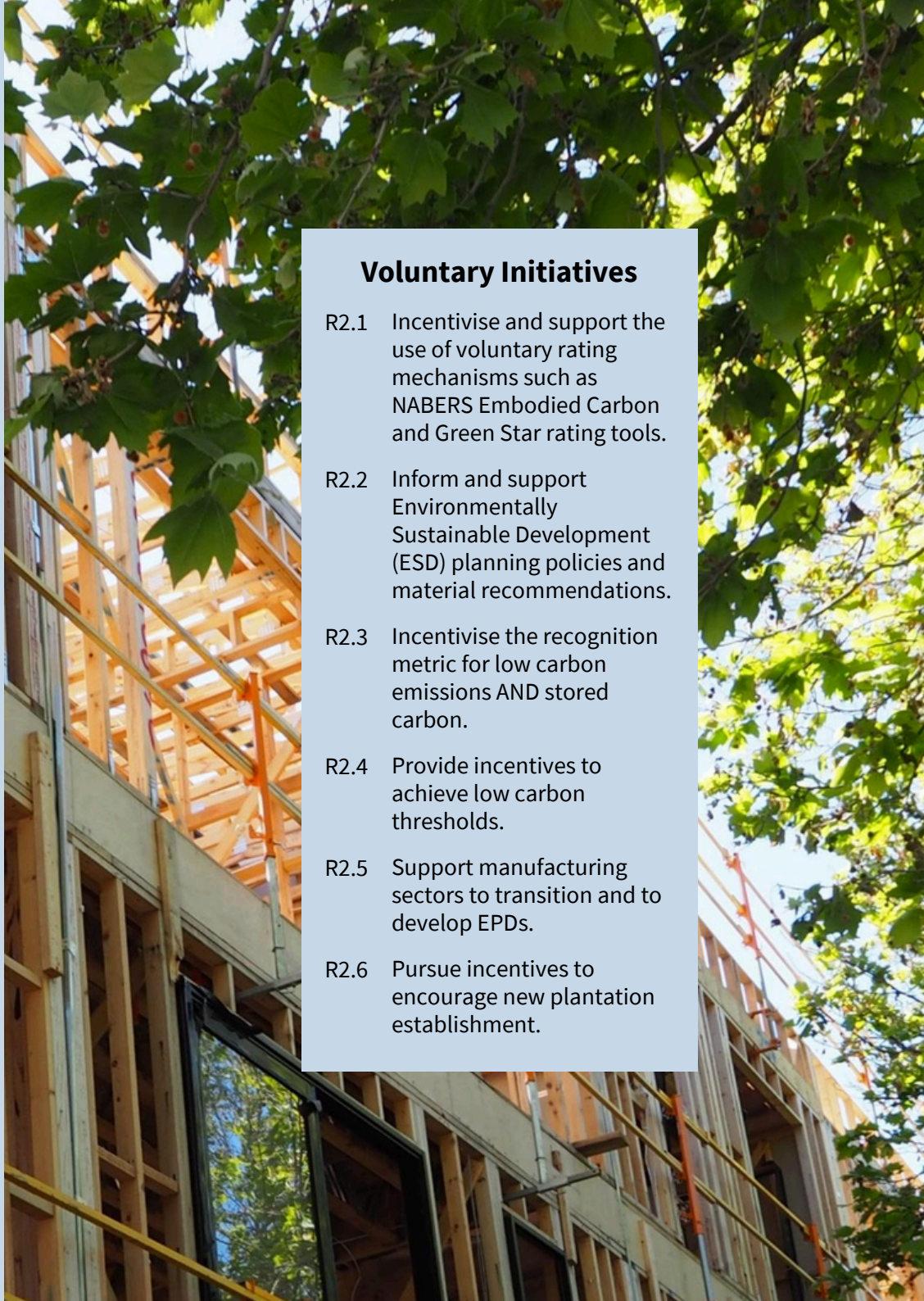


Right: Bendigo Gov Hub - Mass timber (MASSLAM, CLT)

Recommendations – Theme 2 Voluntary Initiatives

‘A quarter of a building’s emissions are locked in on the first day the occupants walk through the front doors.
Every project team gets just one shot to reduce the upfront carbon of their next building.’

Jorge Chapa, Chief Impact Officer, GBCA



Voluntary Initiatives

R2.1 Incentivise and support the use of voluntary rating mechanisms such as NABERS Embodied Carbon and Green Star rating tools.

R2.2 Inform and support Environmentally Sustainable Development (ESD) planning policies and material recommendations.

R2.3 Incentivise the recognition metric for low carbon emissions AND stored carbon.

R2.4 Provide incentives to achieve low carbon thresholds.

R2.5 Support manufacturing sectors to transition and to develop EPDs.

R2.6 Pursue incentives to encourage new plantation establishment.

R2.1 Incentivise and Support the Use of Voluntary Rating Mechanisms such as NABERS Embodied Carbon and Green Star Rating Tools

Voluntary Initiatives

Embodied Carbon Ratings

ISSUE

Rating mechanisms aim to encourage best practice within industry (not business-as-usual) by providing a set of voluntary criteria that allow comparisons between buildings for the benefit of designers, regulators, and consumers; as well as to stimulate competition among market participants.

Agreed and aligned metrics, methods, and sources of raw data, about embodied carbon in building materials is key to allowing a fair comparison of products, and buildings – an assembly of products.

Rating tools provide a transparent method to support the uptake of proven products to meet public procurement and industry requirements. They allow benchmarks to be set, measured, and reported over time. They also assist industries and government's ability to report embodied carbon savings. Utilising the tools, innovators can also market their benefits to carbon conscious consumers.

NABERS and Green Star are 2 Australian rating tools very focussed now on, and leading, the direction on embodied carbon measurement and reduction in the built environment.

Whilst NABERS and Green Star continue to expand their usage, at present there still remains large segments of the market, across many asset types, that have not yet engaged with these rating tools and have been isolated from their benefits.

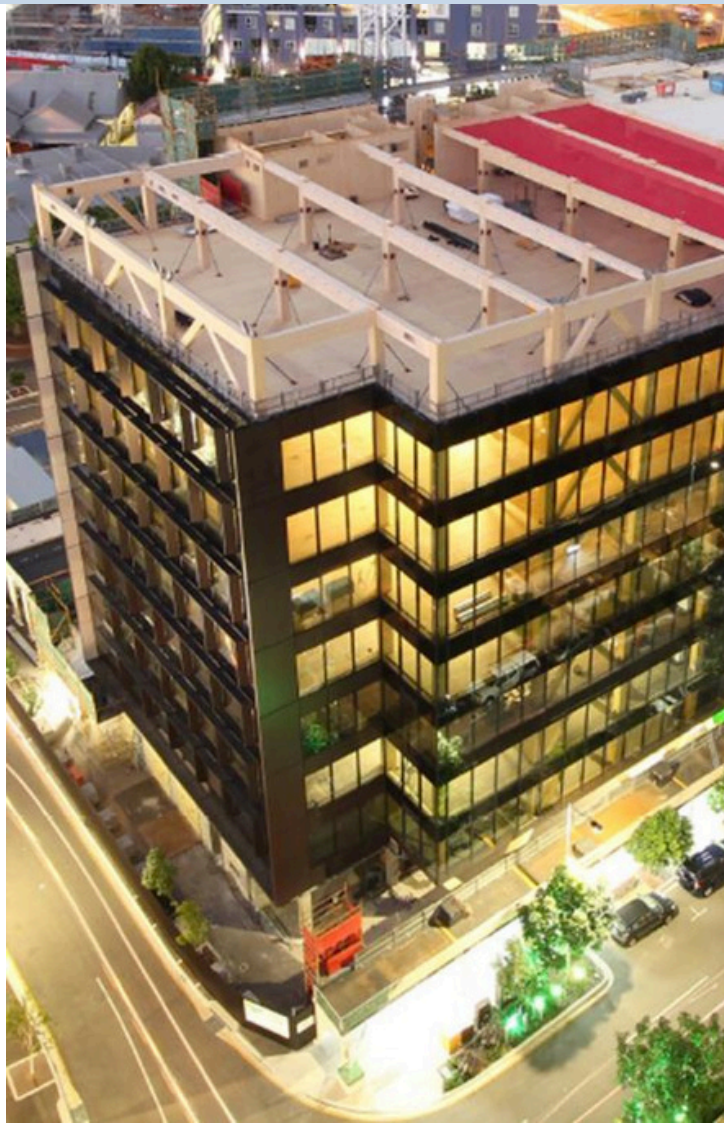
SOLUTION

Rating tools such as NABERS and Green Star should be encouraged to be used across the total built environment. They are currently leading the industry in extending the knowledge and understanding and promoting the true and significant impacts of embodied GHG emissions in the building sector.

Private sector leaders have embraced voluntary rating however, there has not been the same level of adoption in the public sector in all jurisdictions. By leveraging these tools through procurement processes, governments can integrate requirements to help lower emissions in public projects and increase the market for low emission building products and construction systems.

The federal, state, and local governments, and industry, should commit to using trusted, robust, and credible building rating systems, including Green Star and NABERS, and incentivise their uptake on appropriate public projects.

This commitment to achieve certification, can demonstrate how project outcomes align with agreed sustainability policies and targets. This broader, nationally aligned, support would extend the depth of Australia's built environment projects that can directly benefit from the ongoing measurement, verification, and performance management of buildings. Adoption of their evolving carbon emission programs would also assist to driving down emission impacts in building material production and manufacturing.



25 King St, Brisbane - Mass timber (GLT, CLT)

Delivering a reduction in carbon over a 60-year life (8,607 tCO2 e) - compared to a reinforced concrete building, a 38.7% reduction in fossil emissions (excluding the sequestered carbon contribution of timber).

ISSUE

State and local governments all have a direct involvement in 'building' at the community level, in policy setting, regulation, consumer information, and their own building related procurement; it is noted that the topic of low embodied emission building materials and construction methods is starting to become a key focus but needs greater traction.

Twenty-five Victorian councils have specific environmentally sustainable design (ESD) planning policies, 19 of these include the following advice under 'strategies':

> 'Improve the energy performance of buildings through siting and design measures that encourage; use of low embodied energy materials.'

The Council Alliance for a Sustainable Built Environment (CASBE) has lodged an amendment with the Victorian Minister for Planning to introduce elevated sustainability (ESD) requirements for new buildings, to encourage a move towards net zero carbon development; this amendment identifies embodied carbon as a core theme [21].

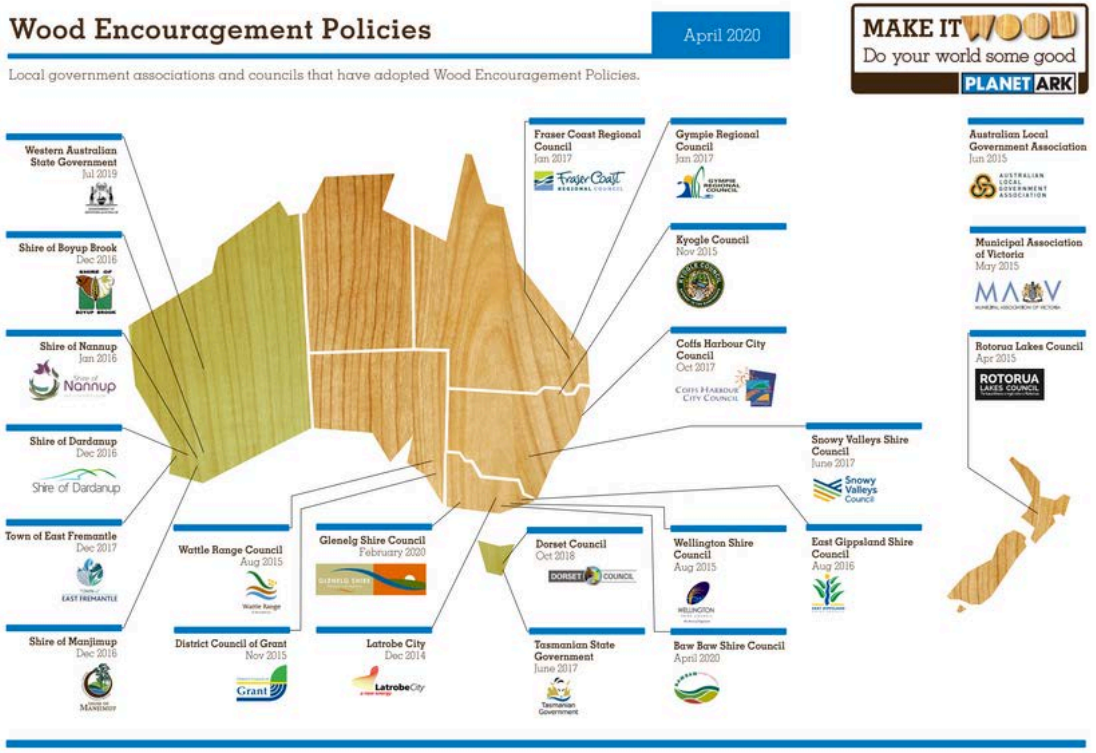
Some state governments and local councils have introduced specific Wood Encouragement Policy (WEP) programs [22] - Western Australia and Tasmania, and 18 local councils: 5 in Vic and WA, 3 in NSW and 2 in SA and Qld and 1 in Tas. WEP's generally require responsibly sourced wood to be considered, where feasible, as the primary construction material in all public new-build and refurbishment projects. They are not intended to be an all-encompassing dictum, but rather seek to ensure that wood is at least considered as the primary structural component in these buildings.

SOLUTION

State and local government ESD and planning policies need to include lower embodied built environment emission requirements and WEP initiatives.

Further work is needed to inform and support this process. A close eye is being kept on the work currently being undertaken by NABERS to develop a *National Standard for Embodied Carbon in Australian Buildings* and also an agreed *Dataset of Emission Factors for Building Products* – the expectation is that this will set the benchmark for others to follow and embrace.

More engagement is needed with, and between, the building sector, supply chain and government departments and authorities on the embodied emission impacts of different building materials and construction processes, to allow them to make proper science-based decisions and policies.



R2.3 Incentivise the Recognition Metric for Low Carbon Emissions AND Stored Carbon

Voluntary Initiatives

True Scientific Recognition

ISSUE

All embodied emission policy, strategy, or delivery tools must be based on, and recognise, true science.

It is an indisputable scientific fact, that bio-based products store biogenic carbon. The true climate value of timber in a building is the sum of the (lower) fossil emissions of constructing the building, and the carbon it has stored (see page 7 for the benefits of stored carbon). The value of stored biogenic carbon is that it represents measurable value for the climate through carbon that is locked away in the building.

At present there is not an agreed national position on how to recognise and value biogenic carbon stored in bio-based products.

NABERS in its current work to develop a N*ational Standard for Embodied Carbon in Australian Buildings* recognises the value of stored biogenic carbon, and as such, will report it separately using a *Stored Biogenic Carbon – Greenhouse Gas Removal Indicator.* The technical rationale [23] here includes that it provides transparency, it is standards compliant - gross emissions are reported separately to removals, it allows stakeholders to set targets based on strategies that match their objectives, and it provides an incentive for the use of stored biogenic carbon in building materials, which is critically important as it drives immediate action in this decade.

SOLUTION

The true scientific value of biogenic carbon stored in bio-based building products must be acknowledged.

It is recommended that for upfront carbon emission assessments that a 'dual metric' GHG emission impact reporting approach be utilised for buildings – **Greenhouse gas emissions + Greenhouse gas removals (stored biogenic carbon).** It should be noted that when a full LCA is undertaken for a building project, the carbon is logically tracked and accounted for through the life cycle.

Low embodied carbon building materials and construction practices policies, strategies, and rating tools, can incentivise this by:

- requiring reporting of performance on government funded and voluntary certified projects based on a 'dual metric'
- setting KPIs for government and voluntary certified projects based on achieving a 'dual metric' benchmark
- requiring government departments to report annually on the amount of carbon stored in assets due to government requirements in total tonnes of CO2eq, and also reported as the $ equivalent value of carbon stored - see R4.5.

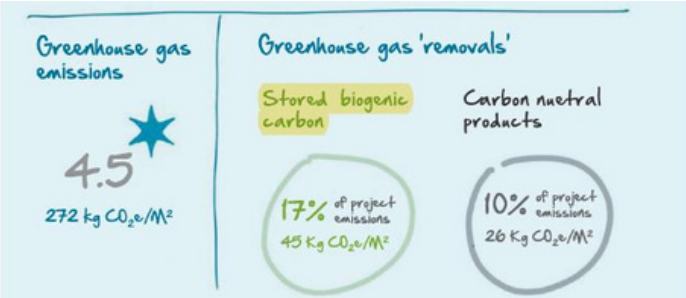


Figure 4.4.2: Example of how a Carbon Removal Indicator could look, based on the Renewable Energy Indicator

Biogenic carbon is 'carbon derived from biogenic (plant or animal) sources excluding fossil carbon.'

The process of removing carbon dioxide from the atmosphere helps to mitigate climate change. For short-lived products, such as food, stored biogenic carbon is typically released back to the atmosphere quickly, effectively cancelling out any net benefit. For long-lived products such as those used in buildings, this atmospheric CO2 will often be stored within the building for several decades, and sometimes even hundreds of years. While this is a temporary effect, removing carbon dioxide from the atmosphere and storing it for several decades can help to buy time for further carbon reduction technologies and methods to be developed.

Embodied Emissions Technical Report
thinkstep-anz, on behalf of NABERS

R2.4 Provide Incentives to Achieve Low Carbon Thresholds

Voluntary Initiatives

Industry Transformation

ISSUE

Low carbon construction is currently only being attempted by relatively few leading developers.

Government developments and government funded projects currently rarely express commitment to reducing embodied carbon.

Without either mandates or incentives to support transformation, little will happen, and the built environment will continue to contribute far more than necessary to climate change.

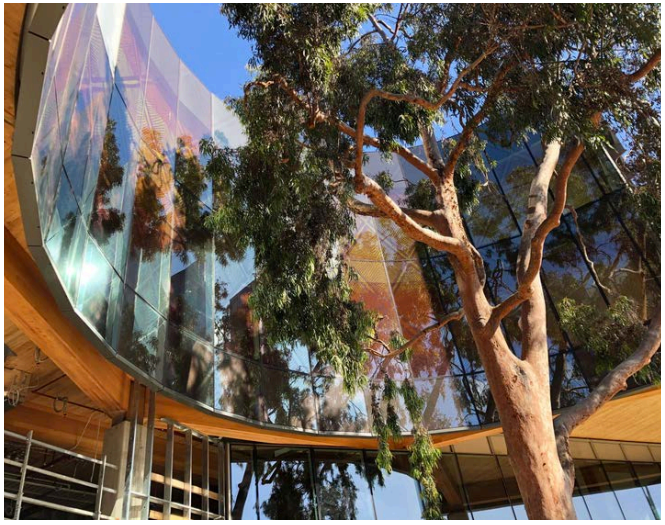
Mandates are important but the reality is that changes to the NCC will at best occur four years from now.

Incentives are a lever that can be implemented on a much faster timeline and can encourage real change.

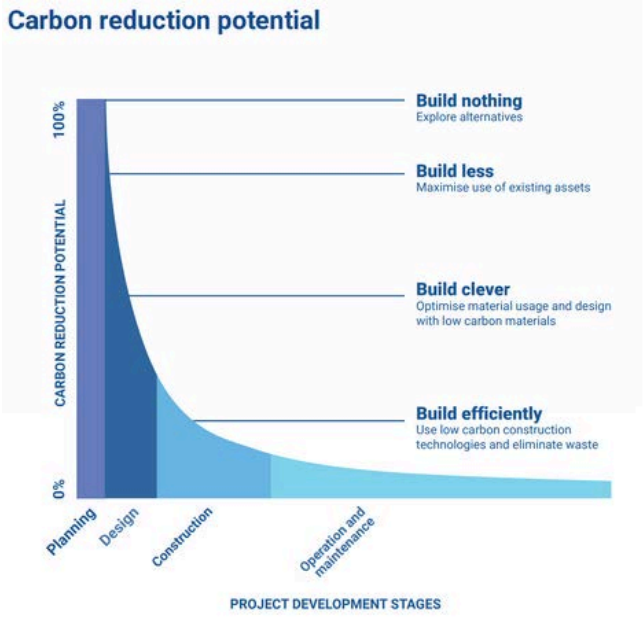
SOLUTION

True valued actions and incentives are needed to achieve low carbon thresholds in the built environment to maximise their contribution to achieving zero carbon and to climate change improvements:

- Government developments and government funded projects must express commitment to reducing embodied carbon by including KPIs in project success criteria (refer to R2.3).
- Governments should include a price on carbon in tender evaluation criteria, based on Infrastructure Victoria's recommendations [14].
- Incentives need to be provided and can take many forms, including relaxing planning requirements, lower interest rates for funds, lower interest rates via CEFC funding, rebates on taxes and duties, rewarding options to reuse existing assets, including low carbon pilots and trials of new products.
- Incentives need to be aimed at all opportunities in the decarbonisation hierarchy, including not building as the first preference.
- Project delivery needs to be focused holistically in government funded and voluntary certified projects on low embodied carbon materials and construction, and management of carbon emissions right though the planning phase of projects (concept – final design – as built) using the carbon reduction hierarchy to ensure that 'no build', 'build less' and 'clever design' solutions are all considered.



Bendigo Gov Hub - Mass timber (MASSLAM, CLT)



Source: World Green Building Council (2019) in Bringing Embodied Carbon Upfront, London

R2.5 Support Manufacturing Sectors to Transition and to Develop EPDs

Voluntary Initiatives

Accurate Data - EPD's

ISSUE

Environmental Product Declarations (EPDs) are independently verified and registered documents that communicate transparent and comparable data about the life cycle environmental impacts of a product. In Australia and NZ most EPDs are registered and published by EPD Australasia [24].

All EPDs include embodied GHG (carbon) emissions of the assessed products – the EPD factor is GWP (global warming potential, expressed in kgCO2-eq/unit). Contributions to GWP can come from either fossil or biogenic sources.

EPDs are the globally recognised tool in supplying these emission factors, and other LCA factors, to the market. The most pressing issue at present is the need for more building product EPDs.

Publishing an EPD provides a fast-track method for achieving Australian Government Climate Active certification for building and construction products.

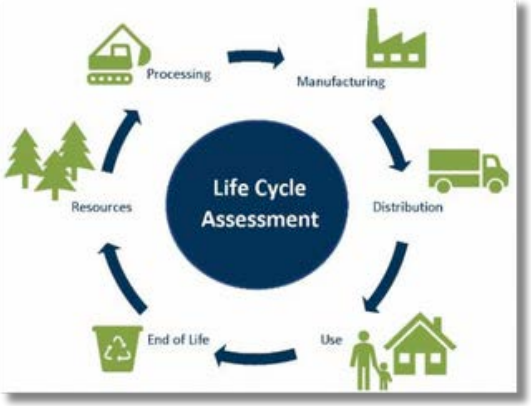
EPD results are also recognised in various rating schemes, such as Green Star Buildings and Infrastructure Sustainability (IS).

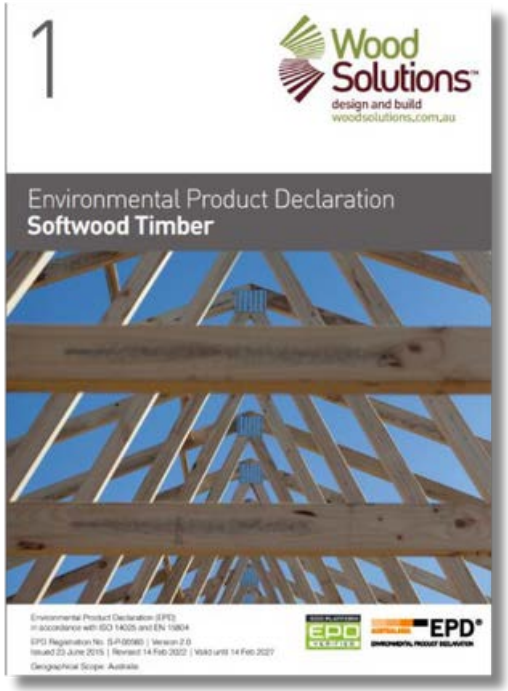
SOLUTION

More EPDs for building products are needed – both generic industry average values (for conceptual design) and products specific EPD's (for accurate as-built design use). Product manufacturers need to be encouraged and incentivised to undertake accurate EPD assessments of their products and to publish the results.

Support to assist here could include the following:

- Development with industry of common model approaches for manufacturing processes.
- Funding assistance to associations or cooperatives to develop models. This creates economies of scale through multiple users taking advantage of a common investment and makes EPDs using these models much more affordable.
- Supporting the development of decarbonisation plans for manufacturers and then the updating and re-publication of EPDs to demonstrate credible measurement of improvements achieved.
- Advocating to the Federal Government that one of its departments or agencies be responsible for governing, publishing and maintaining a national agreed data set of carbon emission factors (for all products – not just building related products) – note the agreed NABERS *Dataset of Emission Factors for Building Products* and the EPD database of emission factors that will be published with this, could form the first iteration of this dataset (see Recommendation R1.1)





R2.6 Pursue Incentives to Encourage New Plantation Establishment

ISSUE

The existing area of commercial plantations in Australia is insufficient to meet current and future demand for wood products. Australia needs to grow its plantation supply base if it is to become more self-sufficient in supplying the local consumer demand for wood products in building and other key use sectors.

The positive role of sustainably managed forests in the global carbon cycle is widely recognised. The forest products industry in Australia is an important contributor to climate change mitigation. Sustainably managed plantations and native forests sequester carbon, and carbon can be stored for many decades in wood products.

There is potential to significantly increase this carbon sink in Australia by growing new commercial plantations to meet the current shortfalls in timber supply and anticipated demand increases.

An increase in the market share of timber in buildings has a dual benefit – the climate benefit from the displacement of greenhouse-intensive alternatives, and the additional carbon sequestration in new plantations required to meet the increased demand for wood products.

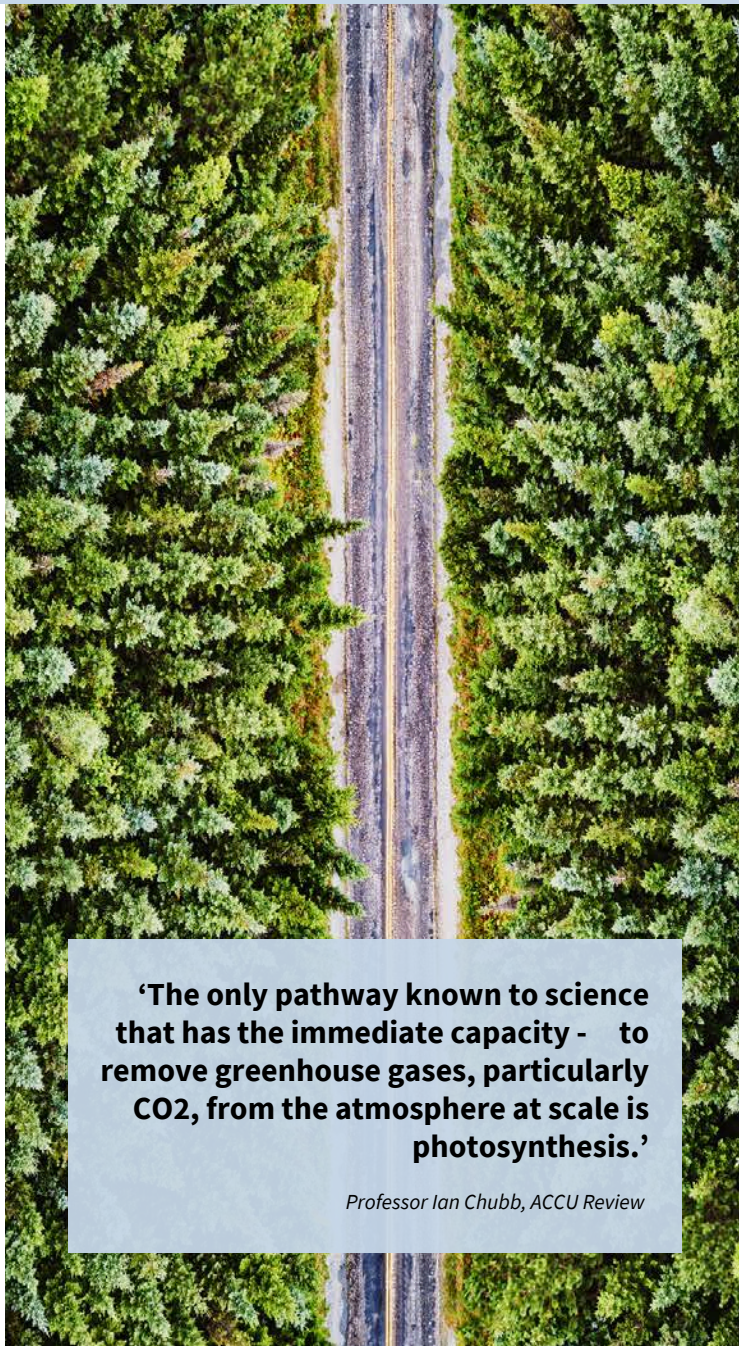
SOLUTION

Australia needs to invest in more commercial plantations to provide its building products.

Historically most of Australia's current softwood plantation area was established through government investment much of it on publicly managed land, with some support also of farm forestry. Currently there is plenty of interest and encouragement by the federal and some state governments to get more plantations in the ground – the main impediment is the land, its availability, and its current price.

If Australia is to see more plantations rapidly in the ground, then:

- States and regions need to coordinate collectively a long-term national plan to rapidly increase new commercial plantations together with agroforestry and farm shelter tree plantings.
- State governments need to directly invest in planation establishment or make available state governed public land for this important use.
- Federal and state governments need to assist and incentivise investors in the initial establishment of more softwood and hardwood plantations specifically for building products. The key here is getting the incentives right. Governments can derisk investment and provide necessary infrastructure and a supportive policy environment by aligning all levels of government and key stakeholders.
- Governments need to coordinate and better target tree planting programs and invest over the long-term in supporting services including extension, farmer networks and planning services and tools, seedling supply and links to industry and markets.
- Regional forestry hubs should look to facilitate new types of investment partnerships with farmers and the timber industry.



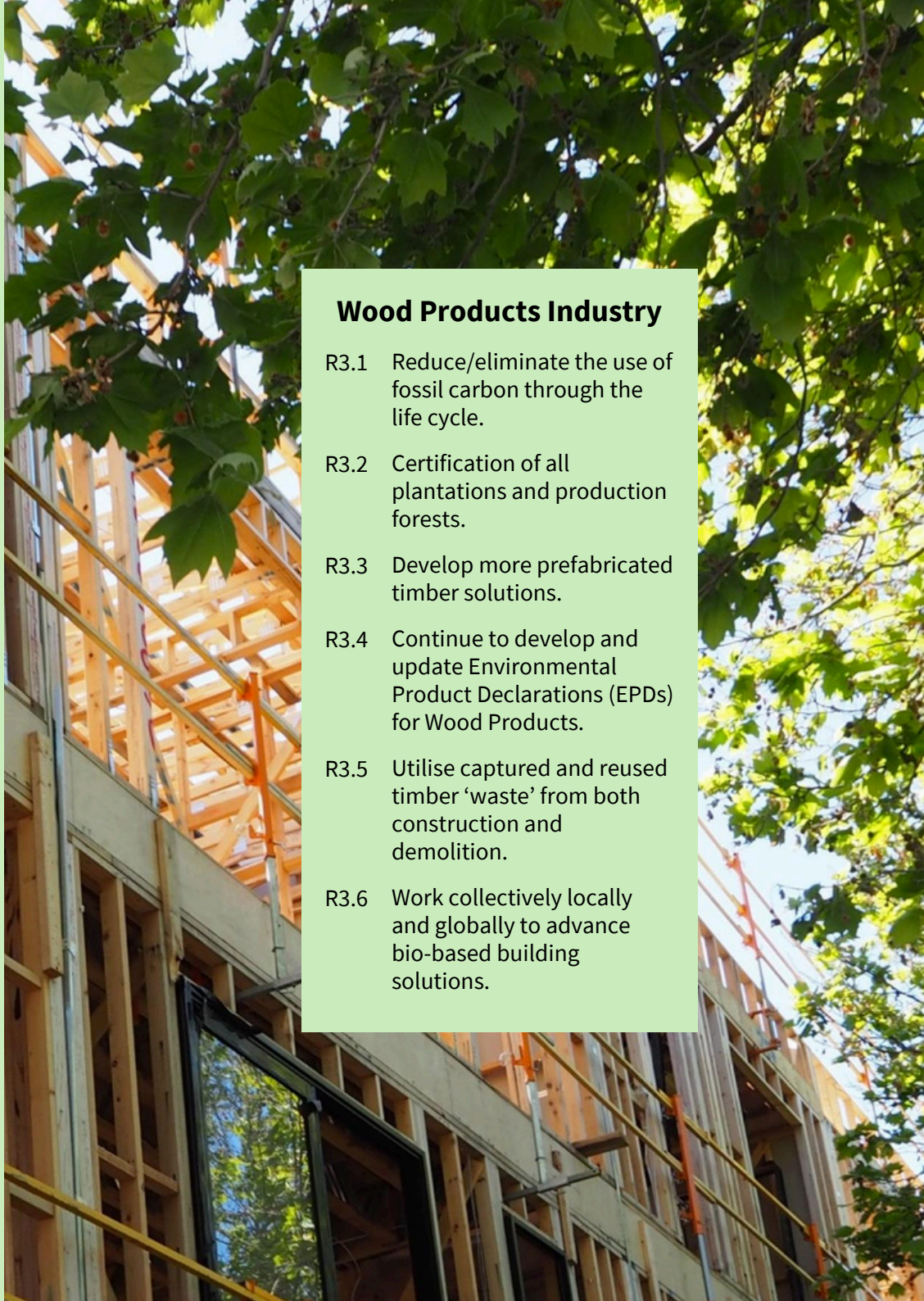
'The only pathway known to science that has the immediate capacity - to remove greenhouse gases, particularly CO2, from the atmosphere at scale is photosynthesis.'

Professor Ian Chubb, ACCU Review

Recommendations – Theme 3 Wood Products Industry

A sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre, or energy from the forest, will generate the largest sustained mitigation benefit.

IPCC 4th Assessment Report



Wood Products Industry

R3.1 Reduce/eliminate the use of fossil carbon through the life cycle.

R3.2 Certification of all plantations and production forests.

R3.3 Develop more prefabricated timber solutions.

R3.4 Continue to develop and update Environmental Product Declarations (EPDs) for Wood Products.

R3.5 Utilise captured and reused timber ‘waste’ from both construction and demolition.

R3.6 Work collectively locally and globally to advance bio-based building solutions.

R3.1 Reduce / Eliminate the Use of Fossil Carbon Through the Life Cycle

Wood Products Industry

Continuous Improvement

ISSUE

The management of commercial forests and processing of logs into wood products requires the use of energy.

Some of that energy may be derived from fossil fuels (e.g. diesel used in machines to harvest trees and trucks to transport logs and products, mechanical log breakdown, etc.) also non-renewable electricity.

Whilst in sawmills, a large proportion of the energy used in the conversion process from logs to wood products may be from biogenic sources such as sawmill residues (for example, many kilns used to dry timber rely on wood biomass for energy) there is still a need to use fossil fuels that results in CO2 emissions that contribute to climate change [25].

The forest and wood products sector needs to clearly understand its total, and segmental, carbon emission profile and develop and enact an industry-wide decarbonisation plan to reduce or eliminate the use of fossil carbon in the supply chain.

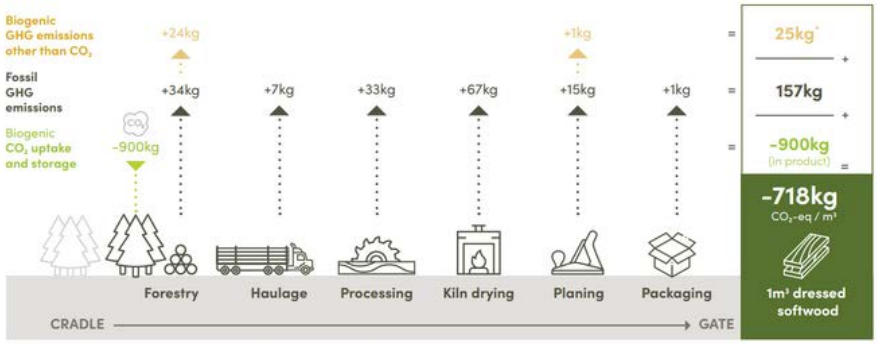
SOLUTION

The forest and wood products sector through FWPA have instigated a project in May 2024 to research and inform an **industry-wide decarbonisation plan and roadmap** to lead the sector to achieve a better than carbon neutral outcome by 2050.

The approach will incorporate carbon sequestration within commercial forest estates and include recommendations for softwood and hardwood plantation forests, wood processing sites, managed native forests, and the paper and packaging manufacturing sector. The project will investigate Scope 1 & 2 emissions for forestry and manufacture of sawn timber and pulp and paper products, and also the relevant Scope 3 emissions for these products; biogenic carbon emissions will be reported separately.

The forest and wood products industry is a pivotal player in the global economy and environmental sustainability. The decarbonisation plan will reinforce the industry's role in contributing to climate goals while managing the resources necessary to assist in building 1.2 million homes over the next 5 years.

Manufacturers of wood products with product specific EPD's need also to interrogate these for specific improvement areas, and also keep these current and update them when any major change is made in their energy supply or manufacturing processes.



Carbon footprint 1m³ of KD dressed softwood
'Cradle to Gate' A1 - A3

*CO_2 biogenic emissions from production (e.g. from combustion and degradation of residues) are excluded as they are balanced by uptake during tree growth (i.e., balance to zero)

ISSUE

All Australian plantations and production forests need certification - this is essential for ensuring the sustainability of the timber and wood products industry supplies, and in ensuring and promoting responsible sourcing practices.

The forest certification process involves assessing and verifying that forest management practices meet stringent environmental, social, and economic standards set forth by certification bodies such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC).

By requiring certification, governments, businesses, and consumers can support responsible forest management and contribute to the creation of a more sustainable and resilient built environment.

SOLUTION

All Australia's plantations and production forests need certification under one of, or both, the FSC and PEFC schemes.

Implementing forest certification for all plantations and production forests brings numerous benefits, particularly for the built environment:

- Ensures Sustainable Sourcing; certified forests adhere to principles of sustainable forest management, including protecting biodiversity, conserving ecosystems, and mitigating climate change. By sourcing wood from certified forests, the built environment can reduce its carbon footprint and promote ecosystem health.
- Demonstrates Legal Compliance; helps to combat illegal logging and ensure compliance with national and international laws and regulations.
- Ensures Biodiversity Conservation; certified forests protect critical habitats for plant and animal species, including those endangered or threatened with extinction. Preserving biodiversity is essential for ecosystem resilience and adaptation to environmental changes, benefiting both natural ecosystems and human wellbeing.
- Fosters Community Engagement; certified forest management practices respect the rights and traditional knowledge of forest-dependent communities, ensuring equitable benefit-sharing and promoting social cohesion.
- Enhances Market Access and Reputation; consumers and businesses increasingly prefer certified wood products due to their environmental and social credentials. By obtaining certification, forest owners and managers gain access to premium markets and demonstrate their commitment to sustainability, thereby enhancing their competitiveness and long-term viability.
- Risk Management; certification helps to mitigate financial, reputational, and operational risks associated with unsustainable forest management practices.

R3.3 Develop More Prefabricated Timber Solutions

Wood Products Industry

Low Emission Construction

ISSUE

Carbon emissions produced during physical construction (Stage A5) are the second most significant contributor to overall embodied carbon [26], and can be very significant for some materials that by their nature require onsite construction. Accordingly, low emission offsite construction (OSC) practices are now strongly encouraged by government and voluntary rating schemes.

OSC involves the planning, design, manufacture, fabrication, and assembly of building elements in environments that are not located on the final construction site [27].

The Office of Projects Victoria's *Offsite Construction Guide* states that 'Encouraging the uptake of OSC on Victorian projects and ensuring its continued successful delivery will unlock benefits such as higher construction productivity, lower lifecycle costs, reduced environmental impacts and improved build quality.'

A recent Infrastructure Victoria report [13] to the Vic Gov includes an Overarching Principle (1) which recommends to 'use construction techniques like offsite or modular construction wherever possible in new builds.' The report notes that '…building efficiently can deliver productivity benefits and carbon reduction benefits.' This includes time savings, cost savings, carbon savings, waste reduction and productivity gains.

SOLUTION

Timber provides a unique low emission building material and construction solution, widely available through existing national supply chains.

For the residential and low-rise construction markets Australia has over 280+ frame & truss fabricators, distributed nationally, supplying a range of high-quality, factory built, lightweight prefabricated timber elements that serve to provide for their customers (builders), improved onsite productivity, speed of construction, and output.

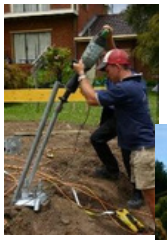
For larger buildings including mid-rise apartments, and offices, a range of mass timber systems are also available.

To further encourage more offsite and modular construction:

- Current design practices, that often follow traditional building standards, need to be updated to recognise the potential demands and opportunities of offsite manufacture and construction.
- New specific design and compliance processes and guidelines need to be developed for offsite manufacture.
- More appropriate contracts and payment for work schedules by financial bodies need to be developed that recognise the offsite manufacture process.
- More skilled workers need to be trained to manufacture and install offsite elemental prefabrication and modular construction.

Corinella Project – Delivering a house from 'Dirt to Lock-up' – in under 6 days!

Day 1 - Footings



Day 2 – Floor cassettes

Day 3 – Panelised walls

Day4 & 5- Roof trusses, fascia & gutter

Day6 - Roof tiles & lock-up

Value Proposition for builder ➔ accelerated progress payments
10% at base stage, 15% at frame stage and 35% at lock-up,

Williams Landing, Melb, lightweight timber, OSC

ISSUE

Environmental Product Declarations (EPDs) are the globally recognised tool in supplying embodied emission factors, and other LCA factors, to the market. The most pressing issue at present is the need for more building product EPDs.

The forest and wood products industry has always been one of the leaders in Australia in the collection of life cycle inventory data (first released in 2009) and the publishing of industry average EPDs.

Currently FWPA has 7 WoodSolutions industry average EPD's providing information on the environmental impacts of raw materials, production, and end-of-life stages of the products life cycle for 28 different timber products.

A large number of companies have also invested in and published product specific EPDs.

Wood product EPDs need to continue to be developed, published, and updated.

SOLUTION

The forest and wood products sector, needs to continue to invest in and publish EPD's to ensure its products are well represented.

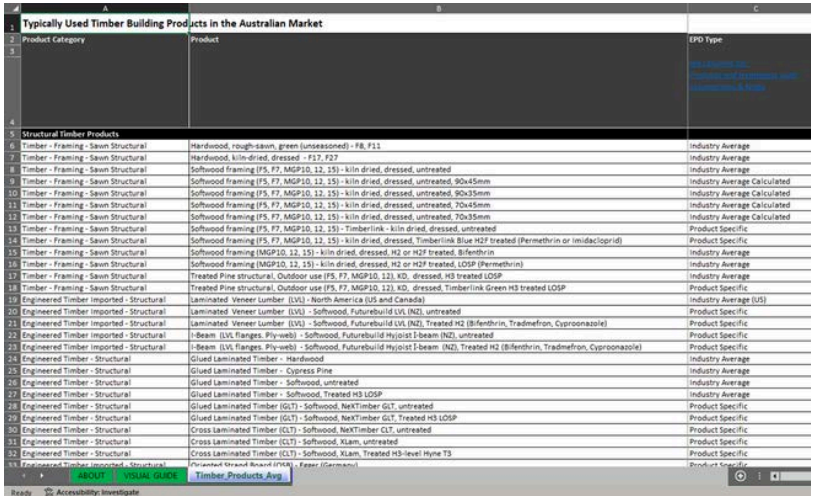
Companies also need to regularly analyse the full range of information provided by the EPDs to identify where they can make improvements in their processes and broader businesses. When improvements have been made then companies should update their EPDs to reflect and promote these improvements.

Industry should also support the development of common models for manufacturing processes – this creates economies of scale through multiple users taking advantage of a common investment and makes EPDs using these models much more affordable.

WoodSolutions has developed the *Australian Timber Products Embodied Carbon Database* [28] which aggregates the embodied greenhouse gas (GWP) emissions for all the major timber products used in the Australian construction market either manufactured in Australia or imported. This resource now provides a single national timber industry agreed source of values for embodied GHG emissions for timber products used in Australia - either manufactured in Australia or imported. Whenever any EPD is updated, or a new EPD is issued, then this information should be supplied to FWPA for inclusion in the aggregated industry database.

	Production
Parameter [Unit]	**A1-A3**
GWP [kg CO_2-eq.]	-718
GWPF [kg CO_2-eq.]	157
GWPB [kg CO_2-eq.]	-875

Table 8: Environmental impacts, 1m³ of dressed, kiln-dried softwood.



R3.5 Utilise Captured and Reused Timber 'Waste' From Both Construction and Demolition

Wood Products Industry

Circular Economy Focused

ISSUE

In building and construction today, there is still a somewhat cavalier attitude towards waste, though things are starting to change with the interest in circular economy principles.

A circular economy is defined as an economic system aimed at eliminating waste and the continual use of resources. Circular systems employ **reuse, repair / remake, and recycle** to create a closed-loop system, minimising the use of resource inputs and the creation of waste, pollution and carbon emissions.

From a materials perspective, the circular economy aims to keep products in use for longer, thereby improving the productivity of these resources. At end-of-product use, materials should no longer be seen just as 'waste', but effectively should be seen as a valued 'feedstock' for another process; either a by-product, or recovered resource for another industrial process, or as regenerative resources for nature (e.g., compost, or for biomass-based products, energy generation – displacing non-renewable fossil fuels).

The circular economy is a concept where wood's physical nature and environmental benefits should shine.

SOLUTION

At the start-of-a-building's-life, all efforts need to be made to:

- minimise actual product use,
- implement design-for-deconstruction principles,
- utilise the most efficient processes to maximise product usage efficiency, and
- utilise any unavoidable waste as a feedstock for another process.

These should, be standard project supply chain requirements of all future construction projects.

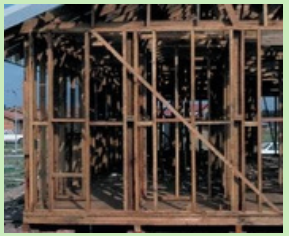
At the 'end' of a building's life, significant opportunities exist for recovering and reusing of materials.

In the residential sector state governments and or local councils should mandate against total demolition of unwanted homes and landfilling disposal of all products. Homes instead should be deconstructed, and all usable materials repurposed.

In the non-residential sector, there is today an increasing use of high carbon storage, large mass timber, offsite constructed systems, particularly using CLT and GLT. It is not unreasonable to assume that economically, these products will have a higher value at the end of a building's life (in 50+ years) than current purchase values, in re-use or re-manufactured applications; so, should be viewed today, as stored assets for a future fibre use opportunity.

Not Demolition Waste – a Valuable Feedstock

For homes constructed pre-1980's the framing material used would have been predominately unseasoned hardwood. This timber, now totally seasoned, could provide a unique and valuable resource for reprocessing into exquisite hardwood appearance products such as flooring or furniture. Even more valuable now in Victoria where Government policy has closed access to public native forests for hardwood timber product supply.



R3.6 Work Collectively Locally and Globally to Advance Bio-based Building Solutions

Wood Products Industry

Local & Global Collaboration

ISSUE

The benefits of sustainably managed forests and wood products, in reducing emissions in the built environment, is now well accepted internationally - **GHG emissions are a global issue and reducing them needs collective global action.**

UNEP [29] notes that:

> Reducing embodied carbon in building materials to net zero is achievable by 2060, if we promote the development and use of best available technologies for decarbonising conventional materials, combined with a major push to advance the increased use of regenerative, circular biomaterials from forest and agriculture streams… Global co-operation is critical towards ensuring a just transition to ethical decarbonisation

At COP28 (6 Dec 2023) a coalition of 17 countries, including Australia, endorsed the *Initiative for Greening Construction with Sustainable Wood* [3]. Since the COP 28 Summit, UNEP and GlobalABC have released the *Global Status Report for Buildings and Construction* [30] which recommends that:

> Governments develop and implement policy and regulatory approaches to reduce embodied carbon in the sector through reuse, circularity and natural or bio-based materials', and also the Ministerial Declaration de Chaillot [31] which acknowledges local, sustainable, bio/geo-sourced, low carbon, energy efficient materials, products and components [5.2.4] and commits to 'promoting the production, development and use of low carbon and sustainably sourced construction material at affordable costs.' [6.5]

SOLUTION

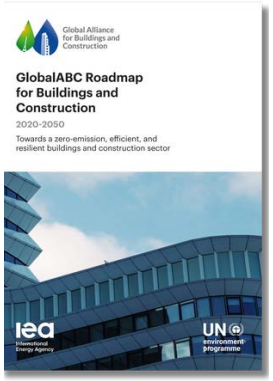
Australia must actively collaborate in the global initiatives to reduce embodied carbon emissions in the building and construction sector; and the local Australian wood products sector must work more efficiently and collectively together at home, strategically and tactically, to advance bio-based building solutions. A formal national *Low Emission Biobased Product Built Environment Carbon Group* should be established.

Industry along with Australian government representatives need to deliver on the intended actions of the *Initiative for Greening Construction with Sustainable Wood* to responsibly accelerate action and scale up impact to:

- advance public policies and enable regulatory frameworks that support sustainable wood production, and that reduce barriers for increased use of wood in construction
- provide systemic collaboration and facilitate access to knowledge and support
- mobilising finance and enhancing risk-taking capacity
- engage societies - promoting a 'wood culture' from the top-down.

Australia should also look to other international guidelines and country-based schemes to assess what works well and what might be adopted in Australia, some of note include the:

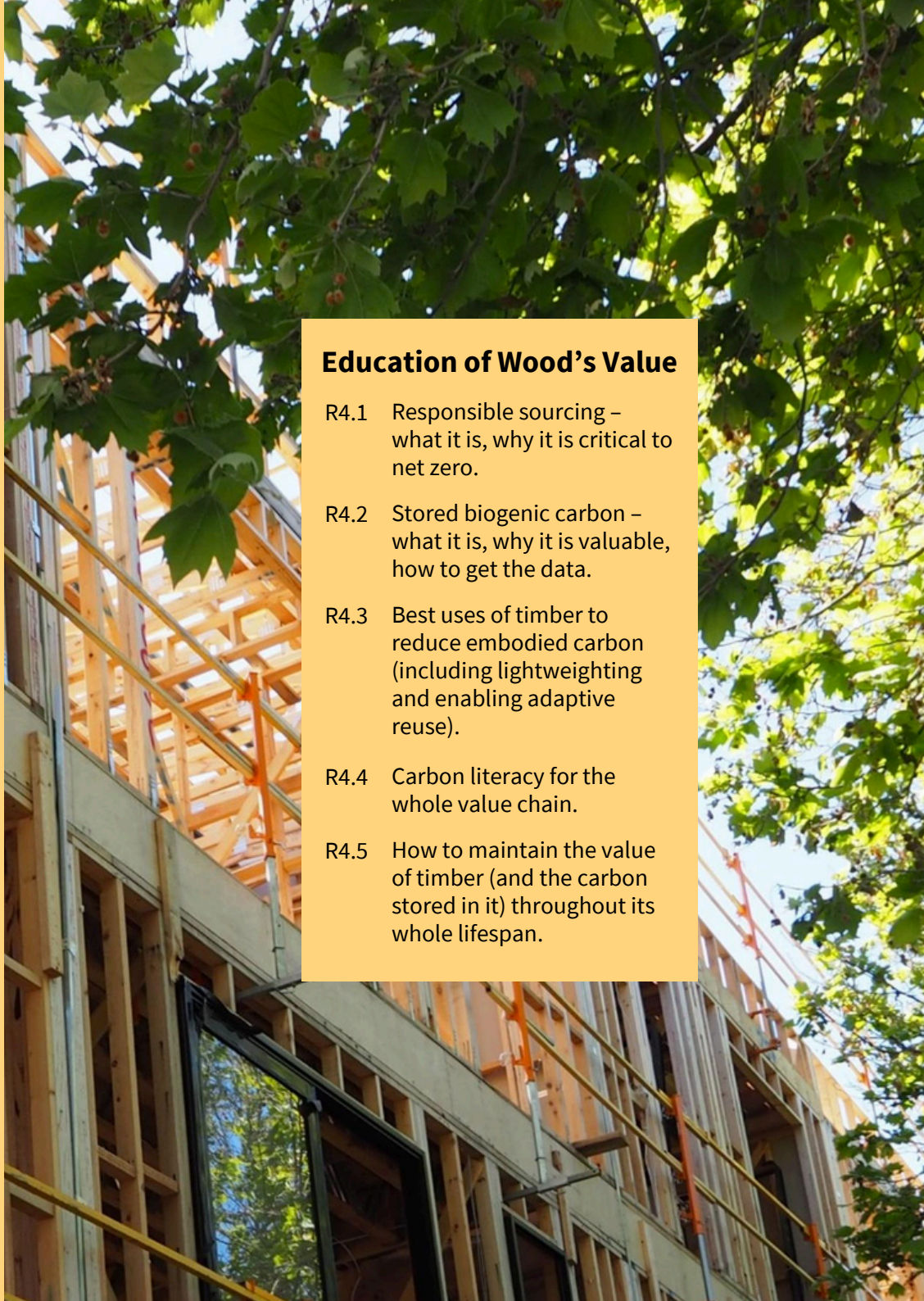
- UNEP *Roadmap for Buildings and Construction 2020-2050 Towards a zero-emission, efficient and resilient buildings, and construction sector* [32].
- CNCA *City Handbook for Building Carbon Neutral Buildings* [33].
- Finland Government's *Wood Building Programme* [34].
- Government low carbon emission building material and wood construction encouragement polices in France, UK, Sweden, Holland, Denmark, Switzerland, Japan, Canada, US, and NZ.



Recommendations – Theme 4 Education of Wood's Value

'Governments and industry coalitions should craft narratives that promote good practices, such as the use of …. traditional low-carbon materials'

UNEP GlobalABC Roadmap for Buildings and Construction



Education of Wood's Value

R4.1	Responsible sourcing – what it is, why it is critical to net zero.
R4.2	Stored biogenic carbon – what it is, why it is valuable, how to get the data.
R4.3	Best uses of timber to reduce embodied carbon (including lightweighting and enabling adaptive reuse).
R4.4	Carbon literacy for the whole value chain.
R4.5	How to maintain the value of timber (and the carbon stored in it) throughout its whole lifespan.

R4.1 Responsible Sourcing – What It Is, Why It Is Critical to Net Zero

Education of Wood's Value

Continuous Improvement

ISSUE

Responsible sourcing is a key issue for all building products and materials.

As our built environment continues to grow, so does the need for healthy, resilient, and positive places. With buildings and fitouts contributing to around 50% of resources used worldwide and about 10% of total global GHG emissions - products need to be identified and rewarded that have lower environmental impact, are transparent, respect human rights, and reduce carbon emissions.

For forest and wood products, responsible sourcing includes forest and chain of custody certification through FSC and or the PEFC.

Responsible sourcing, sustainable forest management practices, and certification, helps to preserve biodiversity, protect and enhance ecosystems, support forest-dependent communities and promote social equity, and assist in mitigating climate change.

As the demand for wood products continues to grow, integrating responsible sourcing principles into construction practices is essential for creating a more sustainable and resilient built environment for future generations.

SOLUTION

Education about the importance of responsible sourcing is critical for all involved in the built environment - the material supply chain, building design professionals, voluntary environmental schemes and tools, regulators, and governments.

Responsible sourcing of wood products helps to preserve valuable ecosystems and biodiversity. Forests are home to a vast array of plant and animal species, many of which are endangered or at risk of extinction due to habitat destruction and fragmentation. By ensuring that wood products are sourced from sustainably managed forests, we can protect biodiversity and ecosystem services, such as water purification, soil stabilization, and climate regulation, which are essential for maintaining the health of the planet.

Furthermore, responsible forest management contributes to the socioeconomic wellbeing of forest-dependent communities. Certified forestry operations adhere to principles of social responsibility, including respect for Indigenous rights, equitable benefit-sharing, and community engagement. By supporting sustainable livelihoods and economic opportunities in rural areas, responsible forest management helps to alleviate poverty and promote social equity, which are essential components of sustainable development.

Chain of custody certification ensures the traceability of wood products from the forest to the consumer, providing transparency and accountability throughout the supply chain. This helps to prevent the illegal logging and trade of timber, which is associated with deforestation, biodiversity loss, and social conflicts. By promoting legal and sustainable forestry practices, chain of custody certification helps to create a level playing field for responsible actors in the wood products industry while deterring illegal and unsustainable practices.

R4.2 Stored Biogenic Carbon – What It Is, Why It Is Valuable, How to Get the Data

ISSUE

With the growing interest by building professionals, regulators, and governments at all levels on embodied emissions impacts there **continues to be misunderstanding, and lack of recognition, around biogenic carbon, and its benefits, particularly in the built environment.**

Biogenic carbon is the carbon that is absorbed and stored (sequestration) by plants and trees through the process of photosynthesis.

All wood products contain biogenic carbon that has been sequestered through the growth of the trees. Each cubic metre of Australian sawn softwood and hardwood timber stores 0.9 and 1.22 tonnes respectively, of CO2 -eq sequestered from the atmosphere – or a simple easy to remember average figure is there is 1 tonne of CO2 -eq stored in 1cubic meter of wood.

Biogenic carbon also remains stored in timber products for the life of the product. This is particularly valuable with buildings constructed from timber as they effectively become carbon storage units.

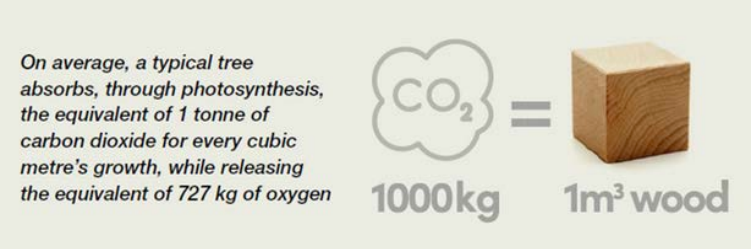
An even greater carbon gain comes from the substitution effect of using wood in place of other, more fossil fuel-intensive materials. Data differs according to material, as well as to country, however all agree that considerable CO2 savings can be made by using wood where appropriate, instead of other materials [35].

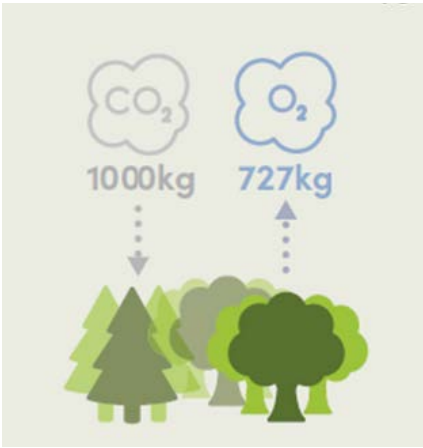
SOLUTION

There needs to be active, consistent, ongoing education to ensure there is acknowledged recognition of the scientific fact that all wood products contain biogenic carbon, and if this wood comes from a certified sustainable and renewable forest source, then this stored biogenic carbon should be recognised as a benefit for timber construction in the built environment in policy, strategies, and rating tools.

The leading national commercial building rating tool, NABERS, recognises the stored biogenic carbon in wood products by reporting it using a separate *Stored Biogenic Carbon Indicator* (see R2.3). A NABERS technical report [23] also '…recommend(s) that both NABERS and wood product manufacturers advocate for stored biogenic carbon to be accounted for in decision-making alongside the final star rating.'

Detailed information on the emission footprint of wood products, including the stored biogenic carbon data, are contained in Environmental Product Declarations (EPDs), For timber products used in the Australian markets these EPD values are accessible from the *WoodSolutions Australian Timber Products Carbon Emissions Database* [28].





Steps Towards a Greener Future | Progress Towards Net-Zero | 33

R4.3 Best Uses of Timber to Reduce Embodied Carbon (Including Lightweighting and Enabling Adaptive Reuse).

Education of Wood's Value

Expanded Use

ISSUE

Timber can be used in a wide range of construction applications, and markets, to reduce overall embodied carbon emission effects.

Timber roof and wall framing is by far the predominant material traditionally used in residential home construction. The weighted average home in Australia uses 14.6m3 of sawn softwood [36], assuming an average nationally yearly build of 100,000 detached homes from timber, and a total cradle to gate net GWP emission value [8] of -718 KgCO2eq/m3, (allowing for a net biogenic sequestration of -875kg CO2-eq GWP-biogenic, and 157kgCO2-eq GWP fossil emissions), this equates to around 1.05 million net tonnes of CO2 stored in these homes – a massive amount.

Apartment blocks in Australia are traditionally built out of high emitting concrete, if more low-rise apartment blocks are built using lightweight timber systems, and mid-rise apartments using mass-timber systems, then more carbon can be stored, and significantly more carbon emissions saved recognising the material 'substitution effect'.

Considering 'Adaptive Reuse' of building - the process where existing buildings are reused at end-of-life in a different capacity to their original purpose, timber construction again provides a major advantage, as its comparative lightness means additional storeys of timber can often be added to existing buildings during refurbishment (vertical extensions), increasing their usable value and preventing them from being demolished in processes that consume a significant amount of energy.

SOLUTION

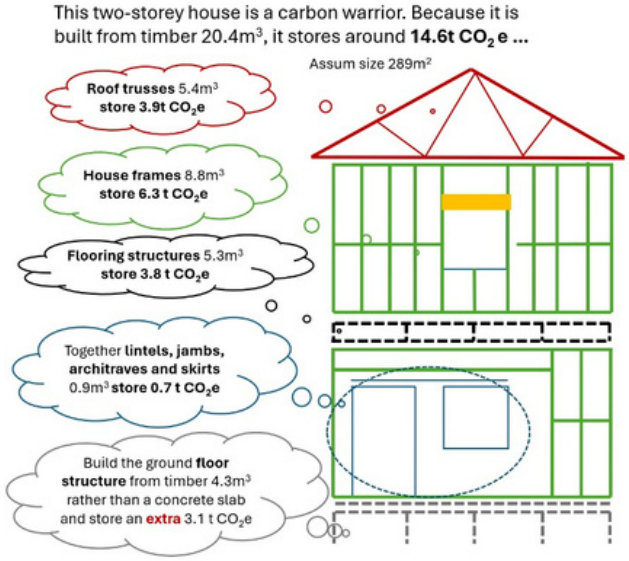
Use more timber construction materials in residential and low to mid-rise construction.

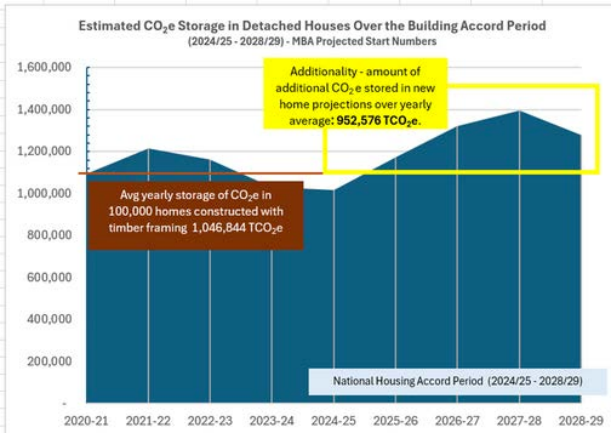
Continue to use lightweight timber framing in residential – detached homes and townhouses, and expand the use of timber construction products in the non-traditional markets such as apartments, offices, schools, aged care, and hospitals. As well as the embodied carbon benefits achieved here, there are also biophilic and wellness benefits [7] when timber is left exposed; and construction, speed, efficiency, and cost benefits using offsite fabrication methodologies.

The Federal Government Housing Accord projections of 1.2 million new homes over 5 years means a need for 240,000 new dwellings built annually – which effectively is an additional 80,000 dwellings a year nationally, compared with current completion levels:

- for detached homes these could all be timber providing an additional 952,000 tonnes of carbon emission storage (CO2e)
- for apartments – more timber lightweight and mass timber use should be the aim.

Another major opportunity for carbon emission reductions is to substitute raised timber construction for concrete slabs in flood-prone zones, and on highly sloping sites, where a raised timber floor is simply a much better construction option for the customer, and each raised timber floor stores an extra 3.1t CO2e.





R4.4 Carbon Literacy for The Whole Value Chain

Education of Wood's Value

Clear Understanding

ISSUE

The current interest and action, both globally and in Australia, to achieve net zero carbon by 2050 is unprecedented. Governments, industries, and the public are all trying to get their heads around this important topic, what it means from their different perspectives, and how it might be achieved.

There is a desperate need for a higher level of literacy and understanding by all involved, as the concepts and details are not simple, and the knowledge, the language, and the support programs are rapidly evolving.

From a forest and wood products sector perspective, this current collective global concern, interest, and action to reduce GHG emissions, particularly carbon dioxide, provides a unique once-in-a-generation opportunity to explain in a truly, undeniable, and scientific way the broad benefits of forests, and wood products from sustainably and actively managed production forests.

Only biobased products can claim to be true net CO2 sequestering and carbon storing – a hugely unique and important attribute when it comes to the choice and use of the wide array of building products available.

SOLUTION

True carbon literacy for the whole value chain must be a priority.

Recognizing the current confusion with terminology MECLA has developed and published a *Dictionary of Carbon* [37] which provides common language definitions for popular carbon-related terms used in the built environment and related industries. MECLA Material Working Groups have also published a series of publications to help provide industry and government with guidance on embodied carbon.

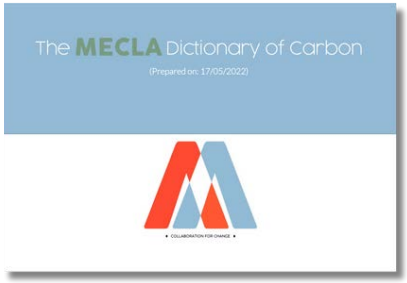
The forest and wood products industries also have a range of educational initiatives including, *The Ultimate Renewable* program and three carbon and net-zero related publications [38]:

- a Carbon Glossary and Primer, explaining concepts & terms
- a policy focussed document Forests, Plantations, Wood Products and Australia's Carbon Balance
- a WS Technical Design Guide No#55 The Role of Wood Products in Zero Carbon Buildings focussed on informing building professionals.

Other wood products sector groups initiatives include the Frame and Truss Manufacturers Association of Australia's (FTMA) *Carbon Warrior* program [39] which advocates for Australian government policies and regulations promoting the use of renewable materials to assist the built environment lower their impact on climate change, similar to other international government initiatives.

Individual companies are also sharing their product carbon emission profiles through product specific EPDs.

Governments and industry coalitions need to continue to craft narratives that promote good practices, such as the use of traditional low carbon materials.



R4.5 How To Maintain the Value of Timber (and the Carbon Stored in It) Throughout Its Whole Lifespan

Education of Wood's Value

Value Acknowledgement

ISSUE

Timber's true total value in its use in the built environment comes from:

- the investment in growing the forests, both financially and ecologically
- the biogenic carbon which is taken from the atmosphere and stored within it
- its constructability and suitability as a high strength to weight ratio structural material, combined intrinsically with
- its aesthetic beauty and biophilic benefits as a natural material.

Timber is sometimes viewed though as a resource that is used once and then disposed of at the end-of-life, either through landfill or burning.

The biogenic carbon that is stored in timber is not viewed as a 'permanent storage' solution which should be actively preserved through future reuse, recycling, or potentially even storage in non-oxygenated conditions.

Exposed timber that is unprotected can weather and degrade over time, reducing its value.

SOLUTION

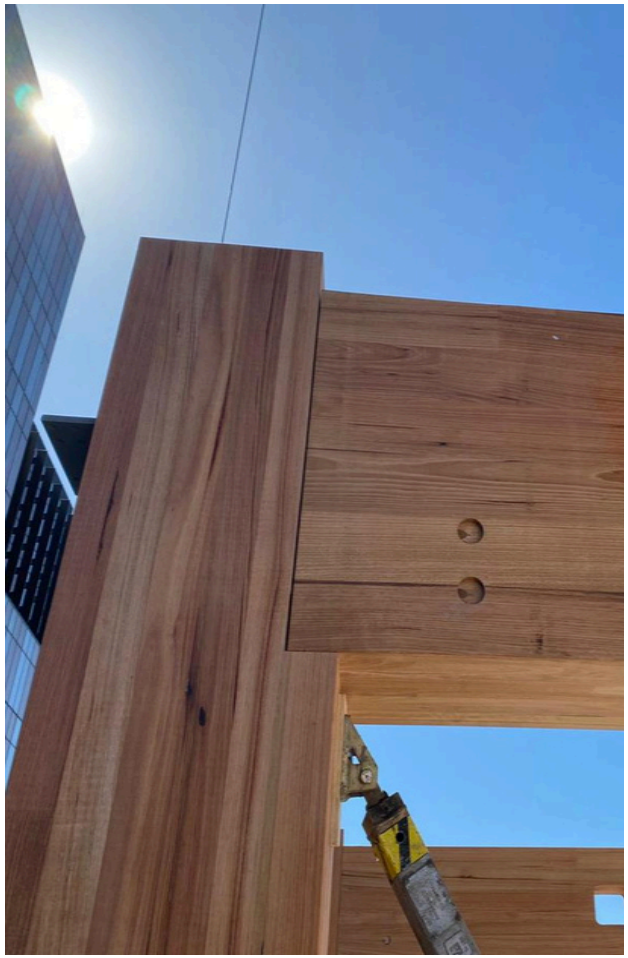
The true value of forest and wood products needs to clearly, and unambiguously, recognised and fostered by governments, the building industry, and the community for the significant social, economic, and environmental - ecological and stored carbon - benefits they provide.

The value of the stored carbon in timber products should be recognised in building project assessments of value to the community by applying Infrastructure Victoria's [14] recommended Carbon Value of 'at least $123 per tonne' (of carbon dioxide equivalent); similar to the NSW Governments value.

This means that 1 m3 of wood, which contains approx. 1 tonne of CO2-e (see R4.2), would have at least $123 of economic value while in use as measured as a reflection of the cost to society, or society's willingness to pay to avoid the impact of emissions.

Wood's potential value at the end of its first building life needs to also be acknowledged. There is absolutely no doubt that mass timber products currently being used, including beautiful hardwood and softwood GLT and CLT, will have a higher value at the end of a building's life (in 50+ years) than current purchase values, in re-use or re-manufactured applications. In terms of a product stewardship approach the timber industry should perhaps mark all timber products 'return to manufacturer' – this might generate some interesting discussion from project developers as to the value and ownership interest of the asset they have purchased.

Exposed and internal structural timber element also need to be inspected and maintained during their use period to preserve their integrity and strength and to ensure their extend life into future applications.



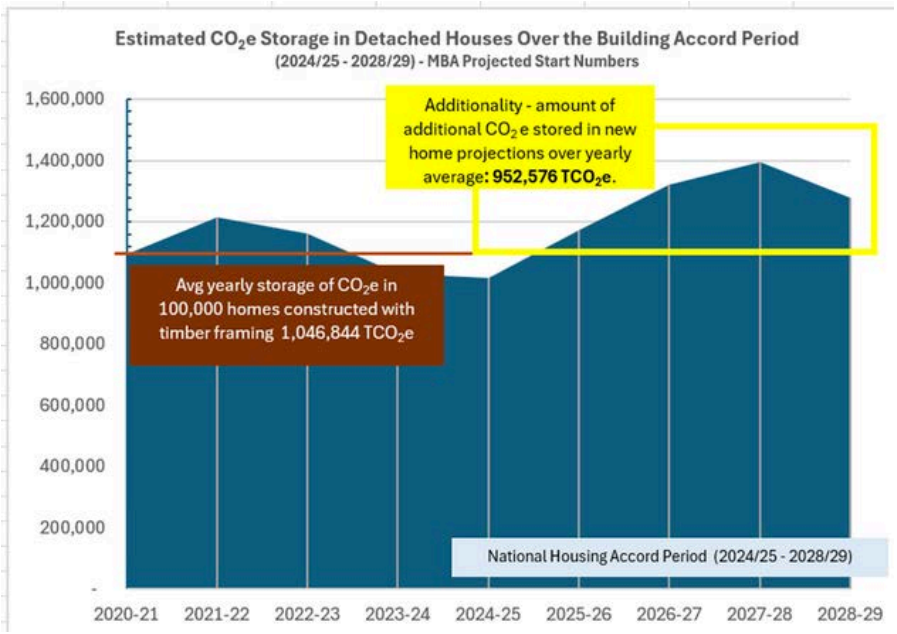
T3 Wellington St, Melb - Mass timber (MASSLAM GLT)

Engineered Wood Products & Systems A Solution to Assist Significant Carbon and CO2e Storage Potential

→

The Australian Building Challenge
1.2 million new homes over 5 Years

A massive amount of CO2 is stored in the detached homes we already build, and **a significant volume more potentially stored if we build more timber framed homes under the Housing Accord**



To meet the Housing Accord, new low and mid-rise apartment units are going to be a major focus – the Missing-Middle.

These dwelling also could.be constructed using low embodied building material and construction solutions – such as timber!

A few small policy tweaks and we can increase the amount of carbon stored in our dwelling stock – by using more timber.

New Government Mandate:

'All new homes in the future in flood prone zones, and on significant sloping sites, to be constructed as an elevated timber ground floor.'

- benefit here is that this timber will store carbon (an extra 3.1t CO2e/floor) and additionally will displace the concrete which is a high carbon emitter'.

New Government Guidelines:

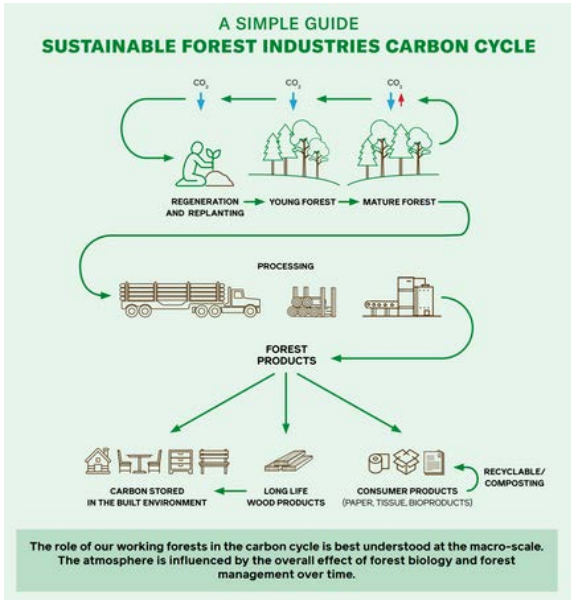
'Any future construction under the Housing Accord should, where feasible, require responsibly sourced wood and timber systems to be considered as the primary construction material.'

- If 100% of new detached homes use timber equates to an additional 952,576 tCO2e stored.
- If 50% of new apartment units (<9 storey) were built in timber, then potentially 558,126 tCO2e might be effectively stored.

Applying a Carbon Value to the community of $123/t to the numbers above gives potential savings of $117 and $68 million respectively.

Industry Snapshot

Australia [40][41]



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