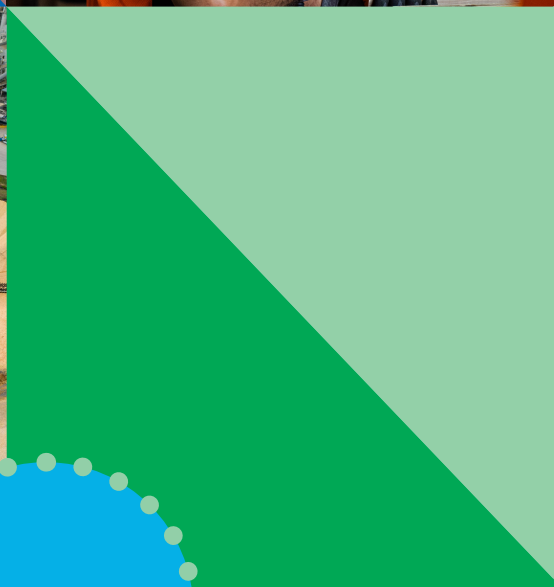




**Indufor**



# **VICTORIA'S FUTURE WOOD FIBRE INDUSTRY ROADMAP TO 2050**



Publication: Victoria's Future Wood Fibre Industry Roadmap to 2050

Project No: VNA664-2324

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**FWPA**  
Forest & Wood  
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**Indufor**



## PREFACE

Indufor Asia Pacific (Australia) Pty Ltd ('Indufor') has prepared this future wood fibre roadmap (the 'Roadmap') for the Victorian Forest Products Association ('VFPA'), the wood fibre industry more broadly, and stakeholders of this industry including the Victorian State Government, the Australian Government, and local governments across the state, providing support to renewable industries.

The primary objective of the Roadmap for Victoria is to identify priority opportunities and actions for the improved use of various wood fibre sources, including by-products and wood product manufacturing residues, end-of-life 'wood waste', and forestry biomass, in a broader range of innovative wood-based products.

The Roadmap recognises the significant contribution that the forest and wood products industry has made to Victorian communities and the economy, over many decades. This contribution goes well beyond the socio-economic impacts of economic activity and employment across the state; it includes directly supporting the active and adaptive management of State forests, the establishment of highly productive plantation forest estates across national plantation regions, and an extensive, skilled workforce with capacity to support land management and forest fibre management to protect natural resources and regional communities.

Looking to the future, the Roadmap recognises the significant ongoing innovation in the development and application of technologies, such as the accelerating shift towards more use of engineered wood products, as well as an exciting range of emerging bioproducts and biofuels, complemented by large scale recycling programs that contribute to a more circular bioeconomy.

Moreover, the Roadmap recognises the vital role the sector can play in addressing key State government policy objectives of meeting the housing needs of a growing population in Victoria, while also reducing emissions to meet net zero targets and contributing to a resilient Victorian economy through a range of new products and supply chain innovations.

This Roadmap will lead to Victoria being a global leader in the use and reuse of wood fibre from sustainable managed forests and advanced manufacturing of a diverse range of innovative, high-value products for a circular bioeconomy benefitting regional communities and the state.

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## A CALL TO POLICY MAKERS

*“2050 is both far away and around the corner... 2050 seems far away, but in fact encompasses just two investment cycles for most of our industries. Decisions cannot wait long.”*

Confederation of European Paper Industries, ‘Unfold the future’, 2011

This Roadmap for Victoria sets a new vision for the forest industry and the state.

*This new vision is for Victoria to be recognised as a global leader in the use and reuse of wood fibre from sustainable managed forests, and advanced manufacturing of innovative, high-value products for a circular bioeconomy, which has transformed regional communities and the state.*

This vision reflects the significant potential and capacity of the wood fibre industry to provide heavy lifting towards Victoria’s key policy objectives over the next two decades. These objectives include realising the State’s emission reduction targets by 2035 and Net Zero by 2045; strengthening the advanced manufacturing capabilities of local firms by investing in technology adoption and upskilling the future workforce; and establishing a world class circular economy system that helps build a more sustainable future for all Victorians.

More boldly, the wood fibre industry can enable this circular economy to become a more sustainable *bioeconomy*, initially within regional hubs, which can underpin the viability of co-located manufacturing facilities, and then link into a broader network that strengthens and underpins the future for Victoria.

To do so, the industry requires policy recognition and support for the Roadmap and the strategic priorities over the next 5-10 years and the decades to 2050. Specifically, policy makers at the federal, state and local government levels can support the industry in the following ways:

1. Establish clear policies promoting the vital importance of a world class, innovative and advanced wood fibre manufacturing sector, based on sustainable forest management, to meet socio-economic needs and the resilience of regional communities and the state.
2. Establish a State Government policy requiring new construction projects to give preference to domestic production of sustainable timber products including engineered wood products, specifically to reduce embodied carbon in Victorian homes and buildings.
3. Support the State Government to adopt a framework for measuring embodied carbon in the built environment and introduce embodied carbon reduction requirements for new buildings, houses and government-funded projects.
4. Fully implement and build on the Gippsland Plantation Investment Program (GPIP) to grow the State’s softwood resource base and support domestic value adding manufacturing.
5. Scope and establish a dedicated hardwood plantation development program focused specifically on growing sawlogs and peeler logs to replace native forest hardwood timber production and support domestic value adding manufacturing including laminated timbers and composites.
6. Facilitate feasibility studies for further investment in new or expanded value adding manufacturing to complement existing capacity in key regions, including glue-laminated timbers, laminated veneer lumber, strand board products, and emerging bioproducts.
7. Support efficient and effective implementation of ACCU Scheme methods to facilitate new plantation establishment for long rotation softwoods *and* hardwoods, and recognition of carbon stored in harvested wood products.
8. Facilitate State government recognition of the vital role the wood fibre industry can play in developing a circular bioeconomy in regions with integrated supply chains and innovation.



## Victoria's wood fibre sector

Victoria's wood fibre industry, encompassing the harvesting of sustainably managed forests, processing and manufacturing of forest products, including wood and pulp & paper products, makes a substantial contribution to the State's economy, with total sales and service income of over \$9 billion (bn) in 2022-23, representing around 1.7% of Victoria's gross state product (GSP), especially in regional centres and communities.

The industry is based on sustainable management and utilisation of a renewable resource, with independent, third-party certification by international forest management certification schemes, notably PEFC and FSC. Victoria can claim to being the leading state for plantation forestry in Australia with the following attributes:

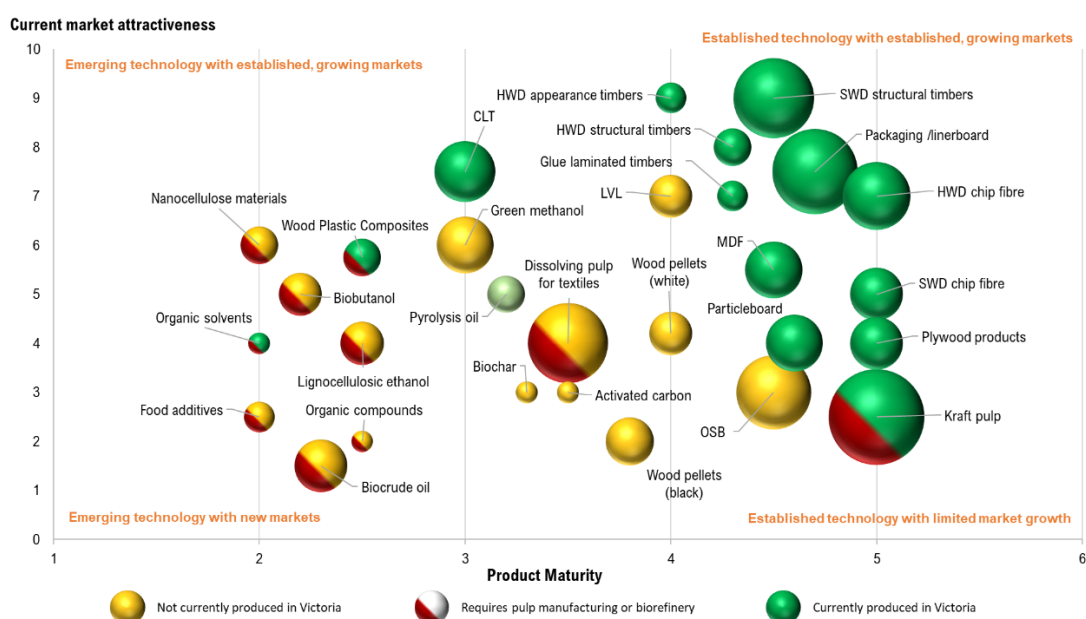
- the largest plantation area – around 23% of the national plantation estate
- the highest level of plantation wood production – approximately 29% of total production
- the largest producer of plantation hardwood fibre - over 37% of total production in 2022-23
- substantial domestic processing capacity including advanced manufacturing of innovative timber products and appearance grade hardwood products for feature applications
- the second highest level of employment in the forestry and wood processing sector in Australia (after NSW), with over 15,250 direct employees reported in the 2021 census.

## Emerging wood fibre product opportunities

Victoria produces a wide range of wood fibre-based products, now manufactured primarily from plantation forest fibre, supplemented by hardwood imported products. The manufactured products include a range of solid wood products, wood-based panels, kraft linerboard and packaging paper products, as well as softwood log and woodchip exports.

While the current base of production and manufacturing represents a broad range of products, there is considerable scope for innovation and growth, in ways that would enable Victoria to improve utilisation and increase value adding – and potentially become a national if not international leader in bio-manufacturing, and product innovation, based on a sustainable supply of renewable resource for construction and broader range of applications. A summary of existing products and new and emerging product opportunities is set out in **ES 1**.

## ES 1 Existing wood fibre products and emerging opportunities for Victoria



Source: Indufor

The development of the Roadmap has indicated the most prospective opportunities for further value-added manufacturing beyond expansion of existing manufacturing, especially over the next 5-10 years, include but are not limited to:

- engineered wood products such as LVL and additional glue-laminated timbers
- new bioproducts such as green methanol and pyrolysis oil
- potentially dissolving pulp for textiles, noting this will require pulp and paper manufacturing or biorefinery manufacturing processes
- other biofuels including white wood pellets.

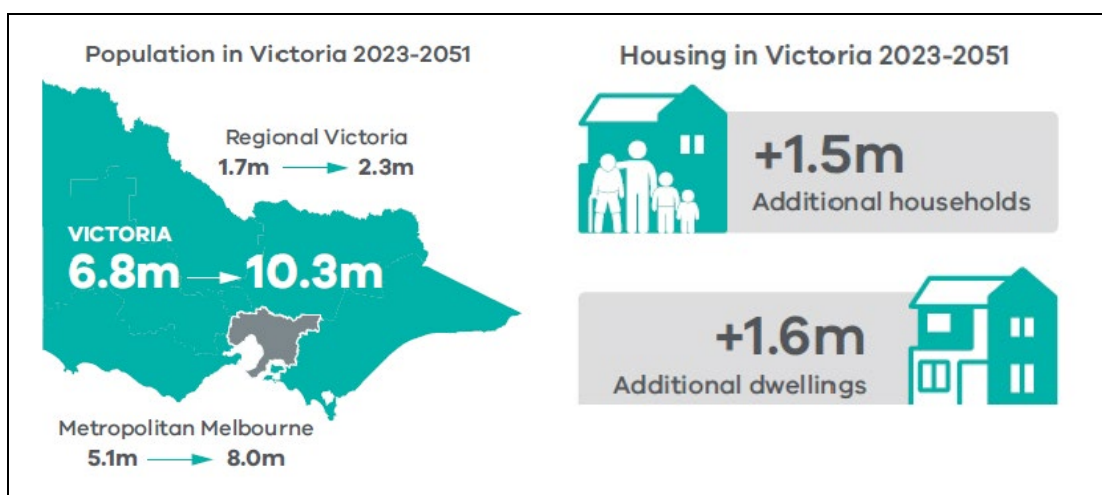
The wood fibre industry in Victoria and its adjacent regions is currently working on some of these opportunities, while others will require further consideration through feasibility studies.

### *Megatrends and key outlook considerations*

The development of the Roadmap incorporated consideration of megatrends and other key drivers of market demand for a broad range of existing and emerging products. The main themes arising from this scan include the following implications for Victoria:

- increasing demand and pressures placed on resources, including wood fibre (**ES 2**)
- increasing demand for decarbonisation to meet Net Zero targets
- increasing drivers to add value to wood fibre through advanced manufacturing.

### **ES 2 Population and housing projections for Victoria, 2023-2051**



Source: Victoria in Future 2023

These themes converge around the conceptualisation of a more circular bioeconomy in Victoria, or specific regions, within which the industry aims to maximise the value of wood fibre by:

- utilising sustainable forest management practices
- promoting carbon sequestration in forests and carbon storage in long lived wood products
- ensuring a cascading allocation of wood fibre products to the highest and best use
- investing in advanced, agile manufacturing of a broad range of high value bioproducts, and
- implementing zero waste processes throughout production stages.

In this context, maximising the value and potential of wood fibre will rely on an ongoing process of product development, for existing and emerging products, supported by coordinated and targeted research and development programs.

### Strategic priorities for the industry

These considerations and analysis led to five key strategic priorities to realise the proposed vision for Victoria's wood fibre industry in 2050. These priorities encompass leadership requirements and actions for industry companies including forest growers and wood fibre processors and manufacturers, regional forestry hubs, R&D organisations and service providers, and government agencies at the federal, state and local levels.

The five key strategic priorities comprise the industry imperatives to:

1. increase value added manufacturing along a wood fibre cascade to highest and best use
2. increase hardwood and softwood plantation forest resources to support increased domestic production of manufactured wood products for the built environment
3. increase recovery and reuse of wood fibre for improved efficiency and circularity
4. decarbonise the wood fibre sector to attain net zero targets and climate positive outcomes
5. support ongoing product innovation for a more circular bioeconomy.

These priorities are aligned with Victorian State Government policy commitments, and some Australian Government policy commitments, as outlined in **ES 3**.

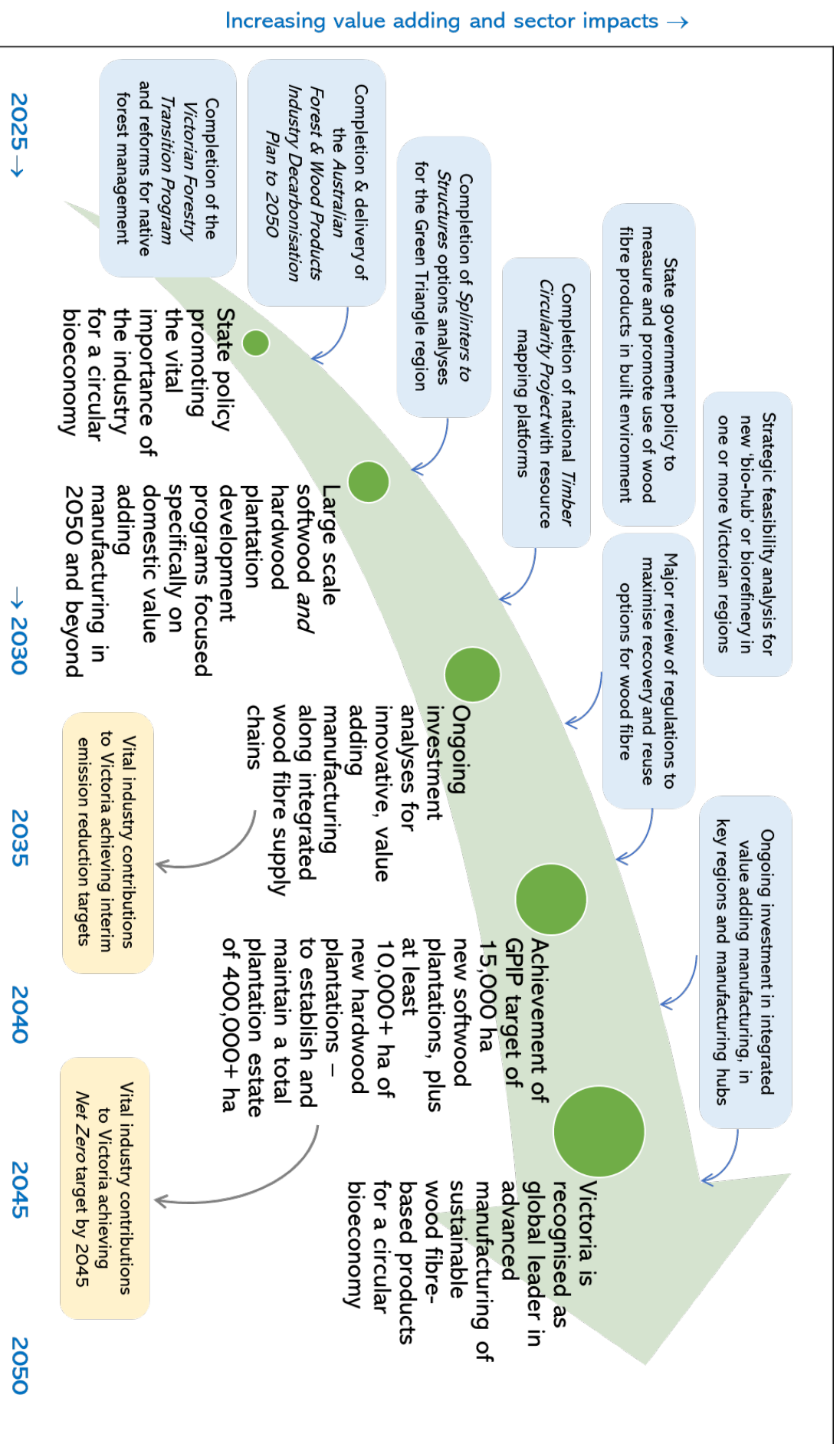
### ES 3 Alignment of strategic priorities with relevant government commitments

Strategic priorities	Alignment with relevant government commitments
<b>1. Increasing value added manufacturing along a wood fibre cascade to highest value use</b>	<ul style="list-style-type: none"><li>• <i>Made in Victoria 2030: Manufacturing Statement (2022)</i>, which aims to enhance sovereign capability and advanced manufacturing, attract and stimulate investment, increase productivity, and create new jobs for Victoria</li></ul>
<b>2. Increasing plantation forest resources to support increased domestic production of manufactured wood products for the built environment</b>	<ul style="list-style-type: none"><li>• <i>National Forest Industries Plan 2018</i>, to support growth in the renewable timber and wood-fibre industries, innovate, and realise the national ambition to plant a billion new plantation trees (~one million ha) by 2030</li><li>• <i>Greening Construction with Sustainable Wood</i>, an Australian Government commitment in 2023 to advancing policies and approaches that support low carbon construction and increase the use of wood from sustainably managed forests in the built environment</li></ul>
<b>3. Increasing recovery and reuse of wood fibre for improved efficiency and circularity</b>	<ul style="list-style-type: none"><li>• <i>Recycle Victoria: A new economy</i>, a state policy platform that aims to reduce waste, increase recycling and create more value from our resources, with monitoring progress towards a new circular economy</li><li>• <i>Victoria's Circular Economy Innovation Fund</i>, which provides funding to stimulate innovation and build capability in the circular economy</li></ul>
<b>4. Decarbonising the sector to attain net zero targets and climate positive outcomes</b>	<ul style="list-style-type: none"><li>• <i>Victoria's Climate Change Strategy</i>, with updated targets to target to reduce Victoria's emissions by 75 – 80% by 2035 and achieve net-zero emissions from 2050 to 2045</li></ul>
<b>5. Supporting the ongoing product innovation for a more circular bioeconomy in Victoria</b>	<ul style="list-style-type: none"><li>• <i>Made in Victoria 2030: Manufacturing Statement</i></li><li>• <i>Recycle Victoria: A New Economy</i></li><li>• <i>Innovation Victoria: Innovation Statement (2021)</i>, which aims to drive growth in the sectors of the future, from advanced manufacturing to emerging digital technologies</li></ul>

The Roadmap for implementation of these strategic priorities for Victoria's wood fibre industry, to realise its 2050 vision, is set out in **ES 4**.



## ES 4 Implementation roadmap for Victoria's future wood fibre industry, 2025 to 2050



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# INTRODUCTION

- 1.1 Why the Roadmap?
- 1.2 Roadmap objectives



## 1. INTRODUCTION

### 1.1 Why the Roadmap?

*“Forestry, through its harvested wood, timber, and paper and pulp products, is at the heart of Victoria’s circular economy and essential to achieving net zero by 2050.*

*Wood will be required for bioenergy, to house our growing population, to provide packaging and hygiene products and to build our clean, low carbon future”.*

*VFPA (2022) Our future grows on trees.*

Victoria’s wood fibre industry, encompassing the harvesting of sustainably managed forests, processing and manufacturing of forest products, including wood and pulp & paper products, makes a substantial contribution to the State’s economy, with total sales and service income of over \$9 bn in 2022-23, representing around 1.7% of Victoria’s gross state product (GSP), especially in regional centres and communities.

The industry is based on sustainable management and utilisation of a renewable resource, with independent, third-party certification by international forest management certification schemes, notably PEFC and FSC.

Furthermore, there is considerable scope for innovation and growth, in ways that would enable Victoria to develop a more circular, low carbon bioeconomy – and potentially become a national if not international leader in bio-manufacturing, and product innovation, based on a sustainable supply of renewable’ resource for construction and broader range of applications.

However, at present, there is no clear roadmap or strategic plan for the whole of the industry, to highlight the opportunities for further innovation and growth, and galvanise industry and public policy support for targeted investments in research, infrastructure and enabling conditions to realise this growth potential.

In contrast, other jurisdictions such as Canada and the European Union have clearly recognised the essential and central role the forest fibre industry can play in realising net-zero targets and developing a ‘bioeconomy’, as illustrated in the following statements from relevant roadmaps:

*“The forest products sector ... has an essential role to play in the transition to a low-carbon economy. Forests are powerful engines for sequestering carbon: as trees grow, they absorb significant volumes of it. When trees are harvested, carbon is locked into the wood over the long term. Long- lived wood products, such as construction materials, keep carbon out of the atmosphere for decades or centuries. Recycling or reusing forest products can prolong the time carbon is stored.”<sup>1</sup>*

*Forest Products Association of Canada (2023) Roadmap Towards Net-Zero*

*“The forest fibre industry, drawing as it does largely on EU raw materials, will have a central role to play in the bioeconomy, where the focus will be on sustainable, renewable and recyclable raw materials, used in the most optimal way, and creating the highest possible added value”<sup>2</sup>*

*CEPI (2011) The Forest Fibre Industry: 2050 Roadmap to a low-carbon bioeconomy.*

Concurrently, the World Business Council for Sustainable Development (WBCSD) is developing a Forest Sector Net-Zero Roadmap, through a phased approach that introduces three main levers for the forest sector to enable this climate action for a net-zero transition. These are:

- A. Reduce greenhouse gas emissions in operations and across the value chain;
- B. Increase carbon removals through sequestration in sustainable working forests and storage in forest products;
- C. Grow the circular bioeconomy through the substitution of non-renewable and fossil-based materials with forest products.

<sup>1</sup> FPAC (2023) *Climate Change Mitigation in Canada’s Forest Products Sector: Roadmap Toward Net-Zero.*

<sup>2</sup> CEPI (2011) *The Forest Fibre Industry: 2050 Roadmap to a low-carbon bio-economy.*

The climate change mitigation potential of all three of these levers is cumulative and the WBCSD has called on forest companies to be working on all three simultaneously to maximise their contribution to the net-zero transition globally.

The WBCSD has also identified four net-zero 'opportunity spaces' that are relevant to Victorian settings. These opportunity spaces comprise low-carbon operations; climate-positive land use; circularity; and product innovation (Figure 1-1).

**Figure 1-1 Four opportunity spaces to realise the potential of the forest sector's three levers of impact for a net-zero transition**



Source: World Business Council for Sustainable Development

In this context, recognising the same or similar challenges and opportunities in Australia, the Victorian Forest Products Association (VFPA) has identified the need for a clear roadmap to set the path that leads to the vision of a more circular bioeconomy, based on sustainable supply of wood fibre resources to a world-leading biomanufacturing hub in Victoria.

## 1.2 Roadmap objectives

This report presents a future wood fibre roadmap for Victoria (the Roadmap), looking to 2050 and beyond. The Roadmap will specifically identify priority opportunities for the improved use of various wood fibre sources, including by-products and wood product manufacturing residues, end-of-life 'wood waste', and forestry biomass, in a broader range of innovative wood-based products.

This Roadmap is intended to support VFPA's vision of repositioning the forestry sector as a key contributor to a resilient Victorian economy through a range of new products and supply chain innovations.

Additionally, the VFPA has developed this Roadmap to align with and recognise the capacity of Victoria's sector to contribute towards State and Federal Government objectives to decarbonise the economy and develop a more circular bioeconomy and highlight the necessary policy and regulatory settings to fully realise the potential of Victoria's wood fibre industry.

The Roadmap has been developed through a consultative process incorporating an extensive review of relevant literature, complemented by a consultation with an interdisciplinary Reference Group and a broad range of interviews with key stakeholders within and across the sector.



# VICTORIA'S WOOD FIBRE SECTOR

- 2.1 Forest fibre resources
- 2.2 Current range of wood fibre products
- 2.3 Recovery and recycling of wood fibre
- 2.4 Socio-economic contribution of the sector



## 2. VICTORIA'S WOOD FIBRE SECTOR

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

Intergovernmental Panel on Climate Change (2007)

### 2.1 Forest fibre resources

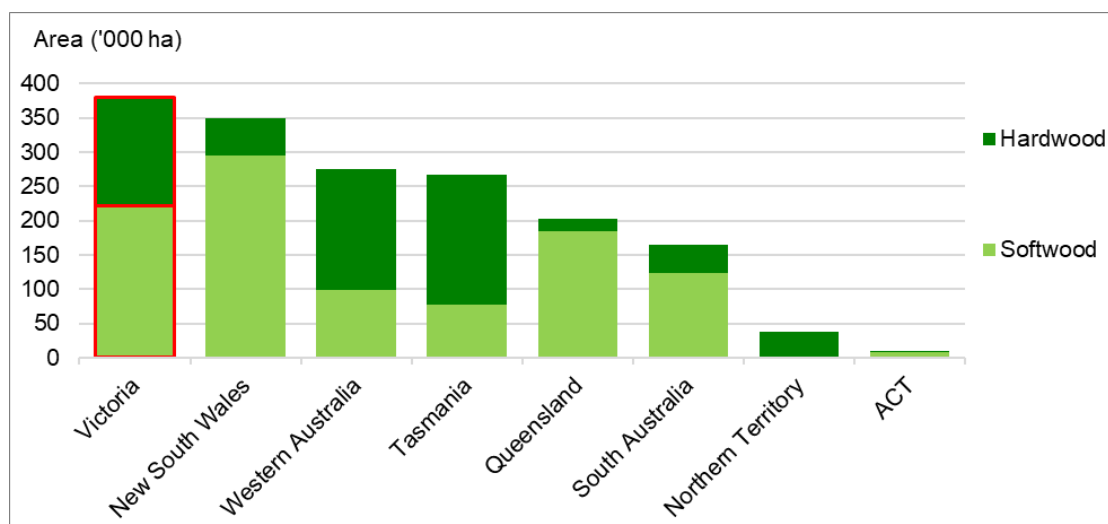
Victoria's wood products sector was historically based on a log supply from native forest hardwoods. However, the State Government policy decision to cease timber harvesting in public native forests from 2024 onwards means the future supply of forest fibre will be predominantly plantation fibre based, with a complementary supply of imports.

As a result of the closure of the native forest timber industry, and preceding to challenges to these operations, the manufacturing capacity of the sector contracted over the past five years especially. This means the future of the industry will need to feature new investments in greenfield facilities designed specifically for existing and emerging plantation resources.

Victoria's plantation estate currently totals around 380,000 hectares (ha) and comprises mainly radiata pine (*Pinus radiata*) softwoods and *Eucalyptus* species hardwoods. Victoria can claim to being the leading state for plantation forestry in Australia with the following attributes:

- The largest plantation area – around 23% of the national plantation estate (Figure 2-1)<sup>3</sup>.
- The highest level of plantation wood production – approximately 29% of total production.
- The largest producer of plantation hardwood pulpwood in Australia accounting for over 37% of total production in 2022-23. This proportion increases to 43% when the South Australian volume exported through Portland is included<sup>4</sup>.
- Substantial domestic processing capacity including innovative manufacturing of mass timber products as well as appearance grade hardwood products for feature applications.
- The second highest level of employment in the forestry and wood processing sector in Australia, with over 15,250 direct employees reported in the 2021 census<sup>5</sup>.

**Figure 2-1 Distribution of plantation area by State and Territory in 2022-23**



Source: ABARES (2024) Australian Forest and Wood Product Statistics

Victoria's plantations are located within five National Plantation Inventory (NPI) regions:

- Green Triangle: plantations in southwest Victoria and southeast South Australia
- Central Victoria: plantations located to the west of Melbourne

<sup>3</sup> ABARES (2024) *Australian forest and wood products statistics, Production to 2022-23*. Refer: *Plantation Areas*.

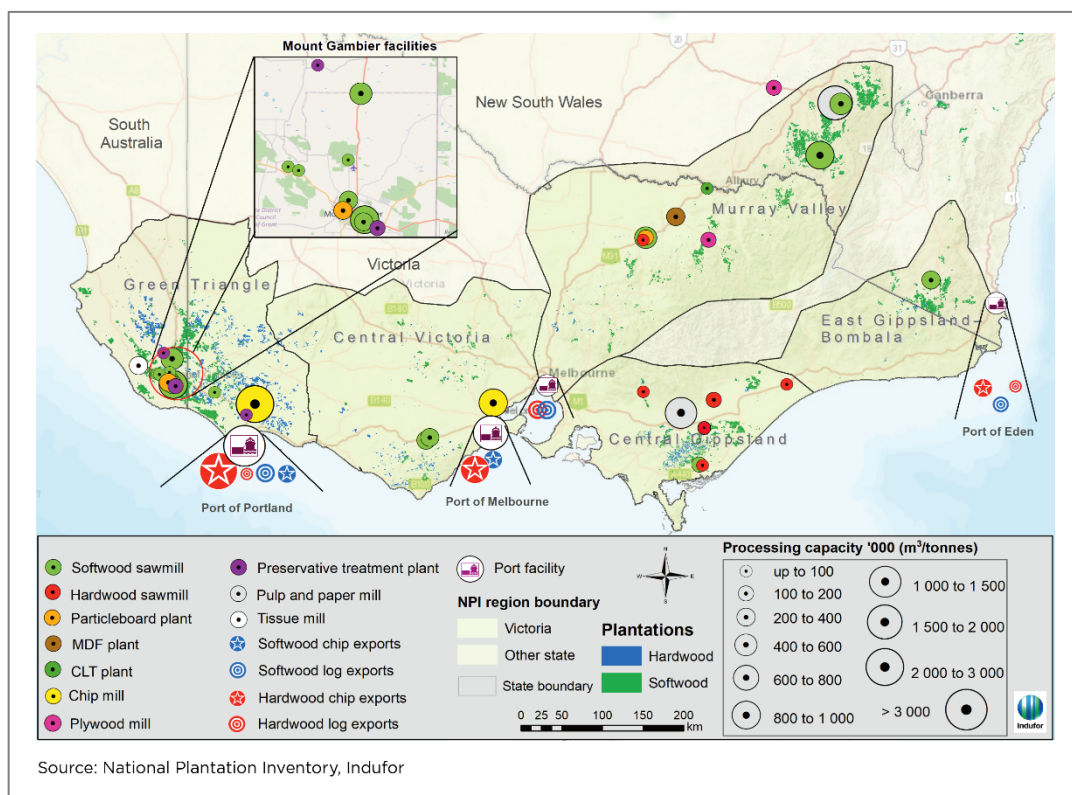
<sup>4</sup> ABARES (2024) *ibid*, with Indufor estimates of plantation area proportions across NPI regions.

<sup>5</sup> ABARES (2024) *ibid*. Refer: *Employment – Census*.

- Central Gippsland: with most plantations around the Strzelecki Ranges
- Murray Valley: located in northeast Victoria and includes plantations in southwest NSW
- East Gippsland–Bombala –with most plantations in the Bombala region of southern NSW.

Figure 2-2 provides a more detailed spatial representation of each of the Victorian NPI regions illustrating the proportion of the plantation area within and outside of Victoria. It shows that parts of the softwood plantations in the multi-state regions are in either South Australia (in the Green Triangle) or NSW (Murray Valley and East Gippsland - Bombala). Conversely, most hardwood plantations within the Green Triangle are located within Victoria.

**Figure 2-2 Overview of Victoria's plantation estate and processing sites by NPI region**



Source: National Plantation Inventory, Indufor

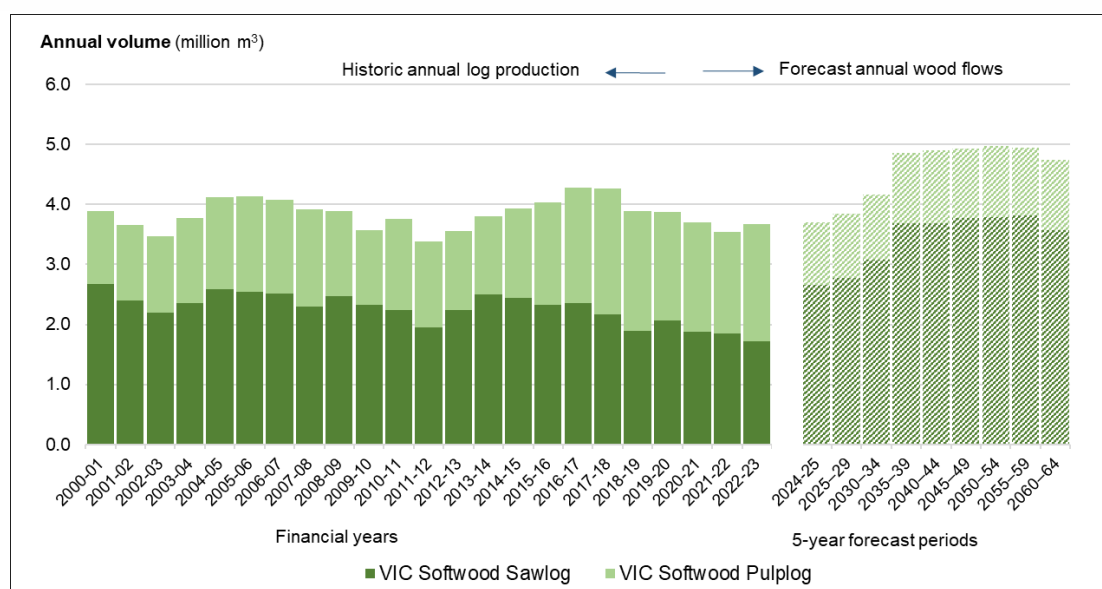
Under the Victorian Forestry Transition Plan, the Victorian Government has invested more than \$200 million to support industry business, works and communities impacted by the cessation of commercial timber harvesting in public native forests. This includes funding commitments to allocate \$120 million to expand Gippsland's softwood plantation estate by up to 14,000 ha by 2035, under the Gippsland Plantation Investment Program (GPIP), together with an additional funding allocation to farm forestry development, and a grants program targeting timber innovation and transition support.

### Softwood plantation resources

Softwood wood flow projections by log type for Victoria are shown below (Figure 2-3). Overall, in Victoria, softwood sawlog harvest levels are estimated to be around 3 – 4 million cubic metres (Mm³) per year until 2034, before an increase in sawlog supply from Central Gippsland and Murray Valley would allow total harvest volumes to increase to 4 – 5 Mm³/year.

The supply of pulpwood is expected to remain relatively stable at around 2 Mm³/year. The total harvest is expected to be around 30-40% of the national softwood yield.

**Figure 2-3 Softwood plantation wood flows and forecasts for Victoria, 2000-2064**



Source: ABARES (2024) *Australian forest and wood products statistics, Production to 2022-23*; and Legg et al. (2021). Note the variance between historic annual log production levels and forecast wood flows can be attributed to the historic wood flows reflecting sawmill production capacity, as well as markets, demand over time and operational constraints, while the forecast wood flows reflect the indicative maximum potential volume based on growth rates.

The predominant products in terms of total volumes comprise sawlogs for softwood timber for house framing and other structural applications, softwood panels such as Medium Density Fibreboard (MDF), engineered wood products such as cross-laminated timber (CLT), hardwood sawn timber for both appearance grade and structural applications (predominantly from imported wood supply now), and hardwood and softwood chip fibre for pulp and paper manufacturing both in Victoria and in other countries (exports).

### Hardwood plantation resources

The hardwood plantation supply in Victoria, shown below (Figure 2-4), is dominated by the Green Triangle region, which will account for almost 80% of Victoria's hardwood pulpwood-grade supply until 2060. Most of this supply is currently exported to North Asia (principally Japan and China) as premium grade fibre for pulp and paper manufacturing, into high-grade copy paper, packaging products and rayon.

However, on account of its scale, the Green Triangle also offers considerable scope for further domestic processing of hardwood fibre and optimised use of fibre resources in Australia.

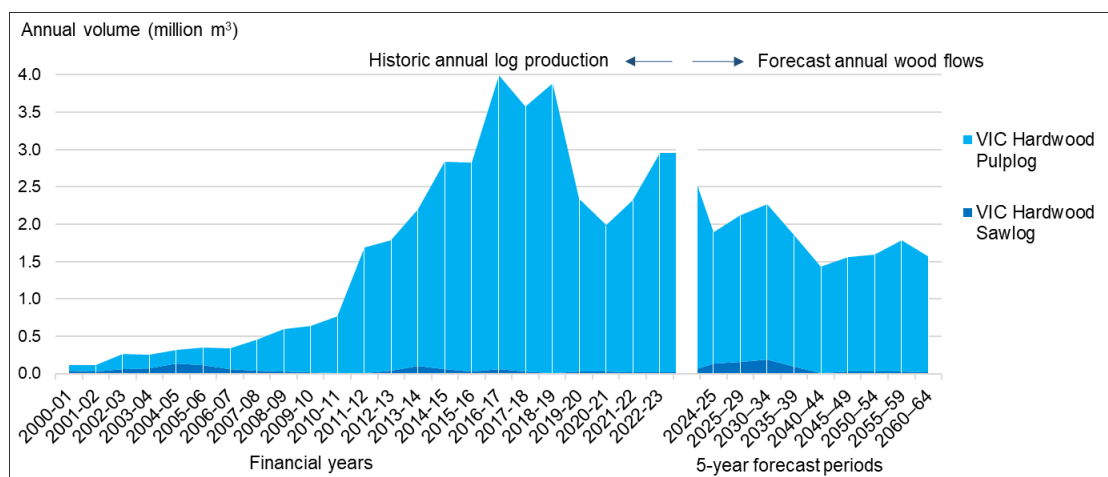
Hardwood plantation supply from Central Gippsland is primarily utilised by Opal Australian Paper's pulp and paper mill at Maryvale in the Latrobe Valley. Based on the current forecast, supply from the existing Central Gippsland hardwood plantation estate will decline from 2035 to negligible levels without substantial replanting investment.

In relation to hardwood sawlogs, the forecast supply from plantations across the five NPI regions is modest, at around 150 000 m³ per year up until 2039, before declining to less than 20 000 m³ per year thereafter. Currently there is no dedicated program of support for hardwood plantation development in Victoria, with a similar objective or scope to GPIIP, which evolved to become focussed entirely on softwood plantation resources.

The lack of private sector investment to date in hardwood plantations grown on longer rotations of 20-25+ years for sawlog production in Victoria indicates that a dedicated investment program would need to be scoped and established to provide a domestic supply base to replace native forest hardwoods for structural and appearance grade timber products.



**Figure 2-4 Hardwood plantation wood flows and forecasts for Victoria, 2000 - 2064**



Source: ABARES (2024) *Australian forest and wood products statistics, Production to 2022-23*. Legg et al. (2021).

## 2.2 Current range of wood fibre products

Victoria produces a wide range of wood fibre-based products, now manufactured primarily from plantation forest fibre, supplemented by imports of hardwood products. A summary of the main types of wood fibre products currently manufactured in Victoria, and their primary end uses, is set out below in Table 2-1. The locations of the main processing centres and export facilities were shown above in Figure 2-2.

While the current base of production and manufacturing represents a broad range of products, the need for a future wood fibre roadmap is premised on the recognition that there is considerable scope for further innovation and use of emerging technologies to increase value added manufacturing within the state and develop new wood-based products.

**Table 2-1 Wood fibre-based products currently manufactured in Victoria**

Wood fibre products	Market outlook
<b>Solid wood products</b>	
Hardwood sawn timber	- Expected strong demand for scarce supply of hardwood sawn timber products, principally for appearance grade application such as flooring and feature beams, in building projects and housing alterations & additions
Softwood sawn timber (MGP10+)	- Expected continued increase in demand for softwood building products, strongly correlated with national population growth and associated house construction
Cross laminated timber (CLT)	- Ongoing expansion of demand in multi-residential and high-rise developments
Glue laminated timber (GLT) & related products	
Industrial, utility & landscaping timber and roundwood products	- Stable long-term outlook for treated posts and poles for agriculture, viticulture, infrastructure and landscaping
<b>Wood-based panels</b>	
Particleboard	- Increasing demand based on national population growth
Medium Density Fibreboard (MDF)	- Australia produces substantially more particleboard and MDF than plywood, with relatively low imports compared to total production of the two main panel groups
<b>Plywood</b>	- Plywood accounts for over 75% of Australia's imports of wood-based panel imports
<b>Pulp &amp; paper products</b>	
Kraft linerboard and packaging paper products	- Strong demand for packaging grades
<b>Biochemicals</b>	
Pyrolysis oil	- Small scale production and market testing for use as a liquid biofuel, especially for local industrial applications
Biochar	- Small scale production, through pyrolysis technologies, for use as a carbon-rich soil additive and fertiliser
<b>Major export products</b>	
Softwood log exports	- Generally exporting either non-preferred log specifications or surplus to domestic capacity - Key markets in China, Korea and India for sawing and veneer production - Driven by ongoing demand from China especially, and long-term tightening in alternative supplies
Hardwood chip fibre exports	- Established markets in North Asia
Softwood chip fibre exports	- Flat to declining demand over medium-longer term; key markets in North Asia

Source: Indufor industry databases

A recent study addressing the scope for diversification of the forest industries across multiple countries comprising the USA, Canada, Sweden and Finland indicated the most promising markets for emerging wood-based products are textiles and construction, biochemicals and biofuels, packaging and bioplastics. These markets clearly extend beyond Victoria's current range of wood fibre-based products and present the opportunity for further consideration of the scope for applications in textiles, biochemicals, biofuels and bioplastics.

Emerging opportunities under these categories are discussed further in section 4.

## 2.3 Recovery and recycling of wood fibre

The other potential source of wood fibre supply is the recovery and recycling of wood fibre products at their end-of-life in current applications. The national *Timber Circularity Project* has observed that at the end-of-life for relevant products, less than 50% of wood fibre is recycled,

with some jurisdictions in Australia recycling less than 2%<sup>6</sup>. This recovery includes biomass to energy recycling, rather than input into higher value products, so the opportunity to recover wood fibre at a higher value would be even greater.

The Timber Circularity Project is developing a matrix of potential solutions for reuse and recycling of treated timber and engineered wood products in Australia, including national and international technology to collect, sort, de-nail, and process end-of-life treated timber. To meet circular economy goals and better align the timber industry with a bio-circular economy, State and local government regulations will need to reduce anomalies and restrictions for moving and processing valuable resources. The project team are developing information sheets for regulators which will help advocate for change to better implement a timber circular economy.

In Victoria, there are various other programs that are tracking the recycling of certain grades of wood and paper products for specific applications, most notably paper and packaging products. Recycling Victoria's circular economy market reports have noted that Victoria's recovered paper and cardboard market and supply chain is mature; however, there is opportunity to improve the current overall recovery rate, which is around 57%<sup>7</sup>. The total paper and paperboard generated in Victoria in 2020-21 was 1.5 million tonnes, and the amount recovered for reprocessing in that year was around 850,000 tonnes. While Victoria's performance for paper and packaging is consistent with other well performing jurisdictions, Recycling Victoria considers that there is a particular opportunity to increase cardboard recovery in the Commercial & Industrial sectors.

Recycling Victoria's circular economy market report captures wood/timber data under 'organics' and has observed that overall recovery of organic material in Victoria is currently low (48%) compared other Australian jurisdictions, in part due to the relatively low recovery of wood/timber products (39%)<sup>8</sup>. This result highlights considerable scope for further recovery and reprocessing of wood/timber products from end of life uses over time.

These and other program initiatives are continuing to develop under jurisdictional policy settings, to improve the recovery and reprocessing of wood fibre and other materials with objectives broadly aligned with net zero targets and circular economy outcomes.

## 2.4 Socio-economic contribution of the sector

Victoria's forest and wood products sector provides direct socio-economic benefits from the growing, harvesting, processing and utilisation of Victorian grown fibre and imported fibre.

Multiple stages of processing and value adding account for the most substantial employment and economic activity. Primary processing in sawmills, woodchip mills and pulp mill facilities, supports secondary processing onsite or downstream along the value chain to manufacture, for example, frame & truss products, timber flooring, other high-end appearance and feature grade products, engineered wood products including LVL, GLT and CLT, and cabinetry and furniture, as well as wood panels and paper & packaging products. There is further economic activity in the recovery and reprocessing of wood fibre to support the development of a circular economy.

The Victorian plantation sector is significantly linked to supply chains across state borders, with wood processing facilities based in the southeast of South Australia and in the southwest slopes of NSW, which process significant volumes of Victorian logs. Similarly, logs arising from outside Victoria are processed in Victorian facilities.

In this context, Victoria's wood fibre sector makes a significant contribution to the state economy and especially regional communities. In 2022-23, Victoria's total sales and service income in forest product industries for all wood products was estimated to amount to around \$9.1 bn<sup>9</sup>, which represents close to 1.7% of gross state product in 2022-23. Total direct employment in the wood fibre sector was reported as over 15,000 jobs statewide, which excludes indirect employment through support services beyond the forestry sector<sup>10</sup>. This contribution was based on approximately \$640 million of gross value of plantation log production.

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<sup>6</sup> University of Sunshine Coast (2024) *The Timber Circularity Project*. Online: <https://www.usc.edu.au/research/forest-research-institute/forest-industries-research-centre/the-timber-circularity-project>


<sup>7</sup> Recycling Victoria (2024) *Circular Economy Market Report 2024*. Online: [https://www.vic.gov.au/sites/default/files/2024-03/circular-economy-market-report-2024\\_0.pdf](https://www.vic.gov.au/sites/default/files/2024-03/circular-economy-market-report-2024_0.pdf)

<sup>8</sup> *Ibid.*

<sup>9</sup> ABARES (2024) *Australian forest and wood products statistics, Production to 2022-23*, ABARES series report, Canberra, July, DOI: <https://doi.org/10.25814/PZH6-3W22>. CC BY 4.0.

<sup>10</sup> *Ibid.* Refer *Employment – Census*. Incorporates direct employment in Forestry and Logging, Forestry Support Services, Wood Product Manufacturing, and Pulp and Paper Product Manufacturing.





These estimates exclude the employment and economic outputs reliant solely on native forest harvesting and processing in Victoria. Commercial timber harvesting in public native forests ceased in January 2024 and industry sub-sectors that were reliant on log supply from public native forests are in transition to new arrangements, which include shifts to plantation log supply where available as well as timber imports.

There is considerable scope for further growth in the sector, subject to relevant policy settings and timely investment in the sector to align capacity with demand. As Australia's population continues to grow, demand for new dwellings will continue to expand, which will in turn will drive consumption of building materials. By 2046 to 2050, the gap between annual average sawn softwood demand in Australia of 6.5 million m<sup>3</sup> and modelled domestic production capacity is estimated to be around 2.6 million m<sup>3</sup> per year<sup>11</sup>. Import supply at that level would represent over 40% of total demand, which would be more than double the long-term average 20% of local demand that has been met by import supply.

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<sup>11</sup> Woods, T. & Houghton, J. (2022) *Future market dynamics and potential impacts on Australian timber imports*. Report prepared for Forest & Wood Products Australia, August 2022.



3

# THE OUTLOOK TO 2050 AND BEYOND

- 3.1 Megatrends
- 3.2 Sectoral trends
- 3.3 Summary of key outlook considerations

### 3. THE OUTLOOK TO 2050 AND BEYOND

*“The world is set to change significantly in the next 30 years. Urbanisation and economic decarbonisation occurring at the same time are forecast to be among the key megatrends between now and 2050.*

*Timber is at the heart of both. Timber offers a unique way to invest in every part of the new circular clean economy that is set to dominate our lives.”*

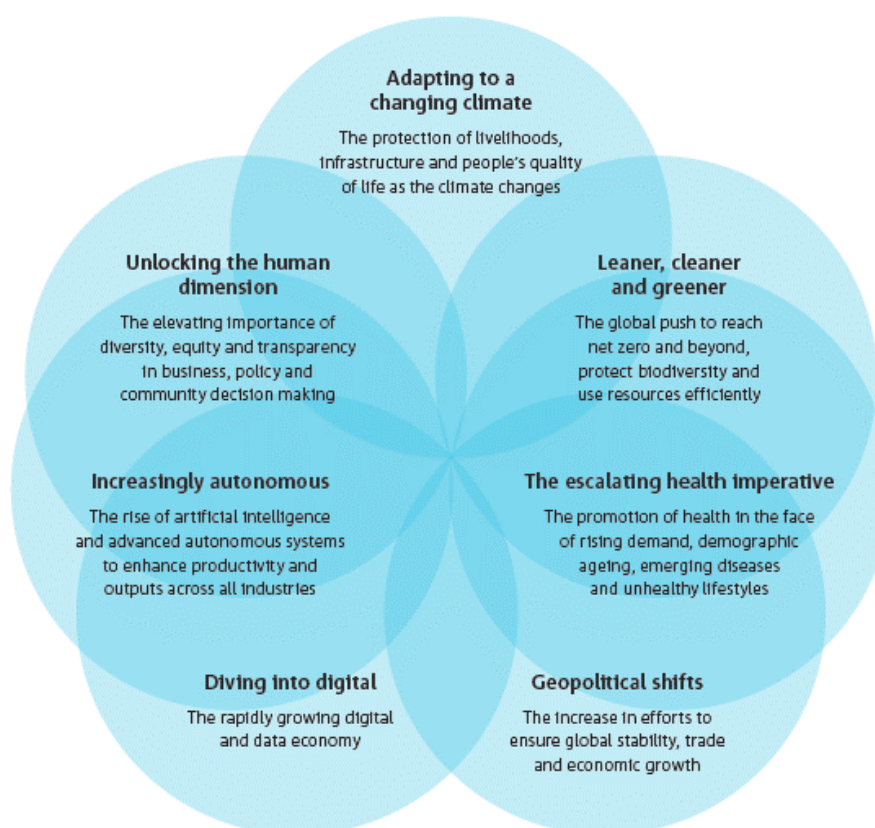
*Gresham House (2020) Global Timber Outlook*

#### 3.1 Megatrends

Demand for wood fibre products will be shaped by broader economy-wide trends, including megatrends (also known as ‘macro-trends’), and policy directions relevant to these trends.

Megatrends have been defined as major shifts in the demographic, environmental, economic, technological, political and cultural landscapes that can be foreseen with a relatively high degree of certainty, though their implications are often more uncertain or ambiguous<sup>12</sup>. CSIRO in Australia has used the term ‘megatrends’ to describe trajectories of change that typically unfold over years or decades and have the potential for substantial and transformative impact. In its most recent *Our Future World* report, CSIRO identified and discussed seven global megatrends out to 2042<sup>13</sup>, as illustrated below (Figure 3-1).

**Figure 3-1 CSIRO view of global megatrends out to 2042**



Source: CSIRO: Our Future World, 2022

Indufor considers the most notable and relevant of these megatrends for the Roadmap for Victoria include the following:

- **Adapting to a changing climate:** The management of forests will need to continue to adapt to climate change and extreme weather conditions, which are increasing in their frequency and scale of impact. This changing climate is expected to lead to periodic disruptions to supply (and demand), such as the impacts of major bushfire events on wood supply chains

<sup>12</sup> WBCSD (2020) *Macrotrends and Disruptions shaping 2020-2030: Vision 2050 issue brief*, May 2020.

<sup>13</sup> CSIRO (2022) *Our Future World. Global megatrends impacting the way we live over coming decades.*



and infrastructure, which need to be factored into future supply planning and risk mitigation strategies, including increased emphasis on sovereign capability and local supply chains.

- **Leaner, cleaner and greener:** As the global population continues to grow and as more people transition from lower to higher income brackets, there will be escalating pressures placed on finite resources, including wood fibre, as well as food, water, minerals and energy. At the same time, these constraints are driving cutting-edge innovations that aim to do more with less, achieve carbon neutrality, reduce biodiversity loss and address the global waste through recycling and creating a more circular economy. This presents opportunities for potential solutions through advanced recycling and the net-zero energy transition.
- **Geopolitical shifts:** The COVID-19 pandemic and geopolitical shocks revealed Australia's vulnerability to global supply chain disruptions. Supplier diversification, onshore manufacturing and contingent contracting have been proposed as potential risk mitigation strategies for companies and governments. In addition, enhancing the uptake of agile manufacturing approaches, leveraging artificial intelligence (AI), robotics and other technologies, have been identified as key enablers for Australian manufacturers to respond dynamically to market changes in a cost-effective manner.

Underpinning these megatrends are the expectations, in Victoria, nationally and globally, of continued population growth and increasing demand for housing and infrastructure.

Over the next decade, Victoria's population is projected to increase by an average of around 125,000 per year, adding 1.25 million people at an annual growth rate of 1.7%<sup>14</sup>. The projected growth rate will slow gradually over time, but by 2051, Victoria's population is expected to reach 10.3 million (Figure 3-2). More than 1.6 million additional dwellings will be required to house the extra population: around 1.3 million in metropolitan Melbourne and over 300,000 in regional Victoria<sup>15</sup>.

**Figure 3-2 Population and housing projections for Victoria, 2023-2051**



Source: Victoria in Future 2023

### 3.2 Sectoral trends

These projections for population growth and additional housing demands in Victoria align with the outlook for many other countries and global markets. Timber consumption globally has been forecast to rise by over 3% per year over the next 30 years<sup>16</sup>, with three key drivers:

- Urbanisation
- Decarbonising economies
- Housing shortages and increased house building.

<sup>14</sup> Victorian Government (2023) *Victoria in Future 2023: Population and household projections to 2051*, November 2023. Report prepared by the Department of Transport and Planning.

<sup>15</sup> *Ibid.*

<sup>16</sup> Gresham House (2024) *Global Timber Outlook 2024*. Available online: <http://greshamhouse.com/>

Globally, most countries including Australia have set significant targets to reduce carbon emissions towards net zero by 2050 – and Victoria has set targets to cut the state’s greenhouse gas emissions and achieve net zero emissions by 2045<sup>17</sup>. Timber, and other wood fibre products - can play a critical part in this transformation. The dual effect of urbanisation and decarbonisation will be more new homes and cleaner, lower carbon intensity buildings built from renewable wood products replacing more carbon intensive steel and concrete products.

These drivers are reflected in national and intergovernmental agreements to promote the use of wood from sustainably managed forests to support low carbon construction. This is evident in the Australian Government’s policy commitment to increase the use of timber in the built environment by 2030. At COP28 in 2023, 17 signatory countries - under the auspices of the Forest and Climate Leaders’ Partnership Coalition on Greening Construction with Sustainable Wood - stated:

*“Recognizing that wood from sustainably managed forests provides climate solutions within the construction sector, we commit to, by 2030, advancing policies and approaches that support low carbon construction and increase the use of wood from sustainably managed forests in the built environment. Such policies and approaches will result in reduced GHG emissions, and an increase in stored carbon.”<sup>18</sup>*



As a result of these key global drivers, and clear policy signals in Australia and other developed countries, Gresham House has forecast an almost three-fold increase in global timber consumption over the next 30 years, from 2.2 billion m<sup>3</sup> consumed today to 5.8 billion m<sup>3</sup> in 2050<sup>19</sup>. This forecast rise in demand is set against a constrained supply that is limited by the long-term growth rate of production forests and limited areas of land available for further expansion.

This growth extends beyond timber products to a broader suite of wood fibre products. For example, urbanisation is driving increased use of cardboard (‘containerboard’) globally as urban communities move increasingly to online shopping and the resultant retail deliveries, coupled with the shift from plastic to paper bags. While rates of growth for some paper grades have declined substantially over the past two decades, notably newsprint and graphic paper, the containerboard market has grown at rates of over 3% per year<sup>20</sup> (2006 to 2015) and now holds by far the largest share of global paper consumption (Figure 3-3).

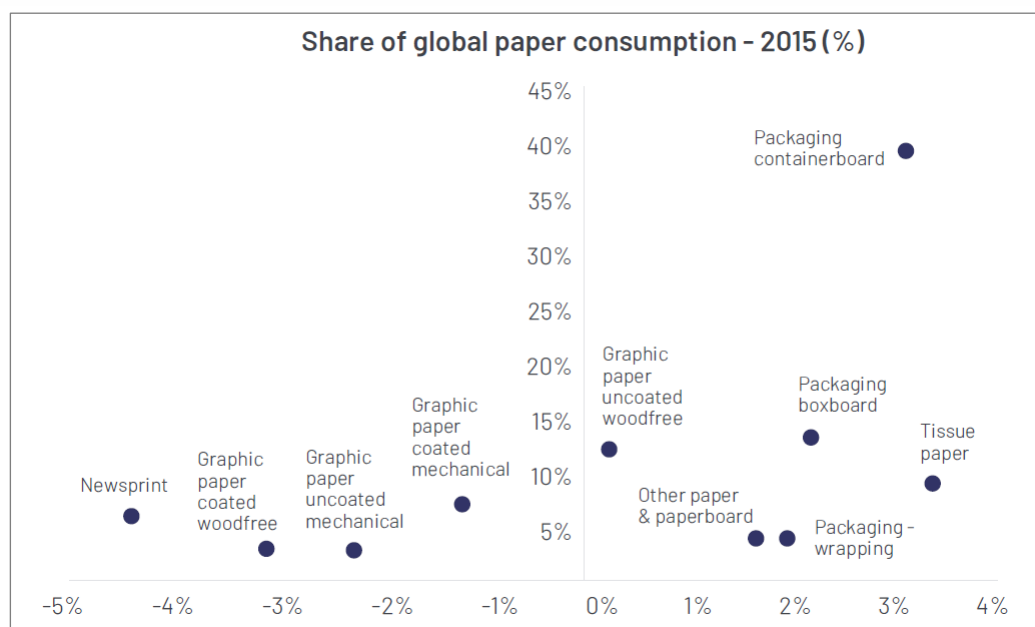
<sup>17</sup> Victorian Government (2023) *Climate Action Targets*: <https://www.climatechange.vic.gov.au/climate-action-targets>

<sup>18</sup> FCLP (2023) *Initiative for Greening Construction with Sustainable Wood*. FCLP Public Announcement. Refer online: <https://forestclimateleaders.org/wp-content/uploads/2023/12/FCLP-COP28-Release-Buildings-06122023.pdf>.

<sup>19</sup> Gresham House (2024) *op cit*.

<sup>20</sup> *Ibid*.

Figure 3-3 Global growth in paper consumption, and market share, 2006 to 2015



Source: RISI, Westpac: Industry Insight – Forest and Wood Products – May 2018

Internationally, the development of roadmaps for use of wood fibre have prominently featured a focus on moving towards a low-carbon bioeconomy, while also ensuring wood fibre is directed to its highest value uses. In Europe, for example, the Confederation of European Paper Industries (CEPI) has developed its '*2050 Roadmap to a low-carbon bioeconomy*' over the past decade. The CEPI roadmap established a pathway to *reducing greenhouse gas emissions by 80% by 2050* ('decarbonising by 80%'), while also *creating 50% more added value by 2050*<sup>21</sup>.

In the CEPI 2050 roadmap, wood fibre is seen as a renewable and recyclable resource that can replace fossil resources and contribute to reducing greenhouse gas emissions – and in this way, create a '*climate-friendly bioeconomy*'. The roadmap set out the industry aims to maximise the value and potential of wood fibre by utilising sustainable forest management practices, promoting carbon sequestration in forests, and implementing zero waste processes in the production of pulp and paper. It also emphasised the importance of paper recycling to keep fibres in the loop and extend the benefits of their renewable origin.

In addition, the CEPI roadmap incorporates the potential for a significant share of added value from the forest fibre and paper industry's product segments to come from the development and growth of new bio-based products. Emerging bio-based products range from food additives to bio-composites, and advanced biofuels to nanocellulose - are expected to bring even more opportunities for growth from innovative solutions to move away from a fossil-based economy.

Europe's pulp and paper industries have also identified the acceleration in digitalisation of manufacturing - the so-called 'Industry 4.0'<sup>22</sup> – and the evolution of consumer behaviour (through forces such as connectivity, the collaborative economy, mass-customisation) are reshaping the future of both products and processes<sup>23</sup>.

In Canada, there is a similar clear focus within the forest products sector on climate change mitigation and the role of the sector in realising the country's net zero targets. The Forest Products Association of Canada has a '*Roadmap to Net Zero*' incorporating three key themes<sup>24</sup>:

- *Reducing direct carbon emissions in forest products sector operations* – and specifically, recognising further opportunities to use bioenergy and carbon capture & storage.

<sup>21</sup> CEPI (2017) *Unfold the future. Investing in Europe for Industry Transformation. 2050 Roadmap to a low-carbon bioeconomy*.

<sup>22</sup> Industry 4.0, representing the Fourth Industrial Revolution, is broadly recognised as the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems, the Internet of Things (IoT), cloud computing, cognitive computing, and artificial intelligence (AI).

<sup>23</sup> *Ibid.*

<sup>24</sup> FPAC (2023) *Climate Change Mitigation in Canada's Forest Products Sector: Roadmap Toward Net-Zero*.

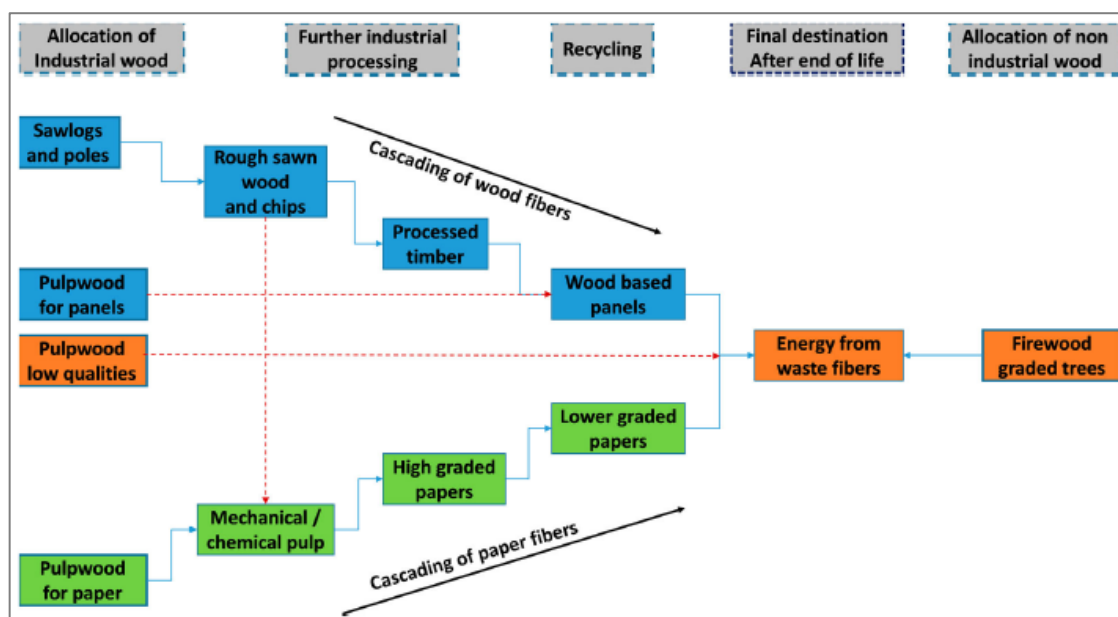


- *Reducing emissions in other sectors and the built environment, by using forest products, e.g. wood and bioenergy* – noting forest products, especially those used in construction, can store carbon over the long term and substitute for more energy-intensive or non-renewable products.
- *Increasing the resilience and carbon sequestration capacity of Canada's managed forests* – by working with the federal, provincial and territorial governments, Indigenous Peoples, NGOs, industry groups, labour partners, and academic institutions to apply climate-smart forestry techniques in its many forms.

Another significant sectoral trend for consideration in Victoria's Roadmap is the increasing prominence of the need to ensure there is a *wood fibre cascade* from highest value use to lowest value use, from the forest through primary and secondary processing value chains.

In Europe, there is recognition of the importance of an efficient wood fibre cascade for the efficient use of forest resources (Figure 3-4)<sup>25</sup>. This recognition has led to EU legislation and directives that specifically incorporate the principle of the *cascading use of biomass* – which aims to ensure that woody biomass is used according to its highest economic and environmental added value in the following order of priorities: wood-based products, extending the service life of wood-based products, re-use, recycling, bioenergy and disposal<sup>26</sup>.

**Figure 3-4 Conceptualisation of cascaded flows for wood and paper**



Source: Sikkema et al. (2017), referring to cascaded flows for wood and paper, starting from the forest and ending up in a preferably "high-efficient energetic use of post-consumer waste wood or waste paper flows".

Relatedly, in Canada, a spatial forest fibre cascade model has been developed to support the potential development of a Canadian forest-based bioeconomy; and specifically, to examine how forest fibre cascades through primary facilities and the secondary forest products sector, to draw conclusions regarding forest fibre supply and demand balance in various regions and estimate mill residue surplus in Canada<sup>27</sup>.

### 3.3 Summary of key outlook considerations

The future of Victoria's wood fibre industry will be shaped by these megatrends and key drivers of market demand for a broad range of existing and emerging products. The main themes arising from this scan include the following implications for Victoria:

<sup>25</sup> Sikkema R., Dallemand, J.F., Matos, C.T., van der Velde, M., San-Miguel-Ayaz, J. (2017) How can the ambitious goals for the EU's future bioeconomy be supported by sustainable and efficient wood sourcing practices? *Scandinavian Journal of Forest Research*, 32:7, 551-558, DOI: 10.1080/02827581.2016.1240228

<sup>26</sup> European Commission (2023) *Renewable Energy Directive*. Online: [https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive\\_en](https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en).

<sup>27</sup> Ghafghazi et al. (2016) Estimating Mill Residue Surplus in Canada: A Spatial Forest Fiber Cascade Modeling Approach. *Forest Products Journal*, 67. 10.13073/FPJ-D-16-00031

- *Increasing demand and pressures placed on finite resources, including wood fibre.*

Population growth and housing requirements will underpin increasing demand for construction materials and other wood fibre products. At the same time, the constraints on finite resources – including forest fibre - are driving cutting-edge innovations that aim to do more with less, achieve carbon neutrality, reduce biodiversity loss and address the global waste through recycling and creating a more circular economy. This presents opportunities for potential solutions through advanced recycling and the net-zero energy transition.

- *Increasing demand for decarbonisation to meet Net Zero targets:*

At the international level, and at national and state levels, there is a clear and consistent outlook for Net Zero targets and decarbonisation plans to drive the sustainability agenda. Timber and wood fibre-based products represent renewable, recyclable resources that can replace fossil-fuel based resources and contribute to reducing greenhouse gas emissions. In this way, Victoria's wood fibre sector has considerable potential to assist the state in meeting its Net Zero targets and contribute towards building a low-carbon bioeconomy.

- *Increasing drivers to add value to wood fibre through advanced manufacturing:*

The increasing demand and pressures placed on finite wood fibre resources, coupled with the increasing risks of supply chain disruptions, underline the need for increasing the level of added value manufacturing in Victoria to build a more self-sufficient, resilient and prosperous economy. The cascade of materials use, to add the most value to forest fibre products, while also optimising recycling and reuse as a raw material before final stage use for energy, needs to be a cornerstone of State government policy and support systems.

Furthermore, the megatrends relating to being *leaner, cleaner and greener*, and addressing *geopolitical shifts*, highlight the need to embrace 'Industry 4.0' and enhance the uptake of agile manufacturing approaches, leveraging AI, robotics and other technologies, to enable Australian manufacturers to respond dynamically to market changes in cost-effective ways.

These themes converge around the conceptualisation of a more circular bioeconomy in Victoria, or specific regions, within which the forest and wood products sector aims to maximise the value and potential of wood fibre by:

- utilising sustainable forest management practices
- promoting carbon sequestration in forests and carbon storage in long lived wood products
- ensuring a cascading allocation of wood fibre products to the highest and best use
- investing in advanced, agile manufacturing of high value wood products and bioproducts
- implementing zero waste processes throughout production stages.

Maximising the value of wood fibre will rely on an ongoing process of product development for existing and emerging products, supported by coordinated research and development programs. Emerging product opportunities for Victoria are discussed further in Section 4.



# EMERGING WOOD FIBRE PRODUCT OPPORTUNITIES

- 4.1 Australian trade in wood fibre products
- 4.2 Overview of emerging markets for wood fibre products
- 4.3 Construction markets
- 4.4 Textiles
- 4.5 Plastics and packaging
- 4.6 Bioenergy and biofuels
- 4.7 Biochemicals
- 4.8 Summary of emerging wood fibre product opportunities



## 4. EMERGING WOOD FIBRE PRODUCT OPPORTUNITIES

*“A broad array of forest products from paper, packaging and personal care to innovative bio-materials for the construction, chemical and textile sectors provide solutions for everyday needs. These products and the forests they come from capture and store carbon. This unique ability positions the forest sector at the center of the transition to a sustainable, low-carbon and circular future, rooted in renewable, natural resources.”*

*World Business Council for Sustainable Development (2019) Forest Sector SDG Roadmap.*

Australia has a substantial trade in a range of forest products. In value terms, Australia is a net importer of wood products. Imports are predominantly manufactured finished goods to supplement domestic production while exports are largely unprocessed primary forest products. This trade profile presents opportunities for new product development in Victoria and increasing the level of added value manufacturing in Victoria to build a more self-sufficient, resilient and prosperous economy.

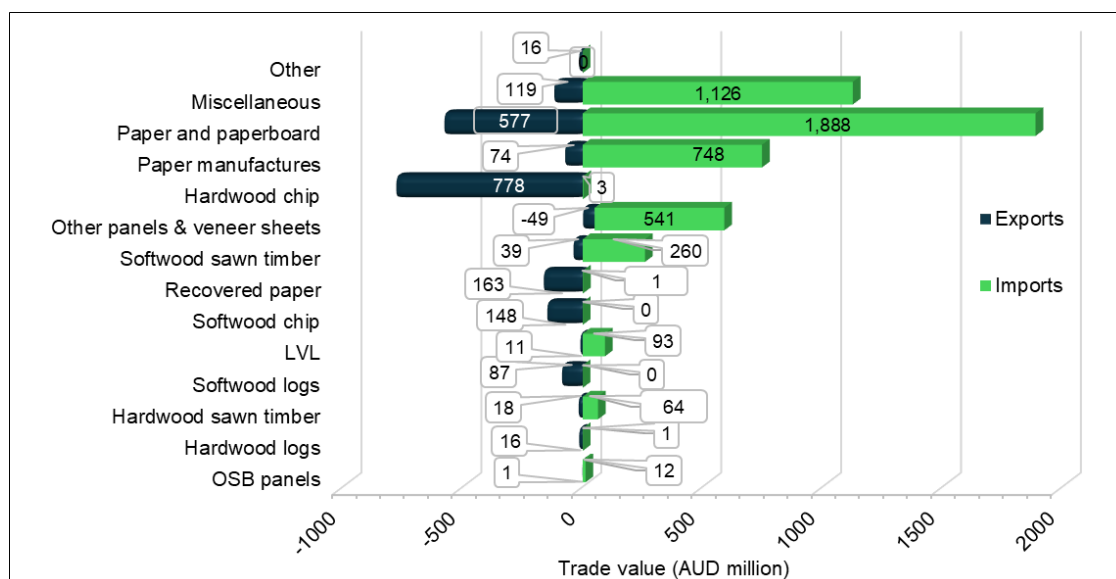
An overview of Australia's trade in wood fibre products is presented below, followed by an overview of new product opportunities for Victoria. This synthesis builds on the existing range of wood fibre-based products made in the state (refer section 2.1) but focuses particularly on emerging or new products that may be considered under the Roadmap to 2050.

### 4.1 Australian trade in wood fibre products

The value of Australia's trade in forest products for 2023-24 is shown in Figure 4-1. The largest trade in value terms is in paper and paperboard products. Australia is a net importer of paper and paperboard products – with imports totalling almost \$1.9 bn in 2023-24 - dominated by printing and writing paper, household and sanitary products and packaging material. 'Paper manufactures' include a diverse range of products including envelopes, diaries, notebooks, exercise books, paper binders and folders, trays, plates and paper cups. The smaller proportion of exports comprise primarily packaging grade material and newsprint.

In terms of exports, the most substantial by volume and value is woodchips, especially hardwood chip fibre, with a smaller contribution of softwood chip fibre, which are exported primarily for manufacturing into paper and paperboard products. With this trade profile, Australia had a net trade deficit in forest and wood products in 2023-24 of around AUD2.7 billion.

**Figure 4-1 Summary of Australian trade in forest and wood products in 2023-24**

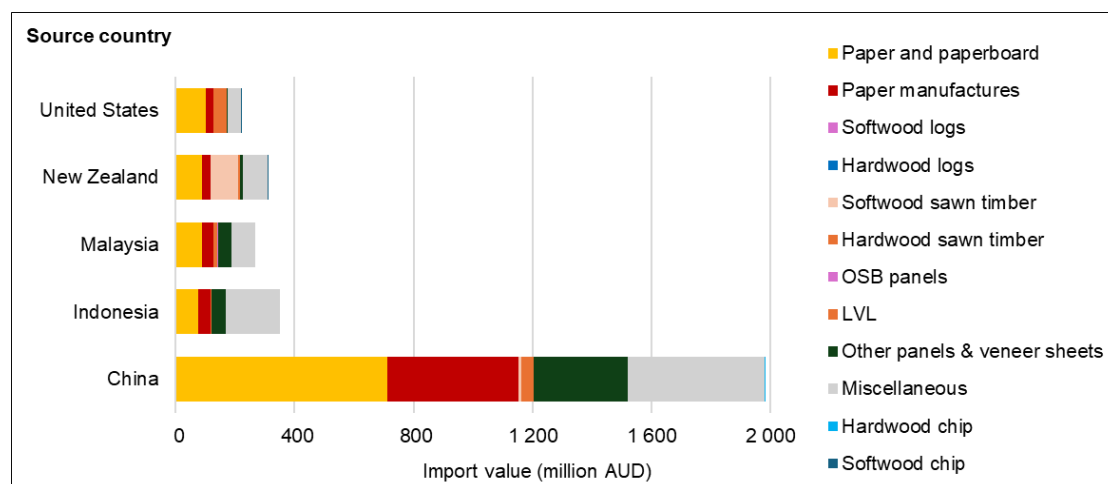


Source: ABARES (2024) Dashboard data tables, Global Trade Atlas. Note: Miscellaneous comprises a diverse range of wood-based products including finished products such as wooden doors, tools, furniture and interior design items. Note: Other comprises railway sleepers and pulp fibre.

The value of Australia's trade in wood fibre products with key trading partners is shown below. This highlights the importance of China as both a key supplier of imported wood products (Figure 4-2) and a source of demand for Australian exports (Figure 4-3). For the categories assessed, China accounted for 62% of total import value and 47% of total export value in 2023/24. This results in a net deficit in Australia's trade with China in forest products of

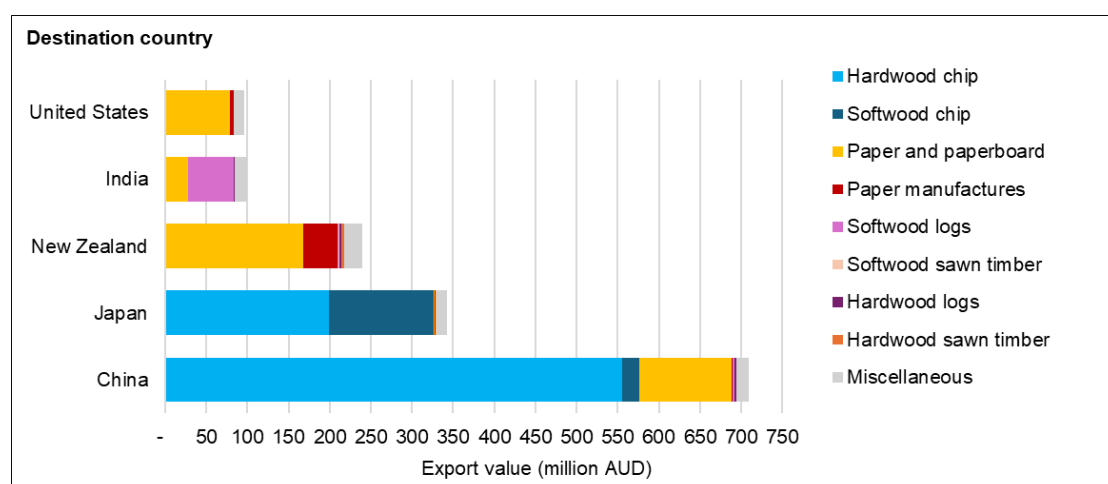
approximately AUD 1.3 billion. New Zealand is the next largest market accounting for 13% of export value and 7% of import value, resulting in a relatively low trade deficit (of around AUD 80 million per year) in forest products.

**Figure 4-2 Value of Australian imports of forest products by top five countries, 2023-24**



Source: ABARES (2024) Australian Forest and Wood Product Statistics.

**Figure 4-3 Value of Australian exports of forest products by top five countries, 2023-24**



Source: ABARES (2024)

This overview of Australia's current trade in forest products indicates the predominance of imports of paper and paperboard products, and paper manufactures (products made from paper), to meet domestic consumption requirements, while exports comprise mainly woodchip fibre plus various paper packaging grades for specific markets. This indicates there may be opportunities for diverting a larger proportion of hardwood and softwood chip fibre that meets export market grades to domestic value-added manufacturing, notably additional production of high value packaging products. However, doing so will require domestic processors to compete with international demand and export parity prices for these fibre resources.

## 4.2 Overview of emerging markets for wood fibre products

A broad range of studies have been conducted over time to identify emerging markets for wood fibre grown and processed in Australia.

These include a comprehensive assessment by Finnish-based VTT of the '*Future options for the cellulosic fibre value chain in the Green Triangle*', with the aim of producing strategic technology roadmaps, business cases and policy recommendations for the region<sup>28</sup>. The study resulted in the development of a series of pathways, over the short term (3–5-year time horizon) and longer term (beyond 5 years). In relation to specific opportunities to broaden the economic base of wood fibre utilisation in the Green Triangle, the study identified the following as showing most promise for future development:

- *Bio-composites, especially wood plastic composites (WPC)*: Bio-composites may contain up to 80% of wood fibre and could also utilise some of the lower quality uncommitted waste biomass and increase ties to composite users such as the car industry.
- *Energy biorefinery - bio-oil by fast pyrolysis*: The manufacture of biofuels through pyrolysis to supply energy first to the sawmill boilers and kilns and later to external customers.
- *Biochar by torrefaction*: The biomass available for torrefaction in the Green Triangle included excess pulpwood, forest biomass and chips produced at sawmills, and the production of biochar could be considered. It was noted the energy sector and mining and metal industry in South Australia uses millions of tonnes thermal coal annually and they could use co-fire 'bio-coal' in their power plants. Torrefied biomass and biochar may also have a significant market for soil enrichment.

These opportunities have since been carried forward and implemented in other regions of Victoria and Tasmania. A WPC facility was established in Bell Bay, Tasmania in 2024, while in Victoria, there are pilot scale plants now producing pyrolysis oil and biochar products. The scope for further application of these technologies within Victoria and adjacent regions including the Green Triangle and Murray Valley can be considered further to realise the optimal use of wood fibre through the cascading allocation of fibre to its highest and best use along value chains.

Concurrent with the VTT study for the Green Triangle, the Wood Council of New Zealand engaged Scion to conduct a *WoodScape Study*, with the aim of supporting an increase in the volume of wood processing nationally; and doubling New Zealand's total export value by 2022<sup>29</sup>. *WoodScape* was a national-level financial modelling analysis and market review to assess the potential of a range of traditional and emerging wood processing technologies. The approach followed a similar methodology to the 2008 Canadian Bio-Pathways study, led by FPIInnovations, which showed that integrating new technologies such as bioenergy and biofuels manufacturing with traditional wood processing pathways led to much higher returns<sup>30</sup>.

The *WoodScape* study identified the need to increase the competitiveness of traditional primary processing options including sawmills, and to realise a transformational shift from exporting unprocessed logs to implementing processing technologies that could manufacture products such as industrial plywood. The study also identified the opportunity to innovate with a substantial section of the current wood processing industry not adding much value to its inputs.

*WoodScape* identified engineered wood products, biofuels and biochemicals as the most promising areas showing returns above 10% and potential to add value; noting the biofuel and chemical processing options relied on residues from primary processing.

Eight years later, the New Zealand Forest Service (*Te Uru Rākau*) established the 'Wood Fibre Futures Project', and between 2020-2021, looked at transforming the forest industry to support existing and new industries, by shortlisting 15 opportunities to transform wood biomass into products to support a transition to a low carbon economy<sup>31</sup>. The Fibre Futures Project identified and selected four priority areas for further investigation within New Zealand:

<sup>28</sup> VTT (2013) Stage 2. *Future options for the cellulosic fibre value chain in the Green Triangle, South Australia: strategic technology roadmaps, business cases and policy recommendations*. Customer report prepared for Regional Development Australia Limestone Coast Inc. Public report.

<sup>29</sup> Scion (2013) *WoodScape Study – Summary Report*. Report for Wood Council of New Zealand Inc.

<sup>30</sup> Scion (2012) *WoodScape project follows Bio-Pathways study*. Refer online: <https://www.scionresearch.com/about-us/about-scion/corporate-publications/scion-connections/past-issues-list/issue-5/woodscape-project-follows-bio-pathways-study>

<sup>31</sup> NZ MPI (2021) *New Zealand Wood Fibre Futures Project - Stage Two Report - Final Main Report*. Online: <https://www.mpi.govt.nz/dmsdocument/51007-NZ-Wood-Fibre-Futures-Project-Stage-Two-Final-Main-Report>

- *Sawn timber products* – representing further investment in upscaling and innovation in this mainstay of the industry, and noting that processing and secondary manufacturing of a broad range of sawn timber products generates large quantities of residues that could be the feedstock for making the following three priority product candidates
- *Biocrude oil* - focused on fast pyrolysis biocrude for use as a fuel source in New Zealand, with the fast pyrolysis pathway selected because the technology is well understood, mature and commercial. In New Zealand, biocrude oil from fast pyrolysis is already being used to provide process and district heat, electricity and as a food flavouring.
- *Liquid biofuels* - including renewable diesel, petrol, and aviation fuels, based on producing ‘drop-in’ renewable diesel, petrol, and aviation fuel production using the gasification *Fischer–Tropsch* approach, which is well understood, mature and commercially viable.
- *Solid fuels* - producing wood pellets and wood chips for use as a fuel source in New Zealand and for exports.

Looking more broadly, an international study of the role of new wood-based products in diversification of forest industries, across Europe and North America, found the most promising markets for emerging wood-based products are in construction, textiles, biochemicals, biofuels, and packing and plastics<sup>32</sup>.

A selection of these new wood-based products, associated with the most attractive markets, is set out below. Noting that many of the new products utilise bio-products as the feedstock – such as residues from sawmilling or pulping processes – the impacts of this diversification on wood fibre optimisation can be manifold.

**Table 4-1 Selected new wood-based products associated with key markets**

Market	Selected products and technologies
<b>Construction</b>	Cross-laminated timber (CLT) Industrially prefabricated modular elements (e.g. mass timber/panel products) Lignin as concrete admixture
<b>Textiles</b>	<i>Spinnova</i> - a yarn directly printed out of cellulose pulp (VTT/Finnish innovation) INOCELL-F - man-made cellulosic fibre (MMCF) providing an alternative to viscose
<b>Plastics and packaging</b>	Flexible plastic packaging Rigid plastic packaging Wood-based composites (WPC)
<b>Fuels</b>	Renewable diesel based on tall oil (byproduct of the kraft pulping process) Ethanol based on sawdust
<b>Platform chemicals</b>	Lactic acid – broad range of uses in biomedical devices, packaging, building boards Furfural – uses as organic solvent Succinic acid – uses as food additive and flavouring agent Ethylene – broad range of chemical uses as a hydrocarbon

Source: Hurmekoski et al. (2018)

These perspectives on new and emerging products can inform further opportunities for Victoria.

### 4.3 Construction markets

Wood has traditionally been used to build single-family homes. However, the accelerating move towards industrial prefabrication and standardisation of wood construction around the world has made it more feasible to utilise wood in large scale construction as well.

#### *Engineered wood products*

Engineered wood products that have emerged over the past four decades have further enhanced the competitiveness of wood in multistorey buildings and other large-scale

<sup>32</sup> Hurmekoski, E., Jonsson, R., Korhonen, J., Jänis, J., Mäkinen, M., Leskinen, P. & Hetemäki, L. (2018) Diversification of the forest industries: role of new wood-based products. *Canadian Journal of Forest Research*. 48(12): 1417-1432. <https://doi.org/10.1139/cjfr-2018-0116>



buildings.<sup>33</sup> Engineered wood products can now more directly compete with steel and concrete due to their more homogenous technical properties in terms of load bearing capacity and dimensional stability compared to sawn wood.

Building on its extensive sawmilling capability, Victoria currently has manufacturing capacity for a select range of engineered wood products, comprising:

- Glue laminated timber (GLT): manufacturing in Gippsland (hardwood) and Melbourne
- Cross laminated timber (CLT): manufacturing in Northeast Victoria (softwoods)

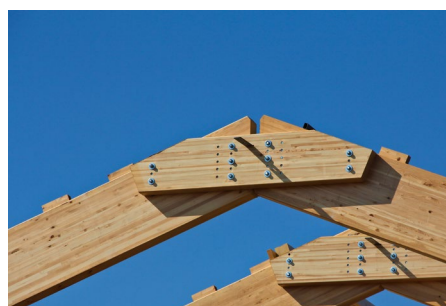
In addition, within the Green Triangle region, CLT and GLT products are manufactured with softwood logs grown in Victoria. These products are manufactured from sawmill by-products and short length timber sections. Demand for GLT and CLT in Australia is continuing to increase to supply mass timber construction projects and should underpin further growth and development of existing facilities, driven by the need to lower embodied carbon in the built environment, as well as speed and cost considerations.

### ***Further value adding product opportunities***

Additional options for engineered wood products that could be produced in Victoria include laminated veneer lumber (LVL) and Oriented Strand Board (OSB).

LVL is an established product that has been in the marketplace for more than 30 years. It uses multiple layers of dried wood veneer, commonly oriented in the longitudinal direction of the grain and bonded together using glue under heat and pressure – and it can be produced in long lengths. Common uses of LVL include solid section beams and I-beams (one of the most common products for structural LVL) as purlins in buildings. Non-structural LVL is commonly made in much shorter lengths (<2.5 m) and thicknesses. Intended end uses include furniture components, interior joinery and house fittings such as stairs and balustrades.

**Image 1 Laminated veneer lumber**



Source: Adobe Stock image

Research in recent years has focused on further reducing the cost of production and weight of the beam while maintaining its structural integrity. Recent developments include the use of lightweight steel bracing and oriented strand board in the webbing of I-beams to provide stiffness, rather than using solid LVL or plywood.

Australia has one local manufacturer of LVL, located in Western Australia. Over 70% of domestic demand is imported. The opportunity to manufacture LVL in Victoria would require further research and assessments of the suitability of Victorian softwoods or the potentially stiffer plantation eucalypt material to meet technical and market requirements. In the Green Triangle region, a research program with this scope is underway, as discussed further below.

Meanwhile, OSB is a structural re-constituted wood panel product. OSB was invented in California in the 1960s. The product was developed as an alternative to plywood, utilising layers of wood stands/flakes which are orientated in a perpendicular arrangement – mimicking the traditional layup of plywood. Utilising pulpwood as a feedstock allowed OSB to compete against structural plywood, which at the time required large diameter peeler logs. This provided OSB with a significant cost advantage in the raw material it could utilise compared to plywood.

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<sup>33</sup> Hurmekoski et al. (2018) *op cit*.

OSB is used extensively as a structural panel in construction, where it is used as a sheathing, flooring and roofing material. It has also become a major source for webbing in the production of I beams. Besides its structural applications, OSB is also used widely in packaging and other non-structural applications.

Both softwoods and hardwoods are used in the manufacture of OSB. Key species used globally include aspen and pine. The process requires roundwood to produce the strands.

Today's world scale mills have capacities of well over 500,000 m<sup>3</sup>/year. The global market for OSB is currently around 30 million m<sup>3</sup>/year most of which (approximately 24 million m<sup>3</sup>/year) is consumed in the North American market<sup>34</sup>. Europe is the next largest market with a total installed production capacity of some eight million m<sup>3</sup>/year.

Australia currently imports around 40,000 m<sup>3</sup>/year of OSB for domestic consumption. Therefore, the opportunity to manufacture OSB in Victoria will depend on securing a large ongoing supply of indicatively 500,000 m<sup>3</sup>/year of pulpwood-grade fibre and a high orientation toward export markets, as a new plant at an international scale would need to export most of its production.

### **Further growth potential**

Assessments of new market opportunities for additional engineered wood product manufacturing in Victoria are underway, with a focus on using lower-quality plantation grown hardwoods (*Eucalyptus globulus*) and softwood logs (*P. radiata*) in the Green Triangle region.

The Green Triangle Forest Industries Hub (GTFIH) is leading an Australian Government-funded project with support from Forest & Wood Products Australia (FWPA) and the Australian Forest Products Association (AFPA) seeking to identify new domestic and export markets for lower quality logs<sup>35</sup>. The *Splinters to Structures* study has conducted a broad ranging market review and is now focused on LVL and GLT as preferred options for technical and market assessment. The study incorporates a detailed analysis of four key export markets for future trading opportunities: Japan, South Korea, Singapore and Malaysia, along with domestic markets. Some of these markets may provide additional opportunities for intermediate products such as veneers and lamella. This study is due for completion in mid-2025 with the findings expected to identify the scale of opportunities to direct more forest fibre resources to value added manufacturing and the associated policy settings and investment requirements to realise this potential.

In addition to these preferred options for southwest Victoria, OSB continues to be an opportunity for further consideration in the future, especially where there is an ongoing, large-scale consistent supply of lower grade logs that are not suitable for sawing or peeling and are not otherwise processed or directed to value added manufactured within the Green Triangle region.

Concurrently, the GTFIH is assessing the feasibility of establishing a designated 'manufacturing hub' in the region, incorporating direct, formalised hub linkages between research and innovation (supported by the Forestry Centre of Excellence at University of South Australia, based in Mount Gambier) through to production of sawn timber products, wood panels, a range of engineered wood products, and bioenergy, i.e. wood pellets.

### **Nanocellulose and building materials**

In addition to engineered wood products, there are emerging opportunities globally for nanocellulosic materials in construction markets, as well as textiles and packaging markets.

**Image 2 Oriented strand board**



Source: Adobe Stock image

<sup>34</sup> ABARES (2024) Dashboard data tables - Imports from 2005–06 to 2022–23: AFWPS: Production to 2022–23.

<sup>35</sup> FWPA (2024) *Splinters to Structures: Identifying new domestic and export markets for lower quality logs*. Online: <https://fwpa.com.au/news/splinters-to-structures-identifying-new-domestic-and-export-markets-for-lower-quality-logs/>

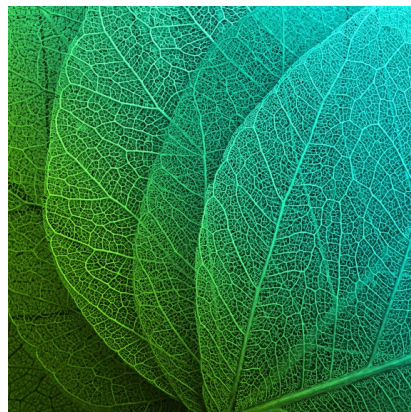
Nanocellulose is a term for a group of materials that are defined as having at least one of its fibrous dimensions at a nano scale. They can be made from kraft or dissolving pulp.

There is significant global interest in the use of cellulose nanomaterials as a substitute for synthetic materials or nano-reinforcement for polymers in various industries, including medical and healthcare, oil and gas, packaging, paper and board, composites, printed and flexible electronics, textiles, filtration, rheology modifiers, 3D printing, aerogels and coating films<sup>36</sup>.

Nanocellulosic materials are also used in the building sector. Micro-fibrillated cellulose (MFC) is being used across Europe and other countries in the production of MDF boards, other fibreboards and ceiling tiles, to enhance reduce the use of resins, reduce product weight, increase production efficiency and increase internal bond strengths for these building products<sup>37</sup>.

These types of applications could be readily applied in Victoria, with its existing MDF production and value chains for a broader range of manufacturing processes. In this context, there is potential for manufacturing nanocellulose products in Victoria, from either or both hardwood and softwood plantation fibres. However, it will require a consistent supply of kraft pulp from the existing pulp and paper manufacturing facility at Maryvale or imports from interstate or overseas. In addition, Victoria will need to acquire or establish specialist expertise and capability to ensure competitiveness with international suppliers and innovative product development programs.

**Image 3 Microfibrillated Cellulose**



Source: Fibrelean® Technologies

#### **4.4 Textiles**

The textile industry is reportedly one of the world's largest industrial sectors in terms of volume, with rapidly growing global demand driven by increases in population and average income. The global market is dominated by synthetic fibres (mainly polyester), followed by cotton, and then man-made cellulosic fibres (MMCF), which account for less than 10% of global market share<sup>38</sup>.

Wood-based fibres are closer substitutes for cotton than synthetic fibres, in terms of both technical properties and production processes. Constraints on the cotton production around the world, including competition for land and limitations on irrigation water and other inputs, have presented opportunities for new MMCF processes to fill a "cellulose gap" in global textile markets. New processes include recent innovations such as the introduction of new solvents for dissolving pulp to create more attractive textile fibre alternative to Viscose, and Spinnova®, a new fibre spinning technology developed by VTT<sup>39</sup>.

Textile value chains start with pulp mill manufacturing processes to pulp the wood fibre, or biorefineries capable of producing dissolving pulp or nanocellulosic material, which can then be spun or otherwise converted into MMCF and yarns for weaving, knitting and other textile treatments. Therefore, the potential for textiles manufacturing in Victoria would require pulp mill capacity or a biorefinery directed to the production of MMCF, using leading edge technologies.

The production of wood fibre-based textiles in Victoria may also need to be oriented towards exports, at least until new value chains are established in Australia. The benefits would be diversifying the manufacturing base in Victoria, potentially as part of a biomanufacturing hub in specific locations, e.g. in Gippsland, and underpin further product innovation and development.

<sup>36</sup> Thomas et al. (2020) Comprehensive review on nanocellulose: Recent developments, challenges and future prospects, *Journal of the Mechanical Behavior of Biomedical Materials*, Vol. 110, 2020, 103884, ISSN 1751-6161

<sup>37</sup> Fibrelean (2024) *MFC for Bio Building Materials*. Online: <https://www.fiberlean.com/markets/building-materials/>

<sup>38</sup> Hurmekoski et al. (2018) *op cit*.

<sup>39</sup> Spinnova (2024) Fibre production technology. Online: <https://spinnova.com/technology/>



## 4.5 Plastics and packaging

This category of wood fibre products encompasses a broad range of evolving technologies, including wood-plastic composites; pulp-based, paper-resembling film for flexible packaging; and other plastic-resembling wood or wood fibre-based materials for more rigid packaging.

The potential applications for these new types of bioplastics and packaging products are vast, as they can be used as replacements for fossil-fuel based plastics used in fields such as food, healthcare, cosmetics. The share of bio-based plastics of all plastics was less than 0.5% in early 2010s but is expected to reach 5% by the late 2030s<sup>40</sup>.

*“Annual plastic production is >380 million tonnes and increasing at an annual rate of 4%; consequently, 6.3 billion tonnes of plastic waste have been generated since 1950. Increasing concern regarding the environmental impact of plastic waste and the plastic related emission of greenhouse gases (GHGs) motivates the transition towards a ‘circular plastic economy’...*

*Bioplastics that are 100% biobased are currently produced at a scale of ~2 million tonnes per year and are considered a part of future circular economies to help achieve some of the United Nations’ Sustainable Development Goals, such as by diverting from fossil resources, introducing new recycling or degradation pathways and using less toxic reagents and solvents in production processes.”<sup>41</sup>*

The main facility for manufacturing paper-based packaging in Victoria is the Opal Australian Paper pulp and paper mill at Maryvale, which produces unbleached kraft linerboard, fluting medium, bag and sack papers for the fibre packaging market in Australia and New Zealand.

At present there is no production of wood-plastic composites in Victoria. However, the opportunity for application of this type of technology is evident in Tasmania, where a new wood-plastic composite (WPC) facility is now producing a range of products including decking boards, edge boards and concealed fasteners. These products are manufactured from a combination of recycled plastic and plantation pine timber residues such as wood shavings<sup>42</sup>.

This development in Tasmania is at a formative stage. However, it is clear in the international literature that there is a growing number of new wood-fibre-based materials and WPCs that can resemble the properties of plastics and thereby substitute for them; in addition to innovations for more traditional products such as structural boards and packaging.

**Image 4 Wood composite decking**



Source: Everdeck® (Timberlink Australia)

## 4.6 Bioenergy and biofuels

Biomass is used extensively to produce energy and biofuels in either solid or liquid form. This section looks at the existing and developing areas of biomass utilisation for energy.

### Wood pellets

Wood pellets are a biofuel made from the compression of organic matter. The range of biomass types that can be used is broad, but wood fibre is the biomass source most associated with biofuel pellets. In Australia, and elsewhere around the world, the production of wood pellets is largely based on utilisation of processing residues rather than roundwood.

The technology for pelletising particulate material has been in commercial use for more than 100 years. It is a well understood process, and its main application was originally in producing animal feed. Adaption to making wood pellets occurred in the early 1970s because of the global energy crisis and the search for alternatives to fossil oil.

<sup>40</sup> Hurmekoski et al. (2018) *op cit*.

<sup>41</sup> Rosenboom, J.G., Langer, R. & Traverso, G. Bioplastics for a circular economy. *Nat Rev Mater* 7, 117–137 (2022). <https://doi.org/10.1038/s41578-021-00407-8>.

<sup>42</sup> Timberlink (2024) Media release: Timberlink® announces new wood composite product range Everdeck®. Online: <https://timberlinkaustralia.com.au/app/uploads/2024/08/Timberlink-Bell-Bay-Media-Release-Everdeck-Composite-Decking-Launch.pdf>



The term 'white pellet' has been used to mean different things. In Europe, white pellets were commonly associated with a product made from clean white sawmill residues and meeting the highest quality standards. Today the term white pellet is mostly applied to differentiate wood pellets (regardless of feedstock colour) made through the pelletising process compared to wood pellets made with the inclusion of a torrefaction or steam explosion step in the process, which produces a pellet that is very dark in appearance and presently referred to as 'black pellets'.

The industry and market for white pellets is now well established in North America, Europe and North Asia. Today white pellets are almost exclusively used for energy generation, whether that be in industrial, commercial or residential applications. Black pellets are less widely used and directed predominantly to industrial uses including co-firing options.

To date, Australia has seen limited domestic demand for wood pellets, with most pellets used in domestic heating or for animal bedding or kitty litter, as well as use in composting processes. Given the small size of the domestic market, it is the export market that holds the attention of the existing and potential major pellet producers.

At present there is no substantial manufacturing of wood pellets in Victoria. There is a large-scale facility in Queensland that is using plantation timber processing residues. The most proximate development to Victoria is plans for a new facility in Mount Gambier to produce over 300,000 tonnes per year of industrial grade pellets, for emerging domestic markets and exports through the Port of Portland<sup>43</sup>. This facility will represent value added manufacturing for a substantial volume of processing residues and potentially some low-grade logs in the region.

### **Bio crude/ pyrolysis oil**

Pyrolysis oil is a liquid fuel produced from wood fibre that can be used in heat and power production to substitute for fossil-based oil, or further refined into transport fuels. The attributes of pyrolysis oil are close to those of heavy fuel oil. Suitable feedstock materials include roundwood, forest residues, sawmilling by-products (i.e. sawdust, wood chips) and black liquor.

Fast pyrolysis is a promising process for producing liquid fuel from solid biomass. In fast pyrolysis, the biomass is heated quickly to high temperatures (around 500°C) in the absence of oxygen. The formed vapours are cooled rapidly to give a dark brown liquid called bio-oil or pyrolysis liquid. Some of the raw material does not liquefy (mainly lignin) and can be burned in the adjacent boiler plant to produce steam for the process. In terms of production costs, pyrolysis oil has proven itself to be the lowest cost option among liquid biofuels today.

Wood-based fast pyrolysis is a maturing technology with near commercial production facilities in countries that include Canada, Finland, Germany and the Netherlands. Most facilities utilise wood residues as a feedstock to ensure a homogeneous bio-oil quality.

In Victoria, Radial Timber has installed a pilot plant at its sawmill in Gippsland to use pyrolysis technology to convert wood residues into biochar. The process was designed with one of the main drivers being to generate heat and energy for the processing facility, with the additional benefit of bioproducts including biochar, wood vinegar and potentially pyrolysis oils<sup>44</sup>.

The use of a pyrolysis/biochar plant can complement other renewable energy sources - notably solar, which can only generate energy in sunny conditions, while pyrolysis can be conducted at other times of the day to charge batteries and close the loop. It is a process that can also utilise processing residues that were previously considered byproducts or 'waste'.

One of the other features of this processing technology is that it can be set up at a small scale, for example with a supply of less than 10,000 tonnes per year of wood fibre residues, especially where the operations are integrated with existing primary processing facilities generating the feedstock. These operations can then be scaled up where it is feasible to utilise low value resource and supply emerging markets for biochar as well as biofuels.

### **Lignocellulosic ethanol ('bioethanol')**

Ethanol is colourless, flammable and antiseptic liquid, and is used mostly as transport fuel. First generation ethanol was and continues to be produced mainly of corn starch, wheat and sugar-containing plants such as sugar beet and sugar cane. Production of first-generation

<sup>43</sup> Timberbiz (2024) *Green Triangle Pellet Mill gets the green light*. Online: <https://www.timberbiz.com.au/green-triangle-pellet-mill-gets-the-green-light/>

<sup>44</sup> Radial Timber (2024) *How Radial's Pilot Plant Uses Pyrolysis For Biochar*. Online: <https://radialtimbers.com.au/how-radials-pilot-plant-uses-pyrolysis-for-biochar/>

ethanol is technologically well established and commercially developed for many years. First generation ethanol has been criticised for its limited greenhouse gas emission savings and for its raw materials that are also used for food production. In recent years, second generation or so-called lignocellulosic ethanol production has emerged to address these criticisms.

Second generation ethanol is produced exclusively of non-edible, cellulose and lignocellulose feedstock such as wood, agricultural residues, straw, grasses and municipal waste streams.

Currently there are no ethanol production facilities in Victoria using lignocellulosic feedstocks and the opportunity would require a substantial ongoing surplus supply of wood fibre residues.

Demand for these biofuels has significant growth potential globally as the world seeks to decarbonise the transport sector, including use of sustainable aviation fuel (SAF)<sup>45</sup>. A key limitation has generally been cost competitiveness to oil-based transport fuels. However, there are examples of various countries driving an increase in the use of renewable fuels, through policies such as the EU Renewable Energy Directive, which has seen the share of renewable energy sources in EU energy consumption increase from 12.5% in 2010 to 23% in 2022<sup>46</sup>. This policy is subject to the principle of the cascading use of biomass, which aims to achieve the resource efficiency of biomass use by prioritising, wherever possible, the material use of biomass over its energy use, thus increasing the amount of biomass available within the system.

### **Lignocellulosic biobutanol**

Lignocellulosic biobutanol is a bio-based alcohol produced of similar feedstock to second generation ethanol. It has been studied mostly for use as 'drop-in' fuel in mixtures with gasoline/petrol. Biobutanol has superior properties compared to bioethanol, on account of its higher energy density, lower volatility and less corrosiveness. Biobutanol also shows promise as an industrial solvent, with other applications that may include use in paints/coatings, resins, pharmaceuticals, food grade extractants, chemical intermediates and herbicides.

At this stage biobutanol is currently not yet commercialised. The opportunity to develop this type of manufacturing process in Victoria would require a biorefinery facility supported by an ongoing fibre supply and other enabling factors including a supportive policy environment and markets.

### **Green methanol and opportunities for biofuels**

Green methanol is another alcohol that can be produced from wood fibre biomass. Like ethanol, green methanol is a colourless liquid mainly used for producing other chemicals such as formaldehyde, acetic acid and plastics.

It can also be used as a fuel source for engines. Unlike traditional methanol, which is derived from fossil fuels, green methanol is produced from low-carbon sources such as biomass or via carbon capture<sup>47</sup>.

The feasibility of producing green methanol in Victoria is currently being assessed, for a production facility at Portland in the State's southwest. The HAMR Energy-led consortium is planning to establish a state-of-the-art plant dedicated to converting around 300,000 tonnes per year of plantation forestry residue into green methanol, specifically to supply biofuels to the shipping industry. Complementing this facility will be a 100-megawatt electrolyser, designed to produce renewable hydrogen from water, i.e. 'green hydrogen'. The intent is to create Australia's foremost green shipping fuel production hub, with production to begin in 2029<sup>48</sup>.

Elsewhere, the opportunity for further expansion of biofuels from wood fibre is reflected in the development plans for a new eFuels manufacturing facility in northern Tasmania, which will feature the supply of residue biomass from hardwood plantation forestry operations. The facility, due for a construction start in 2025, is expected to produce up to 100 million litres of eFuels per year by 2028 and recycle around 250,000 tonnes of carbon dioxide per year from plantation biomass, which is reportedly equivalent to decarbonising 60,000 vehicles every year<sup>49</sup>. The

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<sup>45</sup> CSIRO (2023) *Sustainable Aviation Fuel Roadmap*. CSIRO, Canberra.

<sup>46</sup> European Commission (2023) *op cit*.

<sup>47</sup> World Economic Forum (2023) *Is green methanol the clean fuel the world is forgetting?* Energy Transition article published 31 August 2023.

<sup>48</sup> HAMR Energy (2024) *Thyssenkrupp Uhde*. Media article, 30 July 2024. Online: <https://www.hamrenergy.com/news/hamr-energy-and-thyssenkrupp-uhde-join-forces-to-supercharge-clean-fuel-production-1>

<sup>49</sup> Forico (2024) *HIF Global and Forico team up to deliver Australia's first eFuels plant*. Media release, 27 November 2023. Online: <https://forico.com.au/news/hif-global-and-forico-team-up-to-deliver-australias-first-efuels-plant>

design of this project is based on an established model operating in Chile<sup>50</sup>, producing fuels that can provide direct replacements for fossil fuels used in cars, trucks, ships, and aircraft.

This example highlights the broad range of opportunities for value adding use of various grades of wood fibre from plantation forestry operations - in this case the woody residues remaining on site following forest operations that may otherwise be underutilised.

### Other emerging opportunities for wood fibre-based bioenergy products

Rapid advances in technology development are increasing the range of potential opportunities for the use of wood fibre in bioenergy and biofuel products.

Another leading example of this broad range of opportunities is the emergence of biomaterials such as 'bio-graphite' as a transformative material in electric vehicle (EV) batteries, with the potential to enhance battery performance and sustainability. A New Zealand-based bioeconomy company has developed a low cost and reportedly carbon-negative bio-graphite made from wood biomass<sup>51</sup>. This material has been engineered to replace mined or fossil-based synthetic graphite in lithium-ion batteries, which would address critical supply chain and sustainability challenges in the EV and energy storage sectors. The company is establishing a demonstration site in Southern Finland, in partnership with Stora Enso, on a site that was previously used for pulp production and lignin extraction operations.

While this initiative is still in a development phase, it is illustrative of the types of ongoing advances in new product development using wood fibre materials.

## 4.7 Biochemicals

Biochemicals represent another grouping of emerging product opportunities for wood fibre, specifically following the chemical treatment of wood fibre – typically, through pulp mill technologies used for pulp and paper manufacturing, or through a biorefinery set up specifically to produce and refine a range of chemical derivatives. Broadly, bio-based chemicals (including 'platform chemicals') encompass the following<sup>52</sup>:

- *Bio-based drop-in chemicals such as ethylene and propylene* that are chemically identical to existing fossil-based chemicals with established markets. Applications for these products and derivatives include textiles, polyethylene bottles, packaging and composites.
- *Smart drop-in chemicals such as succinic acid*, whose bio-based pathways provide advantages compared with conventional petrochemical pathways, such as a comparably high biomass utilisation efficiency, low embodied energy or low toxicity. Succinic acid has broad application in industrial markets for making polyurethanes, resins and coatings to smaller, specialty markets including hygiene products and food flavouring products.
- *Dedicated bio-based chemicals such as lactic acid* that do not have an identical fossil-based counterpart and can offer unique and superior properties. Lactic acid is used as a solvent in the pharmaceutical and chemical industries, and in personal care products.

While the technologies for making these products are now advanced and the potential markets globally are vast, there is a stepwise set of challenges that would need to be addressed through industry development plans and feasibility studies to integrate them into value chains in Victoria.

Perhaps most significantly, they require pulp mill manufacturing processes or a biorefinery to enable the chemical extraction or conversion processes. Then, bio-based counterparts to fossil fuel-based products would generally need to compete against petrochemical processes optimised for decades with investments that may already have been amortised<sup>53</sup>. Lignocellulosic feedstocks typically require a larger number of processing steps (such as pretreatment and enzymatic hydrolysis) than sugar crops, to separate and use the lignin, so operating and investment costs would typically be higher, at least in the near term.

<sup>50</sup> These eFuels are made using electrolyzers powered by renewable energy to separate hydrogen from oxygen in water. The green hydrogen is combined with recycled CO<sub>2</sub> to produce carbon neutral eFuels, which are chemically equivalent to fuels used today and can therefore be dropped-in to existing engines without any modifications required.

<sup>51</sup> CarbonScape (2024) *CarbonScape to Build Demonstration Plant for Biographite Production in Finland*. Online: <https://www.carbonscape.com/latest-news/carbonscape-and-stora-enso-select-sunila-finland-for-biographite-demonstration-plant>

<sup>52</sup> Hurmekoski et al. (2018) *op cit*.

<sup>53</sup> *Ibid*.

These types of products and technologies have been developed and tested in Australia previously. For example, in Tasmania, a joint venture partnership between Norske Skog Australia and the Circa Group during the 2010s led to the development of the 'FC5' process at the Boyer paper mill site at New Norfolk, which converted radiata pine sawdust, using reactions under pyrolysis conditions, to produce the "green" biosolvent Cyrene™ - a more environmentally friendly alternatives to existing solvents which have unacceptable environmental impacts<sup>54</sup>. Following a three-year development process, the prototype plant was successfully commissioned and produced in-specification 99% pure Cyrene™ for customers in the USA.

This process led to further product testing in US and European markets, ahead of a move to establish a full-scale commercial facility in France, which has the goal of 80,000 tonnes per year of global offtake capacity by 2030<sup>55</sup>. While this full-scale production has moved offshore, these types of developments highlight the opportunities in Australia for innovative, value adding uses of wood fibre that underpin value added manufacturing and optimised utilisation of wood fibre along industry value chains. These developments also demonstrate the industry investment required to develop and adopt new technologies and establish viable markets for new products.

#### 4.8 Summary of emerging wood fibre product opportunities

This review of emerging wood fibre applications has identified a broad and evolving range of opportunities for wood fibre value chains within Victoria, and more broadly across Australia.

A summary of existing products and new and emerging product opportunities is shown below (Figure 4-4). This summary incorporates a subjective assessment of the relative stage of the product maturity (and in turn understanding of production costs and market prices), the market attractiveness of each wood product from a Victorian perspective (inferred market depth and market growth); and the scale of resource required to be globally competitive (bubble sizes).

This summary indicates the most prospective opportunities for further value-added manufacturing beyond expansion of existing manufacturing, include but are not limited to:

- Engineered wood products such as LVL and additional glue-laminated timbers
- New bioproducts such as green methanol and pyrolysis oil
- Potentially dissolving pulp for textiles, noting this will require pulp and paper manufacturing or biorefinery manufacturing processes
- Other biofuels including white wood pellets.

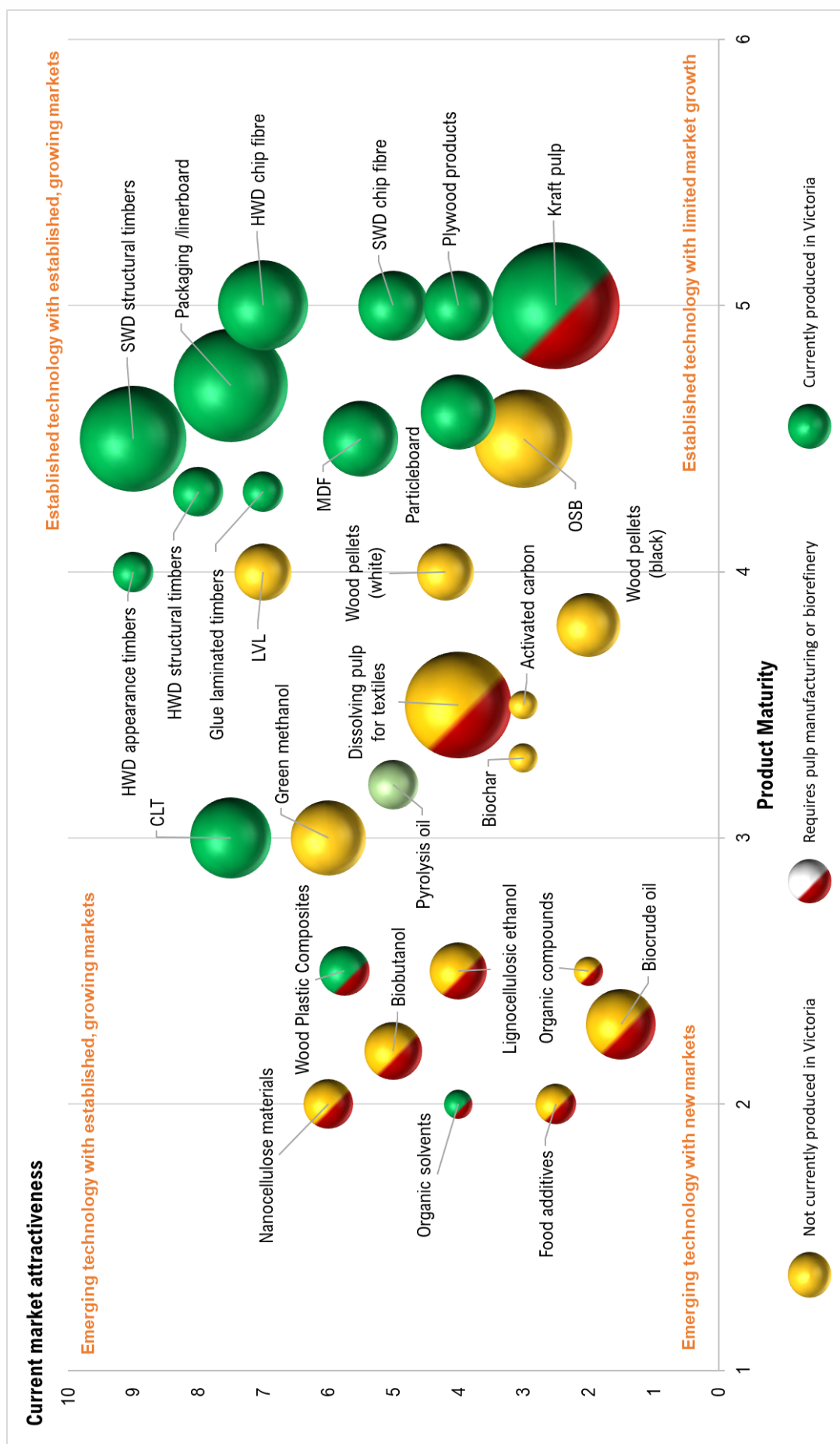
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<sup>54</sup> Norske Skog (2019) *Production of first in-specification 99% Cyrene™*. Media release, January 2019. Online: <https://www.norskeskog.com/About-Norske-Skog/Press-room/Articles/Cyrene-FC5>

<sup>55</sup> Circa Group (2024) *Cyrene™*. Online: <https://circa-group.com/products/cyrene/>



Figure 4-4 Relative positioning of existing wood fibre products and emerging opportunities for Victoria



Source: Indufor project analysis.

# 5



## THE ROADMAP TO 2050

- 5.1 Setting a vision for the future
- 5.2 Strategic priorities for Victoria

## 5. THE ROADMAP TO 2050

*“The bioeconomy is emerging as a transformative force for sustainable development, leveraging biological resources and innovative technologies to address global environmental challenges. By integrating advances in biotechnology and digital tools with circular economy principles, the bioeconomy offers solutions that not only mitigate environmental impacts, but also drive economic growth and societal well-being.”*

World Economic Forum, July 2024<sup>56</sup>

### 5.1 Setting a vision for the future

Victoria is at the forefront of plantation forestry development in Australia and already has an extensive base of primary and secondary processing and manufacturing of wood products and pulp & paper products. In this context, Victoria is well placed to build upon existing wood fibre value chains to meet the growing demand from Australia’s increasing population.

However, to replace native forest hardwood timber production and support the expansion of domestic value adding manufacturing of structural timbers and engineered wood products including laminated timbers and composites, Victoria will need to expand its plantation resources – including hardwood plantations grown for sawn timber and veneer production over the next 25 years to 2050. Without the expansion of the softwood estate and this new hardwood resource, Victoria will continue to face supply limitations and increasing levels of market risk, notably in terms of reliance and dependence on imports to maintain sustainable and efficient supply chains to meet future construction needs and other end use requirements.

Furthermore, the world is changing fast - and amid existential challenges posed by climate change, net zero targets and the digital revolution globally ('Industry 4.0'), the Victorian wood fibre industry must have a clear focus on the future to remain highly competitive, sustainable and profitable. This will require increased levels of coordination and integration, especially in relation to the use and reuse of wood fibre through regional wood fibre cascades to realise the highest possible value from fibre resources, including forest fibres and recycled wood fibres.

Therefore, a 2050 vision is proposed to set a clear charter and direction for the industry and enable industry stakeholders to coordinate further research and investments. This vision is:

***Victoria is a global leader in the use and reuse of wood fibre from sustainable managed forests and advanced manufacturing of a diverse range of innovative, high-value products for a circular bioeconomy benefitting regional communities and the state.***

This vision of Victoria’s wood fibre industry in 2050 is directly aligned with multiple State government policy objectives, including the following:

- **Net Zero targets:** Victoria has committed to a long-term target of net zero greenhouse gas emissions by 2045 and an emissions reduction target of 75 to 80% by 2035<sup>57</sup>. The wood fibre industry can directly support substantial, ongoing emission reductions through carbon sequestration and storage in growing forests and wood fibre products.
- **Made in Victoria 2030:** The State government has committed to helping businesses capture emerging opportunities in a changing global environment and strengthening the advanced manufacturing capabilities of local firms by investing in technology adoption and upskilling the future workforce<sup>58</sup>. The wood fibre industry already has advanced manufacturing across regions but there is considerable scope for further innovation and investment.
- **Recycling Victoria: a new economy:** Victoria has a long-term vision for a world class circular economy system that helps build a more sustainable future for all Victorians<sup>59</sup>. The Roadmap incorporates key components that are directly aligned with this policy,

<sup>56</sup> World Economic Forum (2024) *What is the bioeconomy and how can it drive sustainable development?*

<sup>57</sup> Victorian Government (2023) *Victoria's 2035 Emissions Reduction Target*, May 2023.

<sup>58</sup> Victorian Government (2022) *Made in Victoria: Manufacturing Statement: driving jobs and growth*, October 2022.

<sup>59</sup> Recycling Victoria (2024) *Circular economy market report*, March 2024.

including the use and reuse of renewable, recyclable wood fibre and the potential for advanced manufacturing of bioproducts and can replace non-renewable materials.

## 5.2 Strategic priorities for Victoria

The development of the Roadmap has led to the identification of five key strategic priorities to realise the proposed vision for Victoria's wood fibre industry in 2050. These strategic priorities comprise the following industry imperatives to:

1. increase value added manufacturing along a wood fibre cascade to highest and best use
2. increase hardwood and softwood plantation forest resources to support increased domestic production of manufactured wood products for the built environment
3. increase recovery and reuse of wood fibre for improved efficiency and circularity
4. decarbonise the sector to attain net zero targets and climate positive outcomes
5. support ongoing product innovation for a more circular bioeconomy.

These priorities for the wood fibre industry, which are set out further below, encompass sectoral leadership requirements and actions for industry companies including forest growers and wood fibre processors and manufacturers, regional forestry hubs, R&D organisations and service providers, and government agencies at the federal, state and local levels.

All these priorities are directly aligned with State government policy commitments, and some Australian Government policy commitments, as outlined below (Table 5-1).



**Table 5-1 Alignment of strategic priorities with relevant government commitments**

Strategic priorities	Alignment with relevant government commitments
<b>1. Increase value added manufacturing along a wood fibre cascade to highest value use</b>	<ul style="list-style-type: none"> <li>• <i>Made in Victoria 2030: Manufacturing Statement (2022)</i>, which aims to enhance sovereign capability and advanced manufacturing, attract and stimulate investment, increase productivity, and create new jobs for Victoria.</li> </ul>
<b>2. Increase plantation forest resources to support domestic manufacturing for the built environment</b>	<ul style="list-style-type: none"> <li>• <i>National Forest Industries Plan 2018</i>, to support growth in the renewable timber and wood-fibre industries, innovate, and realise the national ambition to plant ~one million ha by 2030</li> <li>• <i>Greening Construction with Sustainable Wood 2023</i>, an Australian Government commitment to advancing policies and approaches that support low carbon construction and increase the use of wood from sustainably managed forests in the built environment.</li> </ul>
<b>3. Increase recovery and reuse of wood fibre for improved efficiency and circularity</b>	<ul style="list-style-type: none"> <li>• <i>Recycle Victoria: A new economy</i>, a state policy platform that aims to reduce waste, increase recycling and create more value from our resources, with monitoring progress towards a new circular economy</li> <li>• <i>Victoria's Circular Economy Innovation Fund</i>, which provides funding to stimulate innovation and build capability in the circular economy.</li> </ul>
<b>4. Decarbonise the sector to attain net zero targets and climate positive outcomes</b>	<ul style="list-style-type: none"> <li>• <i>Victoria's Climate Change Strategy</i>, with updated targets to target to reduce Victoria's emissions by 75 – 80% by 2035 and achieve net-zero emissions from 2050 to 2045.</li> </ul>
<b>5. Support ongoing product innovation for a more circular bioeconomy</b>	<ul style="list-style-type: none"> <li>• <i>Made in Victoria 2030: Manufacturing Statement</i></li> <li>• <i>Recycle Victoria: A New Economy</i></li> <li>• <i>Innovation Victoria: Innovation Statement (2021)</i>, which aims to drive growth in the sectors of the future, from advanced manufacturing to emerging digital technologies.</li> </ul>

### 5.2.1 Priority 1: Increase value added manufacturing

Victoria's wood fibre industry encompasses a broad range of value-added manufacturing across the state and adjacent regions. Effectively all sawlogs and high-grade logs are directed to domestic processing in modern sawmills and plywood mills, generally with secondary manufacturing facilities including GLT and CLT production; and a large proportion of pulpwood-grade logs from softwood plantations especially are directed to manufacturing facilities including a large scale kraft paper packaging mill, plus MDF and particleboard facilities.

However, there is scope for additional value adding in Victoria, and advanced manufacturing, to optimise the use and reuse of wood fibre resources across the state. This opportunity presents particularly in the context of significant exports of hardwood chip fibre, and softwood chip fibre also, through the Port of Geelong and the Port of Portland. In addition, a significant proportion of other sawmill residues are used on-site for heat and energy, where there may be scope for allocating these resources to higher value uses in structural applications or other wood and paper products and replacing energy needs from other renewables.

Furthermore, the development of the Roadmap has highlighted a much broader range of potential wood fibre-based products than is currently manufactured in Victoria, including the rapid emergence and development of a broad suite of bioproducts.

Increasing value added manufacturing in Victoria and its adjacent regions, along a wood fibre cascade that realises the highest possible value from resources, has multiple benefits including ensuring efficient use of limited resources through integrated supply chains; minimising

emissions associated with trade in unprocessed wood fibre; and increasing opportunities for regional employment and upskilling the future workforce.

### **Priority activities**

Under this strategy priority, key activities for the VFPA, industry members and responsible government agencies over the next 5-10 years comprise the following:

1. Establish clear policies at the State government and Local government level, promoting the vital importance of a world class, innovative & sustainable manufacturing sector, based on renewable resources, to meet socio-economic needs and the resilience of regional communities and the state.
2. Promote and explore further the opportunities to continue to redirect wood fibre destined for short lived end uses in Australia, e.g. woodchips for pulp & paper, to long lived wood products, e.g. panels and engineered wood products, as well as long lived wood products such wood-plastic composites.
3. Facilitate feasibility studies for further investment in new or expanded value adding manufacturing to complement existing capacity in key regions, including glulam, LVL and OSB, and emerging bioproducts such as green methanol. This will require considerable specialist expertise and capacity, which will need to be built upon over time.
  - These feasibility studies should specifically consider the scope for co-location of manufacturing facilities, to enhance their economic viability through shared access to infrastructure, optimised fibre allocation and integrated downstream processing.
  - The Green Triangle region presents a leading example of a manufacturing hub with a largely integrated range of domestic value adding facilities - notably sawmills, particleboard mills, engineered wood product manufacturing plants, and plans underway for wood pellet production and green methanol production.
  - Another example is the potential to further develop a manufacturing hub around the existing pulp and paper manufacturing capacity at Maryvale in Gippsland, to realise the potential for manufacturing a broader range of wood products and other bioproducts through a wood fibre cascade to the highest and best uses within the hub.
4. Establish regular industry forum for closer engagement and collaboration between the construction sector and wood fibre industry representatives in Victoria and nationally, to ensure timber products and innovation are align with the buildings of the future.
5. Invest in comprehensive, updated socio-economic studies to better understand and provide authoritative information for government and the public on the contribution of the wood fibre industry to the economy and society; recognising the most recent, comprehensive studies are based on data from 2015-16 and there has been significant change since that time.

### **5.2.2 Priority 2: Increase plantation base for domestic manufacturing**

This strategic priority is based on increasing softwood *and* hardwood plantation forest resources to support increased domestic production of manufactured wood products.

Victoria has an extensive, mature softwood plantation estate that underpins current processing and manufacturing of structural timber and a range of other manufactured wood products including plywood, MDF and particleboard. However, projections for population growth and housing demand (Figure 3-2) and Australia's imports of softwood structural timber (Figure 4-2) indicate the current resource base cannot support domestic consumption requirements to 2050.

As part of the Victorian Forestry Transition Program, the Victorian Government is actively supporting GPIP, through an allocation of \$120 million to expand Gippsland's softwood plantation estate by up to 14,000 ha by 2035.

This investment in new softwood plantations is expected to increase the supply of softwood sawlogs and peeler logs for domestic processing and manufacturing predominantly in Gippsland.

In relation to hardwood plantation estate, it is almost entirely managed on a silvicultural regime focused on producing high quality pulpwood fibre within 15-20 years. Only a small proportion is focused on producing sawlogs that could replace, to a limited extent, the supply previously available from public native forests managed for sustainable timber production. Furthermore, most of the current hardwood plantation estate is in the Green Triangle region, with only a small

proportion located in the Gippsland region, which is where most of the existing hardwood sawmill processing and manufacturing capacity was established in proximity to native forest hardwoods.

Currently, Victoria has less than 10,000 ha of hardwood plantations managed on a long rotation silvicultural regime to produce sawlogs and peeler logs – and a good proportion of these plantations being farm forestry plantings, which are fragmented in distribution and of variable age and condition. Therefore, Victoria's existing hardwood plantation estate has minimal capacity to support supply chains that are internationally competitive in producing hardwood timber products.

At present there is no State government program comparable to GPIIP with a dedicated focus on hardwood plantations that are grown and managed specifically for sawlog production.

In 2023, the Australian Government launched a '*Support Plantation Establishment*' program to support the establishment of new long-rotation softwood and hardwood plantation forests in Australia, through a grant funding mechanism (funding of \$2,000 for every hectare of new long-rotation plantation forest established, with a minimum plantation area of 20 hectares)<sup>60</sup>. More time will be required to determine whether this mechanism will provide sufficient incentive to catalyse or otherwise contribute to a substantial increase in long rotation hardwood plantations in Victoria.

Until a large-scale hardwood plantation resource is established with a silvicultural regime focused on produce high quality logs with diameters of at least 25-30+ centimetre (cm) to support sawing or peeling, then Victoria will rely on imported hardwoods to supply manufacturing requirements or end uses. This scenario presents a range of implications and risks for Victoria, notably in terms of reliance and dependence on imports as well as maintaining sustainable and efficient supply chains to meet future construction needs and other end use requirements.

Given the ongoing and increasing demand for hardwood products, and the related carbon benefits, there is a significant opportunity for Victoria in terms of establishing a long rotation hardwood supply that provides opportunities for highly skilled employment and support for the Net Zero objectives.

The lack of private sector investment in long rotation plantations over the past decade indicates that more coordinated efforts from government (at all levels), working together with industry and communities, are required to create a more favourable investment environment in Victoria. These coordinated efforts would need to address the range of contributing factors to the current situation regarding hardwood long rotation investments. These contributing factors include hardwood log market arrangements; applying best practice silvicultural approaches; defining site selection frameworks and related productivity estimation processes; assessing the regulatory environment and climate-related factors; and risk mitigation opportunities.

More broadly, increasing Victoria's hardwood and softwood plantation forest estate to support increased domestic production of manufactured wood products would contribute directly to two significant carbon pools for Victoria and potentially other states of Australia. These are:

- *Forest land remaining forest land*, which accounts for most of the carbon stocks within the Land Use, Land Use Change and Forestry (LULUCF) category of Australia's Greenhouse Gas Inventory. Increasing the plantation forest estate, and the productive capacity of this forest land over time, would complement the carbon stocks in public native forests and private native forests across the state.
- *Harvested wood products*, and use of these products in long-lived applications in the built environment, including residential housing constructions, mass timber constructions for large scale buildings, and a broader range of products including wooden furniture. Increasing the proportion of wood fibre directed to long lived wood products will increase this carbon pool over time, and where those products substitute for more emissions-intensive construction materials, the emission reduction benefits are amplified further.

These carbon pools are directly linked, as an expanded plantation forest estate would provide increased capacity for sustainable timber harvesting and production of harvested wood products, which in turn would enable Victoria to move towards sovereign production capacity

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<sup>60</sup> DAFF (2023) *Support Plantation Establishment program*, Department of Agriculture, Fisheries and Forestry, Canberra, accessed 30 September 2024.

and advanced manufacturing, and potentially more competitive wood fibre-based products for application in the built environment.

Victoria currently has a total of around 382,000 ha of commercially managed plantation forests (approximately 60% softwood and 40% hardwood). To address industry scale requirements, Victoria should aim to maintain and expand this estate, with consolidated areas in key plantation regions, and expansion by at least 5-10% would see a mature plantation estate of more than 400,000 ha in 2050, managed in accordance with third party certification for long term supply to a vibrant, efficient and competitive wood fibre industry.

### **Priority activities**

Under this strategy priority, key activities for the VFPA, industry members and responsible government agencies over the next 5-10 years comprise the following:

1. Implement and build on the Gippsland Plantation Investment Program (GPIP), which aims to grow the softwood resource base in the Gippsland region by approximately 15,000 ha over the next 10 years.
2. Draw on lessons learned from GPIP, over the next 5-10 years, to support opportunities for net expansion of the plantation forest resource base in other key plantation regions, notably the Murray Valley, Green Triangle, and Central Victoria regions.
3. Establish a dedicated hardwood plantation development program focused on scoping and growing sawlogs and peeler logs over long rotations of at least 20-25 years, to replace native forest hardwood timbers and support domestic value adding manufacturing, with the aim to grow this resource base by approximately 10,000 ha over the next 10-15 years.
4. Support the efficient and effective implementation of ACCU Scheme methods that are facilitating new plantation establishment, for long rotation softwoods *and* hardwoods, and recognition of carbon stored in harvested wood products.
5. Ensure ongoing coordination between the State Government and Australian Government on new plantation incentive programs, including concessional loan arrangements for greenfield plantation development, to underpin industry scale and capacity to meet domestic fibre needs into the future.

#### **5.2.3 Priority 3: Increase recovery and reuse of wood fibre**

The FWPA-supported Timber Circularity Project has observed that less than half of wood fibre is recycled in Australia, with some jurisdictions recycling much smaller proportions. This highlights the considerable scope to increase the level of recovery and reuse of wood fibre at the end of life for a broad range of products. This includes wood fibre that may become 'waste' through the manufacturing processes, such as frame and truss offcuts, and recovery of wood products including engineered wood products from construction and demolition waste.

The recovery and reuse of timber and wood fibre from these waste streams increases the total pool of fibre available for manufacturing products for domestic consumption, potentially with minimal marginal costs, especially in highly integrated supply chains.

In addition, it can significantly reduce the extent to which timber and other wood fibre is otherwise directed to landfill or other disposal treatments that may accelerate the release of greenhouse gas emissions through oxidation and decay.

### **Priority activities**

In the context, key activities for the VFPA, industry members and responsible government agencies over the next 5-10 years comprise the following:

1. Facilitate further implementation and expansion of the national, FWPA-funded Timber Circularity Project, to identify recovery and reuse opportunities and priorities, including spatial mapping of wood fibre resources within the construction sector across metropolitan and regional centres.
2. Develop a spatially explicit wood fibre cascade model for Victoria and adjacent regions – as a pilot model for a national study or a series of state-based models - to identify sources of forest fibre that could be directed to alternate markets to optimise wood fibre utilisation.



3. Engage with State government agencies to ensure recycling programs - e.g. Recycle Victoria - and regulations support efforts to maximise recovery and reuse opportunities for timber and other sources of wood fibre.
4. Engage with State government agencies and the Australian government to secure support and recognition for wood fibre industry initiatives aligned with circular economy policy commitments and objectives.

#### 5.2.4 Priority 4: Decarbonise the sector to achieve net zero targets

The World Business Council on Sustainable Development has observed the accelerating race to net-zero presents a tremendous opportunity for the forest sector to position itself as a key enabler of the net-zero transition<sup>61</sup>. As stewards of sustainable working forests and manufacturers of wood fibre-based products, the forest sector can provide scalable and cost-effective solutions for carbon capture and storage, along supply chains that extend into the built environment. This will require successfully navigating a fast-changing operating landscape.

This strategic priority focuses on reducing greenhouse gas emissions in operations and across the value chain, which complements the earlier priority focused on increasing carbon removals through sequestration in sustainable working forests and storage in forest products, and the substitution of non-renewable and fossil-based materials with forest products.

Australia's forest and wood products industry is already working on this strategic priority. FWPA is supporting the development of a comprehensive decarbonisation roadmap for the industry, including modelling of industry emissions projections out to 2050. This work will establish baseline projections and identify the most effective avenues for carbon emissions reduction, capture, and storage, as well as risks and opportunities to achieve better than net zero by 2050.

##### **Priority activities**

In the context of this existing program of work, key activities for the VFPA, industry members and responsible government agencies over the next 5-10 years comprise the following:

1. Support the finalisation and implementation of the Australian Forest & Wood Products Industry Decarbonisation Plan for 2050. This plan is expected to set out the most effective avenues for carbon emissions reduction, capture, and storage, which can be implemented over the next 10 years and beyond to meet future targets.
2. Establish a State Government policy requiring new construction projects to give preference to domestic production of sustainable timber products including engineered wood products, specifically to reduce embodied carbon in Victorian homes and buildings.
3. Support the State Government to adopt a framework for measuring embodied carbon in the built environment and introduce embodied carbon reduction requirements for new buildings, houses and government-funded projects.
4. Conduct a sector-wide analysis of the most emissions-efficient transport systems for logs and processed wood products, including electrification of truck fleets, combined with existing and future rail infrastructure. Given the sector wide scope, this analysis should be conducted through collaboration between VFPA and industry members, with support from FWPA and other research organisations, as well as external engagement with the harvest and haulage sector.
5. Facilitate sector commitments and enterprise-level commitments to decarbonisation and regular (annual) reporting on carbon stocks and emissions, especially major corporates with capacity for climate disclosures. These types of commitments and systematic reporting would also underpin transparency, accountability and credibility for the industry on the outcomes of decarbonisation initiatives and assist in communications with key stakeholders on the contribution of the industry to climate positive action and meeting state level targets.

<sup>61</sup> World Business Council for Sustainable Development (2021) *Forest Sector Net-Zero Roadmap. Phase 1: Enabling the transition to the net-zero economy.*

### 5.2.5 Priority 5: Support product innovation for a circular bioeconomy

Around the world, there is clear recognition that the forest sector – and the wood fibre industry more broadly – can be central to the ongoing transition to a low-carbon and circular future based on the use of renewable natural resources; also known as the bioeconomy.

With their ability to capture and store carbon, wood fibre-based materials feed into a broad array of renewable solutions that can substitute non-renewable and fossil-based materials in products we use every day. These range from traditional products such as paper, packaging and personal care products, to more innovative biofuels and biomaterials for the construction, chemical and textile sectors<sup>62</sup>.

Victoria is producing some of these fibre-based materials and renewable solutions; however, there is considerable scope for further collaboration, integration and innovation across the industry, to unlock more value from forest fibres and recovered wood fibres through an optimal cascade and advanced manufacturing.

#### **Priority activities**

Under this strategy priority, key activities for the VFPA, industry members and responsible government agencies over the next 5-10 years comprise the following:

1. Facilitate State government recognition of the vital role the wood fibre industry can play in developing a circular bioeconomy within regions and, as a network, at the state level, with integrated supply chains and innovation.

This recognition is required to secure and maintain investment in research and development for product innovation and process efficiency through national level R&D institutional programs, and support for industry development at community and local government levels.

2. Support a new State Government Policy requiring new building projects to preference to domestically produced sustainable timber products where feasible.

This type of policy would provide a clear, strong signal for the construction sector to incorporate lower embodied carbon materials such as timber and engineered wood products into building designs, to assist in realising net zero emission targets by 2050 and beyond.

3. Conduct strategic analyses of the feasibility to establish a bio-hub and biorefinery in Victoria, drawing on wood fibre feedstock from industry residues and waste recovery streams in one or more regional hubs ('bio-hubs'). There is a broad range of wood fibre-based bio-products that can only be manufactured with pulp manufacturing processes or biorefinery facilities.
  - As noted for Priority 1 above, the feasibility study for a bio-hub or biorefinery should specifically consider the scope and benefits from co-location of manufacturing facilities, to enhance their economic viability through integrated downstream processing and infrastructure developments.
  - For example, Opal Australian Paper's pulp and paper mill at Maryvale in the Latrobe Valley manufactures unbleached kraft linerboard, fluting medium, bag and sack papers for the growing fibre packaging market in Australia and New Zealand. This facility, with its associated infrastructure, could provide a focal point for the further development of a manufacturing hub in Gippsland, to realise the potential for a broader range of bioproducts and complement the existing sawn timber production and engineered wood product manufacturing capacity within the extent of the hub.
  - Further consideration should also be given to the scope for Victoria to expand its capacity for product development and innovation where these capabilities are required.
4. Support the further development of cost-effective renewable energy for processing facilities, including potentially biofuels, to enable wood fibre to be directed to structural applications where possible.

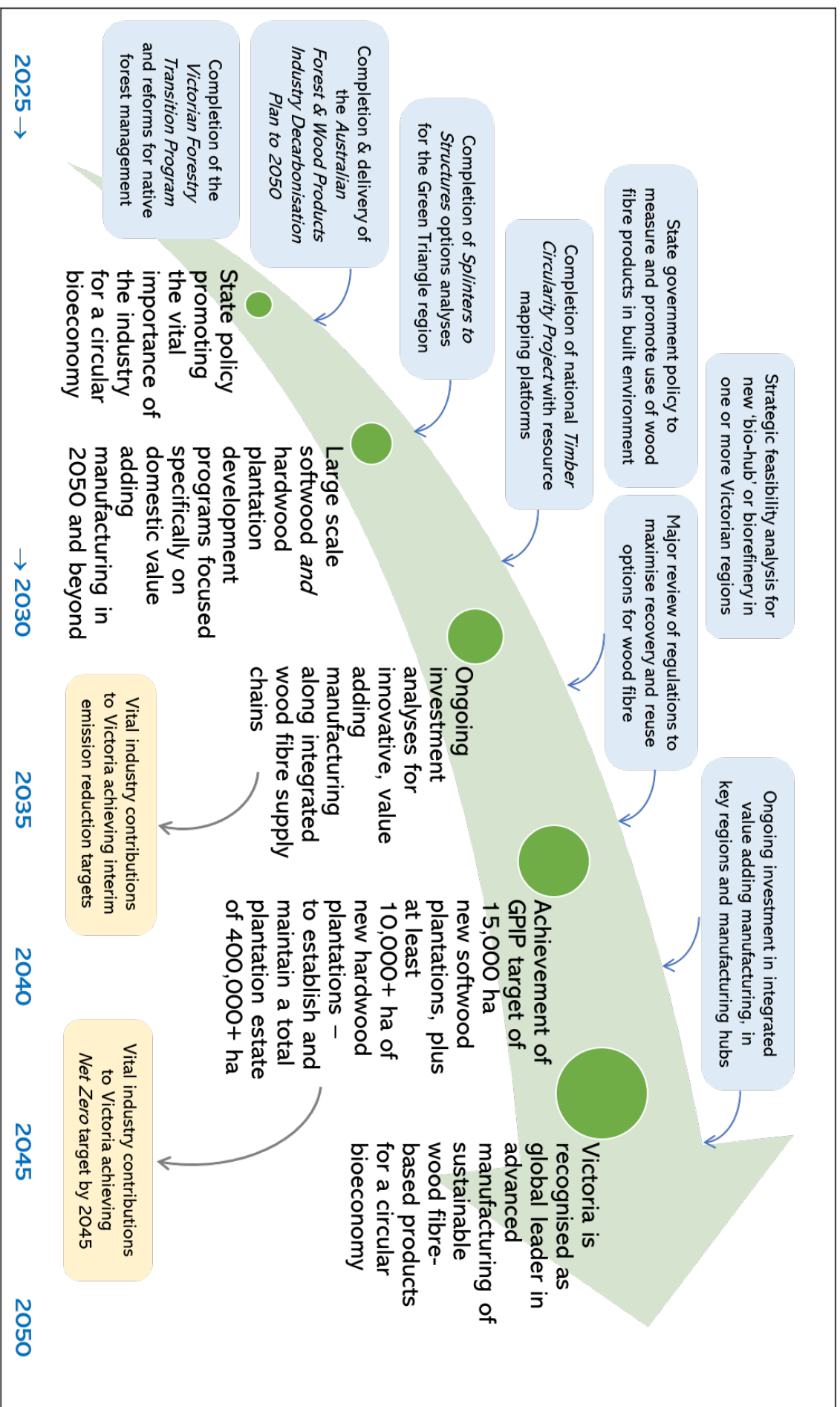
This strategic activity relates to the wood fibre cascade, which would ideally result in wood fibre being directed in preference to wood-based products for structural applications, ahead of energy use – which can be met in part by renewables such as wind and solar, and potentially complemented by biofuels produced from the lowest value wood residues. Summaries of these strategic priorities are set out in Table 5-2 and the Roadmap in Figure 5-1.

<sup>62</sup> World Business Council for Sustainable Development (2019) *Forest Sector SDG Roadmap*.

**Table 5-2 Summary of strategic priorities and activities for wood fibre allocation and usage in Victoria, 2025 to 2050**

Strategic priorities	1. Increase value added manufacturing within state	2. Increase plantation forest resources	3. Increase recovery and reuse for improved circularity	4. Decarbonise the industry to attain net zero targets	5. Facilitate product innovation for a circular bioeconomy
<b>Priority 1</b>	<ul style="list-style-type: none"> <li>- Support the establishment of clear government policies promoting the vital importance of a world class, advanced wood fibre manufacturing sector, to meet socio-economic needs and the resilience of regional communities and the state</li> </ul> <p><i>State and local governments</i></p>	<ul style="list-style-type: none"> <li>- Implement fully and build on the Gippsland Plantation Investment Program (GPIP) to grow the softwood resource base</li> <li>- Draw on lessons learned from GPIP to support opportunities for net expansion in other regions</li> </ul> <p><i>State Government, VFPA, Industry</i></p>	<ul style="list-style-type: none"> <li>- Facilitate expansion of the national Timber Circularity Project, to identify recovery and reuse priorities, including spatial mapping of wood fibre resources within the construction sector across metro &amp; regional centres</li> </ul> <p><i>FWPA and USC-led initiative, underway</i></p>	<ul style="list-style-type: none"> <li>- Support the finalisation and implementation of the <i>Australian Forest &amp; Wood Products Industry Decarbonisation Plan for 2050</i>, with associated plan objectives and recommendations for the wood fibre industry</li> </ul> <p><i>VFPA, AFPA, State Government</i></p>	<ul style="list-style-type: none"> <li>- Facilitate State government recognition of the vital role the wood fibre industry can play in developing a circular bioeconomy within regions and, as a network, at the state level, with integrated supply chains</li> </ul>
<b>Priority 2</b>	<ul style="list-style-type: none"> <li>- Facilitate feasibility studies for further investment in new or expanded value adding manufacturing to complement existing capacity in key regions, with integrated supply chains, including glulam, LVL and OSB, and emerging bioproducts</li> </ul> <p><i>Australian and Victorian governments</i></p>	<ul style="list-style-type: none"> <li>- Scope and establish a dedicated hardwood plantation program focused on growing sawlogs and peeler logs over long rotations (20-25 years) with the aim to grow this resource base by 10,000 ha over the next 10-15 years</li> </ul> <p><i>Australian and Victorian governments</i></p>	<ul style="list-style-type: none"> <li>- Develop a spatially explicit wood fibre cascade model for Victoria and adjacent regions (as a pilot for national study) to identify sources of forest fibre that could be directed to alternate markets to optimise wood fibre utilisation</li> </ul> <p><i>VFPA, AFPA, industry stakeholders</i></p>	<ul style="list-style-type: none"> <li>- Support the State Government to adopt a framework for measuring embodied carbon in the built environment and introduce embodied carbon reduction requirements for new buildings, houses and government-funded projects</li> </ul> <p><i>VFPA, State government, NABERS</i></p>	<ul style="list-style-type: none"> <li>- Support a State Government policy requiring new construction projects to give preference to domestic production of sustainable wood products, specifically to reduce embodied carbon in Victorian homes and buildings</li> </ul> <p><i>VFPA, State Government, NABERS</i></p>
<b>Priority 3</b>	<ul style="list-style-type: none"> <li>- Establish regular industry forum to enable closer collaboration between the construction sector and wood fibre industry and ensure timber products and innovation are aligned with the buildings of the future</li> </ul> <p><i>VFPA, AFPA, Advance Timber Hub</i></p>	<ul style="list-style-type: none"> <li>- Support the efficient and effective implementation of ACCU Scheme methods to facilitate expansion of long rotation softwoods and hardwoods, and recognition of carbon stored in wood products</li> </ul> <p><i>Australian government, industry</i></p>	<ul style="list-style-type: none"> <li>- Engage with State government agencies to ensure recycling programs - e.g. Recycle Victoria - and regulations support efforts to maximise recovery and reuse opportunities for timber and other sources of wood fibre</li> </ul> <p><i>VFPA, State Government (EPA)</i></p>	<ul style="list-style-type: none"> <li>- Conduct sector wide analysis of the most emissions-efficient transport systems for logs and processed wood products, including electrification of truck fleets, combined with existing and future rail infrastructure</li> </ul> <p><i>VFPA, AFPA, State government</i></p>	<ul style="list-style-type: none"> <li>- Conduct a strategic analysis of feasibility to establish a bio-hub or a biorefinery in Victoria, drawing on wood fibre feedstock from industry residues and waste recovery streams in one or more regional catchments</li> </ul> <p><i>VFPA, FWPA, BioPRIA</i></p>
<b>Priority 4</b>	<ul style="list-style-type: none"> <li>- Invest in comprehensive, updated socio-economic studies to provide authoritative information for government and the public on the contribution of the wood fibre industry to the economy and society</li> </ul> <p><i>State Government, FWPA</i></p>	<ul style="list-style-type: none"> <li>- Ensure ongoing coordination between the State and Federal Government to support new plantation incentive programs and underpin industry scale and capacity to meet domestic fibre needs in the future</li> </ul> <p><i>Australian and Victorian Governments</i></p>	<ul style="list-style-type: none"> <li>- Engage with State government agencies and the Australian government to secure support and recognition for wood fibre industry initiatives aligned with circular economy policy commitments and objectives</li> </ul> <p><i>VFPA, State Government (EPA)</i></p>	<ul style="list-style-type: none"> <li>- Facilitate sector commitments and enterprise-level commitments to decarbonisation and regular (annual) reporting on carbon stocks and emissions, especially major corporates with capacity for climate disclosures</li> </ul> <p><i>VFPA, industry stakeholders</i></p>	<ul style="list-style-type: none"> <li>- Support further development of cost-effective renewable energy for processing facilities including potentially biofuels (as a base load), to enable wood fibre to be directed to structural applications where possible</li> </ul> <p><i>VFPA, industry stakeholders</i></p>
<b>Key themes</b>	<ul style="list-style-type: none"> <li>• State government policy support</li> <li>• Increased domestic processing</li> <li>• Value added manufacturing</li> </ul>	<ul style="list-style-type: none"> <li>• Resource for domestic processing</li> <li>• Recognition of carbon stored in harvested wood products</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling and reuse</li> <li>• Climate Positive outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• State government policy support</li> <li>• Sectoral commitment to targets</li> <li>• Transformation of supply chains</li> </ul>	<ul style="list-style-type: none"> <li>• Applied research programs</li> <li>• Further development of innovative bio-products</li> </ul>

Figure 5-1 Implementation roadmap for Victoria's future wood fibre industry, 2025 to 2050







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## 6. REFERENCES

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