# AUSTRALIAN COUNCIL OF RECYCLING SUBMISSION: PRODUCTIVITY COMMISSION INQUIRY INTO OPPORTUNITIES IN THE CIRCULAR ECONOMY

1 November 2024

## About the Australian Council of Recycling

The Australian Council of Recycling (ACOR) is the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia. The Australian recycling industry contributes almost $19 billion in economic value, while delivering environmental benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 430 tonnes of material recycled in Australia.

Our membership is represented across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastic, paper, organic, tyre, textile, oil and e-product reprocessing and remanufacturing, and construction and demolition recovery. Our mission is to lead the transition to a circular economy through the recycling supply chain.

## Contacts for this submission

**Suzanne Toumbourou**
Chief Executive Officer
Australian Council of Recycling
ceo@acor.org.au

**Aziza Kuypers**
Policy Adviser
Australian Council of Recycling
policy@acor.org.au

# AUSTRALIAN COUNCIL OF RECYCLING SUBMISSION: PRODUCTIVITY COMMISSION INQUIRY INTO OPPORTUNITIES IN THE CIRCULAR ECONOMY

## Contents

## Executive summary

Recycling is an integral gear within the circular economy, delivering significant social, economic and environmental value. The Australian recycling industry contributes almost $19 billion in economic value, while delivering benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 431 tonnes of material recycled in Australia. The industry operates across our homes, businesses, factories and construction sites. It collects, sorts and reprocesses material, and makes new products with recycled content, creating more jobs for Australians.

The recycling sector is poised to deliver broader economic, environmental and social benefit, however, current national policy and regulatory settings must be addressed to realise this potential. An overarching priority is markets for Australian recycled material, to ensure the viability and sustainability of this sector.

Regulatory settings frustrate the transition to a circular economy: a National Resource Recovery Framework is a necessary first step to align environmental and circular economy principles and create nationally harmonised regulation.

The effectiveness of product stewardship schemes, another key policy measure, needs evaluation. To date, the recycling sector has not been adequately involved in the establishment or governance of product stewardships schemes. Robust measures must be taken to improve scheme governance, accountability and transparency, and to ensure a proper focus on delivering genuine recycling outcomes and creating markets for domestically produced recycled materials.

Improved product stewardship for e-products is also critical, to address the rising volumes of e-waste, the viability of e-waste recycling and also solve the critical threat posed by battery fires in recycling facilities.

The Australian Government's move to enact mandatory packaging regulation is a welcome launching point for broader circular economy systems and to boost end markets for Australia recycled commodities. At the same time, existing container deposit schemes, product stewardship success stories, should now be harmonised and brought up to best-practice standards.

Current export licensing rules imposed through the *Recycling and Waste Reduction (RAWR) Act 2020* are constraining access to the global circular economy by restricting trade in recycled commodities. It is essential to urgently streamline export licensing in order to enable access to markets and support domestic recycling rates. Furthermore, cost recovery should not be imposed on licensing arrangements that are not fit-for-purpose, leading to perverse outcomes and further dampening resource recovery just as the need for increased resource efficiency is greater than ever.

Finally, the community must be engaged by building confidence in recycling and reducing contamination in recycling streams, through the innovative recycling program Recycle Mate.

There is much potential for our industry to grow and thrive, supported by a range of Government initiatives, that will not only unlock barriers to recycling, but also deliver jobs, advance resource efficiency and unleash innovation and productivity in Australia's circular economy.

## Summary of recommendations

Recommendation 1. Expedite national packaging regulation that prioritises recoverability, recyclability and minimum thresholds for Australian recycled content.

Recommendation 2. Ensure that the proposed National Packaging Design Standards support mandated thresholds for Australian-made recycled content; designing for recyclability; and national harmonisation of State and Territory regulation on single use and problematic plastics.

Recommendation 3. Support national harmonisation of container deposit schemes, prioritising targets for return rates, an increased CDS deposit rate, and expansion of the scope of eligible containers to include glass wine and spirit bottles.

Recommendation 4. Urgently address the inefficiencies and conflicts of interest in the National Television and Computer Recycling Scheme (NTCRS), to support the viability of the Australian e-waste recycling system.

Recommendation 5. Prioritise and expedite holistic e-stewardship reform, with the implementation of a scheme that includes all consumer electric and electronic items, including batteries and solar PV systems.

Recommendation 6. Expand waste export regulation to address unprocessed scrap metal, e-waste and textile waste.

Recommendation 7. Urgently address the escalating hazard posed by batteries in recycling streams: catalogue all items in the market with loose or embedded batteries; roll out a comprehensive safe collection system; deliver a nation-wide community education campaign; implement e-stewardship reform, including a deposit scheme for battery-containing items; and harmonise regulation for battery disposal and collection.

Recommendation 8. Provide appropriate funding to foster collaboration and restore community confidence to 'recycle right' through the national education tool Recycle Mate, generating higher recycling participation nationally, and delivering more data to Government on the ecycling capabilities and community behaviours across Australia.

Recommendation 9. Publish benchmarks, measurements and reports on government procurement of Australian recycled content.

Recommendation 10. Prioritise procurement of Australian recycled content in Government-funded projects, underpinned by a traceability framework for recycled materials.

Recommendation 11. Undertake a holistic review of the provisions for product stewardship within the Recycling and Waste Reduction Act 2020 and all relevant government policies and programs, to ensure that all voluntary and mandatory schemes support genuine recycling outcoms, addressing: scheme design; reuse and recyclability; creation of market demand for recycled materials; enhancing and incentivising collection; and ensuring transparency, accountability and whole-of-supply chain, including recycler representation in scheme governance.

Recommendation 12. As a matter of priority, streamline export licensing and reduce licensing costs for processed recycled commodities.

Recommendation 13. Undertake a holistic review of the Recycling and Waste Reduction Act 2020, addressing the definition of where a 'waste' becomes a 'material' or 'product', and ensuring that recycled commodities are distinguished from waste.

Recommendation 14. Establish an Australian Resource Recovery Board, to deliver a nationally harmonised framework for resource recovery and recycling. The framework should prioritise the definition of 'end-of-waste' criteria and promote circular economy principles.

Recommendation 15. Support confidence in Australian recycling by funding the implementation of an Australian Recyclers Accreditation Program.

Recommendation 16. The recycling sector should sit under the Manufacturing Award, rather than the Waste Management Award.

## List of case studies

# 1 Introduction

## 1.1 The value of recycling

The circular economy is a much bigger system than recycling, however, every product eventually reaches an end of use, no matter how resource efficient, repairable and reusable. Recycling is the critical link that closes the loop in a circular economy.

The Australian Government's 2023 wellbeing framework, Measuring What Matters, identified resource use and waste generation as a key parameter for a more healthy, secure, sustainable, cohesive and prosperous Australia. This priority is reflected in the recent, unprecedented investment by government and industry in recycling infrastructure, and the overwhelming public support for resource recovery, recycling, and local remanufacturing.

ACOR's report on the *Economic Contribution of the Australian Recycling Industry* identified that in the financial year ending 2022, the recycling industry:

- provided nearly 95,000 jobs;
- delivered a 63.1 per cent recycling rate, processing 40.6 million tonnes of material;
- provided higher average employee livelihoods of $82,618, compared to the Australian average weekly earnings of $69,103; and
- grew by 68.8 per cent, compared to Australia's nationwide employment growth of 17.4 per cent.

## 1.2 Policy overview

The policy environment for circular economy and recycling in Australia is rapidly evolving, with a broad range of national initiatives, including the implementation of climate change targets, the *Recycling and Waste Reduction Act 2020* (RAWR Act), an export ban on recyclable materials, the National Waste Policy and Action Plan, the National Reconstruction Fund, a national commitment to a circular economy, the convening of a Circular Economy Ministerial Advisory Group, and a commitment to regulate packaging design.

Australia has regulated the export of unprocessed recyclable materials including glass, tyres, plastic and paper, under the RAWR Act. It is therefore imperative to ensure necessary infrastructure exists to transform these recovered resources into higher value commodities, and that there are viable and robust domestic and international markets.

In October 2022, Australia's Environment Ministers committed Australia to achieving a circular economy by 2030, by designing out waste and pollution, keeping materials in use longer and fostering end markets for recycled material. Every available lever will be needed to achieve this transformation—particularly in light of the fact that Australia is falling short in progressing key targets in the *National Waste Policy Action Plan*, which include:

- reducing the total waste generated in Australia by 10% per person by 2030
- achieving an 80% average recovery rate from all waste streams by 2030
- significantly increasing the use of recycled content by governments and industry
- halving the amount of organic waste sent to landfill by 2030.

The 2022 *National Waste Report* found recovery rates for household waste have stagnated while commercial and industrial waste recovery rates have declined.

To support much-needed progress, investment in recycling technologies will be essential to address priority areas including photovoltaic and battery storage systems, electrical and electronic products, clothing textiles and hard-to-recycle plastics. Addressing organic waste will also be critical in reducing climate emissions towards net zero.

## 1.3 Supporting a thriving recycling sector

It is important to distinguish waste management from recycling. While historically, waste companies integrated recycling as a waste treatment method, these processes are distinct: waste management is a logistical enterprise, whereas the recycling value chain is production, comprising aggregation and sorting,

reprocessing and remanufacturing. Recycling processes are often dependent on effective logistics provided by the waste management sector, which transports and disposes of waste and unwanted materials. But, fundamentally, waste entails pollution and risk, whereas recycling entails resource efficiency, value creation, economic opportunity and circular outcomes.

A legacy of the conflation of waste management and recycling is the resulting poor data and information on recycling, which is an impediment to well-informed policy and investment decisions. Data capture has typically confused the two sectors, so that the true capacity for recycling and re-manufacturing infrastructure in Australia is not well mapped and the markets for recycled materials are not well understood or supported. Logistics operators, aggregators, processors and remanufacturers are often defined as one group in datasets, masking genuine capacity and the value chain required to deliver recycling outcomes.

Other barriers to recycling include the complex and fragmented regulatory environment across the country, the low cost of landfilling which diverts material away from recycling, the relatively low value of recovered material, cost competitiveness with virgin materials, and willingness within the supply chain to embrace change. Targeted funding is an important lever to enable the significant scale required to address these barriers, and as such, funding deployed through the Recycling Modernisation Fund is welcome and necessary. However, strong markets and aligned regulatory frameworks must also be addressed. In particular, the Australian Government must prioritise a nationally harmonised regulatory framework for resource recovery and recycling.

A local circular economy can bolster sovereign capabilities and reduce supply chain vulnerabilities. It will require a transformation of Australia's economy with the creation of new industries, including new collection and recycling infrastructure and remanufacturing of recycled materials.

It must be recognised that the recycling system is essentially comprised of three key elements: collection, processing, and end markets. Each of these elements is vital for real recycling outcomes—and each must be economically viable. A most pressing priority for recyclers is access to dynamic markets, without which the entire recycling system cannot be viable.

There is much potential for our industry to grow and thrive, supported by a range of Government initiatives that will not only unlock barriers to recycling, but also deliver jobs, advance resource efficiency and unleash innovation and productivity in Australia's circular economy.

## 2 Circular economy success stories and measures of success

### 2.1 Economic opportunities of a circular economy

The Australian recycling industry contributes almost $19 billion in economic value, while delivering environmental benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 431 tonnes of material recycled in Australia.

The recycling sector connects with almost every household, business and government entity in the country, either directly or indirectly—processing over 40 million tonnes of material per year.

ACOR commissioned an economic report on the recycling sector's contribution to Australia's economy in 2022. Following is a snapshot of the findings:

**Economic contribution:**

- The industry contributed almost $19 billion to the Australian economy and provided nearly 95,000 jobs in 2021–22.
- $465 in net economic activity is created for every tonne of material recycled.
- Collective industry turnover of over $14.6 billion.
- $5.1 billion in direct economic activity and an additional $5.8 billion indirect value-add to GDP through flow-on demand for goods and services.
- Over $1 billion invested in land, buildings, plant and equipment and vehicles in 2021–22.

**Volumes recycled:**

- Australia's overall recycling rate is 63.1 per cent, equating to 1,568 kilograms of recycled material for each person in 2021–22.
- Australia's recycling sector processed 40.6 million tonnes of material in 2021–22.

**Jobs:**

- Recycling jobs also paid a livelihood over ten thousand dollars higher than average Australian weekly earnings, providing a high-value workforce in an expanding industry.
- One job is supported for every 431 tonnes of material recycled.
- 30,606 direct jobs to Australians and another 25,709 indirect jobs through flow-on activity.
- Provides for one in every 142 jobs in the Australian economy.
- Pays over $2.5 billion in wages and salaries and an additional $253 million in superannuation.
- Higher average employee livelihood in the recycling sector of $82,618, compared to the Australian average weekly earnings of $69,103.
- Recycling industry employment grew by 68.8 per cent compared to Australia's nationwide employment growth of 17.4 per cent over the same period.
- 1,828 recycling businesses operating in Australia.

**Growth:**

- The recycling sector's value-add in current prices grew by 117 per cent over the past decade—significantly faster than Australia's gross domestic product of 45.8 per cent over the same period.

**Enabling Australian manufacturing:**

- The recycled materials delivered into the economy create further benefit, with usage of recycled materials valued at $7.9 billion in 2021–22 and providing an estimated 37,920 jobs.

For ACOR's full report, see Appendix 1: *Economic Contribution of the Australian Recycling Industry****Error! Reference source not found.***.

### 2.2 Australia's circular economy potential, and how to monitor progress and success

There is much potential for our industry to grow and thrive, supported by a range of Government initiatives, as outlined in this paper, that will not only unlock barriers to recycling, but also deliver jobs, advance resource efficiency and unleash innovation and productivity in Australia's circular economy.

A local circular economy can bolster sovereign capabilities and reduce supply chain vulnerabilities. It will require a transformation of Australia's economy with the creation of new industries, including new collection and recycling infrastructure and remanufacturing of recycled materials.

## 2.3 Case studies of circular economy activities

There are countless examples of circular economy activities delivered through the recycling sector. The case studies below provide an insight into operations that showcase the circular economy in action in Australia.

***Case Study 1. BlockTexx***

At BlockTexx, used textiles are not waste, but a valuable resource.

In the last six years, BlockTexx have designed, built, and commissioned the world's first commercial-scale textile recycling facility in Loganholme, Queensland, combining advanced chemistry and engineering. As of 2024, they have a processing capacity of 10,000 tonnes per annum. By transforming cotton/polyester textiles back into high-value raw materials—recycled polyester (rPET) and cellulose—BlockTexx offer a sustainable alternative to landfill, incineration (currently over 200,000 tonnes per annum) and export (currently over 100,000 tonnes per annum).

BlockTexx's operations focus on two key areas: a nationwide logistics and decommissioning service that collects textiles from post-consumer and commercial sources, and a state-of-the-art chemical recycling facility that converts these materials into reusable products. They have built a vast ecosystem of uniform suppliers, retailers, charities, and government agencies, alongside a network of decommissioning partners that support 1,500 indirect employees in preparing textiles for processing.

Using patent pending technology, BlockTexx separates blended materials into their original raw forms, which are then repurposed across various industries. Additionally, proprietary blockchain technology provides full traceability, ensuring transparency and accountability throughout the recycling process.

Beyond recycling, BlockTexx collaborates with clients to design garments for end-of-life recyclability, providing a sustainable alternative to conventional waste disposal or export.

BlockTexx's operations provide significant economic value to Queensland, as shown in the Queensland Government's REMPLAN Economy report. From a direct output increase of $30.892 million, total economic output is expected to rise to $47.406 million, reflecting a Type 2 Output multiplier of 1.535. In terms of employment, BlockTexx's activities are projected to create 96 jobs. This boosts both local employment and consumption, leading to further economic benefits.

Recognised as an 'Australian Hero' for innovation excellence in 2024, BlockTexx is not only driving circularity in textiles, but also contributing to regional growth by creating jobs, wage growth and supporting local businesses and manufacturers.

***Case Study 2. Circular Plastics Australia***

Circular Plastics Australia is building a national network of recycling facilities to process multiple plastic polymers into high-quality food-grade and non-food-grade resins for new packaging products: Circular Plastics Australia (PET) is a joint venture between Pact Group, Cleanaway, Asahi Beverages and Coca-Cola Europacific Partners, and Circular Plastics Australia (PE) is a joint venture between Pact Group and Cleanaway.

Together, these unique industry partnerships aim to provide more sustainable packaging solutions by building advanced recycling infrastructure to ensure that traceable, certified, locally collected and processed food-grade and non-food-grade recycled resin is available to Australasian manufacturers. Their three new world-class facilities will recycle more than 60,000 tonnes of post-consumer plastic packaging into resin each year. Near infrared (NIR) sorting, washing, extrusion and decontamination processing technology will produce high-quality, locally sourced recycled resins at scale.

This is a complete closed-loop approach that will help to accelerate the plastics circular economy in Australia.

***Case Study 3. iQRenew***

iQRenew has launched Australia's first soft plastic processing facility, known as the SPEC (Soft Plastic Engineered Commodities) Facility, marking a significant step toward transforming post-consumer soft plastic waste. This facility, situated on a 54-hectare site on the mid North Coast of New South Wales, aims to evolve into a full-scale plastic and manufacturing precinct to support broader recycling infrastructure.

With the capability to process up to 15,000 tonnes of soft plastic annually, the SPEC Facility tackles legacy waste from the discontinued REDcycle program in partnership with the National Taskforce. It also serves as the primary processor for the Australian Food and Grocery Council's soft plastic recycling trials across Australia, driving innovation in recycling operations.

Over the past four years, iQRenew has pioneered solutions to handle this complex waste stream, which involves multi-layered plastics with labels and foils. Initiatives around this problematic waste stream include:

- introducing kerbside collection through the Curby program
- understanding requirements for MRF infrastructure
- developing a specialised processing facility that produces high-quality LDPE shred, flakes, and resins suitable for manufacturing and potential chemical recycling.

The biggest challenge now lies in growing domestic demand for these recycled materials. Commonwealth support is crucial to meet Australia's recycling targets. By mandating the use of locally sourced recycled materials and backing projects like the SPEC Facility, Australia can create a robust market for recycled plastics and support the circular economy.

iQRenew welcomes all parties in the supply chain to visit the facility or request samples for production trials of this new 100 per cent post-consumer soft plastic feedstock in order to accelerate and support the use of Australian made products.

***Case Study 4. Return and Earn***

The NSW Container Deposit Scheme (CDS) Return and Earn, established in 2017, was the first Australian CDS model that legislated and encouraged the utilisation of convenient retail-based reverse vending machine (RVM) enabled refund points.

As a result of the NSW scheme's split responsibility model, Return and Earn has so far:

- collected over 12 billion eligible beverage containers for high value, mostly bottle-to-bottle, recycling
- established 640 convenient refund points across the entirety of NSW
- reduced beverage container litter by 54%
- recycled almost 1.1 million tonnes of materials
- returned $62.59 million to charities and community groups via donations and fees, and
- generated over 700 direct jobs.

In addition to these positive circular economic outcomes, the establishment of Return and Earn also attracted international investment into the Australian economy. This was predominantly through the market entry of Norwegian multinational circular solutions provider, TOMRA, who were appointed network operator for the scheme in partnership with Australia's largest waste management company, Cleanaway.

TOMRA now has significant operations throughout Australia, employing nearly 350 staff nationwide.

Based on the success of Return and Earn, Victoria, Tasmania and the ACT have now followed the NSW Government's lead and introduced container deposit schemes in the same model.

***Case Study 5. Premier Metal Recyclers***

Located in Perth, Western Australia, Premier Metal Recyclers has been a vital contributor to the recycling industry for many years, processing approximately 30,000 tonnes of scrap metal annually. Their operations generate significant economic value, with an annual turnover of $20 million, underscoring their impact on both the local and national economy.

By employing advanced processing technologies and sustainable practices, Premier Metals effectively minimise landfill waste and reduce their carbon footprint, aligning with Australia's environmental objectives. Their initiatives have led to a measurable increase in recycling rates in the region, showcasing the potential for further growth if challenges such as regulatory constraints and insufficient infrastructure are addressed.

The adoption of circular economy practices has been advantageous for businesses, consumers, and the community. Local businesses partner with Premier Metals to meet their sustainability targets, while consumers benefit from the availability of competitively priced recycled materials. Their educational outreach programs foster greater community awareness regarding recycling, promoting responsible consumption habits.

***Case Study 6. Revolve ReCYCLING***

Revolve ReCYCLING is improving end-of-use outcomes for bikes and e-bikes by refurbishing donated and discarded push bikes for re-use, as well as adding value by modifying pushbikes into e-bikes. Revolve Recycling has trialled a process for reuse that is safe and repairable, with all necessary warranties.

Since 2021, Revolve ReCYCLING has diverted 5,000 bikes per year from landfill, with the opportunity scale further. Every year, 1 million bikes are sold, of which 50 per cent are poor quality bikes from big-box stores which last only 72 hours, as tested by Choice. Meanwhile, research suggests that every year 350,000 households have a bike they no longer need.

Revolve ReCYCLING has also given away 500 bikes per year to disadvantaged children, through the Revolve ReCYCLING Foundation, as well as selling good-quality bikes at affordable prices, providing everyone with the opportunity to get into biking.

***Case Study 7. Samsara Eco***

Samsara Eco is a climate tech innovator addressing the growing plastic problem with an enzymatic recycling technology. This technology transforms end-of-life plastics and textiles back into their original building blocks, enabling remanufacturing.

The potential of Samsara Eco's technology is significant. While 10 billion tonnes of plastics and synthetic textiles have been produced, most end up in landfills or are incinerated. Currently, only about 13 per cent of plastics and as little as 1 per cent of textiles are recycled. This is particularly concerning given Australia is the world's top consumer of fashion per capita. Samsara's technology offers a solution to this problem by recycling difficult-to-recycle plastics and textiles, creating a truly circular loop.

Samsara Eco develops and scales its technology through its facilities in Mitchell and at the Australian National University, Canberra. A new Commercial Innovation Hub in Jerrabomberra, NSW, scheduled to open in mid-2025, will further expand the company's capabilities. Additionally, Samsara Eco plans to establish a facility in South-East Asia in 2026, creating a regional recycling loop.

In collaboration with leading fashion brands like lululemon, Samsara Eco has successfully demonstrated the commercial application of its technology. Together, they have launched the world's first enzymatically recycled nylon 6,6 garment and an enzymatically recycled polyester jacket for public sale.

As brands and industries increasingly focus on sustainability and seek recycled materials, Samsara Eco's technology is poised to play a crucial role in creating a circular economy for plastics and textile domestically and globally.

***Case Study 8. Sims metal recycling***

Sims Limited is an Australian success story. Founded more than 100 years ago in Sydney as a scrap metal business, today Sims Limited is a global leader in metal recycling and circular solutions for technology.

Sims Metal provides high-quality recycled metals in place of virgin materials, which enables the avoidance of emissions, including those associated with extraction and refining of virgin materials, and the production of steel products. When Sims Metal processes discarded metal, it is transformed from waste to a resource that can go directly to a smelter without further processing, ready to be made into new steel. Low-carbon steel is essential for the renewable infrastructure of the future: solar panels, wind turbines, dams and electric vehicles all require steel, along with non-ferrous materials like copper and aluminium that Sims Metal also recovers.

In FY24, Sims Metal recycled over 7.2 million tonnes of ferrous metal, which has the potential to avoid 11.2 million tonnes of $CO_2$-e emissions globally compared to producing the same amount of steel from raw materials. This equates to more than 100 times the carbon footprint of Sims Metal's direct operations annually. For scale, 11.2 million tonnes of $CO_2$-e is comparable to the annual emissions of some of Australia's largest coal-fired power plants.

Sims Lifecycle Services (SLS) plays a critical role in helping enterprises and data centres manage the end-of-use of technology, including refurbishing, reselling, parts harvesting, and recycling. In an industry first, in 2022, SLS launched a calculator to quantify carbon avoidance from recycling, as well as from the reuse of IT assets and components. Detailed dashboards show volumes of equipment processed, disposition routes and the carbon-equivalent emissions avoided, powered by equipment manufacturing data and our own lab-based asset data. For FY24, the total avoided emissions impact was 740,000 tonnes of $CO_2$ e, equivalent to taking more than 161,000 cars off the road for one year.

Sims Limited has also committed to reducing emissions from its own operations, including using 100 per cent renewable electricity in all operations by 2025. Since FY20, Sims Limited has reduced emissions by 31 per cent.

***Case Study 9. Smarterlite***

Smarterlite's Environmental Exit Signs set a benchmark for sustainability with their battery-free design, long lifecycle and plan for circularity.

By avoiding the need for unnecessary batteries, Smarterlite reduces harmful contaminants and the risk of potential fires associated with conventional battery-reliant exit signs. This battery-free design extends the two models' lifecycle to 16 and 30 years, minimises e-waste and supports a sustainable take-back program, contrasting with electric-battery exit signs that only last between 2 and 4 years.

Smarterlite's proactive approach significantly lowers environmental and safety risks associated with electric-battery exit signs. Batteries are the 'Achilles Heel' of these signs, as they contain harmful contaminants and are volatile when damaged. Millions end up in landfills and recycling facilities every year.

The modular design of Smarterlite's signs allows for easy disassembly, ensuring that every component can be efficiently recycled, maximising resource recovery and aligning with circular economy priorities for recovered materials. This comprehensive strategy not only reduces waste but also facilitates full lifecycle management, where Smarterlite takes responsibility for recycling.

Designed and manufactured in Australia, these signs support local jobs and contribute to the economy while delivering substantial environmental and social benefits.

Smarterlite's Environmental Exit Signs successfully disrupt the traditional take, make, and waste model that challenge the waste and recycling sector. It showcases an 'avoid, reduce and design' approach and practical ways of promoting a circular economy through product design, comprehensive lifecycle management, and responsible stewardship.

***Case Study 10. TOMRA***

TOMRA advocates globally for 'holistic resource systems': a combination of well-established waste management techniques using both national and regional level approaches. To maximise recycling and its associated carbon benefits, the framework integrates:

- deposit return schemes,
- the separate collection of specific material types, and
- mixed waste sorting.

Holistic resource systems require governments to take a leading role with innovative legislation. TOMRA's 'Holistic resource systems white paper' and the 'Mixed waste sorting guide' provide further detail.

# 3 Priority opportunities to progress the circular economy

## 3.1 National Packaging Reform that prioritises Australian recycled content

The Environment Ministers Meeting (EMM) announcement in November 2023 of forthcoming packaging regulation of packaging was strongly welcomed by the recycling sector. Not only can this reform support the delivery of a circular system for packaging in Australia, but it can also form a launching point for broader circular economy systems across other priority products.

If enacted effectively, packaging reform can drive Australia's transition to a circular economy and encourage growth in the domestic recycling and packaging manufacturing sector. To do so, this reform must incentivise the procurement of domestically produced recycled materials.

Australia is a net importer of packaging material, all of which reaches domestic waste streams. At the same time, the export of several formats of unprocessed recovered packaging has been regulated, requiring for this material to be reprocessed domestically—a priority for the Australian recycling sector. To that end, it is crucial to prioritise markets for domestically processed recycled content, both within Australia and internationally. Due to higher costs of production in Australia, domestically produced material competes on an uneven playing field with cheaper virgin and recycled imports. Mandatory requirements must be established for procurement of domestic recycled content, to ensure a viable recycling system, diversion from landfill and Australia's move towards a circular economy.

A move to a better regulatory footing is overdue. It has been three years since the *Independent Review of the co-regulatory arrangement under the National Environment Protection (Used Packaging Materials) Measure 2011* (UPM NEPM), identified that key elements of this measure have 'not been implemented or have not been operationalised effectively', creating 'a lack of clarity for producers brand owners, enabled free riders (and) reduced confidence in the scheme'. Eighteen months ago, the Australian Packaging Covenant Organisation's (APCO) *Review of the 2025 National Packaging Targets* identified that these targets were 'not on track to be met' within the nationally agreed timeframe.

ACOR agrees with APCO's assessment that the current coregulatory framework does not contain the required incentives or enforcement to drive the required change. Meanwhile, packaging regulation has not been enforced at the State-level, as intended by the NEPM.

There must be a harmonised national approach for packaging reform, to avoid inefficiency, uncertainty and regulatory fragmentation. There should be a mandatory extended producer responsibility (EPR) scheme for packaging. For a discussion of the priorities for effective extended producer responsibility, see section 5.2.

There are lessons to be learned from Europe, where the failure to prioritise domestic recycled materials has led to 'European plastics recycling companies ... (being) forced to operate well-below their production capacity' due to an 'uncontrolled increase of imports of cheap plastics, both virgin and plastics labelled as recycled' (EuRIC position paper, February 2024).

There must be support for domestic recyclers to prevent Australia being inundated with low-cost and unregulated imported recycled products that threaten the viability of domestic producers and manufacturers. Industry has partnered with State and Federal Governments to invest hundreds of millions of dollars in new and upgraded recycling facilities across Australia. This investment must not be undermined by cheap and unverified products. For example, a significant and increasing volume of food grade rPET (resin and packaging) is already being imported and sold at or below the cost of Australian manufactured products, with questionable provenance.

The proposed packaging laws must ensure there are mechanisms to incentivise the use of verified recycled content made in Australian facilities from recovered packaging, in particular materials whose export is regulated, including plastic resins (PET, HDPE, LDPE and PP) and fibre.

The National Packaging Design Standards should support:

- The mandated use of Australian-made recycled content.
- Designing for recyclability (e.g. mono material packaging).

- Moving away from problematic materials, such as composite formats, expanded polystyrene and rigid PVC, as stipulated by APCO's action plan to phaseout problematic and unnecessary single-use plastic packaging.

In advancing packaging regulation, the following issues should be addressed:

- Low prioritisation of Australian recovered material
- Low recognition of the value of recovered content vs virgin
- Dumping of virgin and recovered materials on the Australian market
- Verified provenance of recycled content
- Composite and laminated design which inhibits recovery and recycling
- Contamination in recycling streams (food remnants, labels, closures)
- Existing collection and sorting systems which may not be suited to recovery of new/different formats and materials
- Ability of product manufacturers to change/rationalise packaging materials
- Definition of 'circular'
- Full consideration of lifecycles.

A suite of necessary measures for domestic recycled content in packaging should include:

- **Environmental standards:** The EU has recently passed laws—the Packaging and Packaging Waste Regulation—which oblige all importers of recycled resins and packaging to meet strict EU environmental standards. Implementing similar measures in Australia would ensure the local recycling and packaging manufacturing industry is not disadvantaged by either rogue domestic operators or the importation of cheaper materials from overseas facilities where environmental, health and labour standards may not meet Australian standards.

  Further, the promotion of the use of locally recycled content in plastic packaging is based on the premise that the material was collected, processed and produced in an environmentally sustainable way, and thereby contributing to Australia's carbon footprint reduction efforts.

  Environmental exceptions in trade agreements already exist, as set out in the WTO Uruguay Agreement on 'Technical Barriers to Trade'.
- **Eco-modulated fees/levies:** A tiered, incentive-based fee system is required to ensure producers meet packaging design standards, potentially including tax offsets. Such a fee system should set a base fee for all packaging placed on market and apply discounts for certain characteristics such as packaging reduction, reuse, recyclability and use of Australian-made recycled content. The fees need to be calibrated to ensure locally recycled products are competitive with imported recycled content or virgin materials.

  The fee structure should be administered by an independent or statutory body and set at a level so that businesses are commercially incentivised to meet the minimum recycled content targets and the funds collected adequately cover the total cost of recovery and recycling of used packaging. The net proceeds should be reinvested into strengthening the domestic circular economy, targeting improvements and scale in collection, sorting, recycling and packaging manufacturing infrastructure.
- **Recycling to substitute virgin materials:** Every recycling process that replaces virgin molecules with recycled molecules in plastic packaging should be treated equally to packaging-to-packaging processes. Using every lever to maximise resource recovery and reduce waste will be the only way to meet targets over the next decade, as our society struggles with legacy waste issues. Not all packaging will achieve the optimal outcome of being recycled back into packaging. To maximise resource recovery, lower-grade materials should be repurposed into alternative products. Eco-modulated levies must therefore also recognise the participation of packaging producers in expanded markets for products derived from recycled packaging materials.
- **Minimum recycled content:** Mandatory minimum thresholds, supported by environmental standards, as outlined above, would guarantee that demand is genuinely stimulated, ensuring that levies are not treated merely as additional taxes but as catalysts for meaningful action and further investment in domestic recycling infrastructure. An example of this is Article 7 of the EU Packaging and Packaging Waste Regulation, which sets minimum recycled content for plastic packaging.

*Recommendation 1.* *Expedite national packaging regulation that prioritises recoverability, recyclability and minimum thresholds for Australian recycled content.*

*Recommendation 2.* *Ensure that the proposed National Packaging Design Standards support mandated thresholds for Australian-made recycled content; designing for recyclability; and national harmonisation of State and Territory regulation on single use and problematic plastics.*

### 3.2 National harmonisation of Container Deposit Schemes

Container deposit schemes (CDS) will soon be operating in every Australian State and Territory. These schemes have attracted industry and community participation and substantially reduced beverage container litter. The schemes increase access to quality recovered material, which leads to highest-value material reuse, such as bottle-to-bottle recycling. For example, the hot-wash PET flake generated from CDS products delivers high-quality rPET for the Australian packaging market. The schemes also deliver uncontaminated glass for high-value recycling.

It is essential that CDS supports meaningful progress towards Australia's National Packaging Targets, by ensuring that recycled content is prioritised in beverage containers and that beverage containers are genuinely reusable and recyclable.

As States and Territories respond to these successes by expanding the scope of eligible containers in schemes around the country—and as the focus of government and community concern shifts from litter reduction to establishing a circular economy—questions will arise as to what role these schemes are intended to fulfil, how they will interact with kerbside recycling collection, how to ensure strong markets for the CDS-generated recyclate, and how they can support higher resource recovery rates.

To be sustainable, container deposit schemes must have an efficient and effective operation, be financially and commercially feasible for all parties, enjoy social licence to operate, and be conducted under the right policy setting.

ACOR's position paper on 'Priorities for nationally harmonised Container Deposit Schemes' (Appendix 2) outlines the following priorities for well-functioning, nationally harmonised CDS:

- return rate targets
- adjusting the CDS deposit rate from 10 to 20 cents, with subsequent two-yearly review periods
- comprehensive access and coverage, including 'return to retail'
- consistent, strong marketing
- improved governance
- expanding the scope of eligible containers to include glass wine and spirit bottles
- prioritising containers that are recyclable and made from recycled materials
- protocols for material recycling facilities (MRFs), glass crushers and other third-party glass aggregators.

*Recommendation 3.* *Support national harmonisation of container deposit schemes, prioritising targets for return rates, an increased CDS deposit rate, and expansion of the scope of eligible containers to include glass wine and spirit bottles.*

### 3.3 E-stewardship reform to deliver e-product recycling and critical minerals

E-waste is defined by the Global E-waste Monitor 2024 as electrical and electronic equipment used by households and businesses, comprising 'electrical appliances such as refrigerators, stoves, washing machines and hairdryers, but also electronic devices such as mobile phones, wireless headphones and tablets'. Many of these products contain embedded batteries.

E-waste is a common contaminant in household comingled recycling bins, resulting in fire risk throughout the waste and recycling systems—particularly in trucks and materials recovery facilities (MRFs) (see section 4.1).

The Global E-Waste Monitor identified that Australia is one of the highest per capita generators of e-waste in the world, outlining also that electronic waste is rising five times faster than documented e-waste recycling.

However, the intrinsic value of critical minerals in e-waste and clean energy waste streams presents an opportunity. A local circular economy for e-waste recycling, or 'urban mining', can bolster sovereign capabilities and reduce supply chain vulnerabilities, while securing critical minerals with lower embodied emissions.

E-waste contains abundant quantities of critical minerals: the value of critical minerals in one kilogram of e-waste can be many hundred times that of an equivalent mass of mining ore. Recovering these highly valuable raw materials through recycling processes will help ensure supply chain security of critical minerals for development of battery and clean energy technologies locally.

Recycling at scale will require a whole-of-government approach across every relevant department. For example, while the Department of Climate Change, Energy, the Environment and Water aims to maximise recycling rates, the Department of Industry, Science and Resources seeks to secure critical minerals for clean energy technology.

Australia currently lacks the infrastructure to recover raw materials contained in e-waste and batteries at a sufficient scale. For example, there is limited onshore capacity for refining battery dust. This lack of scaled infrastructure increases costs: it currently costs 400 per cent more to refine recycled battery dust onshore in the sole facility than to ship it overseas. Additionally, when Australia's battery recyclate is sent offshore for refining, we can exercise little control over poor environmental practices concerning off-gassing and landfilling.

There is an opportunity for Australia's economy to benefit from value-add from recovered critical minerals, and also for Australia to demonstrate global leadership in the safe and environmentally responsible refining of potentially hazardous materials. Scaling e-product recycling would secure a supply of critical minerals and resolve an environmental challenge.

The recycling sector welcomed the Australian Government's signalled intention in 2023 to broaden the scope of e-product stewardship regulation to include all small electrical and electronic products; however, progress has been halted, undermining investment and innovation in this critical area.

***Case Study 11. EU battery recycling regulation***

The recently enacted EU Battery Regulation sets an ambitious best practice standard that Australia should emulate. This regulation mandates minimum recycled content thresholds in batteries: 6 per cent for lithium and nickel and 16 per cent for cobalt by 2031, rising to 12 per cent for lithium, 15 per cent for nickel and 26 per cent for cobalt by 2036.

### *3.3.1 National Television and Computer Recycling Scheme (NTCRS)*

The National Television and Computer Recycling Scheme (NTCRS), established in 2011, provides collection and recycling services for televisions and computers, including printers, computer parts and peripherals. The scheme is intended to divert this form of waste from landfill, increase the recovery of reusable materials, such as green metals, and provide convenient access to recycling services for households and small businesses.

Companies who import or manufacture television and computer products over certain thresholds are liable under the scheme, and are required to pay for a proportion of recycling through membership in an approved 'co-regulatory' arrangement. These industry-run coregulatory arrangements must meet the requirements of the *RAWR Act* and the *Recycling and Waste Reduction (Product Stewardship—Televisions and Computers) Rules 2021*. There are currently approved five co-regulators tasked with the day-to-day operation of the scheme, including organising collection and recycling of e-waste on behalf of producers.

However, the NTCRS is inefficient system with a two-tiered marketplace: the co-regulators of the scheme compete to offer the lowest fees to producers, forcing prices paid for recycling services down to unsustainable levels. This 'race to the bottom' within the NTCRS has been at the expense of best-practice recycling and environmental outcomes, with prioritisation of cost reduction resulting in lower collection

rates and compromised material recovery rates. The negative impact on the recycling industry has increased the possibility of a degree of market failure.

There is little transparent downstream verification or reporting of recycling outcomes: audits in the NTCRS are primarily financial audits, with cursory attention to operational elements.

*Recommendation 4.* *Urgently address the inefficiencies and conflicts of interest in the National Television and Computer Recycling Scheme (NTCRS), to support the viability of the Australian e-waste recycling system.*

### *3.3.2 Comprehensive and holistic e-stewardship*

The recycling industry takes on market, regulatory, investment and operating risk to achieve recycling outcomes, often within product stewardship schemes that do not sufficiently address these risks and therefore lead to sub-optimal recycling outcomes. It will be vital for a future e-stewardship scheme to ensure there are markets for recycled commodities derived from e-products, that compliance is enforced, and that risk and costs are equitably spread across the supply chain.

Any e-stewardship scheme should first and foremost be focused on value creation and environmental outcomes rather than cost-cutting: promoting the recovery of reusable materials, reducing waste to landfill, and supporting Australia's transition to a more circular economy by providing convenient access to e-stewardship services across Australia and fostering shared responsibility across the lifecycle of covered products.

An additional objective for e-stewardship must be to provide an integrated response to problematic e-waste, such as batteries. Regulated extended producer responsibility has the mandate and means to avoid the fragmentation that arises with proliferating voluntary industry-led initiatives that can cherry pick inclusions and exclude those products they don't wish to cover. Hazardous products require a consistent form of safe disposal at end of use.

Multiple product stewardship schemes—exemplified by the current arrangement, with the five coregulators of the National Television and Computer Recycling Scheme (NTCRS), Mobile Muster and B-cycle—also result in too many items that don't align with a specific scheme or don't have a responsible party slipping through the gaps, such as vapes, and goods placed on market illegitimately or illegally.

Vapes are a clear example of the need for an integrated approach without exceptions or exclusions. Vapes contain embedded batteries which cause fires in recycling streams: they must never be placed in conventional bins (nor littered), but there are scarcely any safe disposal options. While their sale has been restricted, they are illegally imported and sold, with no identifiable liable party and scarce options for safe disposal.

Comprehensive e-stewardship must map and quantify actual imports and in-scope material in country, including white label products, online purchases, illegal imports, counterfeit products and banned products. Unless incorporated into stewardship regulation, e-waste from these sources will continue to be littered, illegally dumped and cause devastating fires in recycling infrastructure.

The costs of the safe recovery or disposal of any products exempted from e-stewardship regulation will be borne by the broader community. A simplified all-encompassing scope will avoid public confusion, align the domestic recycling sector with international markets, and reduce waste.

See ACOR's *Recyclers in Product Stewardship* issues paper (Appendix 3), which outlines a suite of priorities to deliver effective, ambitious and accountable product stewardship, including for e-products and batteries.

*Recommendation 5.* *Prioritise and expedite holistic e-stewardship reform, with the implementation of a scheme that includes all consumer electric and electronic items, including batteries and solar PV systems.*

### *3.3.3 Solar panels*

The move to renewables is essential and a coordinated response is required to meet the growing challenge of the end-of-use clean energy technology. Numbers of solar PV system products are rising, with clean energy infrastructure reaching end of use set to increase 30-fold by 2031.

There is an urgent need to scale systems for collection and processing, and ensure there are robust end markets for the commodities derived from recycled clean tech.

While Australian e-product recyclers are investing in technologies to recycle end-of-use solar panels, some entities are exporting end-of-use or faulty PV panels to developing nations, where the waste is unlikely to be managed, resulting in environmental harm.

PV panels contain valuable fractions such as aluminium, and critical minerals including silver and silicon. An effective and robust regulatory framework for recycling end-of-use PV panels can boost confidence in investment in the recovery and re-introduction of these valuable raw materials to the Australian economy, while addressing market creation for lower-value component parts such as solar panel glass.

### 3.4 Recycled materials with lower embodied energy

Many types of recycled materials can deliver products with urgently needed lower embodied emissions.

There is significant opportunity to reduce dependence on virgin materials and maximise value of materials currently in use by replacing or supplementing virgin materials, including but not limited to quarried aggregates, bitumen, plastic, imported crumb rubber with recycled materials, improving resource efficiency and drawing less from virgin resources.

The ways recycling and resource efficiency can contribute to emissions reduction and the path to net zero have not been fully harnessed: NGERs and the safeguard mechanism do not consider lifecycle assessments and emissions, which limits recognition of the ways the recycling sector can contribute to a net zero future. In other jurisdictions, such as California, lifecycle assessments are included in emissions reduction, whereas in Australia only landfill gas capture and organics are regarded as emission reduction activities in the waste and recycling sectors.

In the transition to a net zero economy, the addition of metrics for avoided emissions will help demonstrate the role of recycling in energy efficiency, as well as resource efficiency. Consideration of avoided emissions will help to demonstrate and quantify the lower-embodied energy of recovered materials. It will also help to inform and guide decision-making in preferencing material choices.

The Australian Sustainability Reporting Standards will require large businesses to begin to report on scope 3 emissions two years after commencing reporting on scope 1 and 2 emissions.

***Case Study 12. Visy Glass***

Visy's $50 million upgrade to its Laverton glass recycling facility showcases the environmental and economic benefits of a circular economy. By increasing its capacity to recycle 200,000 tonnes of glass annually, Visy reduces waste, conserves natural resources, and lowers greenhouse gas emissions. Utilising recycled glass in the manufacturing process can reduce energy consumption by up to 30 per cent.

***Case Study 13. Aluminium***

Aluminium is a highly recyclable material with a significant environmental impact. Recycling aluminium requires just 5 per cent of the energy needed to produce primary aluminium, resulting in a substantial reduction in greenhouse gas emissions. Globally, over 30 million tonnes of aluminium scrap are recycled annually; conserving energy and reducing the need for mining and refining virgin aluminium ore.

***Case Study 14. Mint***

Mint have established a world-first bio-refinery to recover gold and other critical minerals from printed circuit boards. Gold recovered from e-waste in their new facility in Sydney saves 90 per cent of the carbon emissions of newly mined gold.

### 3.5 Green steel

The recycling sector is already producing significant low-carbon recycled resources for the Australian economy. The National Waste Report 2022 shows that the recycling sector recovered 87 per cent of the 5.71 Mt of metal waste generated in Australia in 2021–2022, providing 4.97 Mt of recycled metals to the global circular economy.

It is estimated that 2 million tonnes of processed ferrous scrap metal feedstock is used in domestic steel mills annually, amounting to 33 per cent of current new steel output. Representations from the steel

industry indicate this may lift to 45 per cent. Processed ferrous scrap metal is therefore a critical material for the Australian steel industry.

Australia currently exports over 1 million tonnes of unprocessed scrap metal annually, mostly in the form of end-of-life cars and white goods, which also comprise waste materials such as glass, plastics, textiles, and tyres. This practice diminishes the potential for domestic steel production, facilitates the export of over 267,000 tonnes of waste, and increases carbon emissions through long-distance transportation.

Global competition for scrap metal is expected to increase. Many global competitors for scrap metal have lower labour, waste disposal and utility costs compared to Australia—as well as less stringent environmental standards that would likely fall short of community expectations of how Australian waste should be managed. Increasing exports of unprocessed scrap metal are to the detriment of the Australian metal recycling and steel making industries, and general environmental outcomes.

To replace the volume lost through export, the Australian steel industry is either importing processed ferrous scrap metal, or relocating it domestically at great cost.

A ban on the export of unprocessed scrap metal can support a much better outcome for Australian-made green steel. A study led by the National Waste and Recycling Industry Council (NWRIC) has identified that an export ban on unprocessed scrap metal would mitigate approximately 81,110 tonnes of CO2 equivalent emissions annually, as well as bolster the local recycling industry—supporting the goal of green industries in Australia.

Moreover, recycling ferrous scrap metal saves an additional 1.2 million tonnes of Australian greenhouse gas emissions, compared to the use of virgin raw materials. This shift towards local processing not only supports sovereign steel manufacturing capability but also aligns with global sustainability initiatives by reducing carbon footprints associated with waste exports.

Securing scrap metal feedstock will also help to encourage the construction of electric arc furnace steel mills under consideration in Australia, which would be reliant on the supply of high-quality, furnace-ready scrap metal to operate. Without certainty of supply, the business cases for these proposed green steel mills will be significantly compromised.

ACOR joins NWRIC and the Australian Steel Institute in calling for a ban on the export of unprocessed scrap metal, noting that the Australian Government must first reform the waste export process to ensure that the regulation of waste export properly distinguishes between unprocessed waste and processed recycled commodities.

Similarly, banning the export of unprocessed e-waste would responsibly manage Australian waste while deriving environmental and economic benefit from the capture of green metals and critical metals therein. E-waste should also be supported as a growing and valuable source of green steel and aluminium.

Along with decarbonising their own energy use at facilities, e-product and metal recyclers can contribute to decarbonising the supply chain for metals through finer disaggregation as well as better sorting, leading to the cleanest possible materials being processed in foundries. For example, advanced sorting of aluminium fractions, through laser-induced breakdown spectroscopy, can enable recycled aluminium to be used directly in a primary foundry, skipping the secondary foundry and reducing the embodied emissions of the end product. These sorting technologies represent opportunities for investment in Australia.

For further priorities for export licensing, see section 5.3.

***Case Study 15. SK tes coking coal innovation***

With the SMaRT Centre at UNSW, and a grant from the NSW Environmental Trust, electronics recycler SK tes (formerly Tes-Amm) worked with Newcastle-based steel maker Molycop to develop a process for using toner and waste plastic as a replacement for coking coal in steel manufacturing. The project proved the concept, which could support an economical proposal when administered by a metal manufacturer.

*Recommendation 6. Expand waste export regulation to address unprocessed scrap metal, e-waste and textile waste.*

## 3.6 Food and organics recycling

Food and organic composting is a critical measure to reduce methane emissions from landfill, increase resource recovery and produce valuable compost. Halving the amount of organic waste sent to landfill by 2030 is also a key target of the National Waste Policy Action Plan.

However, organic recovery rates are threatened by contamination in organic waste streams: not only from non-compliant products, but also from contaminants like PFAS and asbestos. The traditional approach of managing contamination at 'end of pipe', through the waste management and the recycling sectors, is a fundamental impediment to the Australian Government's policy objectives for a circular economy. Regulation placed solely on recycling creates an unequal playing field between virgin/raw and recovered resources, which can stymie efforts to lift resource recovery rates and meet National Waste Policy Action Plan and circular economy targets.

Testing requirements must also be harmonised so that no jurisdiction is unfairly burdened in cross border trade. The Australian economy is a common market, yet each state has different requirements for product testing and compliance. This lack of consistency creates an uneven playing field within the circular economy.

To ensure the safety of all resources, our strong recommendation is that testing and monitoring requirements for the harmful chemicals under consideration are uniformly applied to all materials applied to land: virgin/raw products as well as recovered resource equivalents. Given the likelihood that PFAS is present across the board—including in chemical fertilisers, pesticides, and herbicides—it is imperative that we take a uniform approach to protect human and environmental health, and do not disadvantage recovered materials by subjecting them to higher regulatory stringency than virgin products.

There is a need to include greater clarity and certainty on roles and responsibilities to implement consistent monitoring and treatment regimens across PFAS contamination streams and networks. This would also help to ensure that costs associated with managing contamination are shared fairly across supply chains and jurisdictions and not solely borne by the waste management and the recycling sectors.

Clear policy and regulatory settings are also needed to signal certainty of investment in the necessary infrastructure to support circularity and innovation. Industry and their stakeholders are awaiting final mandates for FOGO before moving forward with investment. This is stifling the innovation and investment necessary for the circular economy to thrive. Policy uncertainty in the recycling sector renders the case for innovation weak, making it difficult to bank on the capital needed to generate a return.

Greenwashing is a particular concern for organics recycling, given the rise of non-compliant 'eco' packaging on the market. The growing 'green' packaging industry is selling products—often marketed as 'compostable', 'biodegradable' or 'degradable'—which are not actually commercially compostable and equate to contamination in FOGO streams. Government-endorsed certification and verification of compostable products that can be safely and effectively composted by commercial operators needs to be at the forefront of discussions about recovering food in the circular economy.

### *3.6.1 Traceability*

The Australian Government has developed a traceability framework as a key measure to support a circular economy. As Australia moves closer to mandatory recycled content standards—especially for packaging, as committed to by Australia's Environment Ministers—traceability is essential to build confidence in recycled goods.

The traceability framework must go hand-in-hand with government-mandated domestic recycled content thresholds—which could initially apply to packaging, and ultimately across all product categories. Mandatory domestic recycled content thresholds, verified and underpinned by traceability, can shift the current price barriers to uptake. Without mandated domestic recycled content, traceability may become yet another regulatory impediment to recycling rather than an enabler.

Widespread acceptance/adoption of a recycled content traceability framework will be entirely dependent on other supportive policy measures, including mandatory recycled content thresholds and accreditation of Australian recycling facilities (see section 5.5).

Many recyclers already undertake traceability: operators participating in container deposit schemes trace eligible materials through their facilities; the value chain for food-grade packaging involves stringent tracking; recyclers participating in product stewardship schemes trace in-scope products; and many MRFs trace baled materials through their facilities and to the next destination.

The traceability framework can support the Australian Government-led ReMade in Australia initiative, which seeks to develop a verification framework to label and validate products with Australian recycled content. A ReMade in Australia campaign must leverage strong public support for recycling and local investment, elevate consumer awareness and confidence in recycling, and, most importantly, help to generate strong end markets for domestic recycled materials.

***Case Study 16. Close the Loop, Recity and GS1 Australia: soft plastics recycling with traceability***

Close the Loop, in collaboration with Recity and GS1 Australia, have launched a soft plastic recycling initiative with best-practice traceability from collection to final use, in line with the National Framework for Recycled Content Traceability (NFRCT).

Close the Loop aims to reimagine the soft plastics supply chain by enabling real-time, verifiable tracking of recycled content, a first in the industry. Minimum viable product trials are underway between Close the Loop and select supply chain partners, using GS1-standardised labels. This project is set to transform soft plastics recycling, positioning Australia's recycled content on the global stage through Circular Contracts and potential credit schemes—creating new opportunities across the supply chain and opening doors to fresh markets.

The initiative will focus on two key objectives: developing standardised labelling with GS1 Australia, and trialling a traceability platform for efficient data exchange, enabled by Recity.

Close the Loop is an industry-leading product stewardship and circular economy company with a strong focus on innovation and manufacturing with recycled content, focused on recycling problematic materials through robust supply chain partnerships. Close the Loop is partnering with Recity, a leader in waste management and resource recovery technologies, which provides data capture, tracking, and traceability solutions to clients in Europe and India. Together with the CSIRO RISE Accelerator, Recity is exploring market entry opportunities in Australia for its traceability and resource recovery technologies.

GS1 Australia is a global standards organisation for business communication, specialising in supply chain traceability and traceability. The GS1 Australia Team has been actively supporting national and international efforts to assist the waste and recycling sector with processes for supply chain data capture and sharing.

***Case Study 17. Martogg Group***

Martogg undertakes traceability through a quality management system (QMS) compliant with ISO 9001:2015, and an occupational health and safety management system (OH&SMS) compliant with ISO 45001:2018.

Both systems require periodic auditing from an accredited third party, with annual surveillance audits and a complete compliance audit every three years. The QMS documents a wide range of business processes and procedures, with all products made and sold subject to 'one up, one down' traceability.

The QMS enables Martogg to track incoming raw materials by material type, quantity, supplier and source, then through product manufacturing and quality assurance processes, and finally as finished products to customers. For recycled polymer products, only approved raw material suppliers are used, with required demonstration that products meet quality standards and compliance requirements, with additional tests against internal standards.

All raw material input information is held on a works order document and assigned to a batch number, which appears on packaging and sales documentation provided to customers: it is expected that customers incorporate this information into their own product traceability system, satisfying the traceability framework's interoperability requirement.

Martogg also supplies Certificates of Conformance and Analysis for each batch of products, as required by customers. Martogg's QMS system and the traceability process it encompasses meets the requirements of the proposed recycled content traceability framework.

***Case Study 18. Curby***

Curby partners with councils to collect soft plastics from the community via the existing yellow recycling bin. Households download the Curby app and place their soft plastics in a CurbyBag with an attached CurbyTag (or any soft plastic bag with a CurbyTag attached) into their yellow bin. Once the CurbyBag or CurbyTag reaches the sorting facility, iQRenew separates the bag from the other recycling materials. From here the bag is sent on to secondary processing and then turned into new products.

A CurbyTag has two primary functions: to enable MRF operators to correctly identify the bag as program material and pick it out, and to enable the program to collect more accurate information about how much soft plastics is being generated in different council areas, leading to increased provenance and traceability. The intent is a full traceability system from MRF through to end-market manufacturer.

## 3.7 International developments

The case studies below showcase international developments that support circular economy through the resource recovery, recycling and remanufacturing value chain.

***Case Study 19. European Union Waste Electrical and Electronic Equipment (WEEE) Directive***

The European Union Waste Electrical and Electronic Equipment (WEEE) Directive, which came into force in 2012, is an extended producer responsibility scheme that incorporates all electrical and electronic equipment; in short, any product connected to a plug or that contains batteries.

The Directive requires:

- separate collection and proper treatment of WEEE with targets for collection, recovery and recycling
- crackdowns on the illegal export of WEEE
- public awareness and educational programs, funded by the scheme
- all participants across the e-waste value chain to be accredited.

***Case Study 20. European Union Packaging and Packaging Waste Regulation (PPWR)***

The European Parliament has passed strict new rules for packaging, to make packaging more sustainable and reduce waste. Most packaging will have to be recyclable by fulfilling strict criteria, with minimum recycled content targets for plastic packaging, and recycling targets by weight of post-consumer packaging.

The regulation will introduce minimum recycled content thresholds. By 2030, the minimum recycled content for plastic packaging will be 30 per cent for PET packaging and beverage bottles, 10 per cent for contact sensitive packaging from other polymers, and 35 per cent for all other plastic packaging, rising in 2040 to 50 per cent for PET, 65 per cent for beverage bottles, 25 per cent for contact sensitive packaging from other polymers and 65 per cent for all other plastic packaging. All importers of recycled resins and packaging will be required to meet strict EU environmental standards, effectively ensuring that the European recycling and packaging manufacturing industry is not disadvantaged by the importation of cheaper materials from overseas facilities where environmental conditions may not meet required standards.

Other provisions include:

- mandated packaging recyclability
- reuse targets
- packaging reduction targets
- mandatory container deposit schemes
- packaging collection targets
- reporting and labelling obligations
- a ban on PFAS above certain thresholds in food contact packaging.

***Case Study 21. Dutch Extended Producer Responsibility Textiles Decree***

In the Netherlands, an extended producer responsibility scheme for textiles (Uitgebreide producentenverantwoordelijkheid (UPV)) came into effect on 1 July 2023. It establishes the following targets for reuse and recycling, which will ratchet up over time:

- By 2025, 50 per cent of the previous year's total weight sold must be recovered for reuse or recycling. Of this percentage, at least 20 per cent must be reused, with at least half reused in the Netherlands. By 2030, it increases to 75 per cent of the previous year's total weight sold, with at least 25 per cent reused of which 15 per cent must be reused in the Netherlands.
- By 2025, 25 per cent of all textile fibres of discarded textile products must be used in materials for new products (fibre-to-fibre recycling). By 2030, this must be 33 per cent of all textile fibres.
- Producers will have to submit an annual report setting out the details of their compliance with the decree, and are financially responsible for setting up a suitable collection and processing system for discarded textile products. Non-compliance may be punishable with criminal law sanctions.

***Case Study 22. US labelling and composting laws***

Many US states have enacted laws around composting in the past decade, from rules around compostable product labelling and specifications to extended producer responsibility programs, leveraged to divert food and food packaging from landfills, reduce methane emissions and enhance soil and plant health.

- Washington and Colorado are enforcing new labelling requirements in July 2024, aimed at standardising consumer information. These requirements include adherence to ASTM worldwide standard specifications that outline the necessary tests and pass/fail criteria and require third-party certification to ensure compliance. Additionally, they prohibit misleading terminology like 'biodegradable', 'oxo-degradable', and 'decomposable', to prevent confusion for consumers.
- Washington has implemented programs to support compost infrastructure development and has regulations in place to encourage composting. Additionally, Washington has requirements for compostable product labelling and specifications, ensuring that consumers can easily identify and properly dispose of compostable items.
- Extended producer responsibility programs in California and Colorado include composting.
- California has introduced compostable grocery produce bag requirements.

# 4 Hurdles and barriers to a circular economy for businesses and consumers

The recycling sector faces numerous challenges that hinder further expansion and investment. These include viable end markets for domestically produced recycled materials, and policy and economic uncertainty, which can lead to poor investment confidence in recycling infrastructure. Additionally, the manifold risks and consequences of battery fires in recycling facilities and spiralling insurance costs pose an immeasurable challenge. Contamination within recycling streams further complicates the enterprise.

Furthermore, many reasons are cited to avoid circular economy practices such as procurement of domestically produced recycled materials. These include the cost premium of Australian recycled content over imported recycled and virgin materials; perceived risks of recycled content; and a lack of standards and specifications to support procurement (see Appendix 7: *Standards to facilitate the use of recycled material in road construction*).

## 4.1 Battery fire risks

Batteries—in loose or embedded form—are an increasingly alarming hazard in both kerbside and commercial waste and recycling streams. The recycling and resource recovery sector is overwhelmingly concerned about increasing incidents involving batteries causing property damage, serious injury and death—and resulting in skyrocketing insurance fees and financial assurance requirements.

The rapid digitisation of everyday items, the increasing number of 'smart' and 'disposable' items such as vapes containing embedded and sealed batteries, and a lack of safe disposal options and poor consumer education, have all contributed to the steep rise in batteries in inappropriate waste streams. This is causing fires and property damage, and severely compromising collection and resource recovery operations for recyclers all across Australia.

Fires caused by batteries are now widespread across material recovery facilities (MRFs), in waste and recycling trucks, and in depots—in short, at every point across collection, disposal and recovery streams, including scrap metal and e-product recycling. These fires pose great dangers to human health and life, and are also damaging to the environment through smoke and polluted runoff. The economic impact of these incidents is being borne by the community through rising rates, by councils through truck fires and future risk, and by industry in the loss of critical infrastructure.

Research led by ACOR and the Waste Contractors and Recyclers Association of NSW (WCRA) has revealed there were between 10,000 and 12,000 fires in the last year across Australia's waste and recycling sector. Alongside significant infrastructure losses, recycling workers' safety and lives are at risk.

While the damage caused by batteries is critical, current volumes are only the beginning. Batteries are now part of our energy arsenal and everyday lives—and so is their waste. The Australian Government has identified that lithium-ion, sodium-ion, vanadium flow batteries and others will support the transition to a net zero emissions economy.

While issues relating to battery safety reach broadly across society, pointing to an urgent need for battery quality standards, the principal focus of the recycling sector is to address the risks at end of use.

Critical actions to address safe battery disposal are:

- Ensure comprehensive safe collection
- A community education campaign
- E-stewardship reform, including a deposit scheme
- Regulatory harmonisation and enforcement.

For further information on the impact of batteries on recycling see the Appendix 5: *A Burning Issue: Navigating the battery crisis in Australia's recycling sector*, and Appendix 4: 'Industry survey: Battery fires in waste & recycling'.

*Recommendation 7.* *Urgently address the escalating hazard posed by batteries in recycling streams: catalogue all items in the market with loose or embedded batteries; roll out a comprehensive safe collection system; deliver a nation-wide community education campaign; implement e-stewardship reform, including a deposit scheme for battery-containing items; and harmonise regulation for battery disposal and collection.*

## 4.2 Insurance

Battery fires in waste and recycling facilities and trucks is leading to skyrocketing insurance premiums, or an inability to secure insurance at all. ACOR and WCRA's research has revealed that in the last twelve months, insurance costs increased by $114,200 on average per business, which excludes step change increases in insurance premiums in previous years.

In many instances, recyclers are becoming uninsurable, with consequences for operations, financing and growth.

## 4.3 Contamination and community engagement

The kerbside recycling system is a successful model with potential for further resource recovery and efficiency. It is also a valuable resource that must be safeguarded. Contamination is a critical issue that threatens the integrity of the entire recycling system.

When improperly sorted and non-recyclable materials are placed in recycling bins, they compromise the quality of the recyclable materials being processed. This contamination can lead to higher operational costs for material recovery facilities (MRFs), reduce the value of the recyclable materials, and increase the risk of loads being diverted to landfill; resulting in lost public trust which could further jeopardise current capabilities and future opportunities.

Currently, there is a lack of consistent education on proper recycling practices, with many organisations running independent and varying campaigns. A more effective approach would be a unified, coordinated education campaign that directs individuals to a central source for accurate recycling information. This campaign should be implemented across communities, including schools and workplaces, and maintained as an ongoing effort.

A priority should be a comprehensive campaign that emphasises the impact of contamination and the benefits of proper recycling, alongside robust compliance measures. With some MRFs managing contamination rates as high as 35 per cent, it is crucial for governments and industry to collaborate on reducing contamination rates to below 10 per cent.

Recycle Mate, a government- and recycler-supported national education tool, has proven effective in addressing these challenges and should play a key role in this coordinated effort.

Recycle Mate is an ACOR initiative, a first-of-its-kind recycling app, supported by the Australian Government. The live national platform allows governments, recyclers, product stewardship schemes and the whole community to work together to gather, share and update recycling information and avoid duplication of effort as our industry evolves.

Australia has a complex array of kerbside and away from home resource recovery systems, influenced by various factors such as geography, demographics, council resources, infrastructure discrepancies, access to markets and the growth in product stewardship and other social enterprise schemes.

Different recycling information and rules are being delivered to the community by over 500 local councils, state governments, professional recyclers, product stewardship schemes, state container deposit schemes (CDS), charities and social enterprises, environmental organisations, community groups and more. This results in enormous duplication of effort, mixed messages and often incorrect information, which can fuel recycling myths. Adopting a one-size-fits-all approach does not accommodate the current complexities of recycling and circular economy efforts in Australia—and blanket statements that are not reflective of local recycling practices can contribute to confusion and poor recycling behaviours.

With appropriate resources, Recycle Mate also has the data to build interactive 'heat maps' against population density to illustrate community access to safe disposal and recycling options for items either not suitable for kerbside collection or which have more positive away from home recovery options. The mapped data identifies gaps in community access to recovery options to help inform future federal and state policy and legislative actions.

Appropriate labelling is also required to support good community recycling behaviours at the bin. ACOR has identified that growing consumer environmental awareness and desire to recycle correctly is thwarted by a lack of information or complex messaging on packaging, which can hinder the ability to make the correct

choices with respect to recycling or disposing of packaging waste. See also Appendix 6: *Audit and Review of Packaging Environmental Labelling and Claims*.

*Recommendation 8.* *Provide appropriate funding to foster collaboration and restore community confidence to 'recycle right' through the national education tool Recycle Mate, generating higher recycling participation nationally, and delivering more data to Government on the recycling capabilities and community behaviours across Australia.*

### 4.4 Poorly designed and governed product stewardship schemes

The Australian Government oversees both mandatory and co-regulatory product stewardship schemes, and also provides accreditation for voluntary arrangements, giving schemes credence. ACOR strongly supports moves to place greater responsibility on producers and manufacturers for the lifecycle of their goods; extended producer responsibility can be an effective way to ensure recyclability and fund recycling efforts.

However, ACOR is concerned that some existing product stewardship schemes are not delivering strong recycling outcomes, while future schemes are being established without the correct drivers in place to drive effective resource recovery. Now is the time to better align these initiatives, set stronger targets, ensure accountability and address free riders, including imported products.

Common issues among schemes, which serve to undermine recycling investment, include:

- underfunding for recycling (or assumption that recycling is free/cheap),
- lack of prioritisation and meaningful support for end markets for recycled materials,
- prioritisation of scheme administration over resource recovery and recycling outcomes,
- a prioritisation of product stewardship schemes over other effective policy and regulatory levers,
- the proliferation of multiple schemes, with diverse governance structures, operations, priorities and outcomes, resulting in inefficiency and consumer confusion,
- lack of accountability and transparency, and
- conflicts of interest in governance and a lack of representation across the entire supply chain—with a focus on producers rather than collectors, recyclers or purchasers of recycled products.

A poorly designed product stewardship scheme can enable greenwash and cause more harm than good, by:

- slowing momentum with strong marketing that promotes ineffectual activities,
- failing to deliver effective and transparent outcomes for consumers, who essentially fund these schemes, and
- driving down resource recovery outcomes by prioritising cost reduction over performance.

For further discussion of measures to lift effectiveness and governance in product stewardship, see section 5.2.

***Case Study 23. REDcycle***

REDcycle was an industry-led program operating from 2011 as a broad-based return-to-store, soft plastics recovery program in Australia, facilitating the collection and processing of soft plastics into a variety of durable recycled plastic products. Product manufacturers and major Australian supermarkets partnered with REDcycle to run the program.

In November 2022, REDcycle announced that it was suspending soft plastics collection, as processing capacity for soft plastics and markets for recycled soft plastic products became limited. It was later revealed that REDcycle was stockpiling over 10,000 tonnes of unprocessed soft plastic across dozens of locations Australia-wide. In February 2023, REDCycle was declared insolvent, reflecting broader limitations of the recycling system for soft plastic.

As a product stewardship scheme, REDcycle was fuelled by strong marketing and collection rather than a robust recycling supply chain and stable end markets. In a market environment where the production of new plastics is still far outstripping the demand for recycled materials, the collapse of REDcycle underscores the importance of scrutinising the operational aspects of product stewardship schemes to ensure they are capable of fulfilling their objectives and contribute meaningfully to circular economy outcomes.

The failure of REDcycle has had a broad impact on public confidence in recycling, with the media often calling into question the effectiveness of Australia's broader recycling system, demonstrating that the reputation of the recycling industry (rather than manufacturers) is most severely compromised by poorly designed schemes.

## 4.5 Perceived 'risk' of recycled materials

Significant barriers to strong market uptake of recycled material include cost competitiveness with virgin materials and willingness within the supply chain to embrace change. Procurement needs to be significantly scaled up, in order to properly kickstart supply chain integration of recycled products and materials, and establish robust, resilient end markets.

To achieve waste reduction targets, it is necessary to seek ways to explicitly 'de-risk' procurement of recycled materials, to change the behaviour of key decision makers: engineers are by training conservative, and staff don't want to take perceived 'risks' on expensive projects, with little to no incentivisation to try new materials when virgin materials offer lower risk profile.

***Case Study 24. Virgin versus recovered resources***

Below are a few instances of many, where recovered resources meet performance requirements but are nevertheless persistently rejected on the basis of trivial or outdated specifications, general reluctance and lack of motivation.

- APA Group—bedding material: Gas pipeline infrastructure owner APA Group still requires that bedding sand must be a virgin resource. Recycled products are able to meet technical properties however the specification states the bedding sand needs to be yellow to white, and from an approved source: recycled materials can't comply with colour specifications.
- Citipower/Powercor—embedment and backfill sand: Although recovered resource products meet the technical properties of the required specification, Citipower's specification explicitly states the sand must be natural sand (such as river sand). Powercor's technical standards team has not responded to inquiries regarding the potential use of recovered resources.
- Melbourne Retail Water Agencies/ Yarra Valley Water: Although some recycled materials are permitted for use with YVW and other water authorities, they are restricted to embedment applications and/or trench backfill for sewer projects only, not potable nor non-potable water systems. Despite some limited acceptance, there has been a significant lack of progress in adopting further recovered resources within the industry.

See also section 5.1.

# 5 Governments' role in the circular economy

## 5.1 Procurement of Australian recycled materials

Recycling cannot function without viable and robust markets for recycled materials.

While Australia is a net importer, all products and packaging distributed in Australia ultimately reach the Australian waste stream—regardless of whether they are produced domestically or offshore. This is especially the case for plastic packaging, where more than half of all plastic packaging on Australian shelves is imported but the entire amount must be reprocessed onshore, due to waste export regulation.

Rather than growing end markets for recycled goods, access to international markets for recycled goods is constrained under the Australian Government's waste export ban (see section 5.3), due to the fact this regulation also captures finished recycled commodities. With export regulation of recovered glass, tyres, plastic and paper, markets for these recycled materials are vital.

Theoretically, anything is recyclable, however actual recycling must be economically viable, addressing the cost of Australian labour, recycling infrastructure, research and development, and, most critically, end markets for recycled materials. Scale is required, not just to ensure economic viability, but to address the volume of products and materials delivered into local markets. Anything less will fail to deliver scaled outcomes.

As the largest infrastructure client and major procurer of goods, Australian governments have a key role to play in leading market demand for recycled content. Procurement needs to be significantly scaled up, in order to properly kickstart supply chain integration of domestically produced recycled products and materials, and establish robust and resilient end markets.

Thresholds for domestic recycled content in government-procured goods, as well as buildings and infrastructure projects must be mandated, with published benchmarking, measurement and reporting on procurement of recycled content. Measures should be introduced to directly link funding to procurement of domestically recycled materials.

Despite some procurement policies that prioritise recycled materials, there remain persistent and significant barriers to uptake, including cost competitiveness with virgin materials and willingness within the supply chain to embrace change.

Programs to facilitate uptake of Australian recycled materials in infrastructure must be a priority. A leading example is ecologiQ, the delivery mechanism for Victoria's Recycled First policy (see Case Study 26). An effective implementation plan will help unlock government purchasing power to support home-grown markets for Australian-made recycled products.

Enduring barriers to the uptake of recycled content in government procurement are as follows:

- **Technical expertise in procurement staff:** Under-resourcing across procurement divisions and also regulatory agencies has led to a long decline in technical capability. A less technically proficient staff lacks the confidence and appetite to tread new ground in resource recovery. Procurement of major infrastructure is often undertaken at the state level, however States are often unable to compete on salaries with industry or Federal government roles, resulting in further skills shortages. Also, ever-increasing government reliance at all levels on consultants has meant that governments have been largely outsourcing technical skills, retaining generalists internally.
- **Risk aversion:** Culture and systemic change is required to support innovation, which can often be perceived as entailing risk. Road engineers, for example, are conservative by training, and staff don't want to take perceived 'risks' on expensive projects. Furthermore, government procurers are not incentivised to try new materials when virgin materials offer lower a risk profile. A suggested method to facilitate innovation is the use of temporary roads during freeway construction as test beds for innovative recycled materials, offering opportunities for time-limited real-world trials.
- **Specifications:** Specifications will harness or hinder change. Federal specifications provide an opportunity to effect top-down change, as States and Territories tend to follow Federal requirements, and local governments tend to follow the States and Territories.

- **Lack of KPIs and transparency on progress:** Sustainability policies set by policy makers are not filtering down to officers who administer tenders. Unless there are firm KPIs, reporting on progress and consequences for not meeting targets, government procurers will continue to choose virgin materials.
- **Cost parity:** Government tendering processes disincentivise innovation. There is a cost parity issue, where recycled content can be more expensive because they are locally manufactured. Furthermore, requirements that tenders go to a broad market rule out many newly developed recovered resource products which will typically have only one provider—as will remain the case where there is a lack of end markets and market competitiveness, a Catch-22 situation.
- **Green building and infrastructure rating tools:** Green building and infrastructure rating tools provide an excellent incentive for uptake of sustainable materials. However, they should be tightened to deliver meaningful uptake of domestically recovered resources. Requirements must be scaled according to the weight and volume of large infrastructure projects, and must not be able to be traded for small volumes of recycled materials or education campaigns.

Meanwhile, recyclers are also subject to much more stringent controls on storage volumes than those for virgin materials, determined by many overlapping regulators: local councils, state environmental regulators and fire authorities (see 5.4.3). What comes in, must go out: without robust access to deep and broad markets, recyclable resources risk being landfilled. Recycling is a manufacturing enterprise, however unlike other parts of the manufacturing industry, recyclers cannot control the volume or the quality of the material that reaches our facilities: that is dependent on consumption and production patterns, systems for collecting and managing waste, and how the community engages with these systems.

***Case Study 25. Recycled content in roads***

Standards Australia and ACOR have identified ways to advance the use of recycled materials in roads. The use of recycled materials in roads and pavements can positively influence triple bottom line performance:

- **Environmental impact reduction:** Incorporating recycled materials can reduce emissions and conserve natural resources by minimising the need for virgin materials. Depending on the type of recycled materials used, greenhouse gas emissions can be reduced by between 47 per cent and 98 per cent
- **Improved performance:** Certain recycled materials can enhance both the durability and lifespan of road infrastructure. Researchers at RMIT and the University of South Australia tested asphalt with crumb rubber and found that it could double the durability of roads in hot weather. Crumb rubber has also positive effects on pavements, including through reduced noise and risk of cracking.
- **Material cost saving:** The ARRB (2022) estimates that most recycled material applications in road and rail infrastructure can create cost savings between 2 per cent and 83 per cent. The use of reclaimed asphalt pavement has the highest economic benefit, with a cost saving of 83 per cent.
- **Job creation:** Expanding the market for recycled materials can generate additional employment opportunities. A report by Access Economics for the Department of the Environment, Water, Heritage and the Arts found that job creation in the recycling sector is higher than waste disposal with 9.2 jobs created for every 10,000 tonnes of materials recycled, compared with only 2.8 jobs created for sending materials to landfill.

Gaps in procurement policies, lack of evidence demonstrating long-term environmental and performance outcomes, and nascent markets for some materials are several of the barriers that prevent the widespread use of recycled materials in roads. For example, materials such as crushed concrete, reclaimed asphalt pavement, and crumb rubber benefit from established markets with high levels of industry confidence. Other materials such as plastics, however, have less developed markets due to their uncertainty around long term performance and environmental impact.

Standards Australia, the Australian Government, and key industry expert participants should collaborate to modify existing and/or create new performance-based Australian Standards that harmonise the inconsistencies in existing specifications. Standards should support the application of recycled content across jurisdictions, and be up to date with current waste streams and the types of recycled materials used in roads.

Meanwhile, practical guidance material for the use of recycled content in roads should:

- Clearly communicate the benefits and applications of these materials in roads
- Highlight the enabling standards and relevant use cases that govern the use of recycled materials
- Provide the necessary knowledge to dispel misconceptions around recycled materials and the associated Australian Standards.

For further information, see the joint Standards Australia and ACOR report *Standards to facilitate the use of recycled material in road construction* (Appendix 7).

***Case Study 26. Recycled First and ecologiQ***

Victoria's 'Recycled First' policy has proven to be a more effective enabler for procurement of recycled content for infrastructure projects, than, for example, the 'if not, why not' policy applied in NSW.

To a large part, this can be attributed to the requirement for all tenderers on Victorian major transport projects to demonstrate 'how they will optimise the use of recycled and reused materials at the levels allowed under current standards and specifications'.

However, Victoria's ecologiQ program, which facilitates engagement between recyclers and infrastructure projects, has been critical to building capability and confidence in procurement of sustainable and recycled materials.

A barrier to uptake of recovered resources in the built environment is 'fitness of purpose' and procurement standards contracts.

ecologiQ is a program designed to connect big infrastructure projects with those producing recycled material, as a delivery mechanism for Victoria's Recycled First policy. The program facilitates communication between industry and departments, challenging why recycled materials can't be used.

ecologiQ supports innovative procurement methods that might otherwise be perceived as entailing risk, acting as a matchmaker, working to understand concerns by procurement managers about using recycled resources, and soliciting data and testing from industry to demonstrate how materials comply.

In verifying recycled products by enabling these tests and demonstrating results, ecologiQ is building confidence with government procurers, which will flow on to industry.

This model works by methodically changing the behaviour of key decision makers. By sharing perceived risk across organisations, decision-makers can take first steps together.

Ultimately, this program can help to inform mandatory targets for procurement of recycled material, as evidence is gathered in a voluntary context.

*Recommendation 9.* *Publish benchmarks, measurements and reports on government procurement of Australian recycled content.*

*Recommendation 10.* *Prioritise procurement of Australian recycled content in Government-funded projects, underpinned by a traceability framework for recycled materials.*

## 5.2 Effective product stewardship and extended producer responsibility

The RAWR Act provides a framework for managing Australia's recycling and waste reduction objectives, which include the development of a circular economy. The Act identifies voluntary, co-regulatory and mandatory product stewardship schemes as a means to manage the impacts of products and materials throughout their lifecycle, and enables a more accessible framework for accreditation of voluntary schemes. The Act provides for the use of the Commonwealth's logo for accredited voluntary schemes, promoting the recognition and credibility that government accreditation affords.

The Australian Government has signalled a preference for industry action through product stewardship schemes. The establishment of many government-accredited schemes has also been encouraged by the Minister's product stewardship priority list, which identifies products lacking circular or recycling solutions at their end of use.

The recycling sector strongly supports an increased focus on producers and distributors to take greater responsibility across the full lifecycle of products, including at end of use. Product stewardship and extended producer responsibility can be an effective way to reduce waste and lift recycling rates—particularly where recycling rates are low, or materials have low or negative value—but only if these schemes are properly designed in partnership with recyclers.

At present, existing voluntary and co-regulated product stewardship schemes endorsed by the Australian Government predominantly cater to producers. However, it is imperative to recognise that these entities represent only a part of a product's lifecycle.

Many product stewardship schemes appropriately emphasise the waste management hierarchy priorities of avoidance, reusability, and designing for repair, yet all products inevitably reach an end of use, where the ideal outcome is recycling.

Overwhelmingly, when schemes do engage with recycling activities, the focus is primarily on the public-facing, marketable elements of collection and processing, while underinvesting in the equally critical aspect of high-value recycling outcomes and demand generation for recycled material.

Too often, cost reduction is prioritised over quality recycling outcomes in such schemes. Not only does this undermine legitimate recycling operations, but it also erodes community confidence in recycling when the system fails.

The recycling sector is concerned that some existing voluntary and co-regulated product stewardship schemes are not delivering robust recycling outcomes while new schemes are being established without the correct mechanisms in place to drive effective resource recovery. Recent trends indicate recovery rates for household waste have stagnated, while commercial and industrial waste recovery rates have declined. This pattern underscores the urgent need for a concerted effort to invest in genuine recycling outcomes.

The establishment of a scheme must not be seen as an end in itself: it must be a means to delivering sustainable and economically viable circular outcomes, in partnership with the entire supply chain. Engagement with the rest of the supply chain—especially recyclers, who are the subject matter experts on recycling—is essential to ensure product stewardship schemes deliver genuine value to producers, government entities, communities, and recyclers, and support the transition to a circular economy.

With thirteen industry-led government-accredited voluntary and co-regulated schemes and almost one hundred initiatives operating in Australia, and many more in development, now is the time to better align these initiatives, set stronger targets, adopt better governance and ensure accountability, to deliver genuine outcomes that support community confidence and proper investment in recycling.

ACOR's 'Recyclers in Product Stewardship' issues paper (Appendix 3), outlines the priorities and challenges for recyclers in the current context of a drive towards more stewardship and extended producer responsibility models. It recommends measures for product stewardship schemes that will deliver better environmental outcomes and more genuine engagement across the supply chain, including designing for recycling and reuse, expanded collection and safe disposal measures, creating market demand and transparent scheme governance focussing on compliance and consequences.

***Case Study 27. Bureau of International Recyclers position on extended producer responsibility***

The Bureau of International Recycling (BIR) is the world federation that has been supporting the interests of the recycling industry on an international scale since 1948. BIR represents over 30,000 companies across 70 countries, through 37 national associations and over 1000 direct corporate members, covering eight material streams, including ferrous and non-ferrous metals, paper, textiles, plastics and tyres/rubber, as well as electrical/electronic equipment. In 2023, BIR released a position paper on extended producer responsibility, highlighting growing international concern from recyclers about EPR.

Key recommendations outlined in their statement include:

- EPR schemes must not disrupt existing efficient markets, and should be set up only when there is a need and only once the effectiveness and the intrinsic value of a waste stream have been assessed;
- governments should first refer to other policy instruments to increase circularity such as making design for recycling mandatory and legally binding recycled content targets;
- recyclers should be involved in the governance bodies of such schemes to ensure an appropriate balance of interests among the most relevant stakeholders in the value chain, and;
- ownership of waste should be retained by the recycling company entrusted with the responsibility of processing the waste, with transparent and fair tenders and to avoid monopolies and comply with competition rules.

*Recommendation 11.* *Undertake a holistic review of the provisions for product stewardship within the Recycling and Waste Reduction Act 2020 and all relevant government policies and programs, to ensure that all voluntary and mandatory schemes support genuine recycling outcomes, addressing: scheme design; reuse and recyclability; creation of market demand for recycled materials; enhancing and incentivising collection; and ensuring transparency, accountability and whole-of-supply chain, including recycler representation in scheme governance.*

## 5.3 Export licensing

Australia is the only country to have enacted legislation on the export of recycled commodities, through the *Recycling and Waste Reduction Act* (the RAWR Act).

ACOR has been a strong advocate for the implementation of a ban on the export of waste, and supportive of the objectives to build Australia's capacity to generate high-value recycled commodities and associated demand, address concern in Australia and around the world about plastic pollution of our oceans, and the need to ensure that any exports of waste do not cause harm to human health and the environment. However, there are lessons to be learned from Australia's leadership position relating to waste export.

Rules underpinning the RAWR Act ban the export of 'waste material' such as unprocessed recovered glass, tyres and plastic—unless an exemption is granted at Ministerial level. Additionally, a licence is required to export processed recycled materials derived from these 'waste materials'.

These Rules—particularly as they relate to licensing for the export of processed recycled material—are not fit for purpose. The current approach results in the treatment of manufactured materials as waste, adding cost and delay to the trade of recycled commodities and fundamentally undermining investment in domestic recycling infrastructure, including hundreds of millions of dollars contributed by governments through the Recycling Modernisation Fund.

In particular, the current export licensing process is unclear and inefficient, and restricts the trade of Australian recycled polymer commodities. This is a perverse situation, given the unprecedented investment into recycling capability to produce this material, while, at the same time, there are no restrictions on the import of virgin and recycled polymers into Australia.

### *5.3.1 Streamline export licensing*

The current arrangements to procure export licences for recycled commodities are cumbersome and restrict access to dynamic international commodity trading—and underpin a fundamentally uneven playing field with virgin materials.

The Australian Government is making efforts to address these issues, while constrained by the Rules under the Act. Australian recyclers welcomed DCCEEW's decision in May 2024 to no longer regard recycled plastic pellets as 'regulated waste plastic', for the purpose of the *Waste Reduction (Export—Waste Plastic) Rules 2021*.

For recycled materials captured under the existing arrangements, any change to the export licence, such as approving a new buyer, requires a variation to be submitted which can take up to six months to approve, by which time the buyer has generally moved on: manufacturing plants need confirmed in-feed sources to meet production and will move on to sellers who can immediately confirm ability to supply. Australian plastic recyclers are missing commercial opportunities due to the onerous licensing system, which renders plastic reprocessers uncompetitive in volatile global commodity markets, a difficulty piled atop higher shipping and labour costs. The longer the existing process is unchanged, the more it will limit healthy access to markets and contribute to a lack of competitiveness for Australian-made products, ultimately causing Australian recycling rates to lag.

The export licensing system also creates the need for ongoing variations, each sometimes subject to months-long delays. The process seems to be built around the expectation that one company will make only one product and sell to only one company indefinitely, which doesn't reflect the fundamental business practice of seeking as many buyers for products as possible, particularly in an evolving and volatile recycled plastic sector. To compete in this space, export licensing decisions must be made within days, rather than weeks or months.

### *5.3.2 Waste export cost recovery*

On 1 July 2024, cost recovery for the waste export program commenced with the introduction of fees-for-service, including a fee of $19,090 for a new licence, $13,540 for a licence variation or renewals and $13,960 for an exemption.

The recycling sector is concerned about the regulatory conflation of waste and recycled commodities, the uneven regulatory playing field between Australian recycled commodities and imported materials, and

further disrupting international trade of Australian recycled materials through the imposition of fees. All of these elements undermine the recycling sector's ability to deliver strong circular economy outcomes in a globally connected marketplace.

The RAWR Act is soon to be reviewed in the context of product stewardship. A more holistic review must be undertaken, in particular to more clearly define 'end of waste' and ensure that recycled commodities are distinguished from waste.

The licensing fees for exported recycled commodities will also likely create a barrier to entry and stifle innovation, as a blanket fee structure favours high-volume producers. High licensing fees will also likely lead to illegitimate operators seeking to avoid costs.

#### *5.3.3 Cost recovery and product stewardship principles*

In seeking to reduce waste, the Australian Government has prioritised product stewardship, whereby manufacturers, importers and retailers are responsible for the environmentally sound management of products and materials, including at the end of their useful life.

Enacting cost recovery on the recycling sector in order to fund the administration of waste reduction is contrary to this approach, imposing the entire burden of cost recovery on one group of stakeholders at the 'end-of-pipe' rather than at generation.

It should be noted that Australia does not currently place restrictions on importers of materials that are covered by waste export regulation, including for tyres, glass, plastics or paper and cardboard products.

#### *5.3.4 Australian Government Cost Recovery Guidelines*

Cost recovery on the recycling sector counters the Australian Government's Cost Recovery Guidelines (CRGs), Resource Management Guide 304, as set out by the Department of Finance. The CRGs allow for the merits for cost recovery to be assessed on a case-by-case basis, and state that exceptions may be made based on:

- **'the impact of cost recovery on competition, innovation or the financial viability of those who may need to pay charges and the cumulative effect of other government activities':** This is particularly pertinent given the cost sensitivity of markets for exported recycled commodities, and the current additional external pressures of shipping costs, domestic labour and energy costs on the recycling sector. Consideration should also be given to the possible spillover effects on resource recovery rates and landfill if recycling of certain material streams becomes unviable.
- **'how cost recovery might affect the policy outcomes for the activity':** The Australian Government's commitment to establishing a national circular economy will necessitate a strong recycling sector, which this form of cost recovery hinders.

The CRGs allow that, 'in certain circumstances, cost recovery may also be contrary to intended policy outcomes, such as the provision of community services or industry support'. The fees inhibit innovation and growth in an industry the Government has specifically committed to foster through the RMF.

Enacting cost recovery on the recycling sector contradicts the intended outcomes of the National Waste Policy Action Plan, including hampering progress towards the national target of an 80 per cent average recovery rate across all material streams by 2030.

#### *5.3.5 Export licensing and recycling modernisation*

The intention of the Australian Government's Recycling Modernisation Fund (RMF) was to support Australia 'to regulate the export of waste glass, plastic, tyres, paper and cardboard'. Given that the rollout of the RMF is still unfolding, the proposal to enact cost recovery for the export of recycled materials is premature.

While $329 million in government co-funding has been allocated across 139 projects as part of the RMF, the great majority of projects are not yet delivered, with only 40 projects completed, while recycling infrastructure grants made through the RMF were based on business cases that do not incorporate these cost recovery fees. This may result in the underutilisation of funded infrastructure.

In addition to a necessary review of the RAWR Act, cost recovery from the recycling sector should be paused until the RMF has been fully disbursed and infrastructure fully delivered.

### *5.3.6 Constrained markets for recycled materials*

Spurred by the 'waste export' regulation, Australia's recycling sector is working to transform recovered resources into recycled commodities—most of which have low (or negative) value.

As Australia is a net importer of products that generate many of the materials affected by the export bans, these recycled commodities are traded in highly competitive international markets. Increases in costs, due to fees on exported recycled commodities, diminishes their competitiveness and viability.

There has not been enough domestic growth in the market for recycled materials and there are currently no compelling incentives for manufacturers to prioritise locally produced recycled materials over imported virgin materials.

***Case Study 28. Tyre recycling and exporting***

The used tyre recycling sector in Australia has supported the Commonwealth Government imposition of export bans on whole baled tyres. These bans and revised export specifications have driven increased investment in domestic tyre shredding operations.

Australia boasts a high tyre recycling rate, with 97-98 per cent of used passenger and commercial tyres collected. The majority of these tyres are exported as tyre-derived fuel (TDF) to Asian markets, where they are used to reduce greenhouse gas emissions by 30-40 per cent, compared to coal.

Prior to the export ban implementation (2019) around 85,000 tonnes of tyres (around 10.5 million tyres) were being exported in baled form. Baled tyre exports were an environmental and social burden on receiving countries such as Malaysia and Pakistan, and hindered the development of the industry domestically.

A portion of collected material in Australia is still shredded and landfilled as this (especially during the pandemic period) offered a lower cost disposal option than exports.

The tyre recycling industry is highly exposed to export markets and in competition with onshore landfilling operations. Increased costs for the export of used tyre material will make onshore landfilling of tyre shred more economical. Current offshore offtake costs—for TDF to cement kilns in Asia, for example—are in many cases higher than domestic gate fees and landfill levies.

The used tyre sector has supported and complied with the Commonwealth government policy shift. Until domestic markets emerge, this sector is extremely exposed to the export market. The sector questions the rationale behind these costs and whether similar measures will be applied to other export-oriented industries.

Additionally, while legitimate operators comply with laws and regulations, there continues to be a lack of enforcement of export laws. This unfairly advantaging non-compliant actors.

*Recommendation 12.* *As a matter of priority, streamline export licensing and reduce licensing costs for processed recycled commodities.*

*Recommendation 13.* *Undertake a holistic review of the Recycling and Waste Reduction Act 2020, addressing the definition of where a 'waste' becomes a 'material' or 'product', and ensuring that recycled commodities are distinguished from waste.*

## 5.4 A National Resource Recovery Framework

### *5.4.1 Nationally harmonised alignment between environmental policies and circular economy principles*

The stated goal of all of Australia's environment ministers is to move to a circular economy by 2030. There is, however, a fundamental lack of alignment between environmental policies and circular economy principles, hindering the ability to maximise resource recovery.

The main challenges are as follows:

- While the waste management hierarchy objectives are enshrined in legislation across Australian States and Territories to encourage resource recovery and recycling, the mechanisms to lawfully implement such opportunities are the regulatory exception rather than the rule.
- There is a misalignment between environmental protection objectives on the one hand, and circular economy objectives on the other, whereby many recoverable resources are regulated as industrial or regulated wastes that present a contamination risk, rather than prioritised as resource that, with appropriate de-contamination management, presents an economic opportunity and a necessary part of the circular economy supply chain.

- There is a focus on regulation of materials at the 'end of use' to address resource recovery and recycling requirements, rather than working across the full supply chain.
- Policy priorities and settings for resource recovery and recycling across Australia are fragmented and uncertain, particularly across industry sectors.
- Industry is not consistently at the table in regulatory decision-making processes, undermining investment confidence and practical solutions.
- Voluntary and regulated product stewardship models are not progressing efficiently or effectively to meaningfully support circular economy objectives.
- Regulatory processes for resource recovery and recycling are not aligned and opportunities to address this via regulatory impact assessments are often not available where this process is not followed. In turn, this creates uncertainty in the regulatory settings which discourages large-scale investment.
- The regulatory imbalance between raw/virgin materials and recovered/recycled materials has stifled circular economy outcomes for waste material. Exploring opportunities to facilitate broader circular economy outcomes would encourage greater investment in the resource recovery and recycling sector.
- The uncertainty and long timeframes associated with the development/redevelopment of resource recovery and recycling facilities has suppressed innovation, increased costs and created significant barriers to entry.
- Inconsistent waste levies across different jurisdictions and between regions result in landfill often being more economical than resource recovery or recycling. The opportunity exists to reform waste levies to more effectively incentivise resource recovery and recycling.

Substantive and structural reform is required to achieve broadly shared circular economy objectives and also unlock the deep decarbonisation opportunities within a well-functioning circular economy.

***Case Study 29. Plastic recycling regulation***

ACOR has undertaken a review of regulatory requirements placed on plastic recyclers around the country for plastic handling and storage. This review, due to be released in November 2024, has identified that complex legislation, regulation and guidelines, at all levels of government, is reducing the ability of Australian plastic recyclers to be competitive, especially in a global market.

Australian Government policies and targets espouse the objectives and benefits of increased plastic recycling, however, in many cases the regulatory environment has the unintended consequence of impeding and undermining the viability of plastic recycling. This impacts investor confidence and the ability for recyclers to access capital enabling growth and scale to generate a sufficient return on investment.

Key observations:

- Arrangements governing plastic recycling across national, state and local government boundaries lack coordination and create competing and conflicting expectations and outcomes between the various government targets, objectives, regulations and compliance.
- Many regulations do not explicitly reference plastic recycling or prescribe specific requirements for plastic recycling and therefore are unclear as to their relevance and application to plastic recycling, providing discretion for regulators, but uncertainty for recyclers.
- Many regulations that do impact plastic recycling tend to be general in nature as they pertain to the handling of 'waste', and do not provide certainty about those conditions that may specifically apply to plastic recycling.
- Regulations generally treat plastic recycling as a waste management activity and not a manufacturing, circular economy activity.
- The *National Waste Policy Action Plan 2019* and *National Plastics Plan 2021* are silent on the issue of regulations and the disconnect between policies and targets and the reality of current regulations and enforcement.
- Recyclable material, including recyclable plastic for the purposes of what can be put in and collected through kerbside collections, is defined loosely by local councils, and is done either through policy or by-laws.
- Local councils in many cases have an effective discretion to apply conditions on the establishment and operation of a plastic recycling business.
- Plastic recyclers are also subject to non-regulatory requirements such as responding to guidance from fire authorities and meeting requirements from insurance providers.

The review of 'Plastic recycling and regulations in Australia' will be published in November 2024.

### 5.4.2 *Australian Resource Recovery Code Board*

A necessary step in national reform is the establishment of an Australian Resource Recovery Code Board (ARRCB), based on the model of the Australian Building Codes Board (ABCB), to deliver a nationally harmonised framework for resource recovery and recycling. This framework should sit under a portfolio for industry and economic development, rather than environmental protection.

The proposed ARRCB's work would be underpinned by a nationally applied definition of 'end of waste', to provide certainty about when a material is a resource versus a waste. The proposed ARRCB should also oversee an aligned and consistent approach to product stewardship, including container deposit schemes, with the priority of advancing circular economy outcomes.

The existing ABCB provides a relevant governance model for the proposed ARRCB, as it incorporates several key elements that will be essential in delivering a nationally harmonised, sustainable, economically viable and whole-of-supply-chain approach to resource recovery and recycling. For example, this governance model will:

- provide a stable, nationally harmonised resource recovery and recycling framework to improve investment confidence and growth in the sector, while building community trust and ultimately supporting a balanced regulatory playing field between recovered and raw/virgin materials;
- enable the development of consistent definitions for waste and resource recovery, and incentivise the creation of Australian Standards, which can be reflected into State and Territory legislation;
- appoint industry representatives to the Board to ensure a broad range of perspectives, resulting in practical, economically viable and sustainable measures;
- ensure that regulatory processes for resource recovery and recycling are aligned with best-practice regulation, to support policy stability and encourage innovation and scaled investment;
- inform decision making relating to resource recovery and recycling infrastructure to address approval timeframes for development/redevelopment of facilities;
- determine the application of waste levies across jurisdictions and between regions to incentivise resource recovery;
- operate in parallel with other national bodies, including the ABCB, the National Environment Protection Council and Safe Work Australia, to coordinate management and reuse of recovered materials impacted by contaminants; and
- work with industry, across supply chains, to address circular economy issues and inform product stewardship regulation, as well as strong markets for recycled content.

In addition, while noting that resource recovery regulation is largely driven by the States, the Australian Government can nonetheless play an important role in coordinating harmonisation through the Environment Ministers' Meeting (EMM) and Heads of EPA (HEPA), addressing measures including landfill levies, collection systems, and single-use packaging bans.

To create a truly circular economy, governments themselves must be innovative, through the implementation of world-leading legislative and regulatory mechanisms.

Innovative technological solutions to create a more efficient recycling sector already exist—advanced optical sorting solutions, automated textile sorting infrastructure and reuse collection infrastructure, to name a few—and are being used effectively around the world. However, these are unlikely be implemented in Australia at scale without legislative mechanisms in place that support their widescale utilisation.

The following sections identify other key issues that should be addressed through a national resource recovery framework.

### 5.4.3 *Defining 'end of waste'*

A circular economy cannot advance if recovered resources are enduringly defined and managed as waste: regulation prescribing an end-of-waste is essential to enabling a circular economy. The 'once waste, forever waste' outlook is a relic of a linear economy approach. Waste must not be indefinitely controlled as a

pollutant, but rather facilitated as a resource from which social, economic, and environmental benefits can be derived.

In particular, treating recycled materials as waste when they are indistinguishable from virgin products and have a market and a value creates an uneven playing field between producers of virgin and recycled materials and impedes circular economy outcomes. Processed and pelletised recycled plastic, for example, is a commodity that should be regulated under the same terms as tradeable goods made from virgin resources. Instead, Australia's waste export regulations result in the treatment of manufactured recycled materials as waste.

Once a business has invested in developing and manufacturing a recovered resource that has found acceptance with consumers, the safety of that recycled product should be regulated by general consumer and product liability law, along with relevant industry standards and other legislation. The category of waste should be applied as a last resort in a circular economy context, after all other resource recovery avenues have been exhausted, rather than as an initial and enduring classification. In particular, materials that have undergone processing should be given the same designation as manufacturing outputs. Recyclers need to be able to produce recycled products. If our sector can't store and process material without overwhelming compliance costs, scaled production will not be economical.

*Recommendation 14.* *Establish an Australian Resource Recovery Board, to deliver a nationally harmonised framework for resource recovery and recycling. The framework should prioritise the definition of 'end-of-waste' criteria and promote circular economy principles.*

### *5.4.4 Sharing responsibility across the supply chain*

Environmental regulation traditionally places the burden of responsibility for risk management primarily on the waste management and recycling sectors. However, this approach overlooks the source of the most severe risks generated further up the supply chain.

Materials like lithium-ion batteries, asbestos, and other hazardous substances contaminate recycling streams due to poor waste management practices further up the supply chain. These forms of contamination impose an unjust and undue burden on the recycling sector, exacerbating challenges and risks for our industry.

Much more regulatory focus must be applied to addressing risks before they reach waste and recycling streams, with mandatory extended producer responsibility for contaminated items, comprehensively accessible and safe disposal options, stronger compliance measures for incorrect disposal and community awareness and incentives to 'recycle right'.

### *5.4.5 Chemicals of concern and other contaminants*

There must be a nationally consistent approach to managing contaminants, such as chemicals of concern and asbestos, as essential for protecting public health and the environment. PFAS (per- and poly-fluoroalkyl substances) is a group of manufactured chemicals that bioaccumulate, do not easily break down and can persist in the environment (NSW EPA Fact sheet, State-wide PFAS investigation program). PFAS is not added by recyclers, but is introduced into recycling streams through its use in many consumer products, including packaging.

The objectives of resource recovery and a circular economy are fundamentally undermined by thresholds set in State environmental regulations, which set unfeasibly low tolerances for PFAS contamination in waste categorisations, preventing recovery while doing nothing to prevent the accumulation of PFAS through the supply chain. Regulating contaminants at 'end-of-pipe' assigns such burdens to the resource recovery sector rather than responsible parties who produced the contamination in the first instance.

Controls on contamination must be applied consistently across the economy. State-level controls regarding chemical concentrations and applications, for example, are in some places applied to recovered resources but not materials from virgin quarries, which would have the same levels of naturally occurring metals. Virgin and recovered resources require a level regulatory playing field.

A nationally harmonised approach to contaminant thresholds, informed by the National Environmental Management Plan, is critical to maximising resource recovery, with transparent and evidence-based

decision-making. Industry needs transparency and certainty, for example, on deciding what sensitivity of testing equipment to invest in—and whether the methods are both technically and economically feasible. Where thresholds for contaminations are set very low—for example, to the absolute presence or absence of contaminants—this may not be feasible. The obvious perverse outcome: where thresholds are set very low, materials will go to landfill, boosting State revenue from waste levies.

The Australian Government must prioritise effective source-control measures, rather than regulating at end-of-pipe: additional regulations placed solely on recovered resources create an unequal playing field between raw and recovered resources, and depress resource recovery rates and efforts to meet the National Waste Policy Action Plan and circular economy targets.

A nationally consistent approach to managing PFAS is required to protect public health and the environment, with all jurisdictions using the same standards and guidelines for assessing and managing the risks of PFAS exposure. This would facilitate effective communication and collaboration between different stakeholders, such as water utilities, organic process recycling and the agriculture industry, regulators, and affected communities.

While the recent PFAS National Environmental Management Plan provides for this approach, there is a need for greater clarity and certainty on roles and responsibilities to implement consistent monitoring and treatment regimes across PFAS contamination streams and networks. This would also help to ensure that costs associated with managing PFAS contamination are shared fairly across all jurisdictions and not solely at end of pipe.

To ensure the safety of all resources, testing and monitoring requirements for the harmful chemicals under consideration should be uniformly applied to all materials applied to land: virgin/raw products as well as recovered resource equivalents. Given the likelihood that PFAS is present across the board—including chemical fertilisers, pesticides, and herbicides—it is imperative that we take a uniform approach to protect human and environmental health, and do not disadvantage recovered materials by subjecting them to higher regulatory stringency than virgin products.

#### *5.4.6 Balancing risk and reward*

The right regulatory balance has not yet been struck between mitigating the risks of waste and unleashing the benefits of recovered resources. Recovered resources are governed by environmental regulation, rather than recognised as commodities, creating an uneven regulatory playing field between recovered and virgin resources.

Environmental regulators prioritise the precautionary principle in addressing risk. The precautionary principle posits that it is better to avoid any new action that carries a hypothetical risk for human health or the environment, regardless of whether the hypothesis has been subjected to formal testing. However, a more balanced approach is needed in evaluating risks in resource recovery, aligning with ecologically sustainable development and circular economy priorities.

An alternative to the precautionary principle is the ALARP ('as low as reasonably possible') model, originating in the UK and integrated into occupational health and safety legislation in Australia and New Zealand. ALARP focuses on reducing residual risk, acknowledging that total risk elimination is impractical. It involves cost-benefit assessments, considering various factors such as codes of practice, industry standards, and comparisons with similar hazards.

Illustratively, in recycling, while the precautionary principle might advocate for complete avoidance of microplastics in recovered resources, ALARP acknowledges ubiquitous exposure to microplastics and evaluates whether additional risks from recovered resources justify preventive measures. ALARP offers a nuanced approach, considering existing risks comprehensively and supporting ecologically sustainable practices in the circular economy.

#### *5.4.7 Addressing regulatory uncertainty*

A major challenge in advancing innovation in recycling is state and territory regulatory uncertainty. The difficulty arises when recycling technologies don't neatly fit into existing regulatory frameworks, leaving regulators unsure how to address them. This lack of clarity impedes progress, as businesses seeking

regulatory and planning approvals for innovative technologies face project blockages, with regulators hesitating to greenlight initiatives they find challenging to classify.

While regulators play an important role, there must be a bridge between an industry trying to drive circularity and governments trying to support a circular economy. The Australian Government should assist the delivery of a great idea through to commercialisation. For example, a government-funded 'innovation lab' could shepherd worthwhile projects through planning and permissioning: new ideas that drive circularity, pass a range of tests and are ready to scale commercially should bypass the usual planning and regulatory hurdles for the construction of the first commercial scale operation, creating a clear pathway for growth.

An aligned and consistent regulatory environment is essential to delivering a circular economy. To this end, policies relating to resource recovery and recycling must be developed transparently and in collaboration with industry and broader stakeholders, supporting robust health and environmental outcomes, social licence, and investment confidence.

***Case Study 30. iQ Renew and Licella: innovation barrier in NSW***

iQ Renew and Licella sought to build a Catalytic Hydrothermal Reactor (CAT-HTR) technology plant in NSW to process bio-mass and plastics destined for landfill into high-value, low-carbon products. The then-NSW Minister for the Environment (formerly the Minister for Innovation) was enthusiastic about the technology, and instructed the EPA to 'sandbox' the project: a process to allow new technology to be tried and tested outside the normal requirements.

Instead, after 18 months of discussion, the NSW EPA determined it needed to be classed as either chemical recycling or waste to energy, and that if iQ Renew and Licella would set up a $40 million facility, the EPA would consider granting a 12-month licence. This was clearly an impossible scenario. The operation moved interstate and began again.

This example highlights the barriers to investing in new technology. In the research and development phase there is great potential for investment and growth, however, this is impeded by a risk-averse regulatory environment.

***Case Study 31. Mixed waste organic outputs (MWOO)***

In 2018, the NSW EPA revoked the Resource Recovery Orders and Exemptions for the application of MWOO to land. The revocation decision was abrupt, creating industry disruption and investment uncertainty.

To inform this decision, an independent Technical Advisory Committee (TAC) was formed by the EPA to assess relevant research findings and provide recommendations on policy and regulation relating to the land application of MWOO.

As part of the process, NSW EPA provided the TAC with a draft internal policy on beneficial re-use. This 'draft internal policy' has never been publicly released and industry was never provided with the opportunity to appraise the decision-making process against the beneficial re-use policy.

Outcomes of this decision include diversion of almost half a million tonnes of previously productively recovered and reused material to landfill, increased greenhouse gases and the looming prospect of half a billion dollars' worth of stranded recycling infrastructure assets.

The position of the EPA is that this decision was underpinned by rigorous, independent scientific research on specific risks.

The perspective of industry is that this decision-making process:

- lacked transparency
- did not allow a sufficient opportunity for industry to engage proactively and constructively
- was underpinned by research rooted in theoretical, rather than applied, methodologies
- did not sufficiently balance a 'precautionary principle' approach with appropriate assessment of the benefits of MWOO or broader circular economy outcomes and impacts.

There is no publicly available benefits test that illustrates how concepts about benefits were assessed by the EPA, so it is not possible to gain an independent objective view about of the EPA process.

A key learning from this experience is that there is a need for the development and publication by the EPA of how it intends to use the precautionary principle in future to ensure the most appropriate balance between resource recovery within a circular economy and the 'no harm principle'.

## 5.5 Accreditation: improving confidence in recycling outcomes

As recyclers evolve and transition to a more circular economy, there is a need to support better practice across industry and improve confidence in recycling outcomes. Recyclers have a very broad range of capabilities and practices across the sector, and those engaged in poor practices can affect the reputation of the entire industry.

It can be difficult for stakeholders to distinguish waste operations from recycling activities, or good from poor practices, leading to increasing demand for generic third-party performance and outcome verification.

Meanwhile, amid the growing suite of mandatory and voluntary product stewardship initiatives rolling out across Australia, schemes can prioritise cost reduction over recycling outcomes, contracting with cheap and noncompliant operators. Recyclers striving for full compliance operate at a competitive disadvantage to these operators, creating an uneven playing field.

Conflicts of interest also arise when product stewardship schemes create their own accreditation systems. These accreditation systems sometimes involve self-reports which can go unchallenged.

An accreditation program for recyclers will deliver value to industry, government, and the community by providing confidence to stakeholders that accredited recyclers are operating legitimately; are at, or moving towards, best practice; and are proactively meeting appropriate quality outcomes suitable for the recycling sector.

Therefore, a key priority for the recycling sector is the delivery of an Australian Recyclers Accreditation Program (ARAP), a national accreditation program available to all recyclers. The ARAP will establish an objective, consistent and efficient process for assessing a recycling operator's performance, providing assurance around the legitimacy of recycling operations.

The ARAP would be an independently governed program, ensuring transparency and accountability. As a site-based accreditation program, it will offer confidence and reassurance to the community.

In 2021, the Australian Government supported a feasibility study into the establishment of the ARAP, which identified that the implementation phase should be federally funded, after which it would be self-sustained through a user-pays approach. This development to date means the ARAP could be implemented within a short timeframe of 6–12 months.

*Recommendation 15. Support confidence in Australian recycling by funding the implementation of an Australian Recyclers Accreditation Program.*

## 5.6 Recycling sector data

One impediment to strong policy and investment decisions is poor data and information: waste management and recycling are distinct activities, however, these two sectors have historically been conflated, so that the true capacity for recycling and re-manufacturing infrastructure in Australia is not mapped.

While historically, many prominent businesses integrated waste and recycling, in fact waste management and the recycling sector are distinct: the recycling value chain consists of aggregation and sorting, reprocessing and remanufacturing. These processes are often dependent on effective logistics provided by the waste management sector, which transports and disposes of waste and unwanted materials. But fundamentally, waste entails pollution and risk, whereas recycling entails resource efficiency, value creation, economic opportunity and circular outcomes.

One way to properly define, map and support the recycling sector as distinct from waste would be targeted data collection and reporting focussed properly on material recovery, reprocessing capacities and end markets for recycled materials, underpinned by consistent terms and definitions. The abundant data available in Australia's National Waste Report, for example, doesn't sufficiently discern the various processes that comprise the recycling value chain: logistics operators, aggregators, processors and remanufacturers are often defined as one group in datasets, masking genuine capacity and the value chain required to deliver productive and genuine recycling outcomes.

## 5.7 Grants and funding

ACOR welcomes government investment in recycling infrastructure, however, it is now evident that the grant-making processes for delivering the infrastructure required to meet the outcomes of Australia's export regulation, and progress resource recovery targets, have often been inefficient and untimely, resulting in the devaluation of the allocated funding, increasing costs for projects and leading to lost productivity and innovation.

While deadlines for export bans have been fixed and enforced, deadlines for funding have been elastic. In some cases, where years have passed between the announcement of funds and disbursement, the value of promised funding diminished while deliverables and milestones remained unchanged.

Making such funding available is commendable, however, Government grant programs often involve multiple stakeholders, departments, and agencies, and coordinating their efforts and aligning schedules can be challenging. Delays in delivering funds or resources to successful recipients leads to further devalued funding and increased project constraints.

Grant timeframes can also be unrealistic and unworkable. Long lead times for equipment, particularly in the post-pandemic era, are poorly accommodated in grant schedules. Equipment is almost invariably procured from overseas and delivery and commissioning schedules of 16 months or more—not to mention protracted development application and environmental permissioning processes—are incompatible with fixed grant timelines.

These grant applications often represent months of work from businesses, and delaying grants amounts to a productivity drain on our sector. In the recent past, grant announcements have been delayed, altered or abandoned based on unclear priorities.

The uncertainty and administrative burden this creates can discourage potential recipients from investing the time and effort required to apply—contributing to the brain drain of valuable expertise and innovation interstate or overseas, or resulting in innovations failing to come to market at all.

The obstacles identified in grant-making processes underline the importance of streamlining administrative processes, increasing transparency, and providing clear and consistent communication within government grant programs. Without adequately addressing these issues, worthy recipients may be deterred, and innovation and productivity lost, compounding the missed positive impacts grants would otherwise have had on communities, industries, and local economies.

Governments could also consider alternative measures to support industry when seeking to further policy goals. For example, an innovation-focused nation-wide circular economy fund dedicated to the recycling sector could offer several advantages over traditional grant programs. This could include:

- **Customised financial solutions:** Low-interest loans, equity investments, revenue-sharing agreements and patient capital, with revenue from successful waste and recycling initiatives reinvested into new projects, would foster a continuous cycle of innovation and impact. This structure would align incentives between the institution and innovators, ensuring the institution is invested in the long-term success of projects, encouraging more strategic decision-making and enhanced project outcomes.
- **Expert guidance:** Technical assistance, and mentorship to waste and recycling innovators, bolstering the chances of project success, reducing early-stage setbacks, and accelerating the implementation of impactful solutions.
- **Market viability assessments:** Evaluating proposals on their market potential, technological feasibility, and environmental impact, allocating funds to projects with the highest likelihood of success and scalability.
- **Stability:** Consistent and reliable funding over time, unlike grant programs which are susceptible to shifting priorities.
- **Risk-sharing mechanisms:** Sharing risks and rewards to encourage innovation while managing potential financial setbacks more effectively.

Catalysing circular practices with targeted financial support would accelerate the adoption of a circular economy with far-reaching positive impact on sustainability, resource efficiency, and waste reduction.

Collaborating with industry experts and environmental economists would be crucial to ensure the institution's success in driving innovation and positive change within the waste and recycling sector.

A deep and robust recycling sector will benefit the transition to a circular economy, but there are significant barriers to entry. Among these are grant programs that exclude micro recyclers by restricting applications to businesses with turnovers of more than $1.5 million per annum, which excludes the next generation of SME recyclers from developing.

However, the general consensus among recyclers is that it is not necessarily a lack of funding that inhibits recycling, but rather the lack of certainty in the recycling economic model which makes it difficult to justify investment. Some recyclers or investors are fortunate enough to have a balance sheet that allows them to 'take a punt' on what a future market will look like, but many do not.

***Case Study 32. Micro recyclers***

Start-ups and micro recyclers (defined as recycling and manufacturing businesses ranging in size from small-scale to up to $5 million turnover per annum) are a part of the recycling sector with huge potential for innovation. However, they are faced with lack of access to capital, and limited access to research facilities and machinery. They are also excluded from most grant programs by the typical requirement of a minimum annual turnover of $1.5 million. A lot of innovation fails to be realised in Australia due to barriers for small-scale enterprises, expressed in policy and grant settings.

A micro recycler in Australia sought to develop a world-first process to convert powder coating waste into a recyclable plastic. Laboratory work was required to complete the R&D and to seek GECA certification. The recycler approached the CSIRO—who were looking to assist industry—but did not meet the criteria for assistance because they were too small. The recycler ultimately raised capital from investors, managing to bring the innovation to market despite Government and industry obstacles, rather than due to Government support.

***Case Study 33. Vic Circular Economy Recycling Modernisation Fund***

Company A considered investing in recycled PET processing, with funding from Victoria's Circular Economy Recycling Modernisation Fund Round 4, Stream 2, which closed in August 2023.

The lead time for Company A's proposed equipment to be delivered from Germany to an Australian site would have required a minimum of 16.5 months, barring unforeseen delays. The very earliest the equipment could have been operational would have been mid-June 2025, however, the grant terms were for equipment to be operational by 31 May 2025.

European machinery cannot be purchased, made, shipped and installed in the typical grant timeframes.

Company A elected not to apply for a grant given the unworkable timeframe.

***Case Study 34. NSW Remanufacture grants***

In early 2022, Remanufacture NSW announced Stream 1 Infrastructure Grants. Company B applied for $2.4 million for fibre-optic sorting to respond to the regulation of the export of plastic, tyres and paper and cardboard under the *Recycling and Waste Reduction Act 2020*. Applications closed in March 2022, and applicants were told they would be advised within two to three months. Company B wrote to the department on three separate occasions, requesting progress updates. Ultimately, applicants were not advised of outcomes until more than a year later, after the NSW state election, in March 2023.

## 5.8 Education and training

With the right support, the recycling sector is poised to create significant employment benefit to the Australian economy, however, skills development is a challenge for recycling.

There are no dedicated training schemes for recycling. The only available TAFE qualification is waste focused—the Certificate III/IV in Waste Management—but the recycling sector is not the waste sector: the units of competency don't address specifics related to recycling, or the priorities of the recycling industry, or the zero waste hierarchy.

There is an opportunity to create proper training, certified by Government, that will help to deliver waste hierarchy priorities; as things stand, the only available certification is designed to train staff to deliver the lowest priority on the waste hierarchy.

Substantial and practical recycling-specific training is sorely needed, as much recycling machinery is unique to the sector. The lack of recycling-specific training is a missed opportunity to further skills development,

particularly in regional Australia, while the benefits of the Australian Government supporting businesses to establish recycling apprenticeships would be broad and lasting.

A regionally based recycling business attempted to establish an apprenticeship program: the manufacturing code was identified, and TAFE expressed interest. However, the ultimate decision was contingent on the enrolment of an additional 29 applicants, and the course could only be conducted in a capital city, illustrating the challenge of securing apprenticeships in regional areas.

Support to train recycling workers would provide:

- formal education and jobs for youths in regional Australia
- long-term benefits to society from people learning about the importance of recycling
- youth development, leading to greater long-term productivity
- prestige and value attached to work in the recycling sector.

There is also a gap in knowledge on design and material circularity, for which courses should be developed.

Opportunities also exist to provide continuing professional development for recycling sector staff, and to move recycling sector workers across to the Manufacturing and Associated Industries and Occupations Award, rather than the Waste Management Award. As noted above, recycling and waste management are distinct: waste management addresses logistics and containment of waste, whereas recycling is a production enterprise, requiring different skills.

*Recommendation 16. The recycling sector should sit under the Manufacturing Award, rather than the Waste Management Award.*

## 6 Conclusion

There is much potential for our industry to grow and thrive, supported by a range of modest Federal budget measures that will not only unlock barriers to recycling, but also deliver jobs, advance resource efficiency and unleash innovation and productivity around the country.

We encourage the Australian Government to prioritise procurement of domestic recycled materials and facilitate the export of recycled commodities through fit-for-purpose export licensing. To prioritise packaging reform as a stepping stone towards broader Extended Producer Responsibility reforms. To enact a National Resource Recovery Framework to ensure regulation drives a circular rather than linear economy. To support effective product stewardship, particularly for e-products, which will help to protect our critical national infrastructure against growing fire risk while securing critical minerals for a clean energy future. And to help the community to recycle right by supporting Recycle Mate.

ACOR strongly welcomes moves to support the transition towards a circular economy and is committed to playing a constructive role in maximising recycling to further these goals. This submission is an offer to work with Australia's leaders to realise shared goals of supporting a thriving recycling sector and circular economy.

## Appendix 1. Economic Contribution of the Australian Recycling Industry

ACOR
AUSTRALIAN COUNCIL OF RECYCLING

# The Economic Contribution of the Australian Recycling Industry

May 2023

AEAS
Australian Economic Advocacy Solutions

| | |
|---|---|
| Client | Australian Council of Recycling |
| Client contact | Suzanne Toumbourou |
| Date | May 2023 |
| Prepared by | Australian Economic Advocacy Solutions (AEAS) |

# Contents

Figures:



Tables:

# Executive Summary

Australian Economic Advocacy Solutions (AEAS) was commissioned by ACOR (Australian Council of Recycling) to determine the economic benefit of the Australian recycling industry to the Australian and State economies.

The Australian recycling industry in 2021–22 recycled an estimated **40.6 million tonnes** of material. Across the decade the Industry's recycled tonnage has grown by 3.1 per cent each year, compared to Australia's average population growth rate across the same time of 1.4 per cent.

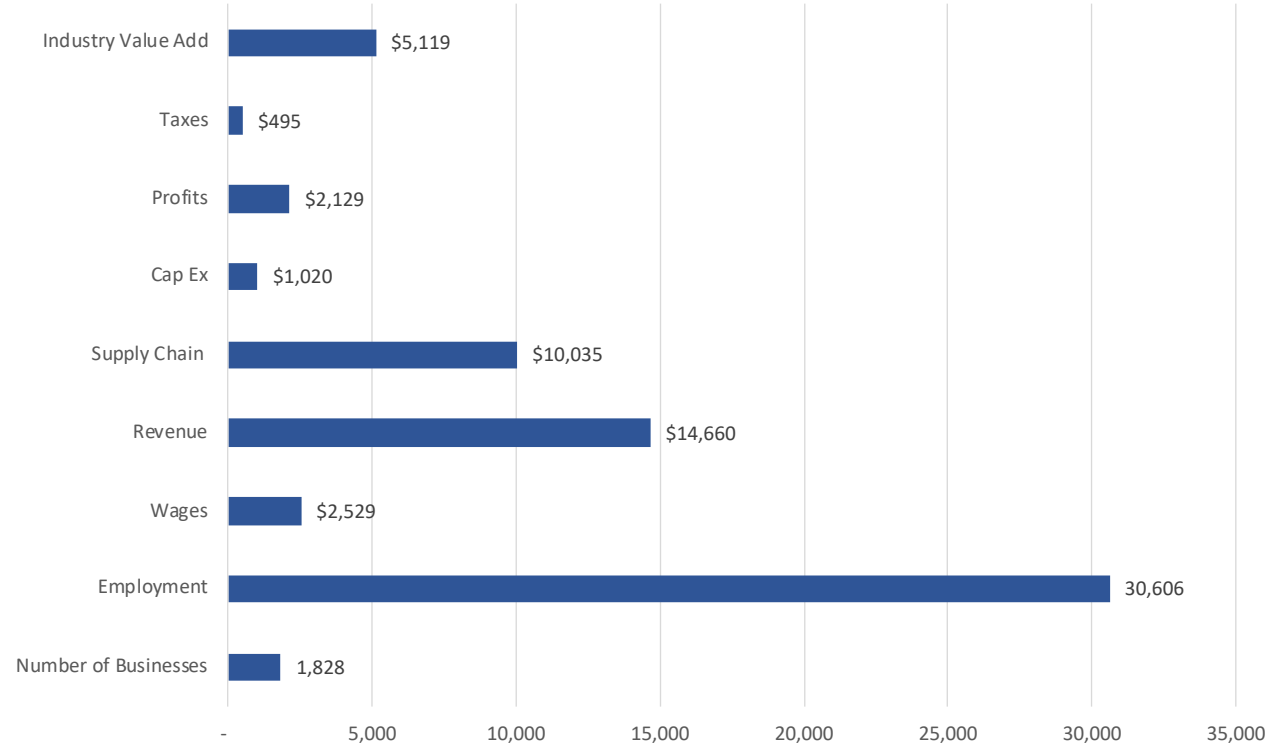
Australia's overall material recycling rate in 2021–22 is estimated at 63.1 per cent, equating to 1,568 kilograms of recycled material for each person in Australia.

**Direct Economic Benefit**

The Australian recycling industry is an important contributor to the Australian economy. Results of a macro-economic analysis of the Industry reveal the following:

- 1,828 businesses operating;
- Recycled and processed 40.6 million tonnes of material in 2021–22;
- Providing 30,606 jobs to Australian residents;
- Pays over $2.5 billion in wages and salaries and an additional $253 million towards employee superannuation;
- Provides an average livelihood to each employee within the industry of $82,618 which compares to Australian average weekly earnings of $69,103;
- Has a collective industry turnover of over $14.6 billion;
- Sources and provides $10 billion in benefit across its supply chain;
- Invested over $1 billion in 2021–22 million in land, buildings, plant and equipment and vehicles each year; and
- Contributes $5.1 billion in industry value add to the Australian economy.

Figure: Direct contribution of Australian recycling industry, 2021–22 key economic metrics ($ millions and persons)




*Source: AEAS 2022*

The Australian recycling industry has grown at a higher rate than commensurate economic indicators for the Australian economy over the past decade. The Industry's value add in current prices has grown across the past decade by 117.1 per cent, significantly higher than Australia's gross domestic product (45.8 per cent). Industry employment has grown by 68.8 per cent compared to Australia's nationwide employment growth of 17.4 per cent over the same period.

### Indirect Economic Benefit

The Australian recycling industry is estimated to contribute a further:

- $5.8 billion in industry value add to GDP through flow-on demand for goods and services, including production and consumption induced effects; and
- 25,709 indirect jobs provided through flow on activity.

### Enabled Economic Benefit

The Australian manufacturing and agricultural industries usage of recyclates including plastics, metals, glass, paper and cardboard, masonry materials, tyres and organics creates further economic and employment benefit. Usage of recycled materials for further value add in the Australian economy is valued at $7,892 million in 2021–22 and providing an estimated 37,920 jobs.

### Total Economic Benefit

Combining direct, indirect and enabled benefits, the Australian recycling industry is estimated to have contributed $18.9 billion in value add to the Australian economy and provided 94,235 jobs in 2021–22.

Table: Total economic contribution to the Australian economy, 2021–22 ($ millions, current prices)

| | $ millions |
|---|---|
| Direct | $5,119.1 |
| Indirect | $5,856.2 |
| Enabled | $7,892.2 |
| Total | $18,867.5 |

*Source: AEAS 2022*

Table: Total employment contribution, 2021–22 (persons)

| | persons |
|---|---|
| Direct | 30,606 |
| Indirect | 25,709 |
| Enabled | 37,920 |
| Total | 94,235 |

*Source: AEAS 2022*

### Australian Recycling Industry's Importance

The Australian recycling industry is assessed to be both an importance economic and employment contributor, providing:

- 0.82 cents in every dollar of economic activity in Australia; and
- 0.7 jobs in every 100 jobs in Australia; that is, for every 142 jobs that exist in the Australian economy, the Australian recycling industry provides one of those jobs.

Expressed alternatively, through the Australian recycling industry:

- $465 in net economic activity is created for every one tonne of material recycled; and
- one job is supported for every 431 tonnes of material recycled in Australia.

Furthermore, Australia's commitment to raise the nation's overall waste recovery rate to 80 per cent by 2030 will lead to the economic and employment contribution measures in this report progressively rising over the period to 2030 and beyond.

# 1.0 Introduction

## 1.1 Overview

Almost all households, businesses and government entities interact with the Australian recycling industry, either directly or indirectly. As such, the recovery and processing of materials is an essential function of the economy. The Industry recovers valuable resources generated during extraction, building and construction and manufacturing processes and those later discarded by society, thereby driving a circular economy and contributing to the economic growth of Australia.

## 1.2 Australian Council of Recycling (ACOR)

ACOR is the leading national industry association for the recycling and resource recovery sector in Australia and is leading the transition to circular economy in Australia. Its commendable vision is an Australian circular economy where resource recovery, remanufacturing and recycling are central to generating economic and social value, while improving the health of Australia's environment.

It represents businesses who are part of a successful multi-billion industry that employs tens of thousands of Australians, at the same time generating considerable environmental benefits to society.

The industry operates across residential homes, businesses, factories and construction sites. It collects, sorts, and reprocesses material, and makes new products with recycled content. ACOR's members span the breadth and depth of Australian recycling, with businesses working to:

- collect, sort and remanufacture recyclate into new products;
- build a domestic circular economy, along with increasing the amount of locally sourced and recycled materials;
- beneficially manage materials from the residential, commercial, industrial, and major infrastructure areas, and;
- process materials ranging from household packaging, tyres and container deposit scheme products to road construction material, batteries, e-waste and more.

Figure 1: Australia's circular economy

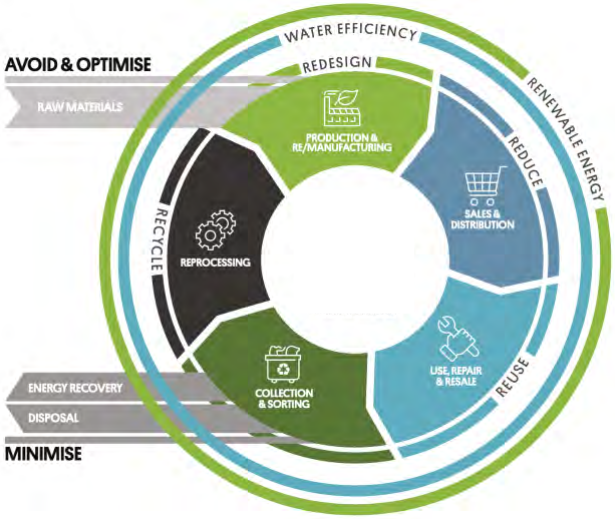
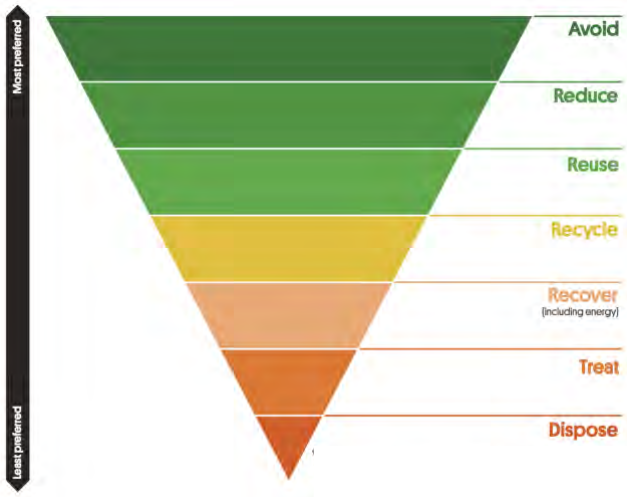



Figure 2:Australia's waste hierarchy




*Source: Green Industries SA*

Increasingly, as Australia moves towards its net zero target, processes adopted by Australian industry are reflecting the waste hierarchy, thereby driving a circular economy and directly contributing to the economic growth of Australia. This has resulted in the recycling industry increasingly seen as a vitally important sector manufacturing input for value add in the economy, as opposed to the historic management and processing of waste material.

The recovery of resources and the efficient operation of the industry in Australia results not only in a variety of tangible environmental benefits, including the reduced use of raw materials, energy and water savings and the avoidance of greenhouse gas emissions, but also considerable economic and employment benefits. This report seeks to measure this benefit.

# 2.0 Policy Drivers Underpinning Australian Recycling

Australia's recycling industry is operating during a period of evolving government policy with the implementation of the Australian Government's response to climate change, the National Waste Policy and the implementation of an export ban on recycled materials.

## 2.1 The Paris Agreement

Australian industry is undergoing a major transformation. One of the major drivers for this transformation is the COP21 Paris agreement. The UN Paris Agreement, signed by 196 countries in 2016, committed the world to limit global warming to 1.5 to 2.0 degrees Celsius above pre-industrial levels. This agreement seeks to reach global peak emissions as soon as possible and achieve net-zero emissions in the second half of this century.

To achieve a 1.5-degree pathway, all sectors of the global economy require dramatic emissions reductions over the next ten years. For this to happen, low-carbon technologies are needed to grow quickly, coupled with waste reduction, reuse and recycling, resulting in diversion from landfill reducing emissions and reducing the need for virgin materials and, in turn, their manufacturing emissions. The climate conferences in Glasgow (2021) and Bali 2022 (COP26) continue to show global support for environmental change.

The Australian Government has signed up to the Paris Agreement and set a target of net-zero emissions by 2050 – in line with the Agreement. All Australian states and territories have committed to achieving net zero targets within varying levels of ambition between 2030 and 2050.

## 2.2 National Waste Policy

The National Waste Policy and Action Plan provides a national framework for action by governments, the business sector, the waste and resource recovery industries, and communities to achieve sustainable waste management and recycling in Australia until 2030.

The policy responds to the challenges facing waste management and resource recovery in Australia, and the China Sword Policy, and reflects the global shift towards a circular economy – including the need for better resource-efficient systems, products and services to avoid waste, to conserve resources and maximise the value of all materials used. It also acknowledges the need to improve our capacity to better design, reuse, repair and recycle goods used.

The following are targets of the National Waste Policy:

1. Ban the export of waste plastic, paper, glass and tyres, commencing in the second half of 2020
2. Reduce total waste generated in Australia by 10 per cent per person by 2030
3. 80 per cent average resource recovery rate from all waste streams following the waste hierarchy by 2030
4. Significantly increase the use of recycled content by governments and industry
5. Phase out problematic and unnecessary plastics by 2025
6. Halve the amount of organic waste sent to landfill by 2030
7. Make comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions

## 2.3 Export Ban on Recycled Materials

In August 2019, a decision was made by the Council of Australian Governments (COAG) to establish a timetable to ban the export of waste plastic, paper, glass and tyres, while building Australia's capacity to generate high-value recycled commodities.

Transforming waste material into high-value materials is hoped to create jobs, build a more sophisticated industry, and provide positive outcomes for the environment and community wellbeing. The Commonwealth, state and territory governments and the Australian Local Government Association agreed to a response strategy at the 13 March 2020 COAG meeting.

All unprocessed glass, mixed plastics, whole used tyres, single resin/polymer plastics and mixed and unsorted paper and carboard will be banned for export by July 2024.

Under the ban, action by all levels of government are required in the following key areas: driving demand for recycled content; public education to reduce contamination at its source; investment in recycling and waste infrastructure; improving access to, and quality of, waste tracking data; improving product design and fostering innovation and commercialisation of new technology; and accelerated development of standards for use of recycled material in civil works.

### 2.4 Implication for Australia's Recycling Industry

It is widely accepted that the Australian recycling industry has a social license in respect to the management, processing and recycling of waste that aligns with the policy directives of Australia's tiers of Government and community expectations. With unprecedented government and industry investment and overwhelming public support for resource recovery, recycling, and local remanufacturing, there is significant opportunity for activating the full potential of Australia's recycling sector through key policy measures.

It is anticipated that the Australian recycling industry's commercial and community importance will be future proofed given the significant market changes arising from the COAG's ban on exports as well as the Australian Government's National Waste Policy and respective state government waste strategies. This has resulted in a renewed, and anticipated to be permanent, focus on developing local markets and resilient nearby supply chains for recycled materials.

## 3.0. Economics Influencers Underpinning Australian Recycling

Recycling is an integral gear within the circular economy, delivering significant social, economic and environmental value. Increasing resource recovery and transitioning to a circular economy is determined by many factors that will come into play, including costs, markets, infrastructure investment, collection systems and behaviour change among waste generators.

### 3.1 Population and Economic Growth

Growth in the amount of waste generated and, in turn, its recycling in Australia can be linked to both population and economic activity. A consequence of Australia's fast-growing economy has been the production of large quantities of waste, particularly packaging, construction and demolition (C&D) and dry commercial and industrial (C&I) waste, which accounts for 85.1 per cent of all headline waste. The link between waste generation and population growth is firmly established, whereby more waste is produced through the consumption of goods and services by a larger population. A higher base of waste leads to a requirement of more processing and recycling of waste to occur.

### 3.2 Economic Viability and Technology

The Australian recycling industry has been recycling materials back into the productive economy for decades, where it has been both economically and technically viable and beneficial. Based on current technology and markets, however, only a portion of waste generation can be recycled. Those materials that are technically, environmentally and economically able to be recovered and processed will be recovered and beneficially reused as inputs for value add in Australia's manufacturing and agricultural sectors. Accordingly, the ongoing challenge is to ensure that economics support Australian materials that are technically or economically suitable for processing, recovery, manufacture and product sale being bought by end users instead of the use of virgin or overseas materials.

### 3.3 User Markets

The long-standing importance of closing the loop remains, with Australian buyers yet to fully embrace purchasing recycled or remanufactured materials. This is compounded by the offshoring of the manufacturing base in Australia, with reduced local demand for recycled materials as a manufacturing input. As technologies improve and market opportunities grow due to increasing awareness and confidence among end-users of recovered products, the proportion of materials that will be recycled are predicted to grow.

### 3.4 Implications for Australia's Recycling Industry

Industry feedback indicates a growing trend in maximising the quality of recyclates to buyers to ensure the best product with no contamination meeting buyer and manufacture specifications. Recyclers' processes are transitioning to ensure processes for output are consistent with the specification of the end user's needs. New technology is enabling material recognition, sorting and higher level of sophistication, that in turn has a higher quality output to meet specifications. The industry is also partnering with manufacturers in their operations.

Among the considerations on whether a material can be recycled or repurposed are the following economic attributes:

- Is there a market for it today?
- Is there a technical, environmental and economic process for the material?
- Is there an achievable specification for the material?
- Is there an available distribution or path to market for the materials?
- Is the product able to be sold at commercially competitive market rates?

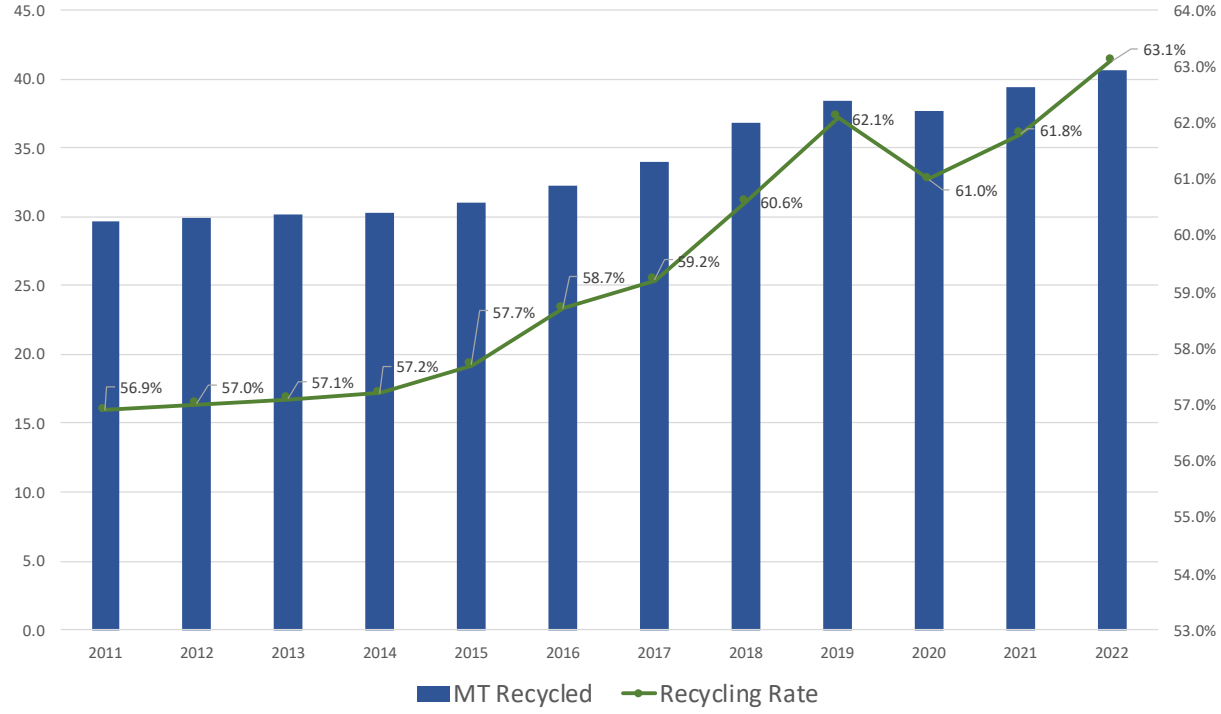
In summary, population and economic growth, economic viability and technology and improved user markets will continue the upward trajectory of Australian recycling. However, further work is needed with a genuine shift to a circular economy also requiring wholesale changes across the whole economy, supply and distribution chains. Change also needs to encompass primary production, extraction, design, manufacturing, energy, distribution and consumption. It also requires substantial revenues raises by waste levies genuinely reinvested by Government in new processing infrastructure to continue to increase the economic and technical attractiveness of Australian recycling.

# 4.0 Australian Material Recycling Headline Statistics

## 4.1 Material Recycled in Australia

The Australian recycling industry in 2021–22 is estimated to have recycled 40.6 million tonnes of material. Across the decade the Australian recycling industry's recycled material has grown on average by 3.1 per cent each year and compares to Australia's average population growth rate over the same period of 1.4 per cent.

Figure 3: Material recycled (Mt) in Australia and recycling rate (%)



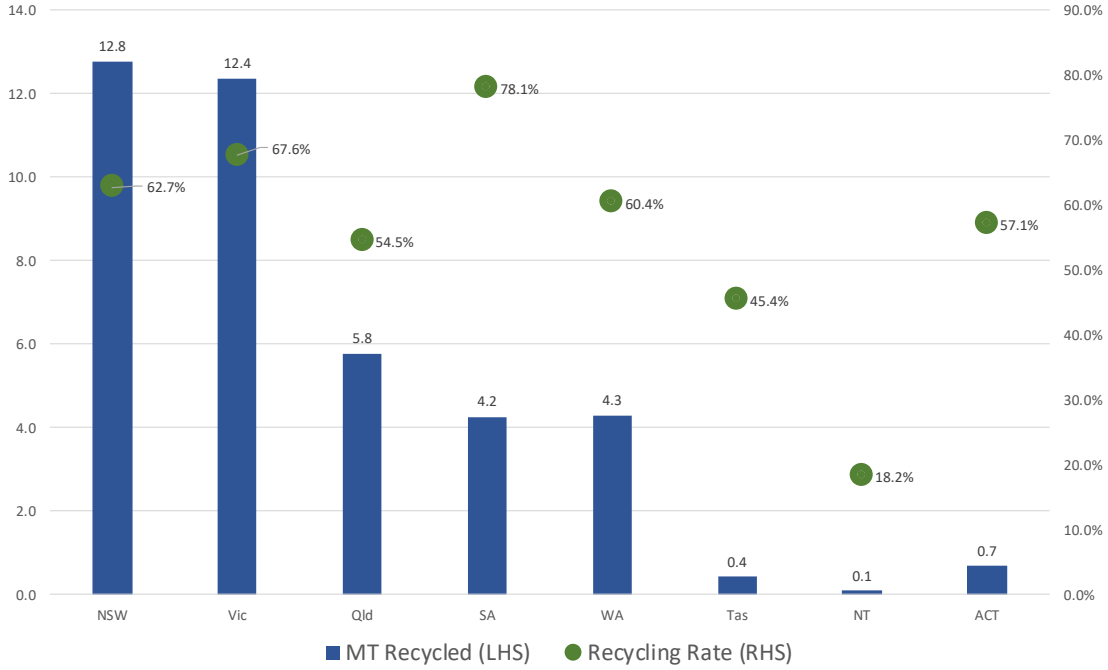

*Source: National Waste Report, AEAS 2022*

The noticeably higher growth rate for material recycled is largely representative of an increasingly higher portion of material being recycled. This has been driven by both population and economic growth (see section 3) but is also a reflection of technological changes, increased uptake by end users, Local Government collection changes, and both Commonwealth and State Government waste and carbon reduction policies (see section 2.0). Accordingly, across the decade Australia's recycling rate has grown from 57.0 per cent in 2011–12 to an estimated 63.1 per cent in 2021–22.

## 4.2 Material Recycled by State

New South Wales accounts for the most tonnes of material being recycled in Australia in 2021–22, with 12.8 million tonnes (31.5 per cent of total) in 2021–22. Victoria is the next largest, with 12.4 tonnes (30.4 per cent), followed by Queensland with 5.8 million tonnes (14.2 per cent), Western Australia 4.3 million tonnes (10.6 per cent) and then South Australia with 4.2 million tonnes (10.4 per cent) of material recycled.

Figure 4: Material recycled (Mt) and recycling rate (%) by state, 2021–22



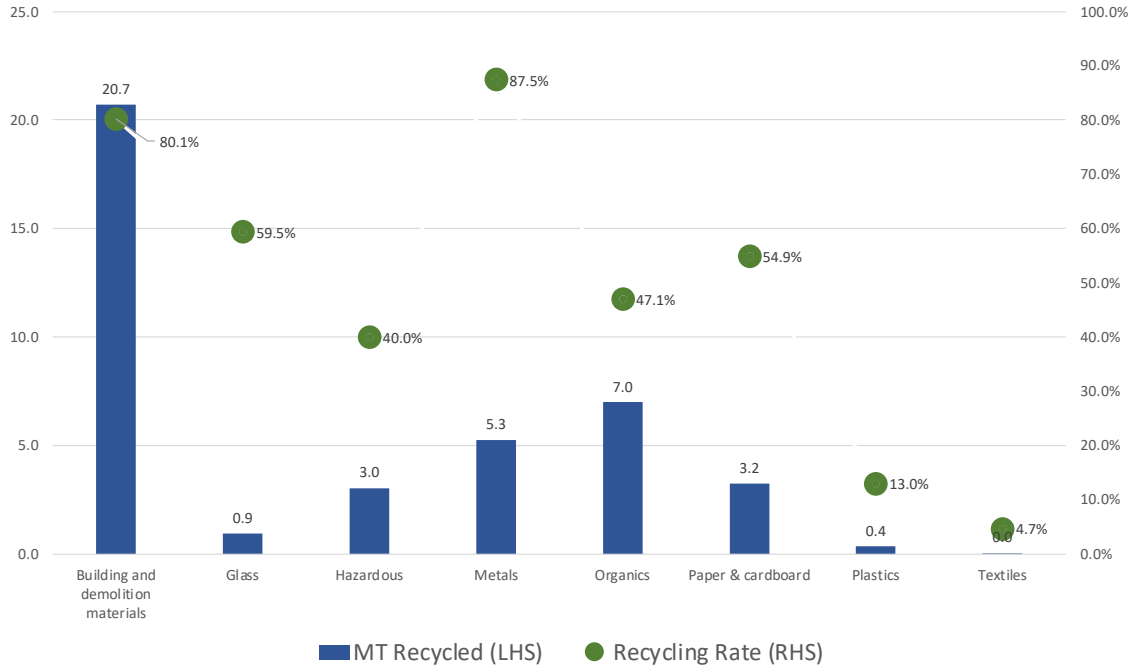

*Source: National Waste Report, AEAS 2022*

South Australia currently has the highest material recycling rate at 78.1 per cent, followed by Victoria (67.6 per cent), NSW (62.7 per cent), Western Australia (60.45 per cent), ACT (57.1 per cent), Queensland (54.5 per cent) and Tasmania (45.4 per cent). The Northern Territory had the lowest recycling rate at 18.2 per cent in 2021–22.

## 4.3 Material Recycled by Type

Building and demolition materials makes up the largest portion of materials recycled nationally, comprising 51.0 per cent of materials or 20.7 million tonnes, followed by organics (17.2 per cent or 7.0 million tonnes), metals (13.0 per cent or 5.3 million tonnes) paper and cardboard (8.0 per cent or 3.2 million tonnes) and hazardous materials (7.5 per cent or 3.0 million tonnes).

Figure 5: Material recycled (Mt) and recycling rate (%) by type, 2021–22




*Source: National Waste Report, AEAS 2022*

Metals has the highest recycling rate (87 per cent) followed by building and demolition materials (80.1 per cent), glass (59.3 per cent), paper and cardboard (54.9 per cent), organics (47.1 per cent). In summary, it is the processing and recycling of these materials and their sale to end users that are not only creating considerable environmental benefits but also economic and employment benefits. These benefits are discussed in section 6.0.

# 5.0 Economic Benefit Estimate Methodology

5.1 AEAS was commissioned by ACOR to determine the economic benefit of the Australian recycling industry to the Australian and State economies based on analysis of existing literature and data, as referenced in Appendix One.

5.2 This report provides a detailed summary of the level of economic contribution to the Australian and State economies by the Australian recycling industry and the multiplier and flow-on effects that are generated by that contribution. The report was developed in consultation with ACOR and identifies a range of vital statistics that the industry contributes to the economy, including:

- the contribution the industry makes to gross domestic product in industry value add;
- the number of direct and indirect jobs created by the industry, measured as full-time equivalents (FTEs);
- the value of wages and salaries paid by the industry;
- level of investment in buildings and plant and equipment made by the industry; and
- the value of Commonwealth, SA and Local Government taxes, rates and charges contributed by the industry.

5.3 The preparation of this report was undertaken in several stages including:

- Processes involved in recycling, and a series of definitions for the sector were identified.
- Desktop research was undertaken to establish the degree of information currently available, for use as a benchmark for AEAS calculated results. A summary of key reference material is provided below .
- Estimates of the direct and flow-on contribution of Australian recycling industry to the Australian and State economies in terms of industry value add, employment, income (i.e. wages and salaries) and other indicators were prepared. Direct impacts, are the first round of effects from direct operational expenditure on goods and services by the industry. The flow-on or indirect effects (i.e. the multiplier effects) are estimated in two parts: production-induced and consumption-induced effects. The production-induced effects arise from expenditure by Industry businesses/organisations on goods and services supplied by other firms in Australia. The consumption-induced effects arise from expenditure of industry workers' income on goods and services supplied by Australian businesses.
- A virtual workshop was held with ACOR members on 16 November 2022 to present draft results and receive industry feedback.

5.4 The economic significance estimates in this report are produced using data primarily from the:

- Australian Bureau of Statistics - Australian Industry (Cat. No. 8155.0);
- National Waste Report;
- other Australian Bureau of Statistics data, including Census data and ABS Catalogues 6202.0 and 5220.0; and
- industry and State economic and employment multipliers previously prepared by AEAS.

5.5 AEAS has used ABS Cat 8155.0 – Australian Industry which presents estimates of the economic and financial performance of Australian industry (ANZSIC). The estimates are produced annually using a combination of directly collected data from the annual Economic Activity Survey (EAS), conducted by the ABS, and Business Activity Statement (BAS) data provided by businesses to the Australian Taxation Office (ATO).

5.6 AEAS has then used the National Waste Report to model the percentage of economic contribution created by recycling businesses operating within ANZSIC's Waste Collection, Treatment and Disposal Services sub-division and more specifically with the 2922: Waste Remediation and Materials Recovery Services classes to calculate Australian recycling industry economic and employment metrics. This information has been used to estimate the recycling sector's share of 5.5 above, after adjusting for recycling's higher value add and employment benefit per tonne compared to other subsectors within the Waste Collection, Treatment and Disposal Services sub-division (eg, collection and disposal).

5.7 One of the objectives of this project is to measure the economic value of waste-related activities across the broader economy. Accordingly, AEAS has used indirect waste industry multiplier estimates for economic activity prepared by EconSearch; and indirect employment multiplier prepared by Deloitte Access Economics for these estimates.

5.8 AEAS has also used estimates sourced from the National Waste Report 2020 of industry sector feedstock sourced from recyclates to calculate the economic and employment benefits of using recycled materials as inputs for further value add in the Australian economy. All estimates are presented in nominal terms (i.e., current prices in the year received), unless otherwise stated.

# 6.0 Direct Economic Contribution of Australian Recycling Industry

Economic significance estimates are presented in this section with interpretation of the results. The data collected by AEAS aims to provide an industry-wide picture of the Australian recycling industry activities and employment. The industry overall is confirmed to be an important contributor to the Australian economy.

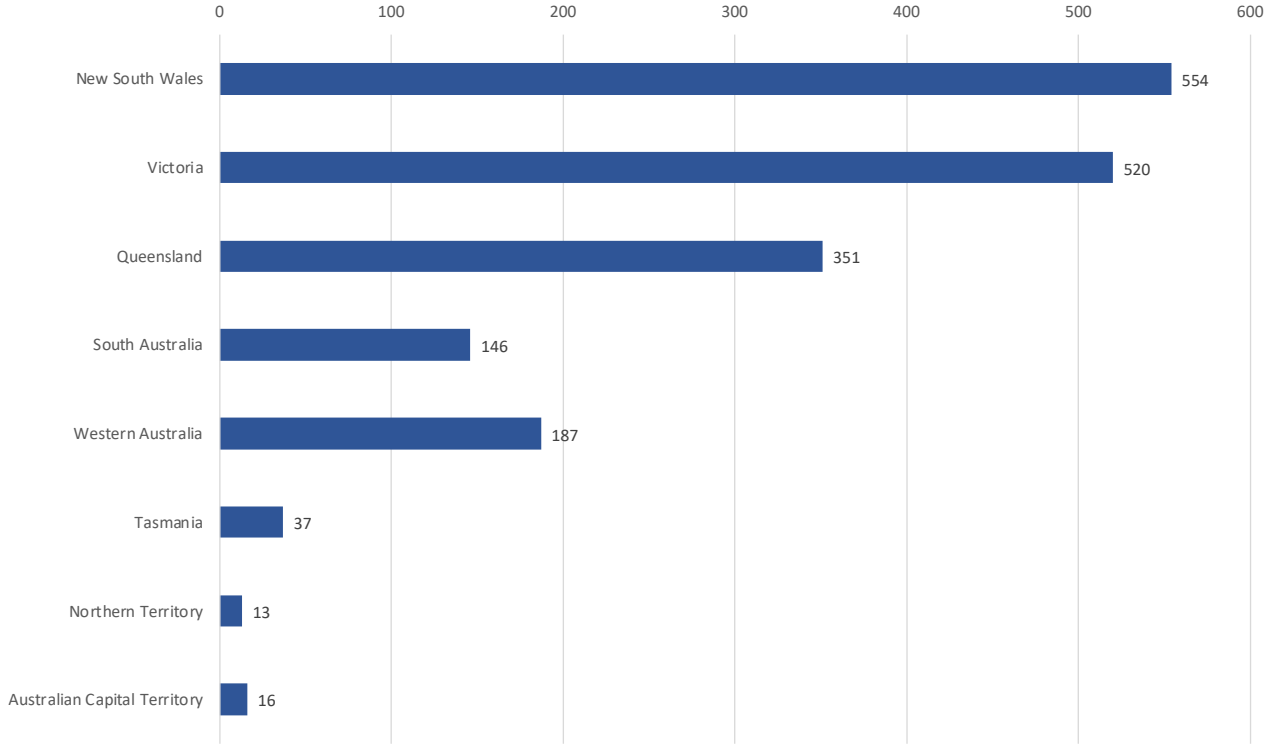
Results of a macro-economic analysis of the industry reveal:

## 6.1 Number of Recycling Businesses

According to the Australian Bureau of Statistics, there were 1,828 recycling businesses operating in the Australian recycling industry in 2021–22. The majority of these businesses are classified as a small businesses employing less than 20 employees (1,732 businesses). There were 89 businesses employing between 20–199 employees and 11 employing in excess of 200 persons. These larger businesses are situated in NSW and Victoria.

NSW has 554 recycling businesses, Victoria has 520, Queensland 351, South Australia 146, Western Australia 187, Tasmania 37, the Northern Territory 13, and the ACT has 16 recycling businesses. The average-sized recycling business employs 16.7 persons and accordingly is defined by the Australian Bureau of Statistics to be a small business.

Figure 6: Number of recycling businesses by state, 2021–22




*Source: Australian Bureau of Statistics and AEAS*

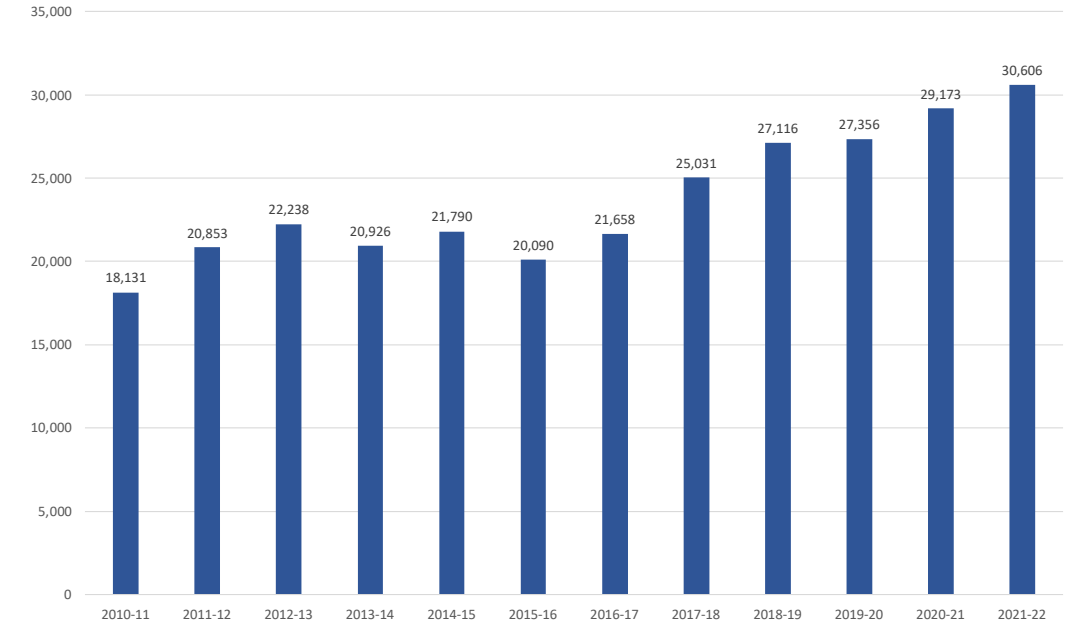
## 6.2 Industry Employment

The Australian recycling industry is estimated to employ 30,606 Australians in 2021–22.

In 2021–22, NSW recycling businesses employed 9,630 persons, Victorian businesses employed 9,311, Queensland employed 4,349, South Australia employed 3,200, Western Australia employed 3,231, Tasmania employed 311, ACT employed 513 and NT employed 62 persons.

In addition, the industry also provides an entry point in the workforce for many younger Australians through the apprenticeships and traineeships that it offers. It is estimated that there are currently 873 Australians in training as apprentices or trainees.

Figure 7: Recycling industry employment, 2021–22 (FTEs)

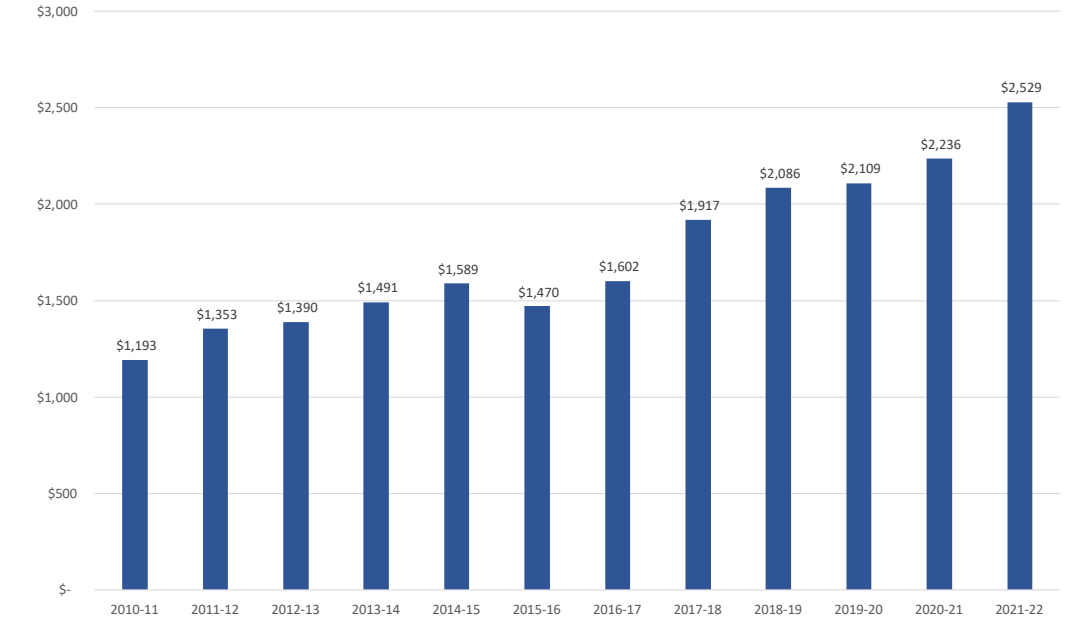



*Source: AEAS 2022*

## 6.3 Wages and Salaries Paid to Australians

The Australian recycling industry is estimated to provide over $2.5 billion in wages to Australians. In 2021–22, NSW recycling businesses provided $796 million in wages, Victorian businesses provided $769 million, Queensland businesses provided $359 million, South Australia provided $264 million, Western Australia provided $267 million, Tasmania provided $26 million, ACT provided $42 million and Northern Territory provided $5 million in wages. The average salary provided to each Australian recycling industry employee is $82,620, compared to the average Australian weekly earnings of $69,100. In addition, AEAS estimates that an additional $253 million was paid by recycling businesses towards employee superannuation.

Figure 8: Recycling industry wages and salaries 2021–22 ($ millions)



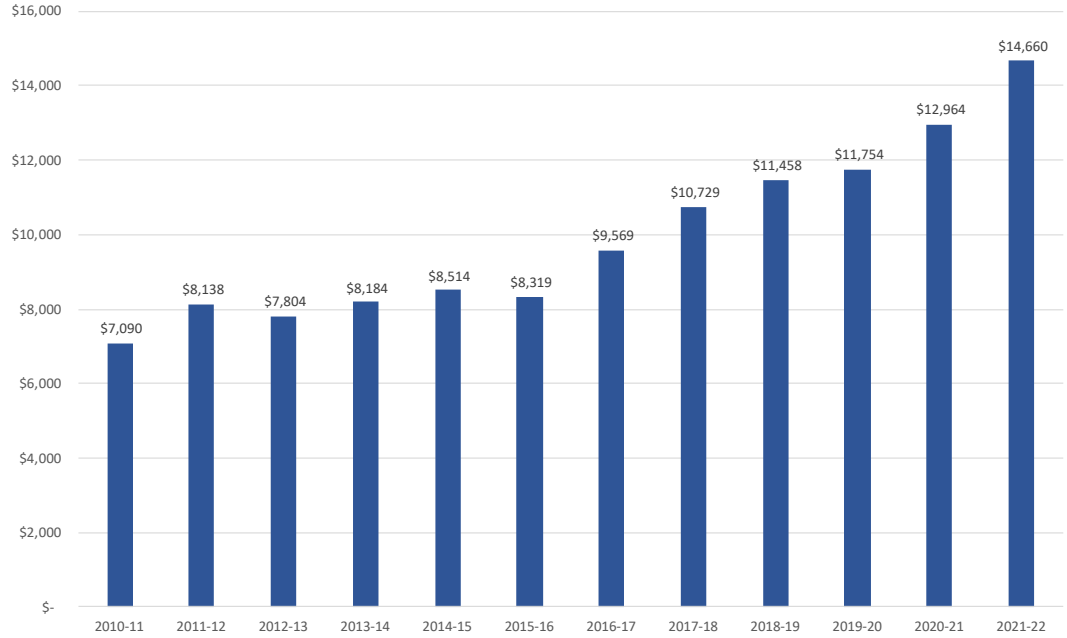

*Source: AEAS 2022*

## 6.4 Industry Sales

The turnover of Australia's recycling industry has steadily increased across the past decade. Through the receipt of inputs and the sale of materials, the Australian recycling industry earned over $14.6 billion in revenue ($14,660 million) in 2021–22. NSW recycling businesses earned $4,613 million in sales, Victorian businesses earned $4,460 million, Queensland businesses earned $2,083 million, South Australia earned $1,533 million, Western Australia earned $1,547 million, Tasmania earned $149 million, ACT earned $76.8 million and Northern Territory recycling businesses earned $30 million

in sales. The average sales per recycling business was $8.04 million in 2021–22. Expressed alternatively, Australian recycling industry turnover is estimated at $361.10 per tonne of recycled material.

Figure 9: Recycling industry sales turnover, 2021–22 ($ millions)

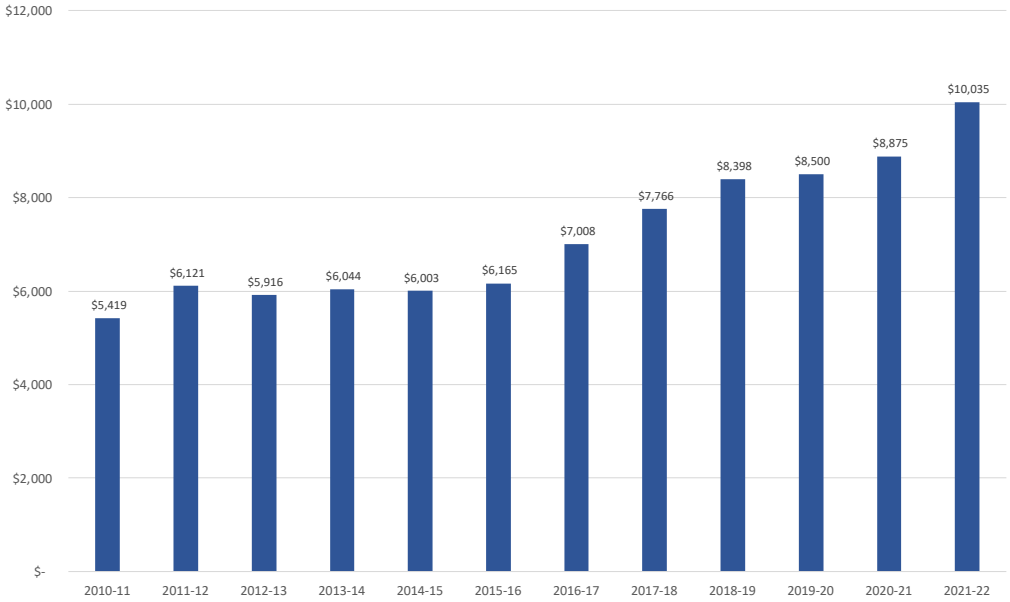



*Source: AEAS 2022*

## 6.5 Supply Chain Expenditure

In 2021–22, Australian recycling businesses supported over $10 billion ($10,035 million) of supply chain expenditure procuring goods and services from other Australian businesses. NSW recycling businesses spent $3,157 million in expenditure, Victorian businesses spent $3,053 million, Queensland businesses spent $1,426 million, South Australia spent $1,049 million, Western Australia spent $1,059 million, Tasmania spent $102 million, ACT spent $168 million, and Northern Territory recycling businesses spent $20 million. Each recycling business, on average, supported a $5.5 million supply chain. Expressed alternatively, Australian recycling industry's supply chain expenditure is estimated at $247.20 per tonne of recycled organic material.

Figure 10: Recycling industry supply chain expenditure by state, 2021–22 ($ millions)




*Source: AEAS 2022*

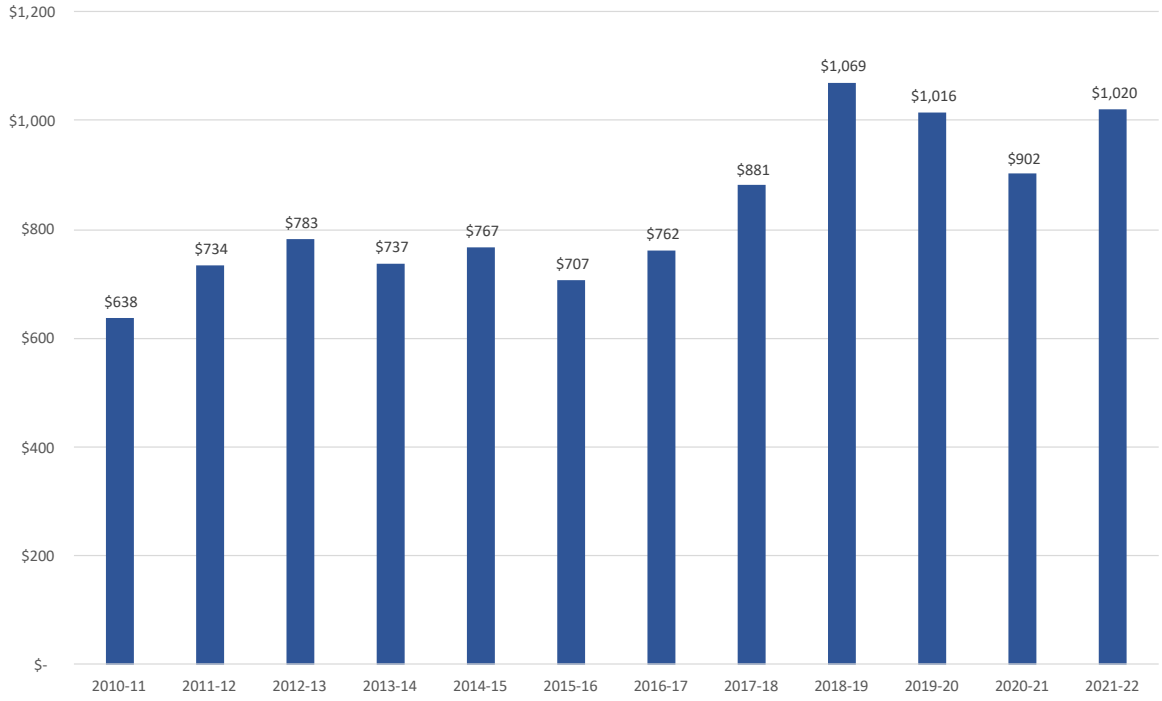
## 6.6 Capital Expenditure

The Australian recycling industry invested over $1 billion ($1,020 million) in 2021–22 in land, buildings, plant and equipment, vehicles and other recycling infrastructure. NSW recycling businesses invested $321 million, Victorian recycling businesses invested $310 million, Queensland recycling businesses invested $145 million, South Australian

recycling businesses invested $107 million, Western Australian recycling businesses invested $108 million, Tasmania recycling businesses invested $10 million, ACT recycling businesses invested $17 million and Northern Territory recycling businesses invested $2 million in land, buildings, plant and equipment, vehicles and other recycling infrastructure.

AEAS notes that this represents actual expenditure during 2021–22 and the total pipeline of planned, committed to and already underway investment is considerably more. The highest level of investment occurred in the area of resource recovery and recycling plant and equipment. Each recycling business, on average, invested $559,210 in land, buildings, plant and equipment, vehicles and other recycling infrastructure in 2021–22.

Figure 11: Recycling industry capital expenditure, 2021–22 ($ millions)




*Source: AEAS 2022*

## 6.7 Profits and Taxes

The Australian recycling industry is no different to other industry sectors in that it operates profitability. In 2021–22, the Australian Recycling's Industry's profits before tax were estimated at $2.1 billion.

The Australian recycling industry is also a major provider of Commonwealth, State and Local Government taxes, fees, rates and royalties, contributing $494 million in receipts to the three tiers of government, helping fund frontline services such as hospitals, education, transport, roads and social infrastructure. Commonwealth taxes included company tax and GST, State taxes included payroll tax, duties, land taxes and royalties, and Local Government collected rates.

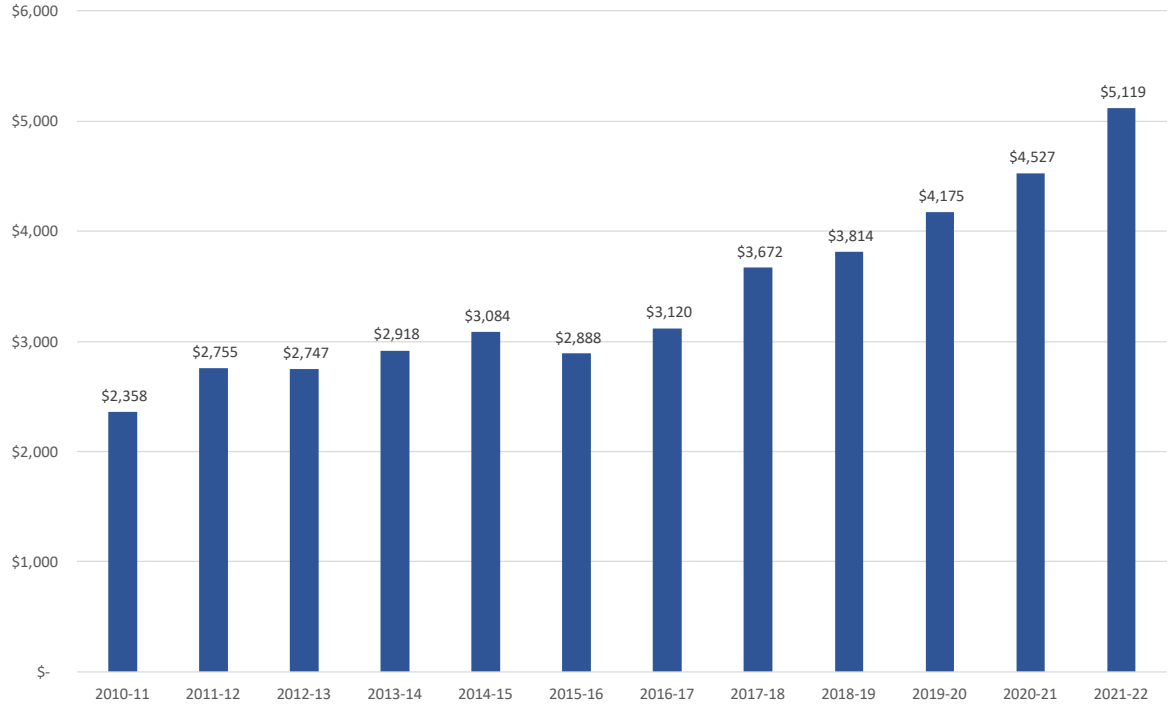
## 6.8 Total Direct Contribution to the Australian Economy

While gross sales or turnover is an easy concept to understand, 'value added' is a better measure in the context of an industry's contribution to the economy. Value added for an industry is comprised of wages and salaries, gross operating surplus of businesses operating in the industry and indirect taxes (e.g., payroll tax). From the data, the direct value added attributable to the Australian recycling industry has been estimated. Australian recycling industry's direct value add (contribution to GSP) in 2021–22 is estimated by AEAS to be $5.1 billion ($5,119 million).

A state breakdown of the recycling industry's value add to the economy indicates NSW recycling businesses' direct contribution to the economy was $1,611 million, Victorian recycling businesses contributed $1,557 million, Queensland recycling businesses contributed $727 million, South Australia recycling businesses contributed $535 million, Western Australian recycling businesses contributed $540 million, Tasmania recycling businesses contributed $52 million, ACT recycling businesses contributed $86 million and Northern Territory recycling businesses contributed $10 million to the territory economy.

In addition to the direct contribution of the economy, the Australian recycling industry is estimated to have contributed indirectly to Australian GDP through flow-on demand for goods and services, including production-induced and consumption-induced effects. These estimates are provided in section 7.0.

Figure 12: Australian recycling sector's direct economic contribution ($ millions)



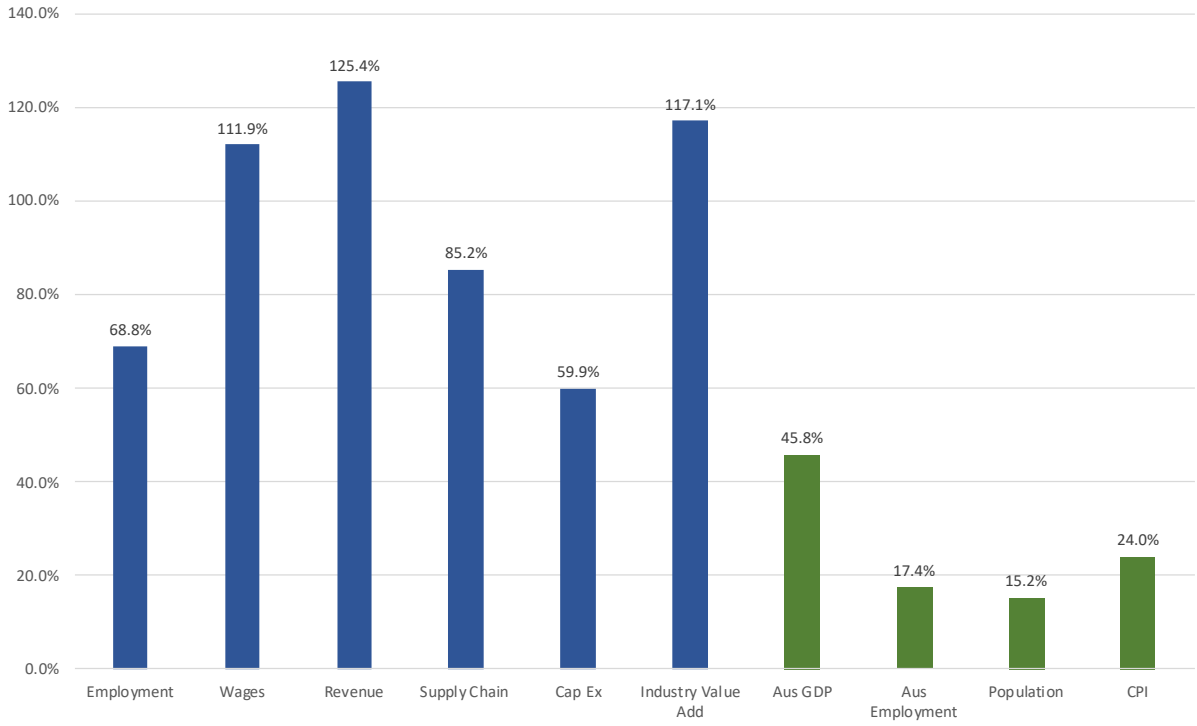

*Source: AEAS 2022*

## 6.9 Industry Growth – 2010–11 to 2021–22

The Australian recycling industry has grown at a higher rate than commensurate economic indicators for the Australian economy over the past decade. The industry's value add in current prices has grown across the past decade by 117.1 per cent, significantly higher than Australia's gross domestic product (45.8 per cent).

The percentage growth of Australian recycling industry's metrics also compares favourably against national employment growth (17.4 per cent), population growth (15.2 per cent) and CPI growth (24.0 per cent) and are provided in Figure 13 below.

Figure 13: Australian recycling industry growth, 2010–11 to 2021–22, benchmarked against key National Metrics (%)




*Source: Australian Bureau of Statistics and AEAS 2022*

The consistently higher growth rates are reflective of Australia's commitment to increasing recycling and promoting Australia's circular economy.

A summary of the growth of the Australian recycling industry's economic contribution since 2010–11 is provided in Table 1 below.

Table 1: Economic contribution to Australian economy, 2010–11 to 2021–22 ($ millions – current prices)

| | Employment at end of June | Wages and salaries | Sales | Supply Chain Expenditure | Capital expenditure | Operating profit before tax | Industry value added |
|---|---|---|---|---|---|---|---|
| 2010–11 | 18,131 | $1,193 | $7,090 | $5,419 | $638 | $461 | $2,358 |
| 2011–12 | 20,853 | $1,353 | $8,138 | $6,121 | $734 | $690 | $2,755 |
| 2012–13 | 22,238 | $1,390 | $7,804 | $5,916 | $783 | $186 | $2,747 |
| 2013–14 | 20,926 | $1,491 | $8,184 | $6,044 | $737 | $662 | $2,918 |
| 2014–15 | 21,790 | $1,589 | $8,514 | $6,003 | $767 | $908 | $3,084 |
| 2015–16 | 20,090 | $1,470 | $8,319 | $ 6,165 | $707 | $683 | $2,888 |
| 2016–17 | 21,658 | $1,602 | $9,569 | $7,008 | $762 | $ 959 | $3,120 |
| 2017–18 | 25,031 | $1,917 | $10,729 | $7,766 | $881 | $1,106 | $3,672 |
| 2018–19 | 27,116 | $2,086 | $11,458 | $8,398 | $1,069 | $948 | $3,814 |
| 2019–20 | 27,356 | $2,109 | $11,754 | $8,500 | $1,016 | $1,161 | $4,175 |
| 2020–21 | 29,173 | $2,236 | $12,964 | $8,875 | $ 902 | $1,882 | $4,527 |
| 2021-22 | 30,606 | $2,529 | $14,660 | $10,035 | $1,020 | $2,129 | $5,119 |

*Source: AEAS 2022*

In respect to overall growth in tonnes recycled not only is this influenced by the recycling rate but there is also causation in growth based on population growth and resulting waste generation. That is the recycling rate is being applied to a higher base of generated waste resulting in higher tonnes recycled. Accordingly, higher-population-growth states, such as Queensland, have had higher growth in economic metrics than lower-population-growth states.

## 6.10 Economic Summary – State Breakdown

A summary of the State breakdown of Australian recycling industry's economic contribution metrics is provided in Table 2 below.

Table 2: Economic contribution by state, 2021–22 ($ millions)

| | Employment at end of June | Wages and salaries | Sales | Supply chain expenditure | Capital expenditure | Operating profit before tax | Industry value added |
|---|---|---|---|---|---|---|---|
| NSW | 9,630 | $796 | $4,613 | $3,157 | $321 | $670 | $1,611 |
| VIC | 9,311 | $769 | $4,460 | $3,053 | $310 | $648 | $1,557 |
| QLD | 4,349 | $359 | $2,083 | $1,426 | $145 | $303 | $727 |
| SA | 3,200 | $264 | $1,533 | $ 1,049 | $107 | $223 | $535 |
| WA | 3,231 | $267 | $1,547 | $1,059 | $108 | $225 | $540 |
| TAS | 311 | $26 | $149 | $102 | $10 | $ 22 | $52 |
| NT | 62 | $5 | $ 30 | $ 20 | $ 2 | $4 | $10 |
| ACT | 513 | $42 | $246 | $168 | $17 | $36 | $86 |
| | | | | | | | |
| AUS | 30,606 | $2,529 | $14,660 | $10,035 | $1,020 | $2,129 | $ 5,119 |

*Source: AEAS 2022*

There is a high correlation for states with a higher recycling tonnage and rate and their recycling industry's economic contribution and importance.

# 7.0 Indirect Economic Contribution

## 7.1 Indirect Contribution Explained

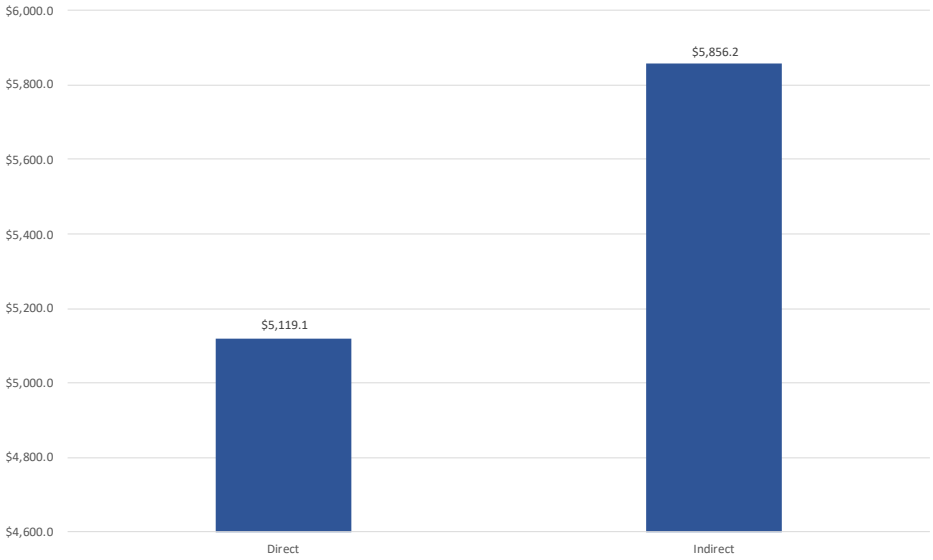
In addition to the direct contribution to the Australian economy, the Australian recycling industry also significantly contributes to Australia's GDP and employment through flow-on demand for goods and services, including production-induced and consumption-induced effects.

The flow-on or indirect effects (i.e., the multiplier effects) have been estimated in two parts: production-induced and consumption-induced effects. The production-induced effects arose from expenditure by recycling businesses on goods and services supplied by other firms in Australia. The consumption-induced effects arise from expenditure of industry employee's income on goods and services supplied by other Australian businesses.

## 77.2 Indirect Economic Contribution

The Australian recycling industry's indirect economic contribution in 2021–22 as a result of both producer- and consumer-induced effects is estimated at $5.9 billion ($5,856.2 million).

Figure 14: Australian recycling sector's indirect economic contribution, 2021–22 ($ millions)

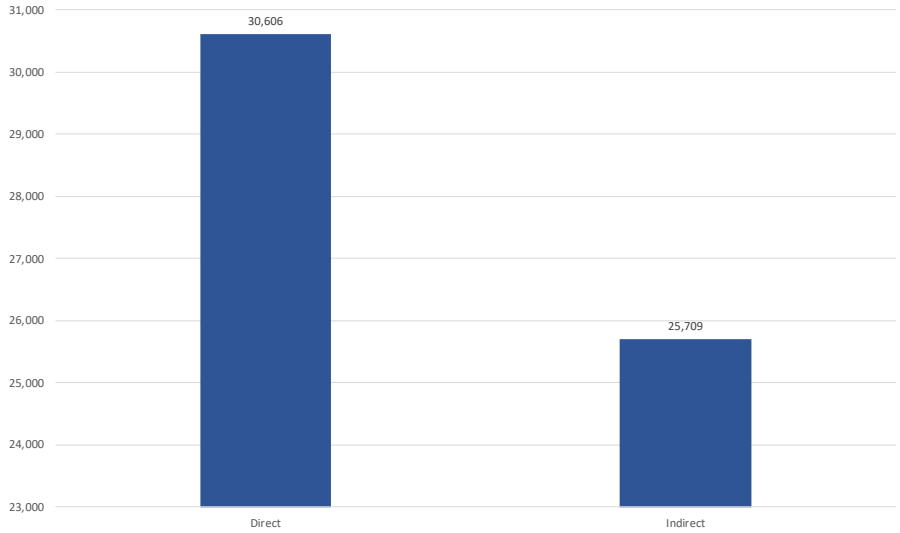



*Source: AEAS 2022*

## 7.3 Indirect Employment Contribution

AEAS estimates that a further 25,709 indirect jobs are created as a result of the flow-on activity estimated above by the Australian recycling industry in 2021–22.

Figure 15: Australian recycling sector – indirect employment (persons)




*Source: AEAS 2022*

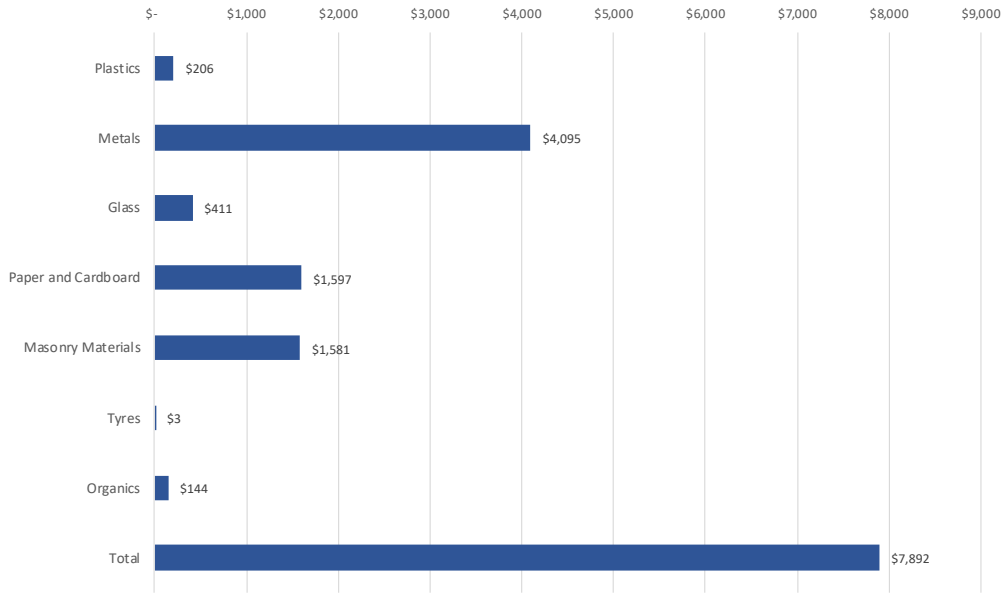
# 8.0 Enabled Economic Contribution

The Australian manufacturing and agricultural industries usage of recyclates including plastics, metals, glass, paper and cardboard, masonry materials, tyres and organics creates further economic and employment benefit. That is, the Australian recycling industry's creation of recycled materials can be used as inputs for further value in the Australian economy. This economic and employment is also considerable.

The Australian recycling industry is 'enabling' the operation of Australian industry. As such, it underpins the sovereign capability to manufacture and grow many products that are of long-term strategic and economic importance to Australia. Without the availability of recyclates across many product streams, the operational costs of Australian manufacturing would be higher and Australian agricultural productivity lower.

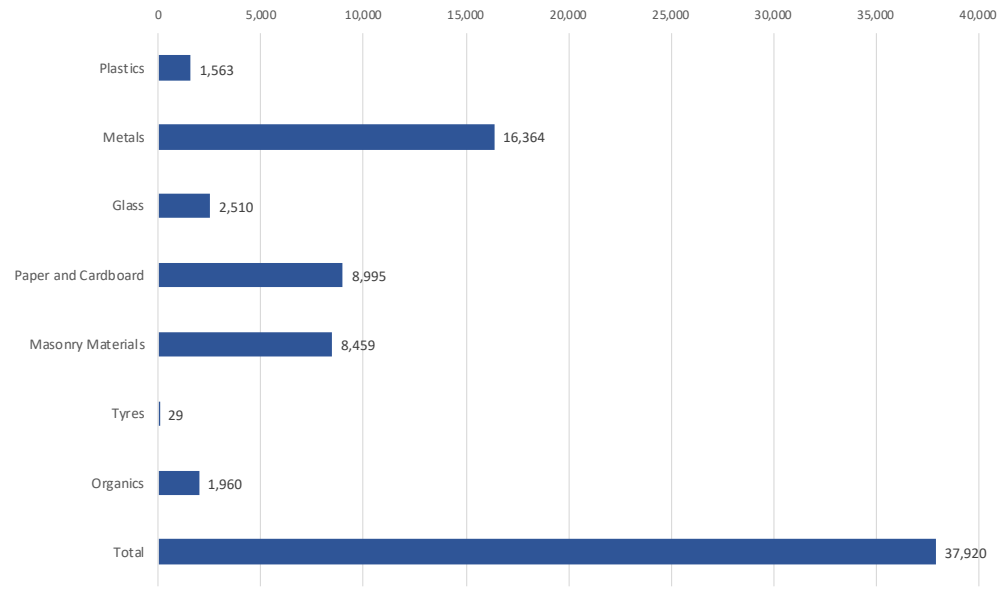
Estimates prepared by AEAS for 2021–22 of the value of this enabled benefit are in the order of $7,892 million. A breakdown of enabled benefit by recycled material is provided in Figure 16. The recycling of plastics and its usage for value add in the economy creates $206 million in further economic activity, metals is $4,095 million, glass is $411 million, paper and cardboard is $1,597 million, masonry materials is $1,581 million, tyres is $3 million and organics is $144 million.

Figure 16: Enabled value add to Australian manufacturing and agriculture, 2021–22 ($ millions)




*Source: AEAS 2022*

Figure 17: Enabled employment in Australian manufacturing and agriculture, 2021–22 (Persons)




*Source: AEAS 2022*

Usage of recycled materials for further value add in the Australian economy also creates significant employment, with an estimated 37,920 jobs. A breakdown of jobs created by recycled material is provided in Figure 17 above. The recycling of plastics is estimated to create 1,563 jobs, metals is 16,354 jobs, glass is 2,510 jobs, paper and cardboard is 8,995 jobs, masonry materials is 8,459 jobs, tyres is 29 jobs and organics is 1,960 enabled jobs.

# 9.0 Total Economic Contribution

## 9.1 Total Economic and Employment Contribution

Combining direct, indirect and enabled economic benefits, the Australian recycling industry is estimated to have contributed $18.9 billion in value add to the Australian economy in 2021–22.

Table 3: Total economic contribution to Australian economy, 2021–22 ($ millions – current prices)

| | $ millions |
|---|---|
| Direct | $5,119.1 |
| Indirect | $5,856.2 |
| Enabled | $7,892.2 |
| Total | $18,867.5 |

*Source: AEAS 2022*

Combining direct, indirect and enabled employment, the Australian recycling industry is estimated to have employed 94,235 persons in 2021–22.

Table 4: Total employment contribution, 2021–22 (persons)

| | persons |
|---|---|
| Direct | 30,606 |
| Indirect | 25,709 |
| Enabled | 37,920 |
| Total | 94,235 |

*Source: AEAS 2022*

## 9.2 Importance – Proportions of Total Economy and Employment

On their own, the above estimates are considerable, but it is important to contextualise them to establish how important the Australian recycling industry is as both an economic and employment contributor. For example, the Australian recycling industry provides 0.82 cents in every dollar of economic activity in Australia. Expressed alternatively, $465 in net economic activity is created for every one tonne of material recycled in Australia.

The Australian recycling industry provides 0.7 jobs in every 100 jobs in Australia; that is, for every 142 jobs that exist in the Australian economy, the Australian recycling industry provides one of those jobs. Expressed alternatively, one job is supported for every 431 tonnes of material recycled in Australia.

Of key relevance is the National Waste Policy and associated action plan's target for an overall resource recovery rate of 80 per cent for all waste streams by 2030. This will lead to the economic and employment contribution measures in this report progressively rising over the period to 2030 and beyond.

# Sources:


- Access Economics (2009) *Employment in waste management and recycling*, report to the Australian Government Department of the Environment, Water, Heritage and the Arts, Access Economics.
- ACOR (2018) *10 point plan for results-based recycling*, ACOR.
- ACOR (2008) *Australian Recycling Values: A net benefits assessment*, ACOR.
- ACOR (2020) *An overview of industry confidence*, ACOR.
- ACOR (2022) *Gearing up for a circular economy: Actions to unleash a booming Australian recycling sector*, ACOR.
- ARUP (2020) *Waste: What future do we want? For the NSW waste sector*, ARUP.
- Australian Bureau of Statistics (September 2022), National, state and territory population, ABS Website, accessed 2023.
- Australian Bureau of Statistics (2018-19), Waste Account, Australia, Experimental Estimates, ABS Website, 2023.
- Australian Bureau of Statistics (2021-22-financial-year), Australian National Accounts: State Accounts, ABS Website, 2023.
- Australian Bureau of Statistics (2020-21), Australian National Accounts: Input-Output Tables, ABS Website, 2023.
- Australian Bureau of Statistics (April 2023), Labour Force, Australia, ABS Website, 2023.
- Australian Bureau of Statistics (November 2022), Average Weekly Earnings, Australia, ABS Website, 2023.
- Australian Bureau of Statistics (2020-21), Australian Industry, ABS Website, 2023.
- Australian Bureau of Statistics (Jul2018-Jun2022), Counts of Australian Businesses, including Entries and Exits, ABS Website, 2023.
- Australian Government (2019) National Waste Policy Action Plan
- Pickin, Joe, et al (2018) 'National Waste Report 2018', report to the Department of the Environment and Energy, Blue Environment Pty Ltd.
- Pickin, Joe, et al (2020), 'National Waste Report 2020', report to the Department of the Environment and Energy, Blue Environment Pty Ltd, https://www.dcceew.gov.au/environment/protection/waste/national-waste-reports/2020
- Deloitte Access Economics (2015) 'Economic effects of the South Australian solid waste levy', report prepared for ACOR, Deloitte Access Economics Pty Ltd, https://www.acor.org.au/resources.html
- Department of Agriculture, Water and the Environment https://www.environment.gov.au/protection/waste-resource-recovery/waste-export-ban
- Centre for International Economics, The (2017) 'Headline economic value for waste and materials efficiency in Australia', prepared for the Department of the Environment and Energy, CIE.
- Allan, Peter (2012) 'Australian Waste Definitions: Defining waste related terms by jurisdiction in Australia', report prepared for the Department of Sustainability, Environment, Water, Population and Communities, Sustainable Resource Use Pty Ltd.
- Rawson, Mark, et al (2016) 'South Australian Waste and Resource Recovery Plan: Waste projection and economic assessment,' report prepared for the Office of Green Industries SA, Rawtec with EconSearch and Jensen Planning and Design.
- Waters, Madelaine, and Wigley, Damien (2020) 'Audit and review of packaging environmental labelling and claims', report prepared for ACOR, Equilibrium, https://www.acor.org.au/resources.html
- Harford, N., and French, J. (2022) 'Australian Recycling Infrastructure, Capacity and Readiness (Plastic and Paper)', report prepared for ACOR, Equilibrium, https://www.acor.org.au/resources.html
- Rawtec Pty Ltd (2021) 'South Australia's Recycling Activity Survey: 2019–20 Report', report prepared for Green Industries SA, Rawtec.
- Schliebs, Dominic, et al (2014) 'Waste Sector Modelling and Analysis: Waste sector emission parameters', report prepared for the Department of Environment, Hyder Consulting.
- Bond, Victoria (2020) 'Public Procurement of Road Building Materials: Research into recycled content', report prepared for ACOR, MRA Consulting Group, https://www.acor.org.au/resources.html
- Denne, Tim (2007) 'Recycling: Cost Benefit Analysis', report prepared for the Ministry for the Environment, New Zealand, Covec Ltd, https://environment.govt.nz/publications/recycling-cost-benefit-analysis/
- NSW Department of Planning and Environment, 'Waste and Sustainable Materials Strategy', June 2021
- PricewaterhouseCoopers (2019) 'NSW Waste Sector, Volume II: Situational analysis)', report prepared for the NSW Environment Protection Authority, PWC.
- PricewaterhouseCoopers (2019) 'NSW Waste Sector Volume 1: Key findings', report prepared for the NSW Environment Protection Authority, PWC.
- Queensland Government (2018) 'Transforming Queensland's Recycling and Waste Industry: Directions paper'.
- Queensland Government (2019) 'Waste Management and Resource Recovery Strategy', https://www.qld.gov.au/environment/management/waste/strategy
- Queensland Government (2019) 'Queensland Resource Recovery Industries: 10-year roadmap and action plan', prepared by Department of State Development, Manufacturing, Infrastructure and Planning.

- Queensland Treasury Corporation (2018) 'Economic opportunities for Queensland's waste industry: final report', prepared for the Department of Environment and Science.
- Rawson, Mark (2016) 'South Australian Waste and Resource Recovery Plan: Waste projection and economic assessment, final report', prepared for the Office of Green Industries SA, Rawtec Pty Ltd with EconSearch and Jensen Planning and Design.
- Senate Environment and Communications References Committee (2018) 'Never Waste a Crisis: The waste and recycling industry in Australia', www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/WasteandRecycling/Report
- Sustainability Victoria (2018) 'Victorian Recycling Industry Annual Report 2016–17'.
- Sustainability Victoria, Victorian Recycling Industry Annual Waste Services Report 2016-17
- State of Victoria Department of Environment, Land, Water and Planning (2020) 'Recycling Victoria: A New Economy'.
- Sustainability Victoria (2015) 'Victoria's Waste and Resource Recovery Infrastructure Investment Prospectus'.

## ACOR

ACOR is the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia. Our membership is represented across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastics, paper, textiles and e-product reprocessing and remanufacturing, road recycling and construction and demolition recovery. Our mission is to lead the transition to a circular economy through the recycling supply chain.

**Contact details:**

Suzanne Toumbourou
Chief Executive Officer
Australian Council of Recycling
ceo@acor.org.au
www.acor.org.au

## AEAS

Australian Economic Advocacy Solutions delivers services in economic analysis, research and advocacy in Australia and was set up by Nick Behrens following two decades of experience applying these skills in the real world for Australia's business community. More specifically, AEAS provides:

- economic analysis and market research;
- government relations and submissions;
- media relations; and
- stakeholder relations.

AEAS delivers services nationally to exemplary organisations including AORA, Australian Industry Group, Australian Gas Industry Trust, Australian Steel Institute, BASF, Brisbane Airport Corporation, CCIQ, Canegrowers, IOR Petroleum, LifeFlight, Master Builders Australia, Natroads, NWRIC, Port of Brisbane, Property Council of Australia, Queensland Resources Council, RACQ, Remondis, Suncorp, VTA, Victorian Waste Management Association, unions, local government authorities, the Commonwealth and State Governments and many others.

**Contact details:**

Nick Behrens
Director
Australian Economic Advocacy Solutions
PO Box 847, Bulimba QLD 4171

www.qeas.com.au
ABN 87 616 587 514

## Appendix 2. Priorities for nationally harmonised Container Deposit Schemes

# Priorities for nationally harmonised Container Deposit Schemes

April 2024

**Background**

Container deposit schemes (CDS) will soon be operating in every Australian State and Territory. These schemes have attracted industry and community participation and substantially reduced beverage container litter. The schemes increase access to quality recovered material, which leads to highest-value material reuse, such as bottle-to-bottle recycling. For example, the hot-wash PET flake generated from CDS products delivers high-quality rPET for the Australian packaging market. The schemes also deliver uncontaminated glass for high-value recycling.

It is essential that CDS supports meaningful progress towards Australia's National Packaging Targets, by ensuring that recycled content is prioritised in beverage containers and that beverage containers are genuinely reusable and recyclable.

Recycling is essentially comprised of three key elements: collection, processing and end markets. These elements generally work well within CDS, ensuring that well-sorted, high-value recovered materials can support domestic closed-loop recycling outcomes, such as recycled PET and glass beverage containers.

As States and Territories respond to these successes by expanding the scope of eligible containers in Schemes around the country—and as the focus of government and community concern shifts from litter reduction to establishing a circular economy—questions will arise as to what role these Schemes are intended to fulfil, how they will interact with kerbside recycling collection, how to ensure strong markets for the CDS-generated recyclate, and how they can support higher resource recovery rates.

To be sustainable, Container Deposit Schemes must have an efficient and effective operation, be financially and commercially feasible for all parties, enjoy social licence to operate, and be conducted under the right policy setting.

This paper sets out key elements of CDS to which all States and Territories should align under a nationally harmonised approach, and also offers principles for how CDS should evolve and expand. The national alignment of container deposit schemes should be effected through relevant intergovernmental forums, such as the Heads of Environmental Protection Agencies (HEPA), and the Environment Ministers Meeting (EMM), in partnership with industry.

It is important to note that each individual measure cannot deliver strong CDS outcomes—they must be progressed together as a comprehensive and complementary package.

**1. Return rate targets**

Clear and consistent return rate targets should be established to ensure Scheme growth and high performance, consistent with existing targets set by Queensland and Western Australia.

Such targets should be supported by effective legislative, Scheme administration, and operational structures, and driven by a strong deposit rate.

Accuracy and transparency of data is vital in measuring progress against targets, and for engaging and building the trust of the community. For example, use of barcodes is a well-established means of generating verified, accurate data.

## 2. Deposit rate setting

It is well understood and broadly evidenced that higher return rates correlate with higher refund amounts.

A useful metric in considering appropriate refund amounts is the number of empty containers required to purchase a new beverage. Comparison of Australia's current refund amount ($0.10) with other successful schemes, such as in Germany (€0.25 or approximately $0.40), show that our refund amount is very low in absolute terms and at the lowest end of international schemes as a proportion of beverage prices.

Recognising that the deposit rate devalues over time with inflation, and also acknowledging the importance of balancing cost of living priorities, a process should be put in place to adjust the CDS deposit rate to 20 cents. Notably, those most affected by cost of living pressures are also those most incentivised to collect and return more containers for additional income.

Following the increase, two-year review periods should be adopted, with the deposit value further increased if return rate targets are not met for two years in a row.

## 3. Convenience access and coverage

Convenience is a core element of a well-functioning CDS. Most world-leading schemes are required to accommodate scheme returns within retail operations, on the basis that retail involvement maximises convenience cost-effectively and increases return rates.

There must be comprehensive access and coverage across geographical areas, with accessible and convenient coverage, including 'return to retail' options.

## 4. Marketing

There must be consistent, strong marketing to create high levels of awareness within the community, in order to maximise return rates.

Beverage companies should market the schemes they're involved in and refer to the refund/deposit amount in their own advertisements. Information on deposit amounts should be printed on retail price displays and customer receipts.

Scheme-wide marketing should aim for agreed metrics, including community awareness levels of at least 95% and be monitored with six-monthly surveys.

## 5. Governance

Governance structures for CDS should protect for inherent conflicts of interest, which must be declared.

A mechanism for government intervention should be possible, in the event that recovery rates fall below agreed levels, with the ability to either raise the refund amount, or address the root cause of failures, such as insufficient marketing, convenience or network coverage.

The Australian Government should support the coordination of those factors that need national alignment: the deposit payment rate; consistent eligible containers; and a consistent registration process.

## 6. Scope

Expanding the scope of eligible containers to include glass wine and spirit bottles will increase the supply of clean glass for high-grade recycling. This move must be adopted in concert nation-wide, to ensure national harmonisation and alignment of CDSs. Any such expansion must consider the impacts on current and planned collection infrastructure, including widely used technologies.

At various times, container deposit schemes have been floated as a possible collection mechanism for additional waste streams, such as batteries, e-waste, soft plastics and other rigid containers. There may be potential to maximise resource recovery through this system, however, many of these other materials have different consumption patterns, and may not be suited to current return infrastructure and technology. In

addition, the potential to cause contamination in high-value pure CDS streams needs to be addressed. Any such expansion would need thorough consultation with industry.

For any additional resource recovery sources to be added, many considerations would need to be resolved, including mandated recycled content (as discussed above), end-markets for recycled materials, return infrastructure, and technology and funding structures.

It is essential that industry is closely engaged in any consideration of broader expansion of CDS to include other container types.

**7. Recyclability**

Beverage containers must be designed to be recovered and recycled, and CDS must not accommodate an unmoderated flow of material that cannot be recycled in practice.

Non-recyclable materials, including all those identified for phaseout within the Australian Packaging Covenant Organisation's (APCO) *Action Plan for Problematic and Unnecessary Single-Use Plastic Packaging*, should not be included in any CDS.

Inclusion of non-recyclable containers not only incurs costs to collect and process containers that are ultimately sent to landfill, but affects the reputation of the scheme and sends the wrong message to consumers. Problematic packaging as identified by APCO includes PVC containers, opaque PET bottles, drink sachets and wine casks. Container formats that are not recyclable in Australia or eligible for the Australasian Recycling Label such as drink pouches and wine casks should not be included.

Essentially, beverage containers included in CDS should be comprised of recycled and recyclable material. Material that is non-recyclable—insofar as it is unrecoverable, lacks processing infrastructure or lacks end markets in the real world—must not be part of any container deposit scheme.

Ensuring that all containers are recyclable and supporting high recovery rates facilitates the priority of mandating recycled content in packaging, which is essential to overcome the price disparity between raw and recovered materials, and ensure end markets for recovered materials, enabling recycling at scale.

Beverage producer payments to the scheme should be eco-modulated based on the value of the material (i.e., higher fees for materials with lower circularity), return rates for specific formats, and Australian recycled content.

It is important to ensure that containers left out of the Scheme due to being non-recyclable do not gain a competitive advantage over recyclable containers in any expanded scheme. Ideally, this would involve a mandated transition process, and there may be an opportunity to work with all Australian States and Territories to expand the parameters of the 'single-use plastic bans' being rolled out across all jurisdictions to include non-recyclable containers. This would also practically support the delivery of the National Packaging Targets.

**8. Protocols**

A protocol for material recovery facilities (MRFs) is vital to sustain the wider recycling supply chain, specifically municipal resource recovery through kerbside recycling. An increased deposit rate will support the collection of higher value recyclable materials through CDS. On the other hand, this has the effect of reducing the volume and affecting the overall quality of recyclable material received by MRFs.

A MRF protocol must support the economic viability of MRFs, which are not only subject to long-term contractual agreements but also highly variable markets for recovered material.

In determining this protocol, it is necessary to ensure a balanced approach to auditing for the purpose of statistical relevance, informed by current systems in place around Australia, and a practical, cost-effective approach to stringency. This approach must also ensure adequate flexibility to ensure SMEs—and specifically regional facilities—can participate.

Additionally, it is important that glass crushing and other third-party glass aggregators must be covered by specific protocols. In particular, there should be a protocol for bottle-crushing services to the hospitality sector, consistent with other jurisdictions such as Western Australia and NSW.

**9. Recycling outcomes must be transparent, tracked and reported**

Container Deposit Schemes must consistently establish detailed downstream reporting requirements, which clearly identify collection channels, to support the highest-possible value material recovery, such as recycling bottle-to-bottle or into food-grade packaging.

**Conclusion**

It is vital that container deposit schemes across Australia support recycling through a nationally harmonised approach to targets, higher deposit rates, broad collection network coverage, strong marketing, appropriate eligibility settings, and robust governance and accountability. These elements are standard practice in well-designed schemes around the world, resulting in strong recycling outcomes and higher return rates than those achieved by Australian schemes. As Australia gears up for nationwide operation of container deposit schemes, now is the time to step up to these globally accepted measures.

**About ACOR**

The Australian Council of Recycling (ACOR) is the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia. The Australian recycling industry contributes almost $19 billion in economic value, while delivering environmental benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 430 tonnes of material recycled in Australia.

Our membership is represented across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastics, paper, textiles, tyres, oil, batteries and e-product reprocessing and remanufacturing, road recycling and construction and demolition recovery. Our mission is to lead the transition to a circular economy through the recycling supply chain.

**Australian Council of Recycling**

Level 23, 520 Oxford Street, Bondi Junction NSW 2022

02 8074 7007 | Email: admin@acor.org.au | www.acor.org.au

ABN 60 574 301 921

## Appendix 3. Recyclers in Product Stewardship: Challenges, priorities, and recommendations from the recycling sector

# Recyclers in Product Stewardship

## Challenges, priorities, and recommendations from the recycling sector

**Issues paper**
*Prepared by the*
*Australian Council of Recycling*

*April 2024*

**Acknowledgement of Country**

We acknowledge that Aboriginal and Torres Strait Islander peoples are the First Peoples and Traditional Custodians of Australia, and the oldest continuing culture in human history.

We pay respect to Elders past and present and commit to respecting the lands we walk on, and the communities we walk with. We celebrate the deep and enduring connection of Aboriginal and Torres Strait Islander peoples to Country and acknowledge their continuing custodianship of the land, seas and sky.

We acknowledge the ongoing stewardship of Aboriginal and Torres Strait Islander peoples, and the important contribution they make to our communities, economies and the environment.

**About ACOR**

The Australian Council of Recycling (ACOR) is the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia. The Australian recycling industry contributes almost $19 billion in economic value, while delivering environmental benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 430 tonnes of material recycled in Australia.

Our membership is represented across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastic, paper, organic, tyre, textile, oil, battery and e-product reprocessing and remanufacturing, and construction and demolition recovery. Our mission is to lead the transition to a circular economy through the recycling supply chain.

# Table of contents



**Case Studies**

# Executive summary

The recycling sector strongly supports an increased focus on producers and distributors (known as 'brand owners') to take greater responsibility across the full lifecycle of products, including at end of use. Product stewardship and extended producer responsibility can be an effective way to reduce waste and lift recycling rates—particularly where recycling rates are low, or materials have low or negative value—but only if these schemes are properly designed in partnership with recyclers.

At present, existing voluntary and co-regulated product stewardship schemes endorsed by the Australian Government predominantly cater to brand owners. However, it is imperative to recognise that these entities represent only a part of a product's lifecycle.

Many product stewardship schemes appropriately emphasise the waste management hierarchy priorities of avoidance, reusability, and designing for repair, yet all products inevitably reach an end of use, where the ideal outcome is recycling.

Overwhelmingly, when schemes do engage with recycling activities, the focus is primarily on the public-facing, marketable elements of collection and processing, while underinvesting in the equally critical aspect of high-value recycling outcomes and demand generation for recycled material.

Too often, cost reduction is prioritised over quality recycling outcomes in such schemes. Not only does this undermine legitimate recycling operations, but it also erodes community confidence in recycling when the system fails.

Recent trends indicate recovery rates for household waste have stagnated, while commercial and industrial waste recovery rates have declined. This pattern underscores the urgent need for a concerted effort to invest in genuine recycling outcomes.

The establishment of a scheme must not be seen as an end in itself: it must be a means to delivering sustainable and economically viable circular outcomes, in partnership with the entire supply chain.

Engagement with the rest of the supply chain—especially recyclers, who are the subject matter experts on recycling—is essential to ensure product stewardship schemes deliver genuine value to brand owners, government entities, communities, and recyclers, and support the transition to a circular economy.

The recycling sector is concerned that some existing voluntary and co-regulated product stewardship schemes are not delivering robust recycling outcomes while new schemes are being established without the correct mechanisms in place to drive effective resource recovery and demand for recycled materials.

With thirteen industry-led government-accredited voluntary and co-regulated schemes, almost one hundred schemes operating in Australia, and many more in development, now is the time to better align these initiatives, set stronger targets, adopt better governance and ensure accountability, to deliver genuine outcomes that support community confidence and proper investment in a robust and competitive recycling value chain.

This paper outlines the priorities and challenges for recyclers in the current context of a drive towards more stewardship and extended producer responsibility models. It recommends measures for product stewardship schemes that will deliver better environmental outcomes and more genuine engagement across the supply chain, including designing for recycling and reuse, expanded collection and safe disposal measures, ensuring robust market demand for recycled materials and transparent scheme governance focussing on compliance and consequences.

**Priority areas to deliver better recycling outcomes from product stewardship are as follows:**

- **Rethink and restructure product stewardship**
- **Design for recycling and reuse**
- **Create robust market demand**
- **Enhance collection infrastructure and consumer incentives**
- **Tighten scheme governance**
- **Enforce compliance and consequences**

# Summary of product stewardship challenges and solutions

| Common issues in product stewardship schemes | Recommendations |
|---|---|
| – Underfunding recycling<br>– Product stewardship prioritised above more effective policy and regulatory levers<br>– Duplicative schemes creating inefficiency and confusion | 1.1 'Trigger Framework' to determine when a product stewardship scheme is required<br>1.2 Assess and embed actual costs of recovery and recycling |
| | 2.1 Federal EPR legislation, initiated by 'Trigger Framework'<br>2.2 Evidence-based targets for recyclability, with targets increasing over time |
| – Weak end markets for recycled materials | 3.1 Robust end markets for Australian recycled content<br>3.2 Economic incentives for use of recycled materials<br>3.3 Minimum thresholds for Australian recycled content<br>3.4 Certification and labelling for Australian recycled content<br>3.5 Target dumped and subsidised imported material |
| – Poor governance, including conflicts of interest, and under-representation across supply chain<br>– Scheme administration prioritised over recycling<br>– Lack of appropriate targets or proportional consequences for non-achievement | 4.1 Expand the scope of mandatory e-stewardship, incorporating all consumer electronic and electrical equipment and loose and embedded batteries into one comprehensive scheme<br>4.2 Gap analysis of disposal options for all electronic and hazardous waste streams<br>4.3 Comprehensive network of safe disposal sites<br>4.4 Incentivise safe battery collection with deposit refund |
| | 5.1 Supply-chain representation in product stewardship scheme governance<br>5.2 Recycling sector expert convenor to engage product stewardship schemes with recycling sector<br>5.3 Clearly defined and measurable objectives, rules and targets<br>5.4 Transparent data about objectives, decision-making processes, recovery rates, recycling outcomes and material movement<br>5.5 Ensure scheme's objectives are met with accountability measures |
| – Poor accountability and transparency | 6.1 Australian Recyclers Accreditation Program (ARAP)<br>6.2 Enforce waste export regulations<br>6.3 Regulate the export of waste textiles, unprocessed scrap metal and unprocessed e-products<br>6.4 Tax incentives or priority access to markets for best-practice recycling facilities<br>6.5 Product stewardship schemes to be subject to third-party audits and/or inspections<br>6.6 A nationally harmonised resource recovery framework |

# Background

The *Recycling and Waste Reduction Act* was passed in 2020, providing a framework for managing Australia's recycling and waste reduction objectives, which include the development of a circular economy.[1] The Act identifies voluntary, co-regulatory and mandatory product stewardship schemes as a means to manage the impacts of products and materials throughout their lifecycle, and enables a more accessible framework for accreditation of voluntary schemes. The Act provides for the use of the Commonwealth's logo for accredited voluntary schemes, promoting the recognition and credibility that government accreditation affords.[2]

The Australian Government has signalled a preference for industry action through product stewardship schemes. The establishment of many government-accredited schemes has also been encouraged by the Minister's product stewardship priority list,[3] which identifies products lacking circular or recycling solutions at their end of use.

The Product Stewardship Centre of Excellence (Centre of Excellence) was established in 2021 with the support of the Australian Government. The Centre of Excellence maintains the Product Stewardship Gateway, a directory of product stewardship schemes in Australia, detailing any reporting data product stewardship schemes disclose.

In 2023, the Centre of Excellence delivered their evaluation of product stewardship and extended producer responsibility activity in Australia,[4] in line with action 3.3 of the National Waste Action Plan 2019.[5] The summary report presented a positive view of product stewardship in Australia, despite acknowledging difficulties in assessing efficacy due to poor reporting from schemes:

> Given the inconsistency and gaps in data collection and reporting, only a few of annual performance indicators could be aggregated. There were also limitations in assessing how effective initiatives are performing. For example, tonnes of waste products collected for recovery and materials recovered were not always reported in the context of total waste arising. Without this data, it is difficult to determine how effective the initiative has been in increasing recovery or diverting waste from landfill.[6]

Some mandatory and well-governed product stewardship schemes have been successful. State-based container deposit schemes (CDS) will soon be operating nationwide. They are generally considered to be an appropriately governed and funded approach by recyclers, industry and government stakeholders alike. These mandatory schemes provide a 10-cent refund for the return of beverage containers, aligning economic incentives with environmental goals.

---

[1] Australian Government Department of Finance, 'Recycling and Waste Reduction Act 2020', Australian Government Transparency Portal website, accessed March 2024.

[2] Department of Climate Change, Energy, the Environment and Water, 'Product stewardship schemes and priorities', DCCEEW website, accessed March 2024.

[3] Department of Climate Change, Energy, the Environment and Water, 'Minister's Priority List 2023–2024', DCCEEW website, accessed December 2023.

[4] Product Stewardship Centre of Excellence (May 2023) 'Evaluating product stewardship: Benefits and effectiveness, summary report', Product Stewardship Centre of Excellence website, accessed March 2024.

[5] Department of Climate Change, Energy, the Environment and Water (2019, 2022) 'National Waste Policy Action Plan 2019', DCCEEW website, accessed March 2024.

[6] Product Stewardship Centre of Excellence (May 2023) 'Evaluating product stewardship: Benefits and effectiveness, summary report', p. 10, Product Stewardship Centre of Excellence website, accessed March 2024.

***Case Study 1: Container Deposit Schemes***

Container deposit schemes (CDS) will soon be operating in every Australian state and territory.

These schemes have attracted industry and community participation and substantially reduced beverage container litter and landfilling. The schemes allow for access to quality recovered material, which leads to highest-value material reuse, such as bottle-to-bottle recycling. For example, the hot-wash PET flake generated from CDS products delivers high-quality recycled PET (rPET) for the Australian packaging market. The schemes also deliver uncontaminated glass for high-value recycling.

Through mandatory product stewardship including a 10-cent refund on returned containers, these schemes have delivered a national average recovery rate of 69%,[7] collectively resulting in the recovery of over 30 billion beverage containers, while supporting jobs as well as fundraising for community groups.

More work now needs to be done to improve return rates to international standards, achieve a nationally harmonised approach and lift governance in some schemes.

Product stewardship and extended producer responsibility schemes are intended to encourage manufacturers, retailers, consumers, and other stakeholders to take shared responsibility for the environmental and human health effects of products. They aim to drive environmentally beneficial outcomes through good design and clean manufacturing, including the use of components and materials that are easier to recover, reuse and recycle, and often involve strategies such as designing products for recycling, creating take-back programs for used products, and promoting responsible disposal practices.

***Case Study 2: Dutch Extended Producer Responsibility Textiles Decree***

In the Netherlands, an extended producer responsibility scheme (Uitgebreide Producentenverantwoordelijkheid, UPV)[8] for textiles came into effect on 1 July 2023. It establishes the following targets for reuse and recycling, which will ratchet up over time:

- By 2025, 50% of the previous year's total weight sold must be recovered for reuse or recycling. Of this percentage, at least 20% must be reused, with at least half reused in the Netherlands. By 2030, it increases to 75% of the previous year's total weight sold, with at least 25% reused of which 15% must be reused in the Netherlands.
- By 2025, 25% of all textile fibres of discarded textile products must be used in materials for new products (fibre-to-fibre recycling). By 2030, this must be 33% of all textile fibres.
- Producers will have to submit an annual report setting out the details of their compliance with the decree, and are financially responsible for setting up a suitable collection and processing system for discarded textile products. Non-compliance may be punishable with criminal law sanctions.

However, all products produced or distributed in Australia ultimately reach the Australian waste stream—including materials banned from export over the last few years. Onshore recycling and the creation of markets for recycled materials must therefore be an overarching priority across all product stewardship initiatives.

At a time when resource recovery rates have stagnated,[9] it is vital that recycling is prioritised. The recycling sector plays an indispensable role in diverting materials from landfill and reintegrating them into the supply chain, closing the loop in a circular economy.

Recycling operates as an integrated system, comprising collection, processing, and end markets for recycled materials. In particular, markets for recycled materials are paramount; without robust markets, the system fails.

---

[7] Total Environment Centre (2023) 'Review: Australian Container Refund Schemes', TEC website, p. 11, accessed March 2024.

[8] Netherlands Enterprise Agency, RVO 'Uitgebreide Producentenverantwoordelijkheid UPV', Business.gov.nl, accessed March 2024.

[9] Blue Environment (2022) 'National Waste Report 2022', report to the Australian Government Department of Climate Change, Energy, the Environment and Water, DCCEEW website, accessed March 2024.

***Case Study 3: REDcycle***

REDcycle was an industry-led program operating from 2011 as a broad-based return-to-store, soft plastics recovery program in Australia, facilitating the collection and processing of soft plastics into a variety of durable recycled plastic products. Product manufacturers and major Australian supermarkets partnered with REDcycle to run the program.

In November 2022, REDcycle announced that it was suspending soft plastics collection, as processing capacity for soft plastics and markets for recycled soft plastic products became limited.[10] It was later revealed that REDcycle was stockpiling over 10,000 tonnes of unprocessed soft plastic across dozens of locations Australia-wide.[11] In February 2023, REDCycle was declared insolvent, reflecting broader limitations of the recycling system for soft plastic.

As a product stewardship scheme, REDcycle was fuelled by strong marketing and collection rather than a robust recycling supply chain and stable end markets. In a market environment where the production of new plastics is still far outstripping the demand for recycled materials, the collapse of REDcycle underscores the importance of scrutinising the operational aspects of product stewardship schemes to ensure they are capable of fulfilling their objectives and contribute meaningfully to circular economy outcomes.

The failure of REDcycle has had a broad impact on public confidence in recycling, with the media often calling into question the effectiveness of Australia's broader recycling system, demonstrating that the reputation of the recycling industry (rather than manufacturers) is most severely compromised by poorly designed schemes.

Currently, many voluntary and co-regulated product stewardship schemes frustrate higher-order recycling outcomes by compounding a disconnect between manufacturers and recyclers, rather than fostering partnership. This divide persists partly because manufacturers are hesitant to bear the entire expense of recycling, which is not a cheap process in Australia, entailing higher costs than other countries in the region due to factors including labour, energy, logistics and stringent regulations protecting the environment and human health. Despite the challenges, the recycling sector remains indispensable in fostering sustainability and responsible material management.

Often, scheme administrators prioritise the establishment of a scheme as an end in itself, with a great portion of funding dedicated to administration, rather than actual and viable recycling. This emphasis on scheme establishment rather than delivery of robust outcomes, leads to many inefficiencies, particularly in crossover markets, as well as aggregation, and overall administration. In this sense, scheme administrators can create duplicative systems, adding cost to recycling systems without adding value.

## Product stewardship and extended producer responsibility

'Extended producer responsibility (EPR)' and 'product stewardship' refer to management approaches that emphasise producer responsibility for end-of-use outcomes for the materials and products they place on market. The terms are often used interchangeably as the sector matures and related initiatives expand and proliferate, which can create confusion among stakeholders.

For the purposes of this paper, product stewardship will be used to refer to both EPR and product stewardship unless stipulated otherwise—with a specific focus on voluntary and co-regulated schemes.

Whether EPR, or voluntary or mandatory product stewardship, or neither, is the correct approach for managing a product at end-of-use will be determined by the nuances such as the material's inherent value and properties, the maturity and economic viability of the recycling supply chain and end markets, and existing policy and regulation.

[10] Australian Competition and Consumer Commission (30 March 2023) 'Cooperation proposed to continue on soft plastics recycling after REDcycle liquidation', ACCC website, accessed March 2024.

[11] Miles, Daniel (30 November 2023) 'One year on from REDcycle's collapse, Australia remains without soft plastics recycling program', ABC News website, accessed March 2024.

***What is extended producer responsibility?***

Extended producer responsibility (EPR) places legal obligations on manufacturers, importers, or brand owners to take responsibility for the end-of-use management of their products. If enacted properly, it can be an effective way to ensure recyclability and fund recycling efforts. EPR schemes can mandate that brand owners take financial or operational responsibility for the collection, reuse, recycling, or safe disposal of their products at the end of their useful life.

Broader application of EPR can support greater resource efficiency if carefully implemented to avoid perverse outcomes. There must be transparency, meaningful and enforceable targets, continuous improvement and the input and involvement of the recycling industry, with EPR designed to work within, and improve, existing recycling systems.

***What is product stewardship?***

Product stewardship schemes can be voluntary, co-regulated or mandatory initiatives, where stakeholders engage in programs or initiatives to reduce the environmental footprint of products. Product stewardship can devolve producer responsibility for managing the lifecycle impacts of products onto a broader pool of stakeholders, particularly retailers, consumers and recyclers.

Currently, product stewardship schemes in Australia largely cater to the brand owners above the interests of the rest of the supply chain, which contains inherent risks and can result in poor environmental outcomes, for both product stewardship schemes and EPR. These concerns are shared by the Bureau of International Recyclers (see Case Study 4).[12]

It has become increasingly apparent that many EPR and product stewardship schemes have not sufficiently met expected targets,[13] and too much power given to only one type of stakeholder has resulted in opaque schemes lacking checks and balances and leading to poor environmental outcomes (see Case Study 9).

***Case Study 4: Bureau of International Recyclers Position on Extended Producer Responsibility[14]***

The Bureau of International Recycling (BIR) is a global federation supporting the interests of the recycling industry. BIR represents over 30,000 companies across 70 countries, through 37 national associations and over 1000 direct corporate members, covering eight material streams, including ferrous and non-ferrous metals, paper, textiles, plastics, tyres/rubber, and electrical/electronic equipment.

In 2023, BIR released a position paper on EPR highlighting growing international concern from recyclers about EPR. Key recommendations outlined in their statement include:

- EPR schemes must not disrupt existing efficient markets, and should be set up only when there is a need and only once the effectiveness and the intrinsic value of a waste stream have been assessed;
- governments should also consider other policy instruments to increase circularity, such as mandatory design for recycling and legally-binding recycled-content targets;
- recyclers should be involved in the governance bodies of such schemes to ensure an appropriate balance of interests among the most relevant stakeholders in the value chain, and;
- ownership of waste should be retained by the recycling company entrusted with the responsibility of processing the waste, with transparent and fair tenders to avoid monopolies and comply with competition rules.

[12] Bureau of International Recycling (November 2023) 'BIR Position Paper on Extended Producer Responsibility (EPR)', BIR website, accessed March 2024.

[13] Many product stewardship schemes do not report outcomes. Of those schemes required to do so, APCO has reported that the 2025 National Packaging Targets are on track but will not be met: APCO (2023) 'Australian packaging material flow analysis for 2020–21', APCO website, accessed March 2024.

[14] Bureau of International Recycling (November 2023) 'BIR Position Paper on Extended Producer Responsibility (EPR)', BIR website, accessed March 2024.

## Recyclers: The missing link in strong product stewardship outcomes

Critical problems arise when a key part of the scheme supply chain is unable to meaningfully engage on costs, logistics, and the state of end markets. While product stewardship schemes are intended to operate with all stakeholders working in concert, this is often not the case. In particular, recyclers and remanufacturers are not sufficiently involved in the establishment or ongoing operations of schemes.

Recyclers can highlight challenges and opportunities in the recycling process, such as recyclability of materials, components that help or hinder the recycling stream and markets for recycled materials. They are also positioned to provide expertise into efficient collection, sorting, quality control and processing methods, improving the overall effectiveness of the stewardship scheme and reducing contamination in recycling streams.

Currently, recyclers and remanufacturers are under-represented on boards across product stewardship schemes. Of the thirteen co-regulated and Government-accredited voluntary schemes in Australia, only five publicly disclose their governance arrangements, and of those, only two show recyclers on the board (as shown in *Appendix 1: Governance arrangements of Australian Government-accredited schemes.*

The involvement of recyclers in the governance of product stewardship schemes can help to ensure that recycling is economically viable and drive market demand for recycled materials. With rising costs across recycling facilities, it is particularly critical that recyclers are at the table to highlight market failures, to inform whether, and when, intervention through a product stewardship scheme is necessary.

***Case Study 5: Tyre Product Stewardship Scheme***

Tyre Stewardship Australia (TSA), which commenced in 2014, raises a 25 cent per tyre levy from participating tyre manufacturers, amounting to $7.6 million in 2023. These funds are distributed across three primary functions: research and development for new end-of-life-tyre (EOLT) products; an accreditation program for collectors, recyclers and retailers; and consumer marketing.

TSA is a manufacturer-led and governed organisation. There is no recycling industry representation on the board and little overall strategic engagement with the recycling sector. TSA has no role in the collection and recycling of EOLTs, and no funds from the scheme are provided to the sector. In the year ending June 2023, while TSA's levy income increased by 20%, spending on market development dropped to one-quarter of the company's spending (47% went to consultancy expenses, advertising and marketing).

This lack of engagement with the recycling sector has led to some ill-informed decisions. For instance, by accrediting 'balers' (the cheapest disposal option for tyre retailers), prior to the Australian Government's ban on the export of whole baled tyres, TSA effectively endorsed many millions of unprocessed EOLTs to be exported to developing countries in our region and to very poor environmental outcomes such as open burning.

The ACCC recently acknowledged concerns raised by sector stakeholders in relation to the effectiveness of the scheme, citing insufficient representation on the TSA board, particularly in relation to the tyre recycling sector.[15] Stakeholders identified further concerns stemming from this lack of representation, including the accreditation, under the scheme, of businesses that were uncompliant with scheme objectives, and insufficient oversight of unprocessed EOLT's exported overseas.

ACCC- and Government-endorsed product stewardship schemes are often called on to speak as authorities on recycling, or are credited with recycling outcomes. TSA, for example, points to increased EOLT recovery rates since the scheme's formation as demonstration of its success; however, this change should more appropriately be credited to tightened state-based regulation: over the same time period, every state substantially reformed regulation of the storage, transportation, fire safety, end-of-use disposal and other environmental management aspects of EOLTs. Together, these regulatory changes provided an impactful disincentive to stockpiling EOLTs and fostered increased recycling investment and activity.

TSA is lobbying the Australian Government to intervene in the sector via regulated product stewardship, despite a 97% collection rate for used passenger and commercial tyres. Since state regulations to limit stockpiling and illegal dumping have been effective, it is unclear what environmental outcome a regulated scheme would deliver.

[15] Australian Competition and Consumer Commission (May 2018) 'ACCC re-authorises Tyre Stewardship Scheme', ACCC website, accessed January 2024.

## Scheme accountability

Government-backed schemes must deliver genuine circular economy and recycling outcomes. One way to deliver meaningful outcomes is to ensure that schemes are advancing progress towards the targets in the National Waste Policy Action Plan and Australia's 2025 Packaging Targets,[16] specifically:

- reducing the total waste generated in Australia by 10% per person by 2030
- achieving an 80% average recovery rate from all waste streams by 2030
- phasing out problematic and unnecessary plastics by 2025
- halving the amount of organic waste sent to landfill by 2030
- 100% of packaging being reusable, recyclable or compostable by 2025
- 70% of plastic packaging being recycled or composted by 2025
- 50% of average recycled content included in packaging by 2025.

Accountability at present is insufficient to ensure best-practice operations and high-value recycling outcomes. A history of self-reporting with little benchmarking or consideration for tangible targets appears to have fostered a culture of accepting any increase in material collection as 'success' of some schemes (see Case Study 5). This self-reported data often goes unchallenged, even where issues are brought to the ACCC's attention, leading to reduced confidence and ultimately constraining investment in new recycling capacity and capability.[17]

Product stewardship schemes in Australia are also able to run their own accreditation programs for recyclers, establishing specific criteria and standards that recyclers must meet to participate in their schemes. These criteria typically focus on factors such as operational processes, compliance with regulations, the ability to meet quality standards for recycled materials, and (ideally) environmental impact. Recyclers seeking accreditation usually undergo assessments, audits, and evaluations to ensure they meet these set standards before being approved to participate in the product stewardship schemes.

These 'bespoke' accreditation programs for recyclers represents a conflict of interest insofar as the priority of schemes is to keep recycling costs low, rather than ensure best-practice recycling outcomes (see Case Studies 7 and 9). This is costly and inefficient for both recyclers and brand owners, given that some recyclers service more than one scheme and are therefore required to be separately accredited. For example, in the mandatory National Television Computer and Recycling Scheme, recyclers must be approved by each and every co-regulator that they supply, resulting in duplication of effort.

Product stewardship schemes must ensure transparency, accountability and effectiveness. In particular, schemes that are accredited by the Australian Government must be required to meet a much higher standard of governance, transparency and material outcomes.

## ACCC leverage and access

Federal accreditation is a six-month process that enables industry-led product stewardship operations to demonstrate to businesses and consumers that the arrangement has the Australian Government's stamp of approval.[18]

An ACCC authorisation can also be granted, where schemes can be exempted from competition provisions—such as those guarding against anti-competitive and cartel-like behaviours—and the ACCC may grant protection from legal action for conduct that might otherwise breach the *Competition and Consumer Act 2010* (the Act). Schemes seek authorisation where they wish to engage in conduct that is at risk of breaching the Act but nonetheless consider there to be public benefit.

---

[16] Department of Climate Change, Energy, the Environment and Water (2019, 2022) 'National Waste Policy Action Plan 2019', DCCEEW website, accessed March 2024.

[17] Australian Tyre Recyclers Association (2 February 2024) 'Authorisations register: Tyre Stewardship Australia Limited', submission, ACCC website, accessed March 2024.

[18] Department of Climate Change, Energy, the Environment and Water (March 2023) 'Product stewardship accreditation', DCCEEW website, accessed March 2024.

Since product stewardship should align with broader public interest by promoting sustainability, reducing waste, and safeguarding environmental and public health, ACCC authorisation affords schemes access to a suite of anti-competitive instruments,[19] such as:

- cartel conduct,
- contracts, arrangements or understandings containing anti-competitive provisions,
- exclusive dealing,
- misuse of market power,
- secondary boycotts, and
- resale price maintenance.

While ACCC authorisation can support the delivery of public benefit through a product stewardship scheme, some schemes have elicited commercial in-confidence data from the recycling industry through their ACCC authorisation, which has subsequently been used to benefit brand owners of the scheme, rather than support a whole-of-supply-chain stewardship outcome.[20] Some schemes also seek to conflate the achievements of the recycling sector with those of the scheme (see Case Study 5).

[19] Robert Janissen (3 September 2021) 'ACCC Authorisation for product stewardship schemes', webinar, Product Stewardship Centre of Excellence website, accessed March 2024.

[20] Australian Tyre Recyclers Association (2 February 2024) 'Authorisations register: Tyre Stewardship Australia Limited', submission, ACCC website, accessed March 2024.

# Recommendations

## 1. Rethink and restructure product stewardship

While product stewardship and EPR schemes can have positive outcomes if operated fairly and transparently, to ensure best practice there needs to be greater critical consideration of the market conditions and alternative approaches before new product stewardship schemes are established.

Consideration should be given as to whether product stewardship should be the only mechanism to be instituted. Other effective mechanisms, such as higher landfill levies, landfill bans, product bans and the enforcement of existing regulation, will be effective in some sectors, and often more cost-effective. Many of these policy mechanisms are blunt instruments that do not place responsibility and costs on the brand owner. EPR should be considered amid this range of policy options, and prioritised where adequate funding is not available for optimum end-of-life solutions, or where there is significant market failure.

Product stewardship schemes should be considered as a mechanism to support the development of infrastructure and markets for recycled materials, encourage correct collection, and increase end producer responsibility. If a robust end market exists with adequate investment in recycling and resource recovery, a scheme could, where appropriate, be wound down.

Product stewardship schemes are more appropriate and effective when applied to new recycling supply chains—or where collection and recycling rates are low—rather than retrofitting to mature recycling markets. Uncertainty about how new schemes might be established will deter investment in particular material streams, with a potential domino effect on investment confidence across broader recycling streams. There is a need for clarity about where the Australian Government will, and will not, intervene, with a priority of engaging closely with the recycling sector to ensure that domestic investment is not disrupted or undermined.

A product stewardship scheme 'Trigger Framework' could define clear parameters about when a scheme should be initiated for a product, or whether a new product or category should be added to an existing scheme in order to improve efficiency and minimise duplication of effort. Ensuring all parties in the supply chain know schemes will be triggered once a set of transparent criteria are met—alongside consultation with relevant supply chain stakeholders, including the recycling sector—will foster market and investment confidence.

While end markets are key to driving recycling, there will often remain a recycling cost to be covered by a credible scheme that distributes risk equitably across the supply chain. In sectors where there are low recovery rates, or the free market does not support an economically viable recycling system, levies must represent the real cost of recovery and recycling, take into consideration different recycling outcomes that can deliver lower and higher value outputs, and support recycling development innovation.

Scheme funding that falls short of covering the cost of recycling fundamentally undermines genuine recycling outcomes.

**RECOMMENDATION 1.1 'Trigger Framework' to determine when a product stewardship scheme is required**

In consultation with recyclers, brand owners and sector experts, the Australian Government should **establish a transparent 'Trigger Framework'** to determine when a product stewardship scheme becomes necessary: when certain market conditions exist or recovery rates stagnate or fall. This framework must include consultation with all supply chain stakeholders, particularly recyclers.

Attached to the 'Trigger Framework', an **exit conditions metric should be outlined for every new scheme,** dictating under what economic and environmental conditions and recycling rates a scheme could be wound down, repositioning some schemes as tools for market rehabilitation and not an end in themselves.

**RECOMMENDATION 1.2 Assess and embed actual costs of recovery and recycling**

Ahead of endorsing any product stewardship or EPR scheme, the Australian Government should work with the recycling sector to conduct a comprehensive assessment of the **actual costs of recovery, recycling and remanufacture** of relevant material streams. This assessment should consider the entire recycling value chain, including collection, logistics, sorting, processing and markets for recycled materials, and would inform appropriate scheme fees and financing.

Governments must ensure that extended producer responsibility measures undertaken by product stewardship schemes address actual costs of recovery and recycling, support genuine and highest-value recycling outcomes, and investment in Australian recycling.

## 2. Design for recycling and reuse

One of the biggest challenges to material recovery at end of use is poor design. A key component for every product stewardship scheme must be to ensure that brands and brand owners design for better material recovery and reuse, with a priority of procuring recycled materials.

Around the world, innovative closed-loop solutions are being deployed independently of product stewardship schemes. For example, an aid in the correct sorting of materials for reuse is the 'materials passport'.[21] Through smart material choices and designing for disassembly, these materials passports will make it possible for manufacturers to recoup some of their original investment, as materials can be sold back into the supply chain, and ultimately used again.

***Case Study 6: Materials Passport and Venlo City Hall***

In the Netherlands, a 'materials passport' innovation was deployed during the construction of Venlo City Hall. The passport records exactly what goes into the building, and will support the correct sorting of materials for reuse.

All components of the building were documented during construction in a materials database—or 'materials passport'—that describes the materials and provides an end-of-use plan, such as how to disassemble and recycle or return them to the manufacturer. By effectively creating a materials bank within the walls of the City Hall and designing for disassembly, it will be possible to recoup some of the original investment, at a later date, as materials can be sold back to manufacturers through a 'buy and buy-back' scheme, and ultimately used again.[22]

Furthermore, during its construction numerous producers and suppliers acquired Cradle to Cradle (C2C) certifications for their products.[23]

It is understood that relatively few products are manufactured in Australia; however, given that all products distributed in Australia ultimately enter into Australian waste streams, it is vital that schemes implement measures to influence design for the Australian market.

Adopting more robust EPR regulations enforces producer responsibility for the entire lifecycle of their products, including collection, recycling, and remanufacture. This, in turn, encourages the design of products that are easier to disassemble, reuse, or recycle.

**RECOMMENDATION 2.1 Federal EPR legislation, initiated by 'Trigger Framework'**

The Australian Government should **implement Extended Producer Responsibility legislation** that holds manufacturers responsible for the end-of-use management of their products, to encourage circular design and increase the demand for recycled materials. This EPR legislation should only be initiated when conditions of a **'Trigger Framework'** (RECOMMENDATION 1.1) have been met.

[21] Cradle to Cradle, 'City Hall Venlo', C2C Venlo website, accessed March 2024.

[22] Ellen Macarthur Foundation (June 2021) 'City Hall from Cradle to Cradle: Venlo', Ellen Macarthur Foundation website, accessed March 2024.

[23] Kraaijvanger Architects, 'Municipal Office Venlo', Kraaijvanger website, accessed March 2024.

**RECOMMENDATION 2.2 Evidence-based targets for recyclability, with targets increasing over time**

Overseen by the Australian Government, product stewardship schemes should set **evidence-based targets** for reuse and recyclability within product categories that are reusable/recyclable and those that are not. Targets for reusability and recyclability should increase over time, with measures in place to hold brand owners and distributors to account.

# 3. Create market demand

Too often, product stewardship advocates appear to consider the establishment of a scheme as an end in itself—in terms of meeting sustainability obligations—rather than a means to this end. A thriving and scaled recycling sector is an essential component of a functioning circular economy—and recycling cannot function without robust markets for recycled materials.

Theoretically, anything is recyclable, but recycling at scale must be economically viable, addressing the cost of Australian labour, logistics, compliance, infrastructure, research and development, and, most critically, supporting end markets for recycled materials.

***Case Study 7: Seamless***

Australians are the second-largest consumers per capita of textiles globally, purchasing on average an estimated 27 kilograms of new fashion and textiles each year, of which on average 93% is disposed of.[24] In 2018–2019, 227,000 tonnes of clothing were landfilled in Australia, 105,900 tonnes were exported, 51,000 tonnes were reused locally, 7,000 tonnes were recycled and 5,000 tonnes went to waste to energy.

The Australian Fashion Council clothing product stewardship scheme, Seamless, launched in June 2023. The Board was announced in in December 2023,[25] with no representation from the recycling sector.

The scheme design outlined a proposal to reduce this consumption and waste by raising a levy of 4 cents per garment to be invested in education, scheme administration, and research and development[26].

This levy does not adequately address the costs of recycling and the scheme design in fact risks potentially locking in a status quo arrangement in the fashion industry: restricting trade and access to feedstock, and remuneration for recyclers.

The scheme design does not address the economic and regulatory mechanisms necessary to drive resource recovery: there are no identified end markets for recycled products generated by the scheme and no firm work plans to develop these markets; no restrictions on the export of textile waste; no landfill bans (noting that some participants are entitled to a waste levy exemption); and insufficient funding for higher-order recycling.

Under the current design, Seamless will likely raise revenue from consumers while increasing export revenue from used textiles (including textile waste), without increasing Australian recycling rates.

There are significant barriers to strong market uptake of recycled material, including cost competitiveness with virgin materials and willingness within the supply chain to embrace change. To date, an uneven approach has been taken by the Australian Government, with a focus on banning the export of 'waste' without measures to address imported products that ultimately enter Australian waste streams. Conversely, there are no drivers to address the import of products that ultimately all become Australian waste, at end of use, as well as imported virgin and recycled materials that compete with Australian recycled products.

While there must be strong prioritisation of domestic end markets, export markets for processed recycled commodities should be recognised as a legitimate avenue, akin to any other exported commodity, noting that the focus must be on domestic processing.

---

[24] Monash Sustainable Development Institute (2022) 'Textiles: A transitions report for Australia identifying pathways to future proof the Australian fashion and textile industry', report, p. 6, Monash University website, accessed April 2024.

[25] Australian Fashion Council (18 December 2023) 'Seamless announces inaugural CEO and Board of Directors', media release, Australian Fashion Council website, accessed February 2024.

[26] Australian Fashion Council (2023) 'Scheme Design Summary Report', Australian Fashion Council website, accessed February 2024.

Establishing a circular economy underpinned by a strong recycling sector will require the correct economic drivers. For example, mandated recycled plastic content in the United Kingdom has catalysed investment in recycled polymers by creating market demand.[27] Requiring manufacturers to use a certain percentage of recycled content in their products has created a stable market for recycled polymers, encouraging investment in recycling infrastructure and technologies to meet this demand.

In Australia, many in the recycling industry advocate for the mandatory implementation of the 2025 National Packaging Targets set out in the Australian Packaging Covenant Organisation. In 2023, the Australian Government committed to regulate packaging and ultimately enforce these targets:[28] the creation of robust end markets by 2025, ensuring that packaging incorporates 50% recycled content on average, and achieving 100% reusability, recyclability, or compostability.[29] While not yet defined, it is anticipated that the scope of this regulation will encompass all packaging sold in Australia, accompanied by consistent benchmarking and transparent reporting.

Formal government adoption of these targets would provide substantial backing for a flourishing, competitive recycling sector by mandating recycled content in packaging. This would support the integration of recycled products and materials into supply chains, fostering resilient and strong end markets.

Circular agreements can also play a useful role in fostering downstream end markets.[30]

**RECOMMENDATION 3.1 Robust end markets for Australian recycled content**

Product Stewardship schemes must prioritise **demand generation** and play an active and specific funded role in directly supporting robust and viable end markets for Australian recycled materials.

**RECOMMENDATION 3.2 Economic incentives for use of recycled materials**

The Australian Government should create **economic incentives** for using recycled materials, such as tax incentives, subsidies, grants, or differentiated regulatory fees, which can offset the cost difference between recycled and virgin materials, making the use of recycled materials more financially attractive for businesses. Incentives to use recycled materials specifically derived from product stewardship schemes should be considered.

**RECOMMENDATION 3.3 Minimum thresholds for Australian recycled content**

All Governments should implement strong drivers and mandated procurement targets to support uptake of Australian recycled content, such as a **price signal** to prioritise Australian recycled content over virgin materials and mandatory **minimum thresholds for Australian recycled content**.

**RECOMMENDATION 3.4 Certification and labelling for Australian recycled content**

The Australian Government should work with industry to **establish certification and labelling programs** that identify products made from recycled materials to help consumers make informed choices and increase demand by driving manufacturers to incorporate more recycled content.

**RECOMMENDATION 3.5 Target dumped and subsidised imported material**

The Australian Government should support a level playing field for the Australian recycling market by more **strongly targeting dumped and subsidised imported materials**.

---

[27] NetZero Pathfinders, 'Recycled Content Mandates: U.K.', Bloomberg website, accessed March 2024.

[28] Department of Climate Change, Energy, the Environment and Water, 'Reforming packaging regulation', DCCEEW website, accessed March 2023.

[29] APCO, 'Australia's 2025 National Packaging Targets', APCO website, accessed March 2024.

[30] Steve Morriss (1 February 2024) 'Circular Contracts: The future of recycling', Close the Loop blog, accessed March 2024.

# 4. Enhance collection infrastructure and consumer incentives

While some product stewardship schemes have achieved desirable collection rates for end-of-use items, this is not the case across all product categories. Schemes that provide little incentive for consumers to return items to away-from-home collection points, and/or haven't supported a comprehensively accessible and well-marketed collection network, generally have poor collection rates.[31]

Of major concern are items that pose a risk across all other collection and recycling streams, such as those containing loose or embedded batteries which cause fires in waste and recycling trucks and facilities. The rapid digitisation and electrification of everyday items, the increasing number of 'smart' and disposable items such as vapes containing embedded and sealed batteries, and a lack of consumer education around their safe collection, have all contributed to the steep and hazardous rise in batteries in inappropriate waste streams.[32]

There is considerable confusion about which items contain batteries and which schemes different electronic products are subject to. For example, it is not widely understood that vapes and digital thermometers contain batteries. Also, while there are an array of schemes addressing electronic and electrical products—including the mandatory National Television Computer and Recycling Scheme (NTCRS), the voluntary Mobile Muster scheme, and the voluntary B-cycle scheme—many items are not accepted by any of these schemes, leaving gaps for necessary collection and creating confusion in the community about appropriate disposal options.

Despite this critical lack of access to safe collection locations for these items, to date no comprehensive geographic mapping of the gaps has been undertaken. Even with a product stewardship scheme in place, if there are limited accessible safe disposal avenues, the only options for the community are to stockpile, litter or dispose into incorrect waste streams.

Not only is there insufficient infrastructure to collect such items safely and comprehensively, but there are also no compelling drivers to divert these types of products from conventional recycling streams (such as household bins), resulting in major hazards across the recycling sector.

As the Australian Government reviews the framework for e-stewardship, it is essential that all e-products (including those with batteries) are addressed holistically, rather than the current piecemeal approach.

There must be comprehensive access for collection, as well as compelling incentives for consumers to return items to appropriate drop-off locations—especially items that pose a risk to human health, the environment or conventional waste and recycling systems.

Highest-value recycling outcomes are achieved through well-sorted and separated recovered products and materials.

At a consumer level, there must be a strong incentive to safely dispose of these products through the introduction of a refund or deposit scheme, similar to container deposit schemes. This will help to drive the correct collection of products at end of use, which is critically important for items that are hazardous, such as loose and embedded batteries. Concerns that a refund on batteries might expose consumers to risk can be addressed by ensuring that refunds are contingent on safe collection practices and appropriate community education.

[31] For example, in 2023, B-cycle's collection rate of in-scope loose batteries was 12%. See B-cycle (July 2023) 'Positive Charge: 2022–2023 Report', B-cycle website, accessed March 2024.

[32] ACOR (December 2023) 'A Burning Issue: Navigating the battery crisis in Australia's recycling sector', ACOR website, accessed March 2024.

***Case Study 8: B-cycle***

B-cycle, which launched in January 2022, is an ACCC-authorised product stewardship scheme for loose batteries, run by the Battery Stewardship Council.

The B-cycle scheme accepts all small loose and easily removable batteries, including regular AA and other sizes, button batteries, rechargeable batteries, and small removable batteries from devices like hearing aids, power tools, e-bikes and digital cameras, but does not accept embedded batteries, batteries over 5 kilograms, mobile phone or laptop batteries, lead acid batteries or exit lighting. Not all loose batteries are within the scope of the scheme, and determining which batteries are in or out of scope remains confusing even for those working in the sector.

The authorisation by the ACCC identified that a levy would be applied to imported batteries at a rate of 4 cents per 24 grams, and would be used to fund the scheme and a rebate system for service providers responsible for the battery's collection, sorting and processing. However, the scheme only applied a 2 cent levy at its inception, raising this amount to 3 cents in 2022 and subsequently applying the 4 cent levy at the beginning of 2024.[33]

Meanwhile, Australia's battery recyclers have identified that the B-cycle funding for recycling is insufficient.[34] In 2023, the collection rate was 12% of loose in-scope batteries.[35]

Some battery manufacturers and retailers are in competition with B-cycle, in an effort to pursue better recycling outcomes more efficiently. Those who independently pay for their batteries to be recycled can achieve higher-value outcomes by paying the recycler directly, rather than paying a levy to B-cycle on one hundred per cent of products for the lower rate of recycling.

**RECOMMENDATION 4.1 Expand the scope of mandatory e-stewardship, incorporating all consumer electronic and electrical equipment and loose and embedded batteries into one comprehensive scheme**

The Australian Government should **expand the scope of mandatory e-stewardship, incorporating all consumer electronic and electrical equipment into one comprehensive scheme**—including any product connected to a plug or that contains batteries, as well as all loose and embedded batteries, to bring Australia into line with European standards.

**RECOMMENDATION 4.2 Gap analysis of disposal options for all electronic and hazardous waste streams**

State and Territory Governments must conduct a detailed **gap analysis of disposal options for all electronic and hazardous waste streams**, to help inform future schemes and policy decisions.

**RECOMMENDATION 4.3 Comprehensive network of safe disposal sites**

State and Territory Governments must ensure that **a comprehensively accessible network of safe disposal options is provided to all Australians** for materials that are hazardous in conventional waste and recycling streams, such as loose and embedded batteries, supported by strong community education campaigns.

**RECOMMENDATION 4.4 Incentivise safe battery collection with deposit refund**

Product stewardship schemes must strongly incentivise safe collection of batteries at end of use by **introducing a deposit refund for safe disposal at appropriate collection points**.

[33] Battery Stewardship Council (December 2023) 'Circular Batteries Australia Position Paper', p. 7, B-cycle website, accessed March 2024.

[34] Lisa Korycki (29 February 2024) 'Ecocycle flags e-waste recycling challenges', *Waste Management Review*, accessed March 2024.

[35] B-cycle (July 2023) 'Positive Charge: 2022–2023 Report', B-cycle website, accessed March 2024.

# 5. Tighten scheme governance

Governments and industry are increasingly relying on product stewardship schemes to meet circular economy principles. A properly functioning circular economy requires participation from every stage of the supply chain. Currently, these schemes typically represent only one stage of the circular economy supply chain: producers and distributors (also known as brand owners).

Many existing product stewardship schemes are not neutral bodies, but rather reflect the interests of brand owners over the rest of the supply chain, including recyclers. To effectively deliver a circular economy, product stewardship schemes must have a governance structure that equitably represents every stage of the supply chain.

Product stewardship schemes often exclude the recycling sector—tasked with delivering the scheme's ultimate outcomes—from meaningful participation in scheme governance, development and design. It is essential that the entire supply chain should participate in establishing a scheme's goals and ongoing operation, through adequate representation on scheme boards.

Stakeholder governance is increasingly acknowledged as a path for organisations to better address environmental, social and governance (ESG) considerations,[36] with conflicts of interests addressed through compliance with director's responsibilities, including fiduciary duties.[37] Scheme governance can also include community and council representatives. An independent chair may also help to address producer dominance of schemes.

Effective stakeholder representation in product stewardship scheme leadership is particularly pressing in light of the ACCC's recently prioritised focus on environmental claims, and given that every product stewardship initiative aims to collect and recycle their products. Schemes must deliver genuine recycling outcomes in order to support a circular economy and community confidence in recycling.

Transparent, objective and consistent data and reporting is also required to assess scheme efficacy against rigorous targets.

**RECOMMENDATION 5.1 Supply-chain representation in product stewardship scheme governance**

Product stewardship schemes must have **supply-chain representation within their governance structures**. This should comprise an independent Chair, and a Board that includes representatives and expertise from all stages of a circular supply chain, with equal decision-making powers and formal channels to provide expertise. Recycling industry representation should be proportionate to the operational costs borne for the actual recycling of the product waste stream.

**RECOMMENDATION 5.2 Recycling sector expert convenor to engage product stewardship schemes with recycling sector**

To address RECOMMENDATION 5.1, establish and adequately resource a **recycling sector expert convenor**, under the auspice of the Australian Council of Recycling, to facilitate engagement with subject matter experts and leaders in the recycling sector and provide guidance and board directors to schemes.

[36] Zishu Chen (June 2022) 'Corporate governance: Meet the new champions of stakeholder capitalism', World Economic Forum website, accessed March 2024.

[37] Various frameworks and guidelines set out directors' responsibilities regarding environmental outcomes, including the European Commission's Corporate Sustainability Due Diligence Directive, the UN's Guiding Principles on Business and Human Rights, and the OECD's Guidelines for Multinational Enterprises and Due Diligence Guidance for Responsible Business Conduct.

**RECOMMENDATION 5.3 Clearly defined and measurable objectives, rules and targets**

Schemes should have **objectives, rules and targets that are clearly defined and measurable**, to track progress, evaluate the effectiveness of the scheme, and make necessary adjustments over time. Well-defined metrics—especially regarding recycling and scheme compliance from all parts of the supply chain—will identify areas for improvement and highlight successes.

**RECOMMENDATION 5.4 Transparent data about objectives, decision-making processes, recovery rates, recycling outcomes and material movement**

**All stakeholders should have access to information** about the scheme's objectives, decision-making processes, recovery rates, recycling outcomes and material movement, reported at a state level. This transparency helps prevent conflicts of interest when tendering for services and ensures that the scheme's actions align with its intended goals.

**RECOMMENDATION 5.5 Ensure that the scheme's objectives are met with accountability measures**

Stakeholders within schemes should be incentivised to actively participate in and contribute to the circular economy, particularly recycling. There must be **mechanisms for holding participants accountable** to commitments and actions in place to ensure that the scheme's objectives are met.

# 6. Enforce compliance and consequences

Ensuring compliance with existing regulations must be a priority to increase recycling rates, along with a harmonised accreditation scheme that supports best-practice recycling outcomes.

'Bespoke' accreditation systems for schemes effectively lead to schemes self-reporting, while creating excessive costs and inefficiencies for both recyclers and brand owners.

Conflict of interest can also go unchecked when schemes develop their own accreditation systems for recyclers, for example, by emphasising cost-cutting measures over high-quality results.[38] Scheme accreditations can introduce uncertain and untrustworthy data, undermining confidence and ultimately limiting investments in expanding new recycling capacities and capabilities.

ACOR has scoped the value of a national accreditation program for Australian recyclers, and is now working with industry and government to advance the establishment to provide a framework for independent, objective and consistent assessments that determine whether a recycling site is operating to a specified standard in a secure, sustainable and resilient manner.

While it is crucial to ensure that recyclers are operating legitimately, it is also a priority to address the fragmented, variable and duplicative regulatory environment across Australia's States and Territories. There must be a nationally harmonised resource recovery framework to prioritise circular economy outcomes, define 'end of waste' and support investment confidence in recycling. There must also be much more effective enforcement of Australia's waste export regulation and a broadening of this regulation to address other materials—including textiles and unprocessed scrap metal—to ensure that Australia's international environmental duties are met, and Australia's recycling capabilities are supported. The cost of this regulation should be placed on producers and distributors, who are responsible for the products placed on market, not on the recycling sector.

[38] For examples, refer to the included case studies.

***Case Study 9: National Television and Computer Recycling Scheme***

The National Television and Computer Recycling Scheme (NTCRS),[39] established in 2011, provides collection and recycling services for televisions and computers, including printers, computer parts and peripherals. The scheme is intended to reduce e-waste to landfill, increase the recovery of reusable materials, and provide convenient access to recycling services for households and small businesses.

Companies who import or manufacture television and computer products over certain thresholds are liable under the scheme, and are required to pay for a proportion of recycling through membership in an approved co-regulatory arrangement. These five co-regulators are responsible for the day-to-day operation of the scheme, including organising collection and recycling of e-waste on behalf of brand owners (known as liable party members within the NTCRS).

However, the NTCRS has become an inefficient system with a two-tiered marketplace: the five co-regulators compete to offer the lowest fees to brand owners, forcing prices down to unsustainable levels, while recyclers are reduced to price-takers. The NTCRS has become a 'race to the bottom' for some brand owners at the expense of best-practice recycling and environmental outcomes.

The drive towards low-cost outcomes has incentivised some co-regulators to reduce accessibility, or compromise on material recovery rates. There is little transparent downstream verification or reporting of recycling outcomes: audits in the NTCRS are primarily financial audits, with cursory attention to operational elements.

The Department of Climate Change, Energy, the Environment and Water is currently leading a redesign of the NTCRS to broaden the parameters of e-stewardship regulation to likely include all small electrical and electronic products as well as solar photovoltaic systems. The revised scheme must address the NTCRS's inefficiencies and inherent conflicts of interest, while driving a properly comprehensive approach to e-stewardship, incorporating all consumer electronic and electrical equipment and loose and embedded batteries.

**RECOMMENDATION 6.1 Australian Recyclers Accreditation Program (ARAP)**

The Australian Government should support compliance through the implementation and adoption of an **Australian Recyclers Accreditation Program** (ARAP).[40]

**RECOMMENDATION 6.2 Enforce waste export regulations**

The Australian Government should more effectively and proactively **enforce existing waste export regulations,** with impactful consequences including fines and imprisonment. The cost of regulation should be placed on producers and distributors, who are responsible for products placed on market.

**RECOMMENDATION 6.3 Regulate the export of waste textiles, unprocessed scrap metal and unprocessed e-products**

The Australian Government should **expand the existing waste export rules** to specifically address waste textiles, unprocessed scrap metal and unprocessed e-products.

**RECOMMENDATION 6.4 Tax incentives or priority access to markets for best-practice recycling facilities**

The Australian Government should create incentives, such as **tax incentives or priority access to markets**, for recycling facilities that consistently demonstrate high levels of compliance.

[39] Department of Climate Change, Energy, the Environment and Water, 'National Television and Computer Recycling Scheme', DCCEEW website, accessed March 2024.

[40] Australian Council of Recycling, 'Australian Recyclers Accreditation Program', ACOR website, accessed March 2024.

**RECOMMENDATION 6.5 Product stewardship schemes to be subject to third-party audits and/or inspections**

The Australian Government should require **regular independent audits** to assess compliance with regulations and internal policies, holding stewardship schemes to greater account via more vigilance, auditing and assessment of claims made by schemes regarding performance, industry data and reporting protocols. **Third-party audits and/or inspections**—underpinned by circular principles—should also be implemented to provide unbiased assessments of compliance and identify areas for improvement.

**RECOMMENDATION 6.6 A nationally harmonised resource recovery framework**

The Australian Government, together with State and Territory Governments, should **establish a nationally harmonised resource recovery framework**, to prioritise circular economy outcomes, define 'end of waste' and support investment confidence in recycling.

# Conclusion

This paper has outlined some of the challenges for recyclers in the current operations and mandates of product stewardship schemes. As governments and industries look towards greater product stewardship and extended producer responsibility (EPR) models as a key tool in the circular economy, it is vital that we encourage a more transparent, inclusive and effective dialogue around their establishment and viable operations. Greater collaboration will ultimately lead to product stewardship schemes that deliver more benefits for brand owners, governments, the community and recyclers.

It is essential to the success of any recycling operation, regulation or policy that recyclers and remanufacturers have a seat at the table, and are consulted often and with intention. In product stewardship schemes, brand owners represent only a small fraction of the mechanism, but hold the most authority and decision-making power. As a key part of the supply chain, the recycling, resource recovery, and remanufacturing sector is essential to ensure product stewardship schemes deliver a circular economy. To date, this sector's experience and expertise has largely been overlooked at best, or systematically ignored at worst.

Ultimately, the key recommendations contained in the paper are an offer from our sector to collaborate, share our expertise and find a path forward to work together with government and industry to achieve a thriving circular economy.

# Appendix 1: Governance arrangements of Australian Government-accredited schemes

| Scheme | Type | Governance arrangements published? | Recycler on Board? |
|---|---|---|---|
| Activ Group | Co-regulated | No | Unknown |
| ANZRP | Co-regulated | Yes | No |
| APCO | Co-regulated | Yes | Yes |
| B-cycle | Voluntary | Yes | Yes |
| Big Bag Recovery | Voluntary | No | Unknown |
| EcoCycle | Co-regulated | No | Unknown |
| Ecoloop | Voluntary | No | Unknown |
| Ecycle | Co-regulated | No | Unknown |
| Mobile Muster | Voluntary | No | Unknown |
| Project Earth (Dulux) | Voluntary | No | Unknown |
| Seamless | Voluntary | Yes | No |
| SPS Aust | Co-regulated | No | Unknown |
| Tyre Stewardship Australia | Voluntary | Yes | No |

# Appendix 2: Summary of recommendations

## 1. Rethink and restructure product stewardship

**RECOMMENDATION 1.1 'Trigger Framework' to determine when a product stewardship scheme is required**

In consultation with recyclers, brand owners and sector experts, the Australian Government should establish a transparent 'Trigger Framework' to determine when a product stewardship scheme becomes necessary: when certain market conditions exist or recovery rates stagnate or fall. This framework must include consultation with all supply chain stakeholders, particularly recyclers.

Attached to the 'Trigger Framework', an exit conditions metric should be outlined for every new scheme, dictating under what economic and environmental conditions and recycling rates a scheme could be wound down, repositioning some schemes as tools for market rehabilitation and not an end in themselves.

**RECOMMENDATION 1.2 Assess and embed actual costs of recovery and recycling**

Ahead of endorsing any product stewardship or EPR scheme, the Australian Government should work with the recycling sector to conduct a comprehensive assessment of the actual costs of recovery, recycling and remanufacture of relevant material streams. This assessment should consider the entire recycling value chain, including collection, logistics, sorting, processing and markets for recycled materials, and would inform appropriate scheme fees and financing.

Governments must ensure that extended producer responsibility measures undertaken by product stewardship schemes address actual costs of recovery and recycling, support genuine and highest-value recycling outcomes, and investment in Australian recycling.

## 2. Design for recycling and reuse

**RECOMMENDATION 2.1 Federal EPR legislation, initiated by 'Trigger Framework'**

The Australian Government should implement Extended Producer Responsibility legislation that holds manufacturers responsible for the end-of-use management of their products, to encourage circular design and increase the demand for recycled materials. This EPR legislation should only be initiated when conditions of a 'Trigger Framework' (Recommendation 1.1) have been met.

**RECOMMENDATION 2.2 Evidence-based targets for recyclability, with targets increasing over time**

Overseen by the Australian Government, product stewardship schemes should set evidence-based targets for reuse and recyclability within product categories that are reusable/recyclable and those that are not. Targets for reusability and recyclability should increase over time, with measures in place to hold brand owners and distributors to account.

## 3. Create market demand

**RECOMMENDATION 3.1 Robust end markets for Australian recycled content**

Product Stewardship schemes must prioritise demand generation and play an active and specific funded role in directly supporting robust and viable end markets for Australian recycled materials.

**RECOMMENDATION 3.2 Economic incentives for use of recycled materials**

The Australian Government should create economic incentives for using recycled materials, such as tax incentives, subsidies, grants, or differentiated regulatory fees, which can offset the cost difference between recycled and virgin materials, making the use of recycled materials more financially attractive for businesses. Incentives to use recycled materials specifically derived from product stewardship schemes should be considered.

**RECOMMENDATION 3.3 Minimum thresholds for Australian recycled content**

All Governments should implement strong drivers and mandated procurement targets to support uptake of Australian recycled content, such as a price signal to prioritise Australian recycled content over virgin materials and mandatory minimum thresholds for Australian recycled content.

**RECOMMENDATION 3.4 Certification and labelling for Australian recycled content**

The Australian Government should work with industry to establish certification and labelling programs that identify products made from recycled materials to help consumers make informed choices and increase demand by driving manufacturers to incorporate more recycled content.

**RECOMMENDATION 3.5 Target dumped and subsidised imported material**

The Australian Government should support a level playing field for the Australian recycling market by more strongly targeting dumped and subsidised imported materials.

# 4. Enhance collection infrastructure and consumer incentives

**RECOMMENDATION 4.1 Expand the scope of mandatory e-stewardship, incorporating all consumer electronic and electrical equipment and loose and embedded batteries into one comprehensive scheme**

The Australian Government should expand the scope of mandatory e-stewardship, incorporating all consumer electronic and electrical equipment into one comprehensive scheme—including any product connected to a plug or that contains batteries, as well as all loose and embedded batteries, to bring Australia into line with European standards.

**RECOMMENDATION 4.2 Gap analysis of disposal options for all electronic and hazardous waste streams**

State and Territory Governments must conduct a detailed gap analysis of disposal options for all electronic and hazardous waste streams, to help inform future schemes and policy decisions.

**RECOMMENDATION 4.3 Comprehensive network of safe disposal sites**

State and Territory Governments must ensure that a comprehensively accessible network of safe disposal options is provided to all Australians for materials that are hazardous in conventional waste and recycling streams, such as loose and embedded batteries, supported by strong community education campaigns.

**RECOMMENDATION 4.4 Incentivise safe battery collection with deposit refund**

Product stewardship schemes must strongly incentivise safe collection of batteries at end of use by introducing a deposit refund for safe disposal at appropriate collection points.

# 5. Tighten scheme governance

**RECOMMENDATION 5.1 Supply-chain representation in product stewardship scheme governance**

Product stewardship schemes must have supply-chain representation within their governance structures. This should comprise an independent Chair, and a Board that includes representatives and expertise from all stages of a circular supply chain, with equal decision-making powers and formal channels to provide expertise. Recycling industry representation should be proportionate to the operational costs borne for the actual recycling of the waste stream.

**RECOMMENDATION 5.2 Recycling sector expert convenor to engage product stewardship schemes with recycling sector**

To address Recommendation 5.1, establish and adequately resource a recycling sector expert convenor, under the auspice of the Australian Council of Recycling, to facilitate engagement with subject matter experts and leaders in the recycling sector and provide guidance and board directors to schemes.

**RECOMMENDATION 5.3 Clearly defined and measurable objectives, rules and targets**

Schemes should have objectives, rules and targets that are clearly defined and measurable, to track progress, evaluate the effectiveness of the scheme, and make necessary adjustments over time. Well-defined metrics—especially regarding recycling and scheme compliance from all parts of the supply chain—will identify areas for improvement and highlight successes.

**RECOMMENDATION 5.4 Transparent data about objectives, decision-making processes, recovery rates, recycling outcomes and material movement**

All stakeholders should have access to information about the scheme's objectives, decision-making processes, recovery rates, recycling outcomes and material movement, reported at a state level. This transparency helps prevent conflicts of interest when tendering for services and ensures that the scheme's actions align with its intended goals.

**RECOMMENDATION 5.5 Ensure that the scheme's objectives are met with accountability measures**

Stakeholders within schemes should be incentivised to actively participate in and contribute to the circular economy, particularly recycling. There must be mechanisms for holding participants accountable to commitments and actions in place to ensure that the scheme's objectives are met.

# 6. Enforce compliance and consequences

**RECOMMENDATION 6.1 Australian Recyclers Accreditation Program (ARAP)**

The Australian Government should support compliance through the implementation and adoption of an Australian Recyclers Accreditation Program (ARAP).

**RECOMMENDATION 6.2 Enforce waste export regulations**

The Australian Government should more effectively and proactively enforce existing waste export regulations, with impactful consequences including fines and imprisonment. The cost of regulation should be placed on producers and distributors, who are responsible for products placed on market.

**RECOMMENDATION 6.3 Regulate the export of waste textiles, unprocessed scrap metal and unprocessed e-products**

The Australian Government should expand the existing waste export rules to specifically address waste textiles, unprocessed scrap metal and unprocessed e-products.

**RECOMMENDATION 6.4 Tax incentives or priority access to markets for best-practice recycling facilities**

The Australian Government should create incentives, such as tax incentives or priority access to markets, for recycling facilities that consistently demonstrate high levels of compliance.

**RECOMMENDATION 6.5 Product stewardship schemes to be subject to third-party audits and/or inspections**

The Australian Government should require regular independent audits to assess compliance with regulations and internal policies, holding stewardship schemes to greater account via more vigilance, auditing and assessment of claims made by schemes regarding performance, industry data and reporting protocols. Third-party audits and/or inspections—underpinned by circular principles—should also be implemented to provide unbiased assessments of compliance and identify areas for improvement.

**RECOMMENDATION 6.6 A nationally harmonised resource recovery framework**

The Australian Government, together with State and Territory Governments should establish a nationally harmonised resource recovery framework, to prioritise circular economy outcomes, define 'end of waste' and support investment confidence in recycling.

## Appendix 4. Industry survey: Battery fires in waste & recycling


# Industry survey:
# Battery fires in waste & recycling

June 2024

ACOR
AUSTRALIAN COUNCIL OF RECYCLING

WASTE CONTRACTORS & RECYCLERS ASSOCIATION OF N.S.W

PRAGMATIC
RESEARCH & ADVISORY

# ACOR

The Australian Council of Recycling (ACOR) is Australia's peak body for resource recovery, recycling & remanufacturing, focused on policy, advocacy, thought leadership and championing the role of recycling in leading the transition to a circular economy.

# WCRA

The Waste Contractors and Recyclers Association (est. 1948), represents waste and recycling industry employers across NSW & ACT. WCRA advocates on behalf of its members to government and stakeholders, promoting best practice across the industry.

# Pragmatic Research & Advisory

Pragmatic Research is an independent market and social research agency that conducts quantitative and qualitative projects across a range of sectors. Principal Pete Wilson has over 25 years experience and is a full member of The Research Society.

# Survey process

**Objective**

- Obtain representative and defensible data to demonstrate the scale of the problem caused by fires from batteries in waste and recycling facilities, to inform policy reform.

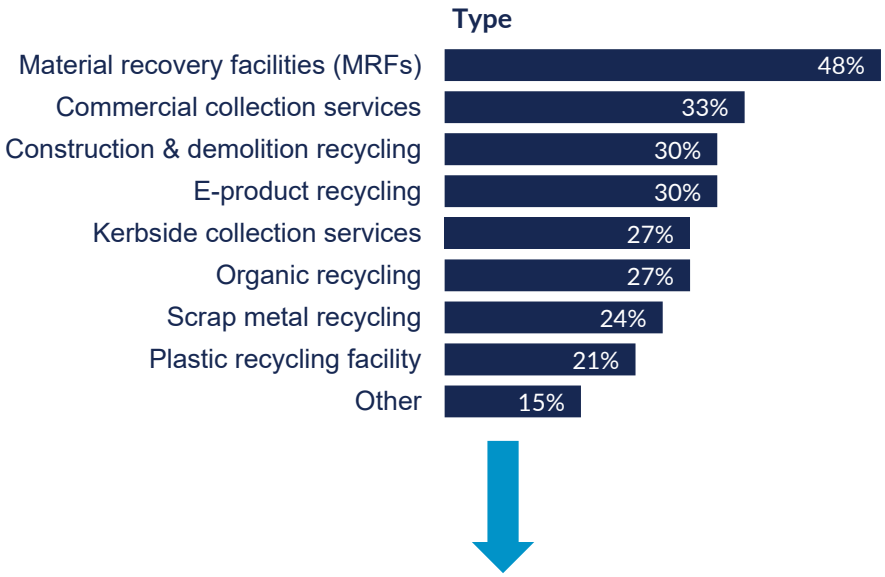
**Methodology**

- Survey addressing the number, type and impact of fires and heat events that have resulted from batteries in the last 12 months.
- Distributed to a broad range of waste and recycling organisations across Australia, via a secure online platform.
- Fieldwork took place from April 2 to 26, 2024.

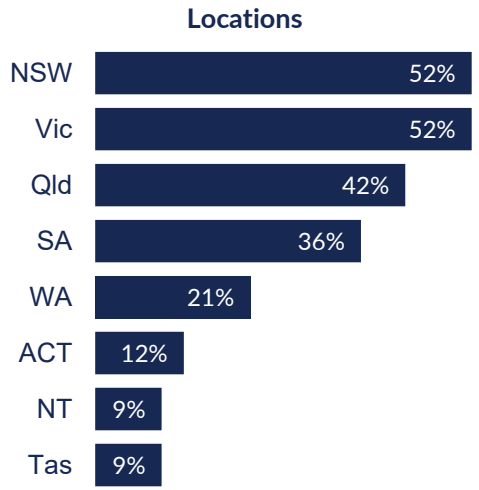
**Sample notes**

- Collectively, survey respondents:
  - Operate around 576 waste and resource recovery collection and processing facilities, representing around 26% of these types of facilities.
  - Process around 20.4 million tonnes of material every year, comprising around 27% of the national total.
- Some data inconsistency in the format and completeness of responses, with particular variability among different organisational sizes.

# Sample profile (ownership)



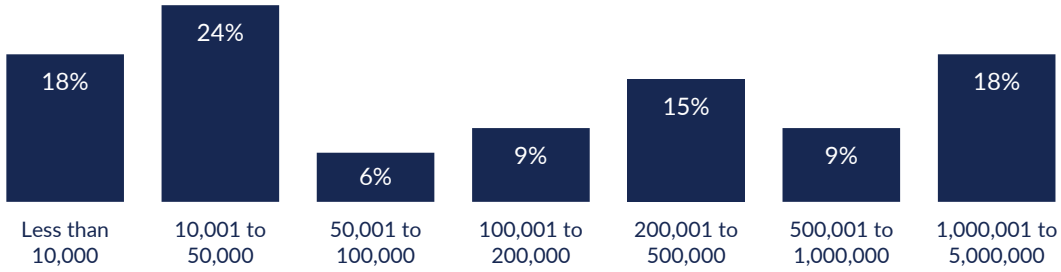

- Other
  - Glass crushing
  - Local government with in-house waste & collection facilities
  - Transfer stations
  - Baling facilities
  - Landfills
  - Tyre recycling
  - Alternative fuels




Geographic spread is generally reflective of population numbers and the locations of recycling and waste services as a whole.

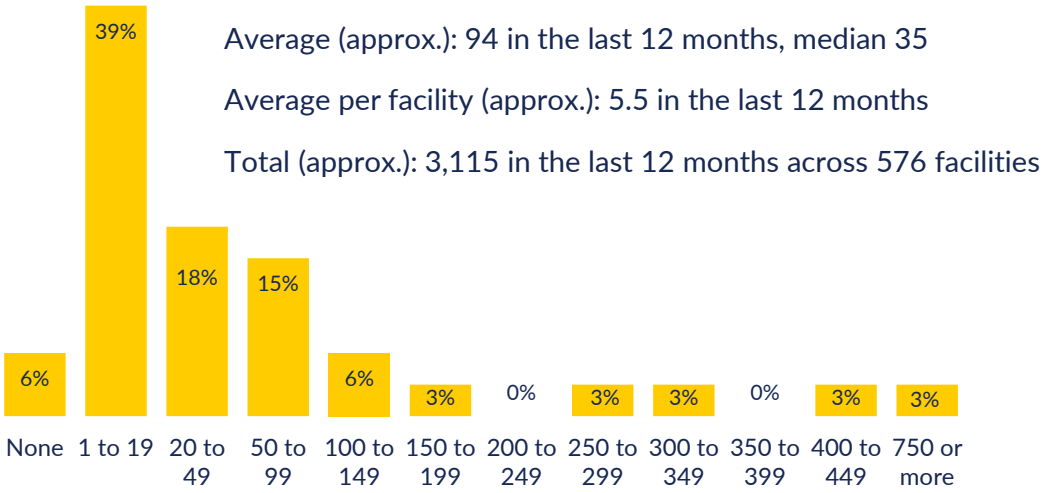
# Tonnes processed annually across survey respondents

Collectively, respondents processed 20.4 million tonnes annually, with an average of 619,000 and a median of 140,000, across 576 facilities.

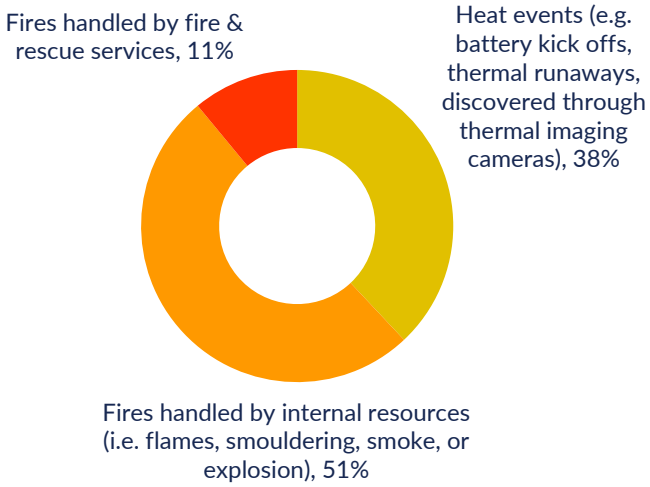


# Battery-related fire and heat events

**Annual battery fires and heat events resulting from batteries in loose and embedded form**




**Types of fires**




- Approximately 3,115 battery-related fires in the last 12 months, average 5.5 per facility.
- Half the fires handled using internal resources (51%), 38% were heat events and 11% handled by fire and rescue services.

# Calculations

**Based on the analysis and assumptions, it is estimated that there are between 10,000 and 12,000 battery-related fires a year across waste and recycling streams in Australia.**

**Industry size**

- Survey respondents collectively operate around 576 waste and resource recovery collection and processing facilities. The Australian Waste and Resource Recovery Infrastructure database lists 2,228 of these types of facilities. Our sample therefore represents around 26% of total number of these facilities.
- Survey respondents collectively process around 20.4 million tonnes of material every year. The 2022 National Waste Report identifies that Australia generates an estimated 75.8 million tonnes per year. Our sample therefore comprises around 27% of this national total.

**Calculations**

- The consistency of the percentages for number of facilities (26%) and tonnes processed (27%) indicates that our sample (and the total number of 3,115 fires) represents around one quarter of all the annual battery-related fires in the sector. In other words, an estimate of around 12,000 fires per year.
- This figure can be cross-checked with data from state and territory fires services who report ‘more than 1,000 battery fires across jurisdictions’. In our sample, 11% report using fire and rescue services to deal with fires. If this 11% represents the 1,000 or more, then we could extrapolate a figure of around 10,000 fires or more per year based on these figures (broadly consistent with the 12,000 figure above).

It is estimated there are between
10,000 and 12,000 battery-related fires
a year across waste and recycling streams
in Australia.

# Cost impacts of battery-related fire and heat events

Estimated cost increases for the following across business assets/facilities combined as a result of the fires, over the last 12 months.

| Cost increases | Average |
|---|---|
| Damage, rebuilding, and replacement costs, including vehicles | $173,988 |
| Insurance increases | $114,200 |
| Clean-up costs | $94,500 |
| Legal costs | $18,800 |
| Feedstock losses | $15,260 |
| Workplace compensation | $800 |
| Fines and penalties | $0 |
| **Total** | **$417,548** |

- On average these fires had increased costs by over $400,000 across business.
- Average damage, rebuilding and replacement costs (including vehicles) were the highest (around $174,000), followed by insurance ($114,000) and clean-up costs ($95,000).
- Responses relate to costs accrued over the last 12 months. Costs before or after this window are not captured. This includes the cost of rebuilding a new MRF (estimated at $60m), or fire management systems installed outside this timeframe.

# Other cost increases

- **Upfront costs:**
  - Fire detection/prevention/suppression systems, including thermal cameras and water cannons (between approx. $75k to $800k per facility)
  - Battery-safe bins
  - Lithium-ion fire extinguishers
- **Ongoing costs:**
  - Staff training, safety protocols, and admin for fire events (estimated over $20k/year)
  - Fire system monitoring (between $5k and $13k/month per facility)
  - Fire watcher security (approx. $15k/month per facility)
  - Disposal of damaged batteries (around $20/kg)
  - Truck fires (cleanup cost average $24k; vehicle replacement cost approx. $250k)
  - Increased landlord insurance premiums
- **Further impacts:**
  - Business interruption, reputational damage and loss of social license
  - Downtime from fire response & cleanup
  - Lost revenue by refusing high-risk jobs
  - Worker injury and illness (7% of respondents identified that these types of fires had resulted in worker injury or illness)

Insurance premiums have skyrocketed due to battery fires, making it increasingly impossible for our essential industry to secure the necessary coverage.

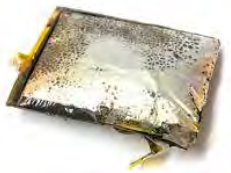
This crisis threatens our operations and underscores the urgent need for supply-chain-wide measures and industry support.

# Many loose & embedded batteries are not covered by stewardship schemes

Flashing wristbands


Electric toothbrush


Toys


Damaged batteries


Hoverboard


Shoes and skates


Emergency lights

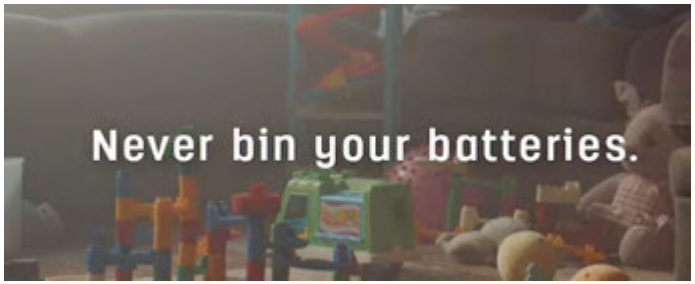

Scrunchies

Digital pregnancy test


Polymer Li-ion batteries


Vapes

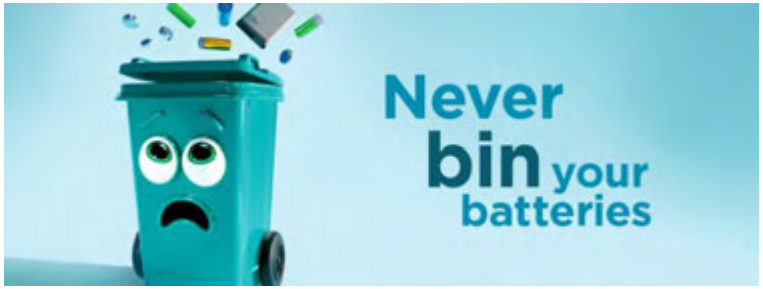
# Community education











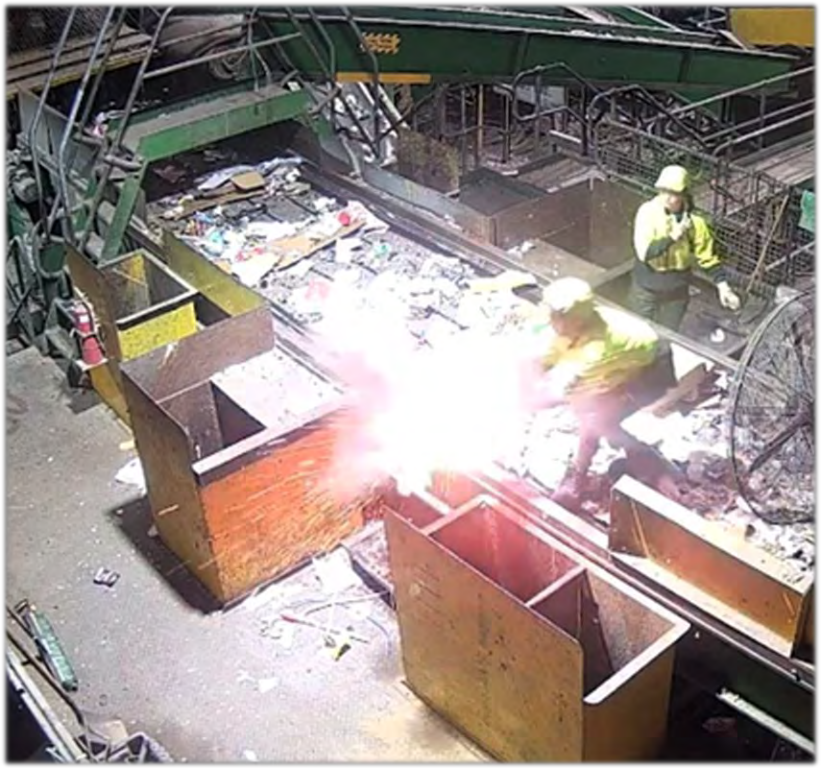
There is no point telling the community not to ‘bin’ their batteries if there are no available alternative disposal options.

There are no comprehensively accessible ‘safe disposal’ options for many items with loose and embedded batteries.

Lives are at risk.

Action must be taken before a worker is killed in a battery fire.

Many workers have already been injured.



When lithium-ion batteries catch fire, many hazardous gases are released, including highly toxic hydrogen fluoride.

Hydrogen fluoride gas poisoning destroys skin and bone tissue, and can cause permanent injury and death.

# Urgent action required by States

1. Conduct a detailed **gap analysis** of disposal options for all loose and embedded batteries in every jurisdiction.
2. Urgently roll out a network of **'safe disposal' collection points,** filling in identified gaps, to ensure there is always an easily accessible option for the community. This should be supported by the Australian Government, working together with relevant stakeholders.
3. Launch a national, comprehensive awareness-raising and **education campaign**, supported by the Australian Government, to ensure that batteries are not disposed of in conventional waste and recycling streams.
4. Support industry and **underwrite insurance** for the waste and recycling sectors to mitigate immediate risks, and prioritise regulatory reform to address the dangers posed by batteries.

# Urgent action required from the Australian Government

1. Expedite the delivery of **extended producer responsibility (EPR) regulation** for all consumer electronic products to fully fund safe collection and, where possible, recycling. Regulation must deliver an integrated scheme covering all consumer e-products, including batteries and items containing batteries (i.e., vapes), and leaving no gaps in relevant product categories.
2. Establish a **deposit scheme** to incentivise safe disposal of batteries and products containing batteries, providing a tangible reward for safe disposal behaviour.

With over 10,000 fires per year
across Australia's waste
and recycling systems,
our sectors cannot afford to wait.

## Appendix 5. A Burning Issue: Navigating the battery crisis in Australia's recycling sector

# A Burning Issue:

## Navigating the battery crisis in Australia's recycling sector

**Issues Paper**

*Prepared by the*
*Australian Council of Recycling*

December 2023

**Acknowledgement of Country**

We acknowledge that Aboriginal and Torres Strait Islander peoples are the First Peoples and Traditional Custodians of Australia, and the oldest continuing culture in human history.

We pay respect to Elders past and present and commit to respecting the lands we walk on, and the communities we walk with. We celebrate the deep and enduring connection of Aboriginal and Torres Strait Islander peoples to Country and acknowledge their continuing custodianship of the land, seas and sky.

We acknowledge the ongoing stewardship of Aboriginal and Torres Strait Islander peoples, and the important contribution they make to our communities, economies and the environment.

**About ACOR**

The Australian Council of Recycling (ACOR) is the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia. The Australian recycling industry contributes almost $19 billion in economic value, while delivering environmental benefits such as resource efficiency and diversion of material from landfill. One job is supported for every 430 tonnes of material recycled in Australia.

Our membership is represented across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastic, paper, textile, tyre and e-product reprocessing and remanufacturing, road recycling, and construction and demolition recovery. Our mission is to lead the transition to a circular economy through the recycling supply chain.

**About Recycle Mate**

Recycle Mate is an initiative of the Australian Council of Recycling, with funding support from the Australian Government's *Environment Restoration Fund* program, and currently supported by the Queensland Government. Adaptation Environmental Support is the program delivery partner.

# Table of Contents

# Introduction

Batteries—in loose or embedded form—are an increasingly alarming hazard in both kerbside and commercial waste and recycling streams. The Australian Council of Recycling (ACOR) and the recycling and resource recovery sector are overwhelmingly concerned about increasing incidents involving batteries causing property damage, serious injury and death—and resulting in skyrocketing insurance fees and financial assurance requirements.

The rapid digitisation of everyday items, the increasing number of 'smart' and 'disposable' items such as vapes containing embedded and sealed batteries, and a lack of safe disposal options and poor consumer education, have all contributed to the steep rise in batteries in inappropriate waste streams. This is causing fires and property damage, and severely compromising collection and resource recovery operations for recyclers all across Australia.

Fires caused by batteries are now widespread across material recovery facilities (MRFs), in waste and recycling trucks, and in depots—in short, at every point across collection, disposal and recovery streams. These fires pose great dangers to human health and life, and are also damaging to the environment through smoke and polluted runoff. The economic impact of these incidents is being borne by the community through rising rates, by councils through truck fires and future risk, and by industry in the loss of critical infrastructure.

In the year ending 30 June 2023, there were over one thousand battery-related fire incidents reported in the waste and recycling sectors nationwide, amounting to over three a day.[1] It is unlikely that this figure even begins to reveal the true extent of the battery crisis for recyclers. A lack of accurate data and information on e-waste fires can be traced to under-reporting—as colossal insurance premiums disincentivise operators to report—along with the fragmented regulatory landscape, with eight environmental regulators, eight fire and rescue organisations and almost 550 local councils nationwide.

While the damage caused by batteries is critical, current volumes are only the beginning. The generation of lithium-ion battery waste is projected to grow exponentially over the next 20 years. The Australian Government has identified that lithium-ion, sodium-ion, vanadium flow batteries and others will support the transition to a net zero emissions economy. Batteries are now part of our energy arsenal and everyday lives—and so is their waste. According to a 2016 report commissioned by the Australian Government's then-Department of the Environment, lithium-ion battery waste alone is projected to increase exponentially from 3,340 tonnes in 2016 to 137,618 tonnes in 2036.[2]

While issues relating to battery safety reach broadly across society, pointing to an urgent need for battery quality standards, the principal focus of the recycling sector is to address the risks at end of use.

There are critical actions that governments must take to address safe battery disposal, including:

- Ensure comprehensive safe collection
- A community education campaign
- E-stewardship reform, including a deposit scheme
- Regulatory harmonisation and enforcement

This issues paper explores the overarching considerations in this space and seeks to identify solutions to this current environmental crisis. We acknowledge the work already commenced by the State and Territory Governments, the Australian Government, CSIRO, the Australian Competition & Consumer Commission (ACCC), and peak bodies, including the National Waste and Recycling Industry Council (NWRIC) and the Waste Management and Resource Recovery Association of Australia (WMRR).

---

1 NWRIC letter to federal ministers, 'Industry call for immediate and urgent action—dangers of incorrectly disposed batteries', 31 July 2023.

2 'Waste lithium-ion battery projections', Randell Environmental Consulting, 19 July 2016.

# Overarching considerations

## Rapid digitisation and single-use electronics

The rapid digitisation of everyday items has led to the increased use of batteries in products across the world, including Australia. As more devices become 'smart' or connected to the internet, they often require power sources to function, and batteries are a common choice due to their portability and efficiency gains.

The proliferation of smartphones, smartwatches, fitness trackers, wireless headphones, and other portable gadgets is contributing to the rising demand for batteries. Additionally, the Internet of Things (IoT) has led to the integration of connectivity and sensors into various household items, from thermostats to kitchen appliances, necessitating power sources, including batteries.

Many consumer goods that enter recycling streams, particularly 'disposable' items such as vapes, contain embedded and sealed batteries that are unable to be safely removed. In many cases, the item is not labelled with advice that it contains a battery, let alone the type. Furthermore, appropriate disposal options are often not accessible or available. Recyclers are now finding these batteries in increasingly obscure items, which makes fire risk harder and harder to address, exposing the industry to increasing danger to people, equipment and property.

While operators are rapidly introducing safety procedures to deal with these items, it is impossible to comprehensively detect batteries that have been placed in waste and recycling streams, including kerbside bins, commercial bins, e-waste collection and scrap metal loads.

A major Australian MRF operator has identified that there is one vape per two tonnes of material received—potentially extrapolating to hundreds of thousands of vapes across all waste streams. Vapes are one of the many new products that are being introduced into the market with no producer regard or responsibility for the safe disposal of their component parts when their useful life comes to an end.

In October 2023, Clean Up Australia and WMRR called for producer responsibility for vape disposal. Due to the battery being embedded, vapes are not included in the nationwide Battery Stewardship Scheme, meaning they cannot be dropped off at battery collection points, like supermarkets and retailers. Clean Up Australia's Pip Kiernan points out that '*at the moment, there is no standardised or consistent way to collect and safely dispose and recover vapes in Australia'* and notes that the onus of figuring out how to safely dispose of them is placed on the consumer, when really it should be the responsibility of the producers.[3]

The use of personal electric vehicles, including electric bicycles (e-bikes), electric scooters (e-scooters), and even one-wheeled or two-wheeled electric vehicles, has also been steadily increasing in Australia, reflecting a global trend toward sustainable and innovative transportation options. Simultaneously, the demand for electric vehicles (EVs) is rising sharply. By June 2023, 8.4% of all new cars sold were EVs, a more than 120% increase on all of 2022.[4]

The International Energy Agency (IEA) reports that annual global battery production for EVs could increase from 160GWh to 6,600GWh in 2030.[5]

This increased use of batteries has wide-ranging implications for recyclers, waste management and environmental concerns related to disposal and recycling. Efforts to manage battery waste responsibly and develop more sustainable battery technologies are becoming increasingly important as digitisation continues to advance.

---

[3] WMRR, 'Producer responsibility needed for vape disposal: Clean Up Australia and WMRR', media release, 4 October 2023, www.wmrr.asn.au/Web/Web/Media/Media_Release/2023/Producer%20Responsibility%20Needed%20for%20Vape%20Disposal.aspx.

[4] Electric Vehicle Council, 'State of Electric Vehicles', July 2023, https://electricvehiclecouncil.com.au/wp-content/uploads/2023/07/State-of-EVs_July-2023_.pdf.

[5] International Energy Agency, 'Net Zero by 2050: A roadmap for the global energy sector', 2021.

## Lack of comprehensive access to safe disposal locations

Currently, there is no comprehensive network of e-waste collection points in the community. We are already witnessing the effects of inadequate or irregular access to safe disposal locations, and with no readily available avenues for consumers to safely (and legally) dispose of their end-of-life batteries, improper storage and disposal has become dangerously common. Unsafe disposal is leading to littering, fires and other critical incidents, and poses risks to human health through exposure to harmful chemicals. Our sector is seeing this scenario play out across Australia at an alarming rate; however, the full extent of these incidents is unknown.

There are two fundamental gaps that must be addressed in order to provide Australians with a comprehensive network of safe disposal locations.

Firstly, there is no comprehensive catalogue of items that contain batteries, which pose a hazard in conventional waste and recycling streams: essentially, anything that is a battery, or has a battery, or is powered by a battery, to produce any movement, noise, light or process. A comprehensive catalogue of these items must be developed to support a sufficiently robust form of categorisation and inform the delivery of a full-coverage safe disposal network.

Such items include:

- E-cigarettes/vapes
- Vehicle batteries, car and boat
- Household batteries
- Emergency locator beacons
- Smoke detectors
- Household appliances with rechargeable batteries
- Products with removable batteries
- Products with integrated batteries: flashing toys, disposable torches, Christmas decorations, kids shoes, musical greeting cards

Secondly, there is a critical lack of access to safe disposal locations for these items, with no comprehensive geographic mapping of the gaps. Where there are no accessible safe disposal avenues, the only options for the community are to stockpile, litter or dispose into incorrect waste streams.

A CSIRO report prepared for the ACCC in 2023, 'Lithium-ion battery safety', acknowledges that, 'At present, there are no readily available methods and sources of information that the public can adopt to allow them to safely manage a damaged battery and places for appropriate disposal/recycling.'[6]

A complete gap analysis of disposal options must be undertaken for all item categories, to inform where and how safe collection points must be provided. Urgent action must then be taken to ensure that all collection point gaps are filled, maintaining adherence to appropriate guidelines and ensuring there is always an easily accessible option for the community to safely dispose of any problem item.

By establishing safe disposal points, we can create a structured, reliable system that encourages responsible recycling practices, protects the environment, and promotes resource recovery.

## Consumer and sector safety

Battery fires are now a real and present threat across MRFs, in waste and recycling trucks, and in depots—in short, at every point across collection, disposal and recovery streams. But they are also becoming an increasing threat to businesses, consumers and public property, with incorrect disposal or storage in households or businesses, and unmonitored collection points at public libraries all at risk.

In one e-waste recycling facility, for example, a recent fire was caused by a lithium-ion battery in an electric toothbrush. Items containing embedded batteries are not conventional e-waste and can't be safely dismantled or recycled, yet at this facility half of all deliveries contain an item with an embedded battery, and one in five contain multiple embedded or loose batteries.

[6] ACCC, 'Lithium-ion batteries and consumer product safety', October 2023, www.accc.gov.au/system/files/Lithium-ion%20Batteries%20report_3_0.pdf.

It is important to remember that batteries such as these are classified as dangerous goods under the Australian Dangerous Goods Code. Lithium batteries, in particular, are deemed 'Class 9—Miscellaneous dangerous substances and articles, including environmentally hazardous substances'.

NSW Fire and Rescue research found that in the first six months of 2023 there were 114 lithium battery-related fires in NSW alone, with key items of concern being power packs and chargers, micro-mobility devices like e-bikes and e-scooters and portable power banks.[7]

> 'Firefighters are responding to an average of more than three battery fires a week from in-home charging issues or incorrect disposal.
>
> As we bring more batteries into our homes, it is important that we dispose of them correctly once they've reached the end of their life.'
>
> *Trent Curtain, Acting Deputy Commissioner, Field Operations, Fire and Rescue NSW*

An Australia-wide audit conducted by ACOR's Recycle Mate program found every Australian council had already banned batteries from kerbside bins. Despite being dangerous substances and banned from kerbside bins, batteries keep ending up there, and no enforcement is applied to keep them out of waste and recycling streams.

In its 2023 'Lithium-ion Batteries Report', the ACCC's first recommendation was that, 'Commonwealth, state, and territory governments should improve, expand and standardise data collection practices around the hazards posed by consumer electrical products, including Li-ion batteries.'[8] The recommendation went on to place critical importance on not just the collection of this data in a timely manner, but also, wherever practicable and to the extent permitted by law, the incident data being regularly shared among stakeholders to facilitate a better understanding of emerging risks and hazards.

This knowledge-sharing is essential to keep consumers and the sector safe, and would inform whether the standards and regulations for the minimum requirements for safe collection, storage, and transport to recycling depots are being met. Understanding what collection points exist where, and what safety and hazardous waste protocols are in place, is essential to public safety. Without this, it is incredibly difficult to enforce the jurisdictional standards and regulations to manage these issues.

## Regulatory inconsistency and confusion

Currently, there are significant gaps between product stewardship schemes that cover batteries and e-products. This goes on to create geographic black holes where no collection points exist for certain—or in some cases any—types of batteries. This leads to increasingly confused consumers seeing no convenient, safe disposal option and therefore disposing incorrectly, often in their kerbside bins.

In January 2022, the ACCC authorised a product stewardship scheme for loose batteries called B-cycle, run by the Battery Stewardship Council. The B-cycle scheme accepts all small loose and easily removable batteries, including regular AA and other sizes, button batteries, rechargeable batteries, and small removable batteries from devices like hearing aids, power tools, e-bikes and digital cameras. But it does not accept any embedded batteries at all, nor mobile phone or laptop batteries, lead acid batteries, remote-controlled car batteries, Dyson batteries, exit lighting, nor any batteries produced by brands not in the scope of the scheme.

B-cycle's latest report, 'Positive Charge: 2022–2023', estimates that only 12% of handheld batteries were collected for recycling in Australia. That means 88% of our batteries are ending up in landfills, MRFs or otherwise disposed of incorrectly.[9]

Regulatory confusion exists across every jurisdiction in Australia. The end-of-life management for e-products and battery products in Australia is structured around an array of product stewardship schemes, with many items falling through the gaps. While mobile phone batteries are accepted by Mobile Muster, laptop batteries

[7] https://www.nsw.gov.au/media-releases/battery-safety-to-prevent-fires

[8] ACCC, 'Lithium-ion batteries and consumer product safety', October 2023, www.accc.gov.au/system/files/Lithium-ion%20Batteries%20report_3_0.pdf.

[9] B-cycle, 'Positive Charge: 2022–2023 report', https://bcycle.com.au/wp-content/uploads/2023/12/B-cycle-Positive-Charge-Report-20231207.pdf.

must go to an NTCRS-affiliated recycler. While an NTCRS-affiliated recycler is paid to recycle a laptop, the battery recycler that subsequently receives the removed embedded battery receives no recycling fee from the NTCRS to recycle the laptop's battery. E-product recyclers themselves find determining which batteries are in and out of scope of the various schemes to be near impossible to navigate.

With their rapid rise in popularity, vapes are an emblematic case study for the practical and policy difficulties around how to dispose of 'smart', 'disposable', or 'single-use' products with integrated batteries. Clean Up Australia Chair Pip Kiernan stated that for years cigarette butts were the most littered item across the country, but vape litter is emerging as a new and serious environmental issue.

> *There is an urgent, overdue need for a safe system for the disposal of vapes devices, refills and e-liquids. There is currently no federal or state legislation governing end-of-life disposal for vapes. They are simultaneously classified as e-waste because of their electronic components, and as hazardous waste due to the liquid nicotine residue, making recycling difficult.*[10]

The recent rise of electric vehicles (EVs) is also an increasing concern, as these first-generation vehicles' batteries approach their end of life. A CSIRO report found that 'most markets have no EV-battery-specific requirements or delineations of responsibility between the producer and the consumer … the lack of regulation creates uncertainties for Original Equipment Manufacturers (OEMs), second-life-battery companies, recyclers and potential customers. The lack of regulation also gives rise to challenges to battery recycling for end-of-life (EOL) lithium-ion batteries and leads to low collection rates, environmental pollution due to poor disposal practices and hazards to the public.'[11]

Beyond OEM and consumer confusion, there are also flow-on economic impacts of regulatory confusion. The National Retail Association stated in its submission to CSIRO that 'inconsistent regulatory approaches are causing trade barriers between jurisdictions, unnecessary costs, commercial risks, and market confusion, ultimately impacting rates of non-compliance'.[12]

Regulations play a pivotal role in shaping the infrastructure, processes, and awareness necessary for proper battery disposal and recycling practices across the country. Currently, regulatory inconsistencies and confusion are impeding safe disposal options, the effectiveness of product stewardship schemes, and creating safety risks at all points of the disposal logistics chain, with increasing economic impacts for recyclers and the resource sector. The cost of unsafe battery disposal is being borne by the community through rising rates, by councils through truck fires and future risk, by industry in the loss of critical infrastructure, in damage to the environment through smoke and polluted runoff from fires, and, above all, through the dangers to human health and life.

---

[10] WMRR, 'Producer responsibility needed for vape disposal: Clean Up Australia and WMRR', October 2023, www.wmrr.asn.au/Web/Web/Media/Media_Release/2023/Producer%20Responsibility%20Needed%20for%20Vape%20Disposal.aspx.

[11] ACCC, 'Lithium-ion batteries and consumer product safety', October 2023, www.accc.gov.au/system/files/Lithium-ion%20Batteries%20report_3_0.pdf.

[12] National Retailer Association, submission to the ACCC Lithium-ion Batteries Issues Paper, https://consultation.accc.gov.au/accc/lithium-ion-batteries-issues-paper/consultation/view_respondent?uuId=1062153462.

# ACOR recommendations

## 1. Ensure comprehensive collection

Any education campaign to raise necessary awareness around battery and e-waste disposal will be ineffective without ensuring that there is a comprehensive network of collection points. Our sector is already aware that some jurisdictions across Australia don't have convenient access to safe disposal options for batteries, so a gap analysis is necessary to support the creation of safe disposal infrastructure.

ACOR has built a national recycling data hub, Recycle Mate, where councils and recycling organisations are able to update their recycling information in real-time, as new collection points and recycling capabilities are introduced. The Recycle Mate data hub is a first-of-its-kind initiative, created with funding support from the Australian Government's *Environment Restoration Fund* program, and currently supported by the Queensland Government.

The Recycle Mate data hub has been developed as a free resource for every local government, recycling program and charitable organisation across Australia to more easily share information about their recycling programs, disposal locations and product stewardship schemes, and contribute better recycling information for all. The data contributed through the hub by local councils, the recycling and resource management sector, and private businesses, helps deliver accurate recycling and waste disposal information through the app to the community, specific to their local area.

Recycle Mate has already catalogued recycling information for all Australian local councils, 10 major product stewardship schemes, CDS schemes and over 2,000 community recycling centres, transfer stations and landfills. Critically, Recycle Mate has the capability to assess and add safe disposal information on new products that hit the market, providing this information via the Recycle Mate app directly to councils and consumers' phones.

Recycle Mate has already identified, through a detailed breakdown of electronic product categories, many regions where there are no recovery paths for certain items, such as types of batteries and electronic waste that are unsafe for kerbside disposal and subject to landfill bans. There also do not appear to be any legitimate disposal options for vapes, apart from pilot programs run by Envirostream, and many councils are hesitant to launch their own trials for fear they will assume the cost of managing neighbouring councils' vape waste.

A solution to addressing this data gap would be an initiative by all State and Territory governments to conduct a detailed gap analysis of disposal options for all electronic waste streams to identify where safe collection points should be located, as well as inform future programs and policy decisions.

Recycle Mate is uniquely placed to conduct a nationwide audit on battery and e-waste safe disposal collection points, with information proactively gathered from product stewardship schemes such as Mobile Muster, B-cycle and the National Television and Computer Recycling Scheme, businesses and councils. Recycle Mate is working with the Queensland Government to conduct such a gap analysis of disposal pathways for the 34 categories of electronic waste, mapping recovery locations against population density. This will result in an interactive data visualisation map, enabling filtered searches of different product categories to show community access to recovery options and quickly identify system gaps.

As the peak industry body for the resource recovery, recycling, and remanufacturing sector in Australia, ACOR is also well placed to initiate the data gathering of critical incidents and battery-related fires that are occurring across the sector.

**RECOMMENDATION 1.** The Australian Government should **prepare a full catalogue of all items on the market** that are known to be causing, or are capable of causing fires and significant issues in household bins. This includes all products that are a battery, have a battery or are powered by a battery to produce any movement, noise, light or process.

**RECOMMENDATION 2.** All State and Territory governments to **conduct a detailed gap analysis of disposal options for all electronic waste streams,** to help identify where safe collection points should be located and inform future programs and policy decisions. This should be delivered as an interactive data visualisation map, which enables filtered searches of different product categories to show community access to recovery options to quickly identify system gaps.

**RECOMMENDATION 3.** The Australian, State and Territory Governments should work together with relevant stakeholders to **fill the identified gaps, so that there is always an easily accessible option for the community** to safely dispose of any problem item. The cataloguing and gap analysis will allow for efficiently targeted allocations of resources to ensure safe disposal pathways.

**RECOMMENDATION 4.** As an emergency measure, **a safe disposal location for all items must be provided within every council area**, with the support of State Governments. The nationwide response to the presence of needles and syringes in the environment and conventional waste streams in the 1990s could offer a model, in terms of comprehensive access to safe community sharps disposal.

## 2. A community education campaign

As the number of everyday items containing embedded and sealed batteries increases, a critical priority will be ensuring that these items are diverted away from conventional waste and recycling streams, collected in a safe manner, and directed towards facilities that are equipped to safely process them. Currently, there is a lack of public education and resources around safe disposal, the risks of improper battery disposal, and consumer responsibility for end-of-life batteries.

There must be a well-funded and comprehensive awareness-raising and education campaign. Recycle Mate is an ideal delivery partner for the education campaign and recycling advice to avoid duplication of effort and information and maximise the potential of data collection. Through Recycle Mate's data, a targeted, cost-effective, evidence-based education campaign could be rolled out across Australia with up-to-date information on collection points, with a particular focus on areas where high incorrect disposal rates are reported.

The language surrounding battery disposal should also be addressed. An emphasis must be made on 'safe disposal', rather than 'recycling' of batteries and e-waste. 'Safe disposal' helps emphasise that batteries can be dangerous, whereas people think of 'recycling' as optional. It is essential that we get all batteries out of household and commercial bins and diverted to safe disposal locations.

Furthermore, Recycle Mate's research already shows that many members of the community associate the term 'recycling' with their household bins—and are likely not aware of alternative disposal options. When something is promoted as being 'recyclable', it can give the impression that it can be recycled in their household bins, where batteries become a major problem.

ACOR believes that any consumer education must contain the following elements:

1. **Risk awareness.** It is necessary for the public to understand the environmental and safety risks posed by improper battery disposal. Awareness must also be raised around products with embedded batteries that consumers may not have considered, such as vapes, digital pregnancy tests and electric toothbrushes.
2. **Safe disposal methods.** Educate people about the correct disposal methods for batteries in designated battery recycling centres, drop-off locations, or collection programs available across communities. This should also extend to storing batteries safely before disposal and how to identify when batteries are at risk of being unsafe.
3. **Convenience and accessibility.** Make it easy for people to find nearby collection points or drop-off locations. Provide up-to-date and easy-to-access information on where these facilities are located and what type of batteries they take.

4. **Broad use of communications channels.** The education campaign should be implemented across multiple channels such as television, social media, and digital advertising, as well as disseminating educational materials in schools, community events, and partnerships with councils, retailers and manufacturers to raise awareness about battery disposal.

ACOR joins with the National Waste and Recycling Industry Council in calling for a nationwide education campaign for the safe disposal of batteries.[13] We believe that ACOR, with support from our Recycle Mate initiative, is uniquely positioned to deliver this campaign.

**RECOMMENDATION 5.** Once a comprehensive collection network is assured, **a comprehensive awareness-raising and education campaign should be launched** nationally to ensure the public understands the risks of batteries in bins, how they can access the existing safe disposal options, and how batteries and e-products can be recycled if they are deposited in the right place. The messaging must be centred on 'safe disposal' rather than 'recycling'.

# 3. E-stewardship reform

With rapid digitisation and the market expansion of battery-powered and smart devices, it is essential that product stewardship schemes take the full breadth of products available on the market.

It is understood that DCCEEW is designing an expanded product stewardship scheme for small electrical and electronic equipment (SEEE) and small-scale PV systems. The scope is expected to include any SEEE weighing less than 20 kilograms, and solar PV systems, including solar panels, racks, inverters and wiring, with household batteries considered for inclusion. The scheme would also include embedded batteries, but not loose batteries, which are proposed to still be captured by the B-cycle scheme.

It is essential that the Federal e-stewardship program continues these reforms to deliver an integrated scheme covering all small e-products and batteries and leaving no gaps in relevant product categories. Under the model currently under consideration, e-waste recyclers are facing the confusing situation of at least three product stewardship schemes covering and excluding different battery types: the current National Television and Computer Recycling Scheme, Mobile Muster and B-cycle.

Under the current NTCRS scheme, scheme operators, called co-regulators, are funded by brand owners to only collect a certain volume per year and can and do cease to fund e-waste recycling when those quotas are filled. Furthermore, the uncertainty caused by the scheme review has led to co-regulators reducing the volume of e-products being funded for recycling even further, as they shore up balance sheets in anticipation of a changing regulatory environment. As e-product-to-landfill bans are implemented around Australia, and the recycling sector bears the brunt of improperly regulated battery collection, the need for holistic and comprehensive extended producer responsibility for battery collection is greater than ever before, as well as strong instructions to the existing NTCRS co-regulators to continue to fund e-product collection and recycling through the scheme at existing levels to avoid worsening an already critical situation.

Furthermore, ACOR recommends that the Australian Government introduce regulations that mandate a deposit scheme to be fully funded by all manufacturers and importers of batteries and products that contain batteries in any form. There must be much stronger incentives to mobilise the population to safely draw them out of waste and recycling streams and towards safe disposal locations.

While some product stewardship schemes may have achieved desirable recovery rates for end-of-use items without incentivisation beyond 'doing the right thing', this is not the case across all product categories. Schemes that provide little incentive for consumers to return items to away-from-home collection points generally result in poor recovery rates. A model to consider is the container deposit scheme (CDS), which provides a refund for the return of these items. By offering a financial incentive for returning containers, CDS

[13] NWRIC, submission to the ACCC lithium-ion batteries issues paper, March 2023, www.nwric.com.au/download/1149/?tmstv=1679277906.

encourages individuals to recycle. People will participate in collection efforts if there is a tangible reward such as a monetary incentive for each container returned.

It is evident that the health and environment risks of disposing of batteries incorrectly are not enough of a deterrent or not widely enough understood for the average community member to always seek out a safe disposal option. The CDS strategy works by aligning economic incentives with environmental goals, and when applied to battery disposal would be a game-changing driver for encouraging safe collection behaviours.

**RECOMMENDATION 6.** As soon as practicably possible, the Australian Government must **enact extended producer responsibility (EPR) regulation for consumer electronic products** to fully fund safe collection, and where possible, recycling. Such regulation must deliver an integrated scheme covering all consumer e-products, including batteries and items containing batteries (including vapes), and leaving no gaps in relevant product categories.

**RECOMMENDATION 7.** Establish a deposit scheme similar to the CDS model to encourage community safe disposal of batteries and products containing batteries, providing a tangible reward for safe disposal behaviour. Lessons should be drawn from the container deposit schemes that have been established in States and Territories across Australia, prioritising safe collection methods and a strong deposit rate to support high recovery rates.

# 4. Regulatory harmonisation and enforcement

The recycling and waste management sector has long faced a fragmented, variable and duplicative regulatory environment across Australia's States and Territories, undermining investor confidence in infrastructure and impeding innovation. While laws and regulations for waste and recycling are implemented at a State level, there is an increasing need for harmonisation and enforcement at a national level to prioritise circular economy outcomes. This is especially critical in the battery and e-waste space dealing with hazardous waste components.

WMRR has noted the necessity of battery and e-product regulation and called on the Australian Government to institute a comprehensive regime, akin to those instituted in Europe, highlighting that the proposed national e-waste scheme scope is too narrow, ignoring key elements such as redesign and repair.[14]

The European Union's Batteries Regulation aims to ensure that future batteries have a reduced carbon footprint, contain fewer harmful substances, rely less on raw materials sourced from non-EU countries, and undergo extensive collection, supporting a high degree of reusability and recycling. This initiative aligns with the circular economy goals outlined in the European Green Deal, marking a milestone in European legislation by encompassing the entire life cycle of batteries—from sourcing and manufacturing to usage and recycling—within a singular law. This comprehensive approach underscores the commitment to sustainability and the EU's objectives of securing raw material supply.[15]

In line with the classification of lithium-ion batteries as dangerous goods under the Australian Dangerous Goods Code, it is imperative that the Australian Government also institutes national standards and regulations for battery disposal collection points. CSIRO's report for the ACCC notes that **'**Current collections occur in public places and stores which can pose a hazard to people and property in the event of fire … Harmonisation would assist in collection and recycling rates and minimise safety hazards, especially for

[14] WMRR, LinkedIn post, 2023, www.linkedin.com/posts/wmrr_international-e-waste-day-australia-needs-activity-7118902238139359232-gQLi/.

[15] European Commission, 'Circular economy: New law on more sustainable, circular and safe batteries enters into force', August 2023, https://environment.ec.europa.eu/news/new-law-more-sustainable-circular-and-safe-batteries-enters-force-2023-08-17_en.

damaged batteries.'[16] Consequently, they recommend the implementation of separate boxes for either damaged/faulty batteries and exhausted/visually intact batteries.

Collection guidelines exist in many State and Territory jurisdictions but are generally not enforced. For example, the Environment Protection Authority has produced extensive guidelines on the storage and management of waste batteries,[17] widely considered a benchmark document. However, these guidelines are often simply not adhered to because there are no regulatory consequences for non-compliance.

A key component to acknowledging the serious economic and environmental risks posed by the unsafe disposal of batteries and e-waste would be to implement stronger rules for collection and disposal of batteries, and ensure penalties are applied for non-compliance. Holding individuals and businesses to account over the irresponsible collection and disposal of batteries and e-waste would send a clear message about the serious risks and consequences these actions place upon community health, the environment, workplace safety and property.

**RECOMMENDATION 8.** The Australian Government should work with State and Territory Governments to **institute national standards and regulations for battery disposal collection points**, with clearly understood and enforceable consequences for non-compliance.

**RECOMMENDATION 9.** State and local governments should work together, in partnership with industry, to ensure compliance with existing rules relating to battery disposal. It is essential that penalties instituted for non-compliance with the end-of-use disposal requirements for batteries under current regulations are enforced.

**RECOMMENDATION 10.** The Australian Government must ensure NTCRS co-regulators continue to fund e-product collection and recycling at current levels while the new scheme is designed.

# Conclusion

The escalating hazards posed by batteries in conventional waste and recycling streams demand immediate attention. The increasing incidents resulting in property damage, injuries, and financial burdens underscore the urgent need for Australian governments, producers and recyclers to work together and take comprehensive action. While the issue of battery safety spans the community at large, the paramount concern for the recycling sector is addressing environmental end-of-use risks to the sector and community.

Governments have a pivotal role to play in ensuring safe battery disposal. Critical actions include establishing a comprehensive collection network, initiating robust community education campaigns, reforming e-stewardship practices, and enforcing harmonised regulations. Regulatory inconsistencies currently undermine safe disposal rates, the effectiveness of stewardship schemes, and pose risks throughout the disposal logistics chain, leading to economic impacts on recyclers and the broader resource sector.

ACOR's proposed cataloguing of problematic items and the recommendation for a fully funded battery stewardship program by manufacturers and importers aims to mitigate these risks. Moreover, deposit schemes have proven successful in driving stronger collection outcomes. Aligning economic incentives with environmental goals, as demonstrated by the success of container deposit schemes, will serve as a pivotal strategy in encouraging responsible battery disposal and recycling practices.

---

[16] CSIRO, 'Lithium-ion battery safety', May 2023, www.productsafety.gov.au/system/files/CSIRO-ACCCLithiumIonBatteries.pdf.

[17] EPA Victoria, '2018: Storage and management of waste batteries – guideline', www.epa.vic.gov.au/about-epa/publications/2018.

## Appendix 6. Audit and Review of Packaging Environmental Labelling and Claims

# Audit and review of packaging environmental labelling and claims

# Australian Council of Recycling

## Final report

EQUILIBRIUM

59 Stubbs Street,
Kensington, VIC 3031
+61 3 9372 5356

194 Varsity Parade,
Varsity Lakes QLD 4227
+61 4 04 899 961

Web – equil.com.au
Email – info@equil.com.au

## Table of Contents



## Tables and Figures

| | |
|---|---|
| **Client** | Australian Council of Recycling |
| **Client contact** | Pete Shmigel (CEO) |
| **Date** | 28 July 2020 |
| **Prepared by** | Madelaine Waters and Damien Wigley (Equilibrium)<br>Mark Field (The Real Food Professor) |
| **Reviewed by** | Nick Harford (Equilibrium) |

## Executive Summary

It has been identified that consumers are becoming more socially and environmentally aware, driven by a greater understanding of global issues through social and traditional media, non-government organisations and key influencers.

The Australian Council of Recycling (ACOR) commissioned Equilibrium to undertake a review (consisting of a packaging audit as well as literature research) to identify logos and claims pertaining to packaging materials and, in particular, recycling claims.

The consumer's ability to make change by reducing the amount of packaging waste that ends up in landfill is a growing consideration when making product or brand selection. While this environmental awareness and consciousness is extremely powerful, this research report shows that lack of information or complex messaging can hinder the ability to make the correct choices with respect to recycling or disposing of packaging waste.

Of the 150 products sampled for this project, 61% displayed a recycling claim or label. Of those that displayed a recycling claim or label, 23% were the Australian Recycling Label (ARL) and 29% were the mobius loop.

Although the majority of products had a recycling claim, the logos were commonly only on outer packaging rather than on each packaging component. As 52% of products sampled consisted of more than one packaging component, this was a significant finding with respect to inconsistent recycling labels relating to one or more packaging types.

Furthermore, it was identified that some labelling is incorrect or non-existent (some claim to be recyclable when not, some have no claim despite being recyclable) and the terminology used to explain the recyclability of the packaging is not consumer friendly (e.g. "this packaging is recyclable" when only the one component is actually recyclable).

Other incorrect statements included liquid paper board packaging that claimed to be recyclable and soft plastic packaging that contained a recycling logo with no explanation or guidance on separating from other recyclables and where to recycle it.

The Tidyman logo appeared on 15% of products sampled, accompanied by statements that included "dispose of thoughtfully or responsibly". It was found to appear on both recyclable and non-recyclable products and offers no instructions or information on the correct waste stream for the type of packaging it appeared on.

The use of resin codes on packaging was also not found to be helpful or useful as it could be misconstrued to mean that the product is recyclable and therefore the material could end up in kerbside recycling. As discussed, this is not the intent of the code and therefore it would be beneficial to any labelling program if it could be entirely eliminated from packaging materials.

The assessment concluded that ambiguity is influencing the consumer's ability to effectively recycle packaging through recycling programs and that recyclability labels need to be specific about the disposal methods of all components, and also include instructions to avoid contamination.

In order to help consumers make the right choices, there needs to be a clear, concise and evidenced based label that is mandatory, engaging and able to raise awareness placed on every product and packaging type sold into the Australian market.

Recycling labels and claims are not consistently used across different packaging types and some labelling is incorrect or non-existent (some claim to be recyclable when not, some have no claim despite being recyclable) and the terminology used to explain the recyclability of the packaging is not consumer friendly.

With so many different and potentially conflicting labels, statements, logos and symbols, consumers deserve something that is simple, incumbent and empowers them to understand how to effectively recycle or dispose of all packaging from products sold into, and used within, the Australian market.

**In summary the major findings were:**

- 88% of the packaging components that were sampled are recyclable through either kerbside recycling or REDcycle, but only 40% had a recycling claim.
- This 40% consisted of 37% from recyclable components, 1% on non-recyclable components and 3% on components where the recyclability was unclear.
- There is a large gap in what is labelled as recyclable and what can potentially be recycled.
- Lack of any disposal labelling, as seen on 51% of products, may also lead to consumers wrongfully placing non-recyclable items into their kerbside recycling bin potentially resulting in contamination.
- Ninety-nine products were Australian made and 49 were imported. Fifty five percent of imported products and 64% of Australian products displayed a recyclability claim.
- 28% of Australian products had the ARL specifically, showing the largest reach of any other label. However, it fell short of capturing all supermarket and other items that were sampled as part of this project.
- There was no consistent placement or sizing of recyclable labels. While majority of them were located on the back of the packaging, they were placed on a variety of different locations and were displayed in different sizes.

**Based on the findings the recommendations are:**

- Labels need to be specific about the management methods of all components, and also include instructions to avoid contamination as ambiguity is influencing consumers' ability to effectively recycle household packaging through recycling programs.
- There needs to be a clear, concise and evidenced based label placed on every product and packaging type sold into the Australian market.
- The preferred label should be made mandatory and be flexible enough to incorporate new technologies and systems as they come online to recycle more products.
- The use of resin codes can be misconstrued as meaning recyclable. Therefore, the material could end up in kerbside recycling which is not the intent of the code. Similarly, the mobius loop could cause consumer confusion. A short cut to achieving greater clarity and consistency to remove these from packaging.
- There is a role for authorities (including the Australian Competition and Consumer Commission - ACCC) in driving and ensuring clarity and consistency in environmental claims and labels pertaining to recycling.

In conclusion to the study, Mark Field, Director of The Real Food Professor has provided the following observation; "the fast moving consumer goods and recycling industries can both play an important role in driving and supporting environmental awareness, with the ultimate aim of making it easier for the consumer to understand the recyclability of their food and non-food packaging, supporting more effective recycling and reducing waste to landfill."

# 1 Introduction

The purpose of this report is to present the findings of an audit and review of an appropriate selection of products and packaging that make up a typical grocery basket (consisting of food and other consumer products and packaging), as well as convenience and other popular fast food product packaging.

The purpose of the review was to identify logos and claims pertaining to packaging material containing the products, indicating whether it can be recycled (including the polymer / resin identification code and mobius loop where they were used) or requires disposal as there are no current recycling options available.

Other “sustainable” claims relating to the product packaging, such as recycled content, were also assessed. In addition to the logos and claims, other specific information relating to the product included on the packaging such as nutritional information, ethical or other allergy statements, country of origin, self-claims and other labels were recorded to enable an assessment across brands, products and packaging type and what information was available overall. Where the claims and logos were typically placed on the packaging was also documented.

In addition to the audit, research on environmental labelling programs that are currently being accessed and used in Australia, as well as current standards and guidelines (including Australian Competition and Consumer Commission guidance), were reviewed to give background on the wide variety of key labelling programs and their relevance to assist consumers to identify whether to recycle or otherwise dispose of the packaging to landfill at end of life.

## 1.1 Background

There are a number of various schemes and logos that are used on packaging, both within Australia and internationally, that have been designed to assist consumers to make an informed choice when it comes to disposing of the packaging. The purpose of these are to help consumers to differentiate and separate packaging waste, reducing product to landfill whilst supporting recycling programs.

These logos and claims have been developed and endorsed by a wide range of organisations, as well as commercial enterprises that collect and recycle products and other materials including packaging, with the aim of providing consumer guidance and supporting the delivery of packaging waste reduction claims by major brands. Some are also apparent self-claims, where there is no external verification or endorsement.

A list of Australian and international disposal, recycling and compostability labels and claims is presented in Appendix A, and are discussed further in this document.

## 1.2 Objective and purpose

The objective of the project is to provide an up-to-date, evidence-based, comprehensive and objective analysis of the range of environmental and recycling logos and labels being used in Australia.

The purpose of the audit and research is to provide the Australian Council of Recycling (ACOR) with an assessment of the range of labels that are used on grocery, convenience, and other fast food products as to:

- the adequacy of current labelling;
- how they are used, and;
- whether they are clear, accurate and can easily be understood by consumers.

This report also provides recommendations with respect to a uniform and consistent approach to environmental labelling with a focus on their relevance, as well as ability to assist consumers to identify whether to recycle or otherwise dispose of the packaging at end of life.

# 2 Scope and audit methodology

## 2.1 Scope

The scope of the project was to audit products purchased from big chain retailers, smaller independent supermarkets, convenience stores and take-away food outlets located in Queensland and Victoria, and assess the packaging for a wide range of information and elements, including but not limited to environmental claims.

A total representative of 150 stock keeping units (SKU's) or meals in the case of fast food venues were audited, consisting of the following broad product categories:

- Baby and infant
- Bakery goods
- Convenience products
- Dairy
- Deli
- Beverages
- Eggs
- Other refrigerated items
- Frozen goods
- Fruit and vegetable items
- Health and beauty products
- Household items (including cleaning products)
- Lunch box and confectionary items
- Meat and seafood
- Pantry goods (including tinned products)
- Pet foods
- Fast (take-away) meal items

## 2.2 Audit methodology

The methodology used to undertake the audit is summarised as follows:

1. Items for purchase were broken down into categories to enable an assessment of a wide range of products to be sampled across the store/locations that were chosen as representative for the project.
2. A shopping list of items was documented by store/location, enabling a representative mix of products from each category to be sampled. Some flexibility was built into the sampling program in case products were not available, or if another product that included packaging that was unique was identified.
3. The methodology used by the auditors to ensure equal and representative products were purchased from the item lists were as follows:
    a. A scan from the top shelf to the bottom shelf or through the product display was undertaken to ensure products were purchased from a variety of placements and not just from eye level only, enabling access across mixed price points and brand positions.
    b. A cross section of brand names as well as private label products were chosen from each category and by each auditor.
    c. Products with packaging that was the most appropriate representation of the category were chosen to ensure that typical products were sampled.
    d. A mix of Australian made and imported products were sampled to compare labels across countries of origin.
    e. Once the product was selected, similar category products were inspected and products that contained the Australian Recycling Label (ARL) were documented.
4. When assessing the packaging, each aspect of the item was reviewed, including:
    a. Sides of packaging
    b. Separate packaging components within the one product
5. Photographs were collected from all component packaging.
6. The following information, including the location of the label on packaging, and any references to support claims was documented:
    a. Store and date of purchase
    b. Product name
    c. Country of origin/manufacture
    d. Packaging material/s (including use of polymer/resin code)
    e. Recycling/disposal claim, label, or instruction (e.g. ARL, return and earn, REDcycle)
    f. Other environmental or packaging claims (e.g. recycled content, FSC, compostable etc.)
    g. Other claims pertaining to product not packaging (e.g. allergens, dietary requirements, religious claims, organic, non-GMO)

All information was captured in a labelling information capture sheet and amalgamated to inform the audit findings presented herein in this report.

## 2.3 Environmental labelling and claims

The desktop research review focused on Australian claims whilst including international environmental labelling and claims.

Although not all international or country-specific labelling and claims have been documented within this report, it has been considered that the majority of labels have the potential to be applicable to products sold and consumed in Australia.

A summary of Australian and international disposal, recycling and compostability labels and claims is presented in Appendix A.

In the context of this report (and in line with AS14021:2018) *environmental claims made in regard to products may take the form of statement, symbols or graphics on products or package labels, or in product literature, technical bulletins, advertising, publicity, telemarketing, as well as digital or electronic media, such as the Internet.*

# 3 Packaging labelling and claims research

## 3.1 Product and packaging content labels

In addition to product and packaging content labels, there are also packaging labels that are concerned with recycled content claims, where packaging may contain some pre-or post-consumer materials.

The applicability of the labels and claims as well as plastic codes is discussed further in this document and summarised in Appendix B.

### 3.1.1 Plastic Identification Code

The Plastic Identification Code (PIC) or resin identification codes distinguish the resin composition of a polymer material into seven categories. Launched in 1988 by the Society of the Plastics Industry (SPI) and introduced to Australia in 1990, the coding system was intended to provide guidance for the recycling industry as to the polymer type for easy sorting and division into new products.

The code provides a number to identify the polymer that is then surrounded by the mobius loop or three chasing arrows.

In its simple form, it is a voluntary scheme for which manufacturers can indicate the resin code on materials (including packaging).

In 2003, Chemistry Australia (known then as the Plastics and Chemicals Industry Association) reviewed the Plastics Coding System against the changing marketplace and revised the Code of Practice to assist the industry on where and how to use the coding symbols and make it easier for re-processors to identify and separate used plastics for new applications.

It is noted that since that time, re-processors in Australia have increasingly employed automated technology to sort used plastics. At Material Recovery Facilities (MRFs) and plastics recycling operations, technology is widely used to sort used plastics into different polymers. Therefore, it is not clear to what extent the code continues to be used by re-processors for the stated purpose of being to identify and separate used plastics.

### 3.1.2 Mobius loop

The mobius loop was launched in 1970 as part of a contest sponsored by the Container Corporation of America (CCA). It is often referred to and used as a universal symbol for recycling indicating the capability of the particular material that bares it to be recycled.

However, it does not mean the product will be accepted for recycling as not all facilities can accept all potentially recyclable materials. The symbol is not trademarked and there is no official regulation for its use. As a result, it can appear on any item and does not necessarily indicate recyclability but could also mean that the material contains a certain percentage of recycled content.

The mobius loop has historically been associated and used in conjunction with resin identification codes although both symbols are not in any way associated with each other.

It appears that a form of mobius loop/recycling triangles continues to be the prevalent label in the Australian beverage industry, even though almost all its companies are members of the Australian Packaging Covenant Organisation (APCO).

Both codes in isolation, and together, do not guarantee that the material bearing the logos will be recycled.

## 3.2 Standards, guidance and specifications

In addition to the environmental labels and claims, there are a number of international standards and guidance that relate to the use of environmental labels and claims.

These standards and guidelines are important with respect to making claims in relation to an environmental statement or number of statements as well as positive enforcement around the relationship of the claim and its relevance to the product.

For completeness, a summary of current environmental labelling standards as well as definitions relating to recycling labels and claims has been presented in Appendix C.

There are a number of standards and guidelines that are applicable to the Australian manufacturing industry with respect to packaging claims and marketing environmental or sustainability claims or information on product packaging.

AS14021:2018 – Environmental labels and declarations – Self declared environmental claims (Type II environmental labeling) is related to the use of self-declared claims which may be made by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such claims.

The standard sets the parameters for ensuring that environmental claims are clear, transparent, scientifically sound and documented so that those who purchase or may potentially purchase products can be assured of the validity of the claims.

The standard contains a number of qualifications that relate to a wide variety of terms that could describe the environmental and sustainability credentials of a particular product including packaging. Terms that are covered by the standard include:

- Compostable
- Degradable
- Design for disassembly

- Extended product life
- Recovered energy
- Recyclable
- Recycled content
- Reduced energy consumption
- Reduced resource use
- Reduced water consumption
- Reusable and refillable
- Waste reduction

The Australian Competition and Consumer Commission guidance on Green Marketing and the Australian Consumer Law published in 2011, states that under Australian Consumer Law businesses must not mislead or deceive consumers in any way. This guidance document, as well as explaining Australian Consumer Law, provides both broad principles that should be considered when making environmental claims and a framework for advertising as it relates to the law.

The guidelines also provide background to a number of regulatory schemes that could apply to particular products as well as assistance to identify and rectify any misleading claims.

In summary, if an environmental claim is made about a product or service then it should be clearly and accurately explained as well as:

- Being honest and truthful
- Detailing the specific part of the product or process it is referring to
- Using language which the average member of the public can understand
- Explaining the significance of the benefit
- Be able to be substantiated.

The ACCC also made comment on recycling claims, namely that to claim recyclability a product or packaging needs to be:

1) Technically recyclable
2) Able to be included in existing systems, and
3) Is actually being recycled

The (APCO Sustainable Packaging Guidelines have been developed to assist signatories to the Australian Packaging Covenant (APC) to adhere to their commitments in the design of new packaging and review of all packaging annually.

The document establishes 10 Sustainable Packaging Principles including on-pack consumer labelling as Criteria 2.5 of the packaging related framework.

Relevant to this project, the guidelines provide reference to labelling of packaging consistent with AS/NZS ISO 14021:2016, (especially the ARL) throughout many of the principles, particularly with respect to the following specific principles:

7. Design to minimise litter
9. Design for accessibility; and
10. Provide consumer information on sustainability.

The Australasian Recycling Label (ARL) was launched in 2018 as an on-pack labelling program designed to help consumers understand what elements of packaging were able to be recycled or not and through what scheme (i.e. kerbside recycling or specific drop off point).

Application of the label requires an assessment utilising the Packaging Recyclability Evaluation Portal (PREP) which is an online tool that assesses packaging recyclability by considering typical Australian and New Zealand recovery systems, such as MRFs and markets for recyclate material.

Access to PREP, and therefore use of the ARL logo, is exclusive only to APCO members.

For Australia and New Zealand, a Technical Advisory Committee (TAC) has been formed by APCO to review the parameters and thresholds underpinning the PREP assessments to ensure all technical and kerbside data is as up to date and verified as possible. The TAC also considers research in areas where the recyclability assessment is not clear. The TAC is:

- Responsible for verifying PREP data
- Comprised of representatives across the supply chain and government
- Comprised of two subcommittees – Plastics & Paper, Glass and Metal

There are currently 391 organisations participating in the ARL program (as at 4 June 2020), and it is supported by consumer and industry education campaigns delivered by Planet Ark (consumer education) and APCO (industry update and engagement) (APCO, 2020).

United Nations Guidelines for Providing Product Sustainability Information were published in 2017. These were established to provide clear guidance on making effective, trustworthy claims to consumers, on product-related sustainability information. The Guidelines outline ten best practice principles, consisting of 5 fundamental principles being:

- Reliability,
- Relevance,
- Clarity,
- Transparency and
- Accessibility.

In the recently released 2020 report titled Can I Recycle This? A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging, the United Nations undertook an assessment of global plastic packaging claims against the 2017 Guidelines, where the ARL received a Net Positive score, meeting the clarity, accessibility and reliability ratings (UN, 2020, p.41)

# 4 Specific project findings

## 4.1 Research findings

As highlighted in the National Waste Report 2018, Australian kerbside recycling bins can contain anywhere between 4 - 16% contaminated materials (Pickin et al, 2018, p.52). This may consist of materials that are not actually recyclable, or materials that can be recycled however are contaminated with food or other materials. Not only does this illustrate that items are being incorrectly placed in the recycling stream, but recyclable items are also ending up in landfill.

The Don't Waste Your Waste study by Nestle and Planet Ark found that 80% of Australians want to reduce what they send to landfill while a UL Environment survey found 70% of respondents claimed to be consciously searching for greener products, which includes waste reduction (UL Environment, 2014, p.18). Despite this, Australians are still placing the wrong items into the recycling and general waste bins.

According to a report by Kelton (2019), only 22% of people are aware of the REDcycle soft plastic return program despite soft plastic packaging representing a third of plastic packaging placed on the Australian market.

Improper disposal of packaging is likely to be in part due to consumer confusion or lack of awareness about what materials can be recycled and what needs to be disposed to landfill either due to contamination or because there are no established recovery streams.

In addition to the absence of recyclability logos and claims, many consumers do not understand the meaning of some labels which may appear to be a recycling or recyclability logo, which has the potential to lead to the incorrect placement of non-recyclable materials into kerbside disposal bins causing contamination at the down-stream processing facility i.e. MRF's). While the mobius loop may not always denote recyclability, 82% of Australians believe that it does (Nestle, 2019). It may refer to recycled content or can apply to the product or the packaging. For this reason, the AS/NZS ISO 14021 stipulates that "if there is any potential for confusion about whether it applies to the product or the packaging, the symbol shall be accompanied by an explanatory statement" (p.6). Words such as degradable, biodegradable, oxo-degradable, bio-based and compostable that appear on packaging often cause confusion among consumers, as they are unaware of the implications of the claims and therefore, how to dispose of the product or packaging (United Nations Environment Programme, 2020, p.22).

It is likely that consumers do not understand the meaning of resin or polymer identification codes which may or may not be located on plastic packaging. Adding further to this confusion is that the codes are displayed within chasing arrows similar to the mobius loop, which could be confused with the fact that the plastic is recyclable. The resin identification code, though designed as a technical aid to recycling, does not specifically convey that the packaging can be recycled as there may not be systems in place to effectively recycle the packaging in the location it was consumed. A recommendation from the United Nations Environment Programme is that the term 'recyclable' or other environmental claims shall not be placed in proximity to resin identification codes (United Nations Environment Programme, 2020, p.25) to avoid confusion in what the consumer should potentially do with the packaging at end of life.

The Organisation for Economic Co-operation and Development (OECD) analysed the growth of environmental labelling and information schemes and listed 544 schemes worldwide from 1970-2012. While providing greater choice for consumers to find labels targeting their values, the multiplicity of labelling systems leads to complexity in supply chain management, difficulty in determining which labels are valued, and confusion for consumers in the criteria and meaning of claims.

Furthermore "theoretical modelling suggests that competition between labels may reduce environmental performance compared to a single label with strict environmental goals" (OECD, 2016, p.10).

It has become clear through the research that there are a small number of key consistent recommendations that environmental claims including the terms recyclable should be:

- Legible and understandable: be written in plain language and consider font and print size so they can be easily read (Federal Trade Commission).
- Specific: the claim should specify what part of the product or packaging it is referring to and should avoid ambiguous terms relating to environmental or sustainability claims (Australian Competition and Consumer Commission).
- Truthful and substantiated: claims must be able to be verified, for example by gaining third party accreditation (United Nations Environment Programme). “ACC Businesses have an obligation not to engage in any conduct that is likely to mislead or deceive consumers” (Australian Competition and Consumer Commission).
- Adaptable: environmental marketing strategies and messages need to be ongoing and adaptable as technology advances (Kaufman et al, 2020). They should also be relevant and take into account different consumer preferences.

Consumer recycling behaviour relating to packaging disposal was compared with and without the ARL over two years (APCO 2020). An increase in correct disposal for packaging with the ARL was noted in all six material components studied, demonstrating a significant potential improvement in recycling from effective labelling. However, the study did not compare the ARL to other recycling labels and therefore a comparison across different labels was not able to be drawn from this research.

Other key insights from the research as provided by APCO included:

- Sentiment for a recycling label continues to be positive, with 77% of respondents agreeing the ARL is a great idea, and 73% would like to see it on all packaging.
- 76% of respondents agree that the ARL is easy to understand and would make them more likely to recycle.
- In influencing purchase, 39% of respondents agreed that the ARL would influence their decision to buy a product.
- Consumers continue to find information on recycling via packaging product (62%) and their local councils (59%).
- 90% of respondents say recycling at home is the right thing to do, 78% say regular recycling is the most helpful thing they can do for the environment, 84% say it is easy to recycle at home although 65% would like more information on what they can and can’t recycle.

It is recognised that increased clarity and consumer understanding of environmental claims will improve brand perception. “When consumers get confused by a product claim, it carries over to how they feel about your brand” (UL Environment, 2014, p.20).

This research supports the need for a consistent and clear recycling label for all Australian products. The following section summarises the audit findings based on an audit of products purchased from big chain retailers, smaller independent supermarkets, convenience stores and take-away food outlets located in Queensland and Victoria for a wide range of information and elements, including but not limited to environmental claims.

A total representative of 150 stock keeping units (SKU’s) or meals in the case of fast food venues, were audited.

## 4.2 Audit findings

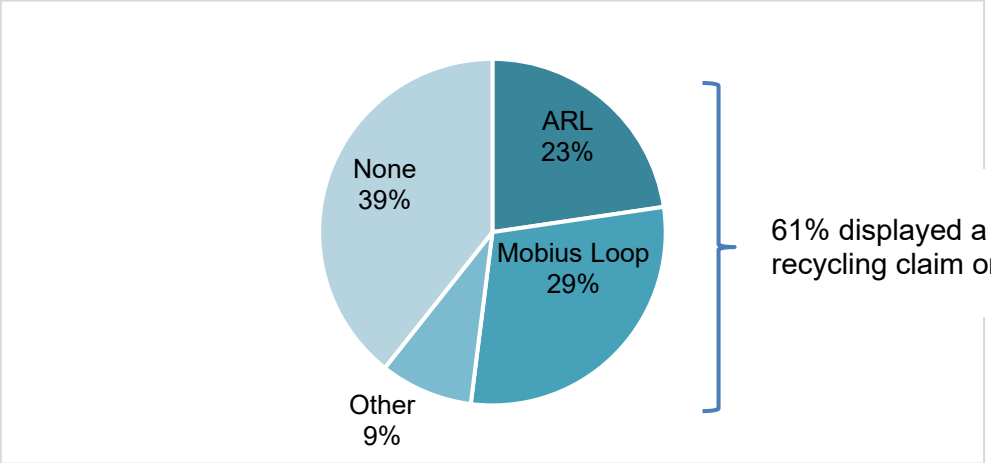
A breakdown of product category items that were audited are provided in Appendix D.

Recyclability claims were reviewed in three separate categories: mobius loop, ARL and other. The 'other' category consists of:

- The REDcycle label (not part of ARL but a program that enables consumers to return soft plastics to a number of collections points
- Container deposit return claims
- Compostable logos or claims
- UK OPRL (was observed on one product that was sampled)
- Brand-specific written claims of recyclability without a recognised logo such as "this package can be recycled" or "soft plastic recycling"

Of the 150 products, 61% displayed a recycling claim or label, 23% of which were the ARL and 29% were the mobius loop. Four products contained compostability logos, three referencing Australian standards and one referencing European Standards. In the data, these four products were defined as recyclable.

**Figure 1: Products displaying a recyclability claim or logo**




The following figures shows an example of a recyclability claim with the mobius loop and the ARL.

**Figure 2: Example of mobius loop on packaging**

**Figure 3: Example of ARL on packaging**


Although the majority of products had a recycling claim, the logos were commonly only on outer packaging rather than on each packaging component. As these are often separated and disposed of at different times, it may lead to incorrect disposal of some components. Only two products with the ARL identifying multiple components actually had the label on each component (see Figure 4 below).

**Figure 4: Example of packaging with ARL (and REDcycle) on all packaging components**


Considering 52% of products sample consisted of more than one component, this was a significant finding with respect to the inconsistency of displaying recycling labels relating to one or more packaging types. Furthermore, as well as not appearing on all components, many recycling logos or instructions did not capture all components of the product.

Figures 5 and 6 display information on the country of origin/manufacture and logos of the products sampled. Ninety-nine products were Australian made and 49 were imported. Fifty five percent of imported products and 64% of Australian products displayed a recyclability claim. Furthermore, 28% of Australian products had the ARL specifically, showing the largest reach of any other label. However, it fell short of capturing all supermarket and other items that were sampled as part of this project.

Of the 66% of products that were Australian made, it was identified that incorrect or ambiguous labelling had been applied to a number of packaging materials. Examples of these that were noted included liquid paper board packaging that claimed to be recyclable (Figure 7) and soft plastic packaging that contained a recycling logo with no explanation or guidance on separating from other recyclables (Figure 8) and where to recycle it.

**Figure 5: Country of origin/manufacture information**

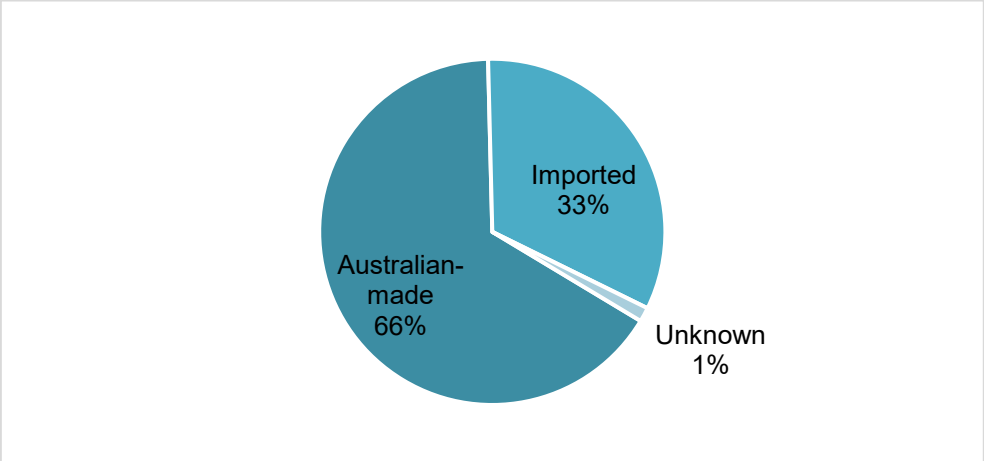



**Figure 6: Recycling claims by country of origin/manufacture**

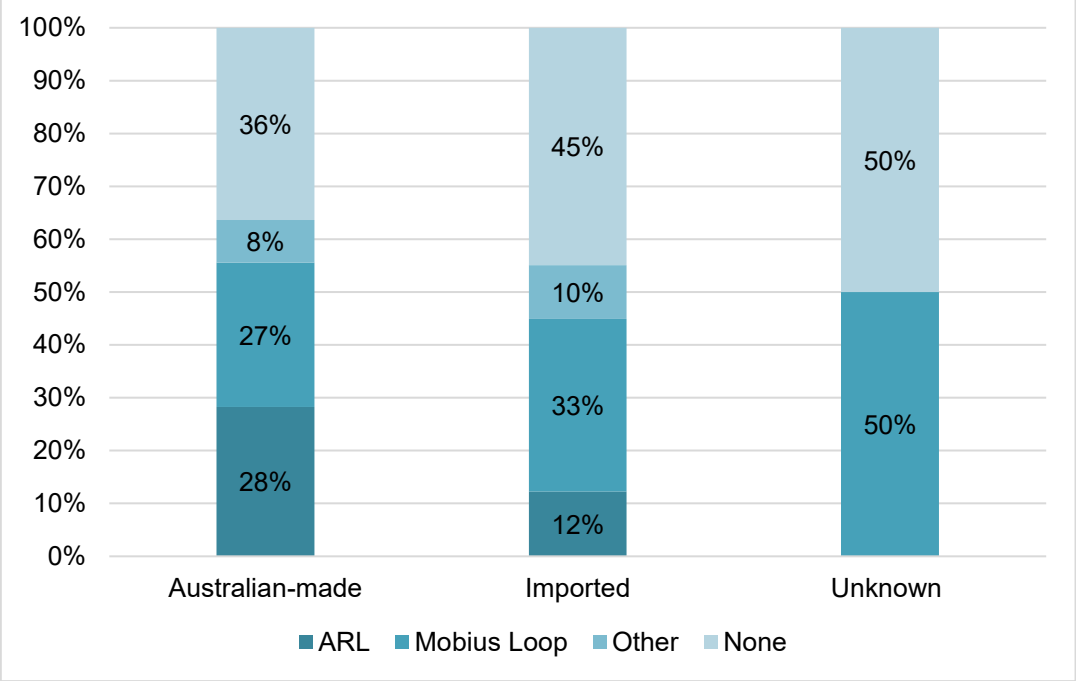



**Figure 7: Liquid paperboard labelled as recyclable**

**Figure 8: Soft plastic with unidentifiable recycling logo and no further explanation on how to recycle the packaging**

Other findings included instances where a logo was used differently in different circumstances such as the ARL or other labels stating a soft plastic film should be disposed of to a general waste bin. This was identified on ARL logos from ALDI brands, presumably since ALDI do not offer REDcycle collections at their stores. As a result, recyclable soft plastics are instructed to be disposed of in general waste.

The Tidyman logo appeared on 15% of products sampled (Figures 9 and 10), accompanied by statements that included “dispose of thoughtfully or responsibly”. It was found to appear on both recyclable and non-recyclable products and offers no instructions or information on the correct waste stream for the type of packaging it appeared on (Figure 11).

**Figure 9: Products displaying a recyclability or disposal logo**

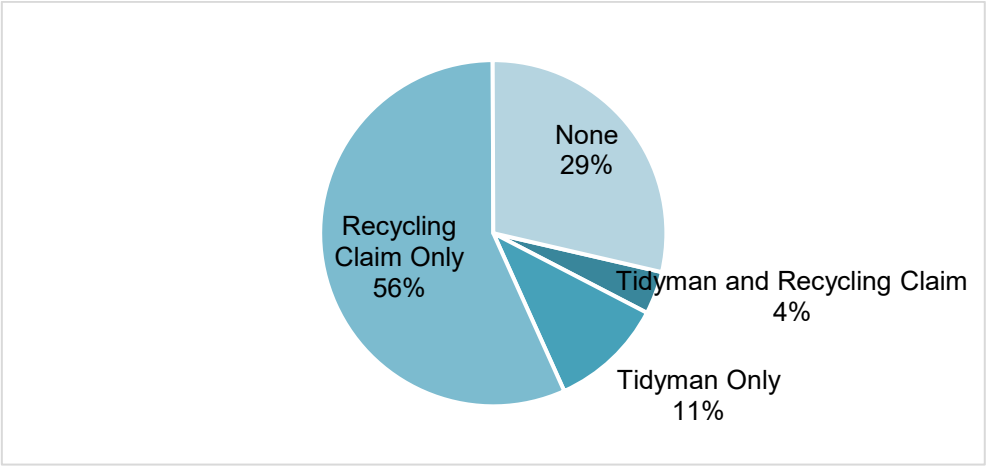


**Figure 10: Products displaying the Tidyman logo**

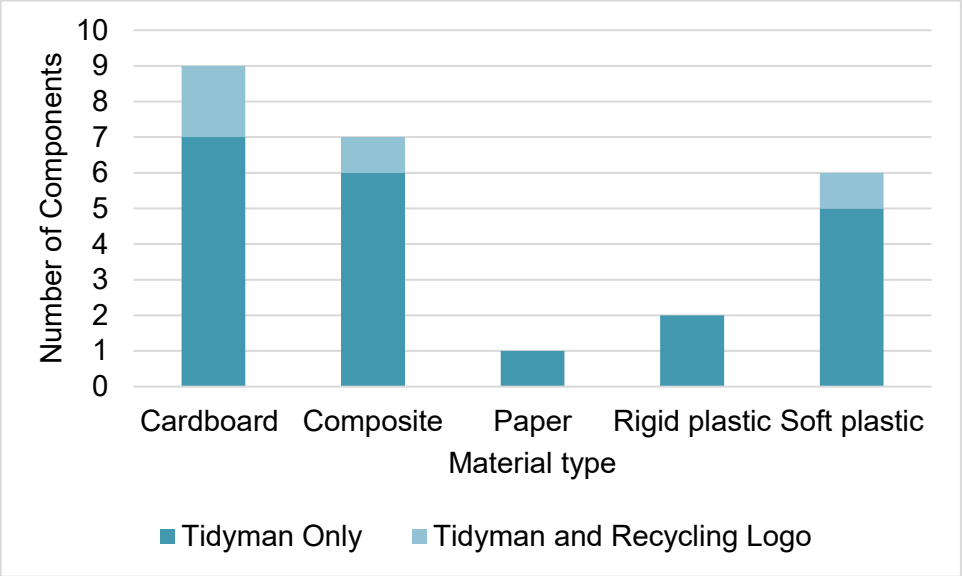



**Figure 11: Example of Tidyman logo**


Inconsistent instructions were found not only in relation to the Tidyman symbol, but also regarding recyclability in general. For example, a product may claim “this packaging is recyclable” when only the cardboard box is and not in the inner component if it was made of a non-recyclable material or if no clear recycling instructions were provided.

**Figure 12: Example of inconsistent instructions**

**Example of consumer confusion**

In the figure above, the consumer is required to investigate or research how to recycle the packaging as the logo states 'recycle at participating stores' with a link to a website.

On first inspection, the consumer might assume that it can be placed into the kerbside recycling bin for recycling.

If the consumer was to visit the website, there is no information relating to what participating stores accept the packaging, it only mentions REDcycle, and pizza boxes are not on the list of accepted products.

As mentioned above, 52% of products consisted of one or more components. A further breakdown into component materials was undertaken, as there were 246 components for the total 150 products. This found that soft plastics made up the highest portion of materials used at 30%, followed by cardboard and rigid plastic at 21% and 20% respectively (see Table 1).

Of plastic packaging components, only 28% declared the resin type. Resin type coding was only provided on 5 of the soft plastic components. This use of resin codes can be misconstrued as meaning recyclable. Therefore, the material could end up in kerbside recycling which is not the intent of the code.

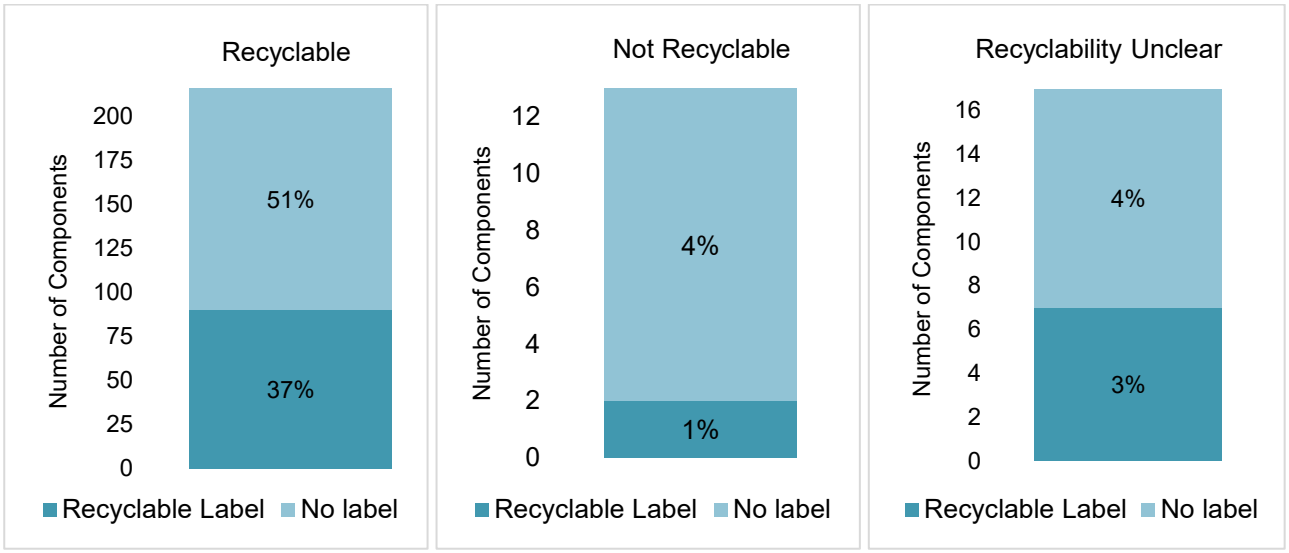
**Table 1. Packaging components**

| Material | Number of components | Percent of components | Components displaying a code | Percent of components displaying a code |
|---|---|---|---|---|
| Aluminium | 5 | 2% | 1 | 20% |
| Bioplastic | 1 | 0% | - | - |
| Cardboard | 51 | 21% | 2 | 4% |
| Composite | 29 | 12% | 2 | 7% |
| Foil | 3 | 1% | - | - |
| Glass | 6 | 2% | - | - |
| Paper | 9 | 4% | - | - |
| Pulp | 1 | 0% | - | - |
| Rigid plastic | 48 | 20% | 29 | 60% |
| Soft plastic | 73 | 30% | 5 | 7% |
| Steel | 14 | 6% | 1 | 7% |
| Liquid paper board | 6 | 2% | - | - |
| **TOTAL** | **246** | **100%** | **40** | **16%** |

It was identified that 88% of the packaging components that were sampled are recyclable through either kerbside recycling or REDcycle, but only 40% had a recycling claim. This 40% consisted of 37% from recyclable components, 1% on non-recyclable components and 3% on components where the recyclability was unclear (see Figure 13 for a further breakdown).

This leaves a large gap in what is labelled as recyclable and what can potentially be recycled. Lack of any disposal labelling, as seen on 51% of products, may also lead to consumers wrongfully placing non-recyclable items into their kerbside recycling bin potentially resulting in contamination.

**Figure 13: Recyclability of components vs recyclable label**

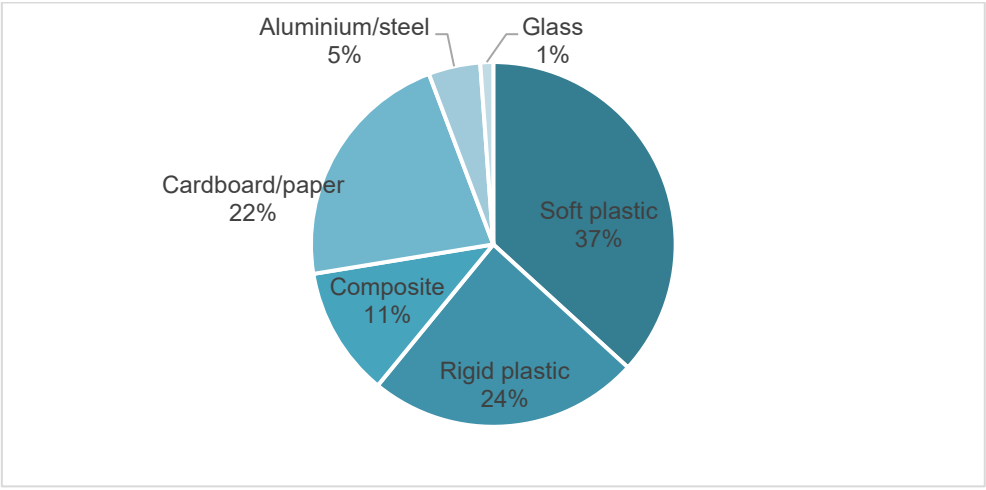



Interestingly, the audit also found a trend in packaging that contained organic and eco-friendly products. These product often do not have any recyclability claims, despite the packaging being easily recyclable.

While these products may cater to people who know the correct disposal methods for materials, it also may appear off-brand to not acknowledge the recyclability of packaging.

Figure 14 shows the material composition of the 59 products without a recyclability claim or logo. All materials except for composite packaging can be recycled either in kerbside recycling or through other drop off points. Moreover, composite materials can sometimes be recycled, depending on their makeup. It was assumed that 2 of the 5 composite materials would be accepted through recycling streams. Not included in this figure are the absorbing pads that were present in 2 meat trays and one fruit tray. The pads are not recyclable.

**Figure 14: Components in products with no recyclability claim**



The audit found no consistent placement or sizing of recyclable labels. While majority of them were located on the back of the packaging, they were placed on a variety of different locations and were displayed in different sizes. It was noted, however, that the labels are usually not on the front of the packaging (only 4%), with nutritional labels taking priority. When a product has many different logos and claims, recyclability labels are often small and placed on the rear of the packaging or underneath.

**Figure 15: Position of disposal logo on packaging**

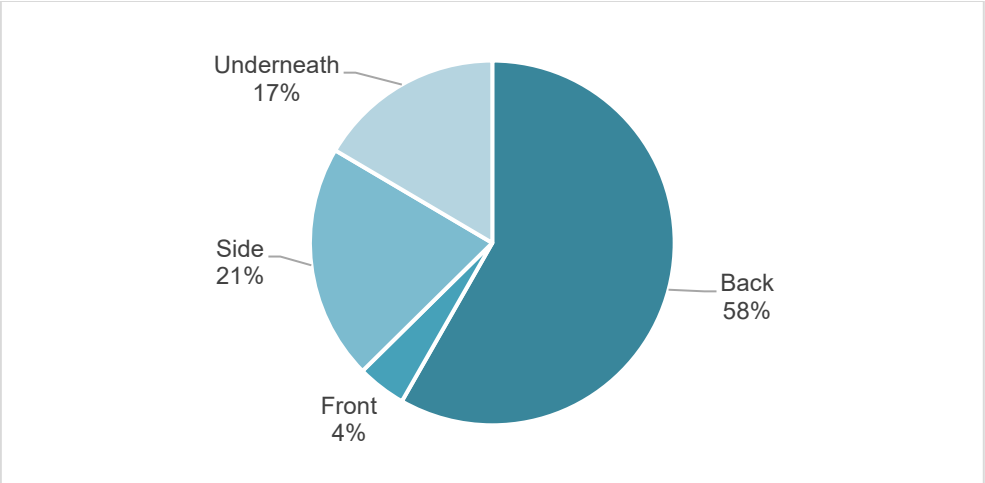



**Figure 16: Comparative sizes of recyclability logos**

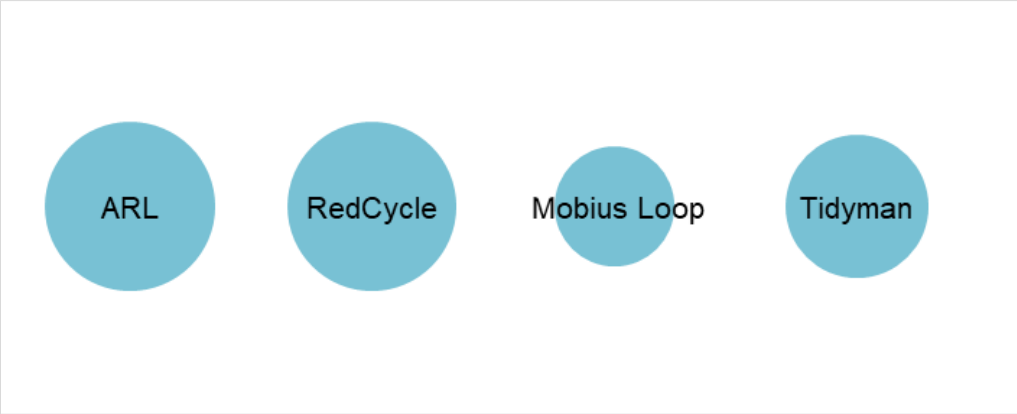



Figure 16 displays the average size of the recyclability logo when compared with the ARL logo. It was found that REDcycle logos are mostly the same size as the ARL, and in some instances are larger. The mobius loop is usually smaller, at approximately 50% the size, while the Tidyman is roughly 70% of the size of the ARL.

There were two instances (both cleaning products) where the ARL was accompanied by other brand-specific recyclability information, as detailed in Figure 17 on the next page.

**Figure 17. Products with ARL and further recyclability claims elsewhere on packaging**

| Product | Images |
|---|---|
| Cleaning spray |    |
| Cleaning wipes |       |

**Example of consumer confusion**

As it can be seen from the cleaning spray example above, there are a number of options available to the consumer to intervene to ensure that the correct packaging is recycled, and non-recyclable components are appropriately disposed of to landfill.

If the consumer was to remove the sleeve (plastic film) from the cleaning spray and assume that it is recyclable (due to the use of the mobius loop) and place it into the kerbside recycling bin, it wouldn't be recycled but rather would cause contamination.

If the consumer were to follow the instructions in accordance with the ARL, remove the sleeve, and dispose of it to landfill then there is a lost opportunity to recycle it through REDcycle or a similar scheme.

## 4.3 Other labelling and claims

The audit reviewed not only recyclability logos and claims, but also other labels on packaging in order to analyse the placement and visibility of environmental labels in general.

The table below outlines the range of additional labels and claims reviewed as part of the audit.

**Table 2. Range of additional labels and claims**

| Other labels/claims audited | Examples |
|---|---|
| Sustainability claims | FSC sustainable wood products<br>Recycled content claims<br>Organic<br>Sustainable Seafood<br>Biobased<br>Non GMO |
| Nutritional claims | Health star rating<br>No artificial colours or flavours<br>No preservatives<br>Sugar free<br>Reduced salt |
| Diet/allergen claims | Vegan friendly<br>Suitable for vegetarians<br>Lactose free<br>Gluten free<br>Low fodmap |
| Religious claims | Halal<br>Kosher |
| Country of origin/manufacture | 100% Australian made<br>Product of China |
| Chemical/health claims | Flammable<br>Paraben free<br>Dermatologically tested<br>Chlorine free |
| Community and charity claims | Bright Smiles Bright Futures<br>Surfrider Foundation Australia<br>MJF Charitable Foundation |

It was found that nutritional, diet and chemical claims take priority on product packaging over the other categories. The Health Star Rating particularly is commonly placed on the front of the packaging and of a reasonable size. Of the 20 products in the lunchbox/confectionary category, 14 have a health/allergen claim on the front while only 2 have a sustainability claim (both of which refer to the organic/certified product rather than the recyclability of packaging.)

Recyclability claims only occurred on the front of food products when there was no back label at all. This was mostly seen on fruit packaging. Interestingly, recyclability claims appeared on the front of 3 of the 11 household items. Sustainability claims given priority are often those associated with healthiness of the product, such as organic or non-GMO.

The country of origin claim is commonly placed on the front of packaging when from Australia, however, is not usually over-emphasised when the product is derived from another country. Considering there are seven other types of claims that were reviewed within the audit, it is common that packaging is overcrowded, and recyclability claims are not prioritised.

# 5 Overall assessment findings

In summary, the findings of this review were that there was a wide range of recycling and environmental claims on packaging in Australia which can be viewed in three separate categories being the mobius loop, ARL and other which in some instances are complementary (i.e. REDcycle) or contradict the recyclability of the product packaging (e.g. Resin Identification Codes).

It was found that the majority (61%) of packaging audited had a recycling logo or claim on pack, but they were often small and placed on the back or underside of packaging. In other words, there was no consistent placement of recycling labels on the products and packaging that was sampled as part of this project.

Although the majority of products had a recycling claim, the logos were commonly only on outer packaging rather than on each packaging component. Furthermore, it was identified that some labelling is incorrect or non-existent (some claim to be recyclable when not, some have no claim despite being recyclable) and the terminology used to explain the recyclability of the packaging is not consumer friendly (e.g. “this packaging is recyclable” when only the one component is actually recyclable).

Other incorrect statements included liquid paper board packaging that claimed to be recyclable and soft plastic packaging that contained a recycling logo with no explanation or guidance on separating from other recyclables and where to recycle it.

The Tidyman logo appeared on a number of products sampled accompanied by statements that included dispose of thoughtfully or responsibly. It was found to appear on both recyclable and non-recyclable products and offers no instructions or information on the correct waste stream for the type of packaging it appeared on, further adding to what can only be described as consumer confusion.

# 6 Recommendations

The assessment concluded that ambiguity is influencing consumers’ ability to effectively recycle household packaging through recycling programs and that rrecyclability labels need to be specific about the management methods of all components, and also include instructions to avoid contamination.

In order to help consumers make the right choices, there needs to be a clear, concise and evidenced based label placed on every product and packaging type sold into the Australian market.

A short cut to achieving greater clarity and consistency is that the use of mobius loop and Resin Identification Code symbols should be removed to further stop the confusion that the particular packaging product bearing them is recyclable. The use of the Resin Identification Code, in particular, is no longer required due to the use of technology to sort particular polymer types from each other during the sorting process. This will enable less cluttered messaging that clearly differentiates between actual recyclability and what can be recycled based on recycling or

collection capabilities. Packaging should also be clear of other confusing messaging such as the Tidyman symbol.

To further support clarity and consistency, a preferred label should be mandatory and be flexible enough to incorporate new technologies and systems as they come online to recycle more products. It should be engaging and able to raise awareness to help consumers understand how to recycle all packaging from products sold into, and used within, the Australian market.

Finally, there is a role for authorities in driving and ensuring clarity and consistency in environmental claims and labels pertaining to recycling. There is merit in the ACCC, in particular considering the findings, especially confusion in practices identified by this research.

# 7 References

APCO (2019). Summary of ARL Research.

APCO (2019). Sustainable Packaging Guidelines. Retrieved from https://www.packagingcovenant.org.au/documents/item/1091

APCO (2020). The Australasian Recycling Label.

Australian Competition and Consumer Commission (2011). Green marketing and the Australian Consumer Law. Commonwealth of Australia. Retrieved from https://www.accc.gov.au/system/files/Green%20marketing%20and%20the%20ACL.pdf

Australian Competition and Consumer Commission (2011). Your consumer rights: Environmental claims. Commonwealth of Australia. Retrieved from https://www.accc.gov.au/system/files/Your%20consumer%20rights%20environmental%20claims.pdf

Federal Trade Commission (2012). Federal Register: Guides for the Use of Environmental Marketing Claims; Final Rule. Retrieved from https://www.ftc.gov/sites/default/files/documents/federal_register_notices/guides-use-environmental-marketing-claims-green-guides/greenguidesfrn.pdf

Kaufman, S., Curtis, J., Borg, K., Meis-Harris, J., Bragge, P. and Downes, J. (2020). Effectiveness of product labelling schemes on influencing circular economy policy outcomes: A rapid evidence review. BehaviourWorks Australia, Monash University.

Kelton, N. (2019). Soft plastics: follow the Red recycled road. Australian Institute of Packaging. Retrieved from https://www.foodprocessing.com.au/content/packaging-labelling-coding/article/soft-plastics-follow-the-red-recycled-road-1510745757

Nestle (2019). Don't Waste Your Waste. Retrieved from https://www.nestle.com.au/sites/g/files/pydnoa356/files/asset-library/documents/nestle_infographic_recycling.pdf

OECD (2016). Environmental labelling and information schemes: Policy perspectives. Retrieved from https://www.oecd.org/env/policy-persectives-environmental-labelling-and-information-schemes.pdf

OECD (2019). Environmental Claims Findings and Conclusions of the OECD Committee on Consumer Policy. Retrieved from https://www.oecd.org/sti/consumer/48127506.pdf

Pickin, J., Randell, P., Trinh, J. and Grant, B. (2018). National Waste Report 2018. Blue Environment Pty Ltd, Department of the Environment and Energy. Retrieved from https://www.environment.gov.au/system/files/resources/7381c1de-31d0-429b-912c-91a6dbc83af7/files/national-waste-report-2018.pdf

Planet Ark (2019). Recycling Near You: Soft Plastics. Retrieved from https://recyclingnearyou.com.au/education/softplastic

Pollinate (2019). Comparison with and without ARL (APCO (2020). The Australasian Recycling Label – supplied to inform the project by APCO)

Standards Australia/Standards New Zealand (2000). AS/NZS ISO 14021:2000 Environmental labels and declarations— Self-declared environmental claims (Type II environmental labelling)

# Appendix A: Australian and international disposal, recycling and compostability labels and claims

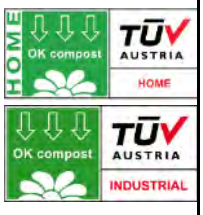
## Used in Australia

| Logo | Name and description | Region of use |
|---|---|---|
|  | **Australasian Recycling Label** – on-pack labelling scheme that helps consumers understand how to recycle products correctly and assists brand owners to design packaging that is recyclable at end-of-life. Developed by APCO, in conjunction with Planet Ark, the label is powered by the Packaging Recyclability Evaluation Portal (PREP) online tool that assesses packaging recyclability in the Australian and New Zealand recovery systems. | Australia and New Zealand |
|  | **Mobius Loop** – the mobius loop is often seen as the universal symbol for recycling. It is used on various recyclable materials globally to indicate the capability to be recycled. However, it does not mean the product will be accepted at all recycling facilities. The symbol is not trademarked and is part of the public domain, therefore it can be found in various colours and styles. The symbol can also be used to denote recyclable content, and therefore is sometimes accompanied with a claim such as “recyclable” or “please recycle me” to clarify the label. | Global |
|  | **Australasian Bioplastics Association Home Compostable Logo** – The Home Compostable Verification logo is a symbol that the product’s claims of biodegradability and compostability as per AS 5810-2010 has been verified. | Australia and New Zealand |
|  | **The Seedling Logo** – a registered trademark owned by European Bioplastics. It proves that a product is certified industrially compostable according to the European standard EN 13432. On a product, the Seedling always has to be shown together with the valid registration number printed below the logo. | EU and global |
|  | **Australasian Bioplastics Association Seedling Logo** – The seedling logo is a symbol that the product’s claims of biodegradability and compostability as per AS4736 has been verified. AS4736, as with EN 13432 provides a basis to allow labelling of materials or products made from plastics as ‘compostable’, for use in such facilities as municipal or industrial composters. | Australia and New Zealand |
|  | **TerraCycle** – offers recycling programs funded by brands, manufacturers, and retailers around the world to help consumers collect and recycle hard-to-recycle waste. Some programmes are free to consumers, while others have a cost. | Various countries including Australia |

| Logo | Name and description | Region of use |
|---|---|---|
| | **REDcycle** – the REDcycle program, developed by Melbourne-based consulting and recycling organisation RED Group, is a recovery initiative for post-consumer soft plastic. Plastic bags and soft plastic packaging can be returned to collection points at Coles and Woolworths to be recycled. | Australia |
| | **Tidyman** – The 'Tidyman' symbol is used in various forms around the world to encourage consumers to dispose of their packaging in a public place rubbish bin, rather than littering. The symbol is in the public domain (not licensed) and its use is entirely voluntary. It is often accompanied with advice, such as 'please dispose of thoughtfully'. While recommended for use on non-recyclable packaging that is likely to be disposed of in a public place, it often appears on packaging that is recyclable. | Global |
| | **Australian Recycled Cartonboard** – Australian Recycled Cartonboard was the first widely available recycled packaging material. It indicated that the packaging was made from recycled inputs, is recyclable and made in Australia. The use of this logo has decreased in the past 5-7 years. | Australia |
| | **BioPak** – BioPak is an Australian packaging company that specialises in compostable packaging. While this is a brand label, All BioPak's compostable products have been certified to EN 13432 or EN 14995 standard for composting in industrial composting plants. | Australia |

**International logos and claims**

| Logo | Name and description | Region of use |
|---|---|---|
| | **How2Recycle Label** – created by the Sustainable Packaging Coalition, How2Recycle is a standardised labelling system that clearly communicates recycling instructions to the public in North America. The label provides instructions on preparing the material for recycling, where to recycle or dispose of the materials, type of material, and the components that are recyclable. | North America |
| | **Japanese recycling symbols** – a series of identification marks used to distinguish various types of recyclable items. These relate to various bins for separate collection. | Japan |

| Logo | Name and description | Region of use |
|---|---|---|
|  | **On-Pack Recycling Label (OPRL)** – the scheme delivers a simple, consistent and UK-wide recycling message on retailer and brand packaging. While it previously featured three categories – widely recycled, check locally, and not yet recycled – OPRL announced in January 2020 that it would remove the check locally label and have only recycle or don't recycle. Specialist labels remain available for items such as coffee cups, and plastic wrap to return to store. | UK |
|  | **EuCertPlast** – created by Plastics Recyclers Europe, the scheme focuses on traceability of plastic materials (throughout the entire recycling process and supply chain), and on the quality of recycled content in the end-product. The scheme creates standards according to European Standard EN 15343:2007. | EU |
|  | **The Compostable Logo by the Biodegradable Products Institute** – The BPI's Compostable Logo identifies products that meet ASTM D6400 (for plastics) or ASTM D6868 (for fibre based applications) and will compost satisfactorily in large scale composting facilities. | North America |
|  | **How2Compost Label** – created by the same organisation that created the How2Recycle label to clarify composting instructions to the public. | North America |
|  | **GreenPla –** Japan Bioplastics Association verification of biodegradable plastics. GreenPla must contain at least 50 per cent organic material and must not exceed specific upper limits for certain heavy metals such as cadmium, lead, arsenic, and mercury. ISO 18606 compliant. | Japan |
|  | **OK Compost label by TÜV AUSTRIA** – Packaging or products bearing the OK compost INDUSTRIAL label are guaranteed to be biodegradable in an industrial composting plant. Compliant with EN 13432: 2000 the EU Packaging Directive ( 94/62/EEC). The OK compost HOME certification system guarantees complete biodegradability in the light of specific requirements, even in your garden compost heap. | EU |
|  | **OK Biodegradable (Soil, Water & Marine) label by TÜV AUSTRIA**. – Verifies biodegradability in various conditions – soil, fresh water and marine waters – without adversely affecting the environment | EU |

| Logo | Name and description | Region of use |
|---|---|---|
|  | | |

## Appendix B: Product and packaging content labels

| Logo | Name and description | Region of use |
|---|---|---|
|  | **Global Recycle Standard (GRS)** – The GRS is an international, voluntary, full product standard that sets requirements for third-party certification of recycled content, chain of custody, social and environmental practices and chemical restrictions. It is owned by Textile Exchange, and while the leading standard for the apparel industry, they ensure continued growth in other industries such as packaging. | Global |
|  | **The Recycled Claim Standard (RCS**) – an international, voluntary standard that sets requirements for third-party certification of Recycled input and chain of custody. The goal of the RCS is to increase the use of Recycled materials. It is owned by Textile Exchange, and while the leading standard for the apparel industry, they ensure continued growth in other industries such as packaging. | Global |
|  | **GreenCircle Recycled Content Certified** – Certifies products for total recycled content based on pre- and post-consumer recycled content definitions. Compliant with ISO 14021 and FTC Green Guides requirements | Global |
|  | **Intertek's Recycled Content Verification Program** – helps suppliers and manufacturers validate and communicate the pre-consumer and/or post-consumer recycled content in their product. ISO 14021 compliant | Global |
|  | **SCS Global Recycled Content Certification** – evaluates products made from pre-consumer or post-consumer material diverted from the waste stream. Certification measures the percentage of recycled content for the purpose of making an accurate claim in the marketplace. Compliant with ISO 14021 and FTC Green Guides requirements. | Global |
|  | **UL Environmental Claim Validation Mark / UL Recycled Content Validation** – The Environmental Claim Validation Program validates the postconsumer, preconsumer (postindustrial) or total recycled content of a product. ISO 9001, UL 746C & 746D compliant. | Global |

| Logo | Name and description | Region of use |
|---|---|---|
|  | **Roundtable on Sustainable Biomaterials (RSB) Excellence in Biomass and Biofuel Certification** – verifies that any bio-based feedstock, biomass-derived material and any advanced fuel, as well as complete supply-chains and novel technologies are socially responsible, environmentally sustainable and credibly sourced | Global |
|  | **Forest Stewardship Council logo** – verifies that the product is FSC certified. The logo on wood or wood based products is assurance that it is made with, or contains, wood that comes from FSC certified forests or from post-consumer waste. There are three types of FSC label: 100%, FSC Mix or FSC Recycled. | Global |
|  | **Programme for the Endorsement of Forest Certification (PEFC) labels** – the PEFC Certified Label indicates that the product or packaging is from sustainable managed forests, recycled and controlled sources. The PEFC Recycled Label indicates that the product or packaging is from recycled sources. | Global |
|  | **Green Dot** – The Green Dot is the financing symbol for the organisation of recovery, sorting and recycling of sales packaging. When you see the Green Dot on packaging it means that for such packaging, a financial contribution has been paid to a qualified national packaging recovery organisation. The Green Dot™ logo merely indicates that a company has joined the Green Dot scheme, and not necessarily that the package is fully recyclable | Global |
|  | **USDA Certified Biobased** – the label provides information to consumers about the biobased content of the product, and assures the customer that the product contains a USDA-verified amount of renewable biological ingredients. It does not certify whether the biobased content was sustainably sourced. ASTM D6866 compliant. | North America |
|  | **Japan BioPlastics Association's BiomassPla Label** – the BiomassPla Identification and Labelling System to help consumers identify biomass-based plastics defined by the JBPA as "high-polymer" materials with a mean molecular weight of at least 1,000 that can be obtained through chemical or biological synthesis from raw materials that contain substances derived from renewable organic resources. ASTM D6866 tested. | Japan |
|  | **OK biobased by TÜV Austria** – certifies products on the basis of the determined percentage of renewable raw materials (percentage Biobased) On this basis, the product is | EU |

| Logo | Name and description | Region of use |
|---|---|---|
| | then rated between 1 star to 4 star bio-based. | |
| biobased % | **NEN Biobased Content** – This certification system is based on the European standard EN 16785-1 which enables independent assessment of claims on the bio-based content of products. | EU |

## Appendix C: Definitions (UN, 2020) and standards

| Term | Definition and Context |
|---|---|
| Standard | Refers to specific criteria or norms of material goods or services, including packaging, which may also serve as benchmarks. |
| Certification | Refers to a formal accreditation process, in which it is confirmed that the certified entity or product/package meets a given set of (minimum) standards |
| Label | Describes a logo or stamp highlighting a product or service's specific characteristic(s), which may also be used as a form of trademark. A label may or may not represent a certification. |
| Claim | Refers to assertions made by companies about beneficial qualities or characteristics of their goods and services |

| Term | Definition and Context |
|---|---|
| Biobased plastics (also called bioplastics or plant-based plastics) | Plastics produced from renewable feedstocks such as corn, potatoes, and sugarcane, or other biomass, rather than fossil fuels.<br>The feedstock used to produce plastic is independent of its ability to be biodegraded or composted. |
| Biodegradable plastic | Biodegradable plastics are plastics that can be broken down by living organisms into elements that are found in nature, such as CO2 or methane, water, and biomass. When true biodegradation is complete, no microplastics should remain. Biodegradable plastics can be manufactured from renewable feedstocks or fossil fuels.<br>Soil biodegradable plastics can be broken down by organisms found in soil.<br>Marine biodegradable plastics can be broken down by organisms found in seawater. |
| Compostable plastic | Compostable plastic is designed to biodegrade in a certain period of time under managed conditions, predominantly characterised by forced aeration and natural heat production resulting from the biological activity taking place inside the material.<br>Compostable plastic will biodegrade during composting but does not contribute to the value of the compost product, since it does not contain nutrients in its composition.<br>Industrially compostable plastic is plastic that requires conditions only achieved in industrial composting facilities (i.e. temperatures over 50°C) in order to biodegrade. Standards exist to specify the conditions and time required in order for a material to be labelled as compostable.<br>Home, or backyard, compostable plastic is plastic that is capable of breaking down at the soil temperature and conditions found in home compost piles. |

| Term | Definition and Context |
|---|---|
| Oxo-degradable (also called oxo-biodegradable or oxo-plastics) | Oxo-degradable plastics are created with the addition of additives that cause them to break down under favourable conditions, most often UV radiation or heat. Oxo-degradable plastic fragments into smaller and smaller plastic particles but has not yet been shown to truly biodegrade, raising concerns that oxo-degradable plastics are a source of microplastics. |
| Recyclable | The definition for recyclable used in this report is the definition developed by the Ellen MacArthur Foundation: "A packaging or packaging component is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale" (Ellen MacArthur Foundation 2018, p. 12). |

**Environmental labelling standards**

| Standard | Description |
|---|---|
| ISO 14020 series on Environmental Labelling, including<br>• ISO 14020 Environment Labeling: General Principles<br>• AS/NZS ISO 14021 Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)<br>• ISO 14022 Environmental Labels and Declarations — Self-Declaration Environmental Claims, Symbols<br>• ISO 14023 Environmental Labels and Declarations — Self-Declaration Environmental Claims, Testing and Verification<br>• ISO 14024 Environmental Labels and Declarations — Environmental Labeling Type I, Guiding Principles and Procedures | The ISO 14020 series governs environmental labelling and declarations.<br>ISO 14021 specifies requirements for self-declared environmental claims, including statements, symbols and graphics. It provides definitions for common terms such as "Recycled Content" and "Recycled Material" and gives qualifications for their use.<br>ISO 14024 establishes the principles and procedures for developing Type I programs. This encompasses the selection of product categories, product environmental criteria and product function characteristics. Type I is a multi-attribute label developed by a third party. |
| ISO 18600 series on packaging and the environment<br>• ISO 18601 Packaging and the environment — General requirements for the use of ISO standards in the field of packaging and the environment<br>• ISO 18602 Packaging and the environment — Optimisation of the packaging system<br>• ISO 18603 Packaging and the environment — Reuse | The ISO 18600 series govern the standardisation of packaging and provide guidelines to integrate environmental consideration in the development of the packaging system.<br>ISO 18604 covers the requirements for packaging to be classified as recoverable in the form of material recycling.<br>ISO 18606 specifies procedures and requirements for packaging to be considered recoverable by organic recycling. |

| Standard | Description |
|---|---|
| • ISO 18604 Packaging and the environment — Material recycling<br>• ISO 18605 Packaging and the environment — Energy recovery<br>• ISO 18606 Packaging and the environment — Organic recycling | |
| ASTM D6400 Standard Specification for Labelling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities<br>ASTM D6868 Standard Specification for Labelling of End Items that Incorporate Plastics and Polymers as Coatings or Additives with Paper and Other Substrates Designed to be Aerobically Composted in Municipal or Industrial Facilities.<br>EN 13432 Packaging. Requirements for packaging recoverable through composting and biodegradation.<br>AS 4736 Biodegradable plastics suitable for composting and other microbial treatment<br>AS 5810 Biodegradable plastics suitable for home composting | In addition to ISO 18606 above, these standards provide specifications for items that are compostable or biodegradable in either home or industrial facilities. |
| EN 16760 Bio-based products - Life Cycle Assessment<br>EN 16785-1 Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis<br>EN 16785-2 Bio-based products - Bio-based content - Part 2: Determination of the bio-based content using the material balance method<br>EN 16640 Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method | These European Standards detail the requirements for determining the bio-based content in products, based on different testing methods. |
| AS/NZS 3831-1998 Waste Management Glossary of Terms<br>AS 4082-1992: Recycled paper - Glossary of terms<br>AS 1886, Glossary of terms relating to plastics | These Australian and New Zealand standards provide definitions for common waste management terms, in particular recycling terms, in order to promote consistency. |
| EN 15343 Plastics. Recycled plastics. Plastics recycling traceability and | EN 15343 Outlines the procedures for the traceability of recycled plastics. This gives the |

| Standard | Description |
|---|---|
| assessment of conformity and recycled content | basis for the calculation procedure for the recycled content of a product. |
| ISO 15270:2008: Plastics - Guidelines for the recovery and recycling of plastics waste<br>ISO/TR 17098:2013 Packaging material recycling — Report on substances and materials which may impede recycling | ISO 15270 details options for the recovery of plastics waste. It establishes the quality requirements to be considered in the recovery process, and provides general recommendations for inclusion in material standards, test standards and product specifications.<br>ISO/TR 17098 outlines the substances that can cause obstruction in recycling activities and is intended to assist in the assessment requirements set out in ISO 18604. |
| ISO 38200:2018 Chain of custody of wood and wood-based products | ISO 38200 outlines the requirements for a chain of custody (CoC) of wood and wood-based products, cork and lignified materials other than wood, such as bamboo, and their products. This standard can be certified against by the Forestry Stewardship Council for paper and cardboard packaging. |
| AS 2400 Packaging | The Australian Packaging Standards set the specifications for packaging, including various material types and packaging components. |
| The Global Recycle Standard (GRS)<br>Content Claim Standard (CCS)<br>Recycled Claim Standard (RCS)<br>Organic Content Standard (OCS) | These standards, owned by the Textile Exchange are designed to ensure chain of custody for preferred materials, and to provide labelling tools for final product claims. They are international, voluntary, full product standards. |
| Recycled Content Standard, V7.0 | This voluntary standard describes the requirements for third-party substantiation of the recycled content claims asserted by companies with regard to specific products. |

## Appendix D: Product category items and type

| Product Category | Product Type |
|---|---|
| Fruit and Vegetable | Raspberries |
| Fruit and Vegetable | Cucumbers |
| Fruit and Vegetable | Tomatoes |
| Fruit and Vegetable | Potatoes |
| Fruit and Vegetable | Mushrooms |
| Fruit and Vegetable | Corn |
| Fruit and Vegetable | Avocados |
| Fruit and Vegetable | Grapes |
| Dairy | Yogurt tub |
| Dairy | Yogurt pouch |
| Dairy | Feta cheese |
| Dairy | Milk |
| Dairy | Butter |
| Dairy | Brie Cheese |
| Eggs and Fridge | Eggs |
| Eggs and Fridge | Pre-packaged sliced meat |
| Eggs and Fridge | Tofu |
| Eggs and Fridge | Dip |
| Eggs and Fridge | Pasta 2 |
| Health and Beauty | Hand Sanitiser |
| Health and Beauty | Deodorant 2 |
| Health and Beauty | Skin care |
| Health and Beauty | Soothers |
| Health and Beauty | Razors |
| Health and Beauty | Toothpaste |
| Health and Beauty | Sanitary |
| Health and Beauty | Toothbrush |
| Health and Beauty | Tissues |
| Health and Beauty | Vitamins |
| Health and Beauty | Panadol |
| Pantry | Baked beans |
| Pantry | Rice |
| Pantry | Pasta sauce |
| Pantry | Stock |
| Pantry | Spice |
| Pantry | Cereal |
| Pantry | Condiment 1 |
| Pantry | Condiment 2 |
| Pantry | Spread |
| Pantry | Tin salmon |

| Product Category | Product Type |
|---|---|
| Pantry | Dried fruit 2 |
| Pantry | Flour |
| Pantry | Cake Mix |
| Pantry | Taco Kit |
| Pantry | Jelly |
| Pantry | Nuts 1 |
| Non-Dairy Milk | Almond Milk |
| Non-Dairy Milk | Soy Milk |
| Non-Dairy Milk | Coconut milk |
| Bakery and Convenience | Cookies |
| Bakery and Convenience | Bread (sliced and packed) |
| Bakery and Convenience | Bread stick |
| Bakery and Convenience | Muffins |
| Bakery and Convenience | Croissants |
| Bakery and Convenience | Cake |
| Bakery and Convenience | Pita bread |
| Bakery and Convenience | Ready to Eat salad |
| Bakery and Convenience | Microwave curry |
| Bakery and Convenience | Oven Pie Crumble |
| Bakery and Convenience | Soup |
| Bakery and Convenience | Mac n Cheese |
| Bakery and Convenience | Curry Kit |
| Bakery and Convenience | Rotisserie Chicken |
| Bakery and Convenience | Sushi |
| Bakery and Convenience | Ready meal |
| Drinks | Tea |
| Drinks | Coffee pods |
| Drinks | Juice pouch |
| Drinks | Juice bottle |
| Drinks | Coconut water carton |
| Drinks | Juice boxes |
| Drinks | Water |
| Drinks | Kombucha |
| Drinks | Hot chocolate |
| Freezer | Frozen fish |
| Freezer | Frozen turkey |
| Freezer | Ice cream cake |
| Freezer | Ice cream sticks |
| Freezer | Frozen vegetables |
| Freezer | Frozen meal |
| Freezer | Puff pastry |
| Freezer | Pizza |

| Product Category | Product Type |
|---|---|
| Lunch box | Chocolate block |
| Lunch box | Cracker chips |
| Lunch box | Cracker square |
| Lunch box | Crackers |
| Lunch box | Lollies |
| Lunch box | Muesli bars |
| Lunch box | Roll ups |
| Lunch box | Chips 1 |
| Lunch box | Chips 2 |
| Lunch box | Microwave popcorn |
| Lunch box | Corn thins |
| Lunch box | Biscuits 1 |
| Lunch box | Biscuits 2 |
| Lunch box | Muesli bites |
| Lunch box | Chocolate snacks |
| Lunch box | Dried fruit 1 |
| Lunch box | Dipper |
| Lunch box | Gum |
| Baby | Baby food 1 |
| Baby | Nappies |
| Baby | Infant cereal 1 |
| Baby | Infant cereal 2 |
| Baby | Custard |
| Baby | Dummy/soothers |
| Baby | Baby food 2 |
| Baby | Baby food 3 |
| Baby | Kids vitamins |
| Baby | Conditioning shampoo |
| Pet | Dry dog food |
| Pet | Tinned pet food |
| Pet | Dog treats |
| Household | Fire lighters |
| Household | Clean Wipes |
| Household | Toilet paper 1 |
| Household | Surface Cleaner |
| Household | Drain Cleaner |
| Household | Window Cleaner |
| Household | Laundry Detergent Box |
| Household | Sponges |
| Household | Bug Spray |
| Meat Seafood Deli | Shaved ham/meat/bacon |
| Meat Seafood Deli | Deli Soup |

| Product Category | Product Type |
|---|---|
| Meat Seafood Deli | Olives |
| Meat Seafood Deli | Single meat tray |
| Meat Seafood Deli | Smoked salmon |
| Meat Seafood Deli | Soft Cheese |
| Meat Seafood Deli | Chicken Drumsticks |
| Convenience | Coffee |
| Convenience | Sandwich |
| Convenience | Hot pie/hot food |
| Convenience | Slurpee |
| Take-away | Subway |
| Take-away | Hungry Jacks |
| Take-away | Local fish and chips |
| Take-away | Local pizza |
| Take-away | Noodle box |
| Convenience | Oil |
| Pantry | Jackfruit |
| Bakery and Convenience | Bakery bites |
| Lunch box | Nuts 2 |
| Pantry | Pasta 1 |
| Household | Toilet paper 2 |
| Pantry | Pancake mix |
| Health and beauty | Deodorant 1 |
| Lunch box | Chocolate |
| Household | Bin bags |
| Pantry | Oats |
| Pantry | Taco sauce |

## Appendix 7. Standards to facilitate the use of recycled material in road construction

STANDARDS Australia 100

CELEBRATING 100 YEARS 1922-2022

ACOR

AUSTRALIAN COUNCIL OF RECYCLING

# Standards to facilitate the use of recycled material in road construction

May 2023

## AUTHOR

Stephanie Groves
Strategic Initiatives

## ABOUT STANDARDS AUSTRALIA

Standards Australia is an independent, non-government, not for profit organisation. We are the nation's peak non-government standards development organisation.

The work of Standards Australia and our staff, stakeholders, members and contributors enhances the nation's economic efficiency, international competitiveness and contributes to a safe and sustainable environment for all Australians.

Standards Australia's vision is to be a global leader in trusted solutions that improve life – today and tomorrow.

# Contents

# Summary

With increasing pressure on natural resources, unprecedented levels of waste and pollution, and the urgent need to address climate change, Australia has begun to explore sustainable solutions to solve these challenges. Rapid economic development and population growth have led to an increasing realisation that the prevalent linear model of “take, make, waste” is financially, socially, and environmentally detrimental. The circular economy model offers a compelling solution to addressing these issues and transforming the way that we value and use resources.

Standards Australia coordinates a Circular Economy Advisory Group (CEAG) comprised of leading industry experts that work to strengthen partnerships and capitalise on opportunities to facilitate Australia’s transition to the Circular Economy. This group has identified immediate priority areas in building/infrastructure, textiles, organics, and plastics. As a part of the CEAG’s work program and in collaboration with the Australian Council of Recycle (ACOR), this report investigates the use of recycled materials in roads and explores how Standards Australia can assist in overcoming barriers to enable their widespread adoption in road construction.

## Key Findings

**The benefits of using recycled content in roads:** The use of recycled materials in roads and pavements can positively influence triple bottom line performance (i.e., social, economic, and environmental).

**Environmental Impact Reduction:** Incorporating recycled materials can reduce emissions and conserve natural resources by minimising the need for virgin materials. Depending on the type of recycled materials used, greenhouse gas emissions can be reduced by between 47% and 98% (ARRB 2022).

**Improved Performance:** Certain recycled materials can enhance both the durability and lifespan of road infrastructure. Researchers at RMIT and the University of South Australia tested asphalt with crumb rubber and found that it could double the durability of roads in hot weather. Crumb rubber has also positive effects on pavements, including through reduced noise and risk of cracking (Jamal, et al., 2022).

**Material Cost Saving:** The ARRB (2022) estimates that most recycled material applications in road and rail infrastructure can create cost savings between 2% and 83%. The use of reclaimed asphalt pavement (RAP) has the highest economic benefit, with a cost saving of 83%.

**Job Creation:** Expanding the market for recycled materials can generate additional employment opportunities. A report by Access Economics for the Department of the Environment, Water, Heritage and the Arts found that job creation in the recycling sector is higher than waste disposal with 9.2 jobs created for every 10,000 tonnes of materials recycled, compared with only 2.8 jobs created for sending materials to landfill.

**Barrier and challenges**: Gaps in procurement policies, lack of evidence demonstrating long-term environmental and performance outcomes, and nascent markets for some materials are several of the barriers that prevent the widespread use of recycled materials in roads. For example, materials such as crushed concrete, reclaimed asphalt pavement, and crumb rubber benefit from established markets with high levels of industry confidence. Other materials such as plastics, however, have less developed markets due to their uncertainty around long term performance and environmental impact. Two of the key barriers that Standards Australia can address include:

- **Inconsistency in local and state specifications and the need for nationally harmonised performance-based standards:** Discrepancies in allowable limits of recycled materials can lead to confusion and practical difficulties that cause reluctance in embracing recycled materials in road construction projects. Research undertaken by Infrastructure Australia (2022) found that prioritisation of the development of national standards and specifications is a key concern to industry stakeholders. The research revealed that an overwhelming 92% of survey respondents considered such standards crucial in supporting business decisions to produce recycled materials for road projects.
- **Lack of guidance and awareness in the use of recycled materials and the enabling standards:** Limited education and practical guidance on the use, performance, safety, and durability of recycled materials can contribute to misconceptions among engineers, contractors, and procurement officers.

### Recommendations – at a glance

1. Standards Australia, the Australian Government, and key industry expert participants should collaborate to modify existing and/or create new performance-based Australian Standards that harmonise the inconsistencies in existing specifications.

   Standards should:

   - Support the application of recycled content across jurisdictions
   - Be up to date with current waste streams and the types of recycled materials used in roads

2. Standards Australia, the Australian Government, the construction and recycling sectors, and circular economy leaders must continue to work together to provide practical guidance material for the use of recycled content in roads and the associated enabling standards.

   Guidance materials should:

   - Clearly communicate the benefits and applications of these materials in roads
   - Highlight the enabling standards and relevant use cases that govern the use of recycled materials
   - Provide the necessary knowledge to dispel misconceptions around recycled materials and the associated Australian Standards

# Background

## Australian Council of Recycling

The Australian Council of Recycling (ACOR) is the peak industry body for resource recovery, recycling, and remanufacturing in Australia, representing a sector that contributes almost $19 billion in economic value, while delivering broad social, economic and environmental benefits.

ACOR's membership operates across the recycling value chain, and includes leading organisations in advanced chemical recycling processes, CDS operations, kerbside recycling, recovered metal, glass, plastics, paper, textiles and e-product reprocessing and remanufacturing, road recycling and construction and demolition recovery.

The recycling industry operates across our homes, businesses, factories and construction sites. It collects, sorts and reprocesses material, and makes new products with recycled content, creating more jobs for Australians and supporting a circular economy.

## Standards Australia

Standards Australia is Australia's peak non-government, not-for-profit standards organisation. We work with Australian industry, government, academia, consumer groups, and the community to help address the challenges and opportunities facing the nation. Standards Australia also represents Australia at the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and specialises in the development and adoption of internationally aligned standards.

Standards Australia's vision is to be a global leader in trusted solutions that improve life – today and tomorrow. This vision has taken on a renewed importance as we face unprecedented biodiversity loss, climate change, and resource depletion. We work with industry, government, academia, consumer groups, and the community to help address the environmental challenges facing the nation.

Standards Australia is responsible for coordinating the attendance of Australian experts in the development of international standards and meetings at ISO and the IEC. Australian participation allows industry, academic, and government experts to shape trajectories and advance Australian values and interests on the international stage.

## The role of standards in the transition to a circular economy

Standards play a crucial role in facilitating the transition to a circular economy by establishing common definitions, measurements, and guidelines for industry, government, and consumers. Standards can provide guidance on issues such as energy and material efficiency, life cycle assessments, greenhouse gas emissions, traceability, and recycling practices. Standards can also encourage industry to design products with end-of-life in mind, so that they are more easily repairable, reusable, and recyclable.

By providing clear and verifiable criteria for evaluating environmental claims, standards can also combat greenwashing. This can deter businesses from making unsubstantiated claims about their products and help empower consumers to make informed decisions about the products they buy.

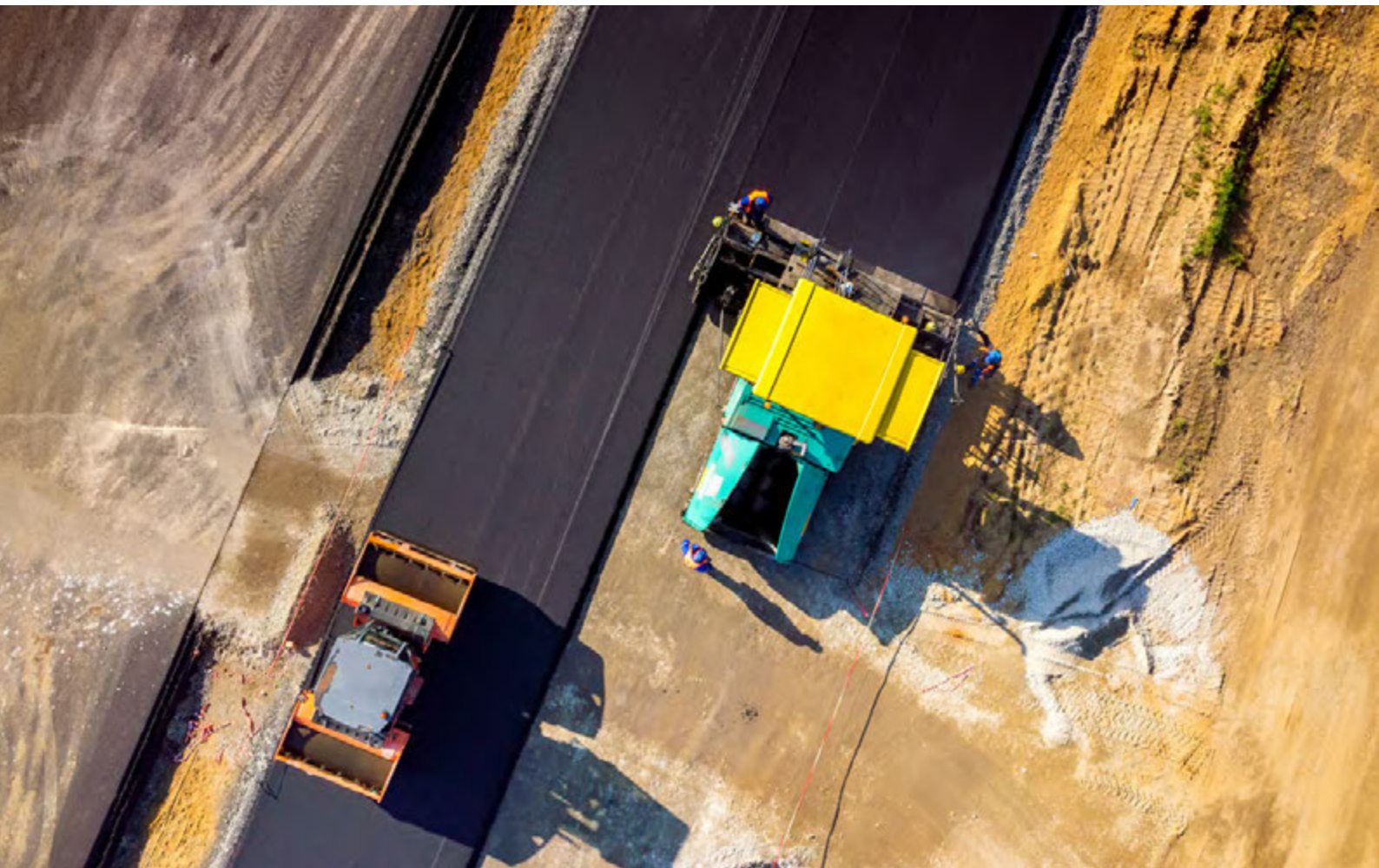
# 1. Introduction

This report is based on initial research conducted by Standards Australia to investigate if standards inhibit the use of recycled materials in roads, urban furniture, and food containers. We reviewed more than thirty International and Australian Standards that can be applied to the sampling, testing, or determination of the characteristics and quality of asphalt, pavement, and aggregates and found that existing Australian Standards are performance based and do not inhibit use of recycled materials in road and pavement constructions.

The previous research recommends:

1. to provide education opportunities for construction sector stakeholders to improve their understanding of the existing standards requirements,
2. where possible, promote the use of recycled materials in roads.

This report aims to extend the previous research by exploring the areas where Australian Standards can facilitate the transition to a circular economy by addressing some of the barriers associated with the use of recycled materials in road construction. Building upon the findings of the Australian Road Research Board (ARRB) and Infrastructure Australia, this report provides recommendations and areas of action to overcome barriers and increase the use of recycled content in road construction.



# 2. Policies and Drivers for the Use of Recycled Materials

## 2.1. National Waste Policy and Action Plan

The Australian Government's 2018 National Waste Policy: Less Waste, More Resources establishes a framework for waste and resource recovery. This policy identifies the following five principles that underpin waste management in a circular economy:

- Avoid waste
- Improve resource recovery
- Increase use of recycled material and build demand and markets for recycled products
- Better manage material flows to benefit human health, the environment and the economy
- Improve information to support innovation, guide investment, and enable informed consumer decisions.

The National Waste Policy Action Plan (2019) included actions to deliver on seven national targets:

1. Ban the export of waste plastic, paper, glass and tyres
2. Reduce total waste generated by 10% per person by 2030
3. Recover 80% of all waste by 2030
4. Significantly increase the use of recycled content by governments and industry
5. Phase out problematic and unnecessary plastics by 2025
6. Halve the amount of organic waste sent to landfill by 2030
7. Provide data to support better decisions

To enable the transition to a circular economy, governments and industry are working to reduce waste generation and improve reuse and recycling of valuable materials. This transition will bring long-term environmental, social and economic benefits to the Australian economy.

In alignment with the National Waste Policy, government and industry have increased the use of recycled materials in their projects including in road infrastructure. Considering the variety of recycled materials that can be used in road construction, this sector can contribute significantly to achieving the resource recovery targets. However, the National Waste Policy specifies few quantifiable targets for the use of recycled content by governments or industry.

## 2.2. National Waste Report

The National Waste Report 2022 estimates that from the 75.8 tonnes of waste generated in Australia for FY 2020-2021, 25.2 million tonnes came from building and demolition materials. The report also estimates that 63.8 million tonnes of the generated waste was 'core waste'[1], from which 29 million tonnes (38%) came from the construction and demolition sector, compared with 14 million tonnes (18%) from households and local government activities. This indicates that there is a considerable supply of recoverable materials available for reuse in the road construction sector.

1 Core waste is generally managed by the waste and resource recovery sector, comprising of solid waste and liquid hazardous waste, and generated in the municipal, construction and demolition, and commercial and industrial sectors, and including biosolids. Core waste generally excludes, to the extent they can be identified, wastes from primary production (National Waste Report 2022).

# 3. Use of recycled materials in road construction

Recycled materials can be used as a supplement for traditional aggregate in concrete. Figure 1 shows where concrete and therefore, recycled materials, can be used in road infrastructure. Examples include bridges, kerbs, footpaths, roads and pavements, pipes, drain covers, and parking lots.

**Figure 1: Applications of concrete in road infrastructure. (a) bridge, (b) kerb, (c) footpath, (d) road, pavement, (e) pipes, (f) drain covers, and (g) parking lots**


The types of recycled material that can be used in road construction include:

- Crushed concrete and brick
- Recycled crushed glass (RCG)
- Reclaimed asphalt pavement (RAP)
- Crumb rubber products
- Ground granulated blast furnace slag (GGBFS)
- Fly ash
- Bottom ash
- Recycled plastics

Several major road projects in Australia have incorporated recycled materials, setting a precedent for future projects. A noteworthy example includes the Mordialloc Freeway in Melbourne, which is made from more than 150,000 tonnes of recycled asphalt, 193,000 tonnes of recycled road base, and 570 tonnes of plastic materials (Sustainability Victoria 2022).

In recent years, the focus has shifted toward maximising the benefits of recycled materials in road construction through optimising their use, enhancing the quality of the products, and exploring innovative applications. This has been facilitated by advancements in recycling technology, improved understanding of material properties, and continued collaboration between government, industry, and research institutions.

## 3.1. Benefits

The use of recycled materials in roads can bring significant benefits through affecting the triple bottom line (environmental, economic, and social outcomes). These benefits impact the whole life cycle associated with the incorporation of recycled materials and industrial by-products in road and pavement construction.

### 3.1.1. Environmental benefits

The benefits associated with the use of materials in roads depend on several factors, such as the type and processing of the materials. Some of the benefits of using recycled materials in roads include:

- **Reducing waste disposal:** By incorporating recycled materials into road construction projects, less recoverable materials are sent to landfills.
- **Reducing greenhouse emissions:** The production of new materials and the disposal of waste materials often involve processes that generate greenhouse gas emissions. Using recycled materials in road construction can significantly lower these emissions.
- **Conserving energy and water:** Conservation of energy and water associated with the production of new materials and the disposal of waste materials
- **Increasing recovery and recycling rates:** When recycled materials are used in road construction, it supports the development of a circular economy.
- **Reducing our reliance on virgin materials and non-renewable resources:** The use of recycled materials in road construction decreases the demand for virgin materials and non-renewable resources and mitigates the impacts associated with extracting and processing these materials.

The ARRB (2022) provided a comprehensive review of the environmental, economic and social impacts of using recycled materials in major infrastructure projects across the road and rail industries in Australia. The report concludes that using recycled materials in roads and rail infrastructure has a significant environmental benefit in terms of reducing greenhouse gas (GHG) emissions. The emission reduction depends on the type of recycled materials used and can vary between 47% to 98%. **The highest emission reduction results from the use of two recycled materials: reclaimed asphalt pavement in surface and base layers and fly ash as a replacement for hydrated lime and cement in stabilised asphalts and concrete pavements. Both recycled materials can reduce GHG emissions by approximately 98%.**

The Recycled Materials Resource Center at the University of Wisconsin Madison developed a life-cycle assessment tool for environmental and economic effects (including reduction of carbon dioxide emissions, energy consumption, and water consumption) associated with the substitution of recycled materials - such as fly ash in concrete, reclaimed asphalt pavement, and recycled concrete aggregate - for conventional virgin materials in highway construction. Using the data collected across six US states, the savings from recycled materials used across all member states were equivalent to the energy consumption of 110,000 U.S. households per year, 9,300 bathtubs of water, and the carbon dioxide emissions produced by 58,000 cars per year (Del Ponte, et al., 2017).

Another estimate was presented by the Southern Sydney Regional Organisation of Councils (SSROC), an association of 11 councils spanning Sydney's southern suburbs, eastern suburbs, CBD, and inner west, which collectively manages approximately 20% of the waste in NSW. As part of their Procure Recycled: Paving the Way initiative, SSROC (2021) estimated that **using recycled crushed glass (RCG) gathered from kerbside collection across 16 Sydney Councils can result in recycling about 93 million glass bottles per year,** without compromising high-order recycling of glass back into beverage containers.

Furthemore, the MRA Consulting Group (2019) was commissioned by ACOR to investigate the use of recycled content in road building materials. The study identified two major road

infrastructure projects in construction in each state, reviewed the current recycling material used within each project, and investigated further use of recycled materials in road construction and upgrades. The results show that **using recycled materials (plastic, tyre crumb, and glass) in just two major road projects per state, could consume almost 2.3 million tonnes of recyclables.**

### 3.1.2. Economic benefits

The economic benefits of using recycled materials in road infrastructure, particularly material cost saving, depend on factors such as materials and market maturity. Some of the benefits include:

- **Reducing waste disposal costs:** Utilising recycled materials in construction projects sends less waste to landfills. This reduces the costs associated with waste disposal, such as landfill fees, transportation, and long-term monitoring expenses.
- **Job creation:** The increased demand for recycled materials in infrastructure projects supports the growth of the recycling sector, which in turn creates new job opportunities.
- **Material cost saving:** Recycled materials often cost less than their virgin counterparts, resulting in significant material cost savings for construction projects. The savings vary depending on factors such as geography, market maturity, and material quality.

The ARRB (2022) estimates that most recycled material applications in road and rail infrastructure can increase the cost saving between 2% to 83%. RAP has the highest economic benefit, with a cost saving of 83%.

Additionally, the adoption of recycled materials can have a positive impact on employment as it creates more job opportunities in the recycling sector to meet the increase in demand for recycled materials. Notably, job creation in the recycling sector is higher than waste disposal with **9.2 jobs created for every 10,000 tonnes of materials recycled, compared with only 2.8 jobs created for sending waste to landfill** (ARRB 2022).

The Recycled Materials Resource Center at the University of Wisconsin–Madison also estimated the environmental and economic life-cycle benefits associated with the incorporation of recycled materials and industrial by-products in highway construction. Using the data collected across six US states, the total economic savings from using recycled materials in highway construction was estimated to be $62.5 million (Del Ponte, et al., 2017).

### 3.1.3. Social benefits

The social impacts of using recycled materials in roads are closely linked to the environmental, health, and economic advantages that arise from this practice. Some of these benefits include:

- **Improving welfare through job creation:** The use of recycled materials in road construction supports the growth of the recycling sector, which in turn can create new job opportunities. These jobs can range from waste collection and processing to manufacturing recycled products, which ultimately contributes to local economic development and overall community welfare.
- **Improving community satisfaction and civic pride:** Sustainable road construction practices demonstrate a commitment to environmental stewardship and responsible resource management. This can enhance community satisfaction and promote civic pride, as residents appreciate living in a region that values and invests in sustainable practices. (ARRB, 2022).
- **Improving intergenerational equity by preserving natural resources for future generations:** Using recycled materials and preserving natural resources can ensure that future generations have access to the resources they need to sustain their communities. This intergenerational equity is an essential component of social sustainability, fostering a sense of responsibility and stewardship for the well-being of future generations.
- **Improving public health:** The use of recycled materials in road construction can lead to improved public health outcomes by reducing greenhouse gas emissions and other

pollutants associated with the extraction, production, and transportation of virgin materials. Additionally, by reducing the need for quarrying operations, which often produce blast noise and vibrations, the use of recycled materials can help mitigate the negative health effects associated with these activities (ARRB, 2022).

### 3.1.4. Performance benefits

Performance benefits play a crucial role in increasing industry confidence in the use of recycled materials in road infrastructure. The performance benefits of using recycled content vary from material to material, however, there are some common benefits (IPWEA, 2016):

- **Reducing the total volume of material required:** By using recycled materials with enhanced properties, the overall quantity of raw materials needed for a project can be reduced. This results in cost savings and decreased environmental impact.
- **Reducing reflective and fatigue cracking:** The incorporation of certain recycled materials, such as crumb rubber, can improve the resistance of road surfaces to reflective and fatigue cracking. This can increase the overall lifespan of the road, reducing maintenance costs and disruptions.
- **Increasing longevity of the roads**: Recycled materials can enhance the durability and performance of road surfaces, increasing their overall lifespan.
- **Reducing traffic noise**: Some recycled materials, such as crumb rubber, can help decrease traffic noise levels when used in road surfaces. This can improve the quality of life for residents in nearby areas and contribute to overall community well-being.

Confirming these benefits, the MRA Consulting Group estimates that the **addition of recovered soft plastics used as recycled polymers enhances the performance characteristics of asphalt, delivering a 65% increase in fatigue life over standard asphalt, and a huge improvement in deformation resistance, from a measurement of 9-11mm for standard** (MRA Consulting Group, 2019).

A United States based company Technisoil, which uses melted-down plastic waste as a form of bulking agent for bitumen, claims that the result of using recycled materials is between **two and three times longer-lasting than standard bitumen, as well as being more flexible and forgiving than standard concrete** (Technisoil, 2020).

Moreover, researchers at RMIT and the University of South Australia tested asphalt with crumb rubber and found that it could **double the durability of roads in hot weather.** Crumb rubber has also positive effects on pavements, including through reduced noise and risk of cracking (Jamal, et al., 2022).

## 3.2. Barriers and challenges

While the benefits of using recycled materials is encouraging, there are challenges and concerns that must be addressed to confidently apply these materials in roads.

The key challenges include the quality, price, availability, and long-term environmental effects of the recycled materials. These concerns vary according to the extent the material is used.

Some materials, such as crushed concrete, RAP, and crumb rubber benefit from established markets, are commonly used to supplement traditional materials, and industry confidence in their use is high. Other materials, such as plastics have a less developed market due to perceived uncertainty around their performance, impact on the environment, health and safety, and their reuse capability.

### 3.2.1. Material specific challenges

Below, we review the ARRB (2022) findings on the market maturity, specifications and guidelines, and the performance of the recycled materials in roads:

- **Recycled Crushed Glass (RCG):** Recycled Crush Glass has been used in embankments, fill, and drainage since the 1970s and several specifications have been developed to support its use. There are a number of barriers for the market; including processes for collection systems and contaminants that can affect the quality of the glass. Despite these challenges, there is a great opportunity to support the use of glass in road contruction.
- **Crushed Concrete and Brick:** The use of crushed concrete and brick is a well-established practice in Australia. It is estimated that using recovered construction and demolition materials can divert up to 8,000 tonnes of resources from landfill per kilometre of road construction. (Department of Transport and Main Roads, 2022). The market is supported by standards and specifications such as AS 2758.1-2014 Aggregates and rock for engineering purposes.
- **Reclaimed Asphalt Pavement (RAP):** Similar to recycled crushed concrete, RAP is also well-established in Australia and in some applications, up to 100% RAP can be used. A variety of standards, specifications, and guidelines has been developed to support its use. such as the AS 1141 series for sampling and testing aggregates or the Reclaimed Asphalt Pavement Management Plan (Australian Asphalt Pavement Association, 2018).
- **Crumb Rubber:** The reduction in noise and a decreased risk of cracking associated with using crumb rubber have been well recognised by the industry. Crumb rubber has developed a relatively mature market in Australia, with adequate supply of end-of-life tyres to increase the use of the material in roads. It is also supported by several specifications and guidelines such as the Crumb Rubber Modified Open Graded and Gap Graded Asphalt (Australian Asphalt Pavement Association 2018) and D&C Specification 3256 Crumb Rubber (TfNSW 2020).
- **Ground Granulated Blast Furnace Slag (GGBFS):** GGBFS has been globally used in roads since the 1960s and has developed a relatively mature application. However, its application is limited in Australia with few producers of the material, with some supplies imported.
- **Fly Ash:** Fly ash has been used in several applications including in concrete since 1975 in Australia. In terms of performance, fly ash has been found to be a good alternative to non-recycled materials. Several specifications and guidelines have been developed to support the use of fly ash. For example, AS/NZS 3582.1-2016 Supplementary Cementitious Materials: Part 1: Fly Ash. However, within existing state specifications there is no consistency of allowable rates. For instance, WA specifies the recovery rate of generated fly ash at 72% compared to 18% in Qld and 10% in NSW.
- **Bottom Ash:** Bottom ash is a by-product from coal combustion or waste to energy plants. This material is confidently applied in roads globally, predominantly in Europe. Considering the development of the waste management sector in Australia, bottom ash has potential to be commercially available in the near future.
- **Recycled Plastics**: Recycled plastic has several applications in infrastructure including roads. However, the market maturity of using recycled plastics in roads is quite low and there is a lack of industry confidence due to environmental questions surrounding microplastics and leachates. On the other hand, the recovery rate of plastics in Australia is only 14% which indicates there is a significant available supply (Department of Climate Change, Energy, the Environment and Water, 2022). Additionally, several emerging initiatives to enhance plastic recycling have been developed by different level of governments to increase the use of recycled plastics across the economy. For example, to address microplastic concerns, Austroads (AP-R669-22) has developed the basis of a performance-based evaluation protocol to assess emissions and microplastics from plastic-modifed bitumen and asphalt.

Table 2 summarised the market maturity of the recycled materials explained above (ARRB, 2022)

Table 2: The maturity of Australia's recycled materials market

| Material | Australian Market |
|---|---|
| Crushed Concrete and Brick | **Mature**<br>It is estimated that it can deliver 8,000 tonnes of construction and demolition waste from landfill per kilometre of road construction |
| Reclaimed Asphalt Pavement (RAP) | **Mature**<br>In some applications, up to 100% recycled RAP can be used |
| Crumb Rubber | **Mature**<br>Adequate supply of end-of-life tyres |
| Fly Ash | **Mature** |
| Recycled Crushed Glass (RCG) | **Relatively new**<br>The supply of glass waste to recyclers is above the demand, but there are a number of barriers for the market including processes for collection systems and contaminants that can affect the quality of the glass |
| Ground Granulated Blast Furnace Slag (GGBFS) | **Limited**<br>Only one operational producer of the material |
| Recycled Plastics | **New**<br>A significant available supply |
| Bottom Ash | **No market in Australia**<br>Confidently applied in roads globally, predominantly in Europe |

### 3.2.2. Market challenges

In addition to the above-mentioned material challenges, market challenges and barriers can negatively affect the use of recycled materials. These include:

- **A lack of evidence to show the long-term outcomes and sustainability benefits of the use of recycled materials:** This includes uncertainty regarding the end-of-life options (e.g., recyclability and resource recovery) of roads containing recycled materials once they reach their end of life. There are concerns regarding whether the roads with recycled materials can be recycled further, if the materials would impact the reuse performance, or require additional energy. There are also concerns regarding chemical additives, health, and safety precautions.
- **Procurement issues:** There is a gap in current procurement policies to optimise the application of recycled materials. Although the Commonwealth's Sustainable Procurement Guide recommends creating mandatory, minimum or desirable requirements for use of recycled material, most government procurements have only mentioned recycled content without setting a specific target or requirements (ARRB, 2022).
- **Lack of nationally harmonised standards and guidelines:** Many existing state specifications prescribe which materials can be used, rather than focusing on performance outcomes. Allowable limits of recycled materials also vary across different jurisdictions. This can limit the demand and hinder growth for the recycled materials market.
- **Lack of guidance and education:** One of the significant non-market challenges in the use of recycled materials is the general lack of harmonised guidance and education about the different types of recycled materials available, the associated benefits, and the standards that enable their use in road construction.

The following parts of this report will discuss the barriers preventing the adoption of recycled materials in road construction and identify opportunities that can be addressed by Australian Standards. Amongst the barriers reviewed above, Standards Australia can assist in creating nationally harmonised, performance-based standards and develop practical guidance for the uptake of enabling standards.

# 4. Opportunities to address market challenges

As reviewed in Section 3, one of the challenges of using recycled materials in roads is the lack of nationally harmonised standards and stakeholder education that supports the application of each of these materials. This section reviews the existing specifications by recycled materials to identify where the development of standards and education regarding their use can facilitate their uptake in road construction.

## 4.1. Existing standards, specifications, and guidelines for the use of recycled materials

The application of recycled materials in road construction is primarily guided by state-based specifications. A review of these specifications reveals considerable inconsistencies and contradictions. This section presents examples of such inconsistencies and discusses the potential for harmonising existing state-level guidance and incorporating performance-based Australian Standards.

The specifications are reviewed per material as follows:

**Recycled Aggregates:** Australian Standards, specifications and guidelines have been developed regarding the use of recycled aggregates including crushed concrete and brick by Standards Australia[2], Austroads, CSIRO, and AfPA. State governments also developed their own specifications. The allowable limits, however, vary amongst states. Table 1 presents the allowable limits by states.

**Table 1: Allowable limits for content of aggregates in recycled concrete; quantities in % maximum allowable content**

| Material | Resource NSW | MR WA | NZTA | DTEI SA |
|---|---|---|---|---|
| Supplementary materials (brick, crushed stone, tiles, masonry, glass) | 3 – 30 | 5 | 3 | 20 |
| Friable materials (plaster, clay lumps) | 0.2 | 2 | 1 | 1 |
| Foreign materials (rubber, plastic, paper, cloth, paint, wood, vegetable matter) | 0.1 | 0.5 | 0.5 (includes bitumen) | 0.5 |
| Bituminous materials (asphalt, seals) | 0.1 | 0 | 0 | 1 (bitumen content) |
| Asbestos | 0 | 0 | 0 | 0 |

2 AS 2758.1-2014 Aggregates and rock for engineering purposes

**Recycled Crushed Glass:** Several specifications have been developed by state governments and a national guideline was developed by Austroads on the use of crushed glass in roads. Table 2 summarises the allowable limits for RCG as set out by specifications across Australian states. As the table shows, the specifications consider different applications for RCG in roads and thus, the allowable limits also are not consistent depending on the applications.

**Table 2: Allowable limits for RCG in road and rail infrastructure**

| State/Road agency | Application | Maximum allowable limit (% of mass) |
|---|---|---|
| ACT/TCCS | Granular base and subbase | 10 |
| NSW/TfNSW | Granular base and subbase | 10 |
| | Asphalt (wearing coarse) | 2.5 |
| | Asphalt (other than wearing coarse) | 10 |
| | Slab replacement work for concrete pavements | 15 |
| NSW/Lake Macquarie City Council | Asphaltic concrete (Roadways) | 30 |
| | Lean mix concrete subbase | 30 |
| | Plain and reinforced concrete base | 30 |
| NSW/IPWEA | Select fill (Class S) | 10 |
| | Bedding material (Class B) | 50 |
| | Drainage medium (Class D75 & D20) | 50 |
| | Drainage medium (Class D10) | 100 |
| | Road Base and subbase (Class R1 & R2) | 10 |
| NT/DIPL | Bedding for drainage works | 100 |
| Qld/TMR | Dense graded asphalt layers (other than surfacings) | 10 |
| | Dense graded asphalt surfacings | 2.5 |
| | Unbound pavements (subtypes 2.3, 2.4 and 2.5) | 20 |
| | Bedding and backfill material | 100 |
| SA | Anti-skid mixtures for pavement markings | 30 |
| Tas | Aligned with DoT | |
| Vic/DoT | Granular base | 5–10 |
| | Granular subbase | 15–50 |
| | Subsurface drainage – granular filter material | 100 |
| | Intermediate and base course layers in dense-graded asphalt | 100 (of total natural sand) |
| | Dense-graded asphalt (wearing coarse) | 5 |
| WA/MRWA | Imported fill for embankment construction | 20 |

*Source: ARRB 2022*

**Reclaimed Asphalt Pavement:** The use of RAP in roads has been supported by national guidelines (developed by Austroads and AfPA) and state specifications. Depending on application, however, the allowable content varies in state specifications. Tables 3 and 4 presents the allowable contents

**Table 3: Allowable contents of RAP in granular layers for each state and territory in Australia**

| RAP content limit | | |
|---|---|---|
| | NSW | |
| Base and subbase | Up to 40% by mass in unbound, modified and bound base and subbase | TfNSW QA 3051 |
| | NT | |
| Base and subbase | Not specified | |
| | QLD | |
| Base and subbase | Up to 20% RAP is allowed in base and subbase of unbound pavements. In lower subbase and subgrade (Subtype 2.5 unbound pavement), up to 45% by mass is allowed | MRTS05 |
| | SA | |
| Base and subbase | Up to 20% (by mass) RAP is allowed in ganular pavement materials | RD-PV-S1 |
| | TAS | |
| Base | Aligned with VIC | |
| | VIC | |
| Base and subbase | Up to 15% for unbound base (Class 3), and up to 40% for unbound and bound subbase (Class 4) | Code of Practice RC 500.02 |
| | Up to 20% in lower trafficed base and up to 50% in lower trafficed subbase | Section 813 |
| | WA | |
| Base and subbase | The use up to 10% (by volume) RAP in stabilised base and subbase layers is allowed | Specification 512 |
| | Up to 15% (by mass of the material larger than 4.75mm) of pavement materials can be RAP) | Specification 501 |

*Source: ARRB 2022*

**Table 4: Allowable contents of RAP in asphalt layers for each state and territory in Australia**

| RAP content limit | | |
|---|---|---|
| | NSW | |
| Surface | Up to 20% in wearing course and up to 40% for other than wearing course in heavy duty dense graded asphalt | TfNSW QA R116 |
| | Up to 25% by mass in wearing course and up to 40% by mass for other than wearing course in light duty dense graded asphalt | TfNSW QA R117 |
| Mix type | RAP is not allowed in CRA, SMA or OGA mixes. For PMB mixes, up to 10% RAP could be used | |
| | NT | |
| Surface | In dense graded asphalts, up to 10% by mass in the wearing course, and up to 15% by mass in base layers | Standard Specification for Roadworks v4.2 |

| RAP content limit continued | | |
|---|---|---|
| | QLD | |
| Surface | In dense graded asphalt, up to 20% by mas RAP is allowed in surfacing course. Maximum allowable limit is 15% if the dense graded asphalt contains PMB and multigrade bitumen<br>In dense graded asphalts, up to 40% (by mass) RAP is allowed in base, intermediate and corrector courses | MRTS30 |
| | The maximum allowable RAP in EME2 is 15% by mass | MRTS32 |
| Mixed type | RAP is not allowed in SMA and OGA mixes | |
| | SA | |
| Surface | RAP is allowed to be used for wearing courses up to 10% (by mass) in coarse dense mix asphalt and up to 20% in fine dense mix asphalt<br>Up to 50% (by mass) RAP is allowed in asphalt pavement layers (other than wearing course). In asphalt mixes containing PMB, the maximum allowable is 20% | RD-BP-S2 |
| Mix type | RAP is not allowed in SMA and OGA mixes | RD-BP-S2 |
| | TAS | |
| Surface | Aligned with Vic | |
| Mix type | | |
| | VIC | |
| Surface | Up to 40% (by mass) RAP content is allowed for dense graded asphalt depending on traffic volume. (Maximum 25% for RAP Level 1 and maximum 40% for RAP Level 2) | Section 407<br>Code of Practice RC 500.01 |
| | Up to 10% (by mass) RAP in Regulation Gap Graded Asphalt | Section 405 |
| Mix type | RAP is not allowed in SMA, OGA and high binder crumb rubber asphalt (HBCRA) mixes and mixes containing PMBs or EME2 binders | |
| | WA | |
| Surface | The use of RAP for surface layers is not allowed | Specification 504 |
| | The use up to 10% RAP in asphalt intermediate course layers is allowed | Specification 510 |
| Mix type | RAP is not allowed in SMA, OGA, or PMB mixes | |

*Source: ARRB 2022*

**Crumb Rubber:** The application of crumb rubber in roads has been supported by two national guidelines (developed by Austroads and AfPA) and state specifications. However, the specified permitted level of crumbed rubber varies depending on the application, mixing methods and performance requirements. For instance, Table 5 displays the requirements for use of crumb rubber in bitumen as a modifier.

**Table 5: Specified requirements for crumb rubber binders**

| | | Requirements | | | | | |
|---|---|---|---|---|---|---|---|
| | | PSTS112, 2017 | | AfPA | PSTS112, 2019 | MRWA, 2018 | MRWA, 2020 |
| **Property** | **Test method** | **CR1** | **CR2** | | | | |
| Viscosity at 175°C [Pa·s] | ASTM D2196 | Report | Report | – | – | – | – |
| Viscosity at 175°C [Pa·s] | AGPT/T111 | – | – | – | – | – | Report |
| Viscosity at 175°C [Pa·s] | ASTM D7741/ D7741M | 1.5–4.0 | 1.5–4.0 | 1.5–4.0 | 1.5–4.0 | 1.5–4.0 | 1.5–4.0 |
| Torsional recovery at 25°C [%] | AGPT/T122 / ATM 122 | Report | Report | Report | Report | Report | Report |
| Resilience at 25°C [%] | ASTM D5329 | 25 min | 20 min | 20 min | 20 min | 20 min | 20 min |
| Softening point [°C] | AGPT/T131 | 57 min | 55 min | 55 min | 55 min | 55 min | 55 min |
| Consistency 6% at 60°C [Pa·s] | AGPT/T121 | – | – | – | Report | – | Report |
| Penetration at 4°C, 200 g, 60 s (0.1mm) | AS 2341.12 | 10 min | 15 min | 12 min | 15 min | 15 min | 15 min |
| Penetration at 25°C (0.1mm) | AS 2341.12 | – | – | Report | – | Report | – |
| Compressive limit at 70°C, 2kg [mm] | AGPT/T132 | – | – | – | – | – | 0.2 min |
| Flash point [°C] | AGPT/T112 | 250 min | 250 min | 250 min | 250 min | 250 min | – |
| Loss on heating [% mass] | AGPT/T103 | 0.6 max | 0.6 max | 0.6 max | 0.6 max | 0.6 max | 0.6 max |

*Source: ARRB 2022*

**Ground Granulated Blast Furnace Slag:** GGBFS is supported by a few national guidelines developed by Austroads. There are also several state specifications with a significant inconsistency in permitted limits of the use of GGBFS. Table 6 presents the specified limits.

**Table 6: Specified limits for GGBFS by road agency**

| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
|---|---|---|---|---|---|
| NSW | TfNSW | Concrete work for bridges<br>Shotcrete work<br>Shotcrete work without steel fibres<br>Lean-mix concrete subbase<br>Concrete for general works<br>No fines concrete subbase | SCM in binary blended cement(1) | 70 | TfNSW D&C 3211 |
| | | | SCM in ternary blended cement(2) | 50 | |
| | | Concrete pavement base | SCM in binary and ternary blended cement | 65 | |
| | | Stabilisation of earthworks<br>Construction of unbound and modified pavement course<br>Construction of plant mixed heavily bound pavement course<br>Insitu pavement stabilisation using slow setting binders | SCM in binary and ternary blended cement | Not specified | |
| | | Roller compacted concrete subbase Roller compacted concrete | | | |
| | | Heavy duty dense graded asphalt<br>Light duty dense graded asphalt<br>Crumb rubber asphalt<br>Open graded asphalt<br>Stone mastic asphalt<br>Thin open graded asphalt surfacing<br>High Modulus Asphalt (EME2) | Binder | Not specified | |
| Qld | TMR | Insitu stabilisation | Binder (stabilising agent) | Not specified | MRTS07B |
| | | Plant-mixed heavily bound (cemented) pavements | | | MRTS08 |
| | | Plant-mixed lightly bound pavements | | | MRTS10 |
| | | Lean mix concrete sub-base for pavements | SCM in blended cement | Not specified | MRTS39 |
| | | Concrete pavement base | | 65 | MRTS40 |
| | | Concrete road and bridge structures | SCM in binary blended cement | 40 | MRTS70 |
| | | | SCM in ternary blended cement | 25 | |

| Specified limits for GGBFS by road agency continued | | | | | |
|---|---|---|---|---|---|
| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
| WA | MRWA | Stabilisation of subgrade | SCM in blended cement | Not specified | Specification 302 |
| | | Low strength infill for the backfilling of redundant or abandoned pipes, culverts and other buried structures | | Not specified | Specification 410 |
| | | Insitu stabilisation of granular pavement layers | | Not specified | Specification 515 |
| | | High performance concrete for structures | | 65 | Specification 820 |
| | | Concrete for general non-structural works | | Not specified | Specification 901 |
| Vic | DoT | Cementitious treated pavement subbase | SCM in blended cement | 50 | Section 306, Section 815 |
| | | | Cementitious binder in a slag-lime blend | 90 | Section 815 |
| | | In situ stabilisation of pavements | SCM in blended cement | 50 | Section 307 |
| | | | Cementitious binder in a slag-lime blend | 90 | |
| | | Dense graded asphalt | Added filler | Not specified | Section 407 |
| | | Structural concrete | SCM in blended cement | 40 | Section 610 |
| | | Concrete for paving (including geopolymer concrete) | | Not specified | Section 703 |
| | | Geopolymer binder | | 100 | Section 703 |
| | | Concrete for drainage pits and covers (including geopolymer concrete) | | Not specified | Section 705 |
| Tas | DSG | Aligned with DoT | | | |
| SA | DIT | Controlled low strength material | SCM | Not specified | RD-EW-C4 |
| | | Stabilisation | SCM in binder | 80(3) | RD-PV-S1 |
| | | Stabilised pavement | SCM in blended cement | Not specified | RD-PV-S2 |
| NT | DIPL | Stabilisation<br>Miscellaneous concrete works<br>Drainage work structures (e.g. culverts) | SCM in blended cement | Not specified | Standard Specification for Roadworks v4.2 |
| ACT | TCCS | Subgrade stabilisation | Binder (stabilising agent) | Not specified | MITS 02C |
| | Austroads | Concrete pavements | SCM in blended cement | Not specified | AGPT04C-17 |
| | | Geopolymer concrete | Binder | Not specified | ATS-5330-20 |

| Specified limits for GGBFS by road agency continued | | | | | |
|---|---|---|---|---|---|
| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
| | | Stabilisation (pavement and earthworks) | Binder (in cement-GGBFS blends) | 60 | AGPT4L-09 |
| | | | Binder (in lime-GGBFS blends) | 70 | |
| | | | Binder (in lime-fly ash- GGBFS blends) | 50 | |
| | | | Binder (in cement-fly ash-GGBFS blends) | 40 | |

*Source: ARRB 2022*

**Fly Ash:** Austroads and state governments have developed several specifications regarding the use of recycled materials in road construction. The specified limits vary depending on the application of fly ash and the product. Table 7 presents the limits.

**Table 7 Specified limits for fly ash by different road agencies**

| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
|---|---|---|---|---|---|
| NSW | TfNSW | Concrete work for bridges<br>Shotcrete work<br>Shotcrete work without steel fibres<br>Concrete for general works<br>No fines concrete subbase | SCM in binary blended cement(1) | 40 | TfNSW D&C 3211 |
| | | | SCM in ternary blended cement(2) | 30 | |
| | | Lean-mix concrete subbase | SCM in binary and ternary blended cement | 75 | |
| | | Concrete pavement base | SCM in binary and ternary blended cement | 40 | |
| | | Stabilisation of earthworks<br>Construction of unbound and modified pavement course<br>Construction of plant mixed heavily bound pavement course<br>Insitu pavement stabilisation using slow setting binders<br>Roller compacted concrete subbase<br>Roller compacted concrete | Binder | Not specified | |

| Specified limits for fly ash by different road agencies continued | | | | | |
|---|---|---|---|---|---|
| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
| | | Heavy duty dense graded asphalt<br>Light duty dense graded asphalt<br>Crumb rubber asphalt<br>Open graded asphalt<br>Stone mastic asphalt<br>Thin open graded asphalt surfacing<br>High Modulus Asphalt (EME2) | Added filler | Not specified | |
| Qld | TMR | Insitu stabilisation | Binder (stabilising agent) | Not specified | MRTS07B |
| | | Plant-mixed heavily bound (cemented) pavements | | | MRTS08 |
| | | Plant-mixed foamed bitumen stabilised pavements | | | MRTS09 |
| | | Plant-mixed lightly bound pavements | | | MRTS10 |
| | | Lean mix concrete sub-base for pavements | SCM in blended cement | Not specified | MRTS39 |
| | | Concrete pavement base | | 40 | MRTS40 |
| | | Concrete road and bridge structures | SCM in binary blended cement | 40 | MRTS70 |
| | | | SCM in ternary blended cement | 32 | |
| | | Asphalt | Added filler | Not specified | MRTS103 |
| WA | MRWA | Stabilisation of subgrade | SCM in blended cement | Not specified | Specification 302 |
| | | Concrete for culvert | | 25 | Specification 404 |
| | | Low strength infill for the backfilling of redundant or abandoned pipes, culverts and other buried structures | | Not specified | Specification 410 |
| | | Insitu stabilisation of granular pavement layers | | Not specified | Specification 515 |
| | | High performance concrete for structures | | 25 | Specification 820 |
| | | Microsurfacing | Mineral filler | Not specified | Specification 507 |
| Vic | DoT | Cementitious treated pavement subbase | SCM in blended cement | 30 | Section 306, Section 815 |
| | | In situ stabilisation of pavements | | 30 | Section 307 |
| | | Dense graded asphalt | Added filler | Not specified | Section 407 |
| | | Concrete pavement courses | Fine aggregate | Not specified | Section 520 |
| | | | SCM in blended cement | 20 | |

| Specified limits for fly ash by different road agencies continued | | | | | |
|---|---|---|---|---|---|
| State | Road agency | Application | Material/Product | Max limit (% by mass) | Reference |
| | | Structural concrete | SCM in blended cement | 25 | Section 610 |
| | | Concrete for paving (including geopolymer concrete) | | Not specified | Section 703 |
| | | Geopolymer binder | | 100 | Section 703 |
| | | Concrete for drainage pits and covers (including geopolymer concrete) | | Not specified | Section 705 |
| Tas | DSG | Aligned with DoT | | | |
| SA | DIT | Controlled low strength material | SCM | Not specified | RD-EW-C4 |
| | | Stabilisation | SCM in binder | 67(4) | RD-PV-S1 |
| | | Stabilised pavement | SCM in blended cement | Not specified | RD-PV-S2 |
| | | Geopolymer concrete (for structures) | Binder | Not specified | ST-SC-S2 |
| NT | DIPL | Stabilisation<br>Miscellaneous concrete works<br>Drainage work structures (e.g. culverts) | SCM in blended cement | Not specified | Standard Specification for Roadworks v4.2 |
| ACT(5) | TCCS | Subgrade stabilisation | Binder (stabilising agent) | Not specified | MITS 02C |
| | | Base and subbase | Filler and/or binder | Not specified | MITS 04 |
| | | Grout for concrete works | Grout material | Not specified | MITS 10 |

*Source: ARRB 2022*

**Recycled Plastics:** The incorporation of plastics in road construction is still in its early stages. A two-year national project funded by the Commonwealth/Transport Infrastructure Council through Austroads investigated the potential benefits, the methodologies, and frameworks for the development of performance-based assessment procedures for incorporating recycled plastics into asphalt (Austroads, 2022).

As a result, Austroads (2021) developed interim guidance (Guideline AP-G96-21) for different types of recycled waste plastic in Australia and how it can be incorporated into asphalt or sealing work. These guidelines are intended for local government for the surfacing of local roads that are not used by a heavy traffic volume or a high proportion of heavy vehicles for a 20 year design period. As confidence grows in the use of recycled plastics, more roads are being built using this material. In Victoria, a section of the M80 has incorporated the equivalent of 35.5 million plastic bags and 800 000 toner cartridges that would have otherwise ended up in landfill (Major Road Projects Victoria, 2022).

Additionally, there are several national and international standards, and a number of specifications developed by VicRoads regarding the use of plastic in noise wall. Table 8 presents the noise wall standards and specifications.

**Table 8 Noise wall standards and specifications**

| Standard | Title |
|---|---|
| | **Australia** |
| AS 5100 | *Bridge Design: Part 1: Scope and General Principles* |
| AS/NZS ISO 717.1 | *Acoustics: Rating of Sound Insulation in Buildings and of Building Elements: Airborne Sound Insulation* |
| AS 1191 | *Acoustics: Method for Laboratory Measurement of Airborne Sound Insulation of Building Elements* |
| ISO 10140-2 | *Acoustics: Laboratory Measurement of Sound Insulation of Building Elements: Part 2: Measurement of Airborne Sound Insulation* |
| | **Vic** |
| Section 765 | Noise Attenuation Walls |
| Section 685 | Anti-graffiti Protection and Graffiti Removal |
| Section 204 | Earthworks |

*Source: ARRB 2022*

## Specification Inconsistencies

Review of the above tables demonstrates significant inconsistencies in the limits and applications of recycled materials across specifications, which can negatively impact the uptake of recycled materials in road construction and rehabilitation. For example, the allowable rate of fly ash in concrete pavement base varies between states, with Queensland allowing 40% and Victoria permitting 20% (Table 7). Similarly, recycled crush glass usage in granular base and subbase is permitted at 10% by TfNSW, compared to a 5-10% granular base and as a subbase at 15-50% by Vic DoT (Table 2). Additionally, some states (such as Western Australia) require that testing regimes for recycled construction materials are more complex than those that apply applies to raw materials.

These inconsistencies not only relate to the application of these materials, but also in their reusability and/or recyclability. For instance, Asbestos Containing Materials (ACM) highlights such inconsistencies. While the New South Wales Environmental Protection Agency (NSW EPA) applies zero tolerance for the reuse of construction and demolition (C&D) material with any quantity of ACM, the Victorian Occupational Health and Safety Act (2004) permits C&D materials “tainted” with up to 0.001% ACM contamination. In Western Australia, there are specific measures in place

to manage asbestos at each stage of the recycling process. Such inconsistency can impose practical difficulties and challenges to incorporating the use of the recycled materials in roads.

In several jurisdictions, certain types of recycled materials continue to be classified as waste and are required to comply with a range of regulations requiring specific infrastructure for their storage. However, there are few constraints on virgin products which can be stored at staging yards or depots, especially for small projects. This adds another barrier to the implementation and use of recycled materials.

### Industry Perspectives

A 2022 survey conducted by Infrastructure Australia for the Replacement Materials: report found that 88% of participants valued how standards and specifications enable the use of recycled materials. However, the report also noted that standards are "not up to date with all current waste streams and waste uses in construction material". The report concluded that where new and updated standards are developed "they should aim for national consistency by lifting, not lowering, the bar, enabling optimal usage across state boundaries" (Infrastructure Australia, 2022).

### Harmonising Potential

Despite the inconsistency in the limits and applications of recycled materials, most state specifications refer to existing performance-based publications for sampling, testing and/ or performance, including Australian Standards developed by Standards Australia. For example, 'AS 1289 Methods of testing soils for engineering purposes' has been referred to by both TfNSW's 'QA Specification R3051 Granular Pavement Base and Subbase Materials' and VicRoads's Specification 812 used in 'TN 107 Use of Recycled Materials in Road Pavements'. However, the former specifies granular base and subbase limits at 10%, while the latter limits granular base to 5-10% and granular subbase to 15-50%. This highlights the opportunity to harmonise existing state level guidance while incorporating existing performance-based Australian Standards.

**Opportunity:** There is an opportunity for the key industry expert participants to collaborate in creating new and/or modifying performance-based Australian Standards that harmonise existing guidance and specifications. Development of performance-based standards and test methodologies that promote the incorporation of recycled materials (particularly less-familiar types of materials such as plastics) can streamline the use of innovative materials into roads and provide confidence in their application.

## 4.2. Education and awareness

Recycled materials have the potential to contribute significantly to the circularity of roads in Australia. However, as noted in the ARRB (2022) report, a general lack of knowledge concerning the types and limits of recycled materials hinders their uptake in roads. Addressing knowledge gaps around enabling standards and the characteristics of recycled materials is essential for the successful transition to more circular practices in road construction. Our previous research shows that there is a significant need for communication, information sharing, and awareness about existing standards as stakeholders may misperceive standards to prevent the use of recycled materials in roads. Shifting to more circular practices requires increased awareness of how these materials can be used and greater knowledge in the implementation of enabling standards.

**Opportunity:** There is an opportunity for Standards Australia, the Australian Government, the construction sector, the recycling sector, and circular economy leaders to work together to provide practical guidance for the use of recycled materials in roads and the associated enabling standards. Improved awareness through the development of educational material and enhanced industry engagement through knowledge sharing activities, can contribute to improving sustainability outcomes and promote circular economy practices in road construction throughout Australia.

# 5. Next Steps and Recommendations

**Recommendation 1: The Australian Government, Standards Australia and key industry expert participants should collaborate to modify existing and/or create new performance-based Australian Standards that harmonise the inconsistencies in existing specifications.**

Standards can function as market enablers to achieving broader business and public policy objectives. Up-to-date and fit-for-purpose standards are critical to enabling the use of recycled materials in roads and achieving the 2030 targets outlined in the National Waste Policy Action Plan. Created using a trusted and consensus-driven process, Australian Standards can provide confidence to engineers, procurement officers, and contractors in the performance, safety, and durability of recycled materials in roads.

Developing nationally consistent standards that promote the optimal usage of recycled materials in roads can also assist in reducing uncertainty in the applications of these materials across state and territory jurisdictions. Standards can also be used as a tool to drive demand for less familiar materials, such as plastics, by building confidence in their performance and safety.

**Recommendation 2: Standards Australia, the Australian Government, the construction and recycling sectors, and circular economy leaders must continue to work together to provide practical guidance for the use of recycled materials in roads and the associated enabling standards.**

As Australia transitions to a circular economy there is growing need to build confidence in new products, materials and processes. Using recycled materials in roads can not only help achieve environmental objectives, but also provide economic and social benefits. Addressing knowledge gaps is essential for the successful transition to more circular practices in the road construction industry. Stakeholders, including contractors, engineers, and policymakers, must be well-informed about the potential benefits and applications of recycled materials and the standards that enable their uptake.

To support the uptake of recycled materials and roads, Standards Australia, government and the road construction community should continue to develop resources and guidance that:

Clearly communicates the benefits and applications of these materials in roads.

Highlights the enabling standards and relevant use cases that govern the use of recycled materials.

Provides the necessary knowledge to dispel misconceptions around the use of recycled materials and enabling standards.

# References

Access Economic for The Department of Environment, Water, Hertiage and the Arts, 2009. Employment in waste management and recycling. [Online]

Available at: https://www.dcceew.gov.au/sites/default/files/documents/waste-and-recycling-employment.pdf

[Accessed 2022].

Australian Asphalt Pavement Association, 2018. Crumb Rubber Modified Open Graded and Gap Graded Asphalt Pilot Specification. [Online]

Available at: https://www.tyrestewardship.org.au/wp-content/uploads/2020/04/pilot-spec-crumb-rubber-modified.pdf

[Accessed 2023].

Australian Asphalt Pavement Association, 2018. Reclaimed Asphalt Pavement (RAP) Management Plan. [Online]

Available at: https://afpa.asn.au/wp-content/uploads/2018/06/AAPA-RAP-Management-plan-12-June-2018.pdf

[Accessed 2023].

Australian Government, 2021. Sustainable Procurement Guide - A practical guide for Commonwealth entities. [Online]

Available at: https://www.dcceew.gov.au/sites/default/files/documents/sustainable-procurement-guide.pdf

[Accessed 2023].

Australian Road Research Board, 2022. Best Practice Expert Advice on the Use of Recycled Materials in Road and Rail Infrastructure: Part A Technical Review and Assessment. [Online]

Available at: https://3003125.fs1.hubspotusercontent-na1.net/hubfs/3003125/ARRB%20Recycled%20Materials%20Best%20Practice%20Part%20A_Final%20June%202022.pdf

[Accessed 2023].

Australian Road Research Board, 2022. Best Practice Expert Advice on the Use of Recycled Materials in Road and Rail Infrastruture: Part B Sustainability Impacts Report. [Online]

Available at: https://3003125.fs1.hubspotusercontent-na1.net/hubfs/3003125/ARRB%20Recycled%20Materials%20Best%20Practice_Part%20B_Final%20June2022.pdf

[Accessed 2023].

Austroads, 2021. Guideline AP-G96-21: Interim Guidelines for the Use of Recycled Waste Plastic in Local Government Road Surfacing Applications, s.l.: Austroads.

Austroads, 2022. AP-R669-22 - Use of road-grade recycled plastics for sustainable asphalt pavements. s.l.:Austroads.

Del Ponte, K. et al., 2017. Life-Cycle Benefits of Recycled Material in Highway Construction. Transportation Research Record, 2628(1), pp. 1-11.

Department of Climate Change, Energy, the Environment and Water, 2022. Australian Plastics Flows and Fates Study 2020-21 – National Report. [Online]

Available at: https://www.dcceew.gov.au/sites/default/files/documents/apff-national-report-2020-21.docx

[Accessed 2022].

Department of the Environment and Energy, 2018. National Waste Policy: Less Waste, More Resources. [Online]

Available at: https://www.dcceew.gov.au/sites/default/files/documents/national-waste-policy-2018.pdf

[Accessed 2023].

Department of Transport and Main Roads , 2022. Recycled Materials in Queenland's Roads. [Online]

Available at: https://www.tmr.qld.gov.au/Community-and-environment/Planning-for-the-future/Building-sustainable-roads

[Accessed 2022].

Infrastructure Australia, 2022. Replacement Materials Understanding the market for replacement materials across major infrastructure road projects. [Online]

Available at: https://www.infrastructureaustralia.gov.au/sites/default/files/2022-12/IA22-Replacement-Materials_REPORT_HR.pdf

[Accessed 2023].

Institute of Public Owrks Engineering Australasia, 2016. The business case for using recycled materials in roads. [Online]

Available at: https://www.ipwea.org/blogs/intouch/2016/06/24/the-business-case-for-using-recycled-materials-in-roads

[Accessed 2022].

Jamal, M., Lanotte, M. & Giustozzi, F., 2022. Exposure of crumb rubber modified bitumen to UV radiation: A waste-based sunscreen for roads. Journal of Cleaner Production, Volume 328.

MRA Consulting Group, 2019. Public Procurement of Road Building Materials - Reserach into Recycled Content. [Online]

Available at: https://www.acor.org.au/uploads/2/1/5/4/21549240/171019_public_procurement_of_road_building_materials_acor_report_final__3_.pdf

[Accessed 2022].

Ortiz, J. L., 2020. 100% Road Recycling with Neo. [Online]

Available at: https://technisoilind.com/technisoil-roads.html

[Accessed 2022].

Prepared for The Department of Climate Change, Energy, the Environment and Water, 2023. National Waste Report 2022. [Online]

Available at: https://www.dcceew.gov.au/sites/default/files/documents/national-waste-report-2022.pdf

[Accessed 2023].

Southern Sydney Regional Organisation of Councils, n.d. Paving the Way to Sustainable Roads - Driving a circular economy through government procurement. [Online]

Available at: https://az659834.vo.msecnd.net/eventsairaueprod/production-impactenviro-public/f6a67b528f2a4b2b8e5b317b1bdb0742

[Accessed 2022].

SSROC, 2021. Paving the way. [Online]

Available at: https://ssroc.nsw.gov.au/wp-content/uploads/2020/08/RCG-RR18.2-200909-Paving-the-Way-Overview1.pdf

[Accessed 2023].

Standards Australia, 2002. HB 155-2002 Guide to the use of recycled concrete and masonry materials. [Online]

[Accessed 2023].

Standards Australia, 2014. AS 2758.1-2014 Aggregates of rock for engineering purposes. [Online]

[Accessed 2022].

Sustainability Victoria, 2022. From your bin to the Big Build. [Online]

Available at: https://www.sustainability.vic.gov.au/news/news-articles/from-your-bin-to-the-big-build

[Accessed 2023].

Transport for NSW, 2020. Specification D&C 3256 Crumb Rubber. [Online]

Available at: https://roads-waterways.transport.nsw.gov.au/business-industry/partners-suppliers/documents/specifications/dc_3256.pdf

[Accessed 2022].

standards.org.au