



Australian Government

Department of Climate Change, Energy,
the Environment and Water

Australia's Circular Economy Framework

Doubling our circularity rate

2024



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Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

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Australia's Mission

Double the circularity of the economy by 2035

A more circular Australia is a future where nature and the economy thrive together.

The circular economy is key to unlocking a future where economic progress goes hand in hand with nature's regeneration, securing Australia's natural wealth for generations to come.

For the first time, Australia is committing to a national circular economy transition.

A circular economy is one where products are designed to be reused, repaired, and recycled, minimising waste and maximising resource efficiency. It aims to create a closed-loop system where materials are continuously circulated and repurposed rather than being discarded as waste.

By 2035, Australia aims to double its circularity – transforming how we use, reuse, and regenerate resources across the economy. This ambitious goal is not just a number; it represents a profound shift toward an economy where waste is designed out, materials are continually cycled, and products are built to last. By embracing these principles, we can regenerate nature, reduce environmental pressures, and build a thriving, future-proof economy.

Modelling by the CSIRO indicates that doubling Australia's circularity in line with this framework's priorities can:



Add \$26 billion in Gross Domestic Product each year by 2035



Reduce greenhouse gas emissions by 14% by 2035ⁱ



Divert 26 million tonnes of materials from landfill each year.ⁱⁱ

Australians are throwing away nearly 76 million tonnes of waste every year, much of which ends up in landfill. Globally, the World Bank projects that waste generation will increase by 70% by 2050 unless immediate action is taken.ⁱⁱⁱ

Shifting to a circular economy will not only protect our environment but also strengthen our economy. For Australia's industries, a circular economy offers the chance to become global leaders in sustainable innovation. By investing in circular systems, Australian businesses can enhance their competitiveness on the international stage, exporting circular products and expertise to the world. This shift will stimulate local supply chains, reduce dependence on virgin materials, and foster greater resilience to global disruptions.

A circular economy reduces the cost of living by promoting high-quality, durable, and repairable products that last longer, minimising the need for frequent replacements.

At the same time, innovation in design, technology, and materials science can be a catalyst for economic growth, providing Australian entrepreneurs and industries with an edge in a rapidly evolving global marketplace.

A circular economy can also support Australia's climate strategy. By rethinking how we produce, consume, and dispose of goods, we can significantly reduce greenhouse gas emissions. A more circular economy helps us meet our emissions reduction targets by extending the productive life of existing materials.^{iv} As we work to decarbonise our economy, circularity is an essential tool in reducing our carbon footprint while simultaneously restoring ecosystems and natural capital.

Ambition and focus

Our goal to double our circularity by 2035 is ambitious. It addresses the entire lifecycle of resources – from design and extraction to reuse. To achieve this, Australia is setting 3 targets that cover the front-, middle- and end-of the product lifecycle.

As a country that is a primary exporter of resources and materials to the world, and an importer of most of our consumables, Australia's transition ambition and priorities will be different from others. Our priorities cover 4 significant Australian supply chains and 6 cross-cutting objectives. These are where rigorous market and competitive analysis reveal Australia can benefit most – economically, environmentally and socially.

Australia is not starting from zero. Several of Australia's largest investment instruments are already supporting the circular economy – including the \$15 billion National Reconstruction Fund, and the \$7 billion Northern Australia Infrastructure Facility. Australia's Ending Plastic Waste Mission, National Waste Policy and Water and Energy Efficiency Labelling schemes are all well-established programs supporting the circular economy. States and territories also have a range of supporting programs.

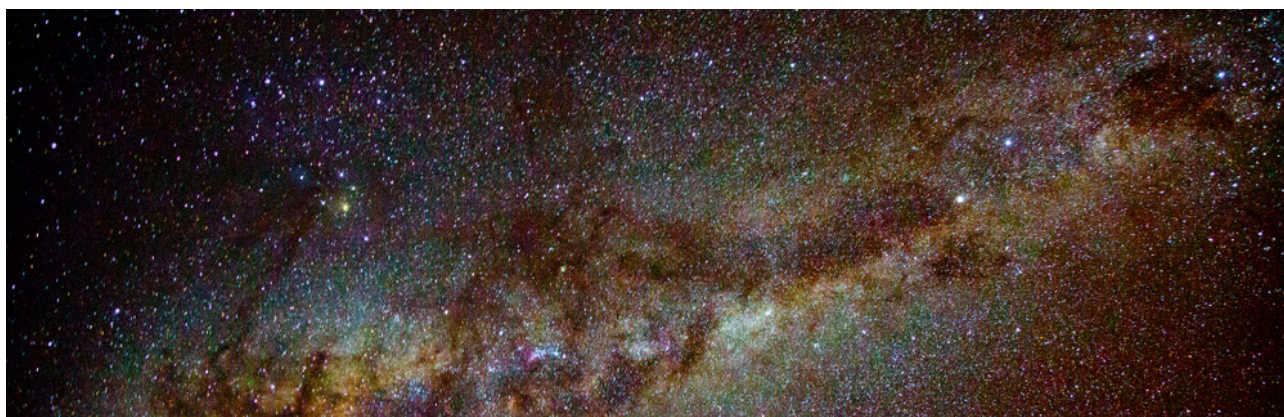
This framework sets Australia's bold 10-year commitment to embrace the circular economy and focusing on what matters most. It weaves together the threads of innovation, collaboration, and stewardship. It offers a shared vision for governments, businesses, investors, communities, researchers, and individuals to unite in their efforts and drive change.

A commitment to First Nations peoples and knowledge

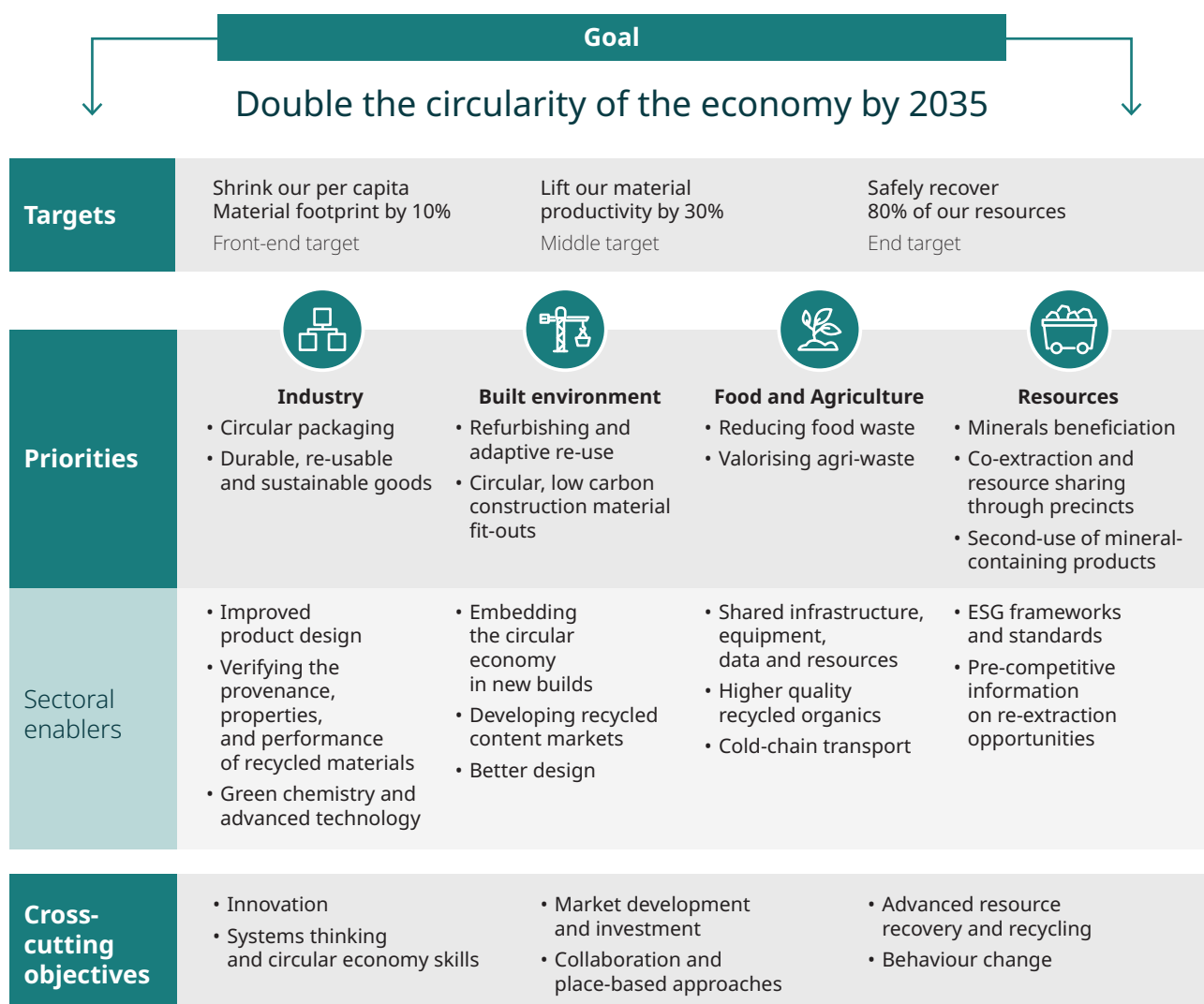
Australia's journey towards a circular economy is a step forward in sustainability but also an opportunity to honour and integrate the deep knowledge systems of First Nations peoples.

For tens of thousands of years, Aboriginal and Torres Strait Islander peoples have practiced a way of life that embodies the principles of the circular economy – caring for Country, minimising waste, and ensuring the natural environment thrives for future generations.

As Australia embarks on a circular economy transition, it is imperative this includes genuine partnerships with First Nations peoples and communities, learning from their wisdom, and ensuring they are integral partners in shaping our sustainable future.^v Measures supporting the transition should progress the priority reforms and targets of the National Agreement on Closing the Gap to ensure there is equitable access to circular economy benefits and opportunities.



Framework at a glance



Implementing the framework

Governments

Governments set the direction and provide the foundation for a successful transition to a circular economy.

They create the conditions that allow circular systems to thrive by implementing supportive policies and regulations, providing financial incentives, and encouraging collaboration and behaviour change across sectors.

Businesses

Must lead by example, adopting circular practices to meet growing stakeholder expectations, ensuring compliance and capitalising on new marketing opportunities.

Investors

By directing capital towards circular solutions, investors can help scale innovative business models, technology and infrastructure that support resource efficiency and waste reduction.

Researchers and NGOs

Research institutions, universities and non-governmental organisations (NGOs) provide the necessary research, education and advocacy to drive the circular economy forward.

Australians

Can contribute by making sustainable product choices and supporting local circular initiatives such as repair cafes, libraries, and secondhand marketplaces.

What is a circular economy?

The circular economy is not an end on its own. It is an economic model that promotes sustainable and efficient use of resources as a way to support environmental, economic and social outcomes. It shifts away from the current linear 'take, make, dispose' consumption approach to one that maintains a circular flow of materials by recovering, retaining or adding to their value.

There are 3 key principles of a circular economy

1

Design out waste and pollution

Things can be used better through purposeful design. When things are designed from the beginning to be repaired, reused and recycled, it's much easier to do so. For example, products that are made to be taken apart are easier to fix and use for longer.

2

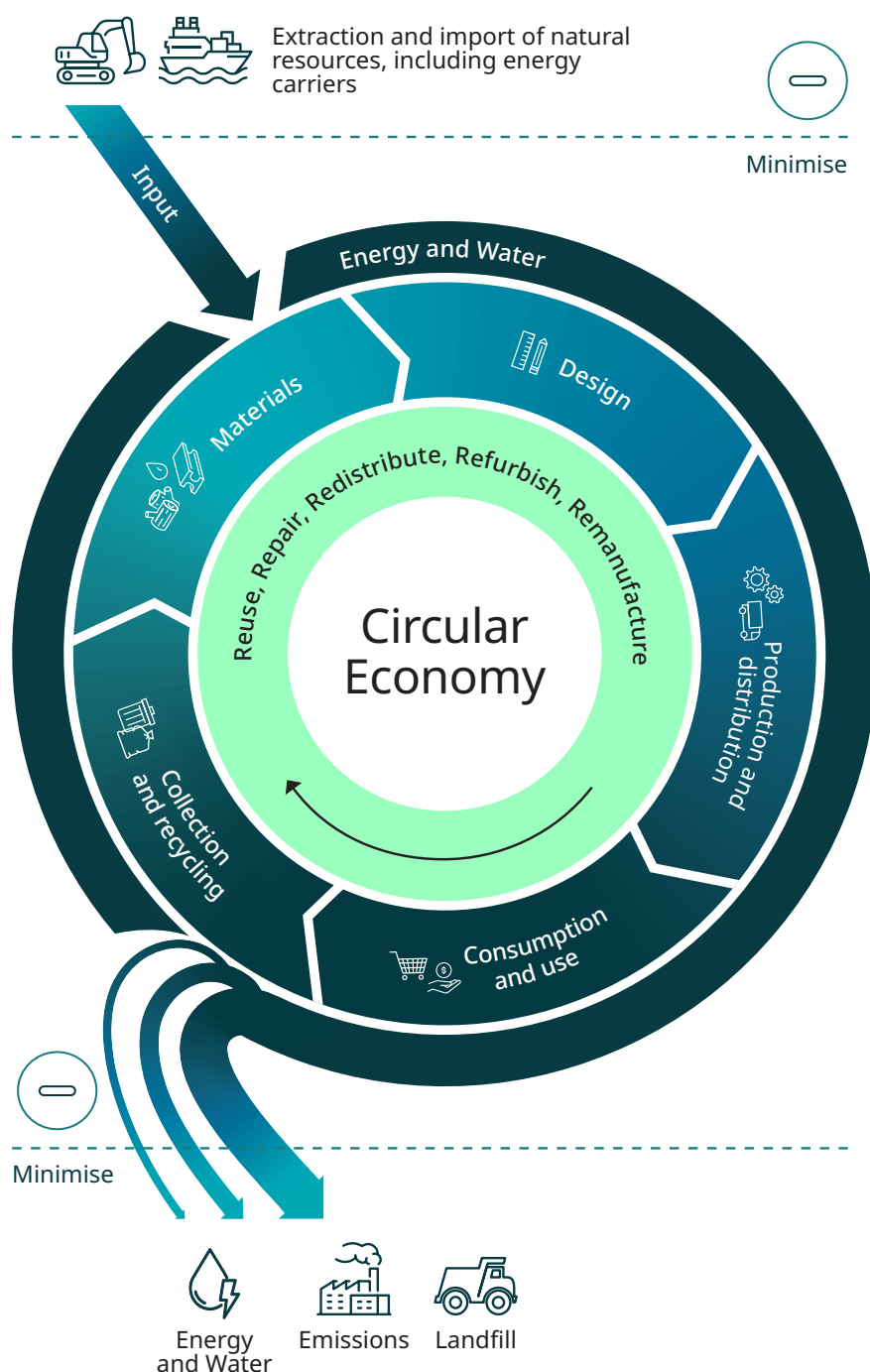
Keep products and materials in use at their highest value

By targeting how we use and dispose of products and materials, we can keep them in our economy for longer. This can mean buying durable products, reusing and repairing. When recycling, we avoid downcycling, which is turning the product into a lower grade material.

3

Conserve natural resources and regenerate nature

The speed at which we are using resources is damaging our environment. When transitioning to a circular economy, actions are considered across product and materials lifecycles to ensure our impact on the environment is reduced and ideally mitigated.



How circular is Australia?

Different metrics are used to assess the circularity of national economies. These include materials-focussed metrics; energy and greenhouse gas emission metrics; water, natural environment, and regeneration metrics; and jobs and investment metrics.

The most common metrics for international comparison are materials-focussed, typified by the 'circularity rate'. This measures the proportion of materials used by a country that are not 'virgin' materials. Circularity rates and other materials-focussed metrics are found in various international frameworks, including the Sustainable Development Goals (SDGs).

The CSIRO estimates that Australia's circularity rate is approximately 4.6%.^{vi} This is the proportion of materials that Australians use that do not come from virgin sources. Australia's circularity rate is lower than the global average of around 7%.

Australia's circular economy potential

The economic structure of a country determines its circularity potential, i.e., the total amount of materials that can be expected to be organised in a closed loop, and this potential is well below 100% in all cases.

As a provider of primary materials to the world, Australia produces very large streams of low value waste such as mine tailings in remote areas. In contrast, regions like the European Union (EU) receive most of their primary materials through imports and effectively leave these waste streams offshore.^{vii} Countries that export large quantities of primary resources generally have lower circularity rates (See Table 1 below).

Australia is also much more geographically dispersed and has a higher population growth rate than most developed countries. Both factors drive a higher use of materials for residential and commercial buildings, roads, and infrastructure.

These factors mean that every 1% improvement in circularity for Australia is significant, and doubling our circularity is more ambitious than other countries. They also help to inform our circular economy priorities, which will differ from country to country.

Table 1. Global circularity rates

Country	Circularity	Circularity Goal	Trade balance*
USA	-	-	
China	-	-	
Japan	-	-	
Finland	0.6%	Double between 2015 and 2035	Materials exporter (-0.09)
Norway	2.4%	-	Materials exporter (-0.09)
Ireland	2.7%	-	Materials importer (0.25)
Australia	4.6%	Double between 2024 and 2035	Materials exporter (-0.53)
Sweden	6.1%	-	Materials exporter (-0.08)
Global avg	7.2%		Neutral (0.0)
Denmark	7.4%	-	Materials importer (0.23)
UK	7.5%	-	Materials importer (0.29)
N Ireland	7.9%	-	Materials importer (0.25)
EU	11.5%	Double between 2020 and 2030	
Italy	18.7%	Reach 24% by 2040	Materials importer (0.12)
Netherlands	27.5%	Fully circular by 2050	Materials importer (0.28)

*Physical trade balance (i.e., imports minus exports) divided by domestic extraction. Countries that are net exporters of resources have increasingly negative scores. Data generated from the International Resource Panel 2019 statistics.

Australia's targets

Australia's ambition is to double the circularity of our economy by 2035.

To do this, we will pursue 3 targets.

Countries can engage in 2 strategies to become more circular.

First, to *raise* their circularity potential, they can focus on initiatives that reduce the amount of materials used, especially those that cannot be recycled, investing in renewable energy, long-lived infrastructure, and active mobility.

Second, they can aim to *reach* their circularity potential by ensuring materials are recovered and reintroduced into the economic process once their first life has been completed, which also drives resource productivity.

Australia's targets reflect both strategies.

Target 1: Reducing material footprint by 10%¹

Material footprint is a measure of the inputs to the Australian economy. It describes how much material is consumed to make the products or services used in Australia. **Per capita, Australia has the highest material footprint of the G20.**^{viii} As at 2023 Australia's material footprint is 31 tonnes per person.

Material footprint is an important driver of Greenhouse Gas (GHG) emissions. Retaining existing materials for longer and making smarter use of materials are significant opportunities to reduce Australia's carbon footprint.

Shrinking Australia's material footprint requires circular economy strategies like improving design and material choices in the built environment, and using longer lasting and recycled materials, in manufacturing.

Target 2: Lifting materials productivity by 30%²

Materials productivity measures the efficiency with which raw materials (such as metals, minerals, and biomass) are used in production processes. It is often expressed as the ratio of economic output to the amount of raw materials consumed. Higher materials productivity indicates that the economy is generating more output with equal or less material input, reducing material waste and environmental impact.

As of 2019, **Australia had the fourth lowest rate of material productivity in the OECD.** And as of 2023, Australia generates only US\$1.20 of economic output for every kg of materials consumed, compared with US\$2.50 which is the average across the OECD.^{ix}

Lifting materials productivity requires circular economy strategies that scale Australian innovation, advanced manufacturing on shore, and more collaborations across supply chains to maximise material value – including internationally. Domestic reuse of Australian recycled materials can also support materials productivity.

Target 3: Safely recovering 80% of our resources³

Australia's resource recovery rate is approximately 63%.^x

Every year **Australian firms spend \$1.4 billion sending \$26.5 billion worth of material to landfill.**^{xi} Recovering, recycling and repurposing these resources creates economic value and jobs and is fundamental to a circular economy. These activities also strengthen the resilience of local supply chains.

Meeting this target will require upstream action in the economy, especially through designing products that can be easily recovered at the end of their life. This involves identifying and removing harmful chemicals that hinder safe recycling and reuse in Australia. Materials substitution and innovation will be crucial to this effort. It will also require active markets for recovered resources and accelerating innovative uses of these resources as value-added products.

Target feasibility

Analysis by the CSIRO shows that Australia's overarching goal, and material footprint and material productivity targets are ambitious but feasible with a suite of circular/sustainable interventions across the sectors that are prioritised in this framework.

Australia's resource recovery target is maintained in line with the existing target agreed by all governments.

1 Versus 2024 levels and on a per capita basis.

2 Versus 2024 levels and on a per capita basis.

3 By 2030 – reflecting the target set in the National Waste Policy Action Plan.

Reasons to go circular

International trade

The priorities described in this framework position Australia to benefit from the rising global demand for sustainable products and expand trade opportunities.

Internationally, governments, businesses and non-government organisations are rapidly adopting the circular economy because of its economic, social and environmental (including climate) benefits.^{xii} The circular economy features in the G7 Alliance of Resource Efficiency, UN Sustainable Development Goals and the Global Biodiversity Framework.^{xiii} It is supported by global environmental agreements such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, and the Stockholm Convention on Persistent Organic Pollutants.

Three quarters of the G20 economies have national circular economy strategies, with G20 leaders recently committing to 'enhance environmentally sound waste management, substantially reduce waste generation by 2030, and highlight the importance of zero waste initiatives'.^{xiv} This framework establishes Australia's equivalent national strategy and is designed to align with emerging priorities in global supply chains.

Australia has well-established connections to many of the key global economies leading the circular economy transition, with trade representing almost half of Australia's GDP.^{xv} More than 40% of our exports go to economies that are embracing the circular economy through stronger product and materials standards. These include Japan, Korea, India, the USA, Taiwan and Singapore.^{xvi} Global trade in green goods, including those designed to use fewer resources and produce less pollution, is projected to quadruple by 2030.^{xvii} Product-based opportunities are prioritised in this framework, including circular packaging and sustainable building materials.

Australians also consume goods imported from all over the world. Controlling the circularity of imports is difficult, but greening global markets are already shaping our transition. By proactively engaging with and adapting to international standards on the circular economy, Australia can best capitalise on growing global demand for sustainable products and processes.

Around a quarter of Australia's Free Trade Agreements (FTAs) include clauses related to renewable energy, climate change, and environmental concerns.^{xviii} Some of these include substantive circular economy commitments, such as the Australia-UK FTA. By embracing circular economy principles, Australia can increase the competitiveness of its exports in growing markets, while also capitalising on FTAs that already include relevant commitments.

Economics, investment and resilience

Smarter, more efficient use of resources drives productivity and economic growth, by allowing businesses to produce more output with the current level of inputs. CSIRO modelling shows that doubling the circularity of the economy is expected to deliver a net economic benefit of \$26 billion in GDP by 2035.

Foreign direct investment in Australia is also growing fast and is tied to circular economy performance. In 2022–23, foreign investment was \$4.7 trillion, with the top 3 foreign direct investors (the USA, UK and Japan) also notable leaders in the circular economy.^{xix} By advancing a circular economy transition, Australia can offer investors a stable and forward-thinking market that aligns with their sustainability goals.

Reducing production waste in the system significantly cuts industry costs. For example, in the construction sector, waste management can account for up to 30% of project costs. By adopting circular economy practices – such as reusing materials, reducing waste, and increasing recycling – industries can lower these expenses. Strategies which reduce municipal waste volumes also help to constrain further pressure on household rates.

Circular products saving resources and costs

A circular economy reduces the cost of living by promoting high-quality, durable, and repairable products that last longer, minimising the need for frequent replacements. Unlike disposable, short-lived products, these well-made items save consumers money over time by cutting down on repeat purchases, thereby lowering overall household expenses and waste. EU projections for 2030 suggest that disposable income in a circular economy could be up to 11 percentage points higher, with households potentially saving around €600 annually.

Similar cost-saving outcomes are already seen in Australia's energy and water efficiency schemes, which conserve resources through better quality products. For example, the Water Efficiency Labelling Scheme (WELS) is estimated to have saved 172 GL of water and \$1.6 billion to the national economy in 2024 through reduced utility bills and prevented 2.39 million metric tonnes of emissions. Applying circular economy principles like product durability and reparability to product design can support additional cost savings, ease financial pressures on households and reduce waste.

Environmental and social benefits

A circular economy minimises waste and pollution. In turn, wasting less takes pressure off our natural environment and supports other aims like restoring biodiversity. By supporting sustainable consumption and production, the circular economy also alleviates pressure on habitats from resource extraction activities.

The natural environment provides a source of cultural and spiritual connection for Australia's First Nations peoples. Respecting the value of resources and minimising impacts on the environment helps to preserve and restore this source of cultural heritage.

Reducing waste and pollution leads to cleaner environments and healthier communities. It also promotes sustainable resource use, creating economic opportunities and enhancing resilience against environmental challenges. A circular economy transition is one of 6 priorities reflected in Australia's Strategy for Nature 2024–2030.

Climate change

The circular economy is increasingly recognised as a decarbonisation opportunity and strategy. As of 2023, 27% of countries Nationally Determined Contributions explicitly mention the circular economy as part of their mitigation measures.^{xx}

Doubling the circularity of the economy by 2035 puts Australia on course to abate up to 23% of Australia's greenhouse gas emissions by 2050 according to CSIRO modelling.^{xxi} A more circular economy lowers energy demand and associated scope 1 and 2 emissions by retaining existing goods and materials for longer. This avoids the need for new extraction and processing activities and their associated emissions.

The circular economy also addresses the scope 3 emissions of materials – particularly in the built environment. These are the emissions associated with materials manufacturing and use, throughout their whole lifecycle. Circular economy strategies retain these embodied emissions for longer, maximising their value.

New export markets for circular goods are developing because of the global net zero transition. This includes circular goods such as recycled steel, food grade packaging, and minerals and materials, avoiding the need for new extraction and processing activities. Adopting circular business models will improve Australian industry competitiveness and access to these markets.

Activities such as material substitution, resource efficiency, and production efficiency can help businesses mitigate fiscal, climate, and nature-related risks. An analysis of over 200 European companies across 14 industries shows that businesses with more circular practices have a lower risk of defaulting on debt over both short-term and long-term periods.^{xxii}

The circular economy plays a key role in reducing climate risks by enhancing resilience and adaptive capacity. For example, using recycled water in agriculture not only conserves fresh water but also reduces the vulnerability of crops to drought conditions, enhancing food security in arid regions. Conversely, using climate and disaster-resilient materials reduces waste by extending product lifespans. Australia's circular economy and climate adaptation are therefore complementary.

Circular economy strategies also support a sustainable, nature positive net zero transition, by ensuring technologies, materials, and infrastructure developed during the transition can be recovered and reused at their end of life.



The following priorities within this framework are expected to support decarbonisation:

Remanufacturing and recycling

Manufacturing products from recycled materials can save the energy associated with creating new raw materials (Scope 2 emissions) and reduces the emissions from manufacturing processes (Scope 1) and consequently, the entire supply chain (Scope 3). It avoids emissions from extraction and initial processing and in most cases reduces emissions from manufacturing.

Design for durability, reuse and lightweighting

This strategy reduces the need for frequent production of new products, lowering upstream emissions associated with raw material extraction and manufacturing. Designing products with modular parts that can be easily replaced or upgraded extends product life and creates this same effect. Designing products to be lighter reduces the material and energy needed for production and transportation, lowering associated emissions.

Reuse of buildings

Adaptive reuse involves repurposing existing buildings for new uses, conserving the energy and materials that would have been used in demolition and new construction (Scopes 1, 2 and 3). For example, converting an old factory into residential apartments or mixed-use spaces preserves the embodied energy in the building materials and reduces emissions from producing new construction materials. This also often involves upgrading insulation and energy systems, thus reducing operational emissions.

Industrial symbiosis

This strategy involves industries sharing and maximising the use of resources, such as waste materials, energy, or water, reducing the need for virgin resources and decreasing waste (Scopes 1 and 3). For example, in an eco-industrial park, waste heat or resources from one plant can be used as an energy source or feedstock for another, lowering overall energy consumption emissions and need for virgin materials.

Product-as-a-Service (PaaS)

The PaaS model, where companies provide products as services rather than selling them, promotes the use of shared equipment and infrastructure, which reduces the need for multiple individual products and encourages efficient resource use. It also encourages the provision of efficient, higher quality and longer lasting products. An example is provision of heating/cooling as a service. This model better incentivises the use of efficient, well-maintained assets that perform well over their lifetime, compared to a user-owner model.

In an agricultural context, a PaaS model could involve a cooperative of farmers sharing access to specialised equipment, such as tractors or processing machinery. Shared infrastructure like biogas plants can convert collective farm waste into valuable products such as electricity, heat, or organic fertilisers, reducing waste and emissions from both the disposal of organic waste and the production of energy and fertilisers.

Reducing food waste

Reducing food waste helps lower GHG emissions by decreasing the amount of organic waste sent to landfills, which cuts down on methane emissions (Scope 1). Additionally, reducing food waste means less energy and resources are needed for food production, processing, and transportation, which in turn reduces indirect emissions from energy use (Scope 2) and emissions across the entire supply chain (Scope 3).

Australia's advantages

Australia has unique advantages that will inform and guide our transition.

A sophisticated research ecosystem

Australia is home to over 65,000 years of First Nations Science. Australian researchers consistently publish world-class research, with Australia ranked fifth in the world for number of highly cited researchers and sixteenth for research and development in the Global Innovation Index in 2023.^{xxiii} Australia's research on sustainability consistently ranks in the top 1% of cited research globally.

Materials innovation excellence

Australia is a leader in materials innovation. Some of the greatest advances in technical polymer design and manufacturing originated in Australia. Australia specialises in developing the kinds of materials that are essential to a circular economy, such as durable and lightweight parts for transport, aerospace, and marine applications, biobased materials for construction, and sustainable textiles.

Capability in technology development

Technology innovation is an essential complement to materials innovation for the circular economy. The technology sector is Australia's third-largest industry, employing 1 in 16 workers and contributing \$167 billion to our economy every year or 8.5% of GDP.^{xxiv} Australia has a sizable ecosystem of startups across the various advanced technologies and has produced 2.3% of the world's technology 'unicorns' (companies worth US\$1 billion or more).^{xxv}

Reputation for quality, standards and trust

Australia has a reputation for premium, safe, high-quality and ethically produced products and is a trusted trading partner across key industries, with a stable and transparent political, economic and regulatory environment. Australia is ranked fourth in regulatory quality in the Global Innovation Index 2023 rankings.^{xxvi}

Highly skilled workforce

Around 60% of Australia's current workforce has a VET or university qualification. Australia has strong skills in engineering and is home to 5 of the world's top 200 institutions for materials science – both of which are aligned with skillsets critical to the circular economy. Australia is also in the top 5 destinations for highly educated workers in the OECD's talent attractiveness index.



Design capability

Australia stands out globally for its robust industrial design capabilities. With over 6,000 industrial designers contributing to sectors such as advanced manufacturing, consumer products, and sustainable technologies, Australia boasts a dynamic talent pool adept at integrating aesthetics, functionality, and sustainability into product development. This expertise not only drives economic growth but also positions Australia as a leader in designing solutions that meet global standards and emerging market demands.

Significant investment capital

Australia has a well-developed and highly regulated financial sector, considered to be one of the most sophisticated and advanced in the world. Australia is ranked first in the world for financial freedom and third for trade freedom.^{xxvii} As of June 2023, Australia's superannuation funds manage assets worth approximately \$3.4 trillion. The country's private capital markets also continue to grow, with assets under management reaching \$139 billion, a 33% increase over 18 months. Venture capital fundraising remained strong, with \$3.8 billion invested in 2023, showing resilience despite challenging market conditions. This robust growth underscores Australia's position as a global leader in financial freedom and capital market development.

Proximity and access to growing export markets

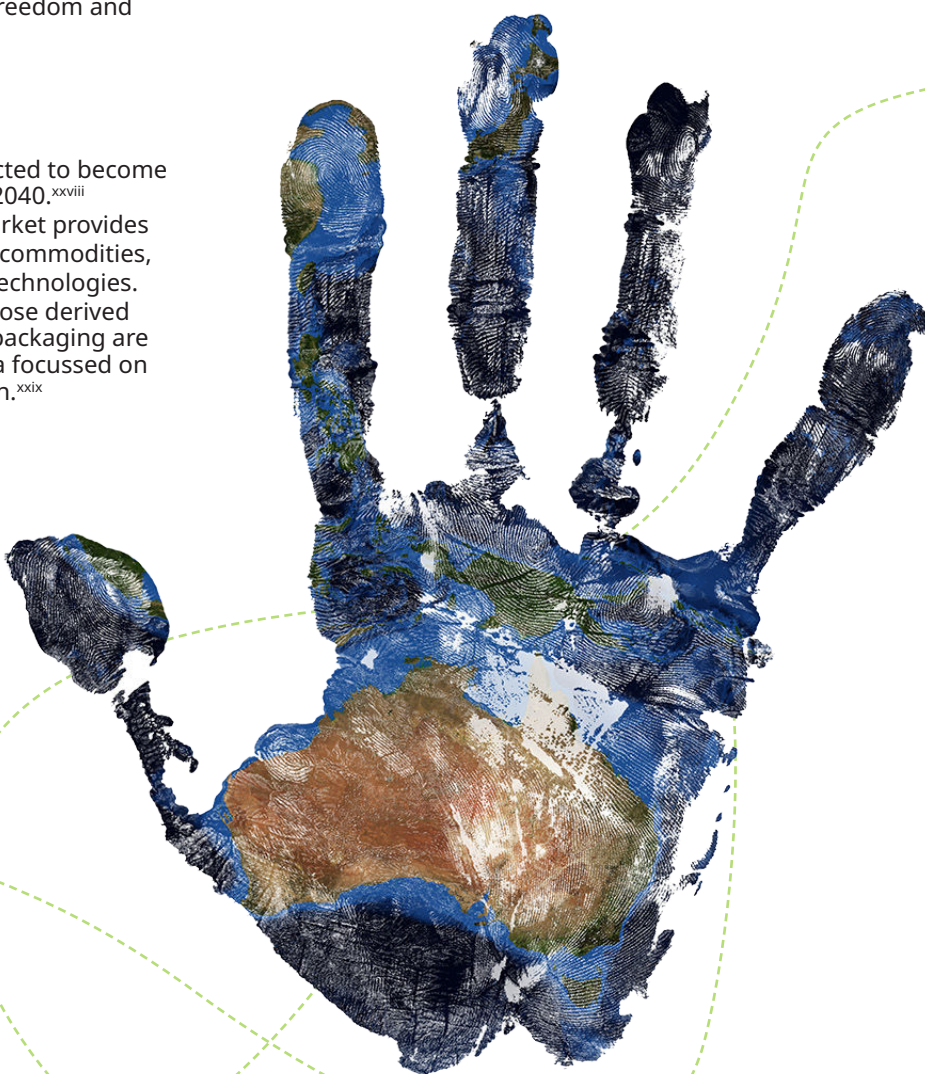
Taken together, Southeast Asia is projected to become the world's fourth-largest economy by 2040.^{xxviii} Australia's regional proximity to this market provides an excellent base from which to export commodities, manufactured products, services, and technologies. Markets for circular goods, including those derived from agri-waste, textiles, and recycled packaging are burgeoning in the region, with Australia focussed on accelerating two-way trade in the region.^{xxix}

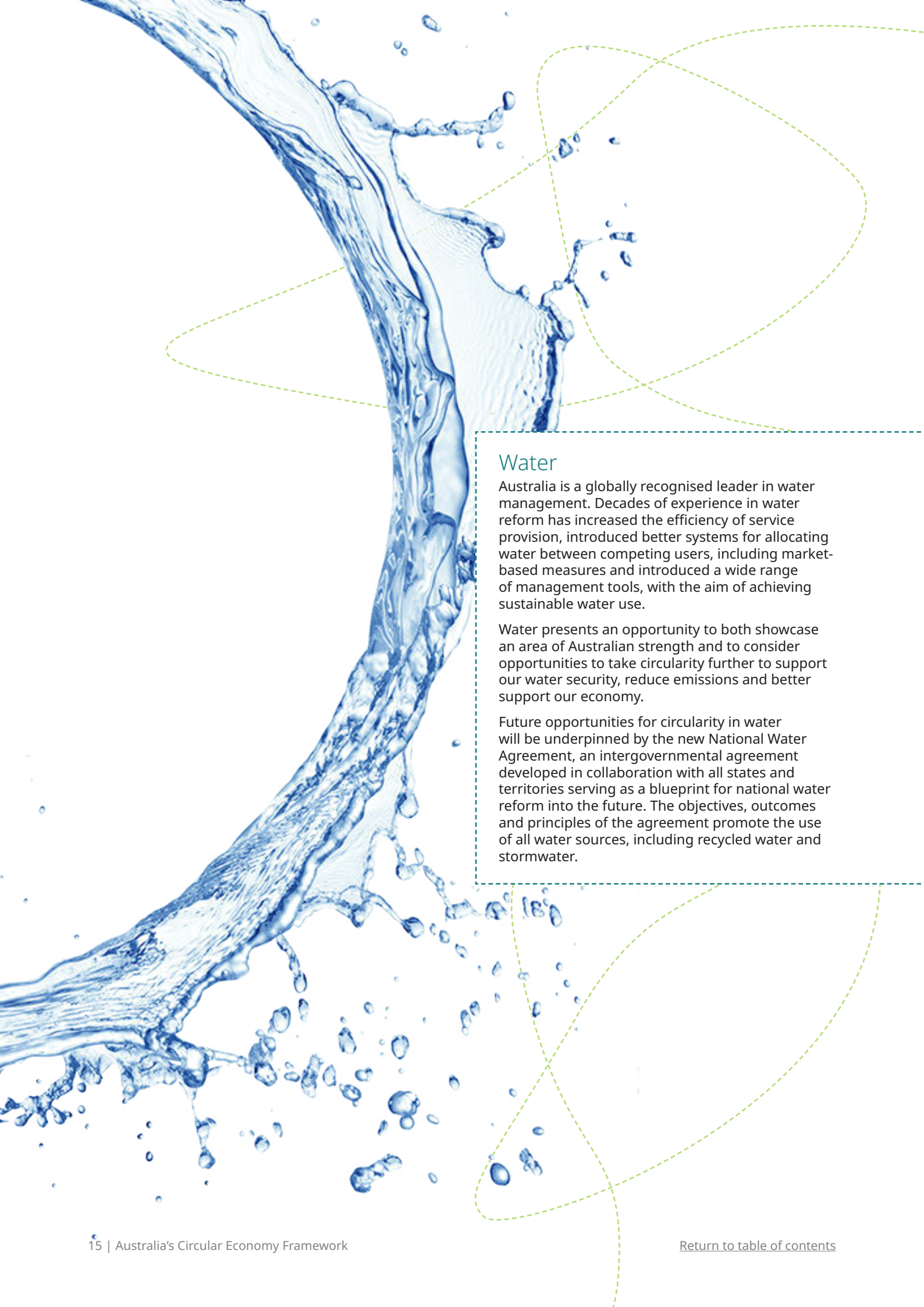
High recycling rates

Over 50% of the municipal solid waste in Australia is recycled – which is significant internationally. Australia has the infrastructure, manufacturing skills, and supply chains needed to effectively control pollution, with the opportunity to reposition the sector to drive circularity. Significant investment in recycling infrastructure has occurred over the last 10 years, including through the Recycling Modernisation Fund, Food Waste for Healthy Soils Fund, and projects supported by the Clean Energy Finance Corporation.^{xxx}

A culture that cares

Eighty-five percent of Australians are concerned about the amount of waste and consumption in society, with younger Australians linking this issue directly with climate change.^{xxxi} Two-thirds of consumers want business to do more to embrace the circular economy.^{xxxii} Australia's unique environments provide Australians with a sense of national identity and cultural heritage, representing intrinsic values deeply rooted in Australia's history and First Nations traditions.





Water

Australia is a globally recognised leader in water management. Decades of experience in water reform has increased the efficiency of service provision, introduced better systems for allocating water between competing users, including market-based measures and introduced a wide range of management tools, with the aim of achieving sustainable water use.

Water presents an opportunity to both showcase an area of Australian strength and to consider opportunities to take circularity further to support our water security, reduce emissions and better support our economy.

Future opportunities for circularity in water will be underpinned by the new National Water Agreement, an intergovernmental agreement developed in collaboration with all states and territories serving as a blueprint for national water reform into the future. The objectives, outcomes and principles of the agreement promote the use of all water sources, including recycled water and stormwater.

Australia's sectoral priorities

Opportunities

Australia's most significant short-to medium-term opportunities to drive a competitive and sustainable circular economy are in:



Industry



Built environment



Food and agriculture



Resources

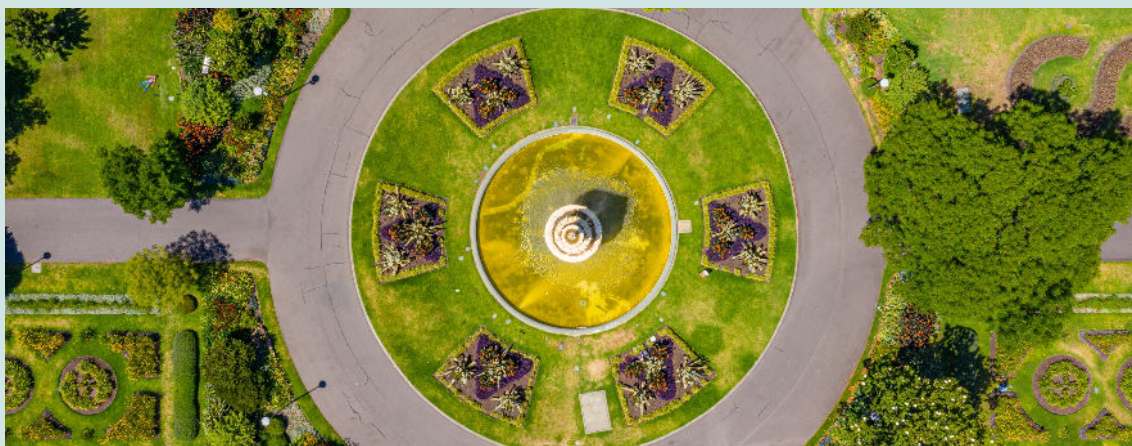
These sectors share at least one of the following qualities.

- **They are a significant part of the Australian economy**
 - meaning Australia has the ability to directly affect change in and through these industries.
- **They are heavy material users**
 - meaning changes in circularity in these industries will result in significant shifts in Australia's circularity rate overall.
- **Australia has a competitive advantage to build-on in these areas**
 - meaning circular economy progress can deliver economic benefits and are more likely to be sustained.

For similar reasons, these circular economy priority sectors are also a focus of the net zero transition and are further described in analysis by the National Science and Technology Council.^{xxxiii}

Within these sectors there are discrete priorities for action. These include specific market opportunities that Australia is well-positioned to meet, drawing on our comparative advantages. They also include enabling activities that will unlock these opportunities.

The sectoral priorities and supporting actions will need to be revisited periodically to ensure they remain contemporary in achieving the overarching, decadal goal. This approach acknowledges that Australia's strategy needs to evolve over time.





Industry

Rationale

Australia is building its domestic manufacturing capabilities through the Future Made in Australia agenda.

This period offers a key opportunity for the use of secondary materials as feedstocks for local manufacturing. Using recycled materials as inputs for manufacturing reduces Australia's exposure to supply chain disruptions. Remanufacturing also supports high-value job-creation in adjacent sectors. This includes Australia's recycling industry, which contributes an estimated \$19 billion to the economy and salaries approximately \$12,000 above the average Australian annual earnings.^{xxxiv}

Australia's comparative advantages in design, and niche, high value manufacturing expertise can support growth in manufacturing durable, reuseable and sustainable goods that are essential to a circular economy.

Priorities

Circular packaging

Packaging is a clear circular economy priority in Australia because of its significant environmental impact and the potential for improvement through sustainable design, recovery, reuse and recycling. In 2020–21, Australia produced 6.74 million tonnes of packaging – 44% of which was disposed of in landfills.^{xxxv}

The demand for food-grade recycled plastic is expected to witness significant growth due to increasing consumer awareness of environmental issues and regulatory pressures to reduce plastic waste. The global food-grade recycled plastics market size was valued at US\$9.1 billion in 2020 and is projected to reach US\$12.9 billion by 2027, with a compound annual growth rate (CAGR) of 5.1% during the forecast period.

This growth is driven by the rising adoption of sustainable packaging solutions by food and beverage manufacturers to meet consumer demand for eco-friendly products. Top brands (representing 20% of all global packaging) average 6.2% recycled plastics in packaging – but most have targets to reach 25% or more by 2025.^{xxxvi}

Australia is reforming the domestic regulation of packaging to ensure products placed on the market are designed to be recovered, reused, recycled and reprocessed safely. Innovative technologies to recover, recycle and remanufacture packaging, and business-to-business procurement of circular packaging solutions are important components of this priority.

Durable, re-usable and sustainable goods

Australia has globally competitive capabilities in manufacturing high-technology bespoke components for mining vehicles, land transport, and high-speed aluminium ferries. Australian exports of transport components, parts, and accessories was over \$1.5 billion, and it has experienced 7% year-on-year growth between 2018 and 2023.^{xxxvii} These products support the circular economy and net zero transitions and are in-demand in international markets.

Another area of niche expertise is novel technology solutions for medical waste. For example, Nanosonics is an Australian technology start-up that has reached unicorn status (valued at over US\$1 billion) whose products eliminate chemicals of concern and are less harmful to the environment.

Australia can leverage its strengths in medical technology innovation by investing to create sustainable alternatives to disposable healthcare products, reducing the burden of medical waste.

'Medical science' and 'transport' are priority areas identified for targeted investment through the \$15 billion National Reconstruction Fund (NRF). With healthcare waste accounting for around 5.9% of Australia's total waste generation, innovating towards reusable or biodegradable medical devices can significantly mitigate environmental impacts while addressing the rising demand for healthcare services.



Enablers

Circular product design

The design stage of a product determines around 80% of its environmental impact.^{xxxviii}

Economies such as the EU, China, Japan and South Korea are developing standards and frameworks to improve the environmental performance of products. Trade-alignment of standards will be important to maintain competitiveness in these markets.

Design priorities include durability, reusability, modularity, upgradability, repairability, and reducing the use of chemicals of concern in products. Better design requires collaboration between product designers, producers, and the resource recovery sector, stronger standards, and product innovation.

Verifying the provenance, properties and performance of recycled materials

Traceability is crucial for enabling remanufacturing within the circular economy, by ensuring that products and materials can be tracked throughout their lifecycle. Australia has developed a National Framework for Recycled Content Traceability to ensure materials used in products are verifiably sourced from recycled inputs, promoting transparency and consumer confidence.

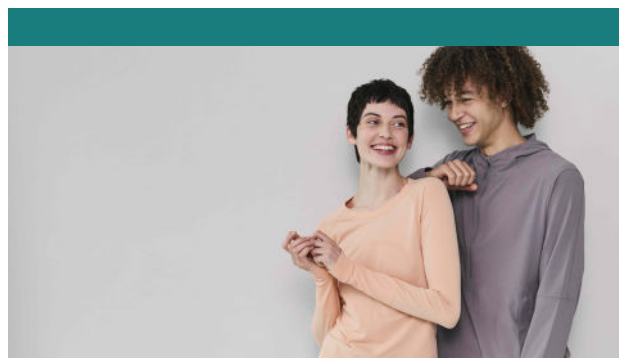
Consistent, verifiable standards and regulations for classification and treatment of recycled materials across different Australian jurisdictions supports integration of recycled materials into manufacturing processes. Harmonising relevant classifications and standards reduces uncertainties and variations in material quality, enabling manufacturers to confidently use recycled content without compromising product integrity. This streamlines production, lowers costs, and enhances market acceptance.

For innovators, consistent standards across Australia ensure that new technologies and processes can be applied and recognised nationwide, supporting smoother expansion.

Green chemistry and advanced technology

The choice of chemical building blocks for materials plays a pivotal role in the safe recirculation and remanufacturing of these materials within the circular economy. Chemicals of concern can pose significant challenges to the recycling process, potentially leading to harmful emissions or residues in recycled products. Consumers and businesses need confidence in the safety and efficacy of recycled products, and this starts with safer product design.

Regulation and policies supporting safe chemical substitution are essential to driving innovation and use of circular materials in the Australian economy. High-efficiency detection technologies are another important enabler for real-time identification and removal of chemicals of concern from circular supply chains.



Case study

Samsara Eco

Samsara Eco is a climate tech innovator at the forefront of the circular economy. Founded in 2021 in Australia, Samsara Eco aims to address the growing plastic problem with its enzymatic recycling technology transforming end-of-life plastics and textiles back into their original building blocks to be used in remanufacturing.

Samsara Eco's technology is developed with Earth in mind. The enzymatic recycling process is completed at low temperatures and low pressure, with a high recovery yield making it an efficient and sustainable solution.

In collaboration with leading fashion brands such as lululemon, Samsara Eco has successfully demonstrated the commercial application of its technology. Most recently, Samsara Eco partnered with lululemon to release the world's first enzymatically recycled nylon 6,6 garment, as well as an enzymatically recycled polyester jacket, which sold out. The apparel was made from post-consumer and post-industrial waste, showcasing the technological feasibility and potential for large-scale implementation in various industries.



Built environment

Rationale

The built environment, which includes buildings and infrastructure, accounts for a third of resource consumption globally and is the primary destination for materials in Australia.^{xxix, xl} In 2020–21, construction and demolition activities alone generated 29 megatonnes (Mt) of waste, making it the largest (and fastest-growing) source of materials received and processed in recycling and waste reuse systems.^{xli}

The built environment represents the most significant opportunity for Australia to decrease material footprint and drive uptake of circular, sustainable materials. It is also an opportunity to reduce GHG emissions through circular economy practices. Recent analysis has estimated that incorporating a circular economy approach into the built environment could reduce emissions by 3.6 million tonnes of CO₂e per year by 2040.^{xlii} Using building materials that are resilient to changing climate conditions and natural disasters also has the potential to substantially reduce waste.

Australia has robust and credible building-rating systems and regulations, such as Green Star, NABERS, and the Buildings Code, which set a solid foundation for further reform focussed on circularity.^{xliii}



Priorities

Refurbishing and adaptive reuse

Refurbishment and adaptive reuse are circular economy strategies that maintain existing buildings and infrastructure assets for longer, reducing waste and emissions associated with demolition and rebuilds. They can also significantly reduce construction times. For example, the Quay Quarter tower refurbishment in Sydney saved 12,000 tonnes of embodied carbon (equivalent of 2 years of operational emissions from building services) and 12 months in construction time compared to a full rebuild.^{xliv}

Adaptive reuse and refurbishment can be supported by financial incentives including environmental, social, and governance (ESG) frameworks recognising retrofitting activities. Other incentives used globally include grants or low-interest loans for sustainable renovations and updating zoning laws to encourage the repurposing of existing structures. This includes zoning overlays that facilitate the conversion of industrial spaces into mixed-use developments or residential spaces. Building codes that prioritise materials efficiency, sustainability and climate and disaster resilience can further support these efforts.

Manufacture and use of circular, low carbon, and climate resistant construction materials and fit outs

The expected growth for green steel and other sustainable construction materials (such as those incorporating recycled content or timber products) is significant. In Australia, the market for sustainable building materials is projected to grow at a CAGR of 12.1% from 2021 to 2026.

The green steel market is forecasted to increase from US\$3.75 billion in 2024 to US\$129.08 billion by 2032, exhibiting a CAGR of 55.6%, and the Asian Development Bank estimates over US\$30 billion needs to be invested in infrastructure across Pacific Island countries by 2030.^{xlv}

Australia's proximity to growing markets of the Asia-Pacific region, and abundance of renewable energy inputs and feedstock materials provide potential to capture export opportunities for green steel and other construction materials.

The Australian Government's [Environmentally Sustainable Procurement Policy](#) will drive demand for recycled content and circular goods and services in the construction sector including construction services and fit-outs of building and office interiors.

Enablers

Embedding the circular economy in new builds

Australia is undergoing a national infrastructure upgrade, focused on projects that improve long term productivity, supply chains and economic growth. This includes modernising to support clean energy and boost technology, housing and local services infrastructure and investments.^{xlvi} These projects present opportunities to embed whole-of-lifecycle thinking from the outset and drive uptake of sustainable, circular materials and practices.

Opportunities include using cross-laminated timber to replace steel in low- and medium-density buildings, prefabrication to reduce waste, modular construction to support repair and partial replacement over rebuilds, and designing for smaller, more flexible buildings.

Developing recycled content markets

Scaling the use of recycled materials paves the way for materials innovation elsewhere in the economy. Priority materials that will significantly lift national recycling rates and reduce material footprint include secondary concrete and steel, ash from coal-combustion, and asphalt.

Infrastructure Australia estimates that around 27% of virgin materials used for road projects could be replaced with a range of recycled materials, lifting to 43% with advanced standards and technology.^{xlvii}

Demand for recycled materials can be supported by developing and using recycled content procurement clauses in construction contracts, and associated material and product standards – which are predominantly managed by state and territory and local governments. Businesses also need to be able to readily identify and access secondary materials to build with them.

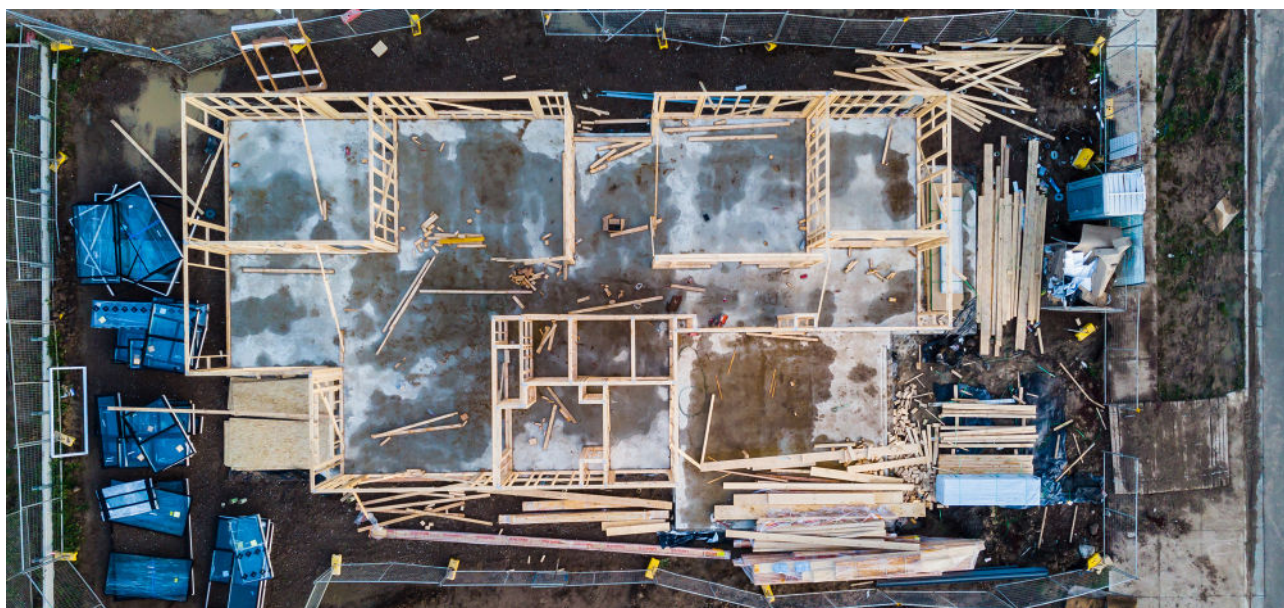
Australian governments, as the largest tenants in the economy, are major buyers of goods and services, particularly for infrastructure and buildings. Governments can leverage their purchasing power to create stable markets for sustainable and circular goods and services.^{xlviii} This may involve purchase of recycled materials or prioritising reuse or asset sharing.

Better design

Circular design strategies can substantially reduce waste and carbon emissions associated with new developments throughout their lifecycle. The following circular economy design priorities support all 3 of Australia's circular economy targets, and Australia's net zero target:^{xlix}

- design to reuse or refurbish existing assets or materials
- design to enable disassembly (including information about materials in buildings)
- design for longevity
- design for modularity
- design for best practice operational waste management
- design with recycled content
- design with others to make use of waste outputs as material inputs.^l

Planning authorities, regulators, procurers and investors have shared responsibility for design changes, through regulations, rating schemes and guidelines, procurements, risk-management strategies and building codes.



Case study

Burwood Brickworks

The Burwood Brickworks precinct in Melbourne, Victoria is a sustainable urban development celebrated for its innovative design, material selection and the reuse of resources.

Developed by Frasers Property Australia, the design process of Burwood Brickworks was driven by the principles of circular economy and sustainability from the outset. The project team employed integrated design techniques, collaborating with architects, sustainability experts, and the local community to ensure the development met stringent environmental standards. The precinct achieved a 6-Star Green Star rating and targeted Living Building Challenge certification, emphasising regenerative design.

Locally sourced, recycled, and low-impact materials were prioritised to minimise the precinct's environmental footprint. Reclaimed timber salvaged from several locations was used in the project including from a dismantled pier at Sydney's Circular Quay and from a Melbourne CBD office building that was being demolished. The 3260 individual roof-mounted solar panels and 250KW battery, ensures Brickworks generates more energy that it consumes. All tenants are also connected to a central thermal network, which avoids the use of more inefficient individual systems.

The precinct features an advanced water management system, including rainwater harvesting and greywater recycling, which significantly reduces potable water consumption. An on-site rooftop urban farm and closed-loop organic waste system allow for the production and reuse of organic products. Food waste from the precinct's restaurants is composted and used to nourish the rooftop garden, which supplies fresh produce to the local community and eateries within the precinct.

Burwood Brickworks precinct shows how sustainable design, material reuse, and resource circularity can be seamlessly integrated into profitable modern precincts to create vibrant, eco-friendly communities.





Food and agriculture

Rationale

Australia's food and agriculture sector accounts for 55% of Australian land use, 74% of water consumption, 13.6% of goods and services exports, and contributes 2.7% of value added (GDP).^{li} Australia also creates more than 7.6 million tonnes of food waste each year, costing the Australian economy over \$36.6 billion.^{lii}

Australian farmers recognise the importance of maintaining soil health and promoting natural capital. Adopting circular economy strategies can further enhance the sustainability of farming practices. Circular opportunities in agriculture address waste reduction, resource and water efficiency, renewable energy and regenerating nature which aligns closely with the principles of the circular economy.

Australia's food and agriculture sector is recognised for its innovation leadership, with opportunities to direct this innovation towards emerging circular economy markets and sustainably improving productivity.^{liii}

Priorities

Reducing food waste

Australia has a current goal of halving preventable food waste by 2030.^{liv} Nearly 300kgs of food is wasted in Australia per person per year, with household food waste making up 2.5 million tonnes, or about 34% of the overall total amount of food wasted. Reducing food waste can save the average family up to \$3,800 per year.

Innovation, behaviour change, and standards are priorities to address these challenges. Innovations in food waste reduction technologies, such as smart packaging and food recovery platforms help mitigate food losses and open up new revenue streams. Promoting simple behaviour changes, such as better meal planning and smarter food storage, can significantly reduce food waste in Australia.

Produce standards and specifications, and supply agreements can support less food waste. An estimated 25% of all fruits and vegetables are wasted due to their odd shapes or sizes not meeting retailer standards.^{lv} Variances between forecast and actual fresh produce purchases by retailers can also drive food waste. Australia has committed to ensuring fresh produce standards and specifications are reasonable, and forecasting volumes are conducted with due care.^{lvi}

Valorising agri-waste

Valorising agricultural waste presents an opportunity to enhance material productivity and service emerging regional markets. For example, agricultural and forestry residues such as stalks,

leaves, husks, woodchips and branches can be used as biofuel feedstocks, creating value from these previously low-value products. Development of these biofuels could tap into a global sustainable aviation fuel market, which is projected to reach US\$25 billion by 2030, offering substantial economic and environmental benefits.^{lvii}

Other relevant markets include alternative proteins and antioxidants. By 2035, alternative proteins are expected to make up 11 to 22% of the world's protein market.^{lviii} Manufacturing techniques such as precision fermentation, which can use organic by-products as feedstock, are one avenue to service this demand. The insect protein market size is expected to grow from US\$288.38 million in 2023 to US\$348.97 million by 2028, at a CAGR of 3.89%. Insect technology creates biomass from agri-food waste and Australia ranks fifth in the world for filing alternative protein patents.

The antioxidant market is also projected to grow by 6.9%, reaching a US\$7 billion valuation by 2031, with the Asia-Pacific region being the primary market. Agri-food by-products, such as grape marc, can be processed to extract natural antioxidants.

Australia's advantages in land availability and agricultural manufacturing innovation position us well to service these growing regional markets. The Australian Government's \$15 billion NRF will also provide finance for projects in priority areas that diversify and transform Australia's industry and economy. Value-adding in agriculture, forestry and fisheries is a priority area identified for targeted investment through the NRF.



Enablers

Shared infrastructure, equipment, data and resources

Around 80% of businesses in the agriculture, forestry and fishing sector are small to medium-sized enterprises, which can struggle to justify capital expenditure on equipment or infrastructure that could significantly reduce waste and increase yield.^{lix}

Pre-farm gate waste can be used to generate new revenue streams such as biofuels, compost, or animal feed, but requires collection at scale and significant processing infrastructure that is not always accessible for small businesses.

Place-based hubs for circular economy activity, including shared equipment schemes and infrastructure, can unlock these opportunities close to where waste is generated. These initiatives help address the 22% of Australia's total food loss and waste comes from the primary production sector.

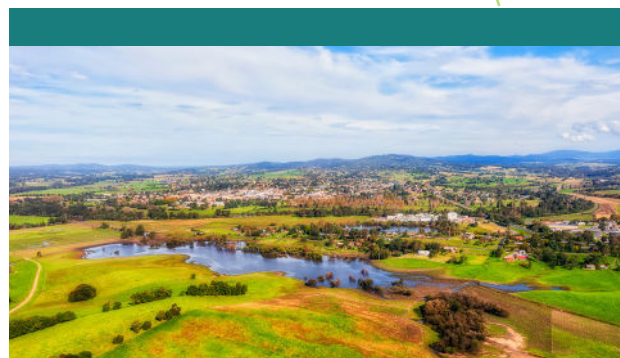
Data tools and approaches to measure and track food waste generated within the food system, especially en route to retailers, also support a more transparent supply chain and help identify circular economy opportunities. These tools also help measure and demonstrate success to investors.

Higher quality recycled organics

Improving the quality of recycled organics requires that organic waste streams are free from contaminants, and are properly sorted and processed, and supports market development and confidence in these products. This can be achieved through better source separation practices, public education on proper disposal methods, and advanced processing technologies like composting and anaerobic digestion that enhance the nutrient content and safety of the recycled organics for use.

Cold-chain transport

Australia's agricultural exports depend heavily on efficient cold chain logistics, yet these systems often result in significant energy consumption and waste. Better adoption of technologies such as energy-efficient refrigeration, smart logistics management, and reusable packaging solutions help minimise environmental impact and operational costs and support the priority of reducing food waste. Integrating reverse logistics for packaging and pallets also enhance resource recovery and reduce waste.



Case study

Bega Circular Valley Initiative

The Bega Valley Shire in New South Wales is home to a pioneering place-based circular economy transition, particularly in its agricultural sector. Known for its dairy industry and diverse agricultural output, the region has embraced circular economy principles to enhance sustainability and economic resilience.

Farmers are central to this transition, actively engaging in practices that minimise waste and maximise resource efficiency. One key project is the integration of organic waste management systems on farms. Agricultural waste, such as manure and crop residues, is converted into valuable compost through advanced composting techniques. This compost is then used to enrich soil health, improving crop yields and reducing the need for chemical fertilisers.

Water circularity is another crucial focus. Farmers have implemented rainwater harvesting systems and efficient irrigation technologies to reduce freshwater usage. Wastewater from dairy operations is treated and reused for irrigation, ensuring that water resources are conserved and sustainably managed.

Collaboration is a hallmark of Bega's approach to circularity. Farmers work closely with local councils, research institutions, and businesses to develop and implement innovative practices. For example, the Bega Circular Valley initiative brings together various stakeholders to create a circular economy hub, fostering knowledge exchange and supporting the adoption of circular practices across the region. The local Shire Council is a key partner in the initiative and plays a core role in showcasing businesses' circular economy innovation to other prospective adopters.

Through these efforts, the initiative demonstrates how agricultural areas can successfully transition to a circular economy. By focusing on waste reduction, water efficiency, renewable energy, and collaborative efforts, Bega Circular Valley is setting a precedent for sustainable agriculture that can be replicated across Australia.



Resources

Rationale

A circular economy approach can maximise the value of minerals, reduce energy demand, and lower the environmental footprint of the mining and resources industry, throughout the product value chain.

Progress towards a circular economy is a priority within Australia's [Critical Minerals Strategy 2023–2030](#). Circular economy principles are also embedded in the government policy priorities to which the [Northern Australia Infrastructure Facility](#) is expected to contribute through its Investment Mandate.

In parallel with the global net zero transition, major consuming economies (such as the US, the EU and China) are also turning their economies to circular ones. Through policies and investment these economies are looking to source minerals inputs through material reuse, repair or in-country recycling. These policies will drive demand for secondary minerals, presenting both an opportunity and challenge for Australia's resources sector.

The mining industry is a leading source of innovation in the Australian economy, with many technologies, products and services driving resource efficiency improvements. These can support the circular economy transition directly or translate into other areas of the economy. Extraction and processing efficiency innovations can be major drivers of materials productivity and reducing Australia's material footprint overall.

Renewable energy technologies are also being widely deployed in the Australian economy, as part of the net zero transition. As these technologies and products reach their end-of-life, Australia must be prepared to recover and reuse the valuable materials and minerals in these products.



Priorities

Minerals beneficiation

Mining tailings and waste from mining projects represent an underutilised resource that can create new value in the industry without requiring new extraction activities. In 2018–19, mining waste was estimated at 620 Mt, more than 40 times the amount of municipal solid waste generated in Australia.^{ix} The volume of tailings is expected to double in Australia by 2035, as the transition to renewable energy increases the demand for critical minerals.^{xi}

Australia has the potential to leverage our competitive advantage in resource extraction and technology innovation to develop new methods and technologies to extract valuable minerals from wastes (such as mining tailings) and renewables technologies (such as batteries and solar photovoltaics).

Australia has the largest penetration of rooftop solar in the world, with over 25% of homes with solar. The earliest installations are now reaching the end of life (20+ years) and are starting to be removed.^{xii} This will establish a predictable supply of materials for testing innovative solutions and building markets around secondary industries. But technology solutions are required to effectively recover, reuse or recycle the resources in these goods.

The Australian Government has committed to develop a regulated product stewardship scheme to reduce waste from solar photovoltaic systems.

Co-extraction and resource sharing through precincts

Mineral co-extraction at Australian facilities represents a significant opportunity to improve resource efficiency and productivity, by extracting multiple minerals from the same ore or material. Partnerships between larger mining enterprises focussed on primary extraction, and small and medium sized enterprises who can operate side industries for secondary co-extraction, are a critical enabler of these opportunities.

Co-extraction viability depends on industries reallocating funds, usually set aside for facility upgrades and maintenance, towards extracting secondary minerals that are not their main source of income. ESG settings and risk-sharing bear significant influence on these business decisions.

Australia is anticipating an increase in its minerals processing capabilities to support the global transition to net zero. Embedding circular economy principles in the design and operation of minerals processing hubs can maximise value and minimise waste in these precincts.

Second-use of mineral-containing products

Second-use provides alternate pathways to extend the life of products, without requiring complete recycling and re-manufacturing. This can include practices like redeploying EV batteries for stationary household energy storage.

Research from the University of Technology Sydney suggests that 30,000 tonnes of EV batteries will reach their end-of-life in Australia by as soon as 2030. This is forecast to increase to 360,000 tonnes by 2040, and 1.6 million tonnes by 2050.

International precedent shows that standards and regulations for consumer safety of second-life goods are key to building consumer confidence in these products and scaling second-use.^{lxiii}

Enablers

ESG frameworks and standards

ESG frameworks and international standards that incorporate and recognise circular economy principles and actions provide an important enabling condition to support further industry investment in innovation. While these frameworks increasingly highlight sustainability, there remains an opportunity to more explicitly consider circularity within ESG criteria.

Pre-competitive information on re-extraction opportunities

Geoscience Australia's Atlas of Mine Waste identifies 1,050 possible sites where critical minerals could be extracted from the waste of existing projects, including mine tailings, waste rock, smelter residues and related mine waste materials.^{lxiv}

Precompetitive information on the profile of waste stockpiles helps reveal the economic viability of re-extraction opportunities, as the value of latent minerals change, and technology improves.





Case study

Heritage Minerals

Heritage Minerals is advancing sustainable resource management through its Mount Morgan Tailings Processing and Rehabilitation program, with owner equity combined with financing from the Northern Australia Infrastructure Facility and grant funding from the Queensland Government.

At its peak in the early 1900s, Mount Morgan was once the largest gold mine in the world, and has yielded approximately 262 metric tons of gold, 37 metric tons of silver and 387,000 metric tons of copper over its lifespan. Heritage Minerals is applying a technology from partner firm, GreenGold Technology, renowned for its expertise in processing gold tailings found in abandoned mines. This project aims to revitalise Mount Morgan by constructing a state-of-the-art tailings processing plant and supporting infrastructure to extract valuable minerals from historic mine waste.

Heritage Minerals is working closely with the local community, Indigenous businesses, and state and local governments to commission the project which aims to rehabilitate land at the same time as mining it. By recovering gold, copper, and pyrite from the tailings, the project reduces environmental hazards while generating economic value from previously untapped resources. The process not only recycles waste materials but also rehabilitates the land, reducing the environmental legacy of past mining activities.

Driven by modern technology, infrastructure and partnerships, the program demonstrates how old mining sites can be transformed into new economic opportunities, aligning with Australia's circular economy goals while supporting regional jobs and sustainable development.



Case study

Yarwun Alumina Refinery

The Yarwun Alumina Refinery, operated by Rio Tinto in Gladstone, Queensland, is making significant strides towards integrating circular economy principles within its operations. This refinery is not only a key player in Australia's alumina production but also in finding innovative solutions to manage industrial by-products and enhance resource efficiency.

A major focus of the Yarwun refinery's circular economy efforts is the management and valorisation of bauxite residue, a by-product from the production of alumina and commonly known as tailings. Traditionally considered waste, this by-product is now being viewed as valuable resources. The refinery has identified pathways that use the characteristics of bauxite residue, significantly reducing the need to store large volumes and environmental impact.

Technologies to recover common and critical materials exist and are in development to produce common commodity materials as well as rare earth elements. These critical materials can be used in various high-tech applications including semiconductors, solar panels and telecommunications.

The refinery's pathway for by-product management also includes the use in construction materials and soil rehabilitation projects. By converting bauxite residue into building products or soil amendments, the refinery further reduces waste and creates circular loops within the industrial and construction sectors.

These initiatives are supported by collaborative efforts with research institutions and industry partners, ensuring that the latest technological advancements and best practices are applied. This collaborative approach not only enhances the refinery's operational efficiency but also promotes knowledge-sharing and innovation within the broader industrial sector.

Australia's cross-cutting objectives

Success in any one of the above priority areas will depend on the following cross-cutting objectives.

Innovation

Australian science is in the global top 10, but we lag in innovation – turning our science into economic benefit. Innovation works best when there is a clear market vision to target, which drives collaboration. This framework provides that clarity by establishing a National Mission for circularity.

Innovation will drive the development of disruptive technologies, business models, and processes that make circular practices practical and profitable. Competitive Australian innovation requires aligning research efforts and investment with policy settings and market opportunities.

To support circular economy innovators and transition from pilot projects to mainstream deployment, financial support and public-private partnerships are essential. In addition to setting clear priorities, investors and businesses need information on the scale and economic viability of opportunities. This is not information businesses can obtain unilaterally. Mapping supply chains to identify the locations, volumes, and types of materials available for recycling or reprocessing, and their proximity to infrastructure and research and development (R&D) hubs, is a crucial enabler.

Business-to-business (B2B) collaboration is essential for the circular economy. However, only 12% of Australian businesses collaborate for innovation. This underscores the need for collaboration-focussed support in Australia's circular economy transition. Competition settings play a key role in enabling companies to collaborate effectively, without compromising market fairness.

Facility-sharing is another important enabler of cooperative innovation, with only 9% of Australian businesses collaboration activities involve sharing facilities. Shared infrastructure supports the development and production of innovative technologies by providing access to facilities that are otherwise too expensive for small and medium-sized companies to develop and/or access on their own.

Market development and investment

Effective markets provide the economic settings necessary to incentivise, scale, and sustain the circular economy transition. Active markets for circular goods and services are an essential first 'domino' for catalysing a whole-of-economy transition. Markets determine investor and business certainty in the value of changing practices – justifying capital outlay for new infrastructure and increasing demand for circular economy thinking and skills.

Demand for circular goods and services can be delivered through clear market signals, such as policy targets and regulation, and prices that reflect the true environmental costs of goods and services. Demand can also be driven through government and business procurement power, particularly business-to-business procurements. Strong business leadership is important to balancing price-driven procurements towards sustainable and circular decisions.

Marketplaces for circular goods and services play a crucial role in facilitating the exchange of circular goods and services. These platforms connect suppliers with buyers, streamline transactions, and enhance transparency, while building demand for circular products.



Advanced resource recovery and recycling

Better resource recovery and recycling are fundamental to enabling the circular economy transition across all sectors of the Australian economy.

Australia's resource recovery and recycling industry is undergoing considerable transformation, driven by global market pressures, evolving consumer preferences, and an increasing focus on reducing the carbon footprint.^{lxv}

Technologies such as AI, robotics and automation are going to play a significant role. Investment in advanced manufacturing sorting technologies is one of the most cost-effective opportunities to support markets for secondary materials.

B2B recovery and recycling is another unmet opportunity. Every year Australian firms spend \$1.4 billion sending \$26.5 billion worth of material to landfill.^{lxvi} Harmonised standards and specifications support greater B2B recovery, along with active markets for secondary materials.

Systems thinking and circular economy skills

For tens of thousands of years, First Nations peoples have used systems-thinking approaches across various aspects of life, including the natural environment and resource management. The transition to a circular economy will require this kind of systems thinking across all professions.

This involves adopting a holistic view of the material lifecycle, from design to disposal, understanding how changes to one part of a system can affect many other interconnected elements, and ensuring each stage is optimised for minimal environmental impact. Incorporating systems approaches will be both necessary and beneficial, providing market advantages, particularly for early adopters.

Specialised skills in areas like materials management, product design for circularity, resource optimisation, and sustainable supply chain practices are crucial to a circular economy. Integrating these skills into fields such as engineering, quantity surveying, design and architecture, business, and economics will help create the cultural change necessary for a widespread transition. This could mean incorporating materials lifecycle thinking into design and engineering courses or adding circular procurement skills to trade apprenticeships.

Collaboration and place-based approaches

No one can go circular alone. Australia's circular economy transition will require cooperation up, down and across supply chains to share resources, design better goods and services, and innovate. And it will require policy settings and tools that support this kind of collaboration.

Local economies are leading Australia's circular economy transition, each driven by different incentives. For some, circularity is the primary way of demonstrating ESG credentials to banks backing local business. For others, the circular economy is an opportunity to pivot from carbon-intensive regional economies to sustainable alternatives. The challenge and opportunity is to support those driving these local transitions.

The challenges of a take-make-waste linear economy concentrate in cities, but cities are also centres for change. Urban planning plays a pivotal role in supporting local circular economies by strategically designing cities and places to optimise the use and management of materials. This includes allocating sites for circular activities on public land and embedding circular economy principles into urban policy levers.^{lxvii}

Behaviour change

Consumer goods, like textiles, packaging, electronic devices, and tools and equipment are where Australians engage at a practical level with the circular economy. Every Australian buys, makes, uses or disposes of these goods – in their business, workplace, community or at home.

Consumers play a crucial role by deciding what to buy, and how to dispose of products. Information about product performance supports informed purchasing decisions. This includes details about product durability, repairability and recyclability. Digital platforms and technologies can be leveraged to provide real-time information, enabling consumers to access details about a product's environmental footprint instantly.

Shifting cultural values towards sustainable consumption and production is crucial for achieving a more circular economy. Public information about the environmental, cultural, social and economic benefits of reducing waste, reusing products, and recycling materials are important drivers for behaviour change.



Case study

Albury Wodonga Regional Collaboration

The Albury Wodonga region provides a model for advancing the circular economy through regional collaboration. A key initiative is the Albury Wodonga Regional Renewable Energy Hub, which facilitates partnerships and provides resources for businesses to adopt circular practices. A notable project involves local manufacturers and waste management companies repurposing industrial waste.

Significant investments in new infrastructure support these circular initiatives. The Albury Recycling Centre receives and prepares for offsite processing, various materials such as plastics, metals, and electronics, turning them into high-quality secondary resources for manufacturing.

The region has also established a plastics reprocessing plant that converts post-consumer plastic waste into pellets for new plastic products. This facility represents a significant investment in the region's circular economy infrastructure, providing local manufacturers with a steady supply of recycled plastic.

Local food producers and waste management services collaborate to handle organic waste. Food waste from restaurants and food processing businesses is collected and transformed into either, fertiliser, protein, compost and bioenergy, diverting waste from landfills, generating renewable energy, and enriching soil for agriculture.

The Albury Wodonga region shows how infrastructure development can support and accelerate the transition to a circular economy. By creating advanced facilities for recycling and manufacturing, the region drives innovation and sustainability, fosters economic resilience, and enhances community well-being, serving as a blueprint for other regions in Australia and beyond.



Case study

The Ricoh Group

The Ricoh Group, a global leader in imaging and electronics, has been a pioneer in integrating circular economy principles into its business strategy. In 1994, it introduced the 'Comet Circle' concept, laying the foundation for its long-term sustainability goals, including reducing environmental impact, promoting resource efficiency, and advancing circular economy principles.

Ricoh's goal is to use resources efficiently across the value chain – by 2030, reduced virgin material consumption rate to 60% (or less) – and by 2050, 12% (or less). Part of its business strategy includes actively participating in sustainability networks and collaborating with stakeholders to promote circular economy practices, share expertise and work on joint initiatives to improve recycling, reuse, and circularity – with initiatives promoted across its international operations.

Ricoh has responded to growing transparency demands in public procurement by ensuring its products meet high environmental and social governance (ESG) standards. For instance, it secured a large public-sector contract in France by meeting stringent sustainability criteria. The company regularly reports its environmental performance and integrates ESG targets into management practices, including executive compensation.

Ricoh's commitment to a circular economy has not only enhanced its ESG credentials but is also creating lasting value for its business.

Implementing the framework

Action is needed from governments, industry, investors, and communities, each in different ways to bring the circular economy framework to life.

Governments: the enablers

Policymakers set the direction and provide the foundation for a successful transition to a circular economy. Governments can create the conditions that allow circular systems to thrive by implementing supportive policies, providing financial incentives, and encouraging collaboration and behaviour change across sectors.

Creating supportive policies and regulations

Countries successfully transitioning to a circular economy deploy strong policies that target product design, placing responsibility on manufacturers to design products with end-of-life recycling and reuse in mind, reducing waste and encouraging innovation.

National efforts are most effective when circular economy principles are embedded across key programs and policies, especially in materials-intensive industries like those prioritised in this framework. Regulatory alignment (domestically and internationally) is crucial to scaling markets for circular goods and services and reaching Australia's targets.

Aligning the economy with circular principles

Governments play a central role in shaping the economic landscape. By embedding sustainability and circularity into financial frameworks, governments can incentivise businesses to adopt circular practices. This can include integrating circular economy principles into public procurement policies, ensuring that government contracts prioritise sustainable materials and solutions.

Trade policies can also be adjusted to align with circular economy goals, encouraging the movement of recycled and reused materials across borders, and setting standards for transparency and disclosure.

Driving behavioural change

Governments have the power to influence behaviour on a large scale, both in the business community and among consumers. By offering incentives and education programs, they can encourage both businesses and individuals to adopt more sustainable behaviours. This change in mindset will help build the demand for circular products and services, reinforcing the overall transition.

Business: the innovators

Businesses are at the forefront of driving innovation in a circular economy. They are uniquely positioned to rethink their products and processes to reduce waste, design for durability and repair, and enable product reuse, remanufacturing, and recycling.

Strategy, planning and reporting

Businesses can support the circular economy transition by making it a leadership priority and integrating circular principles into their core strategies. This includes incorporating these principles into business models, setting clear transition targets, and creating actionable implementation plans.

It is essential to track the transition across all areas of a business to demonstrate the value of business change. This not only informs ongoing strategy but also ensures transparent reporting aligned with internationally recognised standards and frameworks.

Product redesign for circularity

Businesses need to embed circular principles into product design from the outset. This means creating products that are modular, easy to repair, and made from materials that can be reused, recycled or biodegraded. Innovation in material science, product engineering, and packaging can significantly reduce waste and create opportunities for new revenue streams through product-as-a-service models.

Collaboration and partnerships

The transition to a circular economy requires businesses to work together across supply chains. By forming partnerships with suppliers, manufacturers, and recyclers, companies can create closed-loop systems where materials are continually reused. Industry collaboration can help scale circular solutions, share risks, and drive systemic change across entire sectors.

Investing in new business models

Businesses can unlock value through circular business models such as leasing, sharing, and product-as-a-service. These models can help extend the lifespan of products and reduce the need for virgin materials, while also offering customers flexible and cost-effective alternatives.

Business indicators

Circular Transition Indicators: Developed by the World Business Council for Sustainable Development and KPMG, this resource provides a set of indicators that businesses can use to assess their progress towards circularity. The indicators cover various aspects of circularity, including material circularity, renewable energy use, and water stewardship.

CIRCelligence Indicators: Developed by Boston Consulting Group, this resource provides a comprehensive set of indicators for measuring a company's circularity. It covers various aspects of a business, including product design, collaborative business models, reverse logistics, and wider system conditions.

Other circular economy indicators

Different economies track various circular economy metrics including:

Indicators that decrease with the transition	Indicators that increase with the transition
• Material footprint • Households and sector waste • Waste landfilled • Water use • Water pollution incidents • GHG emissions across sectors • Overall energy use • Number of derelict buildings and empty homes • Biodiversity loss	• Resource recovery rates • Reuse and repair enterprises • Companies publishing ESG reports • Green/circular jobs • Water, soil and air quality • Nutrient capture and reuse • Energy from renewable sources • Public sustainable procurement • Patents for circular goods • Retrofitted homes



Investors: the catalysts

By directing capital toward circular solutions, investors can help scale innovative business models, technologies, and infrastructure that support resource efficiency and waste reduction. The financial sector has a significant opportunity to influence the pace of change by aligning investment strategies with circular economy principles.

Prioritising circular economy investments

Investors can drive change by prioritising investments in companies and sectors that are adopting circular practices. This includes businesses that focus on product reuse, remanufacturing, recycling, and innovative materials. Investors can help these businesses scale and compete with traditional linear models, creating both financial returns and positive environmental outcomes.

Venture capital and private equity firms can support early-stage companies developing breakthrough technologies that enable circularity, such as advanced recycling processes, materials innovation, and digital platforms that facilitate product sharing or leasing.

Embedding circularity into ESG frameworks

As ESG considerations become increasingly important in investment decisions, circular economy principles are being embedded into these frameworks. Investors can assess companies based on their resource efficiency, waste reduction strategies, and commitment to sustainable supply chains. By integrating circularity into ESG criteria, investors can encourage businesses to adopt practices that not only benefit the environment but also strengthen long-term resilience and profitability.

Engaging in active ownership and stewardship

Investors can play an active role in promoting circularity by engaging with companies in their portfolios. Through active ownership, investors can influence corporate strategies, encouraging businesses to adopt circular practices, improve product lifecycles, and reduce waste.

Collaborative initiatives among investors, such as the Industrial Circular Economy Investments Alliance, can amplify these efforts by promoting best practices, sharing insights, and advocating for systemic change across the financial sector.

De-risking circular economy investments

Transitioning to a circular economy can involve new risks for businesses, including shifts in supply chains and the need for upfront capital investment. Investors can play a key role in de-risking these transitions by providing patient capital, offering flexible financing terms, or supporting public-private partnerships.





Circular economy in financial frameworks – A growing trend

The integration of circular economy and resource efficiency principles into financial frameworks is gaining momentum as investors and regulators recognise the need for more sustainable economic models. This shift is reflected in the increasing inclusion of circular economy metrics in ESG frameworks and disclosure standards.

- **ESG integration:** Circular economy principles are becoming a key component of ESG assessments. Investors are looking beyond short-term financial gains and focusing on long-term sustainability, evaluating how companies manage resources, reduce waste, and design products for longevity and recyclability. Companies with strong circular practices are being rewarded with higher ESG scores, reflecting their resilience and alignment with global sustainability goals.
- **Disclosure standards:** Global disclosure frameworks, such as the those developed by the Task Force on Climate-Related Financial Disclosures (TCFD) and the International Sustainability Standards Board (ISSB) guidelines, are beginning to incorporate circular economy considerations. Companies are increasingly expected to disclose their resource use, waste management strategies, and efforts to close material loops, giving investors better insights into their sustainability performance.
- **Financial products and bonds:** The financial sector is seeing a rise in sustainability-linked bonds and green bonds that target circular economy outcomes. These financial instruments are tied to measurable sustainability goals, such as reducing waste or increasing the use of recycled materials, providing both financial returns and environmental benefits. For example, the European Investment Bank, alongside Europe's largest public and promotional banks, has committed €16 billion to finance circular economy projects by 2025.

This growing focus on circularity within financial frameworks not only drives more sustainable business practices but also signals a broader shift in how value is measured – moving from a purely financial perspective to one that accounts for environmental impact and resource efficiency.

The Australian Government is contributing to this shift by creating a Nature Repair Market and establishing the Nature Finance Council. These initiatives aim to facilitate investment in projects that restore and protect natural environments, aligning financial flows with nature-positive outcomes.

Australia's Measuring What Matters framework integrates sustainability indicators, ensuring that factors such as resource efficiency and ecological health are considered in national policy and investment decisions. Additionally, the introduction of climate disclosure requirements in Australia is expected to foster transparency and encourage more sustainable business practices.

Researchers and NGOs: the thought leaders

Research institutions, universities, and non-governmental organisations (NGOs) provide the necessary research, education, and advocacy to drive the circular economy forward.

Advancing research and development

Academia plays a role in exploring new materials, technologies, and business models that can accelerate the shift to a circular economy. By investing in research focused on the priorities of this framework and Australia's National Research and Science Priorities, academia can support businesses and governments with the knowledge and tools needed to transition.

Raising awareness and advocating for change

NGOs can act as a bridge between the public, policymakers, and businesses by raising awareness about the benefits of circularity and holding stakeholders accountable for progress. Through campaigns, reports, and community engagement, NGOs help drive the cultural and behavioural shifts needed to make circularity mainstream.

Australians: the changemakers

Australians play a crucial role in driving demand for circular products and services. Their choices can influence market trends and push businesses toward sustainable practices. Empowering consumers with information (for example, on product credentials) and opportunities will be essential for a successful circular economy transition.

Australians themselves can contribute by making sustainable product choices, practicing effective waste management, and supporting local circular initiatives such as repair cafes, libraries and second-hand marketplaces.

Circular Economy in Australia's National Research and Science Priorities

The circular economy is a cross-cutting theme in Australia's National Research and Science Priorities. Australian research that supports the transition to a circular economy should align with these priorities, further defined by the sectoral challenges outlined in this framework.

National Research Priority 1 – Transitioning to a net zero future

- Shifting towards a circular economy through advanced materials and processes
- Technological solutions for sustainably reducing, reprocessing and recycling Australia's waste at scale
- New and innovative ways of extracting, refining and processing critical minerals which minimising environmental impact.

National Research Priority 4 – Protecting and restoring Australia's environment

- Transitioning to a more circular economy.

National Research Priority 5 – Building a secure and resilient nation

- Cost effective built environments that are resilient to climate change
- Secure and resilient supply chains that underpin Australia's prosperity
- Planning, design, materials and engineering of infrastructure and built environments for Australia and our region that account for likely future climate conditions.



Glossary

Term	Description
Biofuel	Liquid fuels produced from biomass feedstocks such as agricultural crops, forestry products, or the organic portion of municipal solid waste.
Chemicals of concern	Refers to chemicals that have properties raising environmental or health concerns. These include chemicals that do not break down easily, are toxic, or can accumulate to high levels in animals.
Circular economy	Is an economic model that promotes sustainable and efficient use of resources as a way to support environmental, economic and social outcomes. It shifts away from the current linear 'take, make, dispose' consumption approach to one that maintains a circular flow of materials by recovering, retaining, or adding to their value.
Circularity	Property of products that all materials used in a product can be recycled several times and kept in almost closed loops. In economics, circularity means a product, service, or resource is renewed or regenerated, rather than wasted. Circularity uses creativity and systems-thinking to eliminate waste and extend the life of important natural resources.
Circularity rate	Is a measure of how much material input into an economy comes from recycled or reused sources. It indicates the proportion of resources that are cycled back into production rather than being disposed of as waste.
Compound annual growth rate (CAGR)	Is a metric used to describe the mean annual growth rate of an investment, company revenue, or market over a specified period of time longer than one year
Critical minerals	Are metallic or non-metallic materials that are essential to Australia's modern technologies, economies and national security, and whose supply chains are vulnerable to disruption
Ecolabelling	A certification scheme that identifies products or services meeting specific environmental performance criteria, helping consumers make more sustainable choices.
Environmental Social and Governance (ESG)	A framework used to assess a company's operations concerning environmental stewardship, social responsibility, and corporate governance practices.
Feedstock	A raw material, also known as a feedstock, unprocessed material, or primary commodity, is a basic material that is used to produce goods, finished goods, energy, or intermediate materials that are feedstock for future finished products.
Financial framework	A financial framework is a system – including policies, procedures, regulations, and standing orders– that guide and support the structure and operations of all financial matters for a business.
Green steel	Steel produced using processes that minimise carbon emissions, often through renewable energy sources and innovative technologies like hydrogen-based reduction
Industrial symbiosis	Industrial symbiosis is the association between industrial facilities or companies in which the waste or by-products of one become raw materials for another.
Linear economy	A traditional economic model characterised by a 'take-make-dispose' approach, where resources are extracted, used, and then discarded as waste
Material footprint	A measure of the total amount of raw materials extracted globally to meet a country's consumption demands, including imported goods.
Minerals beneficiation	Describes processes to reuse and recycle products containing minerals, including mining tailings or mineral-containing products such as end-of-life solar panels or batteries.
Mining tailings	Tailings are the left-over materials from the processing of mined ore. They consist of ground rock, unrecoverable and uneconomic metals, chemicals, organic matter and effluent from the process used to extract the desired products from the ore.
Nationally Determined Contributions (NDC)	Climate action plans submitted by countries outlining their efforts to reduce greenhouse gas emissions and adapt to climate change, as part of the Paris Agreement.

Term	Description
Organisation for Economic Cooperation and Development (OECD)	An international organisation comprised of 38 democracies that promotes policies to improve the economic and social well-being of people worldwide, focusing on sustainable development and economic growth. The OECD's 38 Member countries span the world, from North America and South America to Europe and Asia-Pacific.
Sustainable Development Goals (SDG)	A set of 17 global goals established by the United Nations to address pressing social, economic, and environmental challenges, aiming for a more sustainable and equitable world by 2030.
Sustainability	The practice of meeting present needs without compromising the ability of future generations to meet their own needs, balancing environmental, social, and economic considerations.
Transition broker	An entity or facilitator that assists in the shift towards a sustainable or circular economy by connecting stakeholders, fostering partnerships, and enabling the implementation of sustainable practices.
Value chain	The full range of activities involved in bringing a product or service from conception, through production, to delivery to the end consumer, including after-sales services.
Valorising	The process of enhancing the value of a product, material, or waste by repurposing, recycling, or transforming it into something more valuable or useful.
Virgin materials	Raw materials extracted from the Earth for the first time, as opposed to recycled or reused materials.

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