Circular Economy for Off the Road (OTR) Tyres

Mining Industry in Australia

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Australian Tyre Recyclers Association

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Executive Summary

This report, prepared for the Australian Tyre Recyclers Association (ATRA), assesses opportunities to establish a circular economy for off-the-road (OTR) tyres in Australia's mining industry, highlighting a significant gap between current practices and emerging global expectations. Although Australia generates approximately 537,000 tonnes of used tyres annually, recovery rates for OTR tyres remain very low (around 13%), with large volumes still buried onsite despite their high material value. This represents both an environmental challenge and a missed economic opportunity, as OTR tyres contain substantial quantities of high-quality natural rubber and steel that can be recovered and reused in manufacturing and infrastructure applications.

Globally, there is strong momentum toward tyre circularity, with leading jurisdictions achieving substantially higher recovery rates through regulated stewardship schemes, financial incentives, and mandatory recycling targets. In contrast, Australia's largely voluntary approach, combined with regulatory allowances for onsite burial, has constrained progress. At the same time, major tyre manufacturers, including Michelin, Bridgestone and Goodyear, are rapidly increasing their use of recycled and renewable materials, with many targeting 40% or more by 2030 and full circularity by 2050. This shift is creating a growing international demand for high-quality recovered tyre materials, positioning used mining tyres as a valuable feedstock rather than waste.

The transition to a circular economy for mine tyres is supported by several strong drivers. These include economic benefits from recovering valuable materials, environmental and social pressures to reduce landfill and emissions, and increasing risks in the supply of natural rubber due to climate impacts, disease and geopolitical concentration. In addition, community expectations, particularly from Traditional Owners, are evolving, with increasing opposition to the burial of tyres on country and a preference for sustainable recovery and reuse. Technological advancements and recent investments in recycling infrastructure, including dedicated OTR tyre facilities, are further enabling viable recovery pathways.

However, several barriers continue to limit progress. These include the relatively low cost and regulatory acceptance of onsite disposal, high logistics and transport costs in remote mining regions, limited infrastructure in regional areas and uncertainty around end markets for recycled products. Inconsistent regulatory frameworks across jurisdictions also create complexity and reduce investment certainty. Addressing these barriers will require coordinated action across government, industry and the recycling sector, including policy reform, improved logistics solutions and stronger incentives for recovery.

There are significant opportunities to create value from recovered tyres through a range of applications, including micronised rubber powder for new tyre production, recovered carbon black, construction materials such as rubberised asphalt and energy recovery products. These applications not only reduce reliance on virgin materials and lower environmental impacts but also support domestic manufacturing, job creation and regional economic development.

Overall, the report concludes that Australia's mining industry is well positioned to play a critical role in advancing tyre circularity. With increasing global demand, improving local infrastructure and growing environmental and social expectations, shifting from disposal to recovery is both commercially viable and strategically important. Achieving this transition will depend on stronger regulatory frameworks, continued investment and innovation and greater collaboration across the mining, recycling and manufacturing value chain.



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Acronyms and Abbreviations

Acronym	Abbreviation
ATRA	Australian Tyre Recyclers Association
EOL	End-of-life
EPR	Extended Producer Responsibility
GPSNR	Global Platform for Sustainable Natural Rubber
GTR	Ground Tyre Rubber
KPI	Key performance indicator
MRP	Micronised Rubber Powder
OTR	Off-The-Road
PET	Polyethylene Terephthalate
rCB	Recovered carbon black
rPET	Recycled Polymers
R&D	Research and Development
RTR	Regenerated Tyre Rubber
TDA	Tyre-derived aggregate
USTMA	US Tire Manufacturers Association
vCB	Virgin carbon black

1.0 Background

SLR Consulting Australia Pty Ltd (SLR) has been engaged by the Australian Tyre Recyclers Association (ATRA) to support producing a report that would highlight the circular economy options for used tyres from the mining industry in Australia.

The report focuses on the following three questions, based on high-level desktop-based research and industry expertise:

- Task 1 - What global trends, best practices and targets are shaping the future of tyre recycling in the mining sector?
- Task 2 - What are the drivers for establishing a circular economy for mine tyres in Australia?
- Task 3 - What are the market opportunities for manufacturing new tyres and products from recycled tyres?

2.0 Introduction

For both circular economy opportunities and asset risk mitigation, the sustainable recovery of used mining tyres from site, their processing and the secondary use of this material makes sense.

The case for OTR tyre recovery from Australian Mines

Off The Road (OTR) tyres such as the massive mine tyres used especially in Western Australia and Queensland mines, are collected at extremely low rates of only around 2%.

Unfortunately, this valuable material for domestic manufacturing, new tyre production or use to enhance sustainability in roads is largely buried on site, though recovery volumes are slowly climbing.

This report examines the sustainability, policy, social and manufacturing drivers for the increased recovery of OTR mining tyres from Australian mine sites, including:

- There are real risks to natural rubber production from diseases and supply constraints that warrant investment from Australian miners. As large users of tyres in their operations miners recovering this material for secondary use makes commercial sense to help de-risk new tyre production.
- Recovered OTR tyre material is a valuable product for new tyre production. True circularity for recovered tyres is now available and demand for OTR tyres for this circularity is on the rise.
- Policy developments, especially in Europe[1], are focusing on issues such as avoiding further deforestation. These policies could further constrain supply of virgin rubber by limiting expansion of rubber plantations at a time when demand is increasing.
- Most major tyre manufacturers, including Michelin, Goodyear, Pirelli and others are setting ambitious targets for recovered materials in new tyre production. The mining industry can play a role in ensuring their used OTR tyres are available to supply this emerging market.
- Social licence issues associated with burying tyres in pit, including demands from Traditional Owners are evolving with calls to responsibly recover waste materials and for circular outcomes.

[1] https://www.tyrepress.com/2025/11/ec-proposes-eudr-simplification-tyres-europe-rejects-it/

- The burial of OTR tyres on site was originally determined as a temporary measure with the intention of removing this material for 'future use'. On-site burial by miners has unfortunately become a convenient default and permanent state, enabled by state government regulators.
- Australia's tyre recycling sector has invested significantly over the past 2–3 years in collection, transport and processing infrastructure available to manage Australia's mine sector used tyre arisings.

Domestic processing and manufacturing from recovered mine tyres in Australia is now occurring. Recyclers have invested significantly in this collection and processing capacity including through Federal and State government funding rounds such as the Recycling Modernisation Fund.

This report also details the policy positions and the drivers of major tyre manufacturers regarding the sourcing and sustainability of natural rubber, constraints affecting its global supply and the integration of recycled materials, particularly micronised rubber powder (MRP), into new tyre production. The report highlights the recovered material agendas of leading manufacturers including Michelin, Bridgestone, Goodyear, Continental and Pirelli and the Circular Economy outcomes these manufacturers are seeking in new tyre production.

Current Capacity in the Mine Tyre Recycling Industry

The Australian tyre recycling sector has the capacity to collect, and process used mine tyres from across Australia. Australian Tyre Recycler Association members' capital investment for OTR tyre collection and processing is approximately $100 million in the past 3 years alone.

The collection cost for OTR tyres varies significantly depending on location and accessibility, though backloading of old tyres as new tyres offers significant commercial savings.

Used OTR tyres and conveyor belts from mines can now be utilised as rubber crumb in roads, rubber matting and other soft fall applications, industrial adhesives as well as recovered materials in the emerging realm of new tyre production. Used OTR tyres, with their high ratios of natural rubber and large volumes of this material, are a sought-after resource both domestically and for export into Asia for the production of Micronised Rubber Powder (MRP) and its application in the production of new tyres.

Global tyre manufacturers are actively shifting toward recovered materials in new tyre production as various supply risks and sustainability policies and legislation converge.

As these circular economy opportunities and social and environmental expectations increase mine tyre recovery will grow. Similarly, miners may want to play a role in shoring up their own supply of tyres as critical for their own operations. Diversifying inputs from virgin materials to include recovered products will increasingly be normal business practice.

Figure 1 Natural rubber collection



To be explored further in this report, natural rubber collection remains a labour-intensive agricultural process dependent on a single species of tree (Hevea brasiliensis) originating from South America. Rubber plantations in South America are now virtually non-existent due to the impact of the rubber leaf blight[2] and production is centred in SE Asia.

It would be prudent for miners to be involved in diversifying sources of rubber for new tyre production to include recovered materials.

3.0 Current recovery rates for OTR tyres in Australia

It is estimated that around 537,000 tonnes of used tyres[3] were generated in Australia in 2023–24, of which 66% were recovered and 26% contributed to circular outcomes, like reuse and recycling. Regarding used OTR tyres[4], around 110,000 tonnes of used OTR tyres were buried onsite. Across all OTR tyres (including agriculture), only 13% were recovered (as shown in **Figure 2**).[5, 6]

Figure 2 Recovery rates for various classes of tyres in 2023-24



[2] https://www.bridgestone.com/technology_innovation/natural_rubber/para_rubber_tree/

[3] Used tyres are tyres that are no longer wanted or capable of performing their original purpose but still have the potential for life extension through processes like retreading or second-hand sale.

[4] Off-The-Road tyres covers tyres used on OTR equipment such as construction and mining equipment, agricultural tractors, industrial equipment, aircraft, and defence equipment.

[5] Material Flow Analysis Report 2023–24, Tyre Stewardship Australia, accessed from https://www.tyrestewardship.org.au/tools-and-resources/material-flow-analysis-report-2023-24

[6] National End-of-Life Tyres Options project – Project report, Department of Water and Environmental Regulation, Government of Western Australia, accessed from https://www.wa.gov.au/government/publications/national-end-of-life-tyres-options-project-project-report

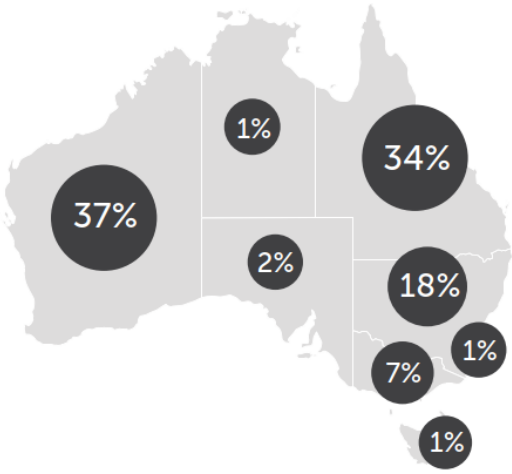
Table 1 shows the 2023-24 estimates for the fate of used tyres across the major tyre classes: passenger tyres (for cars), truck tyres and OTR tyres in Australia.[7]

Table 1 Australian used tyre fates, 2023-24

Fate	Passenger (Tonnes)	Truck (Tonnes)	OTR (Tonnes)	Total (Tonnes)
Reuse	5,200	37,500	3,300	**46,000**
Recycling + Repurposing	16,200	63,600	9,500	**89,300**
Energy Recovery	146,000	63,400	8,100	**217,500**
Recovered	**167,400**	**164,500**	**20,800**	**352,800**
Not Recovered - Remaining in Flow	1,700	1,100	21,300	**24,100**
Landfill	21,000	26,600	2,400	**50,000**
Burning	100	200	700	**1,000**
Onsite Burial	-	-	109,300	**109,300**
Not Recovered	**22,800**	**27,900**	**133,600**	**184,300**
Total	**190,200**	**192,400**	**154,400**	**537,000**

Figure 3 shows the end-of-life[8] (EOL) OTR tyres generation across Australia.

Figure 3 End-of-life OTR tyres generation across Australia



Most end-of-life OTR tyres were generated by the mining sector (79%), followed by the agriculture sector (11%) in 2023.[9]

[7] Tyre Supply Chain Data Pack, Tyre Stewardship Australia, accessed from https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fstorage.googleapis.com%2Ftsa_craftcms_media%2Fassets%2Fpdf-resources%2FTSA-Data-Pack.xlsx&wdOrigin=BROWSELINK

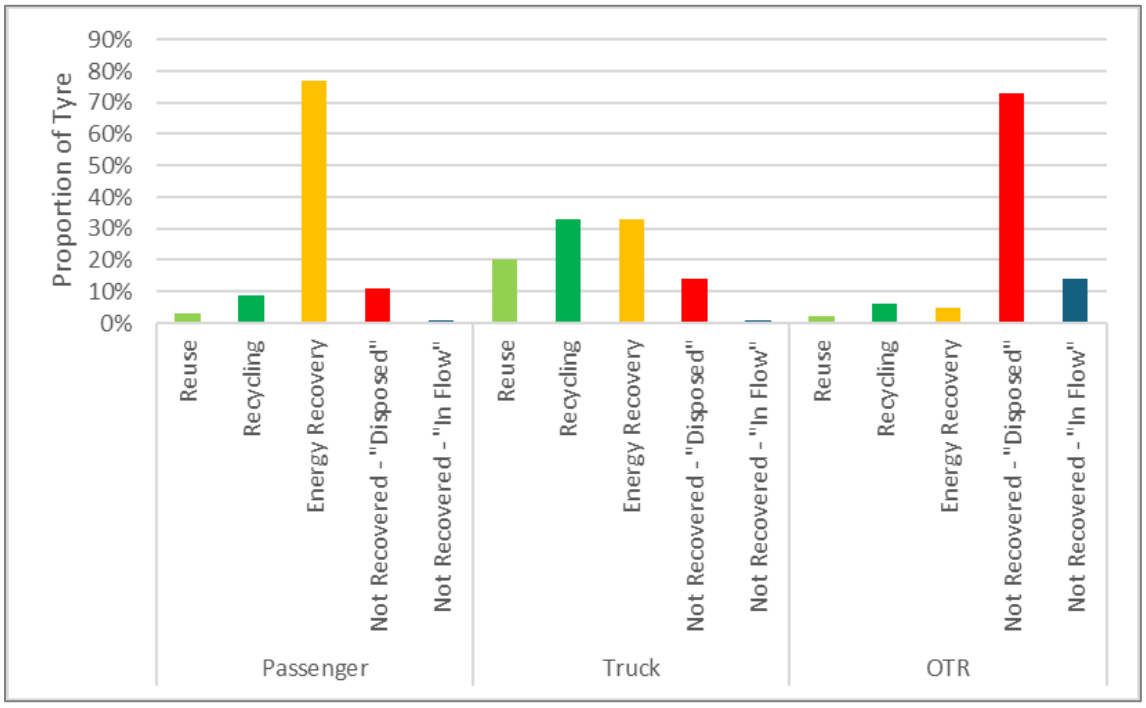
[8] End-of-Life tyres are tyres that are no longer wanted or capable of performing their original purpose where it has been determined that their life cannot or will not be extended.

[9] Paving The Way for Australia's Tyre Circular Economy, 2023, Tyre Stewardship Australia, accessed from https://storage.googleapis.com/tsa_craftcms_media/assets/Annual-Reports/TSA-Annual-Report-FY2023.pdf

The latest data on the recovery of used tyres in Australia shows a massive gap between passenger, truck and bus tyres – all of which are collected at a rate of around 97% - and the recovery of used mine tyres.

This 2023/24 data shows OTR tyre recovery at around 13% (as shown in **Figure 4**), though mine tyre recovery is much lower, at only around 2%.

Figure 4 Used Tyre fates by Segments, 2023-24



So, while the other two classes of tyres are being collected and processed for some secondary use at very high levels[10], mine (and agricultural) tyres demonstrate a significant market failure and need for improvement.

4.0 Tyre Recycling in Mining Sector

Mining tyres pose significant environmental concerns due to their size and weight. The largest of these mining tyres weigh up to 7 tonnes and has a diameter of 63 inches (equivalent to 1.6 meter), as shown in **Figure 5**.[11, 12]

Designed for extreme durability and often located in remote sites, their size and distance to markets make transport and disposal more expensive than onsite disposal.

[10] The difference between 'collection' and 'recovery' is the final point of disposal. While 97% of passenger and commercial tyres are legally collected and disposed of this figure includes some volumes of legal landfill of shredded tyres (ATRA actively advocates for this practice to be banned). The final 'recovery' rate of 88% includes energy, crumb and other secondary uses.

[11] Driving circularity: Supporting the circular economy through effective tyre management, accessed from https://www.icmm.com/en-gb/case-studies/2025/driving-circularity-through-effective-tyre-management

[12] Tyrecycle's new Pilbara facility giving new life to old mining tyres, accessed from https://miningmagazine.com.au/tyrecycles-new-pilbara-facility-giving-new-life-to-old-mining-tyres/

Figure 5 Size of mining tyres



4.1 Global trends and best practices

As indicated in Section 4 above, the Australian mining sector generates an estimated 79% of all used OTR tyres; however, the recovery rate for all OTR tyres remains low at around 13% in 2023–24. In the mining sector, the recovery rate for OTR tyres is even less at only around 2%, with the vast majority ending up stockpiled or buried on-site.[13]

However, several international OTR tyre stewardship programs (or regulated markets) have operated successfully for over 20 years, achieving significantly higher recovery rates through structured end-of-life management frameworks.

The table below compares Australia's current OTR recovery performance and approaches with those of other countries that have established effective tyre stewardship schemes, highlighting both recovery outcomes and the strategies used to drive improvement.[14]

Table 2 OTR tyre recovery rates by country

Location	Recovery Rate	Approach
Australia	13%	• No Mandatory recovery, • Burial permitted
Canada (Ontario)	87% large OTR recovery	• Legislated recovery rate, • Producers must meet recovery rates (60% large tyres and 85% other)
France	78% medium-large OTR tyre recovery	• POM target for tyre recovery, • Moderate fees

[13] Driving circularity: Supporting the circular economy through effective tyre management, accessed from https://www.icmm.com/en-gb/case-studies/2025/driving-circularity-through-effective-tyre-management

[14] Tipping the Balance Report, Tyre Stewardship Australia, accessed from https://tyreresponsegroup.com/tyrestewardship-australia-tipping-the-balance-report/

Location	Recovery Rate	Approach
		• Producers must collect and process tonnages from previous year
Denmark	100% OTR recovery	• Tax scheme, • Moderate fee, granulation and pyrolysis subsidies only, • EPA-approved

Chile is also moving aggressively on regulation, introducing mandates that require 25% of mining OTR tyres to be recycled, increasing to 75% by 2027 and 100% by the end of the decade.[15] Despite a large and growing stockpile of used tyres, these mandates have driven industry action. The Chilean example demonstrates how strong regulation can accelerate innovation, infrastructure investment and sustainable end-of-life solutions for OTR tyres.

Tyrecycle recently opened Australia's first dedicated OTR mining tyre recycling facility in Port Hedland in the Pilbara region of Western Australia, the state's premier mining district. Opened in late 2024, this facility aims to handle 30,000 tonnes of OTR tyres annually, significantly increasing the recycling rate in the mining sector.

Figure 6 T-Rex OTR Tyre Cutter



The facility utilises advanced equipment, including the T-Rex OTR tyre cutter (shown above), capable of breaking down large tyres, weighing up to 4 tonnes, into smaller, manageable pieces. Tyres processed here are transformed into various products, such as crumb rubber

[15] Piling on the pressure to recycle mining tyres, Mining Technology, accessed from https://www.mining-technology.com/features/mining-tyres-recycling/

for roads and playgrounds, and processed materials are exported for the emerging markets for new tyre production.[16, 17, 18]

CTS Tyre Recycling operates a $50 million state-of-the-art facility at Neerabup, north of Perth. The facility recycles all tyre sizes, including the largest OTR tyres, in addition to conveyor belts and other materials. It also has a full remanufacturing line to create a range of valuable new products under the 'Throughcycle Rubber' brand, including soft-fall flooring, acoustic underlay and transport matting.

Figure 7 CTS Tyre Recycling Plant



The $50M CTS plant has capacity to recycle 60,000 tonnes of EOLT and conveyor rubber per annum and around $8M of the build cost was provided by government to support capacity building and solutions for large miners to sustainably manage their end-of-life waste tyres.

[16] Tyrecycle's new Pilbara facility giving new life to old mining tyres, accessed from https://miningmagazine.com.au/tyrecycles-new-pilbara-facility-giving-new-life-to-old-mining-tyres/

[17] Tyrecycle opens recycling facility for OTR mining tyres, Waste Management Review, accessed from https://wastemanagementreview.com.au/tyrecycle-opens-recycling-facility-for-otr-mining-tyres/

[18] Recyclers aim to stop 30,000 tonnes of mining tyres being buried every year, accessed from https://www.abc.net.au/news/2025-09-13/tyre-recycling-facility-hopes-process-more-mining-waste/105642522

Figure 8 The tyres broken down into smaller chunks of rubber



Tyrecycle has partnered with companies like Alcoa Australia to ensure that used mining tyres and conveyor belts are recycled responsibly. This collaboration not only helps in managing waste but also supports Alcoa's goal of reducing landfill waste by 25% by 2030.

Tyrecycle's operations are expected to prevent 30,000 tonnes of tyres from being buried each year, contributing to a more sustainable mining industry.

5.0 The case for increased recovery of used mine tyres

5.1 Natural rubber production and the search for alternate recovered materials

Natural rubber is a critical raw material in tyre manufacturing, accounting for 20–40% of a tyre's weight. With increasing environmental concerns associated with deforestation, policy development and supply chain vulnerabilities, tyre manufacturers including OTR tyre producers are adopting sustainability policies and targets to ensure responsible sourcing of secondary materials and promote circular economy practices.

Australian miners can play an important role in this global agenda to recover used tyres for new tyre production as well as additional sustainability outcomes such as the use of crumb rubber in matting, adhesives and asphalt while also avoiding leaving their waste in the environment and on Traditional Owners' land.

5.2 Policy development impacting rubber production

The European Union has identified natural rubber as a 'critical raw material'[19] for the global economy. It's estimated tyres use 76% of the global supply of this material and there is an ongoing focus on the production of this material, especially supply sources from rainforest destruction and their replacement with rubber plantations[20].

The EU Deforestation Regulation[21] applies import rules associated with the replacement of forests with plantations and to the following materials.

- Cattle (including beef)
- Cocoa
- Coffee
- Oil Palm
- **Rubber**
- Soya
- Wood

EU importers must meet the requirements of the EUDR to import products. This includes collecting a range of sourcing information prior to importation, including:

- A description of relevant products and their quantities
- Geolocations of all production locations
- Date or time range of production
- Adequately conclusive and verifiable information that the relevant products are deforestation-free and were produced in compliance with the export country's relevant local laws.

EU importers will utilise this information to submit a due diligence statement to EU authorities prior to the products entering the EU.

All major tyre manufacturers are also members of the Global Platform for Sustainable Natural Rubber (GPSNR)[22], which sets policy frameworks for ethical and sustainable sourcing of natural rubber.

The EU as a global leader in environmental regulation is setting a stage for increased oversight of natural rubber production. Tyre manufacturers are responding to this and the broader sustainability agenda with various initiatives associated with sustainable rubber supply and diversification of inputs to include recovered materials.

[19] https://en.wikipedia.org/wiki/Critical_Raw_Materials_Act

[20] https://mightyearth.org/work/agriculture/rubber/

[21] https://www.agriculture.gov.au/biosecurity-trade/export/from-australia/european-union-deforestation-regulation

[22] https://sustainablenaturalrubber.org/

5.3 Constraints and risks to natural rubber supply

5.3.1 Geographic Concentration

Over 90% of natural rubber is produced in Southeast Asia[23], making the supply chain vulnerable to regional disruptions. The US Tire Manufacturers Association (USTMA) is in fact urging a domestic supply of this material to help de-risk manufacturing[24].

5.3.2 Climate and Disease

Adverse weather and diseases like leaf blight, mentioned previously and which have completely destroyed the South American rubber industry, have also reduced yields in key producing countries such as Thailand, Indonesia, and Vietnam.

There is a possibility of the arrival of this disease that destroyed the South American rubber industry in Asia[25], which would be catastrophic for the tyre industry and the global economy including miners; dependent as the industry is on tyres for their operations.

5.3.3 Economic Shifts

Farmers are shifting to more profitable crops like oil palm due to low rubber prices, further constraining supply[26].

5.3.4 Demand Growth

Global demand for natural rubber was projected to reach 15.7 million metric tons in 2024, with the tyre industry consuming over 76% of this volume[27].

5.3.5 Supply-Demand Imbalance

In 2025, production of rubber was expected to reach 14.9 million metric tons, while demand will grow to 15.6 million metric tons, resulting in a deficit[28].

Recovering used mine tyres and putting them back into the Circular Economy and new tyre production makes sense from multiple perspectives, including the mining sector playing its part in ensuring ongoing supply of the critical assets of OTR tyres in their own operations.

6.0 Sustainable Materials Agenda of Tyre Manufacturers

Most major tyre brands are shifting material sourcing away from just virgin materials to include a range of recovered and bio-based products including materials recovered from used tyres in the ultimate example of circular economy.

[23] https://www.ustires.org/resources/fast-facts-sustainable-natural-rubber

[24] ibid

[25] https://apsjournals.apsnet.org/doi/10.1094/PDIS-04-17-0592-FE

[26] https://www.sciencedirect.com/science/article/abs/pii/S0143622822002090

[27] https://mightyearth.org/work/agriculture/rubber/

[28] https://rubberworld.com/global-rubber-production-faces-continued-challenges-in-2025/

Figure 9 Tyre Containing Recycled Material



Tyre manufacturers' sustainability and material sourcing are summarised in **Table 3**.

Table 3 Tyre Manufacturers' Strategies

Company	Sustainable Materials Targets	Natural Rubber / Sourcing Policy	Recycled Materials and Technologies	Key Initiatives / Notes
Michelin	• 40% sustainable by 2030 • 100% by 2050 • ~31% achieved (2024)	Strong sustainable natural rubber policy (since 2016); focus on traceability, biodiversity, and community protection	• Micronised Rubber Powder via Lehigh Technologies • >500 million tyres produced with MRP	Leader in circular materials innovation; targeting increased MRP inclusion (12–15%)
Bridgestone	• 40% sustainable by 2030 • 100% by 2050 • 39.6% achieved (2023)	Sustainable procurement practices; aligned with global frameworks	• Recovered carbon black (rCB) • Pyrolysis and recycling tech	E8 Commitment; strong focus on circular economy and material reduction
Goodyear	• Long-term 100% sustainable goal • Scaling recycled inputs (~1.4% currently)	Natural Rubber Procurement Policy focusing on human rights, land use, and traceability	• Recycled, bio-based, renewable materials (e.g., ElectricDrive tyres)	Targeting net zero by 2050; phasing out petroleum oils
Continental	• >40% sustainable by 2030 • 100% by 2050	Sustainable Natural Rubber Policy aligned with	• Recycled Polyethylene Terephthalate (PET), rubber, rice husk ash	Strong innovation pipeline; focus on deforestation-

Company	Sustainable Materials Targets	Natural Rubber / Sourcing Policy	Recycled Materials and Technologies	Key Initiatives / Notes
	• ~26% achieved (2024)	UN SDGs and GPSNR	• Circular materials in UltraContact tyres	free supply chains
Pirelli	Long-term sustainability roadmap (no single % target stated)	Emphasis on supplier collaboration, biodiversity, and traceability	• Recycled and sustainable raw material integration	Structured multi-year sustainability strategy with key performance indicators (KPIs)
BKT	• Increase sustainable input value by 10% by 2030 • ~2.1% recycled, 32% renewable (current)	Sustainable procurement aligned with ISO 20400	• rCB, pyrolysis oil, recycled steel wire	Targeting zero waste to landfill by 2035
JK Tyres	• 50% carbon intensity reduction by 2030 • Carbon neutrality by 2050	Extended Producer Responsibility and sustainable sourcing practices	• Crumb rubber and recycled materials in “UX Green” tyres	Achieved high recycled-material ratios in rubber mix
Yokohama	• 40% sustainable by 2030 • 100% by 2050 • ~28% achieved	Sustainability aligned with decarbonisation and circularity goals	• Recycled rubber, biomass-derived materials	Developing synthetic rubber from recycled/bio sources
Hankook	• Long-term 100% sustainable materials • ~29% sustainable currently	Sustainable sourcing integrated into ESG strategy	• Recycled PET, circular silica, tyre-to-tyre recycling	Net zero by 2050; strong innovation focus
Nokian Tyres	• 50% renewable/recycled by 2030 • ~24.2% renewable currently	Strong environmental and ethical sourcing guidelines	• rCB (low-emissions), lignin, recycled rubber, bio-based materials	Developing alternatives to fossil carbon black (e.g., lignin-based)

Tyre manufacturers’ sustainability agendas and sourcing policies shows a clear and accelerating shift across the global tyre industry toward circular economy practices. Almost all major manufacturers have established ambitious targets to significantly increase the proportion of renewable and recycled materials in their products, with most aiming for around 40% sustainable content by 2030 and full circularity by 2050. This alignment of targets demonstrates a strong industry consensus that future tyre production must reduce reliance on virgin, fossil-based inputs while maintaining performance and safety.

A key driver behind this transition is growing concern about the long-term availability and sustainability of natural rubber. Manufacturers are increasingly implementing responsible sourcing policies that emphasise traceability, biodiversity protection, ethical supply chains and alignment with global frameworks such as the Global Platform for Sustainable Natural Rubber (GPSNR). These policies reflect risks associated with geographic concentration of rubber production, deforestation pressures, climate impacts and supply-demand imbalances, all of which are pushing companies to diversify their material inputs.

At the same time, there is a significant and growing uptake of recycled materials derived from end-of-life tyres, including micronised rubber powder, recovered carbon black and other recycled polymers and rubber products. These materials are being actively integrated into new tyre compounds, supported by ongoing investment in advanced technologies such as pyrolysis, devulcanisation and chemical recycling. This demonstrates that circular material use is no longer experimental but is becoming embedded in mainstream tyre manufacturing.

Innovation is a central theme across all manufacturers, with substantial research and development focused on improving the performance, consistency, and scalability of recycled and bio-based materials. Companies are exploring a wide range of alternatives, including biomass-derived fillers, recycled plastics (such as PET) and novel materials like lignin, alongside improvements in tyre-to-tyre recycling systems. These innovations are critical to achieving sustainability targets without compromising product quality.

Overall, these trends highlight a major structural shift in the tyre industry, where sustainability, supply chain resilience and circularity are becoming core business priorities. This creates a strong and expanding market demand for high-quality recovered materials, positioning end-of-life tyres, particularly OTR mining tyres, as valuable feedstock rather than waste.

7.0 Circular Economy for Mine Tyres in Australia

A circular economy is essential to achieving long-term environmental sustainability. By transforming used tyres from a waste product into a valuable resource, the mining and recycling sectors can:

- significantly reduce carbon emissions
- conserve raw materials
- minimise environmental harm.

This approach not only diverts tyres from landfill but also delivers measurable environmental benefits through reuse, recycling, and the displacement of more carbon-intensive materials.

The circular economy for mine tyres in Australia has the opportunity to advance through increased recovery efforts, innovative recycling models, stronger industry partnerships and consistent regulatory support.

Although the mining industry generates a large volume of waste tyres with a small recovery rate, initiatives are underway to improve collection and repurposing. A circular economy approach is being adopted to convert waste rubber into useful materials for Australian-made products, supporting both job creation and local manufacturing. Collaboration between recyclers, mining companies, and rubber product manufacturers is essential for overcoming technical and logistical barriers to tyre recycling. Additionally, consistent national waste regulations and targeted investment, especially in regional areas, are viewed as critical to strengthening tyre recovery systems.

7.1 Drivers for establishing a circular economy for mine tyres

The shift toward a circular economy for mine tyres in Australia is driven by the mining sector's need to adopt more sustainable, cost-effective, and environmentally responsible practices and to help de-risk their own tyre supply chains. Several key factors are driving this transition.

Developing a circular economy for mine tyres could offer significant economic, environmental and social benefits for Australia.

- **Economic Benefits**:

  Developing a circular economy for mine tyres delivers strong economic benefits by recovering valuable materials, driving innovation, creating jobs, supporting regional development, and attracting significant private investment, helping to diversify and strengthen the Australian economy.

- **Environmental Benefits**:

  Recovering mine tyres provides significant environmental benefits by reclaiming valuable materials, reducing reliance on new resources, lowering greenhouse gas emissions, improving land management and minimising risks such as fire, contamination, and habitat loss, while setting higher standards for sustainable product management.

- **Social Benefits**:

  Recovering mine tyres delivers social benefits by reducing community and environmental risks, supporting Indigenous and local livelihoods, improving health outcomes, and enhancing the reputations of tyre generators and the mining industry.

- **Business Benefits:**

  As outlined, there are multiple risks to the ongoing supply of natural rubber and tyre production. Manufacturers are recognising these risks and seeking alternate sources of material for tyre production and derisking this supply. Tyres are a critical resource for mine operation as they are for the entire global economy. Miners have a role to play in ensuring their used tyres are recovered and made available for new tyre production to support sustainable supply of these critical products.

Advancing a circular economy for mine tyres not only promotes sustainability but also enhances the long-term economic and environmental resilience of the mining sector.

7.2 Barriers for establishing a circular economy for mine tyres

The transition to a circular economy for mine tyres in Australia has been challenged by several systemic barriers that have limited recovery and recycling of this material.

The low cost of on-site disposal is considered a key barrier to improved recovery. State governments have traditionally sent the message to miners that waste recovery was unimportant, and the mining sector is often permitted to bury or stockpile tyres on site, through licensing exemptions.

Distance to markets, uncertain recycling options and end markets have all contributed to an inertia in mine tyre recovery.

Despite the mining industry's strong engineering capability, large procurement scale and ability to influence supply chains, current conditions make disposal, particularly burial, easier and cheaper than responsible recovery.



Backloading of recovered tyres at relatively low cost, regionally situated infrastructure and emerging new circular economy markets are all narrowing the justifications not-to-recycle.

Collectively, continuing to address perceived and actual barriers and scaling the practical solutions enables the mining sector to transition toward a more sustainable and circular tyre management system.

8.0 Opportunities for Recycled Tyres

Australia's tyre recycling market is growing rapidly due to stronger government regulations and sustainability initiatives, like the *Recycling and Waste Reduction Act 2020* and the Export—Waste Tyres Rules 2021, which have banned the export of whole baled tyres, except for tyres processed into shreds, crumbs, or granules. These policies aim to reduce environmental harm and promote domestic recycling capabilities.

The Australian government is actively working to grow the market for tyre-derived products through research and development as well as infrastructure investment, including significant capital from state and federal funds such as the $1Billion Recycling Modernisation Fund (RMF).

The Australian government's commitment to developing new manufacturing industries in the tyre sector is creating strong opportunities for businesses to produce new products from recycled tyres. This initiative supports job creation, economic growth, and the transition to a circular economy by transforming waste tyres into valuable resources.

The growing market for manufacturing new tyres and other products from recycled tyre materials offers strong opportunities for businesses focused on economic growth and sustainability.

Recycled tyres can be processed into high-value materials and transformed into a wide range of new products. This not only reduces waste and reliance on virgin resources but also supports the development of a circular economy by turning end-of-life tyres into commercially valuable products.

Some of the uses from recycled tyres include:

- **Athletic Surfaces**:

  The crumb rubber from recycled tyres can be used in construction materials, sports surfaces and playground equipment. The crumb rubber is ideal for creating surfaces for sports courts and athletic fields due to its excellent shock absorption and weather resistance properties.

- **Construction and Civil Engineering**:

  Recycled tyres, particularly in the form of tyre-derived aggregate (TDA) and crumb rubber, can be used in road construction, drainage systems and erosion control, providing a sustainable alternative to traditional materials.

- **Rubberised Particleboard**:

  Incorporating crumb rubber into standard particleboard can offer a sustainable feedstock, which can be used as alternative feedstock for usual building materials.

- **Energy Production**:

  Recycled tyres can be utilised in energy production processes, contributing to the circular economy by repurposing waste tyres. Tyres can be processed into tyre-derived fuel, which can be used as an alternative fuel in industries such as cement manufacturing.

This fuel serves to reduce greenhouse gases compared with coal by around 30%.[29]

- **Steel Wire:**

  The recovered steel wire from recycled tyres can provide a sustainable alternative to traditional steel sources**.**

- **Recovered Carbon Black:**

  The recovered carbon black can be fed back into the manufacturing of premium mining tyres and other rubber products, like conveyor belts. Recovered carbon black offers a dual benefit: it reduces reliance on newly produced carbon black while preventing waste tyres from being stockpiled or buried on mining sites; both of which pose significant environmental and health-and-safety risks. This makes its reuse a clear win for both sustainability and operational risk management.[30]

- **Micronised Rubber Powder:**

  Micronised Rubber Powder is an ultra-fine powder (as small as 130 microns) produced by recycling end-of-life tyres through advanced grinding processes. MRP's small particle size allows seamless integration into diverse materials, enhancing flexibility, durability and sustainability. All these features make it suitable for a wide range of applications, including asphalt modification, tyre manufacturing, and as a component in 3D printing and aerospace.

These applications highlight the versatility and potential of recycled tyres in producing new, high-value products across a range of industries both domestically and in global markets. By repurposing tyre materials into functional goods, businesses can reduce reliance on virgin raw materials, lower environmental impacts, and generate valuable end products. This not only supports sustainability goals but also strengthens economic outcomes by creating new market opportunities within a circular economy framework.

9.0 Why OTR tyres are sought after for new tyre production

End-of-life OTR tyres are particularly valued for circular economy outcomes and Australian tyre recyclers are actively seeking this material to get it back for manufacturers use in new tyre production. OTR tyres demonstrate the following critical attributes.

9.1 Rubber, Fibre and Steel Composition of OTR tyres

OTR tyres typically contain **higher proportions of natural rubber between 27%**[31] **and 47%**[32]. These natural rubber compounds in OTR tyres provide **better elasticity and durability to withstand the pressures associated with off road, heavy vehicle and load use.**

This quality and of course the quantity of consistent material is extremely attractive to recyclers and ultimately tyre manufacturers.

[29] https://atra.asn.au/wp-content/uploads/2025/11/TDF-policy-position.pdf

[30] Circular by nature: closing the loop on 'waste' mining tyres - The Intelligent Miner, accessed from https://theintelligentminer.com/2025/06/18/circular-by-nature-closing-the-loop-on-waste-mining-tyres/

[31] https://storage.googleapis.com/tsa_craftcms_media/assets/pdf-resources/TSA-OTR-Tyre-Composition-Final.pdf

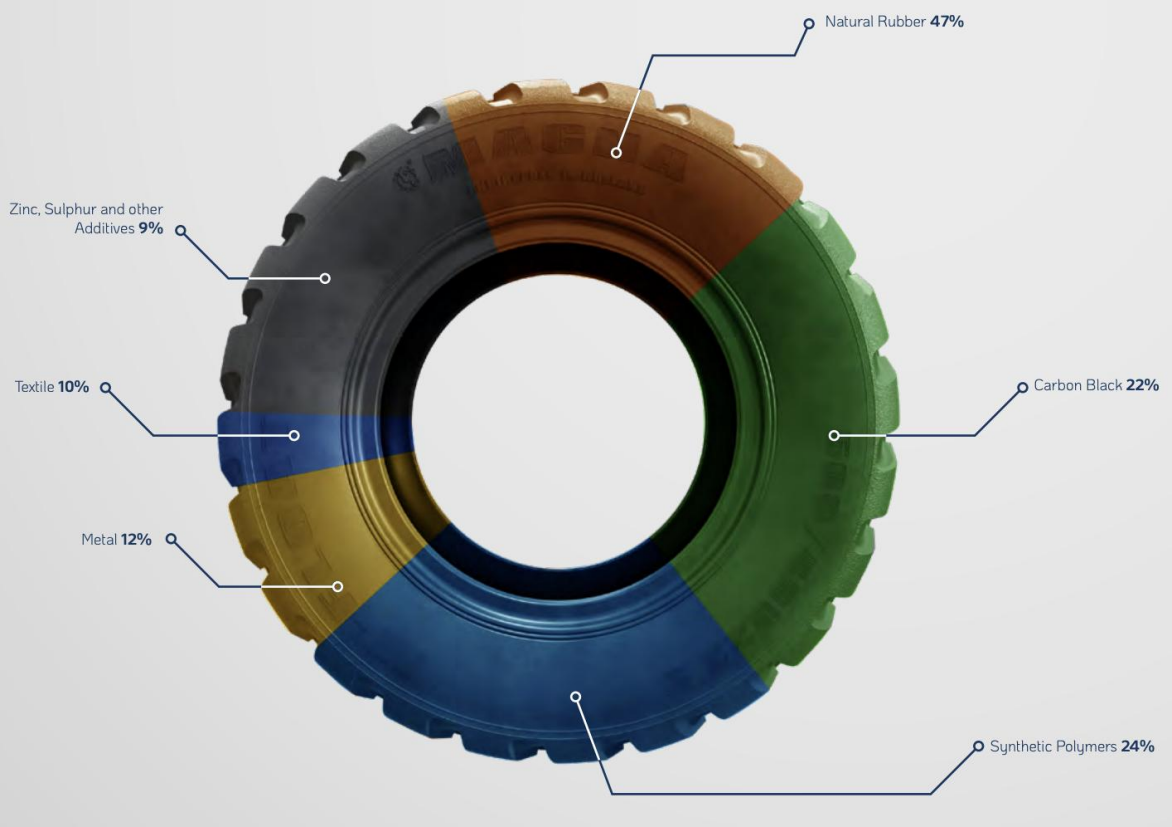
[32] https://magnatyres.com/wp-content/uploads/2023/06/Magna-tyres_white-paper_ingredients.pdf

OTR tyres also contain less textile reinforcement compared to passenger tyres, which have more synthetic rubber and fibre layers.[33]

OTR tyres, especially mining and agricultural types, are mostly **steel-reinforced with minimal textile**, making them easier to process into clean, high-purity rubber powder[34].

OTR tyre-derived MRP has also been found to have **enhanced bonding properties** when reintegrated into rubber compounds, due to its natural rubber content and cleaner structure[35].

Figure 10 Tyre composition



Large mine tyres demonstrate high volumes (27%-47%) of natural rubber available for beneficial use[36].

9.2 Social Licence and Traditional Owners

Indigenous communities in Australia are increasingly vocal about the environmental and cultural risks of mining operations on country with some recent high-profile damage to traditional sites[37].

Many Traditional Owners advocate for sustainable alternatives to onsite used tyre dumping that respect Country and promote long-term ecological health. Indigenous-led recycling

[33] ibid

[34] TSA-OTR-Tyre-Composition-Final.pdf

[35] ibid

[36] https://www.aishred.com/release/how-to-produce-high-purity-and-high-quality-rubber-powder-from-waste-tires.html

[37] https://antar.org.au/issues/cultural-heritage/the-destruction-of-juukan-gorge/

ventures and collaborative mine rehabilitation projects are paving the way for more responsible tyre waste management.

As a recent CSIRO report[38] determined in relation to both the original purpose of onsite burial and its ongoing impact, it's clear this practice is no longer valid or sustainable.

> *… stakeholder engagement revealed the original intent of first allowing tyre burial was rooted in optimism some decades ago that expected future generations would one day wish to dig up these tyres and find a beneficial use for them. This optimism has proven to be heavily misguided.*
>
> *Indeed, while enthusiasm for a circular economy is currently higher than ever in the 21st century, there is now further clarity that buried and contaminated mining tyres will never emerge as an economically attractive feedstock.*
>
> *With about 216,000 tonnes of OTR tyres sold each year in Australia and 85% of end-of-life units buried on-site or landfilled (TSA, 2024) – it is increasingly clear that tyre and conveyor belt burial offers little resource recovery potential, is highly polluting and effectively deflects responsibility for dealing with this waste onto future generations and impacts Traditional Custodians.*

9.3 Push for Sustainable Alternatives

Indigenous-led initiatives like Upcycle Tyre Services[39], are actively working to divert tyres from landfill and create circular economy solutions. These efforts reflect a strong Indigenous commitment to environmental stewardship and sustainable development.

Traditional Owners, such as the Gomeroi people in northwest NSW, have expressed alarm over the burial of mining tyres in areas like the Leard Forest Precinct, which holds cultural and ecological significance. The burial of tyres is seen as a desecration of ancestral lands and a threat to environmental integrity[40].

Projects like the rehabilitation of the Argyle Diamond Mine in WA, in partnership with the Miriwoong and Gija people, demonstrate how tyre waste can be repurposed for community benefit, such as road construction using crumb rubber[41].

10.0 OTR Journey from End to New Life

Recovered OTR mining tyres can be recycled and incorporated into new tyre production or Australia's road network through a series of advanced processes that transform these massive, durable assets into valuable feedstock.

Figure 11 shows the process flows from collection through to new tyre manufacturing.

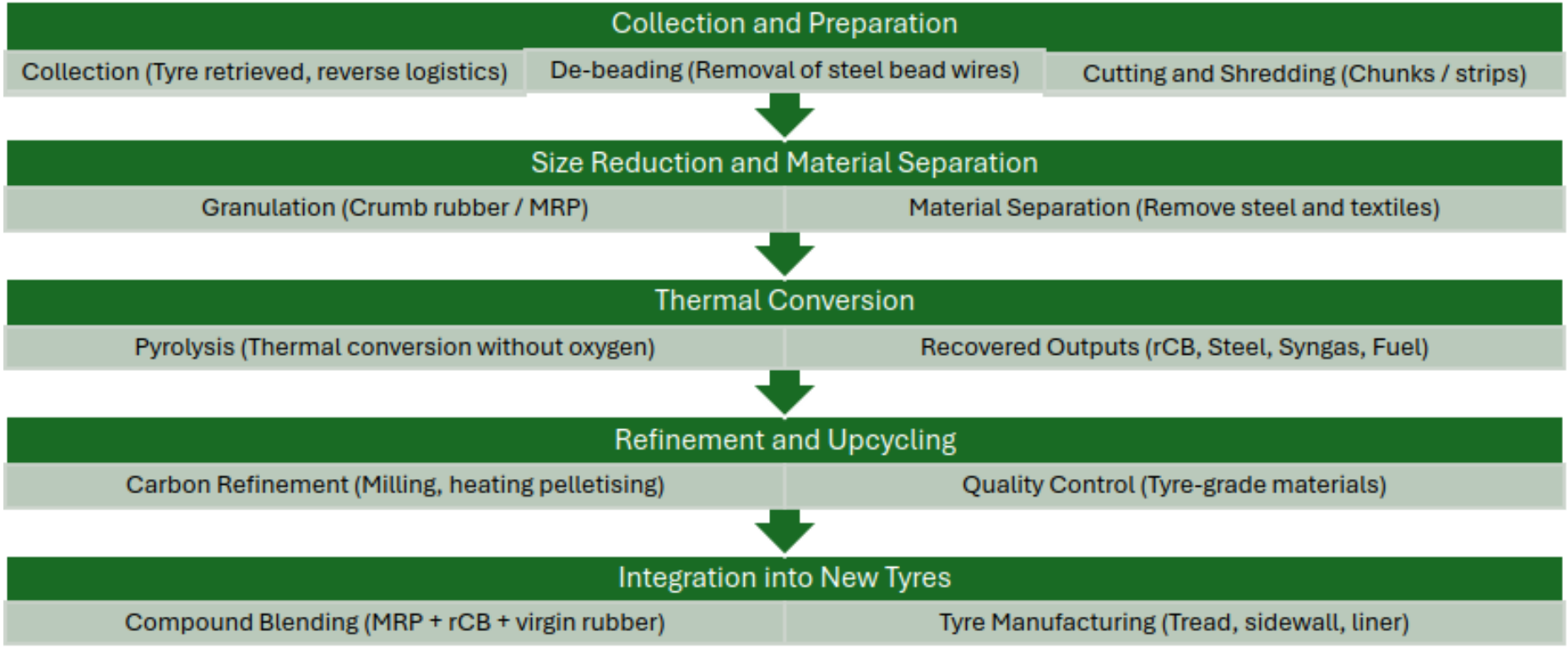
[38] https://www.nespsustainable.edu.au/sites/default/files/documents/IP5.02_Exploring%20opportunities%20for%20increasing%20value%20recovery%20from%20EOLTs%20and%20conveyor%20belts%20in%20in%20WA_Final-20230515.pdf

[39] https://nit.com.au/19-02-2025/16384/upcycle-tyre-services-driving-sustainability-and-empowerment

[40] https://nwprotectionadvocacy.com/epa-tells-whitehaven-coal-to-go-ahead-and-bury-tyres-while-aboriginal-land-council-holds-the-line/

[41] https://www.riotinto.com/en/news/stories/the-next-life-of-a-diamond-mine

Figure 11 Process Flow Diagram for OTR Tyre Recycling Process



11.0 An overview of products from recovered tyres

The following are examples of recovered materials from end-of-life tyres and demonstrate the work being undertaken and progress being made to utilising this material in new tyre production.

Recovered tyres are already being utilised for rubber crumb in asphalt, offering numerous benefits and sustainability outcomes for these pavements, as well as carbon reducing fuels for heavy industry.

The overview of the recovered materials is presented in **Table 4**.

Table 4 Valuable Products from Recovered Tyres

Material / Technology	Production Method	Application in Tyres	Key Benefits	Industry Adoption / Notes
Micronised Rubber Powder	Cryogenic grinding of end-of-life tyres	Incorporated into new tyre compounds	Compared to virgin carbon black, synthetic Elastomers, Polyurethane and Polyproylene, • ~30% reduction in CO_2 emissions • ~70% reduction in fossil resource use • ~50% lower environmental footprint	• Michelin has used MRP in over 500 million tyres • Supplied by Genan and others • Strong growth driven by automotive and EV sectors
Recovered Carbon Black	Pyrolysis of end-of-life tyres	Partial substitute for virgin carbon black (vCB)	• Reduces reliance on fossil-derived materials • Supports circular economy	• Not yet a full 1:1 replacement due to quality differences • Used by Michelin, Bridgestone, Continental • Ongoing R&D improving performance
Ground Tyre Rubber (GTR)	Ambient, wet, or cryogenic grinding	Blended with virgin rubber or polymers	• Reduces landfill waste • Cost-effective material substitute • Environmental benefits	• Widely used across multiple applications • Compatibility improved with surface treatments
Regenerated Tyre Rubber (RTR)	Devulcanisation processes (e.g., microwave, ultrasonic)	Re-integrated into new rubber compounds	• Enhances reuse of rubber • Improves circularity	• Advanced processing improves bonding and performance in new tyres
Bio-based Materials	Derived from renewable sources (e.g., agricultural by-products)	Used as fillers or reinforcement materials	• Reduces dependence on petrochemicals • Lower environmental impact	• Examples: rice husk ash (Continental), wood pulp, flax, kenaf
Recycled Polymers (e.g., rPET)	Recycling of plastic materials such as PET	Integrated into tyre components (e.g., reinforcement fibres)	• Reduces plastic waste • Supports circular materials use	• Increasing adoption alongside sustainability initiatives

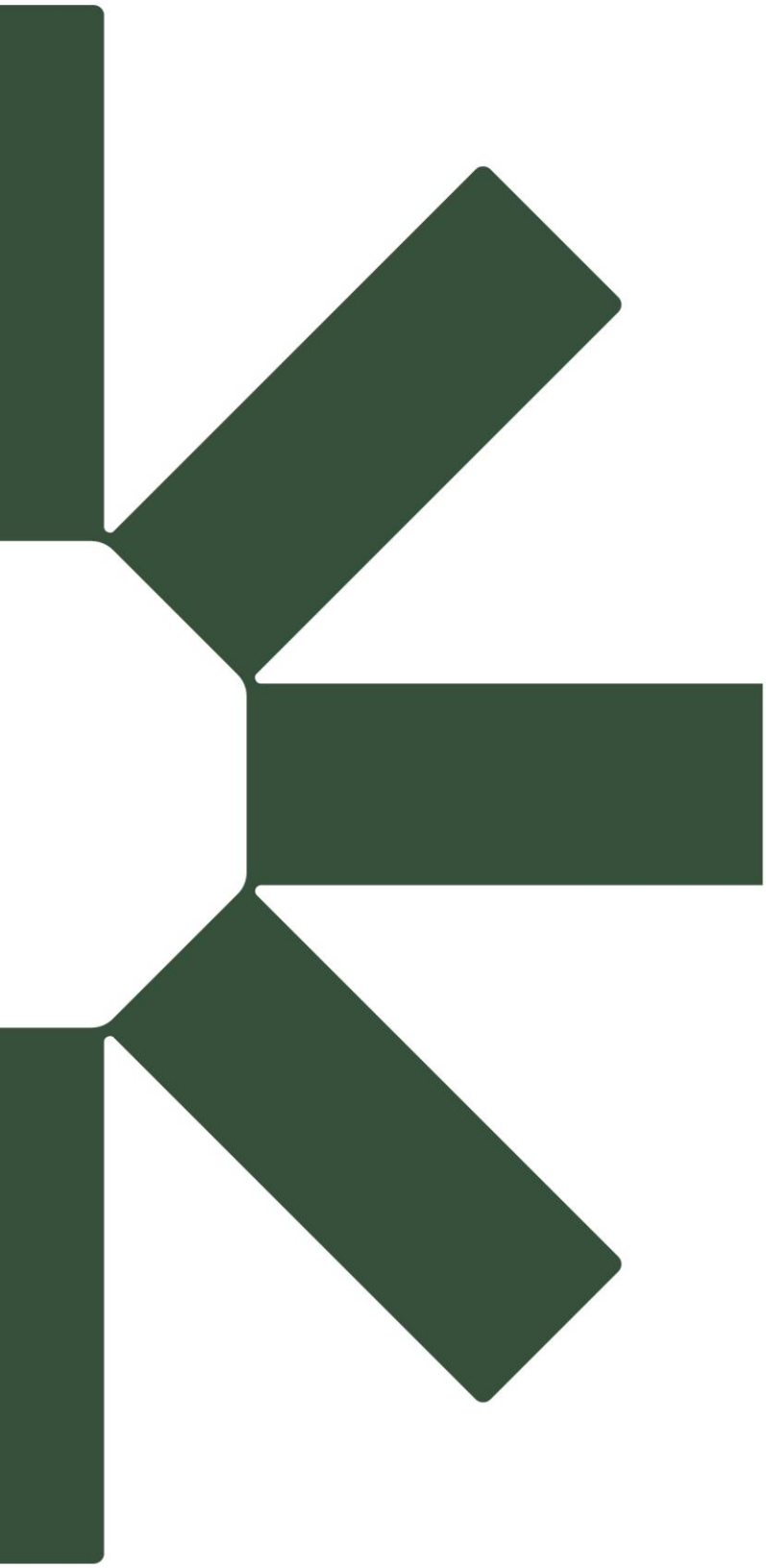
12.0 Conclusion

Off-the-road tyres represent a high-value resource containing natural rubber, steel, and reusable materials, yet recovery rates remain very low, with large volumes still buried on-site. International tyre manufacturers are rapidly increasing demand for recycled and sustainable inputs, creating a strong market pull for recovered tyre materials and reinforcing the strategic importance of transitioning toward a circular economy for OTR tyres. Moving from disposal to recovery is not only environmentally necessary but increasingly commercially viable, supported by technological advancements, growing infrastructure investment, and rising social expectations, including from Traditional Owners.

To accelerate this transition, governments must take a more active and coordinated role by implementing a combination of regulatory, financial, and market-based interventions. Key actions should include the following:

- Introduce mandatory recovery targets
    - Implement regulated recovery rates or Extended Producer Responsibility (EPR) schemes to drive accountability and align Australia with global best practice.
- Phase out onsite burial:
    - Restrict or progressively ban the disposal of OTR tyres in pits or landfill, ensuring recovery becomes the preferred and economically viable pathway.
- Provide financial incentives and funding support:
    - Subsidise transport and logistics from remote mining regions.
    - Expand funding programs (e.g., Recycling Modernisation Fund) to accelerate infrastructure development and scaling of processing facilities.
- Support regional infrastructure development:
    - Invest in strategically located processing hubs near mining regions to reduce transport costs and improve access to recycling pathways.
- Stimulate end-market demand:
    - Mandate or incentivise the use of tyre-derived products (e.g., rubberised asphalt, rCB, MRP) in public infrastructure and procurement projects.
- Harmonise national regulation:
    - Establish consistent policies and standards across states and territories to improve investment certainty and reduce regulatory complexity.
- Encourage innovation, and research and development (R&D):
    - Support development of advanced recycling technologies (e.g., pyrolysis, devulcanisation) and emerging materials to enhance performance and market uptake.
- Strengthen data transparency and reporting:
    - Require tracking and public reporting of OTR tyre generation, movement, and recovery to improve accountability and decision-making.
- Promote industry collaboration:
    - Facilitate partnerships between miners, recyclers, manufacturers, and Indigenous organisations to develop circular supply chains.

With coordinated policy, investment and market development, government can play a critical role in transforming OTR tyres from a persistent waste challenge into a strategic circular economy opportunity, unlocking environmental, economic and social benefits for Australia.



Making Sustainability Happen