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Productivity Commission

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Australia's circular economy: unlocking the opportunities

Inquiry report

No. 107 | 22 August 2025

The Productivity Commission acknowledges the Traditional Owners of Country throughout Australia and their continuing connection to land, waters and community. We pay our respects to their Cultures, Country and Elders past and present.

About us

The Productivity Commission (PC) is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long-term interest of the Australian community.

The PC's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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22 August 2025

The Hon Dr Jim Chalmers MP
Treasurer
Parliament House
CANBERRA ACT 2600

Dear Treasurer

In accordance with section 11 of the *Productivity Commission Act 1998*, we have pleasure in submitting to you the Commission's final report into *Australia's circular economy: unlocking the opportunities*.

Yours sincerely

Joanne Chong
Presiding Commissioner

Alison Roberts
Commissioner

Terms of reference

I, the Hon Jim Chalmers MP, pursuant to Parts 2 and 3 of the *Productivity Commission Act 1998*, hereby request that the Productivity Commission undertake an inquiry into Australia's opportunities in the circular economy to improve materials productivity and efficiency in ways that benefit the economy and the environment.

Background

A circular economy is an economic strategy that maintains the value of materials for as long as possible and ensures materials are used efficiently across all phases of their life cycle. In October 2022, Australia's Environment Ministers committed to accelerate the transition to a circular economy by 2030.

International studies suggest that a more circular economy supports higher economic growth and productivity, including by increasing materials productivity (how much output is produced per unit of raw input). Australia currently has the fourth lowest rate of materials productivity in the OECD. We generate US$1.20 of economic output for every kg of materials consumed, which is under half the OECD benchmark of US$2.50.

The Minister for the Environment and Water's Circular Economy Advisory Group has also identified commercial, regulatory, information and other barriers to achieving a more circular economy, and opportunities for Australia to improve economic and environmental outcomes through greater materials productivity and efficiency.

However, there is currently limited analysis of these matters, including the relative importance of these opportunities and how they should be measured and realised.

Scope

In this inquiry, the Productivity Commission is to investigate and report on:

- The potential scope to lift Australia's materials productivity and efficiency, and the best metrics to measure this opportunity and improvements made.
- Priority circular economy opportunities for Australia, including identification of the sectors, products or supply chain segments:
  - Where Australia has the greatest potential to improve materials productivity/efficiency in ways that can strengthen economic outcomes, such as productivity, economic growth, economic diversity and capability
  - Where other countries have made the greatest progress towards circularity, and the risks and opportunities associated with these developments in international markets for Australia
  - Where cost-efficient emissions reduction could be achieved by improving materials productivity and reducing waste.
- Barriers to enhanced materials productivity and prospective approaches to addressing them, including but not limited to:
  - Place based circular economy activities (e.g. industrial precincts and others enabled by urban planning and development)

- Regulatory frameworks, and other mechanisms that influence businesses' and consumers' decisions on materials purchasing, use and replacement or the competitiveness of circular economy initiatives
- Policy actions that are achievable over the near and medium term
- Policy actions that could be progressed by Commonwealth, state and territory, and local governments, including improvements to existing national policy frameworks.

The Commission's findings will inform policymaking regarding strengthening Australian circular economy. Accordingly, recommendations made by the Commission should, where relevant and appropriate, include an assessment of implementation feasibility and risk.

Process

The Commission should engage with relevant stakeholders and experts, including the state and territory governments, to identify opportunities and constraints in this area.

The Commission should provide a final report to government within 12 months of the receipt of this terms of reference.

The Hon Jim Chalmers MP
Treasurer

[Received 23 August 2024]

Acknowledgments

The Commissioners express their appreciation to the staff who worked on the inquiry – Assistant Commissioner Sara Collard and Acting Assistant Commissioner Paul Loke, who managed the inquiry, and other team members including Hudan Nuch, Rebecca Stoeckel, Belinda Cheong, Sally Harvey, Matthew Hyde, Federica Lannan, Uttam Khanal, Ethan Li, Dominic Merrifield, Jasper Sheehan and Aalya Sukkarieh. Our thanks are also extended to Pragya Giri, Yvette Goss and Leanne Schuck for administrative and project support.

Disclosure of interests

The *Productivity Commission Act 1998* (Cth) specifies that where Commissioners have or acquire interests, pecuniary or otherwise, that could conflict with the proper performance of their functions they must disclose those interests.

Commissioner Joanne Chong holds an honorary position at the University of Technology Sydney.

Contents

Overview

Key points

- **A circular economy aims to meet human needs with fewer and more sustainable materials, reducing the environmental impacts and costs of economic activity.**
  - Circular activities include designing products to use less materials, extending product lifespans via reuse and repair, and recycling and recovering materials to reduce waste.
  - The benefits of circularity include more efficient use of the planet's finite stock of natural capital to support economic and productivity growth; reduced harms to the environment, climate and biodiversity; and improved social outcomes such as health, amenity and intergenerational equity.
  - Some circular activities reduce materials use in ways that simultaneously benefit the economy, the environment and society. Others have trade-offs, such as lowering materials use but increasing carbon emissions (for example, if recycling requires transporting waste long distances).

- **Despite some uptake of circular economy opportunities in Australia, overall progress has been slow.**
  - Barriers to adopting circular economy opportunities include high costs; prescriptive, outdated or inconsistent regulations; coordination challenges and difficulties diffusing circular innovations; and limited practical information on circular opportunities.

- **Circular economy-related policies in Australia are in early stages of development, but in several areas are evolving rapidly.**
  - Government policies related to materials productivity have traditionally focused on recycling. However, governments are increasingly focusing on earlier stages of the product life cycle.
  - All levels of government have recently increased focus on policies that foster circular practices and reduce materials use. For example, actions already underway include reducing regulatory barriers to prefabricated housing and recognising the carbon benefits of biomethane in Australia's carbon reporting system.

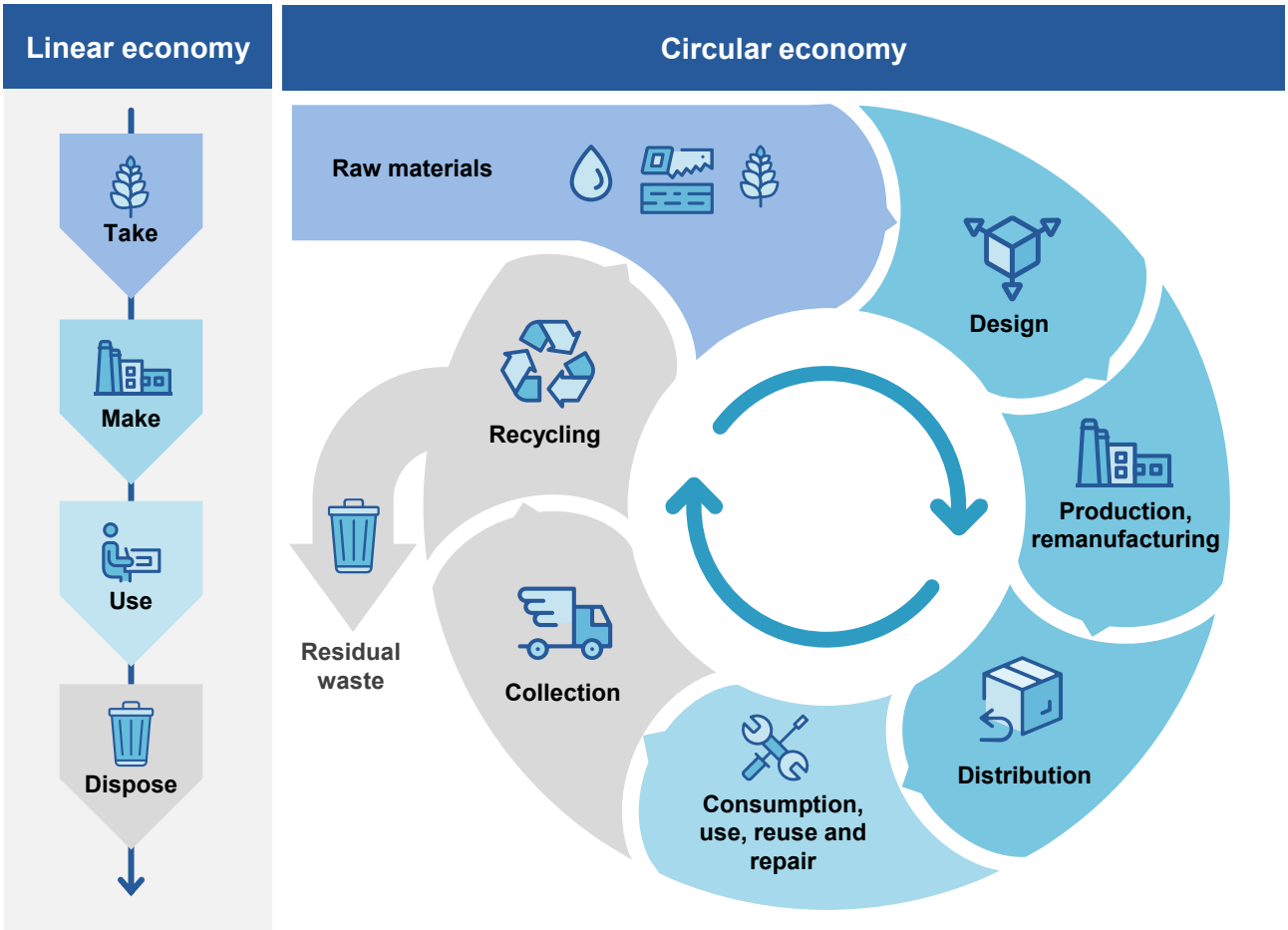
- **The Productivity Commission recommends governments take further action to improve materials productivity in ways that benefit the economy and environment across three broad areas:**
  - streamlining and harmonising regulations to encourage businesses to adopt innovative technologies and practices, while protecting the environment and human health
  - strengthening obligations for businesses that supply products with high-risk or high-value waste streams, such as small electronics or small-scale solar photovoltaic systems, through product stewardship
  - promoting circular activities and innovation through programs and services that facilitate coordination, collaboration and capacity building.

- **The Australian Government should develop an outcomes framework that connects each circular economy policy action to its related economic, social and environmental goals. This will support effective implementation, monitoring and evaluation of circular economy reforms**.
  - The Australian Government should use the outcomes framework to identify areas lacking metrics or data – such as sectors targeted for circular design policies – and develop a metrics and data collection strategy to close these key data gaps.

A circular economy uses materials in more sustainable and efficient ways. Economies have typically adopted a linear 'take, make, use, dispose' model: raw materials are extracted, transformed into products, consumed, then disposed of as waste. By contrast, a circular economy aims to meet human needs with fewer materials, reducing the environmental impacts and costs of economic activity.

Circular economy activities can occur throughout the product life cycle and include: designing products to use less materials (narrowing material loops); extending the time that products are consumed via reuse and repair (slowing material loops); and recycling and recovering materials (closing material loops) (figure 1). A more circular economy can be a more productive economy. With circular economy practices, we can more efficiently use the planet's finite stock of natural capital to support our growing population and economy. They can also reduce the harms to the environment, the climate and biodiversity associated with producing and consuming things. This in turn has benefits for society, such as better health and amenity, and fairer outcomes between generations, including by conserving resources and protecting environmental assets to support future economic activity.

Figure 1 – Comparing the circular and linear economies



Circular economy practices are not new in Australia. For tens of thousands of years, Aboriginal and Torres Strait Islander people have held deep cultural, social, environmental, spiritual and economic connections to Country. These knowledges and practices have sustained the health of Country. Some governments have policies that promote the application of Aboriginal and Torres Strait Islander knowledges and support participation in circular economy opportunities in ways that benefit communities and respect cultural and

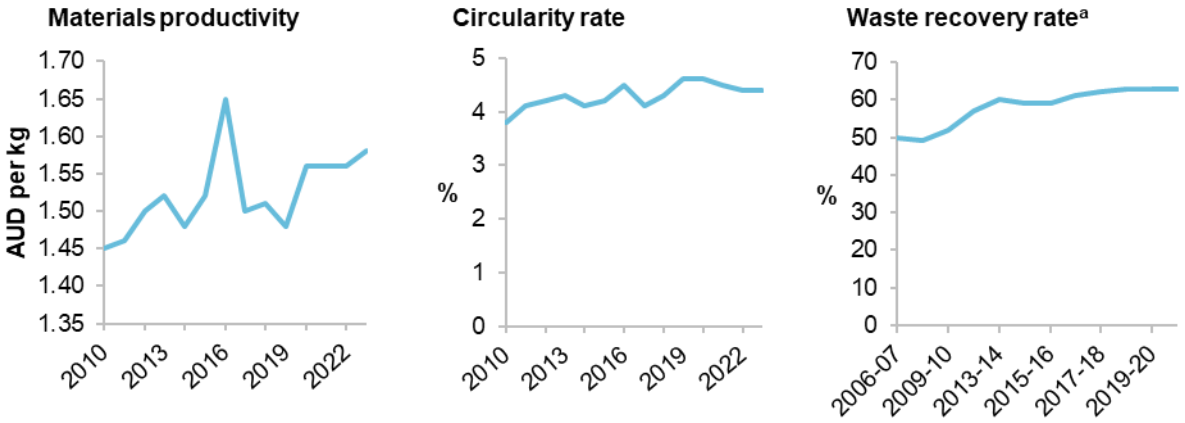
intellectual property rights. However, in practice, governments have some way to go on enabling true partnerships to achieve these aims and to enable economic development opportunities.

Australia's progress towards a more circular economy

Australia's materials productivity, circularity rate and waste recovery rate have increased slightly over the past decade, but progress has been slow (figure 2).[1] Australia's materials productivity of US$1.10 per kg lags the OECD average of US$2.50, but this is largely due to the dominance of materials-intensive sectors in the Australian economy. Materials productivity within sectors in Australia is on par with other OECD countries such as Japan, the Netherlands and Canada. This illustrates the limitations of relying on aggregate metrics based solely on the total weight of materials used and consumed to identify opportunities to improve materials productivity and effectively measure progress.

Conventional productivity measures often do not fully reflect the important role of materials in the Australian economy. For example, the Australian national accounts focus on labour, capital and multifactor productivity and do not explicitly report on materials productivity. Also, Australia's productivity measures typically do not capture the major impact that the depletion of natural capital (such as minerals, water and biodiversity), or its capacity to provide ecosystem services, can have on future growth.

Figure 2 – Circular economy indicators in Australia



a. Waste recovered for recycling, reuse or energy; data unavailable for 2007-08, 2011-12 and 2012-13.

Some households and businesses have adopted circular practices for financial or commercial reasons. For example, households can save money by repairing or reusing objects until the end of their life rather than replacing them (slowing loops). And businesses can reduce their input and waste disposal costs by designing and manufacturing products that use less materials (narrowing loops). Households and businesses weigh these potential savings against the costs of circular practices, such as repair costs or the time and investment needed to change production processes or business models.

Households and businesses have also incorporated sustainable practices into their activities out of concern for the environment and future generations, and in response to changing societal expectations. A 2024

[1] Materials productivity is the amount of economic value (measured by GDP) generated per unit of materials used (measured by the weight of domestic materials consumption). The circularity rate is the proportion of non-virgin or recycled materials used against overall materials used. The waste recovery rate is the proportion of waste that is diverted from landfill and reused, recycled or used in waste to energy activities.

consumer survey found that 96% of respondents engaged in at least one sustainable practice in the last three months, though price and quality continue to be the top drivers of purchases. Ninety-seven per cent of the ASX100 companies reported on their sustainability performance in 2024 and climate-related financial disclosures have been mandatory for large companies since January 2025.

Circular economy-related policies in Australia are in early stages of development, but in several areas are evolving rapidly. Most governments have recently introduced, and are continuing to develop, policies and reforms that promote greater circularity in different parts of the economy.

All levels of government have policies that support the circular economy.[2] Broadly, the Australian Government is responsible for: national legislation, strategies and policy frameworks including international commitments (such as climate change); tax settings; research and development; international trade; and matters of national environmental significance. It also provides national leadership on initiatives that span jurisdictions or industries. State and territory governments have responsibilities for: waste management and resource recovery; infrastructure development and essential service delivery; environmental policy; and the enforcement of environmental regulations. Local governments provide waste management services, manage local infrastructure and promote awareness among residents (such as how to correctly sort waste). All levels of government provide financial incentives for circular activities through means such as direct funding or sustainable procurement policies.

Government policies related to materials productivity have traditionally focused on recycling. However, governments are increasingly focusing on earlier stages of the product life cycle, implementing policies that reduce materials use or its impacts on the environment. Many of these initiatives are still in their early stages. At a strategic level, the Australian Government's 2024 *Australia's Circular Economy Framework* seeks to prompt action across the whole product life cycle and highlights the important role of national policy leadership in Australia's transition to greater circularity.

Addressing barriers to circularity

Households and businesses can face barriers to taking up circular practices. Some circular practices are costly to adopt, requiring investment in new technology, paying for different inputs or transport, or increasing the scale of operation. A lack of information, or prescriptive, outdated or inconsistent regulations can also prevent businesses from implementing more circular practices. Further, many circular economy activities require coordination between and across businesses, governments, community groups and households. Without this, it can be difficult to build connections between relevant stakeholders and share knowledge about best practice.

Governments can support progress by ensuring regulations adequately protect the environment and human health without discouraging businesses from adopting newer or less widespread technologies and practices. Governments can also provide information and help stakeholders to coordinate. However, governments should also be mindful that some circular practices come with trade-offs. For example, even with the right

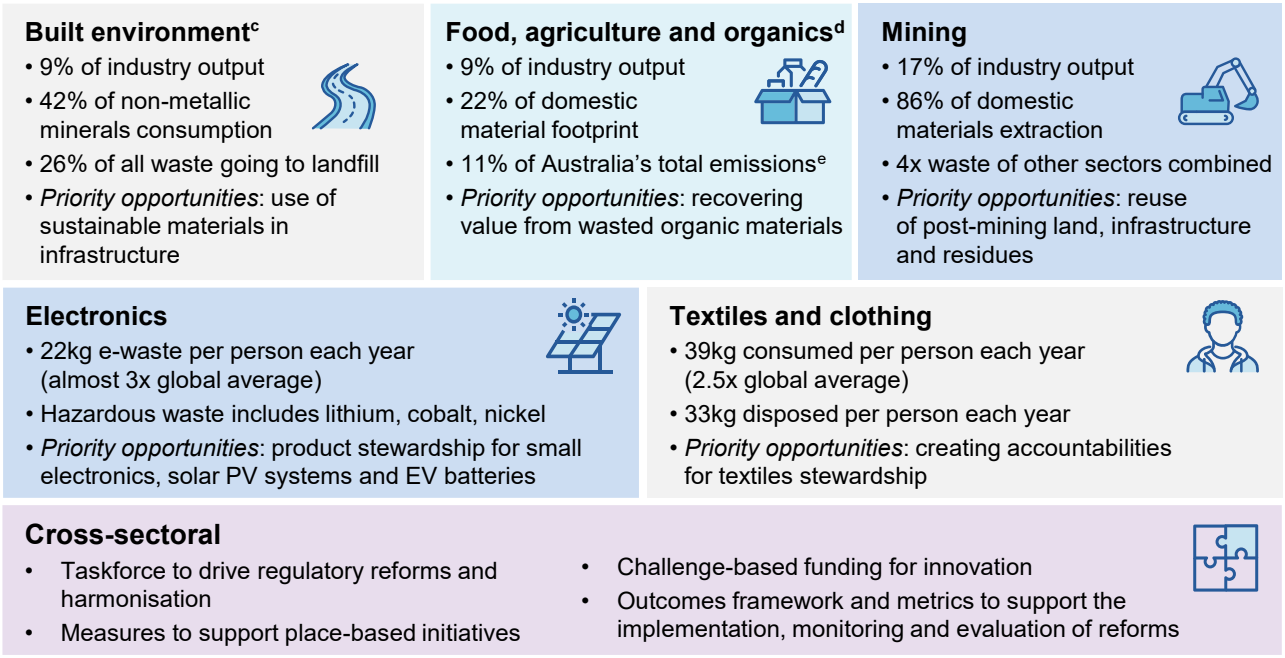
[2] Some policies directly target materials use and waste, such as waste levies on landfill. Others are aimed at reducing environmental impacts more generally and encourage greater circularity where goals are complementary, including climate change policies (such as the Renewable Energy Target, Safeguard Mechanism, Australian Carbon Credit Unit Scheme, Capacity Investment Scheme and New Vehicle Efficiency Standard), water policy (such as the National Water Initiative) and sector-specific policies (such as in construction and mining). Several of these policies aim to put a price on the environmental costs associated with waste or, more generally, on emissions and other impacts.

government policies in place, some circular opportunities may still be too costly for businesses and households to take up.

The Productivity Commission identified opportunities to improve materials productivity in ways that benefit the economy and environment in five sectors: built environment; food, agriculture and organics; mining; electronics; and textiles and clothing. These opportunities were identified based on the environmental and economic significance of the materials involved and how readily they can be applied in Australia and driven or implemented by government (figure 3). Some of these opportunities also relate to the delivery and management of essential service sectors such as water and energy.

The PC also identified opportunities that span multiple sectors across the economy: a taskforce to drive regulatory reforms and harmonisation; challenge-based funding for innovation; measures to support place-based initiatives; and an outcomes framework and metrics to support the implementation, monitoring and evaluation of circular economy reforms. These are relatively low-cost, high-impact initiatives and changes that could help enable circular economy activities across a range of contexts.

Figure 3 – Priority opportunities explored in this report[a,b]



a. Statistics show contribution and impacts in Australia. **b.** Industry output statistics are industry value added for 2023-24. **c.** Built environment statistics are for the construction sector. **d.** The food, agriculture and organics sector is comprised of the following subsectors: agriculture; aquaculture; forestry and logging; fishing, hunting and trapping; agriculture, forestry and fishing support services; food product manufacturing; beverage and tobacco product manufacturing; grocery, liquor and tobacco product wholesaling; food retailing; and food and beverage services. **e.** Emissions statistics are for direct (scope 1) emissions.

The PC's recommendations seek to complement existing government activities. During this inquiry, governments have taken action to reduce regulatory barriers to prefabricated housing, recognise the carbon benefits of biomethane in Australia's carbon reporting system and increase transparency in business sustainability through mandatory climate-related financial disclosures. They have also undertaken reviews. For example, the Recycling and Waste Reduction Act Review has been tasked with making recommendations to improve the efficiency and impact of the Act in addressing current and future circular economy needs, resource recovery and waste challenges.

This report also reiterates recommendations from previous PC reports that would promote greater circularity. For example, the PC's Right to Repair inquiry recommended competition, consumer protection and intellectual property reforms to increase consumers' ability to access competitive repair services for products such as cars, agricultural machinery and small electronics.

This report also identifies ongoing and future policy opportunities and challenges for further government attention.

Streamlining regulations to encourage circular activities

Circular economy opportunities span multiple sectors, locations and processes. Businesses pursuing these opportunities are often affected by many regulations such as health, environmental and planning rules.

Regulations can protect us from adverse outcomes and engender community trust. But some regulations and policies favour linear processes or limit the adoption of circular practices. Updating these would level the playing field for newer or less widespread technologies and practices that improve materials productivity.

Governments should pursue opportunities to streamline regulations and encourage business to adopt innovative technologies and practices in three areas.

- **Reducing overly restrictive standards and specifications relating to infrastructure construction.** This could provide access to lower cost, better performing and more sustainable materials**.** The benefits could be significant. In the next four years alone, investment in future public infrastructure is expected to total $270 billion and efficient net zero transition policy developments are likely to present opportunities for less emissions intensive construction materials. Australian governments need to form a definitive, consistent position on which standards or specifications are too conservative or outdated, and where changes will have the biggest impact. To this end, the Australian, state and territory governments should set up a working group to undertake a staged stocktake and assessment of standards and specifications, including Australian Standards and state infrastructure technical specifications. The assessment should shortlist changes to standards and specifications that could significantly increase the uptake of sustainable materials in infrastructure without compromising safety. These may include replacing prescriptive standards and specifications with performance-based criteria or harmonising standards and specifications across states and territories.[3]
- **Reforming uncertain and restrictive regulations governing the production and use of materials derived from wasted organic material (such as biochar and compost).** This could reduce reliance on virgin materials in applications such as fertilisers and result in environmental and/or economic benefits from nature regeneration. The Australia New Zealand Biochar Industry Group estimates that Australia has an annual biochar production potential of up to 30 million tonnes by 2050, up from a domestic production of approximately 20,000 tonnes in 2020. However, regulatory gaps create substantial uncertainty for biochar users and investors and are limiting uptake. State and territory governments should develop dedicated regulatory pathways that outline the requirements for organic waste to transition into saleable materials, beginning with biochar.
- **Revising regulations affecting mine closure and transition to make it easier to repurpose mined land and infrastructure for a broader range of uses (such as clean energy projects), and to reuse**

[3] Reforming standards and specifications for infrastructure would build on reforms already underway to reduce regulatory barriers to prefabricated construction. The PC has previously estimated that these reforms could contribute $2.9–5.7 billion to GDP by reducing build times and costs. Removing barriers to prefabricated construction could improve materials productivity through on-site waste reduction and enabling design for disassembly, which can make it easier to repair and refurbish dwellings.

mining residues. With around 240 Australian mines expected to end their economically productive life between 2021 and 2040, the economic, social and environmental benefits of greater flexibility in the repurposing of mined land, infrastructure and residues could be substantial.[4] To enable innovative post-mining land uses that have broader benefits for the community, state and territory governments should review their regulatory frameworks and processes that guide mine closure and transition. The reviews should identify processes that could better accommodate repurposing mined land and infrastructure without compromising broader regulatory objectives. A recent NSW parliamentary inquiry into beneficial and productive post-mining land use made similar recommendations for NSW mines.

Reducing (and where possible avoiding) unnecessary inconsistencies in regulations across jurisdictions promotes circularity by reducing costs for businesses operating across state and territory borders. Different settings for different jurisdictions can be justified where local environments, activities and preferences differ. But in other cases, jurisdictional regulations could be harmonised – particularly where the differences between states and territories are definitional or administrative, rather than substantive or relating to outcomes. Harmonising administrative requirements reduces the regulatory burden on businesses with national operations and reduces frictions for businesses deciding where or whether to expand.

Examples of potentially unnecessary inconsistencies in standards and regulations across states and territories include:

- differences in specifications on allowable content for recycled materials in infrastructure construction projects, even where standards are based on the same data and industry standards. For example, New South Wales's specification for allowable recycled crushed glass as granular base and subbase in road pavement is 10%, whereas in Victoria it is 5–10% for granular base and 15–50% for granular subbase
- inconsistent waste classifications, including for organics, e-waste and products made using recycled waste. For example, over 20 different regulations govern the classification, transport and management of plastic waste in Australia.

A taskforce to drive regulatory reforms and harmonisation

To support the transition to a circular economy, the Australian Government should set up a Circular Economy Regulatory Reform Taskforce with state and territory governments. While governments are already harmonising some regulations, a taskforce with dedicated resources and ministerial authorisation would strengthen governments' capacity to reform and harmonise regulations where it would have the largest benefits. To operate effectively, the taskforce should meet regularly, respond to emerging issues, consider circular economy issues from a range of portfolios, and make regulatory reform recommendations that balance broader government objectives and specific regulatory outcomes.

States and territories are considering developing their own product stewardship schemes in the absence of a national scheme. For example, New South Wales has committed to introducing Australia's first state-based, mandatory product stewardship framework for battery products, including small electronics, and some states and territories are considering similar legislation. Without coordination across jurisdictions, these state-based efforts risk further fragmenting the regulatory environment. The taskforce would enable governments to agree on a core set of design features that provide consistency, such as consistent definitions of product scope, clear performance targets for collection and recovery, nationally aligned compliance standards, nationally transferable scheme registration requirements, and shared data and reporting requirements. This

[4] For example, the former Rhonda Colliery mine in Lake Macquarie, New South Wales is being transformed into a motor park and tourist destination. The NSW Government indicated that this will create more than 450 jobs during construction and 229 permanent roles.

would reduce the risk of problems associated with misaligned state action that have arisen from other schemes (such as container deposit schemes).

Product stewardship for high-risk, high-value products

Regulated product stewardship schemes require businesses who make, sell or import products to contribute to the cost of activities that reduce waste throughout the product life cycle (such as redesigning products and funding infrastructure to enable recycling or reuse). However, given the costs of establishing, operating and complying with regulated product stewardship schemes, they should be reserved for products with particularly high-risk and/or high-value waste streams, and only proceed where there is analysis demonstrating they would have net benefits.

There is mounting evidence the Australian Government should progress a national product stewardship scheme for small-scale solar photovoltaic (PV) systems. Australia's clean energy transition is rapidly increasing the amount of waste from electronic products, such as solar PV systems and electric vehicle (EV) batteries, and creating an emerging issue for resource recovery and environmental management. The Australian Government has commissioned analysis that estimates a national product stewardship scheme for small-scale solar PV systems could have a net economic benefit, in present value terms, of $7.3 billion. The Australian Government should also analyse the net benefits of national product stewardship for EV batteries.

The fast growth in small electronics in Australia and problems associated with incorrect disposal (such as fire risks) also requires urgent attention. New South Wales and other states are progressing state-level product stewardship schemes for battery products including small electronics. Given this, the Australian Government should assist and work with jurisdictions to develop and implement a national framework that ensures a consistent approach to small electronics product stewardship across states and territories.

For products with less hazardous waste streams and where recent international policy and standard developments could drive increased circularity of products supplied to Australia, the (current) balance of costs and benefits may not justify immediately introducing a regulated approach to product stewardship. Governments should still, however, support the transition to a circular economy for these products through graduated measures, monitoring international policy and market developments, and by improving the evidence base. For example, the Australian Government should introduce enhanced monitoring and public transparency measures to create greater accountability for textiles businesses to reduce waste and improve materials productivity.

Coordination, collaboration and capacity building

Coordination and collaboration across business, community groups and government (such as exchanging materials, knowledge and learnings) are often vital to realising circular economy opportunities. However, individual organisations (particularly small to medium sized businesses) can face difficulties building these connections, due to lack of knowledge, time or funds. They can also face challenges navigating complex regulatory processes across several levels and departments of government.

Government can help facilitate this coordination, lowering coordination costs for an individual business. Not only does this support the uptake of circular economy practices, it also creates opportunities for businesses to diversify their production processes and build capability in sustainable practices.

This report recommends three ways for governments to improve coordination, collaboration and capacity across business, community groups and government, and facilitate the transition to a circular economy.

Establish a challenge-based grant program focused on the circular economy

Circular economy innovation often requires collaboration and partnerships between businesses from different sectors, as well as governments, researchers and the community. A challenge-based grant program could help businesses, government and researchers across sectors and disciplines coordinate their efforts. Mission-oriented or challenge-based innovation aligns research, innovation and policy around clear, ambitious goals and encourages cross-disciplinary collaboration. To ensure the program offers value for money and facilitates whole-of-economy change, the program should seek solutions that lower barriers to circular practices from across the supply chain and have broader public benefits (such as developing reuse opportunities for solar PV systems). Challenge-based programs in the United States and United Kingdom have successfully stimulated innovation and delivered value for money.

Facilitate place-based initiatives

Place-based initiatives enable coordination, address distance challenges and support businesses to develop and share new ideas. For example, local businesses can use their neighbours' byproducts as material inputs for their own production and learn from each other about innovative circular practices. They can also help governments tailor policies to the specific circumstances of a place and engage the local community as active participants in development and implementation. [5]

State and territory governments should facilitate place-based initiatives by providing guidance and resources, such as templates, to assist local governments developing circular economy plans. They should also fund a pilot for circular economy transition brokers. These brokers would help build the circular economy knowledge and capability of local governments and small to medium sized organisations in ways that are tailored to their context, and help them navigate government processes, such as regulatory approvals. Transition brokers would work in partnership with Aboriginal and Torres Strait Islander people to embed valuable knowledge in place-based circular economy practices and support Aboriginal and Torres Strait Islander people and businesses to lead circular economy activities.

In regions that are expected to experience mine closures, state and territory governments should develop land transition plans that identify the mined land, infrastructure and residues that will become available as mines close and how they can best be used. They should develop these land transition plans, well prior to the point of closure, in partnership with Aboriginal and Torres Strait Islander people and local communities.

Introduce and expand services that build connections between and within government and industry to enhance the impact of government sustainable procurement policies

Knowledge gaps and a lack of experience can discourage industry from using recycled and other sustainable materials in infrastructure. Contractors and asset owners are sometimes unaware of what sustainable alternative materials are available. They may lack confidence about the quality or performance of these materials and can tend to rely on familiar materials to avoid uncertainty affecting their focus on other delivery objectives (such as quality or speed).

To promote industry confidence in sustainable infrastructure materials, state and territory governments with commitments to major infrastructure projects should introduce or expand support services. These services should include dedicated personnel as facilitators that work with suppliers, contractors and asset owners to increase uptake of sustainable materials. Facilitators should provide education about the uses of sustainable

[5] 'Place' does not have a universal definition. To be practical for circular economy policy interventions, the PC defines a 'place' as either one local government area or a cluster of local government areas that are interconnected through their communities, and economic, social and environmental interactions.

materials in projects, assist in navigating regulatory or technical obstacles to using sustainable materials, and connect suppliers of sustainable materials with potential customers. These types of services have proven successful in Victoria, which is the main jurisdiction to offer them. Since its inception in 2019, the ecologiQ program has supported the Victorian Government's Recycled First policy to incorporate 3.4 million tonnes of recycled materials in major public infrastructure, with numerous participants highlighting its effectiveness.

Implementing reforms and monitoring progress

Circular economy policy in Australia is still in its early stages. For some reform areas, the issues are relatively well known and the supporting evidence base for designing reforms is relatively well developed. In these areas, full implementation should progress. For other reform areas, including those in which future opportunities for policy change arise, governments will need to undertake further work to better understand how to design policy changes to have the greatest net benefits.[6] Governments should gather additional information to understand and, where possible, quantify the benefits of intervention options. This can be done through, for example, life cycle analyses or bespoke impact studies. In some cases, a staged approach to policy implementation is preferred, to monitor policy implementation or assess how the impacts of recent international policy actions on supply chains affect Australian markets.

The Australian Government should develop an outcomes framework that connects each circular economy policy action to its related economic, social and environmental goals. This will help governments implement, monitor and evaluate circular economy reforms. For example, removing restrictive regulations could promote circular activities and innovation across the product life cycle, and improve environmental, economic and social outcomes. This may in turn help to achieve circular policy goals, such as circular economy targets (figure 4). The development of the outcomes framework will enable the inclusion of government actions that promote the transition to a circular economy. A starting point could be to include, for example, actions from the National Waste Policy, actions to end plastic waste and actions recommended in this report, but the ultimate scope will depend on the targets and outcomes that are chosen.

The outcomes framework will create a common strategic vision. It will ensure that progress is aligned across all governments and that agencies are clear on the outcomes policies should be achieving. It will also enable governments to identify and collect the data necessary to monitor circular economy policies, promoting transparency, accountability and ongoing improvements.

The Australian Government should use the outcomes framework to identify and fill gaps in data or measurement, such as in markets or sectors where there are policies aimed at encouraging businesses to incorporate circular design principles in product design.

To ensure actions are sequenced effectively across all levels of government, the report includes an indicative phased timeline to guide the implementation of its recommendations, with separate timelines for the Australian Government, state and territory governments, and local governments.

[6] For example, further work is required to determine trial locations for place-based transition brokers and further work is required to determine the specific standards that impede the use of recycled materials in infrastructure.

Figure 4 – Illustrative example of an outcomes framework

Government action	Activities and outcomes	Environmental, economic and social benefits	Impact on circular economy targets
Regulatory reform *Example*: Conduct a stocktake and reform standards and specifications limiting sustainable materials use in infrastructure	**Innovation** is unlocked through prompting a rethink of sustainable materials applications Increased use and exchange of **sustainable materials** Increased **recycling** activity from increased demand for recycled materials	Reduced **greenhouse gas emissions** by using materials with lower embodied carbon **Increased net value** extracted from previously wasted materials Over time as markets develop, the **price of sustainable materials reflects the full costs and benefits** relative to virgin materials	Increased **circularity rate** through increased secondary materials use Reduced **materials footprint** from reduced domestic demand for raw materials Increased **materials productivity and recovery rate** through increased recycling and production of recycled materials

Recommendations

Built environment

Recommendation 2.1
Perform a stocktake and assessment of standards and specifications limiting uptake of sustainable materials in infrastructure to enable regulation streamlining

To promote the fit for purpose use of sustainable materials in infrastructure, Australian, state and territory governments should establish a working group to undertake a staged stocktake and assessment of standards and specifications (including in Australian Standards and state infrastructure technical specifications). The stocktake should start by focusing on standards and specifications related to infrastructure types that use the most virgin materials (such as roads and bridges) or materials with the largest life cycle environmental impact (such as concrete). Drawing on the stocktake, the assessment should:

- identify and catalogue unnecessarily conservative and prescriptive standards and specifications relevant to infrastructure construction and maintenance that constrain the use of sustainable materials
- assess latent industry demand and local supply availability for the identified sustainable materials, to determine the extent to which these standards or specifications are constraining their use
- evaluate the feasibility of reducing these barriers by transitioning from prescriptive to performance-based approaches and/or harmonising standards and specifications across jurisdictions (without compromising safety), aligning with existing work being undertaken by organisations such as Austroads
- recommend a shortlist of changes to standards and specifications based on their expected impact on the uptake of sustainable materials and their associated productivity and environmental benefits.

Drawing on the assessment findings, governments should consider reforms to streamline standards and specifications (for example, through the Infrastructure and Transport Ministers' Meeting) and progress those reforms in collaboration with standards and specifications bodies (such as Standards Australia and Austroads). The Australian Government should consider whether certain reforms could be progressed through national competition policy.

Recommendation 2.2
Introduce or expand support services for suppliers, contractors and asset owners of major infrastructure projects to promote industry confidence in sustainable materials

To promote industry confidence in using sustainable materials in infrastructure, state and territory governments with commitments to major infrastructure projects should introduce or expand support services whereby dedicated facilitators work with suppliers, contractors and asset owners to:

- educate them about the use of sustainable materials in infrastructure, including addressing a lack of information or confidence about using sustainable materials and highlighting opportunities to use sustainable materials
- overcome regulatory or technical obstacles to using sustainable materials in specific projects
- connect suppliers of sustainable materials or products with potential customers (such as contractors and asset owners).

State and territory governments could tailor the scale and scope of these services to their own context including environmental objectives, projected infrastructure expenditure, recycling infrastructure and access to sustainable materials.

Food, agriculture and organics

Recommendation 3.1
Develop clearer regulatory processes to realise the economic and environmental benefits of reusing wasted organic materials

To help realise the economic and environmental benefits of reusing wasted organic materials, state and territory governments should develop dedicated regulatory pathways that outline the requirements for organic waste to transition into saleable materials, beginning with biochar.

In developing dedicated regulatory pathways, governments should:

- clearly outline the requirements for a waste-derived material to be transported, sold, applied to land or used as a livestock feed supplement (including source materials and contamination thresholds)
- balance the risks of processing organic waste streams with the economic and environmental benefits of recovering value from wasted organic materials.

Governments should complement these pathways by changing energy from waste regulations to distinguish between processes such as gasification and pyrolysis to produce biochar and conventional energy from waste processes (such as incineration), where this is not already done.

Mining

Recommendation 4.1
Update regulatory and planning frameworks to enable repurposing of post-mining land, infrastructure and mining residues to increase benefits for the community

To enable repurposing of post-mining land, infrastructure and mining residues that has the greatest net benefits for the community:

- State and territory governments should develop land transition plans for regions and communities that are experiencing or are soon to experience significant mining transition. These plans should assess the sites that will become available and establish priority future beneficial uses for them in partnership with Aboriginal and Torres Strait Islander people and the broader community.
- State and territory governments should review and amend or augment the regulatory frameworks and processes that guide mine closure and transition, to facilitate the development of innovative post-mining land uses where they are of net benefit. The review should include relevant provisions in mining, environmental, health and safety and planning legislation, and associated regulations and policies.
- The Australian Government should update national guidance for leading practice mine closure and transition, incorporating environmental, social and economic considerations. The guidance should establish best practice methodologies and set expectations for mining companies to partner with Aboriginal and Torres Strait Islander people, local communities and local governments, sharing decision-making to determine transition outcomes that offer net benefits to the community.

Electronics

Recommendation 5.1
Develop and implement a national framework to ensure consistent approaches to small electronics product stewardship across states and territories

To reduce the risk of differences in product stewardship arrangements across states and territories imposing costs on industry (without commensurate benefits to safety or the environment), the Australian, state and territory governments should develop a national framework to ensure consistent approaches to small electronics product stewardship across jurisdictions.

The Australian Government should assist and work with jurisdictions to develop and implement the framework based on state and territory governments' requirements. The Australian Government's role should include assisting state and territory governments to resolve regulatory and legislative roadblocks (both Commonwealth and state and territory), providing policy or technical guidance, and facilitating interjurisdictional discussions and ensuring progress and agreement.

Under the framework, states and territories should agree on the key design features that their respective product stewardship scheme for small electronics will include and align on, such as:

- consistent definitions of product scope
- clear performance targets for collection and recovery
- nationally aligned compliance standards
- nationally transferable scheme registration requirements
- shared data and reporting requirements.

Governments should develop the framework within six months.

The Circular Economy Regulatory Reform Taskforce (recommendation 7.1) could provide the forum for interjurisdictional cooperation and collaboration.

Recommendation 5.2
Establish a national product stewardship scheme for small-scale solar photovoltaic (PV) systems and investigate a national product stewardship scheme for electric vehicle (EV) batteries

The Australian Government should urgently establish a national product stewardship scheme for small-scale solar PV systems under Commonwealth legislation.

For EV batteries, the Australian Government should analyse the costs and benefits of national product stewardship, including different implementation models.

National leadership is needed to address the growing waste management risks associated with these products and avoid the problems associated with misaligned state action that have arisen or could arise for other schemes.

Textiles and clothing

Recommendation 6.1
Enhance monitoring and public transparency measures to create greater accountability for textiles businesses to reduce waste and improve materials productivity

To create greater accountability for textiles businesses to reduce waste and improve materials productivity, the Australian Government should introduce enhanced monitoring, public reporting and transparency measures.

This should include setting a clear, time-bound process for governments to consider introducing regulated product stewardship schemes for textiles and clothing if the sector does not meet expectations regarding reduced waste and improved materials productivity.

- Within the next six months, the Australian Government should establish criteria and timelines for assessing industry progress and publish conditions for considering regulatory intervention.
- The government should work with industry to enhance publicly available information for tracking progress towards performance targets, which may include the percentage of businesses participating in voluntary stewardship arrangements or making equivalent efforts to reduce waste and improve materials productivity through circular activities.
- After two years, if voluntary progress against performance criteria is insufficient, the government should commission analysis of regulatory models, including cost-benefit analysis, and implement the most appropriate regulatory pathway. It should ensure the analysis is completed within the next three years.

Cross-sectoral arrangements

Recommendation 7.1
Establish an intergovernmental taskforce to drive regulatory reforms and harmonisation related to the circular economy

The Australian Government, in partnership with state and territory governments, should establish a Circular Economy Regulatory Reform Taskforce to align and adjust new and existing regulations affecting the uptake of circular economy opportunities. The taskforce should:

- task the Australian Government with the lead on assessing regulation for key issues
- take a cross-portfolio approach to circular economy issues
- recommend regulatory reforms in accordance with the principle of regulatory stewardship
- meet regularly and be responsive to issues both emerged and emerging
- be adequately resourced, authorised and accountable
- make regulatory reform recommendations to Ministers in a transparent and timely way, and report on their implementation.

Recommendation 7.2
Develop place-based circular economy plans and pilot place-based circular economy transition brokers

Local governments should identify circular economy opportunities relevant to their area. To realise these opportunities, they should develop place-based plans and/or integrate actions into their other plans and budgetary processes (such as service, infrastructure or community development plans). Plans should be co-designed with Aboriginal and Torres Strait Islander people, local businesses and communities to develop self-determined outcomes. Plans should be evaluated and refreshed every three years.

State and territory governments should provide local governments with information and guidance for developing their place-based circular economy plans.

State and territory governments should pilot in-place circular economy transition brokers, with evaluation and potential extension within three years. Outcomes should be measured against set criteria and published to enable cost-benefit analysis regarding future program expansion. Transition brokers would:

- work with small to medium sized businesses and community organisations to build their circular economy knowledge and capability, including how to increase the circularity of their organisation, to facilitate networking opportunities to foster collaboration, partnerships and knowledge sharing and to assist them in navigating government processes
- partner with Aboriginal and Torres Strait Islander people to embed valuable knowledge in place-based circular economy practices and establish opportunities for Aboriginal and Torres Strait Islander people and businesses to lead circular economy initiatives
- support local governments to develop place-based circular economy plans
- be supported to operate as a network, providing the opportunity for knowledge sharing and capability building.

Recommendation 7.3
Establish a challenge-based grant program to support the adoption and diffusion of circular innovations

The Australian Government should establish a challenge-based grant program to foster innovation and support adoption and diffusion of innovative solutions in the circular economy. The program should consider challenges identified by industry and the community. Key features of the program design include:

- challenges posed by industry and community to target solutions that provide public benefit and address circular economy issues across the supply chain
- dispersing funds in at least two stages, with a first expressions of interest stage to test feasibility
- pairing grant recipients with relevant industry partners to foster collaboration and tailor solutions
- a selection panel with industry and government expertise to adjudicate potential challenges and applications for each stage.

An independent evaluation of the program should occur within three years.

Strategic reform approach

Recommendation 8.1
Implement the suite of recommendations from the PC's Right to Repair inquiry

The Australian, state and territory governments should implement the full suite of recommendations from the PC's Right to Repair inquiry. The Australian Government should publish a formal response to that inquiry that indicates a timeline and workplan for implementing these reforms.

Recommendation 8.2
Develop an outcomes framework to help guide implementation, monitoring and evaluation of government actions to promote a circular economy

The Australian Government should develop an outcomes framework that connects each circular economy policy action to its related economic, social and environmental goals. This will assist governments to implement, monitor and evaluate these policy actions.

Measuring Australia's circular progress

Recommendation 9.1
Develop metrics to enable effective monitoring, evaluation and reporting of government actions to promote a circular economy

The Australian Government should:

- use an outcomes framework (recommendation 8.2) to identify areas lacking metrics or where data gaps exist, such as markets or sectors where there are policies aimed at encouraging businesses to incorporate circular design principles in product design
- develop a metrics and data collection strategy that prioritises filling key gaps, based on considerations such as the significance of the opportunity (in terms of economic and environmental benefits) and the extent to which existing data systems capture relevant data
- establish and oversee arrangements for monitoring, evaluation, reporting and improvement.

1. Introduction

Key points

- **A circular economy aims to meet human needs with fewer and more sustainable materials, reducing the environmental impacts and costs of economic activity.**
  - Australian businesses, households and communities are already pursuing some circular opportunities. They are innovating and forming new partnerships to deliver higher value from materials use.
  - Shifting from linear to circular product life cycles can reduce negative environmental impacts. However, some activities that reduce materials use may result in other impacts, such as increasing energy use.
- **While the circular economy is being increasingly recognised in policy, circular practices are not new.**
  - Aboriginal and Torres Strait Islander people have cared for Country for tens of thousands of years. Knowledge developed and maintained by Aboriginal and Torres Strait Islander communities offers a powerful contribution to circular economy practices and policies. The Australian Government has noted the potential to better value this knowledge, and to facilitate equitable access to circular economy opportunities and benefits.
- **People and organisations are motivated by financial, environmental and other reasons to adopt circular practices, but sometimes face barriers.**
  - Barriers to adopting circular economy approaches include high upfront costs for changing production processes or new business models, outdated or prescriptive regulation, limited practical information on circular economy opportunities, and coordination failures.
- **All levels of government have policies and programs in place to support Australia's transition to a circular economy.**
- **The Productivity Commission identified priority circular economy opportunities to improve materials productivity (and associated policy actions) using three broad considerations:**
  - the environmental and economic significance of the materials use addressed by circular economy opportunities
  - the applicability of circular economy opportunities to Australia
  - the viability of government actions to reduce barriers to circular economy opportunities.
- **The PC is making recommendations relating to both sector-specific circular economy opportunities (for the built environment; food, agriculture and organics; mining; electronics and textiles and clothing) and cross-sectoral opportunities. This includes developing an outcomes framework to support effective implementation, monitoring and evaluation of circular economy reforms. The PC also sets out an indicative phased timeline to guide implementation.**

1.1 Motivations for a circular economy

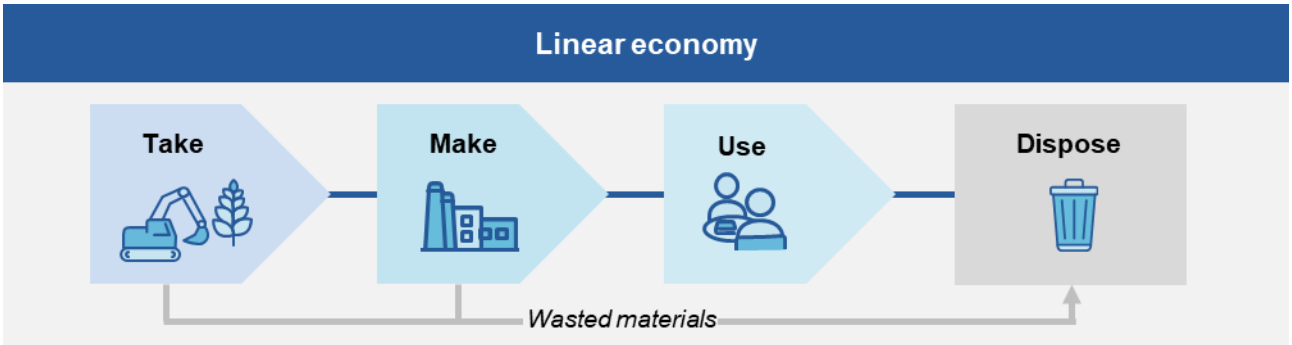
The product life cycle – linear to circular

The product life cycle describes the various stages in which a product is designed, manufactured, used and disposed of, or collected and recycled.

The linear economy represents a one-way flow: once goods are used, they are discarded, generally in landfill, preventing further use of the products or their materials.[1] The linear economy is characterised by the take-make-use-dispose model (figure 1.1).

- **Take** involves extracting raw materials from the environment. These materials generally replenish at a slow rate or do not replenish at all.
- **Make** involves manufacturing goods using the extracted raw materials.
- **Use** involves consuming goods until they are no longer deemed useful or are used up.
- **Dispose** involves discarding goods – generally in landfill.

Figure 1.1 – The linear economy model



Environmental and economic drawbacks of the linear economy

Throughout the 20th century, product life cycles were predominantly linear. However, growing concerns over the local and global environmental impacts of the linear economy have prompted a rethink. Australian production and consumption decisions can impact the natural environment locally as well as globally. Conversely, the environmental impacts of production and consumption decisions in other countries can also affect Australia.

These environmental impacts begin at the 'take' stage of linear product life cycles. Globally, around 55% of greenhouse gas emissions result from extracting and processing material resources (UNEP 2024a, p. xiv). These processes also contribute directly to waste streams. Additionally, biomass extraction and production are responsible for over 90% of land use-related biodiversity loss and water stress, posing a major risk to species extinction (UNEP 2024a, p. xiv).

Environmental impacts also occur at the 'make' stage. In 2021, greenhouse gas emissions from manufacturing and construction activities made up 13% of total global emissions (based on Ritchie et al. 2024). If unregulated, waste from these activities can also pollute surrounding waterways and land.

At the 'dispose' stage in a linear economy, products are generally discarded into landfill with no further use. The availability of sites for new landfills is an ongoing concern for Australian communities and local

[1] Despite the term 'economy', this model relates only to the flow of physical materials. In a sense, the economy is anything but linear considering the decisions, relationships and transactions that feed into its complexity.

governments. For example, estimates suggest that the landfills servicing Greater Sydney will reach capacity by around 2030, with no suitable options currently available for new landfill sites (NSW EPA 2024; Veolia Australia and New Zealand, sub. 8, p. 5).[2] This poses a significant concern to the future security of Sydney's waste management system. Internationally, countries are addressing concerns about environmental and health impacts of processing hazardous waste exported from countries like Australia by increasingly imposing restrictions on waste imports (Donovan and Pickin 2021, p. 10).

Even if suitable land is found to increase landfill availability, major environmental, public health and safety concerns remain with the transport and disposal of wasted materials into landfill (DCCEEW 2024c, p. 19). Landfill has negative impacts on the environment, including on biodiversity and air quality. For instance, leachate[3] from landfills can contaminate groundwater and pose a risk to the biodiversity and regenerative capacity of surrounding ecosystems. Additionally, landfill gas (predominantly carbon dioxide and methane) poses a risk to air quality. If not properly managed, it can create odours and worsen climate change (EPA Victoria 2020).

Questions around the sustainability of the linear model were initially driven predominantly by environmental concerns. However, increased circularity can also have economic and productivity benefits, including intergenerationally, by more efficiently using the planet's finite stocks of natural capital (materials) to support a growing population and economy. The benefits of more sustainable development can also contribute to social outcomes such as better health and amenity, and more sustainable development. Shifting to a circular model reduces some of the negative environmental and economic impacts of the linear model.

Full circle on the product life cycle

There are a range of circular economy opportunities that can lead to environmental and economic benefits (detailed examples for key sectors are discussed in the interim report). Some circular economy opportunities relate to ensuring products and related materials remain in the industrial cycle, such as through reuse, repair and recycling. Other opportunities relate to restoring natural materials cycles and regenerating natural ecosystems. Whilst this inquiry addresses some aspects of nature regeneration, such as returning resource-rich organic materials to the environment, there are a wider set of nature positive circular economy opportunities that are beyond the focus of this report, reflecting the inquiry's terms of reference.

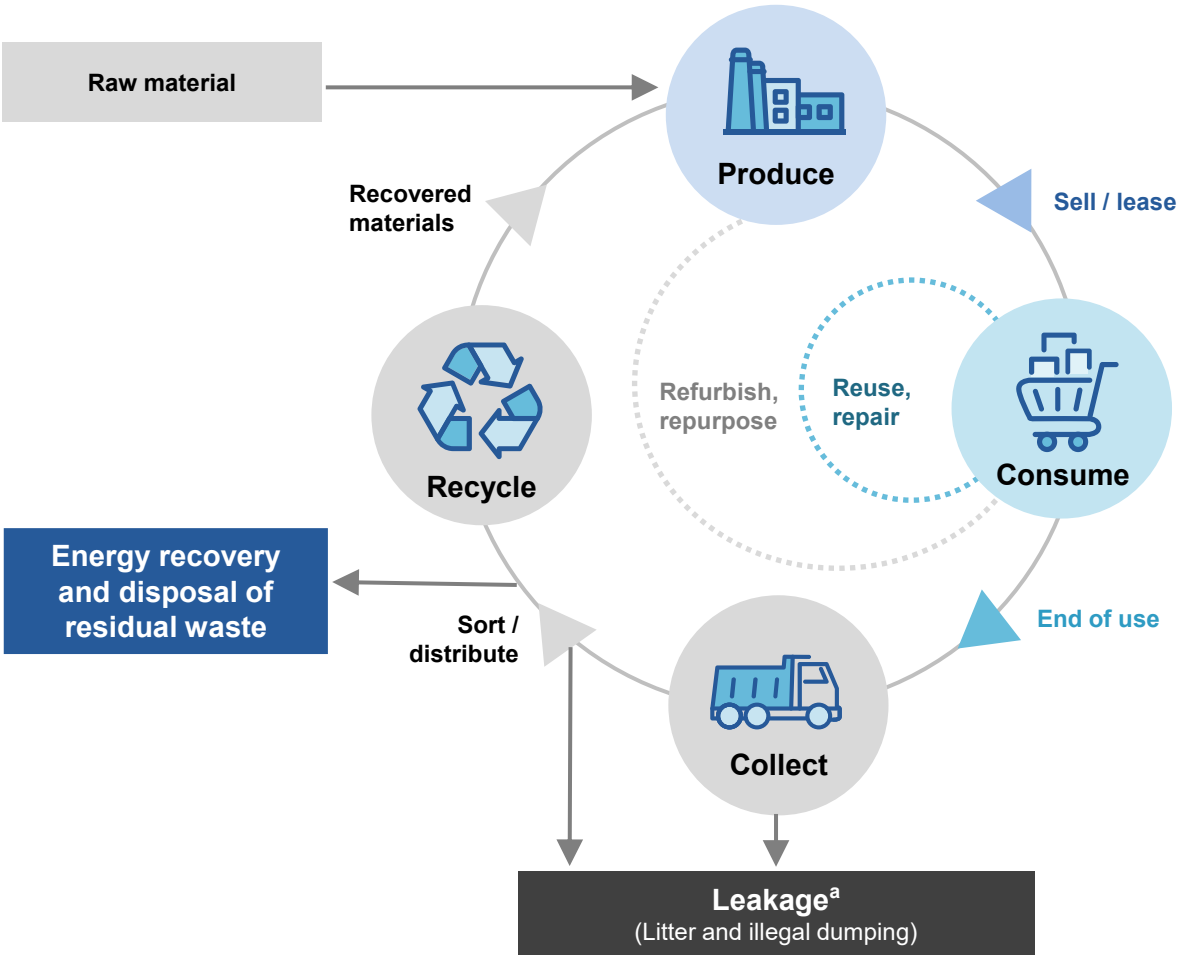
Circular activities throughout the product life cycle can relate to reducing how much raw material is extracted to make the product, repairing and reusing the product as much as possible, and lowering the amount of waste sent to landfill by collecting and recycling materials (figure 1.2). These activities can be categorised into closing, slowing or narrowing resource loops, a framework which has been adopted broadly (Bocken et al. 2016, p. 309; DCCEEW 2024c, p. 49). Circular activities encompass flows of materials and resources between different products, sectors and supply chains.

- **Closing resource loops:** These activities link the production and disposal stages, allowing for circularity in resource flows. Recycling activities, such as extracting and reusing materials from old batteries, close resource loops (BSC, sub. 140, p. 10).
- **Slowing resource loops:** These activities aim to increase the use of the product by either extending the product's life, increasing the ways in which the product can be used, or both. Activities that slow resource loops include designing products for durability, reusing products and repairing products. Repairing clothing to extend its useful life is one example of this activity (WasteLess | SEE Change, sub. 239, pp. 1–2).

[2] Approvals for new landfill sites involve a lengthy process due to suitability checks and community consultation.
[3] Leachate is a liquid contaminant prevalent in landfills. It is produced when rainwater and other moisture accumulates substances of concern that are released from the decomposition of waste.

- **Narrowing resource loops:** These activities aim to minimise the amount of materials that go into a product. At scale, these activities reduce the aggregate demand for raw materials. An example is the use of prefabrication in housing construction, which can lead to less materials use than onsite construction (BCSDA, sub. 175, p. 10).

Figure 1.2 – A simplified model of the circular economy for materials



a. 'leakage' of wasted materials can occur at all steps of the product life cycle.

Source: Adapted from NSW DPIE (2021a, p. 5).

The '10Rs framework' is widely used to articulate opportunities to increase circularity (figure 1.3) (Potting et al. 2017, p. 5). This framework categorises circular activities in a hierarchy, with 'higher-order Rs' focused on activities earlier in the product life cycle.

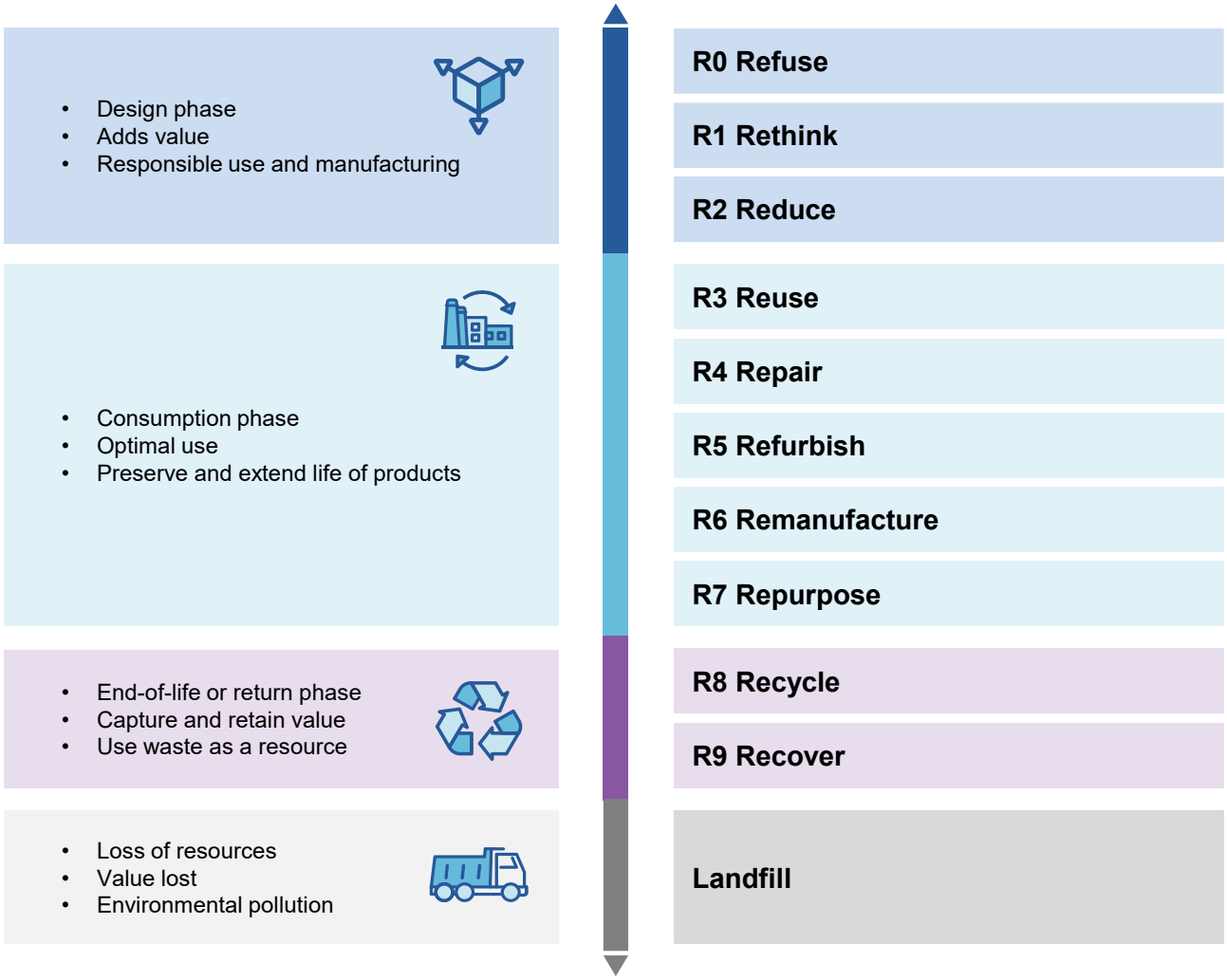
The terms of reference for this inquiry requested the Productivity Commission examine circular activities and opportunities that could improve materials productivity in ways that have economic and environmental benefits. Materials productivity is a measure of the amount of economic value generated per unit of materials used.[4] Australia's materials productivity of US$1.10 per kilogram lags behind the OECD average of US$2.50 (OECD 2022). Conventional productivity measures often do not fully reflect the important role of materials in the Australian economy. For example, the Australian national accounts focus on labour, capital and multifactor

[4] Economic value is measured using gross domestic product (GDP), while materials usage is measured as the quantity of domestic material consumption by weight.

productivity, and do not explicitly report on materials productivity. Also, Australia's productivity measures typically do not capture the major impact that the depletion of natural capital (such as minerals, water and biodiversity), or its capacity to provide ecosystem services, can have on future growth (Gordon 2022, pp. 3–4).

The PC recognises that there are strong interdependencies between how materials and resources (for example, water and energy) are used in the economy and impact the environment. These links are reflected, for example, in the range of circular economy-related activities and strategies provided by participants from the water services sector.[5] A focus on how resources are managed, and how associated water and energy services are delivered, would reveal a wider range of materials-related beneficial circular economy opportunities and potential areas for further policy reform than those identified in this report. Whilst broader water or energy policy reform and associated policy levers are outside the scope of this inquiry, the PC has noted some related opportunities in chapter 2 (built environment) and chapter 3 (food, agriculture and organics), and in chapter 8 outlines how ongoing water policy reforms relate to circularity outcomes.

Figure 1.3 – The 10Rs framework



Source: Malooly and Daphne (2023) adapted from Potting et al. (2017, p. 5).

[5] AWA (sub. 23); qldWater (sub. 51); Urban Utilities (sub. 71); Wannon Water (sub. 88); Water and Catchments Group of DEECA (sub. 72); WSAA (sub. 150).

Circular economy practices have a long-standing history

Aboriginal and Torres Strait Islander people hold deep cultural, social, environmental, spiritual and economic connections to Country. For tens of thousands of years, Aboriginal and Torres Strait Islander knowledges and practices have sustained the health of Country. Aboriginal and Torres Strait Islander people 'have led circular economic practices for generations, living in balance with our ecological and spiritual environments since time immemorial' (First Nations Economics, sub. 252, p. 5). There are various Aboriginal and Torres Strait Islander-led initiatives driving circular activities, such as those undertaken by the Bega Local Aboriginal Land Council and the West Arnhem Regional Council (WARC) (box 1.1). Additionally, the Cherbourg Aboriginal Shire Council operates a materials recovery facility, which processes and recycles materials from the region, supporting circular activities and providing work opportunities to the local community.

Box 1.1 – Examples of Aboriginal and Torres Strait Islander leadership in the circular economy

The Bega Local Aboriginal Land Council is involved in the circular economy primarily through delivering cultural land management programs and providing education and training in circularity.

> Aboriginal people have been in the circularity space for thousands of years. Caring for Country and circularity are interconnected, if you are caring for country you are participating in the circular economy. Cultural land management is very much about circularity, ensuring that things are replaced if they've been removed, to enable circular activity in the environment. For example, cultural fire practitioners ensure circularity in ecosystems during cultural burning, including collecting seeds and returning species to the natural environment.
>
> Education and training in circularity is another piece of work we are involved in. We have established a mobile café, which provides hospitality training and employment opportunities for young Aboriginal people. This is a circular project, as it is interlinked with our horticulture venture – plants from the horticulture venture are used at the café and food waste is brought back to the horticulture venture to be used in the garden. (Bega LALC, sub. 185, p. 1)

The WARC supports five remote Aboriginal communities (Gunbalanya, Jabiru, Maningrida, Minjilang and Warruwi) to implement circular initiatives via its *Reduce, Reuse, Recycle Strategy 2024–2034.*

> This strategy directly confronts the challenges of the region, such as logistical constraints and the need for culturally appropriate engagement, by prioritising community-led systems that eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature … Key initiatives which embody these principles include:
>
> - developing re-use shops to extend product lifecycles and circulate valuable goods within the community
> - implementing organic waste action plans to promote composting and the reuse of green waste, thereby regenerating soils and minimising organic waste pollution
> - creating viable recycling streams to recover valuable materials and reduce reliance on landfill disposal. (First Nations Economics, sub. 252, p. 9)

The Australian Government has made a commitment in *Australia's Circular Economy Framework* to 'honour and integrate the deep knowledge systems of First Nations peoples' and include 'genuine partnerships with First Nations peoples and communities, learning from their wisdom, and ensuring they are integral partners in shaping our sustainable future' (DCCEEW 2024b, p. 5).

However, beyond making statements of commitments, governments have some way to go on implementing the National Agreement on Closing the Gap Priority Reforms to enable true partnership (Priority Reform 1) (PC 2023c, p. 6). Aboriginal and Torres Strait Islander knowledges, practices and expertise also need to be recognised in circular economy policies in ways that benefit communities, and respect and protect cultural and intellectual property rights. Opportunities raised by participants and in literature include Aboriginal and Torres Strait Islander-led initiatives in resource management, agriculture and environmental stewardship, learning from Aboriginal and Torres Strait Islander practices in policy design, and partnering with communities in decision-making.[6]

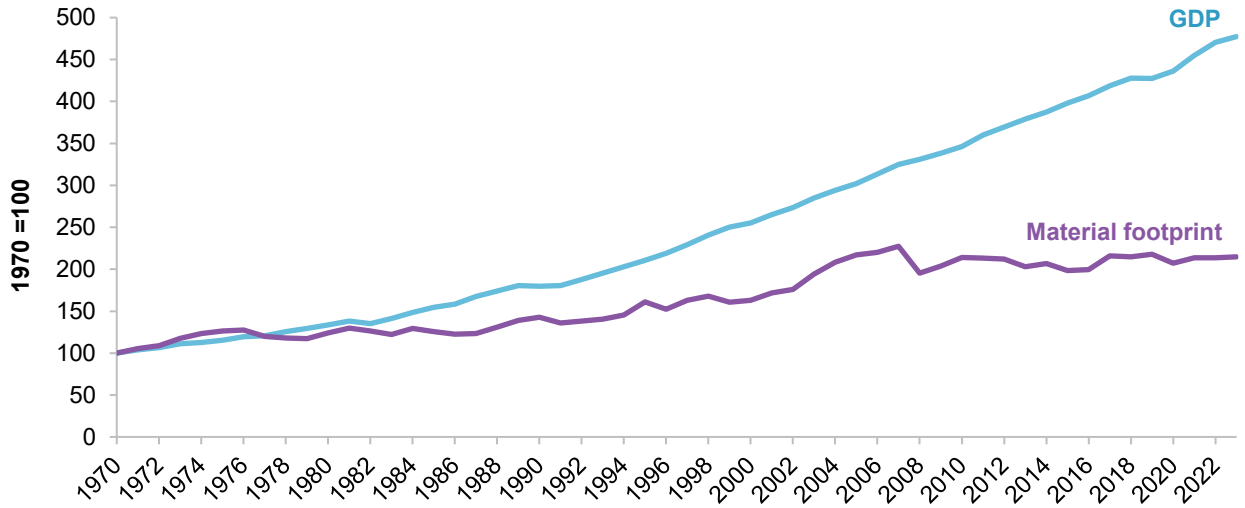
Why does moving to a circular economy matter?

The economy can be strengthened while lowering materials use

Using less materials does not necessarily mean slower economic growth. In the last 40 years, the Australian economy has grown substantially while materials use has increased at a much slower rate (sometimes called 'decoupling' economic activity from materials – figure 1.4). Though many factors can contribute to decoupling, in Australia this was in large part due to a shift towards services, which use significantly less materials than goods production. In the five decades between 1970 and 2020, the share of Australian economic activity generated by services has increased from 66% to 81% (PC 2021b, p. 6).

Figure 1.4 – Australia's materials usage has grown more slowly than GDP since 1980

Materials decoupling in Australia, 1970–2023[a,b]



a. Economic activity, measured through GDP, is used as it is not possible to quantify total welfare. While not a perfect proxy for societal welfare, economic activity is considered a significant contributor to it. **b.** Materials use is represented by material footprint. Material footprint measures the amount of materials needed to meet domestic consumption (by weight), incorporating all raw materials used across the global supply chain.

Source: OECD (nd).

[6] First Nations Economics, sub. 252, pp. 10, 17; Ford et al. 2020, p. 107; Planet Ark, sub. 147, p. 16; RMIT University Circular Economy Hub, sub. 31, p. 14.

Shifting to a more circular economy could help enable the economy to grow while using fewer materials. The shift could contribute to economic growth by creating new markets, products and job opportunities. It could also increase economic diversity and capability, as businesses adopt innovative business models that are focused on sustainable design, reuse or recycling.

Circular activities can also achieve social benefits

While the environmental and economic aspects of the circular economy are relatively well understood, social outcomes are often overlooked. An analysis of 221 definitions of the circular economy found that only 24–27% considered all three domains in their stated objectives of the circular economy (Kirchherr et al. 2023, p. 5). The social benefits of circular activities stem from the importance of environmental quality for health and wellbeing. These benefits can also include direct improvements in health and safety, enhanced amenity, greater social inclusion and support for Australians in need. For example, social enterprises engage in circular activities by conducting food rescue and distribution to those experiencing food insecurity, providing affordable repair services, and facilitating sharing models to increase reuse of products such as tools, toys and other household goods.[7]

Many circular activities will have interrelated environmental, economic and social benefits. For example, reusing mine-site infrastructure for a renewable energy generation and storage project can limit environmental damage by reusing an existing cleared site and can benefit the environment by offering a less polluting and emissions-intensive source of energy. It may also offer social and economic benefits by creating local jobs and increasing energy reliability.

By improving environmental, social and economic outcomes, a circular economy has the potential to support the wellbeing of future generations. Globally, humanity is currently exceeding several planetary boundaries including those related to climate change and biodiversity loss, resulting in a heightened risk of severe and irreversible damage to the environment (Richardson et al. 2023, p. 1).[8] Reducing materials extraction to lower biodiversity loss, avoid pollutants and mitigate greenhouse gas emissions should allow future generations to enjoy the same, if not better, levels of wellbeing as current generations.

However, some circular activities can result in trade-offs

While some circular economy activities can result in environmental, economic and social benefits, others can produce one type of benefit at the expense of another. For example, policies can reduce waste and environmental impacts throughout the life cycle if they encourage businesses to design products and packaging that use more sustainable materials, or make it easier to recycle products. However, they can also increase the upfront cost of purchasing products for households and businesses.

There may also be trade-offs within each dimension – for example, using recycled crushed glass for infrastructure applications has the benefit of diverting excess glass from landfill and reducing the need for virgin materials extraction,[9] which has negative impacts on local ecosystems (UNEP 2023b). However, the processing of waste glass into recycled crushed glass is emissions-intensive, so can lead to worse emissions outcomes when compared to traditional virgin materials (ARRB 2022, pp. 12–13).

Ultimately, the goal of the circular economy is to improve overall public welfare. In designing circular economy policies, a system-wide approach to analysing and monitoring the impact of policy levers is needed to identify and adjust for potential trade-offs.

[7] Australian Library of Things Network (sub. 59, p. 1); BCSDA (sub. 175, p. 8); OzHarvest (sub. 81, p. 9); Toy Libraries Australia (sub. 130, p. 2).

[8] The planetary boundaries framework identifies nine processes that are critical for maintaining the stability and resilience of the Earth's system and the boundaries, or safe operating limits, for those processes (Richardson et al. 2023, p. 1).

[9] Virgin materials are materials that are directly extracted from nature and have not been previously used or processed.

1.2 What drives and what impedes circularity?

Businesses and households are motivated by a range of reasons to pursue circular opportunities ...

Businesses and households pursue circular opportunities for a range of reasons including where it makes financial sense, and out of their concern for the environment. Government policy settings also influence actions, such as through environmental protection regulation and enforcement, waste levies, sustainability requirements in grants, procurement specifications, and a range of other legislated penalties or mechanisms (for example, the Safeguard Mechanism).[10]

Households and businesses can often save money by repairing objects or using them until the end of their life, rather than replacing them prematurely. For businesses, production processes that require fewer materials can reduce input costs whilst also minimising waste. Businesses may also adopt circular approaches in response to preferences by consumers and/or shareholders for environmentally positive products, as this may create brand reputation and customer loyalty (ResiLoop Ltd, sub. 84, p. 5).

Businesses and households may also be motivated to take up circular economy activities by concern for future generations, societal expectations, altruism or other sustainability reasons. People who are motivated by a sense of responsibility to minimise their impact on the environment might choose to purchase sustainably produced goods and services or use goods for longer before replacing them. Businesses are increasingly adopting environmental, social and governance (ESG) principles in their practices. There are also community organisations and social enterprises which aim to increase circularity. For example, the Reconnect Project (sub. 134, p. 1) and WorkVentures (ADIA, sub. 197, p. 13) repair and refurbish used electronic devices to provide to disadvantaged groups.

... but can also face barriers to adopting circular practices

Regulations sometimes make it hard for businesses to adopt circular economy activities. While regulations reduce or mitigate the risks of adverse outcomes, regulations that are too prescriptive, outdated or complicated can hinder the uptake of more circular practices. For example, businesses wanting to develop and market innovative products from wasted materials rely on regulatory arrangements to ensure consumer and public confidence about the safety and environmental credentials of their products. Enforcement of regulations (such as to protect the environment from dumping or pollution) is also critical to their business, as they underpin incentives for suppliers. However, where these businesses are creating 'new' products they may find regulations complex and time-consuming to navigate. Inconsistent regulations across jurisdictions can also pose barriers to businesses (chapter 7). Specific ways in which regulation hinders adoption are explored in more detail in chapters 2 to 6.

Businesses also face costs when changing existing production processes and business models. For example, accessing finance can be more difficult and expensive, because circular technologies may be relatively new and expensive to implement; or lenders might perceive them as higher risk or challenging to value relative to traditional technologies. Where prices of virgin materials do not reflect the full environmental costs associated with their extraction and production, this price relative to recycled material inputs discourages business from using or selling recycled inputs.

[10] The Safeguard Mechanism is a policy that requires Australia's highest greenhouse gas emitting facilities to reduce their emissions in line with Australia's emission reduction targets (CER 2024a).

Imperfect information can also hinder adoption of circular alternatives. Poor quality and availability of information about how products are made limits the ability of households and businesses to make sustainable choices, even if they wish to do so. Households and businesses may also not have clear information on the repairability, reuse potential or recyclability of different items. As a result, they may dispose of these items through landfill or recycle incorrectly and contaminate waste streams.[11]

Businesses, particularly small to medium sized businesses, may also lack the capability and resources to adopt circular opportunities. This includes lacking relevant information about potential circular economy opportunities, their practical applications and associated benefits (CIPS, sub. 161, p. 6; Vejnovic et al., sub. 24, p. 3). For example, they may not know where to source feedstock or find buyers for wasted materials, face challenges navigating regulatory processes due to lack of capability or be unaware of government and other programs that might provide financial support.[12] They may also lack resources and capability to form the networks necessary to coordinate with other businesses on circular opportunities (Roundtable participants, pers. comm., 29 May 2025).

1.3 The role for government in the circular economy

Governments play an important role in supporting overall community wellbeing, especially where the decisions made by households and businesses (private actors) would not otherwise result in the best outcomes overall for the community (maximum net public benefits). As noted in this inquiry's terms of reference, 'regulatory frameworks and policy actions influence businesses' and households' decisions on materials purchasing, use and replacement or the competitiveness of circular economy initiatives.'

Several reasons justify targeted government action to address barriers to improving materials productivity and support opportunities in the circular economy.

- **Externalities** arise when costs or benefits from producing goods or services are not reflected in their purchase price. For example, environmental damage from resource extraction is a negative externality that may not be included in prices.
- A **public good** is something that anyone can use, such as clean air and biodiversity. Without government action, the value of these goods is often not protected sufficiently as no one is excluded from their use or prevented from harming them. Shared or freely available environmental resources are often overused.
- **Information asymmetry** is when different parties have different amounts of information. This can make it hard to make decisions that benefit the community. For example, people who want to make sustainable choices might not have enough information about the impact of their purchases.
- **Equality of opportunity** means a fair distribution of resources, and options for how to use resources, across society and over time. Governments may try to address inequalities, such as the environmental impacts on future generations due to the current use of materials.

Governments should apply policy levers where the benefits to community wellbeing from doing so exceed the costs – that is, where there is 'public' benefit. Government action is not warranted when the benefits are purely 'private'. Quantifying benefits and costs, and valuing policy outcomes, is difficult – particularly when outcomes span interconnected economic, environmental and social dimensions as in the case of circular economy policy. Governments also need to select and design policy mechanisms to appropriately target the activities (of producers or consumers) or points in the supply chain most effective for achieving the desired outcome. Government policies and regulations may also have unintended consequences and costs. The

[11] Chad (sub. 19, p. 3); Infrastructure Victoria (sub. 28, p. 7); Veolia Australia and New Zealand (sub. 8, p. 3).

[12] For example, Business Chamber Queensland (sub. 213, p. 4), CODA (sub. 46, p. 15) and Circular Australia (sub. 126, p. 13).

recommendations in this report cover existing policies and regulations that could be unnecessarily hindering adoption, as well as new opportunities for governments to act on circularity.

Policy levers available to government

Governments have a range of policy levers available to them to support the transition to a circular economy. Levers have been applied by governments internationally to facilitate the transition.

- **Economic instruments** – policies that encourage circular behaviours and practices through price signals. For example, influencing the relative prices of virgin and secondary materials by adding a tax to the virgin material (used by several OECD countries for materials such as plastics) (Svatikova et al. 2025, p. 17).
- **Regulatory instruments** – changes to legal frameworks to promote adoption of circular practices, ranging from changes to minimise the barriers and administrative burdens for organisations trying to adopt circular business models, to placing bans or restrictions on certain product types. For example, the European Union has banned the destruction of returned or unsold textiles and footwear to reduce wasted materials and encourage the reuse of these products (EEA 2024).
- **Information instruments** – government actions that increase or enhance the information available to enable consumers, companies and public institutions to make decisions that increase circularity. For example, the French Government has introduced a repairability index, which indicates how easily repairable a consumer electronics product is to inform consumer decision making and encourage the production of more repairable products (Sirera et al. 2024).
- **Measures to facilitate coordination** – government actions that support businesses and other organisations to coordinate their actions to facilitate circular economy outcomes. For example, as part of the implementation approach for circular economy policies in the Netherlands, governments in some regions have established circular economy transition brokers that support companies to implement circular initiatives and foster collaboration between them (Cramer 2020, p. 3).

Australia's circular economy policies

Circular economy policies in Australia have evolved over time and predate the more widespread use of the term 'circular economy'. Australian governments have been managing waste for public safety and amenity reasons for a long time, initially focusing on disposal. This changed during the 1990s, with a growing appreciation that 'the current high levels of consumption without the efficient use of resources and waste minimisation are not ecologically sustainable' (Senate Standing Committee on Environment, Recreation and the Arts 1994, p. 1). Policies shifted to also incorporate minimisation of wasted materials, with the National Kerbside Recycling Strategy and National Waste Minimisation Strategy introduced in 1992 (Senate Standing Committee on Environment, Recreation and the Arts 1994, p. 11).

More recently, all levels of government have introduced some policies that support the circular economy, with their responsibilities and activities reflecting the division of powers in the Australian Constitution (figure 1.5). Many policies directly relate to circular economy practices by targeting materials use and wasted materials, while others that are aimed at reducing negative environmental impacts more generally may also encourage greater circularity. Circular practices can be influenced both positively and negatively by a wide range of other policies, such as those targeting environmental conservation, climate change and regional development.

Broadly, the Australian Government is responsible for national legislation, strategies and policy frameworks including international commitments (such as climate change); tax settings; research and development; international trade and matters of national environmental significance. It also provides national leadership on initiatives that span jurisdictions or industries. Sustained leadership from the Australian Government is necessary to enable a coordinated approach by states and territories, including in areas such as product stewardship (chapter 5). State and territory governments have responsibilities for waste management and resource recovery;

infrastructure development; essential service delivery; environmental policy and the enforcement of environmental regulations. Local governments provide waste management services, manage local infrastructure and promote awareness of more circular practices among residents (such as how to correctly sort and recycle waste). All levels of governments provide financial incentives for circular activities that narrow, slow and close material loops, through means such as direct funding or sustainable procurement policies. A collation of Australian policies related to the circular economy is available in chapter 2 of the interim report.

Figure 1.5 – Responsibilities of different levels of government in the transition to a circular economy

Australian Government 	The Australian Government is responsible for **national legislation, strategies, policy frameworks and investment**, relating to international commitments, import settings, trade, standards, tax settings, R&D and matters of national environmental significance. The Australian Government also has an important role in providing **national leadership** for **product stewardship schemes** and supporting **cross-jurisdictional coordination**. • **Frameworks, strategies and standards** including *Australia's Circular Economy Framework*, *National Waste Policy*, *National Waste Action Plan*, *National Plastics Plan* and the *Industrial Chemicals Environment Management Standard*. • **Tax and other financial levers** including funding provided to states and territories. For example, the *Recycling Modernisation Fund*, which is provided jointly with states and territories, *Future Made in Australia* and the *Environmentally Sustainable Procurement Policy*.
State and territory governments 	State and territory governments' circular economy policies and programs address **waste management and resource recovery** and **other parts of the product life cycle**. • Legislation and programs governing end-of-life material handling (for example, plastics bans and waste levies). • Environmental protection regulations and natural resource management. • Financial incentives (such as Queensland's *Resource Recovery Industry Development Program*). • Support for circular initiatives in earlier life cycle stages, such as design (for example, Victoria's Circular Economy Business Innovation Centre). • Knowledge-sharing and investment in innovation. • Sustainable procurement guidelines (such as the SA *Green Procurement Guideline*). • Land use and development planning.
Local governments 	Local governments **provide services, manage infrastructure, and oversee land use planning affecting circular economy activities**. Their responsibilities include regulating local waste management, collecting household waste and recyclables, operating landfill sites and delivering education to reduce waste generation. **Local government contexts differ considerably** (urban, regional, remote) and responsibilities differ across jurisdictions**.** Regional councils may collaborate through joint organisations to deliver services. Actions local governments can take to increase the uptake of circular activities include: • integrating circular economy principles into operations and procurement • partnering with industry for reuse and repair initiatives.
All levels of government	**All governments** are committed to progressing Priority Reforms under the National Agreement on Closing the Gap, including through relevant circular economy policies.

Source: ALGA (sub. 21, p. 4); Bower Reuse and Repair Centres (2025); CEBIC (2023); Cherbourg Aboriginal Shire Council (2021); DCCEEW (2018, 2021c, 2024b, 2024f, 2025d, 2025k, 2025l); *Future Made in Australia Act 2024*; Procurement Services SA (2023); QLD Department of State Development, Infrastructure and Planning (2024).

Government policies related to materials productivity have traditionally focused on recycling, overlooking the importance of actions higher up the 10Rs framework (such as reuse and repair) and processes earlier in the supply chain (such as design) (Environment and Communications Committee 2025, pp. 68–69). There has been a recent shift across all levels of government to pursue policies which focus on circular practices earlier in the product life cycle that reduce materials use and/or associated impacts on the environment. While many such initiatives are still in their early stages, at a strategic level, the Australian Government's 2024 National Circular Economy Framework seeks to prompt action across the whole product life cycle and highlights the important role of national policy leadership in setting the direction for Australia's transition to greater circularity.

Circular economy related policies in Australia are in the early stages of development but are evolving rapidly. Governments have recently introduced, and are also still developing, policies and reforms that seek to promote greater circularity in different parts of the economy. During the PC's inquiry, several governments have made progress in reducing regulatory barriers to circular activities, such as reducing regulatory barriers to prefabricated housing (box 2.1) and fully recognising the carbon benefits of biomethane in Australia's carbon reporting system.[13] There have also been improvements in the transparency of businesses' sustainability performance through mandatory public reporting of climate related financial disclosures for large entities (The Treasury 2024d, p. 2). The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) is currently completing a statutory review of the *Recycling and Waste Reduction Act 2020* (Cth), which will consider 'the limitations of the current approaches to product stewardship, including concerns around the viability, integrity and impact of stewardship schemes supported by the Act' (DCCEEW 2025g). Recognising that the circular economy policy space is active and evolving, the PC has aimed to complement existing policy activities when conducting its analysis of priority opportunities and developing its recommendations.

A wide range of other policies also affect the circular economy

In addition to government policies that are directly focused on shifting to a circular economy, there are also policies, including those aimed at reducing environmental impacts more generally, that can encourage more efficient materials use.

For example, the Australian Government's existing climate change policies – including the *Renewable Energy Target*, *Safeguard Mechanism*, *Australian Carbon Credit Unit Scheme*, *Capacity Investment Scheme* and *New Vehicle Efficiency Standard* – act to address the emissions-related negative externalities including those associated with materials use and wasted materials. Circular economy opportunities that reduce greenhouse gas emissions by lowering materials extraction and use could be covered under these policies, to the extent that the circular emission reduction methods are eligible under relevant schemes. However, as emissions policies do not directly address other negative externalities – such as other types of air and water pollution, biodiversity loss, and adverse impacts on human health and safety – they only partially account, and may themselves contribute to, the environmental impacts arising from materials use and wasted materials.

Water policies, such as the *National Water Initiative*, aim to improve the sustainable and productive management of Australia's water resources and increase water security for communities, industries and the environment. While a wider resources efficiency approach has not been used in this materials-focused inquiry, water-related policies, legislation and regulations play important roles in supporting circular economy. These include those related to water efficiency (for example, *Water Efficiency Labelling and Standards*), recovery of resources from biosolids in wastewater that can support regeneration of nature, and

[13] By amending section 2.67C in the National Greenhouse Energy Reporting (Measurement) Determination 2008 (Cth).

policies to ensure and ecologically sustainable, economically viable and culturally responsive infrastructure (PC 2021a, p. 53; WSAA 2023, p. 17).

A range of government policies and regulations that can play a significant role in guiding how businesses use materials and recycle wasted materials are not always labelled 'circular' policies. These are often in sector-specific contexts, such as standards on how recycled materials can be used for building in the *National Construction Code*, regional planning and transformation strategies or requirements about processing mining residues in state-based mining regulations. These policies can be interdependent, and the sequencing of their introduction can be important. For example, a change in a national building code or standard could influence the use of recycled content in a major infrastructure project. Such policies and regulations are discussed further in chapters 2 to 6.

1.4 Considerations for prioritisation

The terms of reference request that the PC identify priority circular economy opportunities for Australia and ways governments can address barriers to their adoption. The PC identified priority circular economy opportunities to improve materials productivity (and associated government actions) using three broad considerations (table 1.1).

Table 1.1 – Summary of the PC's approach to prioritising circular economy opportunities and associated government actions

Consideration	Guiding questions	Rationale
Environmental and economic significance of the materials use addressed by circular economy opportunities	How **large** is the current and projected materials use? How **environmentally harmful** is the materials use and to what extent can the opportunity reduce these harms? To what extent are there **economic or strategic** reasons for improving materials productivity?	The benefits of increased materials productivity are correlated with the size of material use and its impacts.
Applicability of a circular economy opportunities to Australia	To what extent **can Australia influence the part of the product life cycle** an opportunity relates to? How will the **Australian context**, such as geography or population, affect an opportunity's feasibility? What is the **scope for improvement**, given the current adoption of circular practices?	The applicability of circular economy opportunities will depend on Australia's context and economic structure.
Viability of government actions to reduce barriers to circular economy opportunities	What **market or regulatory failures** act as barriers? What **existing regulations, data collection and monitoring arrangements** could be built on? What is the **evidence** that an intervention would be cost-effective? Are there lessons to be learnt from elsewhere? What is the public **support** for the intervention?	Government action is more likely to have net benefits when market or regulatory failures exist, or the policy builds on current arrangements, public support and evidence.

Where possible, the PC used quantitative data to assess the significance of materials use and the applicability of circular economy opportunities to Australia.[14] However, as highlighted by many participants,

[14] While quantitative measures have been examined, the PC has not formally modelled potential impacts of circular economy opportunities in this report.

there are gaps and insufficient granularity in publicly available quantitative data.[15] Case-by-case life cycle analyses would be necessary for in-depth understanding of the impacts of materials use and as inputs to integrated modelling, but are largely not available for Australian materials use. Further, circular economy indicators are partial and imprecise measures on the environmental, economic and social impacts of materials use. For example, using tonnes of materials used to measure environmental impact does not capture how the environmental impacts of producing one tonne of a material varies significantly depending on the material being produced (European Commission nd). The PC also applied qualitative forms of evidence to guide and strengthen the approach to prioritisation. Further information on the prioritisation framework can be found in chapter 3 of the interim report.

When assessing the viability of government action to reduce barriers to circular economy opportunities, and in developing recommendations, the PC has sought to complement existing policy activities. The PC recognises that it is not operating on a blank slate and is not solving for all the potential barriers to the circular economy and related environmental concerns.

1.5 Applying the prioritisation framework

Approach to prioritising opportunities and recommendations

In this inquiry, the PC undertook the following activities to prioritise and analyse circular economy opportunities, and proposes policy recommendations relating to these opportunities.

1. **Identify potential circular economy opportunities:** Review the relevant literature, policy documents and inquiry submissions, and engage with a variety of industry, community, research and government participants to identify potential circular economy opportunities in Australia, and current and planned government policy and programs.
2. **Assess circular economy opportunities and policies to address barriers to adoption**: Apply the prioritisation considerations to understand the extent to which circular economy opportunities could result in environmental or economic benefits (for example, based on current and projected material and product use, and waste generation), the applicability of the circular economy opportunity to Australia (for example, due to industry structure) and the viability of government action to address relevant barriers.
3. **Prioritise circular economy opportunities and outline policy reform directions in the interim report**: Identify circular economy opportunities that perform well against the prioritisation criteria and outline potential directions for policy reform that address the barriers to their realisation (for example, market and regulatory failures).
4. **Seek feedback and refine policy analysis for the final report**: Engage with inquiry participants following the release of the interim report to test the identified circular economy opportunities, barriers and reform directions, and seek additional information to inform policy design, including implementation feasibility and risks.
5. **Develop final policy recommendations**: Finalise the identification of priority circular economy opportunities and develop a series of priority recommendations for government action.

[15] For example, Coreo (sub. 104, p. 14), Engineers Australia (sub. 108, p. 3), Mathur (sub. 10, p. 1), ResiLoop Ltd (sub. 84, p. 4), Swedish Australian Chamber of Commerce Sustainability Committee (sub. 94, p. 2), WALGA (sub. 167, p. 2) and WARRRL (sub. 87, pp. 6-7).

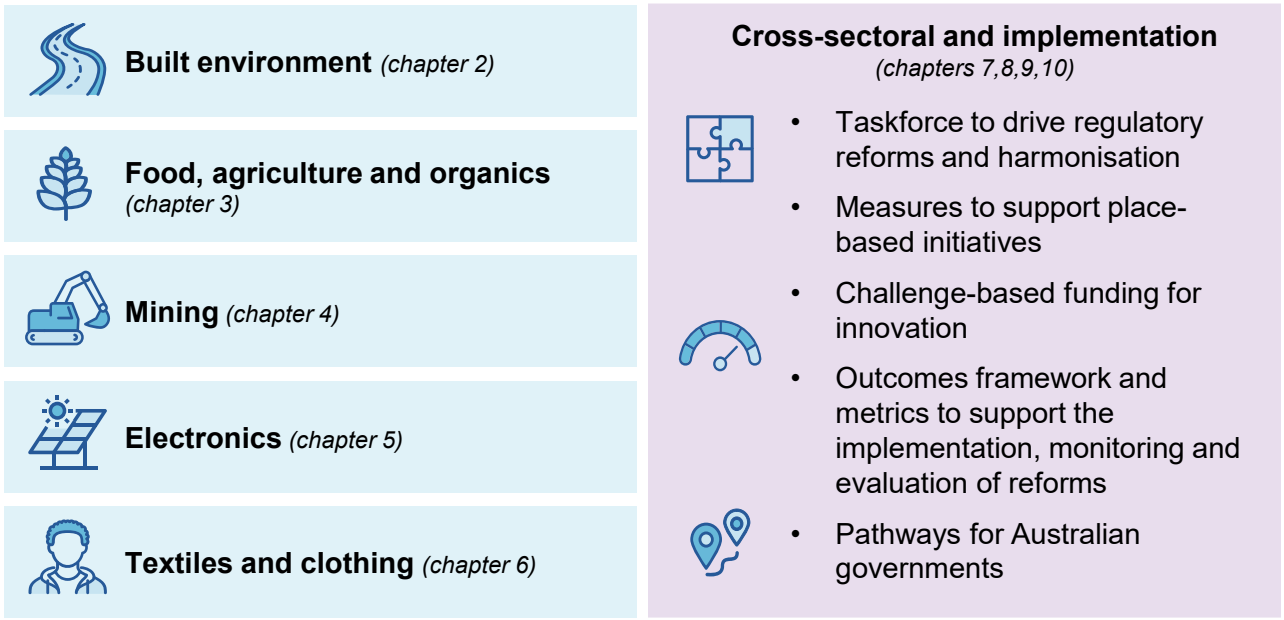
6. **Create an outcomes framework and phased timelines for final recommendations**: Establish how policy actions lead to outcomes that progress the circular economy transition, identify implementation considerations and consider sequencing of recommended policy actions.

Selected priority areas for circular economy opportunities

In this report, the PC examines circular economy opportunities in five priority sectors identified using the above framework (chapters 2 to 6), several changes that would facilitate circular economy opportunities across sectors (chapter 7), an outcomes framework and other considerations to guide implementation (chapter 8), metrics to measure progress in the uptake of these and other opportunities (chapter 9) and phased implementation pathways for government (chapter 10) (figure 1.6).[16] Policies that prompt individual markets and supply chains to adopt more circular practices will go some way to achieving more circular outcomes (with associated economic and environmental benefits) at a national scale. However, for an economy-wide transformation, policies that take a more systemic approach and consider the interconnectedness of markets and sectors are also necessary.

There is some cross-over between the sectors identified by the PC and the sectors selected for deep dives in the Circular Economy Ministerial Advisory Group's final report: built environment, food and agriculture, resources, and water (DCCEEW 2024c). While the PC did not undertake a detailed examination of all circular economy opportunities in all the sectors suggested by participants, the PC has identified cross-sectoral opportunities to improve circularity (chapter 7), with broader applicability than the five priority sectors. For example, the PC considered if, and how, inconsistent regulations, standards and specifications across Australia should be addressed, and this may include settings that apply to other sectors.

Figure 1.6 – Priority sectors, cross-sectoral opportunities, outcomes framework and metrics to support implementation



[16] Discussion of relevant opportunities relating to vehicles identified in the interim report are now addressed within the context of mining (chapter 4) and electronics (chapter 5).

2. Built environment

Key points

- **Incorporating circular economy principles into Australia's built environment can significantly improve materials productivity, with economic and environmental benefits.**
  - For example, addressing knowledge and confidence gaps, and reducing overly restrictive standards and specifications relating to sustainable materials in infrastructure construction could provide access to lower cost, better performing and more sustainable materials.
  - The benefits could be significant. In the next four years alone, investment in future public infrastructure is expected to total $270 billion, and efficient net zero transition policy developments are likely to present opportunities for less emissions intensive construction materials.

- **The Productivity Commission examined opportunities for governments to promote circularity across the built environment life cycle to improve materials productivity and economic and environmental outcomes. The PC is recommending that governments act in the following two areas.**
  - To promote the fit for purpose use of sustainable materials in infrastructure, Australian, state and territory governments should establish a working group to undertake a staged stocktake and assessment of standards and specifications. The assessment should identify a shortlist of changes to standards and specifications to better accommodate sustainable materials in infrastructure that could significantly increase uptake of sustainable materials without compromising safety. These may include replacing prescriptive standards and specifications with performance-based criteria or harmonising standards and specifications across states and territories.
  - State and territory governments with commitments to major infrastructure projects should introduce or expand support services. These services should include dedicated facilitators that work with suppliers, contractors and asset owners to increase uptake of sustainable materials.

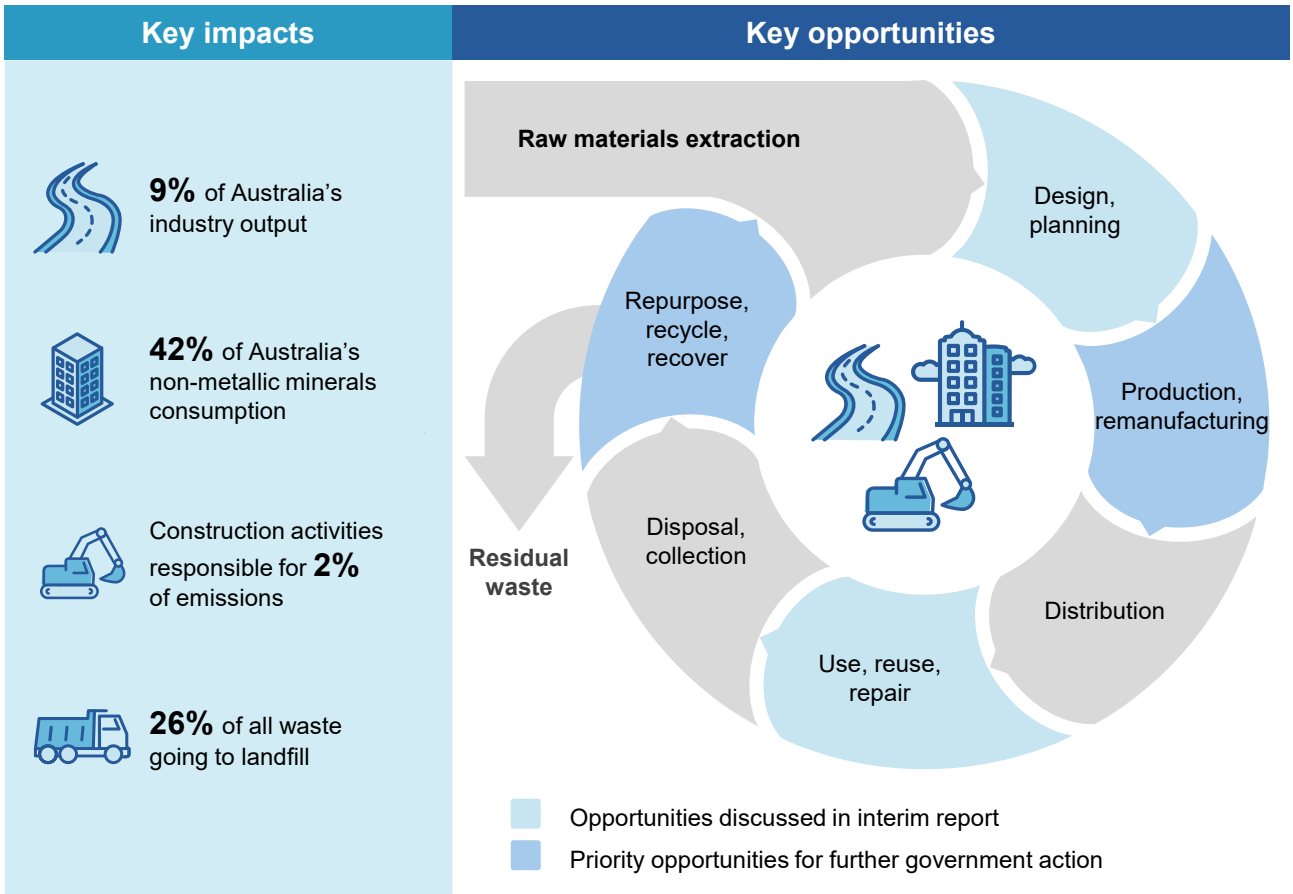
- **These actions would build on what governments are already doing to encourage greater circularity and materials productivity in the built environment.**
  - Australian, state and territory governments are already acting to reduce regulatory barriers to prefabricated construction, including federal funding for state and territory governments to adopt national definitions, speed up compliance with the National Construction Code and facilitate bank lending pathways.
  - If delivered effectively and on schedule, these efforts could unlock significant economic and environmental benefits. For example, the productivity improvements associated with reduced regulatory barriers to prefabricated construction could contribute $2.9–5.4 billion to GDP and improve materials productivity through significant reductions in on-site wasted material and circular design benefits.

2.1 Material use impacts and circular opportunities

The built environment life cycle spans the planning, design, construction, use, disassembly and reuse of structures that people rely on daily. These structures include residential buildings (for example, houses and apartments), non-residential buildings (for example, offices, warehouses and schools), civil infrastructure (for example, bridges, roads and railways), service infrastructure (for example, energy and water) and industrial facilities. The planning phase of the built environment life cycle can occur at different scales (for example, at project, town, city and regional scales) and can include decisions about how to integrate various types of infrastructure (such as transport, water and energy).

Given the large volume of materials used in the built environment and the potential negative impacts of their use and disposal on human health and the environment, even modest improvements in materials productivity could deliver significant benefits (figure 2.1).

Figure 2.1 – The built environment at a glance[a]



a. Many raw materials used in the built environment are supplied by the mining sector (such as sand). Chapter 4 discusses opportunities for increased circularity in mining.

Source: PC estimates, based on ABS (2025a); DCCEEW (2023c, 2025c, p. 82); UNEP (2024c).

In Australia, the construction sector accounted for 9% ($177 billion) of total industry output in 2023-24, and 26% of all wasted materials sent to landfill in 2022-23 (PC estimates, based on ABS 2025a; PC estimates, based on DCCEEW 2025c, p. 82).[1] It accounted for 42% of all non-metallic minerals and 25% of all metallic

[1] Wasted material share is calculated using construction and demolition waste, and core waste figures (excludes ash).

minerals consumed in Australia (PC estimates, based on UNEP 2024c). Construction processes and associated manufacturing activities are responsible for 2% and 8.4% of Australia's emissions respectively (PC estimates, based on DCCEEW 2023c).[2] Additionally, landfilled construction and demolition materials can lead to the leaching of contaminants into soil and water systems (Molla et al. 2021, pp. 7–8).

In the interim report, the Productivity Commission evaluated opportunities for government action to promote greater circularity across the built environment life cycle – including planning, design, construction, use and recycling – to improve materials productivity and economic and environmental outcomes (PC 2025a). Of these opportunities, two priorities for further government action emerged: reviewing standards and specifications that hamper the use of sustainable materials in infrastructure projects (section 2.2), and strengthening sustainable infrastructure procurement through targeted facilitation and coordination initiatives (section 2.3).

The interim report highlighted reducing regulatory impediments to prefabricated construction as a potential reform direction. Since then, governments have implemented several new and ongoing initiatives to address regulatory barriers to prefabricated construction. If delivered effectively and on schedule, these initiatives could unlock significant economic and environmental benefits. These reforms will also contribute to broader policy goals and the associated social benefits, such as delivering 1.2 million homes by 2030 under the National Housing Accord – which is currently projected to fall short by 285,000 homes (Husic 2024; Master Builders Australia 2025) (box 2.1). As a result, the PC has not recommended further government action in prefabricated construction beyond existing initiatives.

Infrastructure assessment frameworks and integrated urban planning have a significant impact on material use in the built environment. While many governments promote efficient and sustainable infrastructure and have outlined goals for integrated planning across transport and urban water, there remains scope to enhance materials productivity by ensuring consistent adherence to these principles.[3] Robust public infrastructure investment processes are a key strategy in advancing environmental outcomes. For example, by choosing not to proceed with projects that lack clear societal net benefits, governments can avoid unnecessary materials use and wastage. While the planning and design stages play a critical role in determining the long-term sustainability and materials productivity of infrastructure, this inquiry did not extend to a detailed review of Australian, state, and territory government frameworks for integrated and sustainable infrastructure development. Nonetheless, the PC reaffirms relevant recommendations from previous inquiries that address infrastructure planning and development (chapter 8). If adopted, these actions would also help deliver stronger economic and environmental outcomes in infrastructure.

[2] Using 2023 emissions, the 'associated manufacturing activities' estimate is calculated by dividing the sum of 'Non Metallic Mineral Product Manufacturing', 'Primary Metal and Metal Product Manufacturing', 'Fabricated Metal Product Manufacturing', and 'Wood, Pulp, Paper and Printing' by 'Total of all Economic (ANZSIC) Sectors'.

[3] Examples of governments promoting efficient and sustainable infrastructure investment include DCCEEW (2024n, p. 13), WA DoT (2024a, p. 4), and Infrastructure NSW (2024, p. 7). Integrated transport and water planning examples include DELWP (2017), Infrastructure NSW (2022), NSW DPIE (2022), SA DHUD (2019) and VIC DTP (2024a).

Box 2.1 – Case study: prefabricated and modular construction

Prefabricated construction involves manufacturing standardised components in a factory and transporting them to construction sites for assembly. In some cases, components are fully preassembled into units – such as bathroom pods, rooms or entire houses – and then installed on-site. These systems range from two-dimensional elements like wall panels to three-dimensional modular units (HIA and AMGC 2022, p. 4; McKinsey & Company 2019, pp. 7–10).

Prefabricated construction techniques have several potential productivity benefits compared to conventional building techniques. International studies indicate that prefabricated construction techniques can result in 20–50% faster completion times and reduce construction costs by up to 20% (McKinsey & Company 2019, pp. 10, 13). PC modelling suggests that if these types of productivity improvements were realised in Australia through greater adoption of prefabricated construction, it could increase GDP by $2.9–5.7 billion (PC 2024a, p. 19). Academic literature and inquiry participants have indicated that prefabricated construction reduces the on-site wastage of materials (greater oversight and control reduces the amount of wasted and contaminated construction materials) (HIA, pers. comm., 5 February 2025; Loizou et al. 2021, p. 17). It can also increase scope for circular practices such as disassembly and reuse (Monash University, sub. 262, p. 5; Yan et al. 2022, p. 2).

Several reports and inquiry participants have noted a variety of barriers to the uptake of prefabricated construction. For instance, there are additional compliance costs due to the National Construction Code (NCC), and state and local government legislation and planning codes having been developed with traditional construction in mind (HIA and AMGC 2022, pp. 35–43). There are also difficulties securing finance and insurance for prefabricated housing as most lending arrangements are designed to suit traditional on-site construction processes and stages (HIA and AMGC 2022, pp. 27, 47).

There are a range of government measures currently in process to address these barriers.

- The Australian Government has provided $120 million in funding for states and territories to work with the Australian Building Codes Board (ABCB) to develop and adopt a national definition for prefabricated and modular construction, remove barriers to prefabricated manufacturer's certificates issued by the ABCB, and to review and amend planning and consumer protection arrangements to level the regulatory landscape for prefabricated and traditional construction (The Treasury 2024e, p. 17).
- The ABCB is also establishing a voluntary certification scheme for prefabricated and modular construction companies, with the aim of streamlining and fast-tracking the NCC approval process (Chalmers and Husic 2024).
- In November 2024, the Australian Government, banks, superannuation funds and other institutional investors began work with industry to address barriers to financing prefabricated housing, with advice to be provided in June 2025 (Chalmers and Husic 2024). This has already resulted in the Commonwealth Bank of Australia providing progress payments, loans of up to $1.5 million, and developing a standard contract for prefabricated construction (CBA 2025).

2.2 Clarify where to focus reforms of standards for sustainable materials

Australian, state and territory governments should perform a staged stocktake and assessment of standards and specifications that unnecessarily restrict recycled and other sustainable construction materials in fit for purpose applications.[4,5] This assessment should prioritise asset classes and materials based on economic and environmental significance. The purpose of this stocktake and assessment would be to help governments form a definitive, consistent position on which changes to standards and specifications (that are limiting the use of sustainable materials in infrastructure) would have the largest net benefits.

This would help address widespread concerns in the built environment sector that many construction standards and specifications unnecessarily restrict the use of recycled and other sustainable materials (box 2.2). Some of these concerns relate to standards or specifications being too prescriptive, conservative or oriented towards traditional materials (for example, concrete and cement standards restrict the use of recycled and low carbon additives). Other concerns relate to variations in standards and specifications across states and territories which can increase costs to businesses that operate across multiple jurisdictions (for example, allowable content specifications used by transport agencies vary across states and territories).

Box 2.2 – Examples of restrictive or inconsistent standards or specifications

A range of participants, from industry associations and businesses to government agencies, reported that current standards and specifications are a barrier to the uptake of recycled and sustainable construction materials.

Restrictive standards and specifications

Several participants noted standards and specifications are often overly conservative, prescriptive and written with traditional materials in mind, therefore limiting allowable recycled content or prescribing that a conventional material must be used. Some noted a general need for standards and specifications to better accommodate sustainable materials or shift from prescriptive to performance-based standards or specifications (ACOR, sub. 256, p. 10; APCC, sub. 74, p. 3; Infrastructure Victoria, sub. 28, pp. 3, 6). Others highlighted specific requirements that limit the use of recycled aggregates, plastics, crushed glass, crumb rubber and reclaimed asphalt pavement in infrastructure applications (for example, ACOR, sub. 75, p. 26; BCSDA, sub. 175, p. 24). For instance, concrete and cement standards (for example,

[4] 'Sustainable construction materials' does not have a universally accepted definition (Ding 2014, p. 40), but generally refers to construction materials that have lower life cycle environmental impacts compared to traditional construction materials. Some recycled materials (such as crumbed rubber) have negative life cycle environmental impacts associated with their usage (such as micro plastics), and these impacts must be considered when determining a material's overall suitability as a sustainable alternative (Environment and Communications Committee 2025, pp. 98–99).

[5] Standards generally refer to high-level design and performance requirements for a product or process (such as Australian Standards). They can be voluntary or mandatory. Voluntary standards can be made mandatory by being referenced in regulations or specifications. Specifications are developed by asset owners (for example, transport departments) and set requirements for a project or asset type when engaging in contracts. Voluntary specifications are also developed by organisations (such as Austroads) and can be adopted by agencies for use in contracts. Most state infrastructure agencies have a jurisdictionally distinct, consistent set of technical specifications that are used in infrastructure procurement (Austroads 2021; Standards Australia 2025b; Sustainability Victoria 2023; TfNSW 2025).

Box 2.2 – Examples of restrictive or inconsistent standards or specifications

AS 3972-2010 – '*general purpose and blended cement'* and AS 3600-2018 – '*concrete structures'*) constrain the use of low-carbon supplementary cementitious materials and recycled aggregates, even when performance is proven (Albemarle, sub. 268, p. 5; CCAA, sub. 55, p. 16; CIF, sub. 222, p. 2; RMIT University, sub. 212, p. 4).

Lack of consistency in standards and specifications across states

Several participants and reports noted that inconsistency of standards and specifications across states and territories increases compliance costs for businesses that operate across multiple jurisdictions and seek to use new or novel sustainable materials (for example, ACOR, sub. 75, p. 28; APCC, sub. 74, p. 3; Australasian Railway Association, sub. 97, p. 6; CIF, sub. 78, p. 13; Engineers Australia, sub. 108, p. 3; Standards Australia, sub. 257, p. 1). The Australian Council of Recycling's submission and co-authored report highlighted instances where states have notably different recycled content limits in procurement specifications despite the procurement specifications referencing the same national standard (ACOR, sub. 75, pp. 183–213; Standards Australia and ACOR 2023, pp. 25–26). For example, the NSW Government's specification for allowable recycled crushed glass as granular base and subbase in road pavement is 10%, whereas in Victoria it is 5–10% for granular base and 15–50% for granular subbase (TfNSW 2020, p. 17; VIC DTP 2023b, p. 6; VicRoads 2017).

Reducing overly restrictive standards and specifications could provide access to lower cost, better performing and more sustainable materials for infrastructure. These benefits could be significant. In the next four years alone, investment in future public infrastructure is expected to total $270 billion (IPA 2024, pp. 2–3), and efficient net zero transition policy developments are likely to present opportunities for less emissions intensive construction materials.[6] Reducing overly restrictive standards and specifications could also help achieve government objectives related to sustainable procurement, particularly those that prioritise the use of recycled materials and the reduction of embodied carbon in infrastructure (for example, DCCEEW 2024f; Infrastructure NSW 2024; VIC DTP 2024b; WA DoT 2024b).

However, moving too hastily to performance-based standards and specifications, or harmonisation without better information on the purpose and details of each standard and specification, could have unintended consequences and result in worse overall outcomes. For example, prescriptive standards and specifications can have lower compliance and enforcement costs, and lower risks for contractors (Coglianese 2017, pp. 22–30; Thomson 2014, p. 6). Participants noted that prescriptive standards and specifications can also provide industry with certainty and ensure a benchmark level of quality without rigorous testing requirements. While greater harmonisation can reduce compliance costs, participants emphasised that it may also make updating standards and specifications more cumbersome. Changing standards and specifications without first identifying high-impact areas may also lead to efforts being focused on materials or asset classes with limited potential to tangibly improve environmental outcomes.

There is currently no definitive or consistent position on which specific standards or specifications are too conservative or outdated, and where changes will have the biggest impact. Several participants noted that while governments had made some progress, the large number of standards and specifications makes it difficult for them to provide meaningful advice on what needs changing. For example, there are over

[6] The public sector share of infrastructure work undertaken is also notably high, with governments responsible for 56% of primary contracting income for heavy and civil construction in 2023-24 (AiGroup 2025).

380 Australian Standards related to construction, and 150 state construction specifications in Victoria alone (Standards Australia 2025a; PC estimates, based on VIC DTP 2025b).7 One participant noted that the nature and extent of this issue is complex and varies significantly across asset classes (such as roads, rail and footpaths) and material types (such as concrete, steel and asphalt), and would require a review process that accounts for this variation. A few reports have catalogued specifications and standards that accommodate the use of sustainable materials and describe best practice applications of sustainable materials in infrastructure (ARRB 2022; Standards Australia and ACOR 2023). However, these reports do not identify specific standards and specifications that could be updated so they are more accommodating of sustainable materials.

To fill this information gap, Australian, state and territory governments should establish a working group to undertake a detailed stocktake and assessment of standards and specifications. The assessment would:

- identify and catalogue unnecessarily conservative and prescriptive standards and specifications relevant to infrastructure construction and maintenance that constrain the use of sustainable materials
- assess latent industry demand and local supply availability for the identified sustainable materials, to determine the extent to which these standards or specifications are constraining their use
- evaluate the feasibility of reducing these barriers by transitioning from prescriptive to performance-based approaches and/or harmonising standards and specifications across jurisdictions (without compromising safety), aligning with existing work being undertaken by organisations such as Austroads[8]
- recommend a shortlist of changes to standards and specifications based on their expected impact on the uptake of sustainable materials and their associated productivity and environmental benefits.

The stocktake and assessment should cover Australian Standards, state and territory government agency specifications (for example, from transport departments) and government-owned business specifications (for example, from water corporations).[9] Due to the breadth and complexity of standards and specifications related to infrastructure, the stocktake should start by focusing on standards and specifications related to infrastructure types that use the most virgin materials (such as roads and bridges) or materials with the largest life cycle environmental impact (such as concrete).[10]

The working group that progresses this review should have:

- representatives from Australian, state and territory governments, to ensure outcomes are fit for purpose across Australia
- technical knowledge of standards and specifications in infrastructure through consultation with relevant standards bodies and research organisations (such as Standards Australia and the National Transport Research Organisation), so recommendations are implementable and incorporate best practice industry knowledge
- connections with industry, such as contractors and material and product suppliers, so that recommendations consider the views and insights of industry at a practical level.

[7] Total Victorian specifications are calculated as the number of separate 100, 200, 300, 400, 500, 600, 700 and 800 series specification documents.

[8] Austroads is currently in the process of developing a suite of uniform road technical specifications for Australia and New Zealand with the goal of states and territories adopting the harmonised specifications to make contract and tendering processes easier (Austroads 2021).

[9] The stocktake and assessment should not include existing project-specific contractual arrangements, to avoid impacts on the speed of existing project delivery and make the scope more tractable.

[10] Concrete and cement have notable life cycle environmental impacts, with cement production contributing to 8% of global emissions, and emitting 4.7 million tonnes of CO2 in Australia in 2020-21 (CIF 2021; E360 2021).

The working group could be formed within an existing intergovernmental body, such as Austroads, or established through the Infrastructure and Transport Ministers' Meeting for the purposes of the stocktake. Drawing on the assessment findings, governments should consider reforms to streamline standards and specifications (for example, through the Infrastructure and Transport Ministers' Meeting) and progress those reforms in collaboration with standards and specifications bodies (such as Standards Australia and Austroads). The Australian Government should consider whether certain reforms could be progressed through national competition policy.

Recommendation 2.1
Perform a stocktake and assessment of standards and specifications limiting uptake of sustainable materials in infrastructure to enable regulation streamlining

To promote the fit for purpose use of sustainable materials in infrastructure, Australian, state and territory governments should establish a working group to undertake a staged stocktake and assessment of standards and specifications (including in Australian Standards and state infrastructure technical specifications). The stocktake should start by focusing on standards and specifications related to infrastructure types that use the most virgin materials (such as roads and bridges) or materials with the largest life cycle environmental impact (such as concrete). Drawing on the stocktake, the assessment should:

- identify and catalogue unnecessarily conservative and prescriptive standards and specifications relevant to infrastructure construction and maintenance that constrain the use of sustainable materials
- assess latent industry demand and local supply availability for the identified sustainable materials, to determine the extent to which these standards or specifications are constraining their use
- evaluate the feasibility of reducing these barriers by transitioning from prescriptive to performance-based approaches and/or harmonising standards and specifications across jurisdictions (without compromising safety), aligning with existing work being undertaken by organisations such as Austroads
- recommend a shortlist of changes to standards and specifications based on their expected impact on the uptake of sustainable materials and their associated productivity and environmental benefits.

Drawing on the assessment findings, governments should consider reforms to streamline standards and specifications (for example, through the Infrastructure and Transport Ministers' Meeting) and progress those reforms in collaboration with standards and specifications bodies (such as Standards Australia and Austroads). The Australian Government should consider whether certain reforms could be progressed through national competition policy.

2.3 Address knowledge gaps and confidence about sustainable materials

To promote confidence in using sustainable materials in public infrastructure, state and territory governments with major infrastructure investment commitments should introduce or expand related support services that establish dedicated facilitators for suppliers, contractors and asset owners (such as government agencies). Essential features and functions of these services would include establishing a small team of facilitators to interact with industry and government to address sector concerns, facilitate knowledge sharing, and better understand and implement sustainable ideas in infrastructure projects.

Engagement for this inquiry found knowledge gaps and a lack of experience can discourage industry from using recycled and other sustainable materials in infrastructure. Contractors and asset owners are sometimes unaware of the sustainable alternative materials available and can have misconceptions about their quality or performance. They also tend to lack confidence in the strength, durability and quality of sustainable materials, and rely on familiar materials to avoid unnecessary risk and focus on other delivery objectives (such as quality or speed) (for example, ACOR, sub. 75, p. 27; APCC, sub. 74, p. 3; CCAA, sub. 55, p. 18).

Existing government information and support services such as circular design guidelines and knowledge hubs are often insufficient to address these knowledge and skills gaps among suppliers, contractors and asset owners. For example, overcoming stakeholder concerns about using sustainable materials requires hands on, ongoing expert advice to work through regulatory and technical obstacles, or knowledge gaps about where to procure sustainable materials in specific projects.

In Victoria, the government is addressing these concerns through the ecologiQ program. EcologiQ is an ongoing program which works with suppliers, contractors and asset owners of major infrastructure projects to encourage uptake and optimise the use of recycled materials (VIC DTP 2023a). Its activities include helping businesses to overcome prescriptive or conservative technical specifications and working with departments and standards bodies to draft new standards.

The ecologiQ program is often cited as a leading example in providing personnel-based, tailored information and support services to build industry confidence in procuring sustainable materials (for example, ACOR, sub. 75, p. 29; Arup, sub. 52, p. 6; Australasian Railway Association, sub. 97, p. 5). For example, ecologiQ teams were instrumental in working with asset owners and specification bodies to develop a specification for the use of recycled plastic in freeway noise walls, which resulted in the development of a new national Austroads technical specification, and the use of more than 570 tonnes of wasted household plastic for the Mordialloc freeway (Austroads 2023; Sustainability Victoria 2022). The Australian Council of Recycling noted that the ecologiQ program has been ‘critical to building capability and confidence in procurement of sustainable and recycled materials’ (sub. 75, p. 29). Through delivery of the Recycled First policy, ecologiQ has incorporated approximately 3.4 million tonnes of recycled materials in major public infrastructure since its inception in 2019 (VIC DTP 2025a). The benefits of this type of model include the ability to accumulate and transfer learning from project to project and better understand stakeholder concerns.

Facilitation services, such as those provided by the ecologiQ program, are likely to be beneficial to other jurisdictions with commitments to major infrastructure projects. Challenges such as changing industry attitudes and filling knowledge gaps affect many novel or innovative sustainable practices, products or materials being used (such as low-carbon cement mixes or alternatives), not just recycled materials. Allocating even a very small proportion of the billions of dollars in public funding spent on public infrastructure to dedicated support services could help increase uptake of sustainable materials and practices, with economic and/or environmental benefits.

State and territory governments with commitments to major infrastructure projects should introduce or expand support services whereby dedicated facilitators work with suppliers, contractors and asset owners to:

- educate them about the use of sustainable materials in infrastructure, including addressing misplaced concerns about using sustainable materials and highlighting opportunities to use sustainable materials
- overcome regulatory or technical obstacles to using sustainable materials in specific projects
- connect suppliers of sustainable materials or products with potential customers (such as contractors and asset owners).

State and territory governments could tailor the scale and scope of these services to their own context including environmental objectives, projected infrastructure expenditure, recycling infrastructure and access

to sustainable materials. These changes would complement measures to help governments form a definitive, consistent position on which changes to standards and specifications (that are limiting the use of sustainable materials in infrastructure) would have the largest net benefits (recommendation 2.1).

Recommendation 2.2
Introduce or expand support services for suppliers, contractors and asset owners of major infrastructure projects to promote industry confidence in sustainable materials

To promote industry confidence in using sustainable materials in infrastructure, state and territory governments with commitments to major infrastructure projects should introduce or expand support services whereby dedicated facilitators work with suppliers, contractors and asset owners to:

- educate them about the use of sustainable materials in infrastructure, including addressing a lack of information or confidence about using sustainable materials and highlighting opportunities to use sustainable materials
- overcome regulatory or technical obstacles to using sustainable materials in specific projects
- connect suppliers of sustainable materials or products with potential customers (such as contractors and asset owners).

State and territory governments could tailor the scale and scope of these services to their own context including environmental objectives, projected infrastructure expenditure, recycling infrastructure and access to sustainable materials.

3. Food, agriculture and organics

Key points

- **Greater adoption of circular principles in the management of food, agriculture and organics could increase materials productivity and bring about economic, social and environmental benefits.**
  - Food production, packaging and distribution in Australia uses 215 million tonnes of raw materials annually, and Australian businesses and households waste more than 14 million tonnes of organic materials each year.
  - Reducing regulatory uncertainty for businesses seeking to produce, market or use products derived from wasted organic materials (that is, secondary organic materials, such as biochar) could increase materials productivity by diverting organic materials from landfill for productive uses.
- **After examining opportunities for circularity across the food and organics life cycle, and considering government policies already underway, the Productivity Commission is recommending further streamlining of state and territory regulations relating to organic materials reuse.**
  - To help realise the economic and environmental benefits from reusing wasted organic materials, state and territory governments should develop dedicated regulatory pathways that outline the requirements for organic waste to transition into saleable materials, beginning with biochar.
  - As a complementary measure, state and territory governments should change energy from waste regulations to distinguish between processes such as gasification and pyrolysis to produce biochar and conventional energy from waste processes (such as incineration), where this has not already been done.

3.1 Material use impacts and circular opportunities

The food and agricultural system in Australia uses and produces significant volumes of organic (and other) materials across primary production, distribution, retail, consumption and disposal activities. While many circular opportunities related to organics arise within the food system (for example, reducing the quantity of food discarded by farms, retailers or households), others arise elsewhere (for example, collecting and reprocessing household garden waste, or converting wastewater biosolids into circular products).

Opportunities for greater circularity of organic materials within the food system are interdependent with broader circular opportunities for organics. For example, greater conversion of food and agricultural wastes into natural fertilisers, biochar (box 3.2) or compost helps to develop the pathway for similar reprocessing of other organic materials such as wastewater biosolids managed by the urban water sector[1] and household waste (and vice versa).

[1] AWA (sub. 23, p. 1); Logan City Council (sub. 61, p. 2); qldWater (sub. 51, p. 2); Urban Utilities (sub. 71, p. 3).

Regardless of the source of reprocessed organics, these opportunities represent potential benefits for agricultural productivity and nature regeneration. The use of organic compost has been associated with improved soil health through increased microbial biomass and nutrient cycling, and improved soil structure (Larsen et al. 2022, p. 8). And the application of biochar to soils or as a livestock feed supplement has been associated with improved agricultural outcomes (Howell et al. 2023, pp. 152–153; Man et al. 2021, p. 208). Organics reprocessing also has broader benefits such as greenhouse gas emissions reductions. For example, converting organic materials to biochar and applying it to soil helps store the carbon of its organic inputs, avoiding the emissions that would otherwise enter the atmosphere during decomposition (Joseph et al. 2021, p. 3).

The food system and natural resources

Food production relies on natural resources, including land and water, and their associated ecosystem services and biodiversity. Approximately half of Australia's land area is used for agricultural production (ABS 2018), and the agriculture industry accounts for the majority of Australia's water consumption (BoM 2021, p. 44).

Food production can result in negative environmental impacts including the degradation of natural resources and ecosystem services such as water purification, nutrient cycling and pollination (Williams et al. 2021, p. 23). For example, prolonged fertiliser and pesticide use, where not well managed, can increase soil acidity, reduce the availability of plant nutrients and harm soil organisms and useful bacteria (Agriculture Victoria 2024). In Australia, regional natural resource management organisations work with people (including primary producers) and communities to take an integrated, landscape scale approach to managing land, water, soils and ecosystems. This approach regenerates and sustains productive landscapes and biodiversity (NRM Regions Australia 2025). Other innovations, such as precision agriculture techniques, have also reduced the unintended environmental impacts of some farming methods (Whelan 2019).

Some types of food production are also emissions intensive. Activity in the food and agriculture sector collectively contributed 11% of Australia's direct (scope 1) emissions[2] in 2023 (PC estimates, based on DCCEEW 2025b). Agriculture alone contributes more than half of Australia's total methane emissions each year (Hughes et al. 2024, p. 10), three quarters of which are ruminant emissions from livestock (CCA 2023, p. 9). Wasted organics[3] in landfills, approximately 75% of which is food and garden waste (DCCEEW 2021b), contributes about 2.5% of Australia's total emissions annually (DCCEEW 2025e).

The costs of food waste

Food waste occurs at all stages of the food product life cycle, including production, distribution, retail and consumption. Food waste includes both edible waste (food produced for human consumption but disposed of without consumption) and inedible food waste (such as seeds, bones, skins and peels) (DEE 2017, p. 8). Approximately 70% of Australia's food waste is edible food (FIAL 2021, p. 14). Australians collectively waste about 7.6 million tonnes of food each year, led by households (32%) and primary producers (22%) (PC estimates, based on FIAL 2021, p. 12), costing the economy almost $37 billion annually (FIAL 2021, p. 18).

[2] This includes direct emissions from the agriculture; aquaculture; forestry and logging; fishing, hunting and trapping; agriculture, forestry and fishing support services; and food, beverage and tobacco manufacturing subsectors. It does not include an adjustment for forest and wood product stocks, or account for other organics related emissions.

[3] Organic waste includes food and agricultural waste as well as timber waste and biosolids (DCCEEW 2025c, p. 45).

Opportunities for greater circularity

Food, agriculture and other sectors that use or produce organics contribute substantially to Australia's economic output and employment. The food system requires a significant volume of materials, particularly biomass (organic materials from plants and animals such as seeds, fertilisers and pasture). In the 2023-24 financial year, Australia's food and agriculture sector[4] accounted for about 9% of total Australian industry output (PC estimates, based on ABS 2025a). In the same period, about 2.4 million people (18% of the Australian workforce) were employed in food and agriculture jobs (PC estimates, based on ABS 2025a). The CSIRO estimates that the Australian food provision system accounts for 22% of materials used in Australia (215 million tonnes) (PC estimates, based on Miatto et al. 2024, p. 19). Consequently, even small materials productivity improvements could generate large economic and environmental benefits.

In the interim report, the Productivity Commission considered a range of opportunities for government action to increase circularity in the food and agriculture sector (figure 3.1). Some of these opportunities were:

- sustainable agriculture and natural resource management practices, both on individual farms and at landscape scales, which can reduce the materials intensity of agricultural production
- redirecting more surplus, edible food from waste for consumption
- advanced food barcode labelling, including origin and expiration information, which can reduce food wasted by retailers and distributors because of distribution inefficiencies
- advertising and labelling schemes which can raise awareness and knowledge among households about how to sort waste to reduce contamination and improve the recyclability of organic waste streams
- better accounting for the emissions reduction benefits of using biomethane in national carbon reporting rules, which could incentivise anaerobic digestion projects using residual organic materials.

In many cases, governments have taken, and are continuing to take, actions that facilitate the uptake of these (and other) opportunities. For example, several government policies have recently been introduced to reduce Australia's food waste throughout the product life cycle (box 3.1). A wider range of natural resource management and sustainable agriculture opportunities are outside the scope of this inquiry, but some of these could be supported by the place-based initiatives proposed in chapter 7.

After assessing opportunities against several considerations (chapter 1), the PC is recommending streamlining state and territory regulations to help realise the economic and environmental benefits from reusing wasted organic materials.

Since the interim report, the Australian Government has progressed changes to better account for the emissions reduction benefits of substituting natural gas for biomethane derived from the anaerobic digestion of organic materials.[5] The Australian Government's *National Greenhouse and Energy Reporting (Measurement) Amendment (2025 Update) Determination 2025* (Cth) addresses the potential accounting gaps identified in the interim report.[6] In particular, the amendments now recognise renewable gas certificates, awarded for biomethane consumption, as evidence of abated emissions for Safeguard Mechanism or National Greenhouse

[4] The food and agriculture sector includes non-forestry agriculture subsectors and food manufacturing, wholesaling and retailing subsectors. Compared to other sectors discussed in this report, the inclusion of wholesaling and retailing contributions may increase the estimated economic size of the sector. However, as these are important stages of the food life cycle, they have been included. This estimate also does not capture the value of the broader organics sector, which provides essential services (such as wastewater management) that underpin public health and wellbeing.

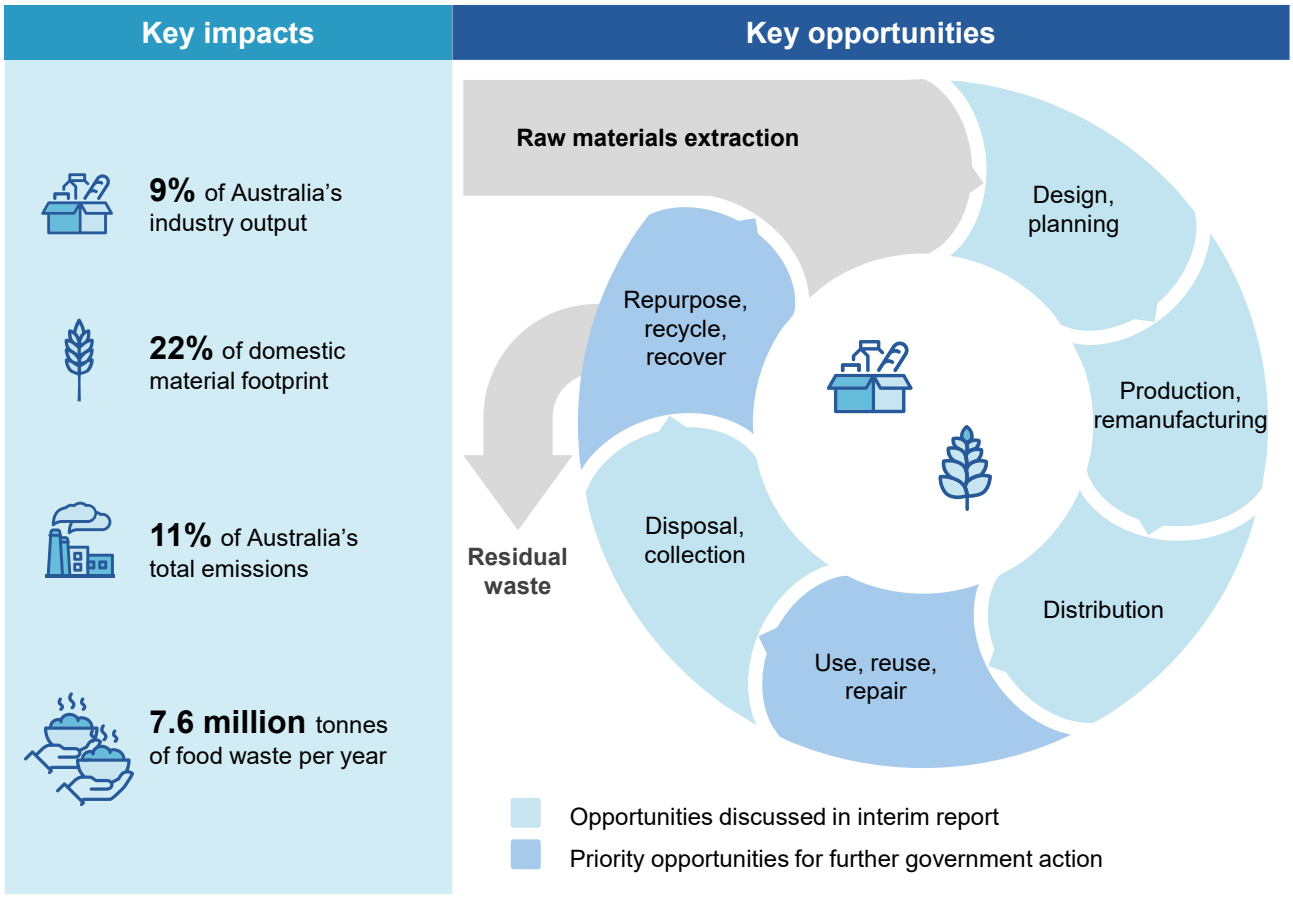
[5] Biomethane is a net zero energy source, as combusting biomethane only releases the carbon absorbed by the organic material from which it was derived (CER 2022a, p. 7).

[6] The amendments are enacted by inserting section 2.67C into the *National Greenhouse Energy Reporting (Measurement) Determination 2008* (Cth).

and Energy Reporting (NGER) obligations. As a result of this change, both consumer and investor confidence in biomethane should improve (APGA, sub. 258, p. 2; Jemena, sub. 250, pp. 3-4; RGA, sub. 254, p. 3), along with, in turn, the economic feasibility of anaerobic digestion projects.

Likewise, the Australian Government Minister for Agriculture has also committed to developing a national food strategy to improve Australia's food security and food system (Collins 2025). This strategy should identify where and in what quantity agricultural commodities are grown and distributed, and where there are opportunities to reduce food waste.[7] This information would enable the strategy to include social and environmental goals of the food system, such as reducing food waste and aspects of food insecurity. For example, better mapping of biological material flows (including food) would enable food rescue organisations to recover more edible food and reduce food waste (Nelson et al. 2025, p. 73). Once developed, this strategy could be combined with existing information repositories, such as FoodBank's recently developed *Hunger Map* (FoodBank Australia 2025), to inform policy decisions about additional measures to reduce food waste and food insecurity, such as regional food storage hubs (box 3.1).

Figure 3.1 – Food, agriculture and organics at a glance



Source: PC estimates, based on ABS (2025a); DCCEEW (2025b); Miatto et al. (2024); FIAL (2021).

[7] This is in line with recommendations 14 and 18 of the House of Representatives Standing Committee on Agriculture's inquiry into food security in Australia (Agriculture Standing Committee 2023, pp. 103–104).

Box 3.1 – Food waste remains an issue, but governments, businesses and communities are taking action

Governments at all levels have taken a range of actions to encourage the reduction of food waste.

At the production level, recent changes to the **Food and Grocery Code of Conduct** impose stricter financial penalties on retailers for negligent over-forecasting of fresh produce demand and require fresh produce standards (including shape and size) to be reasonable (ACCC 2025b; The Treasury 2024c, p. 10). At the household level, state and territory governments fund **education campaigns** to inform households how to sort their waste to enable recycling and reduce waste contamination (GISA 2021). And the Australian Government provided $10 million of funding to the End Food Waste Australia charity to administer a national behaviour change campaign targeting household food waste (EFWA 2024, p. 23). States are working with local governments to improve the collection and recycling of household food waste. For example, the NSW Government has committed to work with local governments to achieve state-wide **food organics collection** by 2030 (NSW EPA 2025). The Australian Government has also committed to Sustainable Development Goal 12.3: halving Australia's food waste by 2030, an objective articulated in ***Australia's National Food Waste Strategy*** (DEE 2017).

Some governments are also pursuing opportunities to reduce food waste and food insecurity by addressing barriers to food rescue. Each year, approximately 2 million Australian households – disproportionately located in regional areas – experience severe food insecurity, which is characterised by reduced food intake and multiple indications of disrupted eating patterns (Guerrero et al. 2024, pp. 8, 55, 63, 67). While there are many causes of food insecurity, a lack of donations – particularly of fresh food – is a contributing factor (Kroell 2023, p. 5). Meanwhile, primary producers generate approximately 1.4 million tonnes of edible food waste annually (PC estimate, based on FIAL 2021, p. 14), including food that was either surplus to retail orders or did not meet retailers' requirements for food appearance. Though some of this wasted food could be diverted to people experiencing food insecurity, the costs of storing and transporting rescued food is often prohibitive (AFGC 2024, p. 4; AUSVEG 2024, p. 6; Food & Fibre Gippsland Inc. 2024, p. 1; NFF 2024, p. 3). To reduce these costs of donating food, the Victorian Government has recently invested in regional food hubs. In the 2022-23 financial year, six government-funded regional food hubs in Victoria distributed more than 2,200 tonnes of food (predominately sourced through donations) to people in need (DFFH 2024, p. 21), which has reduced both food waste and food insecurity. Beyond the environmental and emissions benefits of reduced food waste, reductions in food insecurity has several social benefits, such as improved psychological wellbeing (Ejiohuo et al. 2024, p. 2), physical health (Pollard et al. 2019, p. 7), student performance (MacDonald 2019, pp. 11–12), and improved community relationships (Vaiciurgis et al. 2024, p. 6).

Government policies that aim to reduce food waste and alleviate food insecurity through food rescue provide an opportunity to advance the priority reforms in the **National Agreement on Closing the Gap**. For example, investing in food relief infrastructure could provide opportunities for governments to empower community-controlled sector leadership of local food systems. This would advance the fourth goal of the ***National Strategy for Food Security in Remote Aboriginal and Torres Strait Islander Communities***: supporting Aboriginal and Torres Strait Islander families and communities to provide access to culturally appropriate and nutritious food (NIAA 2025, p. 40).

3.2 Develop clearer regulatory processes for reusing organic materials

Valuable organic materials are being lost in landfill

Each year, Australian households and businesses landfill millions of tonnes of organic material which contributes to Australia's greenhouse gas emissions.[8] In the 2022-23 financial year, more than 6 million tonnes of organics (including food and garden organics, biosolids[9] and timber) were disposed of in landfill (DCCEEW 2025c, p. 84). Organic waste in landfill is estimated to release 13 million tonnes of carbon dioxide equivalent emissions annually, or 2.5% of Australia's total emissions (DCCEEW 2025e).

The productive life of residual organic materials can be extended by using them to produce organic fertilisers and products such as biochar (box 3.2). Diverting these materials from landfill, transforming them into carbon-stable products and substituting them for synthetic alternative materials not only avoids the greenhouse gas emissions associated with organic material decomposition, but also creates broader environmental benefits. For example, the use of organics-derived materials has been shown to help improve soil chemistry and nutrient bioavailability, and reduce the negative effects of synthetic materials use, such as nitrogen run-off (Larsen et al. 2022, p. 8; Wei et al. 2021, p. 7).

Box 3.2 – Biochar as an alternative to sending organic materials to landfill

Although some production methods of biochar are relatively new, Aboriginal and Torres Strait Islander people have used biochar for thousands of years to promote soil health, improve crop growth and mitigate the risk of bushfires. Biochar is a carbon-rich, charcoal-like solid that can be used as a feed supplement, alternative fertiliser or construction material, and has been associated with improved agricultural outcomes (Chowdhury et al. 2025, pp. 14, 16; Man et al. 2021, p. 208). Agricultural waste, crop residues, animal waste, biosolids in wastewater sludge, and digestate (a solid by-product from anaerobic digestion) can all be transformed into biochar through advanced processing methods such as pyrolysis or gasification (Amalina et al. 2022, p. 1). Biochar also stores much of the carbon of its organic inputs, avoiding the emissions that would otherwise arise as the organic material decomposes (Lehmann et al. 2006, p. 405).

[8] These effects would be even more pronounced if not for existing efforts from households, businesses and governments to recover wasted organics. Over 60% of the 14.6 million tonnes of organic waste produced in Australia in the 2022-23 financial year was recovered for composting, fertilisers and energy production (DCCEEW 2025c, p. 45).

[9] Biosolids are a mix of the water and organic materials leftover from the sewage treatment process. Biosolids can contain valuable macronutrients such as nitrogen, phosphorous, potassium and sulphur, but can also contain hazardous contaminants such as arsenic, mercury and selenium (ANZBP 2016, p. 1).

Regulatory barriers are stifling the production, sale and use of secondary organic materials

Regulations can stifle the production and use of secondary organic materials.[10]

In some states and territories, regulatory requirements governing the sale, transport and use of secondary organic materials add to producers' costs of production and constrain their ability to recycle wasted organic materials without contributing to regulatory objectives such as protecting the environment, human health or social amenity.[11] For example, in some jurisdictions, regulatory processes classify secondary organic materials as a waste. This means to be able to produce, transport or receive these materials, businesses must satisfy a range of requirements. These requirements can apply uniformly across a range of materials, despite differences in costs, risks and benefits. For example, in Victoria, biochar, bottom ash and digestate are all classified as a 'reportable priority waste' and are regulated by the same generic waste classification regulation which applies to all residues from industrial waste treatment (VIC EPA 2025a).

The absence of clear guidance about what requirements must be met for a material derived from otherwise wasted organics to transition from classification as a waste to a material (for example, through an end of waste code) adds further uncertainty and compliance costs. While some governments have developed codes for some materials (such as biosolids and digestate), only Queensland has developed a code for biochar, finalised in May 2025 (QLD DETSI 2025). Investors and industry groups have indicated this lack of a clear regulatory pathway has created substantial uncertainty for users and investors and stifled the uptake of biochar opportunities in particular.[12] Pyrocal (sub. 209, p. 2) noted, in the case of Logan City's biosolids gasification plant, the lack of specific regulation governing when biochar can be applied to land had also prevented the generation of economic returns to existing investment in biochar.

In addition, biochar production can also be stifled by policies that restrict thermal treatments of waste for energy recovery, because some types of thermal treatment processes (such as pyrolysis and gasification) are those that can be used to also generate biochar. The objective of these policies is typically to incentivise businesses to reuse materials for, alternative, higher value purposes, rather than disposing of and treating waste to generate energy only. For example, in the Australian Capital Territory, all thermal processes for treating waste are banned (ACT TCCS 2020, p. 9). Similarly in Greater Sydney, thermal treatment of some wasted organics, including for the production of secondary materials, is not permitted (NSW DPHI 2025).[13] However, by restricting processes such as pyrolysis and gasification, these effective bans also restrict or prevent the production of biochar. As noted, biochar has broader economic and environmental benefits beyond energy recovery alone, such as improvements to agricultural productivity and carbon sequestration (box 3.2). In recognition of these benefits, Victoria, for example, has already instituted exemptions from waste to energy production caps for 'thermal pyrolysis process[es] to sequester carbon' (VIC DELWP 2021, p. 13), which includes biochar production. An international study also demonstrated that using pyrolysis to create biochar produces emissions which are simpler to control compared to conventional energy from waste methodologies, such as incineration (Flatabø et al. 2023, p. 11). By classifying all 'thermal' treatments of

[10] A secondary material is a material which has been used once before, recovered and reprocessed for subsequent use (Circle Economy 2025, p. 65).

[11] For example, risks such as the contamination of groundwater, release of bacteria into the atmosphere, or creation of odour (VIC EPA 2025b).

[12] ANZBIG (sub. 173, p. 44); Jemena (sub. 250, p. 5); Pyrocal (sub. 209, p. 2); WMRR (sub. 168, p. 7); WRAP (sub. 230, p. 11).

[13] Some exceptions to these restrictions exist in Greater Sydney, including for the thermal treatment of contaminated soils or biosolids. The first overarching principle used by the NSW Environment Protection Authority to assess proposals to thermally treat waste for energy recovery is that 'higher value resource recovery outcomes are maximised' (NSW EPA 2023).

waste together (such as incineration, pyrolysis and gasification), regulations can become poorly targeted and fail to account for the specific costs, risks and benefits of each process.

Specific regulations for recovering wasted organic materials should be a priority

To help realise the economic and environmental benefits from reusing wasted organic materials,[14] state and territory governments should develop dedicated regulatory pathways for organic waste to be converted into saleable materials.

Dedicated regulatory pathways which clearly outline the requirements for a material derived from wasted organic material to be transported, sold, applied to land or used as a livestock feed supplement would facilitate greater regulatory certainty and transparency for businesses, and allow regulations to be tailored to the unique risks, costs and benefits of each material. These pathways could be established through, for example, guidelines, an end of waste code or a resource recovery order and exemption (depending on the existing regulatory architecture in each jurisdiction). In turn, this would unlock the potential of these materials while managing the risks of their production and use.

To complement these pathways and accommodate the production of secondary organic materials where it is economically feasible, state and territory governments should amend energy from waste regulations to distinguish processes such as pyrolysis and gasification to produce biochar from traditional energy from waste processes (such as incineration) to recognise the circular benefits of the former, where this distinction is not already made. This would be in line with the European Union's *Best Available Techniques Reference Document for Waste Incineration*, which notes that pyrolysis and gasification can be used to recover both the energetic and chemical value of waste (including its chemical properties), unlike combustion which can recover only the energetic value (Neuwahl et al. 2019, p. 57). As discussed, some jurisdictions have already instituted these distinctions. These regulations should be harmonised between different jurisdictions as far as practicable. Governance arrangements which facilitate harmonised circular economy regulations are discussed in chapter 7.

Biochar is a priority material for the development of dedicated regulatory pathways given its particular agricultural and environmental benefits when used, and its scope for increased production in Australia. According to the Australia New Zealand Biochar Industry Group, Australia has an annual biochar production potential of up to 30 million tonnes by 2050 (Rebbeck et al. 2022, p. 6), up from a domestic production of approximately 20,000 tonnes in 2020 (ANZBIG 2023, p. 8). Though the Emissions Reduction Assurance Committee (ERAC) has not prioritised developing a proposed biochar production Australian Carbon Credit Unit (ACCU) method,[15] it did note there was a large and diverse range of potential feedstocks for biochar production which represented a large carbon abatement opportunity (DCCEEW 2024j, p. 18). A 2023 South Australian parliamentary inquiry into biochar also recognised the benefits of greater regulatory clarity,

[14] This recovery is consistent with targets three and six of the National Waste Policy Action Plan 2024 (DCCEEW 2024h, pp. 9, 12): to increase the resource recovery rate from all waste streams to an average of 80% and to halve the amount of organic waste sent to landfill by 2030, respectively.

[15] The Australian Government Department of Climate Change, Energy, the Environment, and Water (DCCEEW) is implementing a new proponent-led process for developing and modifying ACCU methods, which was recommended by a 2022 Independent Review of the ACCU scheme (Chubb et al. 2022, p. 10). While the Australian Government progresses legislative reforms to implement the review's recommendations, there is an interim process whereby proponents put forward method expressions of interest to the ERAC for inclusion in the scheme. The ERAC then uses triage criteria (including scale, complexity, innovation, co-benefits and adverse impacts) to inform their recommendations to the Minister about which expressions of interest should be prioritised for method development (ERAC 2024, p. 5).

recommending the development of regulations and certifications for biochar producers to facilitate greater production (Natural Resources Committee 2023, p. 73).

In designing dedicated regulatory pathways for organic waste to be converted into biochar and other saleable materials, governments will need to balance the protection of public health and safety with the economic and environmental benefits of regulatory settings that encourage the conversion of wasted organic materials to circular products. This trade-off arises because regulations that ensure materials derived from wasted organic materials meet certain quality standards increase production costs and therefore reduce the feasibility of opportunities to repurpose wasted organic materials (ACOR, sub. 75, p. 19; Hunter Joint Organisation, sub. 172, p. 13; Pyrocal, sub. 209, p. 2). Some participants noted concerns that preliminary efforts to create a dedicated process for biochar use in Queensland[16] resulted in regulations that are overly cautious.

- Jemena (sub. 250, p. 5), a renewable energy producer, noted that the end of waste code for digestate (a by-product of anaerobic digestion and common source of biochar) requires digestate to have lower levels of contaminants (including per- and polyfluoroalkyl substances) than would be present in the general environment before it can be used as an input. They describe this regulation as 'unnecessarily strict'.
- Pyrocal (sub. 209, p. 2), a biochar production engineering firm, noted the end of waste code for biochar would require producers to undertake testing for contaminants that would cost approximately $130,000 per year, resulting in reduced uptake of the production technology.

In assessing the suitability of contamination thresholds and broader production licensing arrangements for secondary organic material production and marketability, governments should ensure that regulation governing the recovery of organic waste, like all government regulation, does not unnecessarily inhibit innovation nor constrain the productivity of these materials. Robust and transparent regulatory approaches, in line with the principle of regulatory stewardship (chapter 7), provide greater certainty for investment in organic waste processing technology and facilitate the uptake of circular opportunities.

In addition to dedicated regulatory pathways, governments could also support the uptake of biochar and other organic waste derived materials opportunities by continuing to evaluate regulations for both existing and emerging contaminants of feedstock. Some inquiry participants[17] suggested that reforms to prevent chemicals of concern from entering products and waste streams in the first place should also be considered as a means of facilitating the recovery of value from wasted organic materials. Approaches to dealing with chemicals of concern are discussed further in chapter 8.

Some participants also suggested that additional supports for the separation of organic waste from other waste at its source would reduce contamination and incentivise organic material recovery and valorisation in ways that return nutrients to soils (GISA, sub. 245, p. 3; Veolia Australia and New Zealand, sub. 193, p. 3). Source separation of organic waste is already incentivised through the NGER legislation, where segregating organic waste for composting, anaerobic digestion or fuel production is recognised as emissions abatement (CER 2024b). Up to January 2022, only 13 projects had been registered under the method and collectively claimed just under 7,000 ACCUs (CER 2022b, p. 1). As noted by one inquiry participant, this relatively low uptake could be caused by the complexity of the measurement requirements under this method (GISA, sub. 245, p. 2). The source separation of organic waste ACCU method is currently under review by DCCEEW (DCCEEW 2025h). This review will consider the sufficiency of the method in promoting source separation of organic waste and should also include consideration of whether the complexity of measurement requirements is a barrier to higher uptake.

[16] The Queensland Government finalised the biochar end of waste code after submissions to this inquiry had closed.
[17] ACOR (sub. 256, pp. 12-13); LGAQ (sub. 244, p. 6); qldWater (sub. 51, p. 4); Veolia Australia and New Zealand (sub. 8, p. 2); WARRRL (sub. 87, p. 11); WMRR (sub. 168, p. 6); ZWV (sub. 169, p. 4).

Recommendation 3.1
Develop clearer regulatory processes to realise the economic and environmental benefits of reusing wasted organic materials

To help realise the economic and environmental benefits of reusing wasted organic materials, state and territory governments should develop dedicated regulatory pathways that outline the requirements for organic waste to transition into saleable materials, beginning with biochar.

In developing dedicated regulatory pathways, governments should:

- clearly outline the requirements for a waste-derived material to be transported, sold, applied to land or used as a livestock feed supplement (including source materials and contamination thresholds)
- balance the risks of processing organic waste streams with the economic and environmental benefits of recovering value from wasted organic materials.

Governments should complement these pathways by changing energy from waste regulations to distinguish between processes such as gasification and pyrolysis to produce biochar and conventional energy from waste processes (such as incineration), where this is not already done.

4. Mining

Key points

- **Incorporating circular economy principles in Australia's mining operations (including in mine closure and transition) could increase the economic and social benefits derived from materials.**
  - For example, enabling repurposing of post-mining land, infrastructure and mining residues could result in social, economic and environmental benefits. For perspective, around 240 Australian mines are expected to end their economically productive life between 2021 and 2040.

- **The Productivity Commission examined opportunities for governments to promote circularity across the mining life cycle and found the key priorities relate to repurposing of post-mining land, infrastructure and residues.**
  - Companies adopt circular opportunities in exploration, extraction and processing for commercial reasons, once technologies reach sufficient readiness. Governments also support the mining sector to adopt circular practices in various ways, such as funding mining research and development.
  - There is lower uptake of circular opportunities that capture value from repurposing post-mining land, infrastructure and residues.

- **Australian governments should facilitate increased repurposing of post-mining land, infrastructure and residues, where this is of net benefit to the community.**
  - State and territory governments should develop land transition plans for regions and communities that are experiencing or are soon to experience significant mine closures. These plans should assess the sites that will become available post-mining and establish priority future beneficial uses for them in partnership with Aboriginal and Torres Strait Islander people and the broader community.
  - State and territory governments should review and amend the regulatory frameworks and processes that guide mine closure and transition, to facilitate the development of innovative post-mining land uses where they are of net benefit to the community. The review should include relevant provisions in mining, environmental, health and safety, and planning legislation, and associated regulations and policies.
  - The Australian Government should update national guidance for leading practice mine closure and transition, incorporating environmental, social and economic considerations. It should set expectations for partnering with Aboriginal and Torres Strait Islander people, community members and local governments, to inform mining companies' decision-making throughout a mine's operation, including preparing for after mine closure.
  - These actions would work together: regional plans would enable communities to identify priority repurposing opportunities; national guidance would help embed best practice option evaluation and engagement in plans; and reducing regulatory barriers would reduce the cost of realising the opportunities.

4.1 Material use impacts and circular opportunities

The mining sector extracts naturally occurring resources such as metal ores, coal, sand, gravel and natural gas (ABS 2013). Mining involves exploration and planning, extraction, sorting and basic processing (such as grinding and washing). This report has not examined circular opportunities in more advanced mineral processing. Due to its role in extracting raw materials, the mining sector has supply chain links with many other sectors, such as the built environment (chapter 2). Enhancing circular practices and improving materials productivity in mining can therefore have flow-on impacts to other sectors.

Environmental impacts associated with materials mining

Developing and operating mine sites can significantly disturb lands and waterways, resulting in air and water pollution, biodiversity loss and soil erosion, which can in turn negatively affect human health, and social and cultural connections to the land (Leyton-Flor and Sangha 2024, p. 2). These impacts can remain long after a mine closes. Australia has over 50,000 abandoned mines (Salmi et al. 2022, p. 6). Many of these pose contamination risks because they operated before regulators introduced modern environmental and safety practices (Abraham et al. 2018, p. 123). Even modern mines that are subject to stricter environmental management can continue to have long-term impacts on the landscape. For example, a 2017 research paper found fewer than 30 examples of fully rehabilitated and relinquished mines across Australia (Campbell et al. 2017, p. 10).

Mining activities produce various residues such as overburden (soil and rock removed to access the desired commodity), waste rock and tailings (fine particle residue left after the desired materials are removed during processing). In 2020-21, the mining sector produced 620 million tonnes of wasted materials, which was more than four times the wasted materials of all other sectors combined (DCCEEW 2022a, p. 17). If mining companies do not properly manage tailings and other residues, or if there is a failure in tailings storage facilities (TSFs), contaminants can negatively affect water quality, surrounding soils, and the air (Salmi et al. 2022, p. 11; University of Melbourne, sub. 36, p. 8).

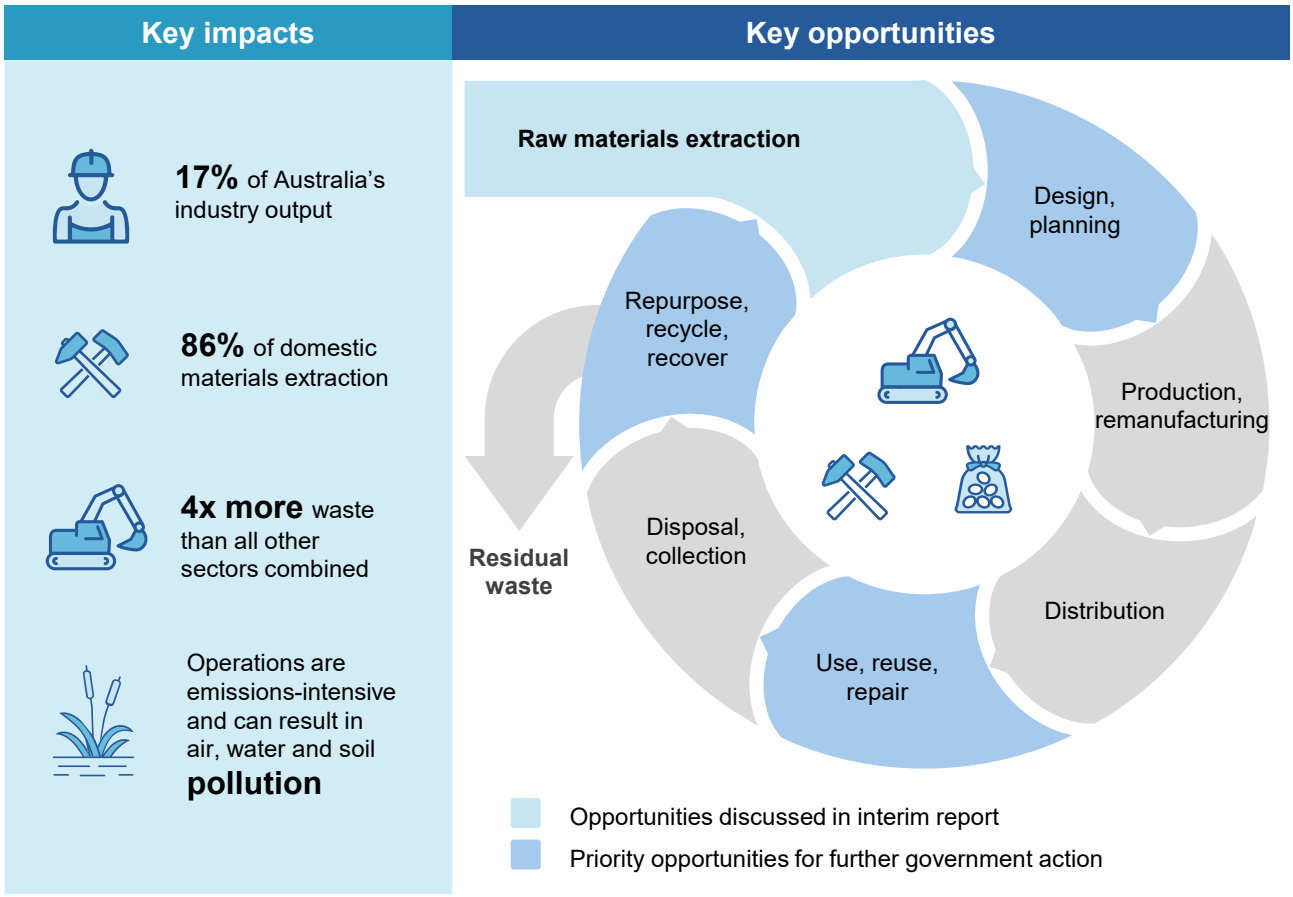
Opportunities for greater circularity in mining

In the interim report the Productivity Commission identified a range of circular economy opportunities across the mining life cycle that are applicable in an Australian context (figure 4.1):

- minimising generation of wasted materials through lower-impact and precision techniques that enhance the precision of exploration and selectivity of extraction (CSIRO 2017, pp. 47–48, 2023, pp. 12–13)
- life-extension and reuse of mining equipment through maintenance and refurbishment
- recovering mineral resources, such as critical and strategic minerals, from mining residues
- recycling mineral residues into products such as silica-sand products (ore-sand), low-carbon geopolymer concrete, mineral fertilisers, or for backfilling and road construction (Golev et al. 2022, p. 4; MRIWA 2024)
- repurposing mining tailings for carbon capture through mineral carbonation
- reducing and recycling non-mineral materials that have been wasted, such as plastic packaging
- repurposing of post-mining land and infrastructure through alternative post-mining land uses.

After assessing opportunities against several considerations (chapter 1), the PC is recommending government actions to facilitate repurposing post-mining land, infrastructure and residues. Circular economy opportunities in mining residues and post-mining land uses appear to have significant potential to increase materials productivity, with scope to grow due to their lower rates of adoption. As discussed below, there are also potential impediments to adopting these activities arising from current regulations, which governments could address.

Figure 4.1 – Mining at a glance



Source: ABS (2025a); DCCEEW (2022a); Leyton-Flor and Sangha (2024); Miatto et. al (2024).

The PC is not recommending additional government actions to promote circular economy opportunities in the exploration, extraction and processing phases of the mining life cycle. In these earlier phases, governments offer support by funding research and development initiatives such as CSIRO's development of NextOre, a precision mining technology that uses magnetic resonance imaging for advanced sorting of mineral ores (MCA 2022, pp. 22–23). Moreover, these practices are already relatively widespread in Australia, as efficiency improvements are often aligned with commercial incentives (MCA, sub. 269, p. 4).

Inquiry participants have suggested that a ban on in-pit burial of off-the-road tyres be implemented to increase the recovery rates of off-the-road tyres (ATRA, sub. 227, p. 5; Tyrecycle, sub. 261, p. 2). Some participants noted a ban would have safety and environmental benefits including reduced fire and contamination risk (TSA, sub. 148, p. 88; Tyrecycle, sub. 261, p. 3). However, a ban would impose costs on mining companies and result in environmental impacts associated with transporting tyres from remote mines to recycling facilities (although there may be reverse logistics opportunities in some instances). Governments would also need to allocate substantial additional resourcing to monitor and enforce compliance with a ban. Moreover, in the absence of sufficiently developed end markets for recovered materials and products in Australia,[1] wider economic and environmental benefits of efforts to increase collecting tyres cannot be realised at this time.

[1] In 2023-24, 75% of recovered end-of-life tyres (by weight) were exported, mainly for use in energy recovery (TSA 2024, p. 3).

The PC understands that there is a current government process investigating policy reforms for end-of-life tyre management that could potentially fill the information gaps (DCCEEW 2023a, p. 3). The Western Australian Government, via the Department of Water and Environmental Regulation has led a national project on options for end-of-life tyres to support Australian Environment Ministers as they consider the next steps for end-of-life tyre management. The project researched the issues and various policy solutions for end-of-life tyres, and included an investigation into the challenges and opportunities for off-the-road tyres (WA DWER, pers. comm., 24 July 2025).[2] As such, the PC considers Australia's Environment Ministers to be best placed to decide on policy actions regarding end-of-life tyre management. However, any decision must consider the key issues highlighted above including the environmental impacts of the various options for end-of-life tyres, the economic costs of compliance for industry and enforcement for government, and progress in developing viable markets for end-of-life tyre products.

4.2 Facilitate repurposing of post-mining land, infrastructure and mining residues

Mine closures offer challenges and opportunities for communities

Australia faces current and emerging challenges associated with managing the impacts of materials use and disposal in mining, once mining activity has ceased. Current challenges include managing the environmental and economic impacts of current and historic mining practices, which can persist long after mine sites have closed (Beer et al. 2022, p. 9), as well as realising the value from left over mining materials and by-products. These challenges are significant in Australia given it is home to over 2,200 active mines and over 50,000 closed and abandoned mine sites (CSIRO 2023, p. 2; Salmi et al. 2022, p. 9).

An emerging challenge is managing socioeconomic and environmental transitions in regions significantly impacted by mine closures. Around 240 Australian mines are expected to end their economically productive life between 2021 and 2040, with most of these closures concentrated in Western Australia, Queensland and New South Wales (CSIRO 2023, pp. 2, 55). Mine closures can have major economic and social impacts on the surrounding communities and broader regions (Sinclair et al. 2022, p. v). Many regional areas in Australia are highly reliant on mines for employment. In 2024, 45% of the mining workforce was in regional or remote Australia (AUSMASA 2025). Mining also generates local business activity (such as food, accommodation and healthcare services), which in turn support the local economy and enhance the quality of life for residents (Blackwell et al. 2017, pp. 2–3). For example, Resources NSW estimated that coal mining created 22,000 direct jobs and around 89,000 indirect jobs in New South Wales (2022, p. 4). This means when mines close, there can be flow on effects to the broader region.

Applying circular principles to post-mining land, infrastructure and residues could help address both these challenges. Traditionally, when a mine closes, the goal of site rehabilitation is to return it to a safe, stable and non-polluting landform suitable for its pre-mining use (such as agriculture) (enviroMETS QLD 2023, p. 5; MCA, sub. 269, p. 6). However, there are opportunities for alternative uses that repurpose elements of post-mining land, infrastructure and residues for social, economic and environmental benefit. These opportunities vary considerably by site and range from proposals to reprocess mine tailings and other residues to extract remaining minerals and create valuable products, to using mined land to host clean energy projects, recreational or scientific facilities (AMEC, sub. 143, pp. 6-7; Beer et al. 2022, p. 21; CRC

[2] Project findings were provided to Australian Environment Ministers at their 10 December 2024 meeting, along with an undertaking to release two reports in 2025, which detailed the project's research and findings.

TiME, sub. 224, p. 2). One example of repurposing post-mining land that aims to generate economic benefits is the Rhonda Colliery mine in Lake Macquarie, New South Wales. The former mine site is in the process of being transformed into a motor park and tourist destination, and the NSW Government has indicated that this will create more than 450 jobs during construction, 229 permanent roles and generate ongoing economic activity through tourism (Houssos 2024).

Despite the potential benefits, there are only a handful of Australian examples of mining companies or third parties repurposing closed mine sites for alternative social or economic uses (AMEC, sub. 143, pp. 6-7; Beer et al. 2022, p. 21; CSIRO 2023, p. 38). The small number of successful examples of repurposing reflects the barriers that exist, in particular the limitations of existing regulatory and planning processes.

How governments should facilitate repurposing post-mining assets

Develop land transition plans for affected regions

To facilitate post-mining land uses that benefit and are aligned with local community needs, state and territory governments should develop land transition plans for regions and communities that are experiencing, or are soon to experience, significant transitions away from mining. State and territory governments should assess the mined land, infrastructure and residues that will become available as mines close, and develop plans that establish priority future beneficial uses for them, informed by a collaborative planning approach in partnership with communities and aligned with existing regional plans.

Current approaches to mine transition are usually site-focused and proponent-led (CRC TiME, sub. 224, p. 7). However, impacts of mine closure are felt regionally, particularly where mine closures are concentrated in one area. For example, it is predicted that decarbonisation and the rollout of alternative energy sources will lead to extensive coal mine closures, which will have significant impacts for certain regions (Wood et al. 2022, pp. 44–45). In Australia, coal mines are heavily concentrated in the Mackay region (Bowen Basin, Queensland) and in the Hunter Valley and surrounding areas (Sydney Basin, New South Wales) (Geoscience Australia 2025b). There are also locally important coal mining operations in Collie (Western Australia) and the Latrobe Valley (Victoria) (Geoscience Australia 2025b). In New South Wales, it is expected that by 2040 most of the state's coal mines will be closed, which will have significant impacts for the Hunter region (Department of Regional NSW 2024). Collie and the Latrobe Valley are also experiencing significant coal mine closures (Government of Western Australia 2023a, p. 1, 2023b, p. 1; State Government of Victoria 2020, p. 3). An uncoordinated approach to mine closure and transition risks not producing the best environmental, social and economic results for the local region (Hunter Renewal, sub. 206 attachment, pp. 12–13).

State and territory governments should develop land transition plans through a collaborative regional planning process that partners with Aboriginal and Torres Strait Islander people, community members and local governments to determine priority uses for post-mining land, infrastructure and residues. A regional approach allows the selection of priority land uses for sites to be informed by broader regional needs and the sites' comparative advantages. For example, some sites will have characteristics that make them relatively more suited to future industrial uses, such as renewable energy generation or municipal waste recovery. Such characteristics include established infrastructure, access to electricity and transport networks, access to suitable workforces and specific landform features (NSWMC, sub. 200, p. 2; State Development Committee 2025, pp. 105–106; WMRR, sub. 233, p. 10). Other sites may have characteristics that make them relatively more suited to biodiversity and conservation activities, such as location in a potential biodiversity corridor or having unmined buffer lands or rehabilitated areas that have significant biodiversity value (State Development Committee 2024, p. 20). Certain areas may have Indigenous Land Use Agreements in place, whose agreed outcomes should be reflected in transition plans.

The process of genuine partnering and shared decision making should align with governments' obligations under Priority Reform 1 of the National Agreement on Closing the Gap. Reflecting the products of this engagement transparently in public planning documents, should give communities confidence that their priorities are being considered in the decisions made by mining companies, and also by regulators when approving alternative post-mining land uses. One potential model for this is in Victoria's Latrobe Valley, where state government, local government and the community are guiding post-mining land use planning, as part of broader regional development planning and investment. The collaborative planning process is being supported by the Cooperative Research Centre for Transformations in Mining Economies. It proposes future land use options for post-mining lands that are supported by key stakeholders and address a range of community benefits, including Aboriginal and Torres Strait Islander people's aspirations. The project incorporates existing regional strategies and plans, aiming to support broader regional economic development (CRC TiME 2024a; Haque et al. 2024).

While collaborative planning in the Latrobe Valley occurred in response to imminent mine closures, there are benefits to developing regional transition plans well before mine closures occur. Establishing regional plans early creates greater certainty for mine operators and potential developers looking to invest in alternative post-mining land uses, given that the approval process for changing post-mining land uses can be lengthy and the outcome is uncertain. Regional plans should promote the shared responsibility of mining operators for post-mining transitions by guiding their activities before closure, including shaping their financial contributions to any industry or government-managed regional development funds. Establishing priority land uses should enable mining companies to adjust their mine closure plans early and tailor any progressive rehabilitation activities towards known goals. This also benefits mining operators by reducing the risk that considerable resources are expended on rehabilitation activities, which are then potentially disturbed by new development or that potentially valuable infrastructure is removed (NSWMC, sub. 200, p. 23). It may also facilitate the progressive realisation of opportunities during the life of a mining operation. For example, the Stawell Underground Physics Lab in Victoria reuses mining infrastructure in a closed portion of an operating mine (CRC TiME, sub. 224, p. 4).

The significance of mine closure and transition on a region should be assessed to determine if a transition plan will be beneficial. While mining occurs in all states and territories of Australia (Geoscience Australia 2025a),[3] as discussed, some states currently have, or will have, areas with higher concentrations of mine closures. Also, some mine closures are likely to have greater regional impacts due to factors such as low regional diversification in non-mining economic activities. State and territory governments should consider the social, environmental and economic impacts of mine closure before selecting which regions, if any, require land transition planning.

Review state and territory regulatory frameworks and processes

To facilitate the beneficial repurposing of post-mining land, infrastructure and mining residues, state and territory governments should review and amend the regulatory frameworks and processes that guide mine closure and transition. The review should include relevant provisions in mining, environmental, land management, planning and health and safety legislation, and associated regulations and policies. The review should consider:

- making regulatory pathways for modifying agreed post-mining land uses clearer and more streamlined, to facilitate innovative post-mining land uses and multiple successive land uses

[3] There is no mining in the Australian Capital Territory apart from quarries used for construction materials.

- creating clear decision frameworks for regulators to assess the net benefits (environmental, social and economic) of future uses
- ensuring that any increases in flexibility appropriately balances the need for rehabilitation to be undertaken in a manner that is safe and environmentally responsible
- ensuring that amendments to the regulatory frameworks and processes sufficiently consider and incorporate governments' commitments under the National Agreement on Closing the Gap. For example, ensuring that goal and objective-setting for these regulatory reform processes is undertaken in partnership with and reflects the interests of Aboriginal and Torres Strait Islander communities. Amendments to approval processes should maintain or improve requirements to partner and engage with Aboriginal and Torres Strait Islander communities.

Environmental regulation, planning and approval processes are necessary to keep mining companies accountable for managing mining residues, mine rehabilitation and closure in an environmentally responsible and safe manner. However, they can add unnecessary compliance burden if they are overly restrictive (for example, not risk-based) or do not evolve with changing circumstances. Regulatory burdens and the associated delays can negatively impact the commercial value of former mine sites and their assets, reducing their competitive advantage over other unmined sites (NSWMC, sub. 200, p. 7). The opportunities created through regulatory reform could be significant, for example, enviroMETS (sub. 208, p. 3) estimates that 'regulatory reform could unlock 20–40 viable PMLU [post mining land use] and reprocessing projects across Queensland within 5 years'.

The rehabilitation objectives that define a post-mining land use are typically agreed upfront as part of the mining project's development and environmental approvals (Cooper et al. 2024, p. 1225). Mining lease holders are also required to provide a draft mine closure and/or rehabilitation plan prior to commencing operations (Hamblin et al. 2022, p. 29). Traditionally, governments and regulators have preferred mining companies return land to its pre-mining state following mine closure (CRC TiME 2024b, p. 4). Establishing rehabilitation objectives upfront is necessary to provide protections against future environmental and safety risks. However, it also means that the objectives are set many years before a mine closes, so may not represent the greatest benefit to the community at the point of mine closure. In fact, they may be in conflict with beneficial post-mining land uses and can result in mining operators removing potentially valuable mine assets, such as infrastructure, as part of the mine closure process (Cooper et al. 2024, p. 1225; CRC TiME 2024b, p. 4).

The process for altering approvals to allow for an alternative post-mining land use is often complex and time-consuming, which acts as a deterrent to pursuing alternative land uses (State Development Committee 2025, pp. 22–23). Regulations that affect repurposing of existing mines include mining lease conditions, state and potentially Australian Government environmental approvals, along with related land use agreements with Traditional Owners (MCA, sub. 269, p. 6). Changing the agreed post-mining land use therefore requires many separate but interlinked approvals under different pieces of legislation, which are the responsibility of different government departments (NSWMC, sub. 200, p. 8-10).

Mining operators may also be disincentivised from considering alternative post-mining land uses as mining lease arrangements result in them taking on new risks when accommodating alternative uses (enviroMETS QLD 2023, p. 8; Kragt and Manero 2021, p. 4). For example, in New South Wales, the mine operator must continue to hold the mining lease until the new development (alternative post-mining land use) is finalised and the rehabilitation of the site is certified by the Resources Regulator as complete. As a result, the mining operator continues to be liable for the site and maintains the security deposit for the mining lease while works are being carried out, likely by third parties (NSWMC, sub. 200, p. 3).

Mining-related regulations can also act as a disincentive to innovative uses of mining residues, although the extent of this barrier varies dependent on circumstances. For example, regulatory barriers are limited where the reprocessing occurs at an operating mine, where the same operator extracts the primary ore and undertakes tailings reprocessing for the same mineral (Albemarle Lithium, sub. 268, p. 8). However, regulations can shift legacy environmental liabilities from previous operators onto new operators when taking over a site to repurpose its land or assets, such as reprocessing historic mining residues, affecting the viability of these operations.[4] There are also restrictions on transporting mining residues which can limit these opportunities, for example in Queensland 'benign waste rock is unable to be used off site as it is considered 'quarry material'… There are instances where large rocks are imported from overseas for various uses in dam and port construction when local materials from mines could easily provide resources' (AMEC, sub. 248, p. 4).

There is a risk that increasing regulatory flexibility results in an increase in perverse outcomes, such as rehabilitation not being completed in a satisfactory manner. When reviewing and amending the relevant regulatory frameworks and processes, consideration should be given to maintaining or improving biodiversity and conservation outcomes, to ensure that the benefits associated are not lost when increasing flexibility for the repurposing of post-mining land, infrastructure and residues. Regulators will also have to ensure that they have the appropriate skills and resources available to assess the risks, costs and benefits of innovative post-mining land uses.

Publish renewed national guidance for mine closure and transition

The success of the mining industry in Australia depends on its ability to meet community expectations on environmental, social and governance standards (MCA 2021, p. 3), and post-mining land use is emerging as a significant social license consideration (CME, sub. 251, p. 2). For industry to 'gain access to future resources it needs to demonstrate that it can effectively manage and close mines with the support of the communities in which it operates' (Commonwealth of Australia 2016, p. 1).

Renewing the national guidance for mine closure and transition,[5] would allow the Australian Government to establish current leading practice principles and approaches as well as setting expectations for how mining companies manage mine closure and transition. National guidance would help inform mining operators and state governments on how to update their policies and practices in line with community expectations and global expertise. National guidance can build on international guidelines released by the International Council of Mining and Minerals in their Integrated Mine Closure Good Practice Guide (3rd Edition). These are valuable sources of best practice, but given the breadth of their target audience, they cannot replace guidelines that are fine-tuned to the Australian context and that take into account Australia's institutional and regulatory capacity (Beer et al. 2022, p. 14).

Updating national guidance is an opportunity for the Australian Government to collate the lessons learned by various state and territory governments and use them to inform ongoing practices. States and territories have disparate approaches to the management of mine closure which 'represents an array of perspectives on how best to balance the range of environmental, economic, and social concerns associated with mine closure' (CRC TiME 2022, p. 1). Some state and territory governments are exploring options that may better facilitate circular economy opportunities in post-mining land use. They also have existing practices and lessons learnt that could be of value to other states, notwithstanding the differences between jurisdictions. For example, in Western Australia, the *Land and Public Works Amendment Act 2023* introduced a new land

[4] Albemarle Lithium, sub. 268, p. 8; enviroMETS QLD 2023, p. 9; MCA, sub. 269, p. 6; PC 2020d, p. 230; SA DEM, sub. 260, p. 2.

[5] The current national guidance is the Mine Closure Handbook which is part of the Leading Practice Sustainable Development Program for the Mining Industry series (Commonwealth of Australia 2016).

tenure option called a diversification lease. This lease enables multiple activities to coexist on the same land, which may facilitate circular opportunities such as reusing mining infrastructure for renewable energy projects. In South Australia, decisions around post-mining land uses are guided by a Multiple Land Use Framework which 'aims to balance the interests of multiple stakeholders and promotes transparency and consistency when making land use decisions, including through targeted engagement with communities' (SA DEM, sub. 260, p. 2). In New South Wales, a recent parliamentary inquiry was conducted into beneficial and productive post-mining land use, which made a number of recommendations including a review of post-mining regulatory frameworks and processes and a comprehensive program of reform of current land uses and opportunities for future uses across regions experiencing mining and energy transition (State Development Committee 2025, pp. x–xii).

The Australian Government should ensure the updated national guidance advises mining operators and relevant government departments on how they should evaluate the environmental, social and economic values and trade-offs of post-mining land use options (recognising the considerable variability that exists between different types of mines and materials). For example, the national guidance could include an expectation that mining operators and government departments use contemporary tools to evaluate environmental, social and economic values, such as natural capital assessment and accounting (where feasible) and identify relevant resources to help them apply those tools.

The Australian Government should also ensure the updated national guidance sets clear expectations and offers guidance on how mining operators engage and partner with communities to inform decision-making. For example, ensuring engagement, partnerships and planning about future opportunities begins early in the mine's life cycle and continue to be iterated in response to communities' changing expectations and needs. The guidance should clarify how mining companies should partner with Aboriginal and Torres Strait Islander people, community members and other groups to determine mine transition outcomes that benefit the community (CRC TiME, sub. 224, p. 7). A key element of this includes acknowledging and integrating Aboriginal and Torres Strait Islander knowledges and values into plans and enabling shared decision-making.

> This includes respecting cultural knowledge around sacred sites and protocols (such as the Barramundi Dreaming site at Argyle Mine … integrating Indigenous ecological knowledge around appropriate species selection and restoration objectives … and incorporating local cultural values around both the aesthetic and practical aspects of post-mining land use. (Holcombe et al. 2025, pp. 6–7)

The guidance should also clearly articulate mechanisms through which environmental, economic and social benefits can be shared with Aboriginal and Torres Strait Islander people, including through private arrangements such as negotiated agreements.[6]

One inquiry participant has suggested that the Australian Government develop enforceable national standards around mine closure (Hunter Renewal, sub. 206, p. 1). While guidelines are non-enforceable, elements of them can become enforceable if state regulators encourage their incorporation into mine closure plans as a condition of holding the mining tenure (Guj and Rogerson 2024, p. 8). Through consultation, the PC has heard there is substantial variation among states and territories, both in terms of their regulatory

[6] Negotiated agreements are a potential way for mining operators to share the benefits derived from post-mining opportunities with Aboriginal and Torres Strait Islander people and enable self-determined cultural, environmental and socioeconomic outcomes through the mine closure process. For example, an agreement between the Dja Dja Wurrung Clans Aboriginal Corporation (DJAARA) and Agnico Eagle, the operator of Fosterville Gold Mine, will enable DJARRA to influence the environmental elements of current mining operations and remediation work after the mine closes. The agreement also facilitates employment, training and business opportunities for Dja Dja Wurrung people (Agnico Eagle 2024). However, such agreements can have risks and limitations where there is unequal bargaining power between the parties (Holcombe et al. 2025, pp. 8-9).

environment and the types of mining assets within their jurisdictions. Developing guidelines rather than standards offers flexibility, enabling adaptation to specific contexts and customisation to accommodate jurisdictional differences.

Land transition planning, review and amendment of regulations related to mine closure and updated national guidance would work together to enable the repurposing of post-mining land, infrastructure and mining residues that results in the highest community benefit. Regional plans would enable communities to identify priority repurposing opportunities; national guidance would help embed best practice option evaluation and engagement in plans; and reducing regulatory barriers would reduce the cost of realising the opportunities.

Recommendation 4.1
Update regulatory and planning frameworks to enable repurposing of post-mining land, infrastructure and mining residues to increase benefits for the community

To enable repurposing of post-mining land, infrastructure and mining residues that has the greatest net benefits for the community:

- State and territory governments should develop land transition plans for regions and communities that are experiencing or are soon to experience significant mining transition. These plans should assess the sites that will become available and establish priority future beneficial uses for them in partnership with Aboriginal and Torres Strait Islander people and the broader community.
- State and territory governments should review and amend or augment the regulatory frameworks and processes that guide mine closure and transition, to facilitate the development of innovative post-mining land uses where they are of net benefit. The review should include relevant provisions in mining, environmental, health and safety and planning legislation, and associated regulations and policies.
- The Australian Government should update national guidance for leading practice mine closure and transition, incorporating environmental, social and economic considerations. The guidance should establish best practice methodologies and set expectations for mining companies to partner with Aboriginal and Torres Strait Islander people, local communities and local governments, sharing decision-making to determine transition outcomes that offer net benefits to the community.

5. Electronics

Key points

- **Greater adoption of circular principles could markedly increase materials recovery and productivity, while managing key environmental, health and safety risks of electronic waste (e-waste).**
  - Australia collects only half its e-waste, with 80% of this sent to low-efficiency recycling processes. This suggests an opportunity to recover valuable materials, reduce reliance on virgin materials, and lower the risks from disposing e-waste (including fire hazards from the improper disposal of lithium-ion batteries).
- **The Productivity Commission has considered opportunities for governments to promote circularity across the electronic product life cycle, recognising efforts already underway. The PC is making recommendations relating to product stewardship for three types of products: small electronics, solar photovoltaic (PV) systems and electric vehicle (EV) batteries.**
  - Given New South Wales has committed to introducing Australia's first state-based mandatory product stewardship framework for battery products including small electronics, and other states and territories are considering similar legislation, the Australian Government should work with state and territory governments to develop and implement a national framework, including key design elements, to ensure a consistent approach across jurisdictions. This work should be an immediate priority given the environmental, health and safety risks of lithium-ion battery fires.
  - To prevent similar risks of regulatory fragmentation across jurisdictions, the Australian Government should urgently establish a national product stewardship scheme for small-scale solar PV systems under Commonwealth legislation and investigate the merits of a similar scheme for EV batteries.
- **To strengthen the impact of product stewardship schemes for electronic products, complementary measures should also be implemented, such as product labelling, reuse and repair targets, broader right to repair policies and consumer education campaigns.**

5.1 Material use impacts and circular opportunities

Electronic products, from household appliances and communication devices to emerging technologies such as solar photovoltaic (PV) systems[1] and electric vehicle (EV) batteries, are ubiquitous in modern life. The waste from these products, 'e-waste', is now one of the world's fastest growing waste streams and is outpacing the capacity of the collection and recycling sector by almost a factor of five (UNITAR 2024, p. 12; WHO 2024). The growth in e-waste globally is being driven by increasing demand for electronic products

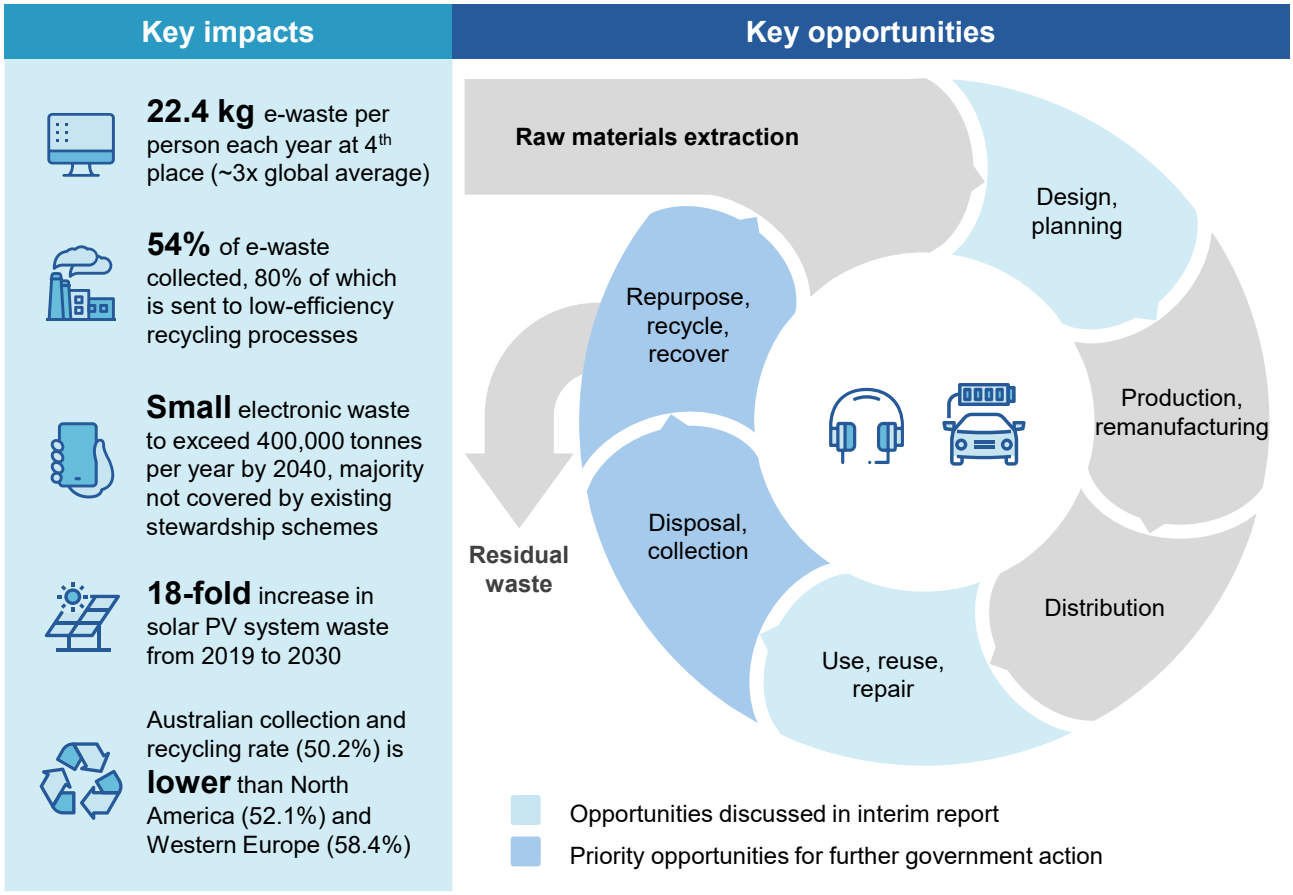
[1] Solar PV systems include solar panels, inverters, attached cabling, racking and household energy storage batteries.

and the faster turnover of these devices, partly due to consumers' desire to upgrade to newer models and because many products are not designed for repair and therefore have shorter lifespans. Limited repair options or awareness around recycling may also be contributing to the growing volume of e-waste in Australia and internationally (AMTA, sub. 221, p. 5; Sircel 2024, p. 18; UNITAR 2024, p. 28).

E-waste poses environmental, health and safety risks, including fire hazards from lithium-ion batteries and the leakage of toxic substances and persistent organic pollutants. In 2022 alone, global e-waste led to an estimated US$78 billion in costs to human health and the environment (UNITAR 2024, p. 16). Yet there is also significant value in the metals contained in e-waste, worth an estimated US$91 billion globally that same year, including copper, gold and iron (UNITAR 2024, p. 16).

In the interim report (PC 2025a, pp. 129–130, 132–149), the PC identified a range of opportunities to increase the adoption of circular economy practices across the life cycle of electronic products. It noted that Australia produces high e-waste per person but has low recovery rates compared to other countries (figure 5.1).

Figure 5.1 – Electronics at a glance[a]



a. Many raw materials used in electronic products are supplied by the mining sector (chapter 4).
Source: PC estimates, based on UNITAR 2024, pp. 12, 119–120, 122–137; CIE 2023a, pp. 3–4; DCCEEW 2021a, pp. 7–8.

Moreover, Australia's electronics supply chain is largely import-dominated, with little domestic influence over product design. The interim report examined how government actions could improve repairability and durability and support the reuse and repair sector. The interim report also examined the effectiveness of product stewardship for small electronics, solar PV systems and EV batteries.

After assessing these opportunities against several considerations (chapter 1), the PC is recommending progressing the development of product stewardship schemes for three classes of electronic products: small electronics, solar PV systems and EV batteries. Addressing the circularity of electronic products in Australia requires a whole-of-life approach with scaled funding and coordination, given Australia's net importer status and the expected increase in high-value, high-risk waste streams from the clean energy transition. Product stewardship (box 5.1) requires all parties involved in a product's supply chain (including manufacturers, importers and retailers) to share responsibility for managing its environmental impacts across the life cycle, including safe recovery and material reuse. Product stewardship provides a potential mechanism to drive both upstream design improvements and downstream recovery systems, especially where other policy tools such as import standards, landfill levies or export bans are unlikely to be effective on their own.

Box 5.1 – Product stewardship schemes in Australia

A product stewardship scheme (PSS) establishes shared responsibility among businesses across the supply chain, including manufacturers, importers and (sometimes) retailers, to manage a product's environmental and human health impacts throughout its life cycle (DCCEEW nd; PSCOE nd).

Each PSS is run by a scheme operator (industry or government), which pools funding from participating businesses to address the product's collective impact. This can include establishing collection points for used products, supporting recycling facilities, running public education campaigns or developing design standards.

Under the *Recycling and Waste Reduction Act 2020* (Cth), PSSs can be voluntary, co-regulatory or mandatory, with government involvement varying based on industry structure and the level of risk associated with the product (Environment and Communications Committee 2025, p. 80; Nous Group 2024).

- Voluntary PSSs allow businesses to choose whether to participate, without official regulatory oversight from the government or other body.
- Mandatory and co-regulatory PSSs require businesses (meeting specified criteria) to participate, with penalties for non-compliance.
  - Under a mandatory PSS, government establishes and administers the scheme, setting obligations for all liable parties.
  - Under a co-regulatory PSS, industry administers the scheme, but government oversees compliance.

Most PSSs in Australia are voluntary (such as schemes for mobile phones, tyres and loose, handheld batteries). At the Commonwealth level, Australia currently has one mandatory PSS (oil) and two co-regulatory PSSs (packaging and televisions/computers) (DCCEEW 2024i). All state and territory governments operate mandatory PSSs for beverage containers. New South Wales has recently implemented the *Product Lifecycle Responsibility Act 2025* (NSW), establishing a framework for mandatory product stewardship for specific products such as small electronics.

Voluntary schemes can work well for low-risk products or industries where coordination is easier, while mandatory schemes may be needed for high-risk products or fragmented supply chains (Nous Group 2024). However, a common criticism of voluntary schemes is free riding, which is when businesses benefit from a PSS without contributing to its costs (Environment and Communications Committee 2025, p. 82).

PSSs are particularly valuable because they incentivise manufacturers, importers and retailers – those with the most influence over product design and higher-order circularity initiatives – to take responsibility

Box 5.1 – Product stewardship schemes in Australia

for the products they place on the market. This can drive more cost-effective circular practices across the entire life cycle (John Gertsakis nd; PSCOE, sub. 267 att. 1, p. 5).

Other policy instruments, such as import standards, taxes, subsidies, right to repair legislation, waste levies and export bans, can complement PSSs by targeting specific stages of the product life cycle. However, none of these instruments alone offer the systemic approach of an effective PSS, with its shared accountability across the supply chain and ability to foster collaboration and innovation among industry players (PSCOE and UTS ISF 2023, pp. 15, 17).

The PC has also previously recommended a suite of policy measures to facilitate consumer access to affordable repair services, including for electronics, which the Australian Government is yet to implement. These include a product labelling scheme for repairability and durability, the inclusion of reuse and repair targets in the National Television and Computer Recycling Scheme (NTCRS), and broader right to repair policies around copyright, consumer and competition reform.[2] Progressing these measures from the PC's Right to Repair inquiry (2021c) would complement the recommendations in this chapter, encouraging greater circularity of electronics in Australia. Improving public awareness and consumer education on the safe disposal of e-waste, particularly for products with embedded lithium-ion batteries due to the risk of fires and injuries as raised by the ACCC (2023b, p. 42), is also an important complement to well-designed and effective product stewardship.

5.2 Ensure a nationally consistent approach to product stewardship for small electronics

Small electronics, including personal devices (mobile phones, tablets, laptops, cameras, game consoles), household products (kitchen appliances, grooming devices, electric toothbrushes, remote controls, small vacuum cleaners) and other equipment (power tools, children's toys, lighting products) represent one of the fastest growing e-waste categories in Australia. By 2040, the volume of small electronic waste in Australia is projected to exceed 400,000 tonnes annually, a significant proportion of which remains unmanaged under existing product stewardship schemes (CIE 2023a, pp. 3–4). All Australian Environment Ministers have recognised the urgent need to address the fire risks largely caused by embedded batteries in small electronic waste (DCCEEW 2024d, p. 1, 2024e, p. 2).

The incorrect storage and disposal of small electronic products can cause harm to the environment and present serious health and safety risks, as well as missed opportunities for the recovery of highly valuable metals such as gold and silver. Many of these devices contain embedded lithium-ion batteries and other hazardous components, and their small size means that households often discard them in general waste streams or store them indefinitely (Jayasiri et al. 2023, p. 1). The increased prevalence of lithium-ion battery products is expected to increase battery-related fires in homes, trucks and waste facilities, as well as the risk of toxic leachate contaminating soil and groundwater (ACCC 2023b, pp. 16–17, 20).

[2] These include amending copyright laws to allow repairers to bypass digital locks for legitimate repair activities; requiring manufacturers to provide access to repair information, spare parts and tools; stronger enforcement of consumer guarantees on durability; and oversight of restrictions that potentially limit competition in independent repair markets.

In Australia, governments and industry manage e-waste for some electronic products through voluntary or co-regulated product stewardship schemes.[3] Such schemes require liable parties to take responsibility for the end-of-life management of these products (box 5.1). While these schemes currently focus on recycling, partly because outcomes are easier to measure and infrastructure is more established, they also have scope to support reuse and repair activities, such as by setting targets, funding repair and parts recovery services and helping to develop secondary markets.

As identified earlier, many small electronic products such as kitchen appliances, personal care devices, power tools, children's toys and e-cigarettes do not fall under these existing product stewardship schemes. The main mechanisms for managing their disposal (if any) include voluntary programs, ad hoc council collection points and retailer take-back initiatives.

Inquiry participants identified the need to address the risks posed by the incorrect disposal of small electronic products, particularly fire hazards associated with embedded lithium-ion batteries, and noted that voluntary, industry-led product stewardship schemes are inadequate to manage these risks effectively (ACOR, sub. 256, p. 5; BSC, sub. 223 att. 1, pp. 2–3; WMRR, sub. 233, p. 12). The Senate Environment and Communications References Committee's report on waste reduction presented evidence from submissions and testimonies of the limited effectiveness of existing voluntary product stewardship schemes (including those for tyres and batteries), citing low participation rates, lack of enforcement mechanisms and free-rider problems (Environment and Communications Committee 2025, pp. 82–84).

Product stewardship could help drive both upstream design improvements and downstream recovery systems for small electronic product waste in Australia in a more holistic, flexible and cost-effective way than addressing specific issues individually through policies like import standards, financial incentives (such as import taxes, landfill levies or 'cashback' schemes), disposal bans and export restrictions.

- While import standards can prevent unsafe or low-quality small electronics from entering Australia, they do not address fire risks, which typically result from improper disposal and storage regardless of product design. Import standards also do not encourage consumers and businesses to divert used electronics from landfill to reuse or recycling, especially given the low cost and convenience of disposal, even when recovery would deliver net benefits. Enforcement is also challenging, particularly for products sold online or entering through complex supply chains. Additionally, when based on international benchmarks, import standards may not align with the maturity of Australia's recycling infrastructure or recovery systems.
- While financial incentives and disposal bans can influence behaviour, such as discouraging the landfill of small electronics, designing these instruments to be cost-effective and avoid unintended consequences can be challenging. For example, raising waste levies alone may lead to increased illegal dumping or stockpiling in households. Avoiding such outcomes requires adequate collection and recycling infrastructure to also be in place, which is a core focus of product stewardship schemes.
- Export restrictions may prevent harmful dumping of e-waste overseas and keep valuable materials within Australia, but without a framework to fund and coordinate safe collection and recycling they do not ensure that domestic systems exist to manage this waste effectively.

In contrast, product stewardship schemes embed life cycle responsibility into industry practice and offer a coordinated framework for managing e-waste. Unlike standalone policy tools, they can integrate upstream and downstream activities, aligning design improvements, consumer education and infrastructure funding within a single system. The nature of e-waste, including its growing volume, small and dispersed form, and combination of both valuable and hazardous materials, means that risks emerge across multiple stages of the electronic product life cycle. These range from poor design and limited repairability, to unsafe disposal

[3] The NTCRS is a co-regulatory product stewardship scheme for televisions and computers. Mobile Muster and B-cycle are two government-accredited, industry-led, voluntary product stewardship schemes for mobile phones and loose, hand-held batteries respectively.

and loss of critical resources. The measures discussed above may complement product stewardship, but they cannot replace its integrated, system-wide approach.

The Australian Government has previously acknowledged the shortcomings of existing arrangements for managing e-waste streams, and commissioned analysis examining the benefits of a national co-regulatory product stewardship scheme for small electronics and solar PV systems. The *Wired for Change* discussion paper outlined a national co-regulatory product stewardship proposal for small electrical and electronic equipment (SEEE) and for small-scale solar PV systems (DCCEEW 2023d). A cost benefit analysis of the SEEE scheme found the costs associated with processing, administration and network operations would ultimately be borne by the consumer but are outweighed by the environmental benefits, with an estimated net economic benefit in present value terms of approximately $32 billion (CIE 2023a, p. 8).[4]

Australian Environment Ministers noted at the June 2024 Environment Ministers' Meeting (EMM) that battery fires were becoming an escalating issue and interventions were required throughout the battery product life cycle (DCCEEW 2024e, p. 2). Inquiry participants, including some state and territory governments, raised the limitations of 'patchwork' schemes across Australia and indicated their preference for a nationally led approach. These limitations included inconsistencies between jurisdictions, industry compliance, and dealing with a large and diverse set of imported consumer electronics. However, given the urgent risk of battery fires, the December 2024 EMM discussed a draft regulatory impact statement on state-based legislation presented by New South Wales and Victoria (DCCEEW 2024d, p. 1). The *Product Lifecycle Responsibility Act 2025* (NSW) was introduced in March 2025 and is Australia's first state-based, mandatory product stewardship framework, focusing initially on battery products including small electronics and requiring 'brand owners'[5] to register products, manage safe recycling and disposal, lead public education and improve product design for safety and recyclability.

As it appears through regular interjurisdictional meetings that states and territories are considering similar legislation to progress their own product stewardship schemes for battery products, there remains an important role for the Australian Government to assist states and territories to ensure national consistency to limit compliance burdens on manufacturers, importers, local governments and industry. To achieve this, the Australian Government should work with state and territory governments to develop and implement an agreed national framework for state-based schemes. This national framework should focus on a core set of design features that provide consistency and reduce the risk of fragmentation, unnecessary complexity and cost to industry, including:

- consistent definitions of scheme scope – clearly identifying which small electronic products are covered under schemes to avoid confusion and regulatory gaps
- clear performance targets for collection and recovery – ensuring that all jurisdictions are working towards the same measurable outcomes, such as minimum collection rates or material recovery thresholds, to drive accountability and ongoing improvement
- nationally aligned compliance standards – so that safety, transport and handling protocols are harmonised, reducing risks in managing hazardous components and ensuring recyclers can operate across jurisdictions without duplication or conflicting requirements
- nationally transferable scheme registration requirements for brand owners – establishing clear processes, including a shared forum for registering products and identifying responsible entities, with consideration of mutual recognition between jurisdictions, to streamline compliance and improve transparency
- shared data and reporting requirements – to support robust monitoring, enable cross-jurisdictional analysis and build a national evidence base for improving scheme performance over time.

[4] This estimate is largely driven by non-market benefits – consumers' willingness to pay for environmental damage avoided by the scheme of about $150 per adult per year, on average (CIE 2023a, pp. 81, 84).

[5] Under s. 6(1)(a) of the *Product Lifecycle Responsibility Act 2025* (NSW), a 'brand owner' owns the name under which a product is supplied in New South Wales. This could include manufacturers, importers or retailers.

These design features help ensure that businesses operating across jurisdictions face clear, consistent obligations. They also enable the tracking and analysis needed to monitor scheme effectiveness, identify emerging issues and adjust settings over time.

Additional elements, such as incentives for circular design, targets for reuse and repair, responsibility for education campaigns and shared oversight mechanisms should also be incorporated to align with broader circular economy objectives and strengthen the system's ability to deliver higher-order environmental outcomes. However, these elements depend on the core features identified above to function effectively. Without consistency on scope, targets, compliance, registration and data, the system risks becoming fragmented, underperforming and costly to administer.

The Australian Government should also assist jurisdictions by identifying and resolving regulatory and legislative roadblocks (both Commonwealth and state and territory), providing policy or technical guidance, and stepping in where interjurisdictional discussions stall or reach their limits. In particular, the Australian Government may need to take a more active role in areas beyond state and territory governments' control or influence (such as import controls and product design standards) or where national coordination may be needed (such as consistency around the cross-border movement of waste) to ensure a coherent national approach.

To reduce the risk of individual state- and territory-based schemes resulting in regulatory fragmentation and unnecessary complexity and cost to industry, the Australian, state and territory governments should agree to key design features of product stewardship for battery products, including small electronics, within six months. The Circular Economy Regulatory Reform Taskforce outlined in recommendation 7.1 could provide the forum for this interjurisdictional cooperation and collaboration.

Recommendation 5.1
Develop and implement a national framework to ensure consistent approaches to small electronics product stewardship across states and territories

To reduce the risk of differences in product stewardship arrangements across states and territories imposing costs on industry (without commensurate benefits to safety or the environment), the Australian, state and territory governments should develop a national framework to ensure consistent approaches to small electronics product stewardship across jurisdictions.

The Australian Government should assist and work with jurisdictions to develop and implement the framework based on state and territory governments' requirements. The Australian Government's role should include assisting state and territory governments to resolve regulatory and legislative roadblocks (both Commonwealth and state and territory), providing policy or technical guidance, and facilitating interjurisdictional discussions and ensuring progress and agreement.

Under the framework, states and territories should agree on the key design features that their respective product stewardship scheme for small electronics will include and align on, such as:

- consistent definitions of product scope
- clear performance targets for collection and recovery
- nationally aligned compliance standards
- nationally transferable scheme registration requirements
- shared data and reporting requirements.

Governments should develop the framework within six months.

The Circular Economy Regulatory Reform Taskforce (recommendation 7.1) could provide the forum for interjurisdictional cooperation and collaboration.

5.3 National product stewardship for solar PV systems and EV batteries

With Australia's clean energy transition, waste from electronic products such as solar PV systems and EV batteries (including in hybrid vehicles) is creating an emerging issue for resource recovery and environmental management. Australia's solar boom is projected to generate an 18-fold increase in PV waste from 2019 to 2030 as existing stock comes to the end of its useful life (DCCEEW 2021a, p. 7). The projected growth between 2025–2035 of the next generation of small-scale solar PV systems (262% over the next 10 years) means the challenge managing this waste stream will extend well beyond 2030 (ACAP 2024, p. 5). The rapid rise in the use of large-format batteries in products such as EVs is also expected to result in a stock of just over 4 million tonnes of EV batteries by 2050 (approximately 200,000 tonnes reaching end of life in 2050) (BSC and UTS ISF 2023, pp. 68, 72). Because of their bulky nature and the high costs associated with recycling (including specialised handling and infrastructure) or proper disposal (Ecocycle, sub. 217, p. 5; RMIT University, sub. 212, p. 15), solar PV system and EV battery waste is often stockpiled or illegally dumped or exported to other countries (AADA, sub. 242, p. 3; Mathur, sub. 10, pp. 2–3).

This stockpiling and improper disposal can present significant environmental, health and safety risks, including leachate, fires, air pollution and the depletion of finite resources. Solar PV panels contain hazardous materials such as lead and cadmium, while the batteries used in both solar PV systems and EVs contain lithium, cobalt, nickel and other high-value critical materials that can pose serious fire risks if not properly managed. While only five of the 673 lithium-ion battery fires attended to by emergency services in New South Wales from January 2022 to June 2024 involved EVs (Fire and Rescue NSW 2024, pp. 15, 23), the end-of-life management of EV batteries presents emerging challenges due to increasing demand for EVs, the specialised training and equipment required to address fires at the disposal stage, and the risk of re-ignition hours or even days after the initial incident (Schmidt 2024).

Currently, neither solar PV systems nor EV batteries are managed in a consistent or comprehensive way once they are considered to have reached their end of life. In Australia, the majority of end-of-life PV systems are sent to landfill or discarded in shredder floc, with some illegally dumped on roadsides or in bushland (CIE 2023b, p. 3). Though some private recycling services exist in Australia (for example, Sircel, PV Industries, Ecoactiv), only 17% of solar panel components are recycled (specifically the aluminium frame and junction box), with the remaining 83% of (valuable) materials treated as waste (Baumgurtel et al. 2024). This is largely due to the cost barrier of recycling solar panels, which is approximately six times the cost of sending them to landfill (Baumgurtel et al. 2024). Most EV batteries in Australia have not yet reached their end of use in passenger vehicles; however, as EV adoption grows, this waste stream is soon expected to increase.

There are some secondary markets for EV batteries, such as repurposing used batteries as stationary energy storage for households. Australia's EV battery recycling market is currently in its early stages, with limited onshore processing capacity and few facilities able to safely or effectively disassemble complex battery packs, especially those not designed for end-of-life recovery (Infinitev, pers. comm., 23 July 2025). The growing volume of these import-dominated waste streams, the high-value, high-risk nature of their materials and the cost barrier to high-efficiency recycling in comparison to improper disposal means limited oversight and ad hoc, voluntary approaches will not suffice in achieving circularity or managing potential environmental or physical harm.

Introducing regulated product stewardship schemes for small-scale solar PV systems and EV batteries could address these challenges.

- These schemes could provide secure funding for the development of specialised recovery infrastructure and logistics networks, which are essential for managing these complex and high-value, high-risk

products. A regulated scheme ensures coordinated investment in safe collection, transport and processing systems that fragmented or voluntary efforts are unlikely to achieve at scale, especially as these waste volumes surge (BCA, sub. 99, p. 2; CPVA, sub. 62, p. 4).
- These schemes could also provide stronger oversight through a legally enforceable framework that holds manufacturers (and importers, given the import dominance of these products in Australia) accountable for the full life cycle of their products. By making producers responsible for end-of-life outcomes, this framework encourages higher-order circular activities, including design improvements such as enhanced repairability and easier disassembly for recycling, as well as support for secondary markets (such as second-life battery applications) (Infinitev, pers. comm., 23 July 2025).

Product stewardship could help address the growing end-of-life challenge from solar PV systems and EV batteries in a cost-effective way.

- Whilst levers such as import standards or import taxes may improve the environmental profile of products entering the market, by themselves they do not ensure collection, safe handling or material recovery when systems are decommissioned. For solar PV systems and EV batteries, the introduction of import standards (that is, alignment with current international benchmarks or regulations) would need to be timed appropriately, considering: the possibility (at least initially) of higher purchase prices for consumers; ongoing advancements in product design; and the barriers to realising wider benefits due to Australia's currently limited recycling infrastructure and second-life market readiness (WMRR, sub. 233, p. 12).
- Waste export bans may help keep solar PV systems and EV batteries available for recycling in Australia, but would not by themselves be sufficient to drive the development of infrastructure to recycle used products or develop markets for second-life applications. New risks could also emerge if waste export bans result in increased stockpiling, in addition to other potential trade-related risks.

In contrast, a product stewardship scheme establishes a clear framework that assigns shared responsibility to manufacturers, importers and retailers (box 5.1). By establishing regulated outcomes or targets, such a scheme can incentivise design improvements and/or the import of products with improved design, supporting cost-effective scaling of recycling activities and second-life applications, and ensuring more equitable cost-sharing across the supply chain. Product stewardship can also create a platform for governments and industry to consider and develop complementary measures in a coordinated way, allowing flexibility as these waste streams grow and evolve.

International experiences with regulated product stewardship schemes for solar PV systems and EV batteries suggest effectiveness in supporting end-of-life management and resource recovery. The European Union (EU) introduced mandatory producer responsibility for solar PV panels under the *Waste Electrical and Electronic Equipment Directive* (WEEE Directive) in 2012 (EU 2012, pp. 16, 23) and regulations that require battery producers to finance collection and meet recycling efficiency and recycled content targets in 2023 (HSF Kramer 2023). Policy literature highlights the importance of regulatory frameworks, such as the EU's inclusion of solar PV panels under the WEEE Directive, for enabling effective recycling practices (Ndalloka et al. 2024, pp. 4–5). Modelling of the EU's 2023 EV battery regulations suggests that mandatory recycling requirements encourage investment in recycling infrastructure, though balanced support is needed to preserve second-life battery markets (Seika and Kubli 2024, p. 1).

In Australia, the challenges associated with managing solar PV and EV products are shared across all states and territories. The solar PV sector is dominated by a relatively small number of large importers and manufacturers operating nationally, who supply a broad network of local retailers and a large number of installers. The EV market is also dominated by a relatively small number of large importers and manufacturers operating nationally. Given the projected scale of these waste streams and their importance to emissions reduction targets, as well as the nationwide operations of businesses serving Australian markets, the PC is

recommending that the Australian Government establish a national product stewardship scheme. A national scheme is essential to prevent inefficiencies, reduce confusion, and minimise increased compliance costs that may result from inconsistent regulatory schemes at the state and territory level, as have occurred in container deposit schemes and is at risk of occurring with state-based product stewardship for small electronics.

An industry-led, co-regulatory approach to product stewardship for these waste streams is likely to be more effective than a voluntary or ad hoc approach and less onerous or inflexible than mandatory regulation. Industry leadership is needed for the strong technical expertise and insight necessary to design effective collection systems, identify emerging waste trends early and adapt to new recovery or recycling technologies as they enter the market. Some degree of enforceable regulation, however, is also needed to address the low participation and free riding typical of voluntary schemes. Mandatory regulation may not offer the appropriate flexibility needed to deal with the complexity and evolving nature of these emerging waste streams, including changes to product design and advancements in recycling technologies.

In 2023, the Australian Government proposed a national co-regulatory scheme for small-scale solar PV systems under the *Wired for Change* proposal, covering both new and legacy units. Organisations that import or manufacture PV systems above a certain threshold would fund the scheme by paying fees to a central administering body (appointed and overseen by the Australian Government) to provide drop-off points, undertake recycling activities and manage contracts and payments with network operators (DCCEEW 2023d, pp. 28–30).

Cost-benefit analysis commissioned by the Australian Government found that scheme costs for the *Wired for Change* proposal are likely to be outweighed by the environmental benefits of greater uptake of high-efficiency recycling, with an estimated net economic benefit in present value terms of $7.3 billion (CIE 2023b, p. 75).[6] Specifically, though scheme costs would ultimately be passed on to consumers in the form of higher upfront prices for solar PV systems, they are expected to be offset by the reduced price in charging for the decommissioning of these systems at the end of their life (CIE 2023b, p. 81).[7]

There is currently no equivalent analysis for a national EV battery product stewardship scheme. Reflecting the different levels of evidence to support co-regulatory schemes for solar PV systems and EV batteries, the Australian Government should urgently progress its proposed scheme for solar PV systems and conduct a cost-benefit analysis with input from industry to understand the feasibility of a similar scheme for EV batteries (BSC 2024), including exploring and comparing different options for scheme design and implementation models. The existing cost-benefit analysis on the national solar PV systems scheme and any future study on a national EV battery scheme should be made public to allow independent assessment.

[6] This estimate is largely driven by non-market benefits – consumers' willingness to pay for the environmental damage avoided by the scheme of about $1,577 per solar PV system installed, on average (CIE 2023b, pp. 73, 75).

[7] On 15 August 2025, the Energy and Climate Change Ministerial Council Meeting discussed the need for mandated stewardship arrangements to proactively manage solar panel waste. Energy and Climate Change Ministers agreed the Australian Government and New South Wales will lead investigations into how different models of a national product stewardship scheme will work including evaluating Australian Government and state-based approaches (DCCEEW 2025m).

Recommendation 5.2
Establish a national product stewardship scheme for small-scale solar photovoltaic (PV) systems and investigate a national product stewardship scheme for electric vehicle (EV) batteries

The Australian Government should urgently establish a national product stewardship scheme for small-scale solar PV systems under Commonwealth legislation.

For EV batteries, the Australian Government should analyse the costs and benefits of national product stewardship, including different implementation models.

National leadership is needed to address the growing waste management risks associated with these products and avoid the problems associated with misaligned state action that have arisen or could arise for other schemes.

6. Textiles and clothing

Key points

- **Greater adoption of circular opportunities across the textiles and clothing products life cycle could increase materials productivity and bring economic, social and environmental benefits.**
  - Textiles material use and waste in Australia is high by world standards. Each year, Australian households and organisations consume an average of 39 kg textiles per person – two and a half times the global average – and discard around 33 kg, suggesting potential to significantly improve materials productivity and reduce waste.
  - In Australia, some textiles businesses support circularity through voluntary, industry-led product stewardship schemes, which are funded through levies and support circular activities such as designing durable products, building recycling infrastructure and promoting sustainable consumption. However, the effectiveness of these voluntary schemes has been hampered by low participation (free riding) and inadequate funding.
- **After examining opportunities for government action to promote circularity across the textiles and clothing life cycle – including design, production, distribution, retail, consumption, reuse and recycling – the Productivity Commission recommends the Australian Government should introduce enhanced monitoring, public reporting and transparency measures to create greater accountability for textiles businesses to reduce waste and improve materials productivity.**
  - The Australian Government should also set a clear, time-bound process for moving to a regulated product stewardship scheme if voluntary arrangements do not meet defined expectations and if a viable regulatory model can be developed.

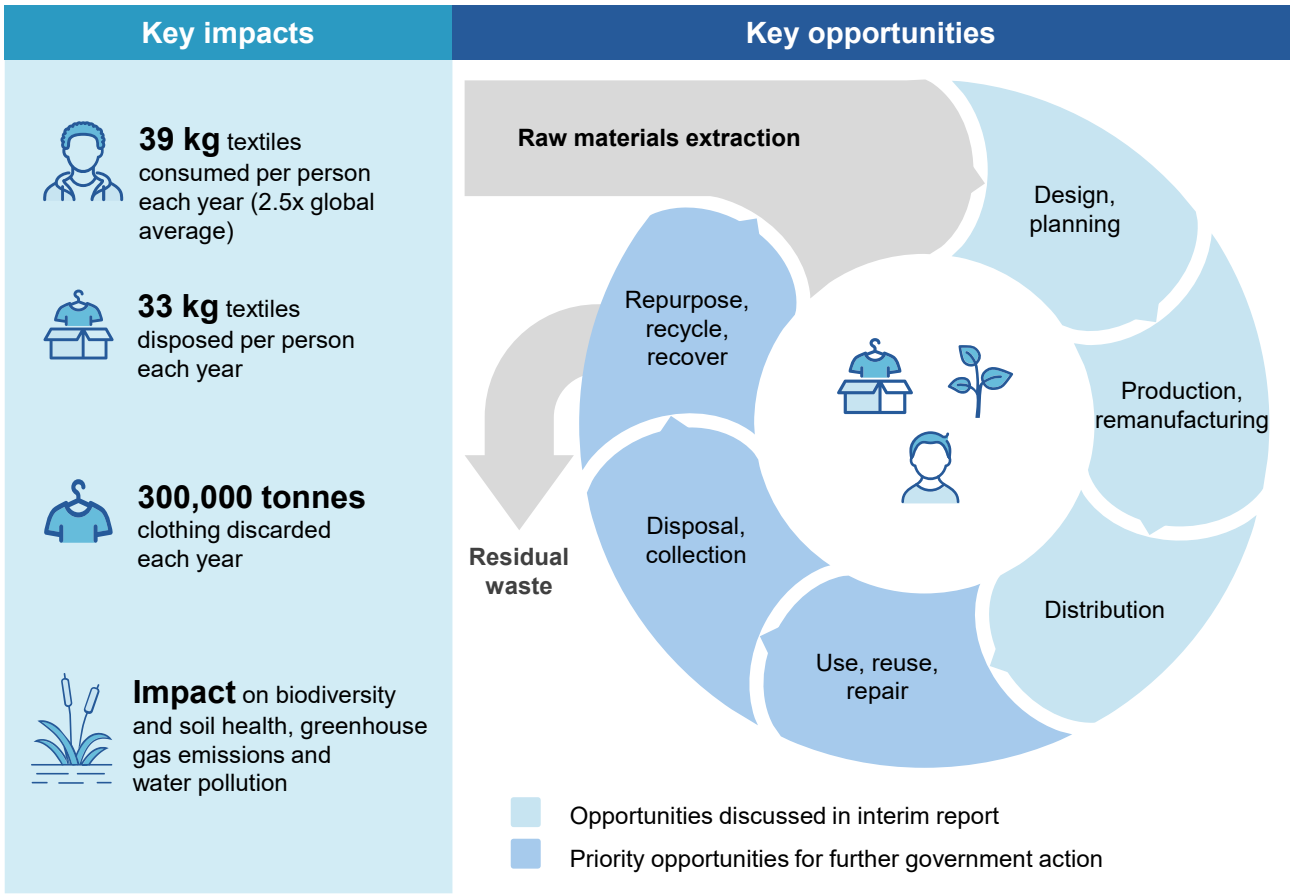
6.1 Material use impacts and circular opportunities

In Australia, various businesses make, import or sell a wide range of textiles and clothing products for both industrial use (such as tents, ropes and vehicle upholstery) and household use (such as clothing, carpets and mattresses). About 97% of new clothing products purchased in Australia are made in other countries (AFC 2022).

The production, processing and disposal of textiles and clothing products can have negative effects on the environment and human health (figure 6.1). The production of natural fibres, such as cotton, can require extensive amounts of water, pesticides and fertilisers, which can result in soil degradation and biodiversity loss (Ellen MacArthur Foundation 2017; UNEP 2023a). However, natural fibres are renewable and can offer a more readily biodegradable, lower pollution impact alternative to synthetic materials (El Bourakadi et al. 2024). Machinery used to manufacture textiles often use emissions-intensive fuels and large amounts of chemicals, contributing to global emissions and generating hazardous waste. Transporting textiles long distances can use large amounts of

high-emissions fuels. Washing and drying textiles uses electricity (which can be emissions-intensive) and releases microfibres into waterways. Disposed textiles, particularly synthetics, persist in landfills and contribute to ocean pollution (Collie et al. 2024; Kroon et al. 2018). Globally, the textiles supply chain accounts for up to 8% of emissions each year and about 9% of microfibre in oceans (UNEP 2023a).

Figure 6.1 – Textiles and clothing at a glance



Source: ACTA (2021); DCCEEW (2025c); Textile Exchange (2024); UNEP (2020); UNEP (2023a).

Businesses that make textiles and clothing products use natural fibres (such as cotton, wool and silk) and synthetic materials (like polyester and nylon). In Australia, about 60% of clothing sold domestically is made predominantly from synthetic fibres and about 40% is made from cellulosic fibre sources, primarily cotton (AFC 2022). Textiles material use and waste in Australia is high by world standards, and the recycling rate is low. Each year, Australian households and organisations consume an average of 39 kg of textiles and clothing per person (two and a half times the global average) and discard about 33 kg of textiles and clothing. One third of textiles waste generated each year (860,000 tonnes, including 300,000 tonnes of clothing) is sent to landfill (DCCEEW 2025c). The textiles recycling rate in Australia is 5%, compared to 12% in France and 15% in the United States (Girling 2024), suggesting potential to significantly improve materials productivity and reduce waste.[1]

[1] Seamless, the administrator of Australia's clothing product stewardship scheme, indicated that diverting clothing that is currently sent to Australian landfill each year can reduce landfill costs equivalent to savings of more than $30 million per annum in disposal fees (Seamless, sub. 240, p. 3).

In the interim report, the Productivity Commission evaluated opportunities for government action to promote greater circularity across the textiles life cycle – including design, manufacturing, distribution, use and recycling – that offer environmental and socioeconomic benefits (PC 2025a). After assessing opportunities against several considerations (chapter 1), the PC is recommending introducing enhanced monitoring, public reporting and transparency measures to create greater accountability for textiles businesses to reduce waste and improve materials productivity (section 6.2). The Australian Government is yet to use monitoring and public reporting to increase industry effort and participation in voluntary product stewardship schemes, to its full potential.

In the interim report, the PC identified that enhanced textiles product labelling focusing on circular design principles such as repairability, durability and sustainable materials, is a potential area for further government action. Inquiry participants and studies highlighted that improving the availability and reliability of information about the circularity of textiles products could increase materials productivity by enabling sustainable business and consumer choices and more effective reuse and recycling, noting examples from other countries (box 6.1).

Australia will be in a better position to assess the benefits and optimal design of a domestic labelling scheme for textiles and clothing once recently introduced international schemes and design standards (including those in France and the European Union (EU))[2] have been in operation for a longer period. As major brands that operate in or supply these markets will need to change their product labels to meet these requirements, the additional costs of adopting similar labels for the Australian market (a major net importer of textiles and clothing products) could be comparatively low. Further, evaluations of the impacts and effectiveness of international schemes will help clarify whether and how an Australian scheme could work. For example, they could clarify consumer responsiveness to labels, the specific types of information consumers would value and the feasibility of collecting it,[3] the most cost-effective way to present the product information (physical or digital format),[4] and the appropriate governance model.[5]

[2] For example, the EU is revising its textiles labelling rules to introduce requirements on physical and digital labelling standards. The French *Anti-Waste for a Circular Economy Law*, in force since 2023, already requires verified environmental labelling for clothing.

[3] Enhanced labelling would create several costs to business and/or the entity overseeing the scheme, including data collection and system information upgrades.

[4] Physical labels (such as existing mandatory care instructions) have limitations, such as being cut off resulting in lost information (Kestenbaum 2023). While digital labelling or a digital product passport, such as those being developed in the EU, provide a way to overcome the constraints of physical labels (Circular Australia, sub. 126, p. 8; WRAP, sub. 230, p. 16), their implementation currently presents challenges related to data standardisation and access to businesses that do not have technologies to digitise their supply chain (EPRS 2024, p. 46).

[5] Options range from a fully government-led approach, where the government sets and enforces labelling standards, to an industry-led model with government endorsement.

Box 6.1 – Potential benefits of enhanced textiles labelling

Households and businesses in Australia are becoming increasingly interested in textiles products that are environmentally friendly. For example, a survey of 3,080 Australians found that when buying new clothing, 76% reported prioritising items made without harming the environment and 73% looked for clothing free from harmful chemicals. Among second-hand clothing buyers, 72% said environmental benefits motivated their purchases (Payne et al. 2024, pp. 37, 38). Another survey found that 84% of respondents were willing to pay more for sustainable clothing products in comparison to regular products (Statista 2021).

Inquiry participants highlighted that lack of access to reliable information about textiles products (such as fibre composition, recycled content, chemical treatments, durability, repairability and end-of-life options) limits sustainable consumer choices and circular business practices.[6]

A labelling scheme that enhanced the availability and reliability of information about the circularity of textiles products at the point of purchase (via a physical or digital label) could promote materials productivity by enabling more informed consumer decisions. For example, including trustworthy information on textiles durability and repairability on product labels could help consumers purchase and use textiles products in a way that extends the average life of those products (WRAP 2023b, 2023a). Including information on textiles content could prompt consumers to consider materials that have lower impacts on the environment (such as recycled materials or single fibres).

Such a labelling scheme could also promote materials productivity by providing businesses with critical information for the safe and economic reuse and recycling of textiles. For example, information on the fibre and chemical composition of textiles products can help recycling businesses determine end-of-life strategies, such as whether a fabric should be recycled or composted (RMIT University School of Fashion and Textiles, sub. 231, p. 7) and prevent toxic chemicals from recirculating (European Environment Agency 2022, p. 15).

There is some (albeit limited) evidence that labelling schemes highlighting the circularity of textiles products have been effective in changing consumption patterns and facilitating recycling and reuse opportunities in other regions. An evaluation of the EU Ecolabel scheme found it enabled consumers in Europe to buy environmentally conscious products (European Commission nd). The WRAP (2023b) and the Ellen MacArthur Foundation (2017) reported that recyclability labelling can increase textiles recycling rates by guiding consumer disposal behaviour and improving industrial sorting and processing.

There is some evidence that product labels related to sustainability affect purchasing behaviour for other products. For example, the 2023 Energy Consumer Behaviour Survey found that 94% of Australians consider a high energy efficiency rating important when buying large appliances such as TVs, fridges and washing machines (Energy Consumers Australia 2023). Similarly, over 80% of Australians recognise and use the Water Efficiency Labelling and Standards label when shopping, with the scheme contributing to water savings of more than 1,800 gigalitres since its introduction in 2005 (DCCEEW 2025i). In France, the Repairability Index – which reports on the ease of repairing consumer electronics – has led to retailers selling more repairable products in greater proportions than less repairable ones (Sirera et al. 2024).

[6] CTWG (sub. 196, p. 3); GS1 Australia (sub. 225, p. 3); Reeves (sub. 189, p. 3); RMIT University (sub. 212, p. 13); Third Pillar (sub. 219, p. 3); WMRR (sub. 233, p. 9).

6.2 Enhance textiles stewardship through greater transparency and accountability

To create greater accountability for textiles businesses to reduce waste and improve materials productivity, the Australian Government should introduce enhanced monitoring, public reporting and transparency measures. In doing so, it should set a clear, time-bound process for governments to introduce regulated product stewardship schemes for textiles and clothing if the sector does not meet defined expectations and if a viable regulatory model can be developed.

Limitations of textiles stewardship in Australia

In Australia, businesses that make, import or sell textiles may support initiatives to reduce waste and improve circularity in textiles through voluntary industry-led product stewardship schemes or their own initiatives.[7] Currently, there are voluntary product stewardship schemes for clothing (commenced 2024) and bedding (commenced 2023).[8] These product stewardship schemes collect levies from member organisations to fund circular activities such as designing durable products, investing in recycling infrastructure and promoting sustainable consumption behaviour. More detail on product stewardship schemes in Australia can be found in chapter 5 (box 5.1).

Reflecting high levels of waste generation,[9] low recycling rates[10] and limited impact of voluntary efforts in the textiles sector, the Australian Government Minister for the Environment included clothing textiles on the Minister's Priority List in 2021-22, and mattresses in 2022-23. In early 2024, the Minister for the Environment stated that if the voluntary stewardship scheme for clothing is not sufficiently adopted by industry, it will be formally regulated by the Australian Government (DCCEEW 2024k).

Several participants noted that the voluntary nature of the product stewardship scheme for clothing could severely limit its effectiveness in reducing waste and increasing adoption of circular practices for textiles.[11] They noted that the voluntary nature of the scheme results in free riding,[12] which reduces the amount of funding for sector-led initiatives (Resource Work Cooperative, sub. 30, p. 6; SSROC, sub. 26, p. 9). The clothing product stewardship scheme, Seamless, estimated there are 14,000 potentially liable parties across the sector (Seamless, sub. 240, p. 7), but the scheme had only 58 member businesses as at July 2025 (Seamless nd).

Reflecting these concerns, several participants called for the Australian Government to make participation in product stewardship schemes in the textiles and clothing sector mandatory (PSCOE, sub. 267, p. 6;

[7] Examples of product stewardship initiatives managed by individual business include the Conscious Koala product stewardship initiative, Kathmandu product stewardship initiatives, Kitx product stewardship initiative, Nudie Jeans repair initiatives, Patagonia Worn Wear program, and The ICONIC product stewardship initiatives.

[8] The Australian Bedding Stewardship Council Scheme, an industry-led non-accredited voluntary scheme, was introduced in 2023 and provides national recycling solutions for mattresses (including in regional communities). The scheme is funded through a product stewardship fee of $10 per mattress, approved by the Australian Competition and Consumer Commission (ACCC).

[9] In the 2022-23 financial year, approximately 860,000 tonnes (33 kg per capita) of textiles related waste was generated, an increase from about 780,000 tonnes in 2016-17 (DCCEEW 2025c, p. 46).

[10] Australia's textiles recycling rate (excluding charitable donations) is 5% (DCCEEW 2025c, p. 41).

[11] Monash University (sub. 262, p. 10); RMIT University School of Fashion and Textiles (sub. 231, p. 15); Third Pillar (sub. 219, p. 4); WRAP (sub. 230, p. 18); WMRR (sub. 233, p. 10).

[12] Free riding occurs when a business benefits from the actions of another without paying for or sharing the costs. In the context of voluntary product stewardship schemes, non-participating businesses can benefit from the collection and recycling infrastructure funded by the schemes.

Seamless, sub. 240, p. 6). The Seamless Consortium noted that making participation in textiles products stewardship schemes mandatory would make it easier for stakeholders to progress change, alleviate participants' concerns that their contributions are supporting free riders and make it easier to forecast income, expenditure and the level of contribution required (AFCC 2023, p. 21). Seamless noted that 'by adopting mandatory participation in industry-led schemes, the administrative burden on government can be shifted to industry, with government instead focused on enforcement to ensure compliance' (sub. 240, p. 7).

Others noted that businesses do not participate in voluntary product stewardship schemes for a variety of reasons, and that non-participation does not mean they are not making efforts to reduce waste or implement circular practices. Reasons for not participating in voluntary product stewardship schemes can include the high cost of the levy relative to the private benefits of participation, sustainability and circularity not being core business objectives, and businesses already having their own sustainability practices (RMIT University School of Fashion and Textiles, sub. 231, p. 15; WRAP, sub. 230, p. 18).

If participation rates in product stewardship schemes do not increase, it is unlikely Seamless will achieve its goal to 'make Australian clothing circular by 2030, and significantly reduce the 222,000 tonnes of clothing that goes to Australian landfill each year' (Seamless, sub. 240, p. 1). Seamless assumed close to full market participation when it calculated the levy[13] that is necessary to deliver sufficient revenue to achieve the scheme's objectives (which it estimated at $60 million per year).

Increasing accountabilities for textiles stewardship

While a regulated product stewardship scheme for textiles and clothing would have advantages (such as making it easier for stakeholders to progress change), implementing such a scheme without first allowing for other policy measures (including international reforms) to take effect, could result in avoidable costs. These costs include the costs for government in setting up, administering and enforcing the scheme, as well as compliance costs for businesses (which could potentially impact on their customers). Moving to a mandatory model too soon might also hinder productive voluntary collaboration on textiles sustainability.

Furthermore, the Australian Government is yet to use monitoring and public reporting to increase industry effort, and participation in voluntary product stewardship schemes, to its full potential. The government should adopt additional measures to create greater accountability for textiles businesses to drive the required behaviour change. Despite textiles and clothing having now been on the Ministerial Priority List for four years, there is little sign that issues in the sector such as high levels of waste generation, low recycling rates and persistent free riding under the voluntary scheme are abating.

First, the Australian Government should set a clear, time-bound process for introducing regulated product stewardship schemes for textiles and clothing if the sector does not meet expectations for reducing waste and improving materials productivity.[14] These expectations (possibly including targets) would be made public, and could relate directly to advancing the objects of existing policies such as the *Recycling and Waste Reduction Act 2020* (Cth) (RAWR Act) (for example, reducing the amount of waste generated, increasing resource recovery and recycling, and reducing the environmental and human health impacts of products and waste materials). The government could also require individual businesses to collect and report on related data.

[13] Seamless is funded by a levy on each item of clothing placed on the Australian market, paid by clothing brands and retailers who are members. The levy is 4 cents per new garment and 3 cents for garments that meet eco-modulation criteria (i.e. garments primarily made from mono-material or single fibre type at a minimum of 95%).

[14] The process could draw from existing frameworks, such as the Treasury's approach to prescribing industry codes of conduct that provide a structured process for transitioning from voluntary to mandatory codes (The Treasury 2017).

Second, the Australian Government could provide public access to a database which lists all brands and retailers who are members and non-members of the voluntary arrangements. It could also issue periodic statements tracking progress towards performance targets, which may include the percentage of clothing businesses participating in voluntary stewardship arrangements or making equivalent efforts to reducing waste and increasing resource recovery and recycling.[15]

If voluntary efforts fail to sufficiently meet the expectations set by government, within three years the government should commission and complete work examining different models for a regulatory scheme as well as cost-benefit analysis of potential options. The analysis would determine whether, and how, a regulated stewardship scheme (and complementary measures beyond product stewardship such as import standards) for the different textiles product categories could have net benefits, reinforcing the credible threat of regulation.[16] The government should signal its intent to implement a regulated stewardship scheme (and complementary measures) if the analysis finds a workable regulated model that would have net benefits.

Recommendation 6.1
Enhance monitoring and public transparency measures to create greater accountability for textiles businesses to reduce waste and improve materials productivity

To create greater accountability for textiles businesses to reduce waste and improve materials productivity, the Australian Government should introduce enhanced monitoring, public reporting and transparency measures.

This should include setting a clear, time-bound process for governments to consider introducing regulated product stewardship schemes for textiles and clothing if the sector does not meet expectations regarding reduced waste and improved materials productivity.

- Within the next six months, the Australian Government should establish criteria and timelines for assessing industry progress and publish conditions for considering regulatory intervention.
- The government should work with industry to enhance publicly available information for tracking progress towards performance targets, which may include the percentage of businesses participating in voluntary stewardship arrangements or making equivalent efforts to reduce waste and improve materials productivity through circular activities.
- After two years, if voluntary progress against performance criteria is insufficient, the government should commission analysis of regulatory models, including cost-benefit analysis, and implement the most appropriate regulatory pathway. It should ensure the analysis is completed within the next three years.

[15] Such powers are already available under existing legislation for accredited voluntary product stewardship arrangements. Under the RAWR Act, the Minister may set out their views in relation to the performance of voluntary arrangements, and name brands and retailers who are members and non-members of the voluntary arrangements (RAWR Act, s. 68).

[16] Experience and analysis from other countries suggest that extended producer responsibility (EPR) schemes can improve textiles circularity. In France, collection rates have improved since the mandatory EPR scheme for textiles introduction in 2008 (2 kg per person in 2009 to 3.7 kg per person in 2019) and outperformed the EU average collection rate (31% in France compared with 22% in the EU) (Brown and Borkey 2024; Wilson 2021). WRAP (2022) estimated that implementing a national textiles EPR scheme could increase textiles recycling by 8% and reduce landfill by 18% in the UK. A study by Eunomia (2022) found that EPR with modulated fees (such as lower fees for more durable or recyclable products) incentivises design for longevity, repairability and recyclability in textiles.

7. Cross-sectoral arrangements

Key points

- **Governments should further enable the circular economy transition by progressing three cross-sectoral reform areas: reforming and aligning regulations, facilitating place-based approaches, and supporting innovation.**
- **Reforming onerous or inconsistent regulations governing materials use (including wasted materials) across states and territories would reduce the cost of taking up circular opportunities at scale for businesses and households.**
  - The Australian Government should establish an intergovernmental Circular Economy Regulatory Reform Taskforce comprising representatives from Australian, state and territory governments to work to align and reform regulations that affect the circular economy. The taskforce should take a cross-portfolio approach and address current as well as emerging areas of regulation, such as product stewardship for small electronics.
- **Place based circular economy plans and brokering services would enable communities to identify and pursue circular opportunities that reflect their aspirations, strengths and circumstances.**
  - Where local governments have identified circular economy opportunities in their area, they should consider developing place-based plans to realise them, in partnership with the communities they serve. State and territory governments should fund a pilot for circular economy transition brokers, who would assist local governments, communities and businesses to develop local circular economy actions by connecting people and building capacity, and evaluate their potential for broader adoption.
- **Better tailoring innovation support to circular economy challenges facing businesses and communities could help deliver solutions that benefit broader society.**
  - The Australian Government should establish a challenge-based grant program to foster innovation and support adoption and diffusion of innovative circular economy solutions.
  - This would complement existing government measures that improve investor confidence and promote innovation, such as sustainable procurement policies.

In addition to the opportunities identified for individual sectors (chapters 2 to 6), governments need to consider a range of other levers to catalyse and influence economy-wide change. Improving regulatory settings to support circularity, diffusing innovation, helping connect businesses (including locally through place-based approaches), increasing circularity in government procurement, and improving investor confidence are ways governments can bring about systemic change at different parts of supply chains and drive adoption of circular practices by business, households and government itself.

The Australian Government can play an important role by coordinating and convening jurisdictions to identify regulatory reforms needed to improve circularity, such as encouraging consistency on state- and territory-based product stewardship schemes, and can support innovation through challenge-based grants.

Governments can play a key role in catalysing place-based or local circular economy approaches by supporting transition brokers. These brokers would collaborate with local communities, businesses and governments to identify, plan for and address local circular economy needs.

7.1 Reform, harmonise and align regulations

Addressing regulatory barriers and inconsistencies

Reducing (and where possible avoiding) inconsistencies in regulations across jurisdictions promotes circularity by reducing costs for businesses operating across state and territory borders. Different settings for different jurisdictions can be justified where local environments, activities and preferences differ. But in other cases, jurisdictional regulations could be aligned – particularly where the differences between states and territories are definitional or administrative, rather than substantive or relating to outcomes. Aligning administrative requirements reduces the regulatory burden on businesses with national operations and reduces frictions for businesses deciding where or whether to expand.[1]

Below are some examples of potentially unnecessary inconsistencies in standards and regulations across states and territories.

- Differences in specifications on allowable content for recycled materials in infrastructure construction projects, even where standards are based on the same data and industry standards. For example, New South Wales's specification for allowable recycled crushed glass as granular base and subbase in road pavement is 10%, whereas in Victoria it is 5–10% for granular base and 15–50% for granular subbase (TfNSW 2020, p. 17; VIC DTP 2023b, p. 6; VicRoads 2017, p. 1). The Productivity Commission recommends governments facilitate a stocktake and assessment of standards and specifications limiting uptake of sustainable materials in infrastructure to enable reforms to streamline regulations (chapter 2).
- Inconsistent waste classifications, including for organics, e-waste and products made using recycled waste. For example, over 20 different regulations govern the classification, transport and management of plastic waste in Australia (ACOR 2024, p. 8; DCCEEW 2024o, p. 44).

In addition to the regulatory barriers and inconsistencies highlighted in the previous chapters of this report, participants also highlighted regulatory inconsistencies in other areas, such landfill levies (Veolia Australia and New Zealand, sub. 193, p. 2), planning and zoning regulations (Australian Pork Ltd, sub. 69, p. 2; Jemena, sub. 250, p. 1; Xseed, sub. 7, p. 14) and health regulations (ACOR, sub. 75, p. 37; CIPS Australia and New Zealand Pty Ltd, sub. 161, p. 6), which affect the economic feasibility of circular activities relative to linear alternatives.

[1] The benefits of harmonised regulations are not unique to the circular economy. For example, the PC inquiry into creating a more dynamic and resilient economy has identified duplicate or inconsistent regulation as a prominent government failure across the economy which adds an unnecessary regulatory burden on businesses (PC 2025b, p. 32). Likewise, as part of the national competition policy reforms, the PC has estimated harmonised regulations and adopting international and overseas standards in regulatory frameworks (both relevant to the circular economy and beyond) to have benefits of between $1.9 and $3.8 billion dollars per year (PC 2025d, p. 3).

Coordinated government action to align rules (and reform them, where they are onerous) could reduce the cost of taking up circular opportunities at scale without compromising regulatory objectives (such as protecting public safety). Where new regulations are being developed across multiple jurisdictions (such as state-based product stewardship frameworks (chapter 5)), ensuring that they are consistent and not unnecessarily onerous or restrictive from the outset is the best way to reduce costs and uncertainty for business. Delays in reforming and aligning regulations could postpone the associated economic and environmental benefits and risk locking in suboptimal arrangements.

Australian, state and territory governments should work together on aligning regulations because each level of government is responsible for different policy instruments (chapter 1) operating concurrently to achieve desired economic and environmental outcomes.

Establish a taskforce to drive further regulatory reforms and harmonisation

To support the ongoing transition to a circular economy, the Australian Government should, as soon as practicable, set up a Circular Economy Regulatory Reform Taskforce with state and territory governments. The objective of the taskforce should be to align and adjust new and existing regulations affecting the uptake of circular economy opportunities. While governments are already aligning some regulations,[2] as noted by the Circular Economy Ministerial Advisory Group, existing intergovernmental forums (such as the Environment Ministers' Meeting or senior officials meetings) have not addressed longstanding regulatory issues such as the fragmentation of regulations governing the classification and reuse of waste materials (DCCEEW 2024o, p. 44). A taskforce with dedicated resources and ministerial authorisation would strengthen governments' capacity to reform and align regulations affecting the circular economy.

The taskforce should be located within the Australian Government, to task the Australian Government with the lead on key issues where inaction could result in costly differing state-led approaches. This leadership is especially important where jurisdictions have differing priorities and regulatory resources. The convening power of the Australian Government would also provide jurisdictions with a dedicated forum to agree on which regulations should be addressed as a priority, how regulations should be aligned (for example, alignment to which settings) and where exclusions or location-specific settings may still be required.

Given the resources already allocated to the Circular Economy Division within the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW), the taskforce should initially be based in DCCEEW. However, recognising the interconnected economic, environmental, and social advantages of eliminating regulatory barriers to a circular economy – as well as the fact that relevant regulations are not solely managed by environment portfolios – consideration should also be given to the potential for enhanced leadership from central agencies (chapter 10). At a minimum, the taskforce must establish strong connections with the regulation reform and review agendas of treasury and finance departments.[3] This would ensure their recommendations are aligned with the principles of regulatory stewardship (discussed below).

[2] State and territory governments are working together on harmonising requirements under the National Kerbside Collections Roadmap following in-principle agreement from the Environment Ministers' Meeting (DCCEEW 2024d, p. 1). Austroads is also in the process of developing a set of harmonised state infrastructure specifications for roads and bridges (Austroads 2021, p. 3).

[3] The PC's inquiry into creating a dynamic and resilient economy proposes stronger scrutiny of regulation through Cabinet (PC 2025b, p. 36).

To make meaningful progress on the circular economy transition, the taskforce should:

- include permanent representatives from the Australian Government, including central agencies (as outlined above), and all state and territory governments
- consult widely with stakeholders from community, industry and broader government
- develop a workplan of key issues reflecting ministerial priorities, and schedule regular meetings aligned with that plan
- engage a rotating technical advisory committee specific to the issue(s) at hand
- be provided with adequate resources, including a clear pathway to ministerial authorisation
- consider circular economy regulations from a range of portfolios, including but not limited to the environment portfolio (for example, construction regulations, as discussed in chapter 2) which cover both existing and emerging issues (such as the conversion of wasted organic materials to secondary materials such as biochar, as discussed in chapter 3)
- provide detailed recommendations for regulatory adjustment and alignment to ministers, including justifications for those recommendations
- report on the progress of implementing the taskforce's recommendations.

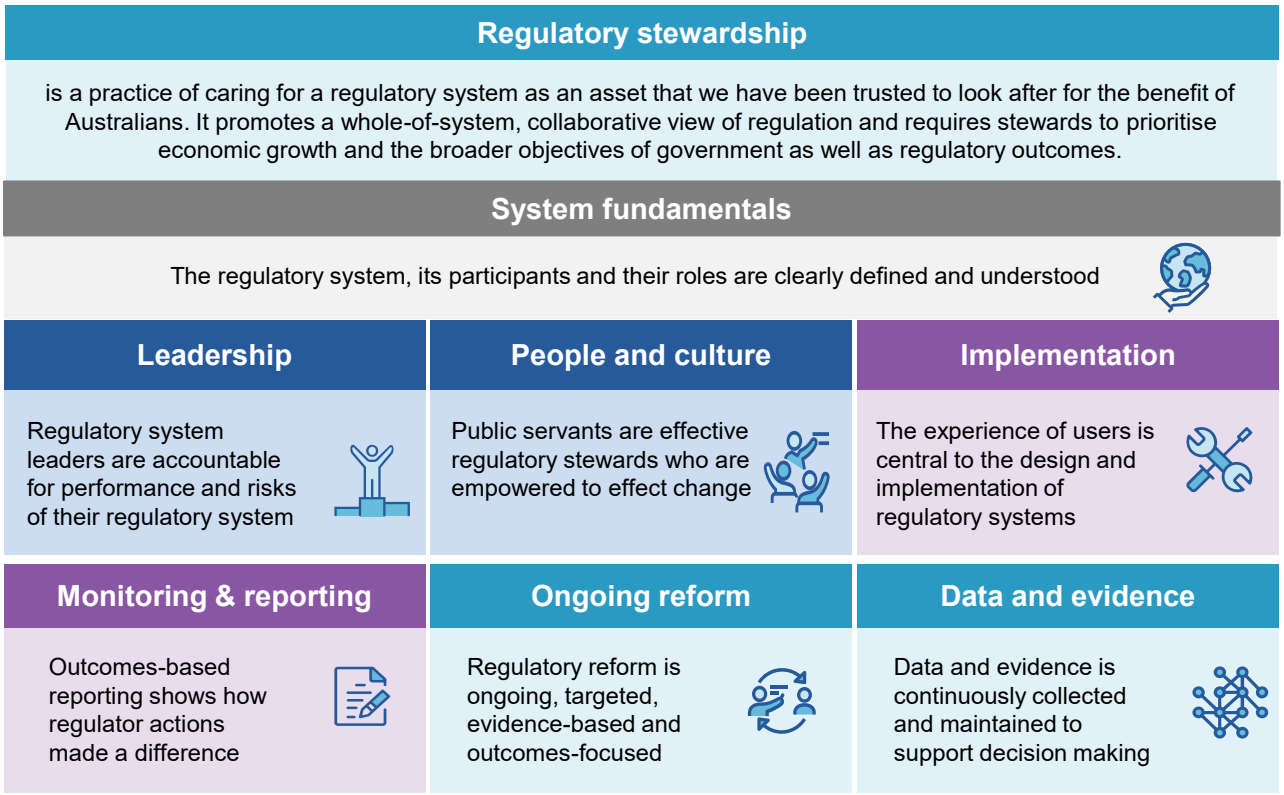
A taskforce strikes the right balance between catalysing the transition to greater circularity across the economy and minimising administrative cost. While some participants suggested bodies with a stronger policy-making power, for example, a circular economy ministerial council (TSA, sub. 220, p. 20) or an independent circular economy standards board (DCCEEW 2024c, p. 44; Monash University, sub. 262, p. 19), these bodies would involve considerably higher administrative costs and risk introducing unnecessary layers of bureaucracy. Some submissions observed that minimising bureaucracy was an essential consideration for the efficiency of any new harmonisation body (AMEC, sub. 248, pp. 8–9; MCA, sub. 269, p. 3). In the interest of stimulating the circular economy transition at the lowest cost, a regulatory reform taskforce is the most appropriate first step.

The taskforce should formulate recommendations for regulatory alignment in accordance with the principles of regulatory stewardship (figure 7.1), outlined in the PC's inquiry into building a dynamic and resilient economy (PC 2025b, pp. 42–45). Regulatory stewardship requires public servants (involved in policy, regulation and program and service delivery) to manage regulatory systems to promote a dynamic and resilient economy, not just as a tool to reduce harm or manage risk. When making decisions, policymakers should focus on the overall societal benefits the regulations will promote, rather than specific narrow objectives.

Stewardship also requires policymakers and regulators to foster a collaborative culture which encourages regulatory consistency (both between Australian states and territories, and between Australia and the rest of the world) and minimises duplication. Stewardship ensures the ongoing relevance and suitability of regulation through ongoing monitoring, data collection and review. These principles are especially relevant to regulations pertaining to the circular economy, where technical innovation and product development has historically outpaced regulatory evolution (for example, regulations for biochar as discussed in chapter 3).

The work of this taskforce will also include identifying and progressing other cross-sectoral reforms. However, it is not the PC's intention that the regulatory reforms recommended elsewhere in this report be dependent on the establishment of the taskforce. For example, the steps required to progress the regulatory stocktake of infrastructure construction standards and specifications (chapter 2), to establish dedicated regulatory pathways for secondary organic materials (chapter 3) or to design consistent product stewardship regulations for small electronics (chapter 5) cannot, and should not, be constrained by any delays in the establishment of this taskforce. Further detail on the proposed staging of the reforms recommended in this inquiry is in chapter 10.

Figure 7.1 – The principles of regulatory stewardship[a]



a. Regulatory stewardship applies to public servants involved in policy, regulation and program and service delivery.

Source: PC (2025b, p. 45).

Recommendation 7.1
Establish an intergovernmental taskforce to drive regulatory reforms and harmonisation related to the circular economy

The Australian Government, in partnership with state and territory governments, should establish a Circular Economy Regulatory Reform Taskforce to align and adjust new and existing regulations affecting the uptake of circular economy opportunities. The taskforce should:

- task the Australian Government with the lead on assessing regulation for key issues
- take a cross-portfolio approach to circular economy issues
- recommend regulatory reforms in accordance with the principle of regulatory stewardship
- meet regularly and be responsive to issues both emerged and emerging
- be adequately resourced, authorised and accountable
- make regulatory reform recommendations to Ministers in a transparent and timely way, and report on their implementation.

7.2 Support circular transitions for local communities and businesses through place-based approaches

Place-based approaches can facilitate circular economy transition

Place-based approaches target the specific circumstances of a place4 and engage the local community as active participants in development and implementation, requiring shared decision-making between the community and government (Victorian Government 2020, p. 3). By contrast, more conventional government actions are planned and coordinated centrally, so may not engage with the specific characteristics of a place. Place-based approaches can be impactful where a community faces a complex or multifaceted challenge that needs a long-term and cross-sectoral response. They can be effective where a problem cannot be addressed through (centrally delivered) services or infrastructure provision alone and requires local communities to be actively involved to find relevant solutions (Victorian Government 2023).

A place-based approach could be well-suited to facilitating a more circular economy at the local level, as circular economy solutions often rely on local resources, industries and community involvement. Local expertise and infrastructure can support circular practices such as resource recovery, repair and reuse (DCCEEW 2024c, p. 71). Place-based approaches to a circular economy can:

- foster economies of agglomeration creating the necessary concentration of businesses, consumers and/or production factors required to perform circular economy activities
- reduce the distance and therefore transport costs (including time and emissions savings) between organisations along the supply chain, such as downstream customers and upstream suppliers and inputs
- increase the proximity and therefore the accessibility of infrastructure by enabling co-located organisations
- facilitate the circulation of information and increase the coordination of local actors, accelerating change (Tapia et al. 2021, pp. 1444–1447).

Place-based connectivity also has broader benefits such as local employment opportunities, social engagement and cohesion. In establishing place-based circular initiatives, there is an opportunity to integrate caring for Country principles and Aboriginal and Torres Strait Islander knowledge systems so that these resource management and regenerative practices can be undertaken (Bega LALC, sub. 185, p. 1; DCCEEW 2024c, p. 29).

Identifying local opportunities and co-designing circular economy plans

Across Australia there are place-specific circular economy opportunities and challenges. Places have unique built and natural environments, economic conditions and communities, and are at different points in their transition to a circular economy, with particular differences between cities and regional areas (Monash University, sub. 262, p. 21). For example, some regional and remote areas may not have access to basic waste management infrastructure, including local facilities such as recycling stations or materials recovery centres, which limits their practical engagement with the circular economy (First Nations Economics, sub. 252, p. 15). However, filling those infrastructure gaps can also present opportunities to build in circular economy principles and practices from the outset. This can then deliver economic and social benefits – for example, the establishment of the Cherbourg Materials Recovery Facility on Wakka Wakka Country in Queensland has created jobs and upskilling opportunities for the community (Bell 2019). Other places are

[4] 'Place' does not have a universal definition. To be practical for circular economy policy actions, the PC defines a 'place' as either one local government area or a cluster of local government areas that are interconnected through their communities and economic, social, and environmental interactions.

progressing broader sets of actions in their circular economy transition, such as Bega Valley in New South Wales. Bega has well-developed local business partnerships that support circular economy outcomes – such as utilising waste streams,[5] synergistic agricultural practices such as 'enterprise stacking' and regenerating nature. There are also opportunities to integrate circularity into regions and areas which are being developed and transformed to meet complementary goals (for example, Renewable Energy Zones, the Western Sydney Aerotropolis, sites for the Brisbane 2032 Olympics and areas experiencing mine closures (chapter 4)).

Local government structures and governance arrangements also vary significantly from place to place. For example, Queensland has a series of Indigenous Councils where local governments are primarily run by Aboriginal and Torres Strait Islander communities, and New South Wales has Joint Organisations, which are statutory bodies that enable councils in regional areas to collaborate on strategic priorities.

Australian and state government circular economy plans, such as *Australia's Circular Economy Framework* or Recycling Victoria's *A new economy plan*, set the broad policy direction for a circular economy but need translation to a level of detail that engages with local grassroots initiatives or industry. They may also inevitably miss contextual differences and challenges, particularly for regional and rural areas (Mathur, sub. 10, p. 1; Monash University, sub. 262, p. 21). The PC heard that translating these objectives into solutions at the local level is complex (Roundtable participants, pers. comm., 29 May 2025). Local government could use place-based circular economy plans to guide their delivery of local solutions (Monash University, sub. 262, p. 21).

Local governments should identify circular economy opportunities relevant to their area. To realise these opportunities, they should develop place-based plans and/or integrate actions into their other plans and budgetary processes. Plans should be developed through a co-design process with local businesses and communities, including Aboriginal and Torres Strait Islander people. To ensure that the plans reflect local communities' priorities, the co-design process should empower communities to identify their economic, environmental and cultural priorities and needs that can be addressed through circular economy initiatives. These priorities and needs should be translated into measurable goals, which local governments can monitor progress against. Evaluation and iteration of the plan should occur at minimum once every three years to promote accountability and ensure it remains relevant.

Places are diverse and local governments will vary in their capacity to influence the transition due to factors such as demographics, council structures, resources and location (Hume City Council, sub. 20, p. 2). Local governments should therefore select an approach to circular economy planning that is fit for purpose given their context. For some local governments, a circular economy plan may simply highlight barriers requiring investment and support from state or Australian governments, such as lack of waste management and materials recovery infrastructure. By contrast, local governments that have greater resources or those with existing circular activity in their region will develop more multifaceted plans with a broader transformation agenda. Local governments could also integrate actions related to the circular economy into their other plans and budgetary processes instead of, or as well as, developing a specific circular economy plan. Relevant plans and processes that could incorporate circular economy actions include service, infrastructure or community development plans, local environmental or economic plans, or regional plans such as those for Special Activation Precincts or Renewable Energy Zones, as noted above.

[5] For example, The Bega Group's dairy factory boiler runs on wood waste and fly ash residue used as a lime replacement on pastures, and extracts milk minerals from whey waste using a new evaporator (Courtney 2024).

Potential features that could be included in circular economy plans are:

- **analysis and monitoring of material flows**, ranging from engaging in professional material flow analyses to a high-level assessment of significant waste streams and material uses
- **analysis and monitoring of environmental indicators** linked to material production and use, such as biodiversity values, carbon emissions and water use (these indicators could also be used to demonstrate environmental, social and economic benefits from nature regeneration opportunities)
- **priority areas for circular economy initiatives in that place**, including recognising existing initiatives that should be prioritised for scale-up
- **local circular economy opportunities that draw on traditional knowledge** and innovative practices. Relevant services could be procured by government and delivered by local Aboriginal and Torres Strait Islander people and organisations (First Nations Economics, sub. 252, p. 23)
- **measurable goals for circular economy transition in that place**, with milestones for assessing progress and measures of success for future evaluation
- **clear roles and responsibilities** for both government and non-government actors
- barriers to participation in the circular economy that require targeted investment and support from state or Australian governments.

In identifying local opportunities and developing place-based circular economy plans through a community-wide co-design process, local governments should be progressing their commitments under the National Agreement on Closing the Gap.

- Consistent with Priority Reform 1, governments, when developing place-based circular economy plans, should do so in partnership with Aboriginal and Torres Strait Islander people to embed valuable knowledge of place and support self-determination of desired outcomes from a local circular economy transition (Bega LALC, sub. 185, p. 2; Roundtable participants, pers. comm., 29 May 2025), while protecting Indigenous Cultural Intellectual Property rights (First Nations Economics, sub. 252, p. 7).
- Consistent with Priority Reform 2, governments should ensure place-based circular economy plans identify local opportunities that draw on traditional knowledge and innovative practices to be delivered by partnering with community-controlled organisations and local Aboriginal and Torres Strait Islander people. Potential opportunities include cultural land management programs, sustainable housing initiatives, community recycling projects and local food systems (Bega LALC, sub. 185, p. 2; First Nations Economics, sub. 252, p. 23).

State and territory governments should offer information and guidance to support local governments in developing place-based circular economy plans. State governments are well-positioned to collate examples of place-based circular economy plans as they are developed as well as existing examples of local circular economy plans such as the *Hunter and Central Coast Circular Economy Roadmap* in New South Wales or *Circular Economy Opportunities Limestone Coast* in South Australia (Hunter Circular 2022; RDA Limestone Coast 2022). They could also provide resources such as templates and guidance for plan development, tailored to suit local governments at different stages of the circular economy transition.

Brokers could catalyse place-based circular economy transitions

Where governments have identified that place-based approaches are likely to be an effective way of achieving circular economy outcomes, they can support local communities by providing access to intermediaries or transition brokers. Transition brokers facilitate sustainability transitions by connecting and aligning diverse stakeholders to create momentum for change, enable collaboration and drive innovation (Kivimaa et al. 2019, pp. 1062–1063; Lobo et al. 2025, p. 5013). Transition brokers can take the form of a

person, team or organisation and, depending on the context, could be from a range of institutions including government, research institutions, industry associations and not-for-profits.

Other countries offer successful examples of transition brokers in a range of sustainability contexts, including facilitating transition to using biogas in a region of Brazil, supporting the development of eco-fashion start-ups in Finland, and helping build eco-innovation capability for companies in Sweden (Kanda et al. 2020, p. 457; Lobo et al. 2025, p. 4998). A case study of circular economy transition brokers in six Dutch regions found that they 'enhance processes of change, build alliances, help create the necessary preconditions, and develop impactful circular initiatives' (Cramer 2020, p. 1). In the study, each broker drafted a circular economy program based on regional strengths and then supported companies to implement circular initiatives, including through fostering collaboration. At the time of the study, some regions were at the stage of repeating and upscaling successful initiatives, with the eventual goal of making the circular economy mainstream within the region (Cramer 2020, p. 10).

While a program of circular economy transition brokers would be relatively novel in Australia, governments and inquiry participants have indicated the potential value of such brokers to furthering the success of circular initiatives (CERN APAC, sub. 215, p. 3; DCCEEW 2024c, p. 71). Inquiry participants with experience in place-based approaches agreed that transition brokers could provide several benefits including providing local leadership for change, helping local businesses and communities form networks, find partnerships and take up circular opportunities, and guiding how local government, businesses and communities can contribute (Roundtable participants, pers. comm., 29 May 2025).

The Bega Regional Circularity Cooperative (RCC) is one of the few examples of using circular economy transition brokers in Australia. The RCC has developed a ten-year program to identify, accelerate and implement enabling projects to enhance the delivery of circularity in the region. The transition brokers in the RCC have helped coordinate circular economy initiatives from the local community and businesses, as well as large businesses, corporations, financial institutions, research organisations and multiple levels of government. The knowledge, resources and networking opportunities provided by the RCC have accelerated the uptake of circularity projects in the region (DCCEEW 2024c, p. 72; RAI, sub. 100 att., p. 27).

Building capacity and partnerships for local circular economy transitions

Transition brokers could help local businesses and community organisations build circular economy capabilities in ways that are tailored to the local community and context. Businesses often lack the necessary information, tools and resources to successfully adopt circular practices (CIPS, sub. 161, p. 6). General circular economy training (where available) is often not sufficiently tailored to assist small to medium businesses and community organisations successfully apply ideas to their own context.[6] For example, First Nations Economics highlighted 'current policies and programs are rarely communicated in ways that reflect First Nations worldviews or address community-specific realities' (sub. 252, p. 15). A broker could help address these limitations through co-design of their services and partnering with local communities to offer services (such as education and support for circular economy activities) to ensure they are relevant to the local context.

Transition brokers could also help facilitate cross-sector partnerships and knowledge sharing among local organisations through initiatives such as hosting circular economy forums, workshops and networking events (RAI, sub. 203, p. 3). Transition brokers should develop networking opportunities that are suited to the relevant place. Informal regular meet-ups or introductions between complementary organisations can be as valuable as formal networking events. As identified by roundtable participants, 'businesses trust each other

[6] ASBFEO, sub. 270, pp. 3-4; CIPS, sub. 161, p. 6; Roundtable participants, pers. comm., 29 May 2025; Vejnovic et al., sub. 24, p. 3.

and can diffuse information about the circular economy in ways and in a language that makes sense to them' (Roundtable participants, pers. comm., 29 May 2025). Local organisations that have successfully engaged with circular opportunities act as powerful examples for their peers and can demonstrate the value of circular behaviours in a local context (Roundtable participants, pers. comm., 29 May 2025).

Transition brokers could also be particularly valuable in helping small to medium businesses and community organisations navigate government processes, such as obtaining regulatory approvals and applying for financial support. Due to their limited resources, and lower capability and maturity in regulatory compliance, these organisations often face greater challenges when navigating regulatory complexity and have lower awareness of available support mechanisms (Business Chamber Queensland, sub. 213, p. 4; DCCEEW 2024c, p. 63).

Transition brokers could also help local governments develop and implement place-based circular economy plans. The PC heard that 'leadership and trusted relationships between local government, community and local businesses are essential to create and maintain momentum for circular economy change' (Roundtable participants, pers. comm., 29 May 2025). Transition brokers can connect relevant parties to identify local opportunities, align efforts and develop solutions to barriers (DCCEEW 2024c, p. 71). They could also assist local governments in building their own circular economy capability and knowledge.

Transition broker pilots would build the case for a wider program

Some state and territory governments are already conducting and funding the types of services that transition brokers would engage in. For instance, Green Industries South Australia facilitated collaboration between Holla-Fresh, Bio Gro, and Rainbow Bee Eater to support Holla-Fresh's transition to a renewable energy source (biomass to energy) (RAI, sub. 100, p. 5). Sustainability Victoria, through its Circular Economy Innovation Fund, has supported a number of capability building activities (CEBIC 2024). One such activity was run through the Gippsland Climate Change Network, which ran a training program to address gaps in circular economy knowledge and foster collaboration among Gippsland small to medium businesses (GCCN 2025).

While there is broad support for government investment in the services transition brokers would offer among inquiry participants,[7] expanding support from state and territory governments to establish place-based transition brokers across Australia would require increased investment.[8] While there are some examples of successful transition broker services internationally (Cramer 2020; Kanda et al. 2020; Lobo et al. 2025), further evidence (including formal evaluations) is needed to robustly understand how to best design and analyse the benefits and costs of an in-place circular economy transition broker program across Australia.

To build understanding of how in-place transition brokers can best assist local communities transition to a circular economy, state and territory governments should pilot in-place transition brokers in up to (for example) six initial locations. Within three years, state and territory governments should complete a concurrent evaluation of the pilots' effectiveness. If successful, governments should extend the piloted transition brokers and roll out the program to other places across Australia. The pilots would act as a proof of concept of the transition broker model for facilitating place-based circular economy transition, and would enable the identification of common risks, costs, benefits and success factors to inform future rollout. Given

[7] ASBFEO (sub. 270, pp. 3–4); Business Chamber Queensland (sub. 213, p. 5); CERN APAC (sub. 215, p. 3); CA ANZ (sub. 211, p. 2); First Nations Economics (sub. 252, p. 28); Planet Ark (sub. 147, p. 5); RAI (sub. 203, p. 3); RMIT University (sub. 212, pp. 23–24); Roundtable participants, pers. comm., 29 May 2025.

[8] For example, if the 'regions' covered by Regional Development Australia were used to approximate the number of 'places' that require a transition broker, 50 transition broker positions would need to be established (Regional Development Australia nd).

the pilots' purpose is to act as an evidence base for future policy decisions, pilots should establish clear criteria for success and measure outcomes against them, as well as assess costs and benefits. State and territory governments should make their evaluations of the pilots publicly available to contribute to a nation-wide body of evidence about this approach.

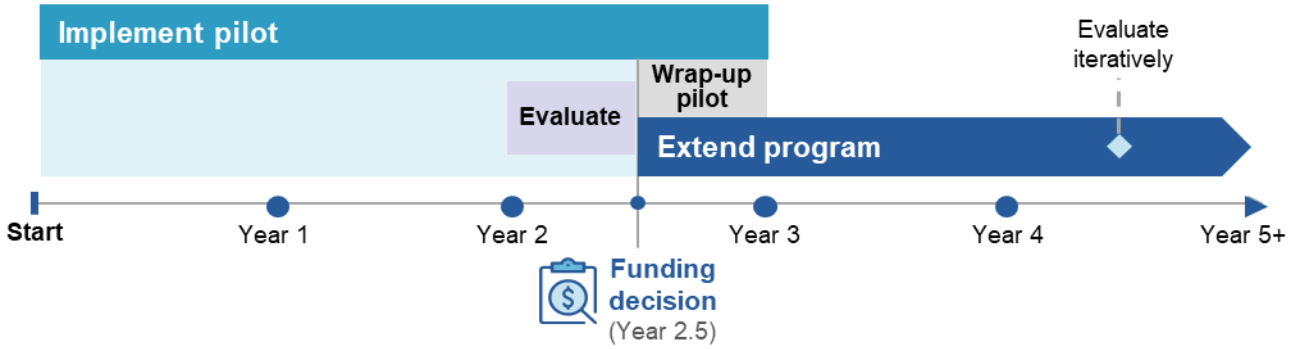
The number and places selected for pilots should be sufficiently diverse to provide insights into the varying opportunities and challenges that exist in places across Australia. Dimensions to consider include socioeconomic factors, geographic (urban, regional and remote), existing infrastructure (such as materials recovery facilities) and existing engagement and support for circular economy initiatives. The brokers could be based within state government, but another option is to base them within existing organisations such as Regional Development Australia, National Resource Management Regions, local branches of industry associations or chambers of commerce, not-for-profits or local governments. This not only offers an opportunity to draw on the capability and experience of personnel within these entities (many of whom perform brokerage roles and functions) but provides the potential for co-funded roles. The transition brokers should be supported to act as a network, meeting regularly to share relevant resources, knowledge and lessons learned to minimise duplication and iteratively improve their services.

In implementing these pilot programs, state and territory governments should progress their commitments to the National Agreement on Closing the Gap.

- Consistent with Priority Reform 1, brokers in each place-based pilot should partner with Aboriginal and Torres Strait Islander knowledge holders to ensure that their services are 'culturally relevant, promote intergenerational learning and reflect Indigenous governance principles' (First Nations Economics, sub. 252, p. 23).
- Consistent with Priority Reform 2, brokers should also seek opportunities to partner with Aboriginal and Torres Strait Islander organisations to deliver services that build circular economy capability (such as education and support for circular economy activities).
- Consistent with Priority Reforms 1, 2 and 3, governments should seek opportunities to recruit and resource Aboriginal and Torres Strait Islander partners as brokers.

If the evaluations show that the transition broker approach is effective, a longer rollout is needed to create lasting change. The optimal program length may vary depending on the specific requirements and opportunities in a place – for example, the Bega RCC has established a ten-year transition program (RAI, sub. 100 att., p. 27). For the pilot, the decision to end or extend funding should be well before the initial funding ceases (figure 7.2). A rolling funding approach and early decision on future funding would ensure continuity (or an orderly conclusion if funding was discontinued). The PC has heard from participants that staffing and resourcing continuity are essential for building trusted relationships with the community and local businesses, which are the basis for creating and maintaining momentum for circular economy change at the local and regional level (Roundtable participants, pers. comm., 29 May 2025).

Figure 7.2 – Illustrative timeline for transition broker pilot



Recommendation 7.2
Develop place-based circular economy plans and pilot place-based circular economy transition brokers

Local governments should identify circular economy opportunities relevant to their area. To realise these opportunities, they should develop place-based plans and/or integrate actions into their other plans and budgetary processes (such as service, infrastructure or community development plans). Plans should be co-designed with Aboriginal and Torres Strait Islander people, local businesses and communities to develop self-determined outcomes. Plans should be evaluated and refreshed every three years.

State and territory governments should provide local governments with information and guidance for developing their place-based circular economy plans.

State and territory governments should pilot in-place circular economy transition brokers, with evaluation and potential extension within three years. Outcomes should be measured against set criteria and published to enable cost-benefit analysis regarding future program expansion. Transition brokers would:

- work with small to medium sized businesses and community organisations to build their circular economy knowledge and capability, including how to increase the circularity of their organisation, to facilitate networking opportunities to foster collaboration, partnerships and knowledge sharing and to assist them in navigating government processes
- partner with Aboriginal and Torres Strait Islander people to embed valuable knowledge in place-based circular economy practices and establish opportunities for Aboriginal and Torres Strait Islander people and businesses to lead circular economy initiatives
- support local governments to develop place-based circular economy plans
- be supported to operate as a network, providing the opportunity for knowledge sharing and capability building.

7.3 Support innovation and investment

Governments can play a role in fostering innovation and investment through a variety of instruments. This includes direct support such as procurement and grant programs, and indirect support such as removing regulatory barriers to simplify the innovation and investment ecosystem.

Challenge-based funding for circular innovations

By its nature, circular economy innovation often requires collaboration and partnerships between businesses from different sectors, as well as governments, researchers and the community. While innovation can start in any one business, diffusing knowledge and collaborating across businesses and supply chains are integral to the widespread adoption of successful circular innovations.

Circular innovators benefit from a diverse skillset. For instance, expertise in circular design, along with the ability to think critically and systematically, can support the development of innovative products and solutions. However, successful adoption of circular innovation goes beyond individual capabilities. It requires development and cultivation of the competencies needed to implement and scale circular practices, within organisations and governments (chapter 8).

Testing, developing and adopting new approaches or technologies is a risky endeavour for any one business – particularly for small to medium businesses – and innovation diffusion across Australian businesses generally has been slow (PC 2023a, pp. 6–7). To improve the rate of diffusion, governments can minimise investment risk through innovation programs.

Existing Australian Government programs support circular initiatives that promote materials productivity by helping businesses to scale up existing innovations[9] and by funding large-scale research aimed at progressing the technological frontier.[10] State, territory and local governments have also administered significant innovation programs focused on the circular economy. For example, through the Smart City Innovation Challenges, the NSW Government funded a solution to track precinct-level materials usage (NSW Government 2025), and the Victorian Government has provided grants to 25 recipients across four rounds[11] of the Circular Economy Innovation Fund (CEBIC 2024). Additionally, the Inner West Council in New South Wales offers grants to support local organisations undertaking circular activities and to increase community awareness and knowledge of the circular economy (Inner West Council 2025, p. 5).

An approach to innovation that is being increasingly adopted in policy is mission-oriented or challenge-based innovation. This approach allows policymakers to determine the direction of growth (Mazzucato et al. 2020, p. 421), and aligns research, innovation and policy around clear, ambitious goals which encourage cross-disciplinary collaboration (Australian Academy of Science and ARC Centre of Excellence in Synthetic Biology, sub. 144, p. 1; Monash University, sub. 138, p. 5).

Inquiry participants have noted success with this approach (AMEC, sub. 248, p. 11; Monash University, sub. 262, pp. 18–19). For example, Unearthed Solutions has partnered with mining companies to source solutions for a variety of challenges, including those related to the circular economy (AMEC, sub. 248, p. 11;

[9] For example, the National Reconstruction Fund, Future Made in Australia and green bonds.

[10] For example, Cooperative Research Centres, public research funding (CSIRO, universities) and the Critical Technologies Challenge Program.

[11] Round 1 focused on collaboration initiatives and innovation in the food sector. Round 2 focused on initiatives to prevent wasted materials across the supply chain and textiles innovation. Round 3 focused on research and development of sustainable market solutions. Round 4 focused on initiatives that increase business knowledge of the circular economy.

Unearthed Solutions 2022). Over the past decade, Unearthed Solutions has helped source potential solutions for 70 challenges faced by the resources industry (based on Unearthed Solutions 2025).

Challenge-based grant programs have also been used to uplift innovation in government procurement. The NSW Government's Choose Circular program funds solutions to challenges posed by government agencies seeking to incorporate new technologies and uses for recycled materials in their operations (NSW Government, sub. 139, p. 9). Similarly, the Australian Government's Business Research and Innovation Initiative (BRII) targeted innovative solutions from small to medium businesses to address challenges posed by various government agencies. Despite recent evidence suggesting that Australian Government business grants, as currently designed and implemented, may not overall be an effective lever for improving the financial performance of small to medium business recipients (Kavourakis et al. 2024, p. 5), an evaluation of the BRII found that of the nine small and medium businesses that progressed to the proof of concept stage[12] in the first round of funding, five had their solution procured by government and eight had commercialised their solution (Nous Group 2021, p. 7). Evaluations of similar challenge-based programs in the United States and United Kingdom found that such programs successfully stimulated innovation and delivered value for money (NASEM 2020, pp. 132–133; Steer Economic Development 2022, pp. 55–56).

An Australian Government challenge-based grant program focused on the circular economy could help overcome difficulties coordinating innovation among businesses, governments and researchers, and across sectors and disciplines. While innovation is inherently risky, a well-designed program can lead to significant environmental, social and economic benefits for the public, and successful commercialisation outcomes (box 7.1).

Box 7.1 – A challenge-based grant program to support innovative circular solutions

Key features of a proposed challenge-based circular economy innovation program include having industry and community collectively pose challenges of varying complexity and scale in an open and criterion-based application process. In setting criteria and guidance for potential challenges and solutions, the Australian Government should convey that selection will be based on their likelihood to deliver economic, environmental and social benefits. If desired, this could be targeted to specific sectors or circular economy activities (design, reuse, repair, etc.).

Oversight of these processes should be carried out by a panel with diverse expertise to ensure robust assessment. Such a panel should have both government and industry expertise, as this has proven to be effective in similar challenge-based initiatives (Nous Group 2021, pp. 67–68). For challenges that are place-based, the panel should incorporate relevant community members into the selection process to ensure solutions are workable within that community.

Challenge funds should be dispersed in two stages to ensure funding (and applicants' time) is used efficiently. Progression to each stage should be based on an assessment by the selection panel.

- The first expressions of interest stage would see successful applicants receive grant funding to test the feasibility of their proposed solutions and develop full proposals.
- The second stage would enable successful applicants to develop a working model of their solution to demonstrate its capacity to solve the challenge.

[12] At this stage, successful grant recipients receive funding to develop a prototype of their solution and to demonstrate its capability to address the challenge (DISR 2025).

Box 7.1 – A challenge-based grant program to support innovative circular solutions

The amount of funding and timeframe afforded to successful applicants in each stage should vary depending on applicant circumstances, and the size and complexity of the challenge. However, a minimum scale of funding and timeframe is likely needed for any challenge, however small. For the first stage, a minimum of $50,000 and a minimum timeframe of six months should be given to ensure applicants have sufficient resources and time to undertake testing. For the second stage, a minimum of $250,000 and 18 months should be afforded to applicants.

While these minimum requirements may be suitable for smaller challenges,[a] some challenges which provide large public benefit and involve significant collaboration will require funding commensurate with their scale. For reference, the Victorian Government's Circular Economy Innovation Fund and Business Support Fund have offered grants of up to $1 million (CEBIC 2025) and the European Union's Horizon Europe program, which funds solutions for large-scale circular economy challenges, provided grants with an average size of €3 million (European Commission 2023).[b]

Evaluations of similar programs have suggested that further funding and support should be provided beyond the second stage of the program. The integration of industry and community perspectives through the challenge formulation process, as proposed in this program, should bolster prospects for successful adoption or commercialisation within the first phase.

To encourage further collaboration and boost prospects of commercialisation or adoption, relevant industry and/or community mentors should be matched with successful applicants to better tailor solutions to industry and/or community needs.

a. For example, those that are funded through the BRII (DISR 2024a, p. 7, 2024b, p. 7), the Small Business Innovation Research program (United States), the Small Business Research Initiative (United Kingdom) and the Innovative Solutions Canada program (Nous Group 2021, pp. 101–102). **b.** Funding from these programs was contingent on co-contributions from funding recipients.

This inquiry has identified some priority areas for challenges in the proposed program that would deliver significant public benefit. These challenges will require various scales of investment to address issues across these supply chains.

- For e-waste, challenges could form around viable reuse opportunities for emerging waste streams including solar photovoltaic systems and electric vehicle batteries (chapter 5).
- Challenges could also seek to establish circular infrastructure in regional communities for materials of concern including e-waste, tyres and plastics (Monash University, sub. 262, p. 22).

Challenges should seek not only technical solutions but address a broad range of barriers. For example, through the Horizon Europe program, the European Union has posed a challenge to overcome the barriers to scaling up circular water management in agriculture. As part of this, funding recipients are required to develop solutions that overcome societal, behavioural and regulatory challenges that hinder the uptake of circular water solutions for irrigation (European Commission 2025b, pp. 89–90).

When implementing the challenge-based program, the Australian Government should also progress its commitments under the National Agreement on Closing the Gap. With respect to progressing Priority Reform 1 (partnerships and shared decision-making) and Priority Reform 3 (transforming government organisations), this program should invite and partner with community-controlled organisations to develop challenges that would support, for example, workforce development, capital infrastructure and service delivery. To do this, such challenges could be identified, grant recipients selected and grants administered

through direct partnerships with Aboriginal and Torres Strait Islander organisations and communities (recommendation 7.2). This would enable the program to be more culturally informed, responsive and accountable. In practice, this could involve resourcing an Aboriginal and Torres Strait Islander partner to administer the grant program in partnership with the Australian Government, and joint selection panels that are made up of majority Aboriginal and Torres Strait Islander people to help ensure solutions are selected based on self-determined outcomes.

An independent initial evaluation of the program should occur within three years of the program first providing full grants. This timeframe allows for a sufficient number of challenges and solutions to be collectively evaluated against their economic, environmental and social objectives. The evaluation should inform a decision on extending the program and, if extended, identify opportunities for improvement.

Recommendation 7.3
Establish a challenge-based grant program to support the adoption and diffusion of circular innovations

The Australian Government should establish a challenge-based grant program to foster innovation and support adoption and diffusion of innovative solutions in the circular economy. The program should consider challenges identified by industry and the community. Key features of the program design include:

- challenges posed by industry and community to target solutions that provide public benefit and address circular economy issues across the supply chain
- dispersing funds in at least two stages, with a first expressions of interest stage to test feasibility
- pairing grant recipients with relevant industry partners to foster collaboration and tailor solutions
- a selection panel with industry and government expertise to adjudicate potential challenges and applications for each stage.

An independent evaluation of the program should occur within three years.

Other measures for supporting innovation and investment

A challenge-based grant program would complement several existing cross-sectoral policies (and recommended sector-specific policies) aimed at supporting innovation and investment in the circular economy.

Sustainable procurement policies

Inquiry participants across various sectors have identified government procurement as a way to increase uptake of circular economy activities (BSC, sub. 140, p. 10; TSA, sub. 148, p. 64; WMRR, sub. 233, p. 9), noting government purchasing power can have material impact on market outcomes for particular sectors.

Several governments already have sustainable procurement policies, with some explicitly promoting the adoption of circular practices or products. For example, the Australian Government has released the *Environmentally Sustainable Procurement Policy* for construction services, information and communication technology, textiles, and furniture, fittings and equipment (DCCEEW 2024f, p. 9). Under this policy, Australian Government agencies will have to consider a range of sustainability principles focused on climate, environment and circularity for purchases in the specified categories that are above a particular value threshold. The principles include procuring goods that are durable, repairable, reusable and/or recyclable, and ensuring goods are recycled at the end of their useful life (DCCEEW 2024f, p. 7).

As noted in chapter 2, dedicated support personnel and coordination services could enhance the effectiveness of sustainable procurement policies for major infrastructure. These services help educate stakeholders about the use of sustainable materials in infrastructure, address stakeholder concerns, overcome regulatory or technical obstacles, and connect suppliers of sustainable materials to potential customers (recommendation 2.2).

Sustainable finance

The Responsible Investment Association Australasia found 36% of surveyed Australian investment managers incorporated waste management, zero waste or circular economy-related investments into their strategies (Dandarvanchig et al. 2024, p. 32). However, investors can be reluctant to invest in circular economy opportunities due to a lack of consistent information about businesses' circularity performance (CA ANZ, sub. 211, p. 3), and regulatory and policy uncertainty and fragmentation (ACOR, sub. 75, p. 19; Jemena, sub. 250, p. 5).

To help address the information gap and boost investor confidence, the Australian Sustainable Finance Institute has, in partnership with the Australian Government, developed the *Australian Sustainable Finance Taxonomy* to support sustainable finance markets in Australia. While the first version of the taxonomy focuses on setting criteria and classifications for climate mitigation activities across six sectors,[13] it also sets criteria to ensure that these activities do no significant harm in the transition to a circular economy (ASFI 2025, p. 130). These criteria ensure that resource use and wasted materials from an activity are identified, minimised and managed. Specifically, activities should:

- have a comprehensive waste management plan that incorporates the waste hierarchy
- use product stewardship schemes or extended producer responsibility if available
- develop recommissioning and rehabilitation plans when required to do so by law.

The development of the taxonomy is an important first step in addressing the broader issue of the lack of consistent reporting and disclosure about circularity. Widespread business adoption of the Australian Standard for measuring and assessing circularity performance[14] would also help standardise collection of circular information. Having consistent definitions, classifications and processes for collecting circular information is integral to having consistent information reported between different businesses.

Some inquiry participants noted that the taxonomy alone will not provide sufficient information to investors and suggested a need for mandatory reporting of circularity metrics akin to the recently introduced climate disclosure requirements (CA ANZ, sub. 211, p. 3). Introducing mandatory reporting requirements on circular performance would improve the consistency of information available to investors but would also impose compliance costs on businesses (CIF, sub. 222, p. 4). Such an introduction at this current time would be premature given the nascency of the circular economy.

In addition to co-development of the taxonomy, the Australian Government is also supporting investment in circular economy activities through its Green Bond program. The program aims to enable investors to back public projects that drive Australia's clean energy transition and support environmental objectives (The Treasury nd). Green bond proceeds can be used to finance government programs that improve environmental outcomes, including circular objectives for reducing and recovering wasted materials (AOFM 2023, pp. 16, 28).

[13] Agriculture and land, minerals, mining and metals, manufacturing and industry, electricity generation and supply, construction and buildings, and transport.

[14] Standards Australia 2024, AS ISO 59020:2024 Circular economy – Measuring and assessing circularity performance.

Removing other barriers to circular innovation will also support and improve investor confidence, and several reforms in this inquiry are targeted at these critical roadblocks to circularity.

- Regulatory reform can improve confidence by enabling a consistent and stable investment environment. Reforms such as standards and certifications for prefabricated construction and alignment of circular economy regulations across jurisdictions can minimise the risk of investments being non-compliant.
- Knowledge sharing can improve confidence by enabling investors to make informed decisions about circular economy investments. For example, place-based transition brokers can help build circular capability in small to medium sized businesses, allowing them to invest in suitable circular innovations.
- Co-funding from governments, such as through a challenge-based grant program, improves investor confidence by reducing the risk of pursuing or adopting circular innovation.

While removing these roadblocks is important for boosting investor confidence, by itself it is not sufficient to drive investment at the scale required to deliver broad public benefits. Complementary policy reforms (such as tax reforms to drive investment) are also essential to create the right incentives and market conditions.

8. Strategic reform approach

Key points

- **To promote a whole-of-economy transition to a more circular economy, governments should progress the recommended actions in this report, as well as other policy reforms and actions already underway that reinforce incentives for circularity.**
  - These reforms include those relating to individual sectors as identified in chapters 2–6, and more generally to rights to repair, packaging and plastics, and infrastructure investment evaluation.
- **Maintaining progress towards a circular economy requires governments to be adaptive and consider a broader view – beyond circular-specific policies – to effectively reduce barriers, manage risks and influence behaviour change.**
- **The Australian Government should develop an outcomes framework that enables all governments to connect circular economy policy actions to related economic, social and environmental goals, to support implementation, monitoring and evaluation.**
  - An outcomes framework would create a common strategic vision and enables transparency, accountability and ongoing improvements in circular economy policies.

8.1 Drive strategic reforms already underway

Beyond the recommended actions in this report, governments can promote a whole-of-economy transition to a more circular economy by progressing reforms already underway that have common objectives and/or reinforce incentives for circularity. Implementing these reforms in full will support a whole-of-economy transition to a circular economy.

Implementing Right to Repair reforms

Repair is a core activity of the circular economy. It enables households and businesses to extend the life of products where they choose to do so, and keeps materials in circulation for longer.

The Productivity Commission's *Right to Repair* inquiry (2021c) recommended a range of policy measures in the areas of competition, consumer protection and intellectual property to increase consumers' ability to access competitive repair services for products such as cars, agricultural machinery and small electronics (box 8.1). For example, recommendations relevant to small electronics include the introduction of a product labelling scheme for repairability and durability (chapter 5), and broader policies around copyright, consumer and competition reform that provide access to repair information, software updates and parts.

Governments have made progress in some areas, such as the review of the Motor Vehicle Information Scheme and implementing a designated complaints process (The Treasury 2024b, 2025b, p. 3). And, the Treasurer has indicated that the Australian Government is leading work on developing a general right to repair (The Treasury 2024a). However, most of the recommendations from the Right to Repair inquiry have not yet been implemented, and the Australian Government has not formally responded to the inquiry report to indicate which recommendations it intends to implement.

Implementing the remaining reforms would have economic and environmental benefits, and promote the transition to a more circular economy. With regards to the economic benefits, PC modelling of a selection of reforms from *Right to Repair* estimated that introducing a repair supplies obligation for agricultural machinery could increase gross domestic product (GDP) by $97 million, while implementing the suite of recommendations relating to consumer law and intellectual property could increase GDP by $311 million (PC 2024a, pp. 23, 30).

Box 8.1 – Recommendations from the Right to Repair inquiry

The Right to Repair inquiry made recommendations across a range of areas that aimed to reduce barriers for consumers to access competitive repairs.

Consumer law

Several recommendations related to ensuring consumers have adequate access to their rights associated with consumer guarantees. Reforms included the addition of a new consumer guarantee for software updates, improving access to consumer guarantees by adding a 'super complaints' process, improving consumer guarantee dispute resolutions in each jurisdiction and enhancing regulatory powers to enforce consumer guarantees. In addition, it called for manufacturers to make clear that the use of independent repairers or spare parts does not void consumers' rights associated with consumer guarantees.

In 2024, a 'super complaints' process was established through the *Competition and Consumer (Designated Complaints) Determination 2024*. Designated complaints can be submitted to the Australian Competition and Consumer Commission by consumer and small business advocates that have been given approval to lodge complaints (The Treasury 2024b).

Competition

The inquiry recommended measures to review competitive outcomes in specific repair markets (motor vehicles, phone and tablets, watches and medical devices). It also recommended the introduction of a repair supplies obligation on agricultural machinery to improve competition and choice for repairs.

In 2024, the Australian Government commissioned a review of the Motor Vehicle Information Scheme (Australian Government 2024a, p. 300). In June 2025, Treasury commenced the review and released a discussion paper inviting interested parties to submit responses in relation to the scheme's performance (The Treasury 2025b, p. 1).

Intellectual property

Three amendments to the *Copyright Act 1968* were also recommended. These amendments sought to improve repair market outcomes by providing repairers with better access to repair information and to strengthen copyright exceptions provided by government.

Box 8.1 – Recommendations from the Right to Repair inquiry

E-waste

The report identified e-waste as an emerging waste stream and made several recommendations to manage its growth. It called for the National Television and Computer Recycling Scheme to include annual reuse and repair targets, and for the adoption of tracking devices to monitor e-waste market outcomes.

Product obsolescence

A broader product labelling scheme detailing product repairability and durability was also recommended. This included initial testing under a pilot scheme for household appliances and consumer electronics.

Source: PC (2021c).

Recommendation 8.1
Implement the suite of recommendations from the PC's Right to Repair inquiry

The Australian, state and territory governments should implement the full suite of recommendations from the PC's Right to Repair inquiry. The Australian Government should publish a formal response to that inquiry that indicates a timeline and workplan for implementing these reforms.

Packaging regulation

Packaging designs that use more sustainable and potentially fewer materials, and better enable recycling and/or reuse, will play an important role in the transition to a more circular economy. Packaging uses a large volume of materials such as paper, paperboard, plastic and glass to preserve and protect a range of goods (APCO 2024b, p. 1). In the 2022-23 financial year, more than 7 million tonnes of packaging was placed on the Australian market (APCO 2024b, p. 14). Just under half of the packaging placed on the Australian market was manufactured in Australia using domestically sourced materials (PC estimate, based on APCO 2024a, pp. 43, 66, 88, 117, 134).[1]

Packaging is currently regulated with a co-regulatory scheme.[2] In November 2023, the Environment Ministers' Meeting agreed that the Australian Government would reform packaging regulations by mandating packaging standards, including design rules such as minimum recycled content requirements and chemical restrictions (DCCEEW 2023b, p. 1). The reform commitment followed an independent review in 2021 and the

[1] Due to data availability, this estimate is based on data from the 2021-22 financial year.

[2] Liable packaging brand owners are required to either become a signatory to the Australian Packaging Covenant and fulfil its associated obligations (including designing more sustainable packaging to increase recycling and reduce litter) (APCO 2017, p. 1) or abide by relevant state and territory packaging regulations. The *National Environment Protection (Used Packaging Materials) Measure 2011* (Cth) requires that state and territory regulations do not place signatories to the Australian Packaging Covenant at a competitive disadvantage in the market.

collapse of the REDcycle soft plastic recycling scheme in 2022.[3] The review found that the current co-regulatory scheme for packaging was inconsistently implemented across jurisdictions, poorly understood by liable parties and had limited (and in some cases no) monitoring and enforcement (MP Consulting 2021, p. 6). The current scheme is ineffective at promoting packaging circularity: only 19% of plastic packaging was recovered for reuse in the 2022-23 financial year, one percentage point less than the previous year and well behind the target of 70% (APCO 2024b, pp. 1, 20). While 86% of all packaging placed on the market is classified as having good recycling potential, only 46% of plastic packaging has this classification (APCO 2024b, p. 9). The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) has received submissions from, and conducted consultations with, hundreds of industry stakeholders as part of their preparation of packaging regulation reform (DCCEEW 2025f).

A central issue being considered by DCCEEW is whether a mandatory extended producer responsibility scheme should be imposed on all liable suppliers to address concerns that the current co-regulatory system, which allows suppliers to opt into one of two different regulatory streams, is resulting in inconsistent enforcement and free riding (AFGC, sub. 105, p. 3; Monash University, sub. 262, p. 11). Other related issues include whether, and how, to recover the operating costs for the scheme through eco-modulated fees, and if minimum recycled content thresholds or targets should be applied. Many inquiry participants supported a mandatory extended producer responsibility scheme for packaging with eco-modulated fees.[4] For example, participants observed that a mandatory scheme for soft plastic packaging with minimum recycled content thresholds is essential for the successful development of the market for recycled soft plastics (SPSA, sub. 202, p. 4). Other participants emphasised the need to consider international packaging regulations in the development of the scheme's elements (BCA 2025, p. 7; Tetra Pak, sub. 41, p. 5), such as the Packaging and Packaging Waste Regulations which will apply standards for labelling and chemicals use for packaging across the European Union (European Commission 2025c), and the associated cost of deviating from these standards.

In its interim report, the PC recognised the potential benefits of a mandatory scheme but also noted that the impacts of different scheme models need to be examined, including by considering administration and enforcement costs and the potential for cost pass-through to consumers. The PC also noted the need to analyse how measures in adjacent policy areas (such as the recently introduced public reporting of scope 3 emissions for large entities) influence greater uptake of sustainable packaging (PC 2025a, p. 166). Recently, the Australian Government joined 96 other countries in supporting the *Nice wake up call for an ambitious plastics treaty* (Watt 2025), a document which reaffirms Australia's commitment to the *High Ambition Coalition to End Plastic Pollution* with the objective of establishing a treaty with the aim of ending plastic pollution by 2040 (Plibersek 2024). The commitments within this treaty would necessitate further policy changes which drive packaging sustainability.

To maintain reform momentum, build industry and community confidence and buy in, and enable external scrutiny, it is critical that the Australian Government publishes its proposed packaging regulatory reforms and supporting analysis without delay.

[3] REDcycle was an industry-led program which partnered with major supermarkets to recover and recycle soft plastics (such as plastic bags, cling wrap and bubble wrap) (ACCC 2023a). In 2022, REDcycle suspended operations due to a lack of suitable recycling facilities, and supermarkets assumed responsibility of the approximately 11,000 tonnes of soft plastics stockpiled and awaiting recycling (ACCC 2025a).

[4] Boomerang Alliance (sub. 2, p. 1); Pact Group (sub. 77, p. 2); TEC (sub. 79, pp. 6–7); Tetra Pak (sub. 41, p. 3); Veolia Australia and New Zealand (sub. 8, p. 1; sub. 193, p. 5); WMRR (sub. 168, p. 6).

A 2025 Australian Senate inquiry into waste reduction and recycling policies considered a United Kingdom style tax on packaging (both domestically and internationally manufactured) made from virgin plastics[5] to complement these reforms (Environment and Communications Committee 2025, pp. 75–77).[6] However, the effectiveness of such a tax in Australia to drive or influence sustainable packaging in domestic or global markets, at least in the immediate short term, may be constrained by the limited plastics recycling capacity currently in place domestically.[7] With few ready substitutes to virgin plastics, a short-term effect of the tax could be to increase the costs of packaging production, which could be passed through to consumers in higher prices of packaged goods.

Further analysis is needed to consider to what extent such a tax would influence the longer-term development of domestic plastic recycling activity and any shift towards imported plastics, and how this could be impacted by international developments. A tax on virgin plastics could incentivise private and/or public investment in plastic recycling infrastructure. However, investors must also evaluate the operational costs of domestic recycling (such as the costs of recovering, transporting and sorting used plastic) and how any international growth in plastics recycling from the widespread adoption of a treaty against plastic pollution would impact the competitiveness of domestic recycled plastics against imported alternatives. Where domestic recycling operations are constrained by high administrative costs – for example, because of the fragmented regulations currently governing the classification, transport and reuse of wasted plastics in Australia (chapter 7) – they reduce the attractiveness of investing in domestic plastic recycling infrastructure compared to importing recycled plastic from overseas. In these cases, governments should prioritise harmonising and streamlining regulations affecting domestic recycling before introducing taxes or subsidies.

The Australian Government would also need to consider what action is required to guarantee the credibility of recycled plastics claims. Without an adequate traceability mechanism[8] to distinguish recycled plastics from virgin plastics (whether manufactured domestically or internationally), any government action against virgin plastics could not be enforced.

The PC also suggests monitoring the recently introduced suite of United Kingdom packaging regulations – such as requirements for businesses to purchase credits to cover the difference between their actual plastic packaging recycling rates and the targets set by government (UK DEFRA and UK EA 2025) – and evaluate the potential applicability of these policies to Australia once more evidence becomes available.

[5] Plastics are difficult to recover and recycle – almost 90% of wasted plastic is landfilled each year (DCCEEW 2025c, p. 46), where it poses contamination risks to ecosystems and waterways through leachate (Hossain et al. 2024, p. 1). Plastics can also shed microplastics (plastic fragments less than five millimetres) into the environment during manufacturing, use, recycling or disposal which can pollute oceans and cause adverse health effects in sea life and humans when consumed (Issac and Kandasubramanian 2021, p. 5; Jadhav et al. 2021, pp. 1, 2, 6; Ncube et al. 2020, p. 2; Suzuki et al. 2022, p. 8).

[6] The United Kingdom Government introduced a tax (currently GBP 223.69 per tonne) on manufacturers and importers of plastic packaging made from less than 30% recycled plastics in April 2022 (UK HMRC 2023, 2025).

[7] In the 2022-23 financial year, Australia had an annual plastic packaging recycling capacity of 343,000 tonnes, but placed approximately 1.3 million tonnes of plastic packaging on the market (APCO 2024b, p. 27). Therefore, even if operating at maximum capacity – which is unlikely, given only 38% of Australia's plastic packaging recycling capacity was utilised in the 2022-23 financial year (PC estimate, based on APCO 2024b, pp. 22, 27) – as of June 2023, Australia could only supply enough recycled plastic to meet roughly 27% of plastic demand for packaging (PC estimate, based on APCO 2024b, pp. 14, 27).

[8] Australia currently has a voluntary national framework for recycled content traceability which takes an outcome-focused approach for all recycled materials (DCCEEW 2025a, p. 6).

Managing emerging chemicals of concern

Hazardous materials in waste streams represent a persistent risk to human and environmental health.[9] Whilst waste streams containing some hazardous materials (for example, lithium) can pose circular economy opportunities, others (for example, chemicals of concern such as per- and polyfluoroalkyl substances (PFAS)) can constrain what benefits can be realised from the circular economy at present and in future. While in this inquiry the PC has noted how regulatory settings for the contamination of organic waste streams has implications for higher value uses such as biochar production (chapter 3), how hazardous materials, including chemicals, are managed has implications across a range of sectors.

The Australian Government regulates industrial chemicals through the Australian Industrial Chemicals Introduction Scheme.[10] The scheme regulates the importation and manufacture of industrial chemicals by conducting scientific risk assessments on the introduction and use of industrial chemicals, and by operating a certification system that authorises import and use. However, the scheme does not regulate the use, storage and disposal of manufactured products that contain industrial chemicals (AICIS 2025) as this is regulated by other Australian, state and territory legislation.[11]

To continue effectively managing the risks posed by chemicals of concern, governments need to design and implement regulations that are adaptable and responsive.[12] Regulatory approaches to achieving this include:

- harmonisation across jurisdictions, products and applications to avoid compliance confusion and ensure best practice is the norm (Wakefield-Rann 2022, pp. 8–9)
- designing regulation informed by timely information from industry and research to enable an assessment of the level of scale and magnitude of impact of the hazardous materials
- evaluating the point in the product life cycle for regulatory action that maximises net benefits. For example, inquiry participants have suggested that regulating the manufacture, importation and use of such chemicals, or products that contain them, could provide a significant benefit relative to the costs of addressing contamination (ACOR, sub. 256, pp. 12–13; WMRR, sub. 233, pp. 8–9). Such a regulation could be supported by designing regulations that are guided by the principles of green chemistry[13] and enable substitution to safer materials (DCCEEW 2024b, p. 18; Wakefield-Rann 2022, p. 12).

However, any new or altered regulations need to balance social, environmental and economic risks and benefits, and consider the cost of implementation, as well as any new enforcement requirements for governments.

Undertaking infrastructure investment evaluation

Infrastructure development is critical to economic growth and providing essential services that support basic human needs. Best practice infrastructure development means proceeding with those projects that demonstrate clear societal net benefits. By avoiding projects that do not demonstrate this, governments can improve materials productivity by avoiding unnecessary materials use and wastage (chapter 2).

[9] Hazardous materials include those that are explosive, flammable, poisonous, toxic, ecotoxic or infectious (DCCEEW 2025j).
[10] Chemicals in other uses are regulated by other schemes. Agricultural and veterinary chemicals are regulated by the Australian Pesticides and Veterinary Medicines Authority, chemicals used in food are regulated by Food Standards Australia and New Zealand, and chemicals in medicines are regulated by the Therapeutic Goods Administration (AICIS 2025).
[11] For example, state and territory legislation regulates the handling of asbestos prevalent in construction materials.
[12] For example, in December 2024, Environment Ministers agreed to publish an updated *PFAS National Environmental Management Plan*, complementing the standards established under the *Industrial Chemicals Environmental Management Standard* which will reduce the environmental impact of PFAS (DCCEEW 2024d, p. 2).
[13] These principles outline a design process to minimise or eliminate the use or generation of hazardous chemicals over the course of the product life cycle (US EPA 2025).

Governments can thus support the transition to a circular economy by ensuring major infrastructure projects undergo rigorous and transparent cost-benefit analysis, and are assessed within the context of long-term integrated planning (section 8.2).

The PC therefore reaffirms recommendations from its recent inquiries related to infrastructure investment that governments are yet to fully implement and/or require enduring commitment. The PC's *Advancing Prosperity* inquiry recommended governments address the absence or disregard of rigorous cost-benefit analysis in major infrastructure projects (PC 2023a, p. 74).

In the *National Water Reform* inquiry, the PC recommended that the National Water Initiative (NWI) be renewed to ensure water security in the face of ongoing challenges including climate change and growing water demand (PC 2024b, p. 2). While the renewal of the NWI focuses on achieving water security more generally, it also can support the transition to a circular economy as sustainable, economically efficient investment in water security factors in the environmental impacts of materials use. The PC recommended the use of frameworks that enable all options to be considered (for example, including demand management, purified recycled water and decentralised/modular infrastructure), and that infrastructure is assessed against the criteria that it is economically viable, ecologically sustainable and culturally responsive prior to the commitment of funding (PC 2021a, p. 194, 2024b, pp. 121–122).

8.2 Ongoing and future opportunities and challenges

While there is significant innovation occurring towards circularity, the areas of reform identified in this inquiry reflect the fact that Australia's transition to a circular economy is in its early stages overall. Generally, households and businesses are aware of the benefits of circular practices but are faced with challenges in adopting circular activities (Collins et al. 2023, pp. 23–25; Torres de Oliveira et al. 2021, p. 4). The recommendations in this report are actions that governments can take in the short and medium term to reduce barriers and increase uptake of circular activities, and in doing so improve materials productivity.

However, there are future opportunities and risks for the circular economy beyond the scope of the recommendations in this report. As governments implement proposed reforms and look ahead, they will need to take a broader view of what the circular economy encompasses and consider policies and metrics that effectively monitor and manage a wider set of issues (chapter 9). The following sub-sections present some of these broader issues, however this is not exhaustive and there will be other areas that governments will need to consider.

A range of skills will be required

A well-trained workforce is an important enabler of the circular economy transition. At present and in future, a range of both transferrable and specialised skills are required to develop new circular products and approaches, adopt circular innovation and undertake various circular economy activities. Transferable skills, as identified in the Circular Economy Ministerial Advisory Group's final report and *Australia's Circular Economy Framework*, include the use of systems and critical thinking, while more specialised skills include knowledge of materials flow analysis and sustainable product design (DCCEEW 2024b, p. 28, 2024c, p. 66).

Newer and broader (multifaceted and versatile) skillsets will be required as the circular economy transition progresses. For example, these will be required in place-based transition brokers (recommendation 7.2) and the personnel engaged to offer facilitation, information and support services to enable circularity in large infrastructure projects (recommendation 2.2) will need to have diverse skillsets to encourage uptake of circular activities within their communities and across industries. Such brokers and facilitators will need to

have the skills to engage with diverse stakeholders across supply chains, as well as broad technical knowledge and strategic thinking to understand the applicability of the circular economy in various contexts.

The need for broader skillsets also applies to government agencies involved in implementing circular economy policies. The economy-wide nature of the circular economy transition means that policies are not isolated to a sector and aim to achieve a range of interconnected environmental, economic and social benefits. This highlights a need for individuals and teams in central agencies and departments to adopt a cross-portfolio approach to analyse how circular policies result in flow-on impacts across different parts of the economy, environment and community; assess these different kinds of impacts (not just those that can be quantified in conventional monetary terms) to inform decisions; and foster collaboration and coordination across agencies and levels of government, and between governments, industry and community.

As circularity within the economy grows, and to drive this growth, demand for these skills will increase. However, there may be shortages in training or specialist skills that vary by sector (Schandl et al. 2024, p. 18). Skills gaps in the broader economy can also limit progress of the circular economy transition. For example, the current skills shortage in regional areas may be a barrier to undertaking circular economy activities in these communities, and the current shortage of tradespeople may limit the uptake of circular economy skills that are required to progress circularity in the built environment (Jobs and Skills Australia 2023, pp. 13–14). To ensure that Australia has the skills necessary for a circular economy, governments should monitor the magnitudes and duration of shortages across various locations, sectors and disciplines, and any future policy action must be targeted at specific skills gaps.

Integrated urban planning can improve circularity

Integrated urban planning is an important aspect of city and town design and management that is both an opportunity and an enabler of the circular economy. It incorporates urban design, transport, housing, health and biodiversity in the same planning processes (UNEP 2024b), across decisions about land use, service delivery and civil infrastructure development.

As an opportunity, integrated planning can improve materials productivity and environmental outcomes by minimising materials use in urban development. The development of the Western Sydney Aerotropolis is an example of integrated planning. The integrated planning of land use and transport will be made possible through consultation with community and coordination across various levels of government and will ensure that materials use is optimised to meet community transport needs (Western Sydney Planning Partnership 2020, pp. 6, 38). Additionally, the integrated planning of water systems with infrastructure will provide a range of benefits including better water cycle management, waterway health and urban heat management (Western Sydney Planning Partnership 2020, p. 23). At a precinct scale, integrated planning was used in One Central Park in Sydney. The complex contains a mix of commercial and residential real estate as well as a water recycling plant that distributes treated water throughout the complex and to neighbouring areas for secondary use.

Many state and territory governments have stated objectives around integrated planning, including in infrastructure and transport (Infrastructure NSW 2022; SA DHUD 2019, p. 27; VIC DTP 2024a), and urban water planning (NSW DPIE 2021b, p. 123; VIC DELWP 2017, p. 5). However, there can be challenges in its implementation. For example, the PC identified barriers to integrated water management relating to a lack of clear objectives, clarity of roles and responsibilities, and communication between the urban planning and water sectors (PC 2020c, p. 40). In undertaking integrated planning, governments should introduce measures to reduce these challenges to avoid significantly lengthening planning approval timeframes, which are already leading to slow development (PC 2025c, pp. 45–46).

Where governments are supporting major economic and infrastructure transformations in specific regions or places (for example, the Bradfield City Centre (Western Sydney Aerotropolis), Brisbane Olympics or Renewable Energy Zones), these offer significant opportunities for integrating circular economy goals and innovations, ideally from the initial planning stages. Chapter 7 outlines the benefits and some mechanisms to progress place-based circularity, which may also apply to large-scale regional developments.

Behaviour change needs to be supported

Inquiry participants identified behaviour change as an important element for the circular economy transition within their industry and for the circular economy more broadly (ARA, sub. 265, p. 1; BSC, sub. 223 att. 2, p. 13; CERN APAC, sub. 215, p. 2). *Australia's Circular Economy Framework* recognises governments as an enabler for the circular economy transition and calls for education initiatives (DCCEEW 2024b, p. 30). State, territory and local governments are already implementing a range of programs which recognise the need for and value of support for behaviour change in the transition to greater circularity (section 7.2).[14]

However, changing household, business and community behaviours and choices (such as reusing or repairing products, or purchasing products better designed for circularity) is a gradual process and requires sustained action. To influence behaviour, tailored education and mentoring about the circular economy can help build capability and understanding of its application in various contexts, and increase engagement with circular activities (ASBFEO, sub. 270, p. 4; GCCN and Sustainability Victoria 2024, p. 8; Roundtable participants, pers. comm., 29 May 2025).

Governments have an important and continuing role in educating Australians to make informed decisions and support behaviour change over time. Behaviour change can be directly targeted through initiatives like product labelling or be an outcome of programs such as product stewardship.

8.3 Develop an outcomes framework for circular economy reforms

Circular economy policy in Australia is still in its early stages. For some reform areas, the issues are relatively well known and the supporting evidence base for designing reforms is relatively well developed. In these areas, full implementation should progress. For other reform areas, including those in which future opportunities for further policy change arise, governments will need to undertake further work to better understand how to design policy changes to have the greatest net benefits. Governments should gather additional information to understand and, where possible, quantify the benefits of policy options. This can be done through, for example, life cycle analyses or bespoke impact studies. In some cases, a staged approach to policy implementation is preferred to monitor policy implementation or assess how the impacts of recent international policy actions on supply chains affect Australian markets.

[14] For example, the Victorian Government funded the Gippsland Circular Futures Initiative which improved awareness and adoption of circular practices in businesses in the Gippsland region (GCCN and Sustainability Victoria 2024, p. 8).

The Australian Government should develop an outcomes framework that enables all governments to connect circular economy policy actions to related economic, social and environmental goals. This will help governments implement, monitor and evaluate circular economy reforms.

- **An outcomes framework would create a common strategic vision**. It would enable a systematic and mission-based approach[15] to circular economy policy by ensuring that progress is aligned across governments and that agencies are clear on what outcomes policies should be achieving. This is particularly important in the circular economy context as reforms are both sector-specific and cross-sectoral, meaning roles for implementation, administration and evaluation will be spread across various levels of government and government departments.
- **An outcomes framework would enable transparency, accountability and ongoing improvements for circular economy policies**. By setting out the outcomes that policy actions intend to achieve, an outcomes framework would enable parties to identify and collect the data necessary to monitor policy effectiveness and make policy improvements over time. This may include developing specific metrics to measure progress over time (discussed further in chapter 9), as well as filling evidence gaps to strengthen the case for further reform (for example, developing methods to better capture the social, economic and environmental benefits of government action). The framework also provides a basis for the community to hold governments to account on its policy decisions.

Developing the outcomes framework will enable the inclusion of government actions that promote the transition to a circular economy. A starting point could be to include, for example, actions from the National Waste Policy, actions to end plastic waste and actions recommended in this report. As circular economy policy implementation progresses, the outcomes framework will also support the identification of further priorities and policies to develop. The ultimate scope will depend on the targets and outcomes that are chosen.

Figure 8.1 presents a stylised outcomes framework. It illustrates how an outcomes framework can be used to connect government policy actions to a range of objectives that promote uptake of circular activities across the product life cycle (such as those relating to circular design, product repair, reuse and recycling), and how these activities contribute to outcomes relating to environmental, economic and social benefits that achieve longer-term circular policy goals (such as those identified in the National Circular Economy Framework).

An important element of this framework, and the outcomes framework to be developed by the Australian Government in future, is the mapping of reforms and outcomes relevant to governments' commitments under the National Agreement on Closing the Gap. In developing a broader outcomes framework, the Australian Government must identify, develop and map relevant reforms and outcomes in partnership with Aboriginal and Torres Strait Islander organisations. This would help ensure outcomes are valued by Aboriginal and Torres Strait Islander communities (PC 2020a, p. 3), and that the valuable traditional knowledge and innovation strengths of Aboriginal and Torres Strait Islander cultures is incorporated into the framework (First Nations Economics, sub. 252, p. 14). The extent of integration within the overarching outcomes framework, or whether a separate, linked outcomes framework is preferred to embed self-determined outcomes for relevant reforms, needs to be determined by Aboriginal and Torres Strait Islander people.

[15] A mission-based approach allows policymakers to determine the direction of growth (Mazzucato et al. 2020, p. 421) by implementing policies that will achieve clear and ambitious circular economy goals. Using this approach for Australia's circular economy transition has been supported by inquiry participants (Monash University, sub. 262, p. 18; RMIT University, sub. 212, p. 1).

Figure 8.1 – Indicative outcomes framework for Australia's circular economy transition[a]

Overarching vision: improve wellbeing of all Australians through economic, social and environmental benefits

Inputs	Intermediate objectives	Activities/outputs	Benefits	Second order outcomes/CEF Goals	Indicators (2035 targets)
Investment **Price instruments** **Regulatory reform** **Information** **Education** **Coordination** **Evaluation, reporting and improvement**	Systems thinking and circular economy skills Innovation Behaviour change Business practices, market development and investment Advanced technology for resource recovery and recycling Collaboration and place-based opportunities	**Design** Refuse Rethink Reduce **Consume** Reuse Repair Refurbish Remanufacture Repurpose **Return** Recycle Recover	**Efficient materials use** such as circular design, reduced waste generation, increased recycling **Environmental benefits** such as reduced emissions, reduced pollutant discharge, improved biodiversity **Economic benefits** such as value extracted from previously wasted materials, secondary markets created **Social benefits** such as strengthened social connections, healthier communities	Australian businesses have reduced dependence on virgin materials Resource efficiency is maximised, materials are continually cycled and products are built to last Australia is a global leader in sustainable innovation and has a thriving future proof economy Cultural heritage is preserved and restored Nature is regenerated and emissions are reduced Waste is minimised	Double circularity rate Reduce materials footprint by 10% Increase materials productivity by 30% Safely recover 80% of resources

External factors and assumptions

a. The framework incorporates reforms and outcomes from this inquiry and *Australia's Circular Economy Framework* (CEF) (DCCEEW 2024b).

Figure 8.2 demonstrates the outcomes framework in action, with worked examples drawing on the policy actions identified in recommendations 2.1 and 7.2. For example, removing restrictive regulations could promote circular activities and innovation across the product life cycle and improve environmental, economic and social outcomes. This may in turn help to achieve circular policy goals, such as circular economy targets.

Figure 8.2 – Australia's circular economy outcomes framework in action

Government action	Activities and outcomes	Environmental, economic and social benefits	Impact on circular economy targets
Regulatory reform *Example*: Conduct a stocktake and reform standards and specifications limiting sustainable materials use in infrastructure	**Innovation** is unlocked through prompting a rethink of sustainable materials applications Increased use and exchange of **sustainable materials** Increased **recycling** activity from increased demand for recycled materials	Reduced **greenhouse gas emissions** by using materials with lower embodied carbon **Increased net value** extracted from previously wasted materials Over time as markets develop, the **price of sustainable materials reflects the full costs and benefits** relative to virgin materials	Increased **circularity rate** through increased secondary materials use Reduced **materials footprint** from reduced domestic demand for raw materials Increased **materials productivity and recovery rate** through increased recycling and production of recycled materials
Coordination and information *Example*: Place-based transition brokers connect and provide information and advice to small to medium sized businesses on adopting circular economy practices	**Innovation** is fostered through agglomeration, collaboration and knowledge sharing Businesses adopt new practices that increase beneficial activity across the **10 Rs** Organisations develop required circular economy **skills** to adopt circular activities	**Reduced pollution impact** on amenity, environment and public health. Depending on activities and local context, potential to **regenerate nature** Strengthened **community connections** Advanced local and regional **economic development** priorities	Dependent on what activities are adopted by local organisations For example, a waste stream from one organisation may be able to be used as an input by another. At scale, this could increase the **circularity rate** and **materials productivity**, and **reduce materials footprint**

Recommendation 8.2
Develop an outcomes framework to help guide implementation, monitoring and evaluation of government actions to promote a circular economy

The Australian Government should develop an outcomes framework that connects each circular economy policy action to its related economic, social and environmental goals. This will assist governments to implement, monitor and evaluate these policy actions.

9. Measuring Australia's circular progress

Key points

- **Developing new metrics with greater sectoral detail or coverage of the '10Rs' would enhance policymakers' ability to track overall progress and evaluate new and emerging circular economy policies.**
  - Such metrics could also guide or influence private sector actions, by highlighting where businesses could do more to increase materials productivity and pursue potential areas of market growth.
- **The Australian Government should develop metrics to enable effective monitoring, evaluation and reporting of government actions to promote a circular economy. A strategic approach to selecting these metrics relies on governments first developing an overarching policy outcomes framework (chapter 8). The Australian Government should:**
  - use an outcomes framework (recommendation 8.2) to identify areas lacking metrics or where data gaps exist, such as markets or sectors where there are policies aimed at encouraging businesses to incorporate circular design principles in product design
  - develop a metrics and data collection strategy that prioritises filling key gaps, based on considerations such as the significance of the opportunity (in terms of economic and environmental benefits) and the extent to which existing data systems capture relevant data
  - establish and oversee arrangements for monitoring, evaluation, reporting, and improvement.

Metrics and indicators[1] are key tools to track progress and evaluate whether government policies have met their desired outcomes. They also help governments monitor longer term progress towards economic, environmental and social objectives more generally. Indicators and metrics for the circular economy are important for governments to set policy direction, show progress, identify opportunities, and demonstrate impact (Ellen MacArthur Foundation 2024).

The terms of reference for this inquiry ask the Productivity Commission to identify metrics to measure opportunities and improvements made in Australia's materials productivity and efficiency.

[1] These terms are often used interchangeably but their meaning can differ depending on context (Better Evaluation 2025). In the context of key performance indicators, an indicator is indirect and requires interpretation and explanation (for example, the circularity rate) whereas a metric is a figure that provides an easily interpreted sign of performance (for example, number of patents approved in a year for circular design) (Better Evaluation and ANZSOG 2022, p. 4).

9.1 Opportunities to enhance circularity metrics

In Australia, circular economy policies are shifting in focus from waste management to opportunities in specific sectors and at earlier stages of the product life cycle (such as encouraging sustainable product design). The Circular Economy Ministerial Advisory Group recommended 'developing sector-specific transition strategies' which 'could include sector-specific targets and focus on priority materials to drive circularity' (DCCEEW 2024c, p. 28). The priority sectors identified in *Australia's Circular Economy Framework* include industry, built environment, food and agriculture, and resources sectors (DCCEEW 2024b, p. 6).

Metrics and indicators currently collected and reported on an ongoing basis by governments have several limitations[2] for evaluating whether circular economy policies have met their desired outcomes. For example, these metrics:

- **primarily focus on circular activities that occur at the end of the product life cycle (namely recycling)** and do not enable monitoring of activities in consumption (for example reuse, repair, refurbish, remanufacture and repurpose) or design (for example refuse, rethink, reduce) phases (box 9.1). This limits the ability of policymakers and businesses to design, implement and understand the effectiveness of actions that seek to increase circular economy practices earlier in the product life cycle, such as uptake of sustainable product designs
- **tend to focus on materials volumes or weight** but do not (generally) capture other environmental (for example carbon, water, biodiversity) or economic impacts, or distinguish between the value (or other characteristics) of different material types
- **are often highly aggregated** which can make them difficult for policymakers or businesses to interpret and use. For example, metrics such as Australia's circularity rate (the proportion of materials used in an economy that are recovered and reintroduced as secondary materials) are reported at the national level to enable economy-wide tracking of the transition to a circular economy but that metric does not provide insights into where or how progress has been made
- **lack sectoral detail** which may reduce the ability of policymakers or businesses to track the effectiveness of measures targeting priority sectors (such as those identified under *Australia's Circular Economy Framework*) or parts of the product life cycle (such as designing for repurpose). For example, the existing waste source categories (municipal solid waste, commercial and industrial, and construction and demolition) were developed prior to the National Waste Policy and may not be fit-for-purpose to inform the priority areas identified in *Australia's Circular Economy Framework*. Before introducing circularity targets for priority sectors, the Australian Government will need to develop more granular sector-specific metrics to track progress.

General productivity measures, such as multifactor productivity, also have limitations in capturing changes in the efficiency of materials use (chapter 1).

[2] For example, Coreo (sub. 104, p. 14); Engineers Australia (sub. 108, p. 3); Mathur (sub. 10, p. 1); NSW Government (sub. 139, p. 12–13); ResiLoop Ltd (sub. 84, p. 4); Swedish Australian Chamber of Commerce Sustainability Committee (sub. 94, p. 2); WALGA (sub. 167, p. 2) and WARRRL (sub. 87, pp. 6–7).

Box 9.1 – What metrics do governments currently report?

The Australian Government's *Measuring What Matters* dashboard currently reports on the following circularity metrics:

- waste generation per person
- proportion of waste recovered for reuse, recycling or energy
- circularity rate (the proportion of materials used in an economy that are recovered and reintroduced as secondary materials)
- material footprint per person (materials needed to meet domestic consumption measured in tonnes per person)[a]
- materials productivity (the amount of economic value [measured by GDP] generated from a unit of materials used measured by dollars per kilogram).[b]

The first two metrics draw on information collected by state and territory governments under the National Waste Policy reporting. The above metrics and indicators (and supporting metrics) align with the OECD framework for monitoring progress towards circularity.

Australian, state and territory and local governments are also undertaking material flow analyses, which enable governments to measure how materials are used and flow through the economy. These material flow analyses can be done on specific materials, sectors or at an economy-wide scale. They can also be done as a one-off or regularly and are used to identify priorities for increasing circularity and developing policies to support and drive behaviour change. For example:

- CSIRO have been funded under the National Environmental Science Program (2020–2027)[c] to develop a national material flow account by material input, processing, production, use, systems of provision,[d] and end-of-life. They also included estimates for domestic extraction and material footprint for each jurisdiction
- Green Industries South Australia commissioned a material flow analysis of the South Australian economy and for four sectors including food and organics, built environment, electronics and textiles
- the Hunter Joint Organisation and the NSW Government have mapped 21 waste materials across each local government area in the Hunter and Central Coast region and developed a suite of success measures. Hume City Council undertook a material flow analysis in 2021 to inform its circular economy roadmap and the Limestone Coast region has also mapped material flow data (including tonnes of carbon dioxide emissions) to identify sector opportunities with next step actions including establishing some circular economy indicators.

a. Material footprint does not include an estimate of the environmental impact (carbon, water or other) of material use. **b.** Domestic materials consumption is used to calculate materials productivity and the circularity rate. Domestic materials consumption measures materials consumed in a domestic economy by weight, specifically the amount (weight) of materials extracted or harvested in the country, plus materials and products imported, minus materials and products exported. **c.** Project IP5.04.01 Metrics, data and indicators for material flow and stocks, waste and emissions to monitor the progress of Australia's circular economy transition. **d.** Housing, mobility, food, energy, communication, waste management and other.

Source: ABS (2024); Arnold and Cannon (2022, p. 24); Bricout et al. (2022); DCCEEW (2022b, 2024b, p. 9, 2024l); Hume City Council (sub. 20, attachment); Hunter Joint Organisation (sub. 172); KPMG (2021); Miatto et al. (2024); OECD (2024, pp. 32–34); RDA Limestone Coast (2022, p. xi).

Developing additional metrics with greater sectoral detail or coverage of the '10Rs' would enhance policymakers' ability to evaluate new and emerging circular economy policies. It could also guide or influence

private sector actions, such as by highlighting where businesses could do more to increase materials productivity or understand market growth potential. However, developing, collecting and reporting on new (and existing) metrics comes at a cost to governments and reporting entities. The costs can be exacerbated where there is duplication of effort in collecting data or where reporting requirements are not harmonised across states. For example, state and territory governments collect the waste and resource recovery data used in the national reporting from their own monitoring and reporting processes. However, the methods used by the Australian Government for the national waste report are not always the same as those used by individual states and territories, with some data supplemented or replaced by national industry data or other national estimates (DCCEEW 2024a).

9.2 Use a strategic approach to metric development

To maximise net benefits from introducing additional circularity metrics, the Australian Government, together with state and territory governments, should take a strategic approach that considers metrics within a broader monitoring, evaluation and reporting framework[3] for circular economy policies (box 9.2).

Box 9.2 – Monitoring, evaluation, reporting and improvement (MERI) frameworks

Good practice

The Commonwealth Evaluation Toolkit notes it is good practice to plan how monitoring and evaluation will be undertaken from the start and to collect robust performance information at all policy stages. The three main stages of evaluation are:

1. planning and budgeting (including setting evaluation objectives)
2. measuring and assessing (defining evidence and data sources, collecting them, analysis and interpretation)
3. reporting and accountability (report findings and implementing improvements).

Ideally, evaluation strategies are developed upfront, during the design phase of programs, and:

- track how well a program is progressing towards outcomes
- assess whether objectives have been achieved
- identify reasons for success or lack of progress
- test the assumptions underlying the theory of change
- apply insights generated to improve the design and implementation of activities.

The Toolkit notes it is also important that policy proposals consider the financial resources and capability required to undertake monitoring and evaluation.

Measuring and assessing will require having performance indicators in place, including for:

- activities (information on who conducted the activity and what they did)
- outputs (describe the products, services and deliverables that result from the activities)

[3] Monitoring, evaluation, reporting and improvement (MERI) frameworks are also known as monitoring and evaluation (M&E) frameworks or monitoring, evaluation and learning (MEL) systems.

Box 9.2 – Monitoring, evaluation, reporting and improvement (MERI) frameworks

- outcomes (describe the change that occurs as a result of delivering the output)
- and impact (describe progress towards higher-level goals and take a broad perspective).

Activity and output indicators are often described as leading in that they provide feedback on whether interventions to affect change are on track whereas outcome and impact indicators are more lagging in reflecting whether the interventions influenced the desired outcomes and impact.

National Waste Policy MERI

The National Waste Policy sets out how it will assess progress and report in accordance with a MERI framework as follows:

- the Australian Government provides a national report on progress against the targets on behalf of all governments
- all governments report annually on actions identified in their implementation plans
- implementation of the Action Plan is overseen by a body including representatives from each government (Australian, state and territory) who provide advice and report to Environment Ministers on the progress against the targets and areas for improvement
- a review of the Action Plan and government implementation plans will be undertaken every two years; however, governments can update implementation plans at any time.

Source: DCCEEW (2024h, pp. 15–16); J-PAL (2025); PC (2023b, p. 98); The Treasury (2025c, 2025a).

The first step in the strategic approach would be for the Australian Government, with input from state and territory governments, to develop and then use the outcomes framework (recommendation 8.2) to identify areas lacking metrics or where data gaps exist. This will increase the policy relevance of new metrics by linking metrics to desired economic, social and environmental outcomes and policy goals. For example, if the aim of government action is to increase the use of sustainable materials in infrastructure projects, data and reporting on the extent businesses are substituting virgin building materials with sustainable alternatives will help evaluate the effectiveness of such policies. Also, if a barrier to adoption of circular practices is confidence or knowledge (for example, on how sustainable materials can be used in infrastructure), data collected on changes to these areas over time can help indicate early progress towards innovation uptake. Figure 9.1 illustrates how metrics could be mapped to outcomes for recommendation 2.1.

The second step would be for the Australian Government, with input from states and territories, to develop a metrics and data collection strategy prioritising new metrics that are of particular interest to policymakers (such as metrics relating to sectors with significant material use or environmental impacts) and can be collected at relatively low cost (because there are existing systems for reporting relevant data). Collecting, collating and interpreting data to inform indicators incurs costs, for both governments and businesses (CIF sub. 222, p. 4; WRAP sub. 230, p. 31), however, participants in this inquiry largely supported an expanded set of circularity indicators.[4]

[4] ACOR (sub. 256, pp. 25–26); CA ANZ (sub. 211, pp. 3–4); Circuiti (sub. 198, pp. 1, 5); Forward Thinking Design (sub. 194, p. 6); Global Circular Network (sub. 186, p. 9); GBCA (sub. 255, p. 7); Impacts Renewable Energy (sub. 190, p. 3); Jemena (sub. 250, p. 8); LGP (sub. 187, pp. 9–10); RMIT University (sub. 212, pp. 29–31); Western Australian Circular Observatory (sub. 243, pp. 3–4); WMRR (sub. 233, pp. 2, 3, 14–15); WRAP (sub. 230, pp. 32–34).

In developing the strategy, the Australian Government should build on existing metrics and data collection efforts (box 9.1) to avoid duplication, and keep in mind which metrics and data are relevant to broader environmental and social outcomes. For example, greenhouse gas emissions from businesses' production activities by sector are reported in *Australia's National Greenhouse Accounts* (DCCEEW 2023c) and *Australia's Integrated Environmental-Economic Accounts* and *National Ecosystem Accounts* (ABS 2021, 2025b) have been developed under separate policy frameworks and the linkages to circular outcomes will need to be considered as part of developing the MERI framework.

Figure 9.1 – Example of outcomes framework guiding possible metrics and indicators[a,b]

Government action	Activities and outcomes	Environmental, economic and social benefits	Impact on circular economy targets
Regulatory reform *Example*: Conduct a stocktake and reform standards and specifications limiting sustainable materials use in infrastructure	**Innovation** is unlocked through prompting a rethink of sustainable materials applications Increased use and exchange of **sustainable materials** Increased **recycling** activity from increased demand for recycled materials	Reduced **greenhouse gas emissions** by using materials with lower embodied carbon **Increased net value** extracted from previously wasted materials Over time as markets develop, the **price of sustainable materials reflects the full costs and benefits** relative to virgin materials	Increased **circularity rate** through increased secondary materials use Reduced **materials footprint** from reduced domestic demand for raw materials Increased **materials productivity and recovery rate** through increased recycling and production of recycled materials
Metrics and indicators	Investments in infrastructure supporting circular business models beyond waste management Rate of secondary material use in production Capacity of waste recovery infrastructure by type	Measure for greenhouse gas emissions Trade in recovered and recycled materials Domestic extraction from natural stocks (renewable and non-renewable)	Circularity rate Materials footprint Materials productivity Recovery rate

a. Examples of potential metrics based on OECD (2024). **b.** Circular economy targets are from *Australia's Circular Economy Framework* (DCCEEW 2024b).

The Australian Government should also work in partnership with specific industries and communities to ensure metrics are relevant, understandable and trusted (OECD 2024). Many Australian businesses monitor and report against circular economy-related indicators and metrics, including as required by[5] or aligned

[5] Currently, environmental, social and governance reporting obligations in Australia only include those under the climate-related disclosure framework as specified under sections 292A and 296A of the *Corporations Act (2001)* Cth.

with[6,7,8] environmental, social and governance reporting frameworks. For example, the Green Building Council of Australia has a voluntary Green Star certification program[9] which is recognised as a measure of sustainability outcomes under the Australian Government's Environmental Sustainability Procurement Policy[10] and has been working with governments to develop guidance to meet sustainability procurement requirements for the built environment (GBCA 2025; GBCA and GISA 2023).

To achieve better policy outcomes, Aboriginal and Torres Strait Islander people's values, expertise and lived experiences must be reflected in what is evaluated and how evaluation is undertaken (PC 2020b). Adopting Aboriginal and Torres Strait Islander community-defined measures of success ensures communities have ownership over defining and measuring outcomes that truly matter to their communities and supports self-determination.

In line with the principle of centring Aboriginal and Torres Strait Islander people, perspectives, priorities and knowledges, evaluations of circular economy policies and programs 'should consider the impacts of the policy or program on Aboriginal and Torres Strait Islander people at the policy development/early evaluation planning stage so that the right evaluation questions are asked and data are collected' (PC 2020b, p. 23). This means using Aboriginal and Torres Strait Islander defined measures of success. For example, First Nations Economics (sub. 252, p. 11) notes that conventional MERI frameworks in Australia 'tend to focus on quantitative, economic and environmental metrics' whereas the 'literature emphasises that First Nations peoples often define and measure "success" differently, using culturally grounded frameworks centred on values of interdependence, respect for Country, kinship and long-term community well-being'. They emphasise that 'these holistic paradigms challenge the dominant models of evaluation and offer powerful alternatives that can enrich Australia's transition to a circular economy' (First Nations Economics, sub. 252 p. 11).

Measures of success will vary by community and should be developed in partnership with Aboriginal and Torres Strait Islander communities when MERI frameworks are established. Culturally appropriate evaluation methods support the implementation of Priority Reform 4 of the National Agreement on Closing the Gap, and

[6] European companies' obligations extended to reporting on a range of environmental factors in 2025 including biodiversity, ecosystems and resource use and the circular economy under the European Corporate Sustainability Reporting Directive (European Commission 2025a).

[7] For example, B Corp Certification is a designation that a business is meeting standards independently verified on performance, accountability and transparency across the areas of social, environmental and governance impact topic areas (B Lab 2025a). There are currently 560 certified B Corporations headquartered in Australia, 74% of which have been certified in the past five years (B Lab 2025b).

[8] The Kunming-Global Biodiversity Framework calls for businesses to 'disclose their risks, dependencies and impacts on biodiversity' (target 15) and identifies the nature-related financial disclosures framework as a key indicator for this target (SCBD 2022). Fifteen Australian organisations have committed to making nature-related financial disclosures as of 6 August 2025 (TNFD 2025).

[9] Certifications increased by more than 80% in the 2022-23 financial year with over 800 certifications issued that year and over 4,500 certifications in total (GBCA 2023).

[10] The Australian Government's Environmental Sustainability Procurement (ESP) Policy aims to stimulate industry investment and innovation in sustainable goods, where success (for circularity) is the extent to which there is an increase in the use of circular economy principles (DCCEEW 2024f, p. 7). The ESP Reporting Framework for Phase 1 (construction services) requires suppliers to report a minimum of one of the four innovation metric categories of design, products, materials or processes in meeting the principles (Australian Government 2024b). Given the recent implementation of the ESP Policy, as of 10 June 2025, DCCEEW had not published any progress against the metrics established under the ESP Policy Reporting Framework (DCCEEW 2024m).

facilitate shared access to existing data, and the capability to collect, use and interpret locally-relevant data in a meaningful way.

The Australian Government should lead the monitoring, evaluation, reporting, and improvement arrangements for the outcomes framework (including reporting on metrics over time). The focus on circular economy opportunities for specific sectors is cross-jurisdictional and the Australian Government can provide a coordinating role by leading the development of MERI arrangements, particularly where smaller jurisdictions face resource and capacity constraints. It will be critical for the Australian Government to allocate resources to develop this outcomes framework, and to establish associated MERI arrangements for it at the outset of its circularity policy journey. This will ensure the information will be available when policymakers need it and will help prioritise efforts in collecting data.

In developing the outcomes framework and associated MERI arrangements, governments will also need to ensure that desired outcomes, policies and ways of measuring and monitoring are consistent with progressing governments' commitments to the National Agreement on Closing the Gap.

Recommendation 9.1
Develop metrics to enable effective monitoring, evaluation and reporting of government actions to promote a circular economy

The Australian Government should:

- use an outcomes framework (recommendation 8.2) to identify areas lacking metrics or where data gaps exist, such as markets or sectors where there are policies aimed at encouraging businesses to incorporate circular design principles in product design
- develop a metrics and data collection strategy that prioritises filling key gaps, based on considerations such as the significance of the opportunity (in terms of economic and environmental benefits) and the extent to which existing data systems capture relevant data
- establish and oversee arrangements for monitoring, evaluation, reporting and improvement.

10. Phased pathways for reform

Key points

- **Implementing the recommendations outlined in this report will require a phased approach.**
  - This chapter sets out phased implementation timelines for the Australian Government, state and territory governments, and local governments.
- **A whole-of-economy transition to a circular economy requires sustained and shared commitments across different levels of government and across different portfolios.**
  - Central agency guidance and leadership can, and should, play a key role.

10.1 Phased and sequenced timelines for implementation

In recent years, Australian governments have placed increasing policy emphasis on advancing the transition to a circular economy. A range of significant reforms have already been implemented or are currently underway to facilitate this shift. Whilst businesses, communities and other organisations have been innovating, there remains substantial untapped potential. This report outlines several reforms and policy actions to further realise this potential.

Implementing the recommendations outlined in this report will require a phased approach. As outlined elsewhere in this report, the circular economy is a busy policy space, and our approach has been to set out a course of action that complements and accommodates other work underway. The figures below focus only on recommendations in this report, but present phased timelines[1] to guide implementation for the Australian Government (figure 10.1), state and territory governments (figure 10.2), and local governments (figure 10.3). Actions in the timelines are split by those involving implementation (enact and embed) and those involving evaluation (evaluate and extend).

The phased timelines reflect interdependencies within each reform area. For example, governments need to do preparatory work to understand where the greatest opportunities are to amend standards and specifications that restrict sustainable materials use in infrastructure projects. Similarly, the challenge-based grant program evaluation can only occur once the program has been in operation for sufficient time (three years).

The phased timelines also reflect interdependencies across reform areas. For example, developing an outcomes framework (recommendation 8.2) and associated metrics (recommendation 9.1) will enable the

[1] These phased timelines are intended to serve as a guide to implementing the Productivity Commission's recommendations in this inquiry. They highlight a potential path and timeline to implementation, but the path taken may differ depending on the priorities, resources and existing policies of state, territory and local governments.

governments to track the progress of other reforms recommended in this report. Similarly, prioritising the establishment of the Circular Economy Regulatory Reform Taskforce (recommendation 7.1) will help governments progress reforms, such as establishing a nationally consistent approach to product stewardship for small electronics (recommendation 5.1).

Sustained and shared commitments across government

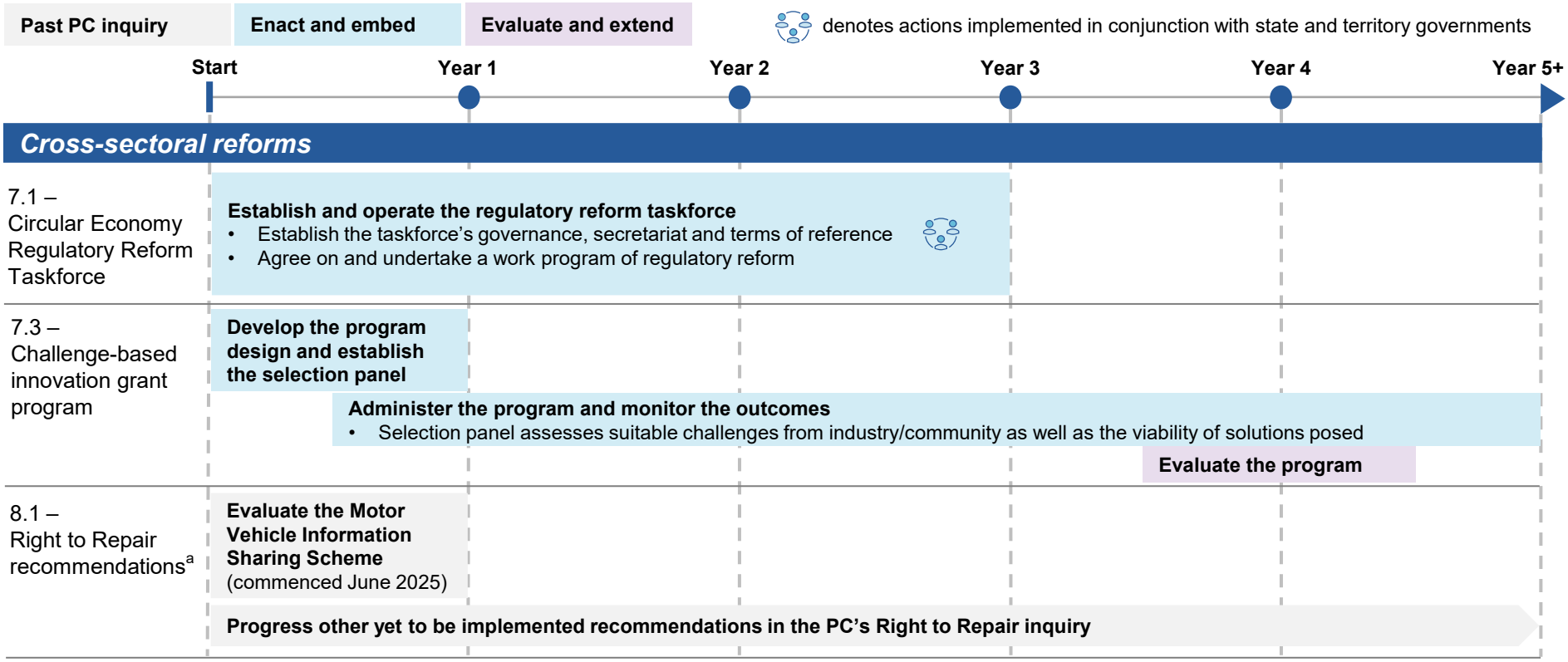
A whole-of-economy transition to a circular economy will require sustained and shared commitments across different levels of government and across different portfolios.

The Australian Government will play an increasingly important role in circular economy policy as the focus moves beyond waste reduction and recycling, which are largely the responsibility of state, territory and local governments. In 2024, the Australian Government committed to *Australia's Circular Economy Framework* to enable a national circular economy transition. The framework includes a goal of doubling circularity by 2035 and sets out targets that span the entire product life cycle (DCCEEW 2024b, p. 5). It also provides high level policy direction on how the Australian Government can support this transformation.

Similarly, involvement in circular economy policies may need to expand beyond environment portfolios to departments connected to sectors with significant circular opportunities, such as transport. Central agencies, including Treasury departments, and Prime Minister/Premier and Cabinet departments, have had varying degrees of involvement in circular economy policy depending on the jurisdiction. Given the broad economic, environmental and social linkages within a circular economy, additional central agency guidance and leadership will be important to engender a whole-of-government approach to circularity. One example of cross-portfolio central leadership is the removal of barriers to prefabricated and modular construction through Treasury's work on revitalising national competition policy (The Treasury 2024e, p. 17).

A whole-of-economy transition to a circular economy will also require involvement and support from ministers and departments across a diverse range of portfolios. Coordination and leadership from central agencies will help create the authorising environment across the Australian, state and territory governments. Specific sectors will also need championing by respective portfolio ministers to bring about change.

Figure 10.1 – Indicative actions for the Australian Government



a. The indicative timeline of 5+ years for implementing recommendations from the PC's Right to Repair inquiry is not applicable to all unimplemented recommendations. Some recommendations (such as the product labelling scheme) may take over five years to fully implement, however some recommendations (such as the mobile phone and tablet market study, and the review of the medical device market and regulations) can be implemented within one to two years.

Figure 10.1 (continued) – Indicative actions for the Australian Government

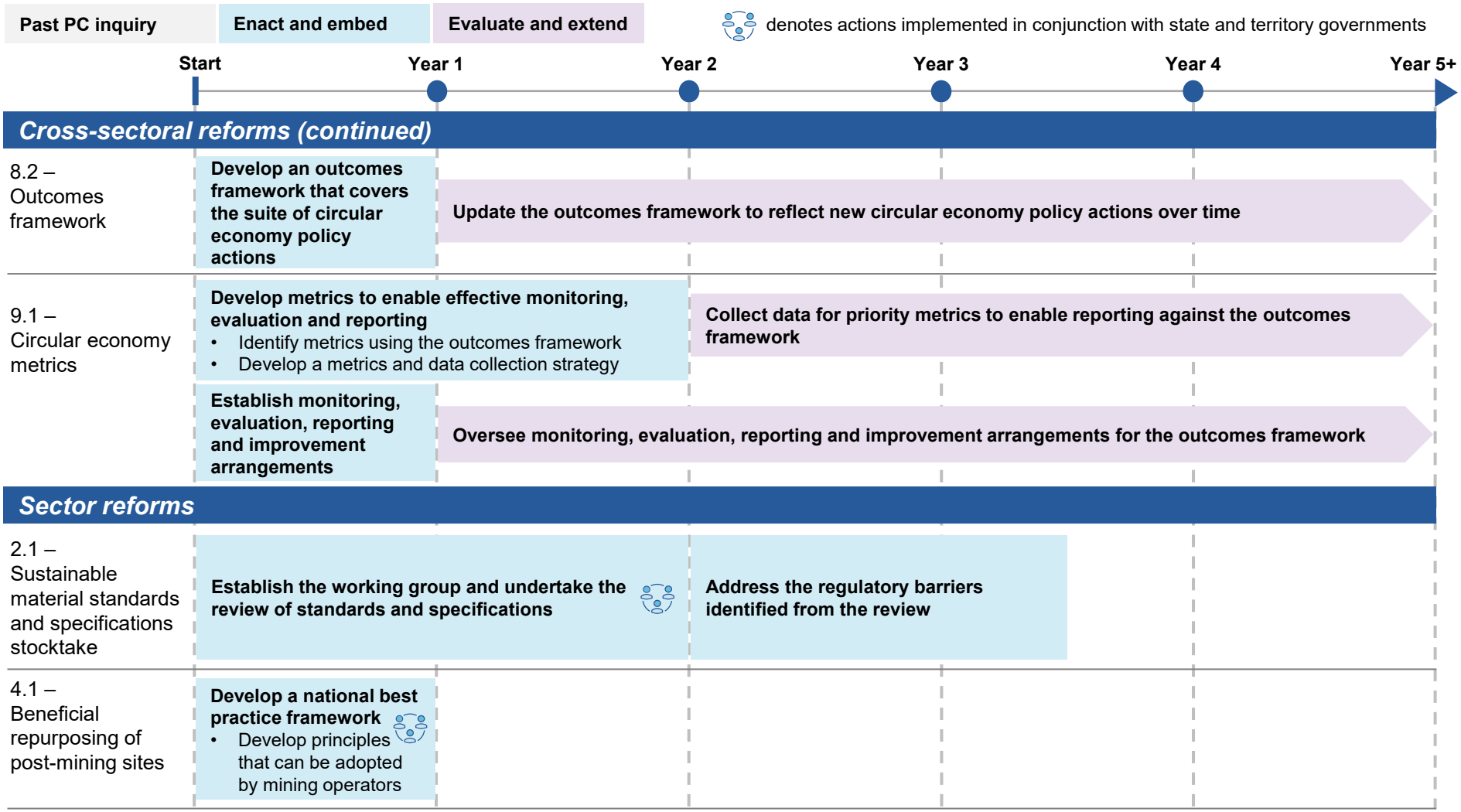
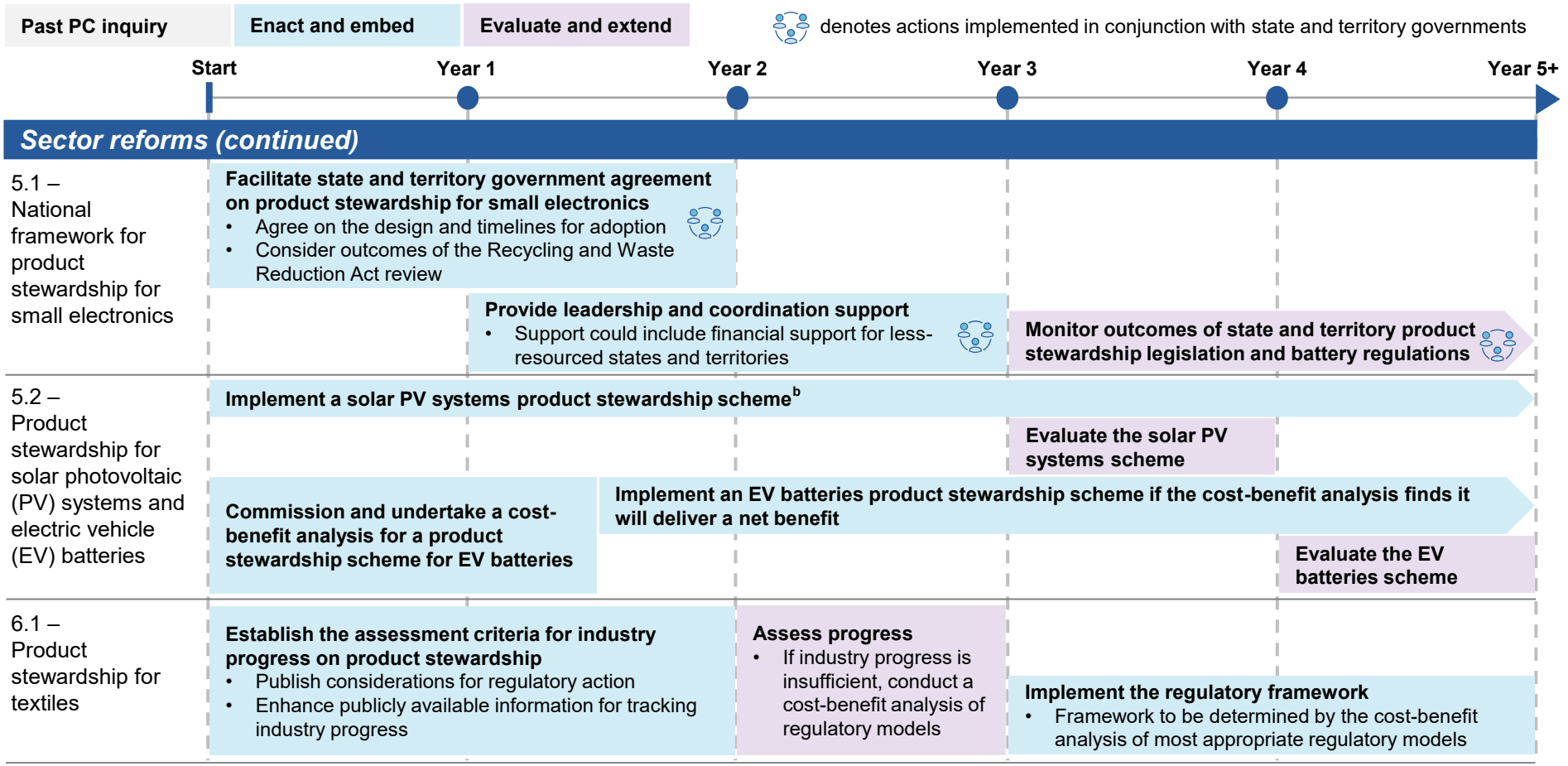


Figure 10.1 (continued) – Indicative actions for the Australian Government



b. On 15 August 2025, the Energy and Climate Change Ministerial Council Meeting discussed the need for mandated stewardship arrangements to proactively manage solar panel waste. Energy and Climate Change Ministers agreed the Australian Government and New South Wales will lead investigations into how different models of a national product stewardship scheme will work including evaluating Australian Government and state-based approaches (DCCEEW 2025m).

Figure 10.2 – Indicative actions for state and territory governments

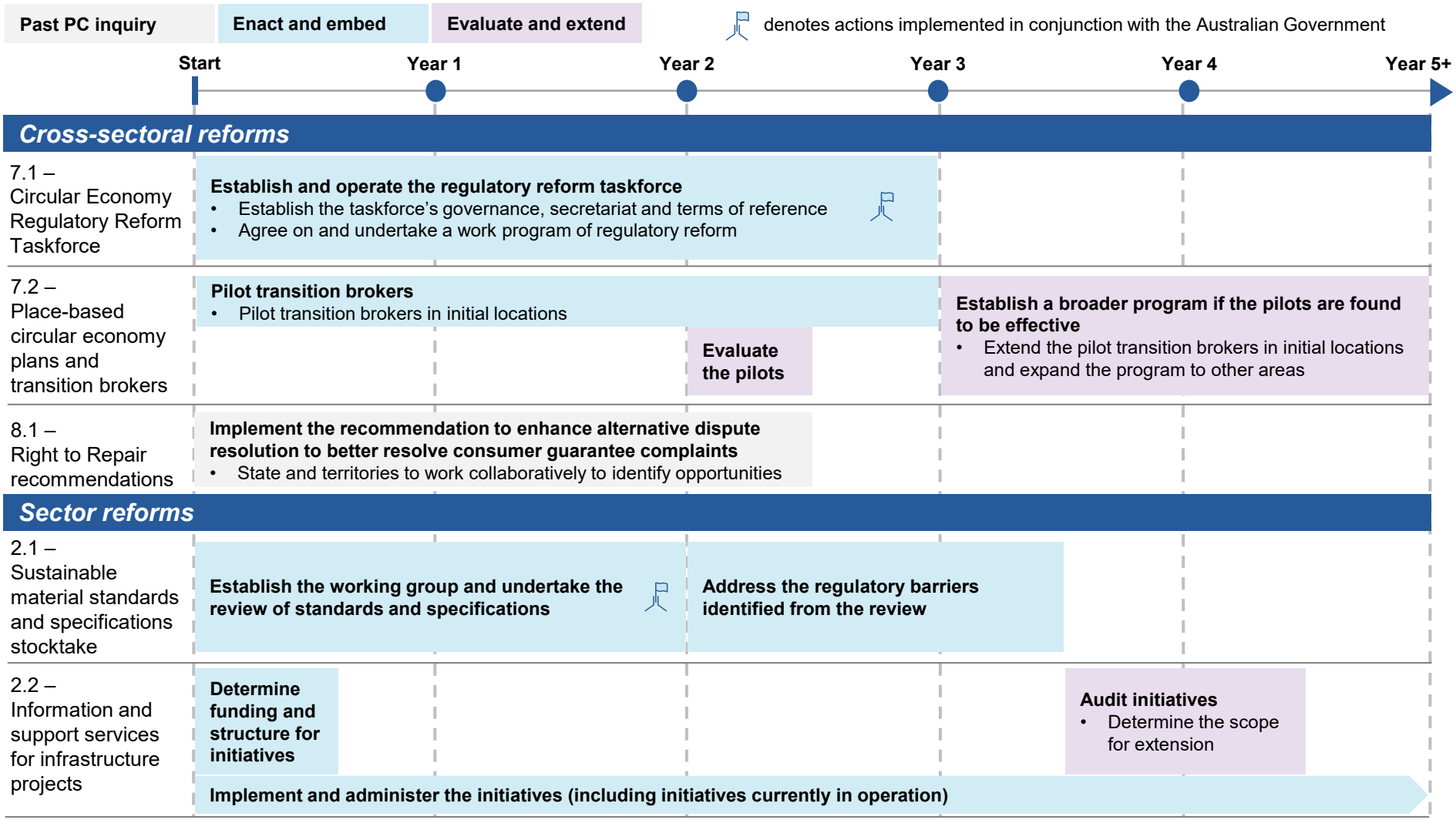


Figure 10.2 (continued) – Indicative actions for state and territory governments

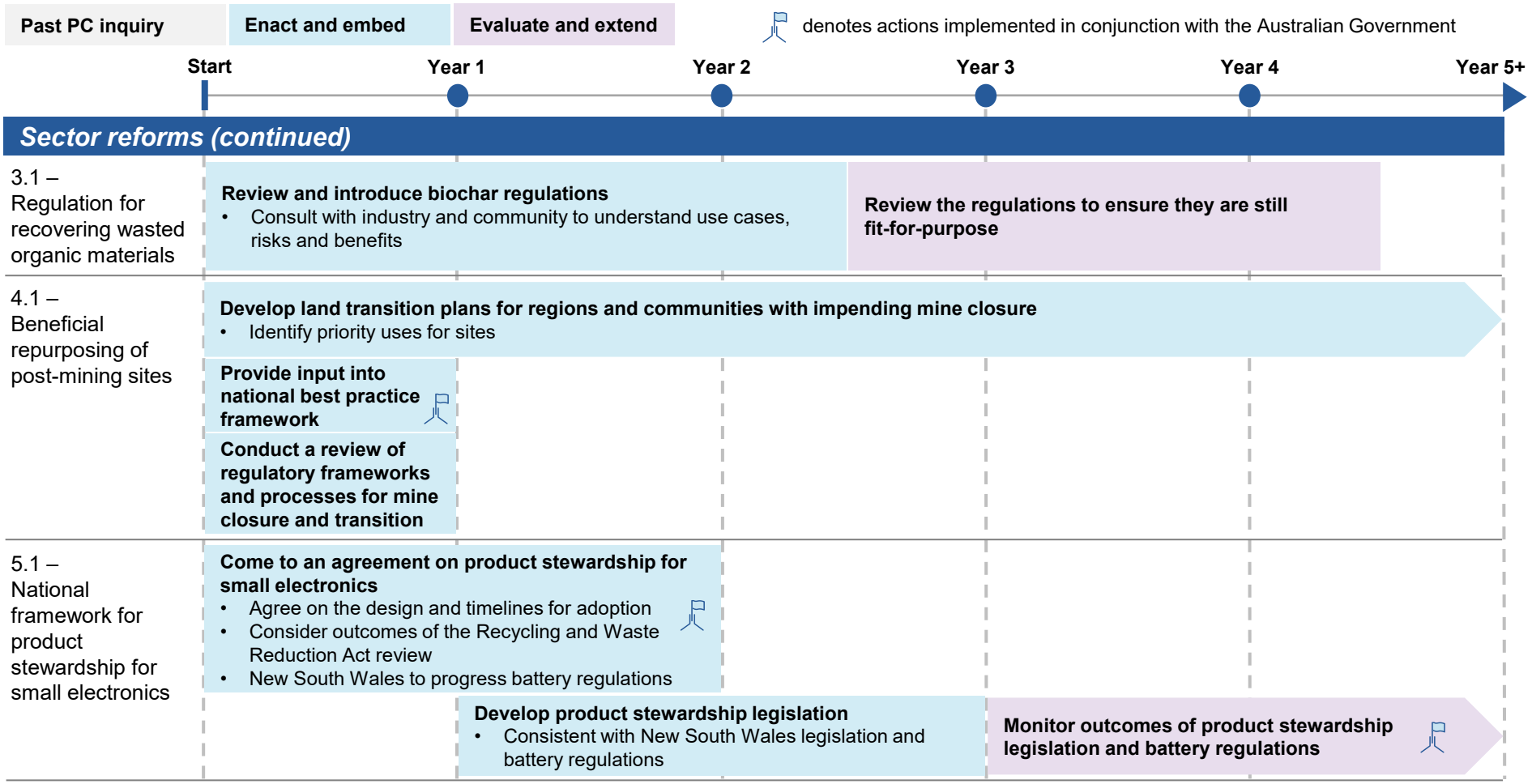
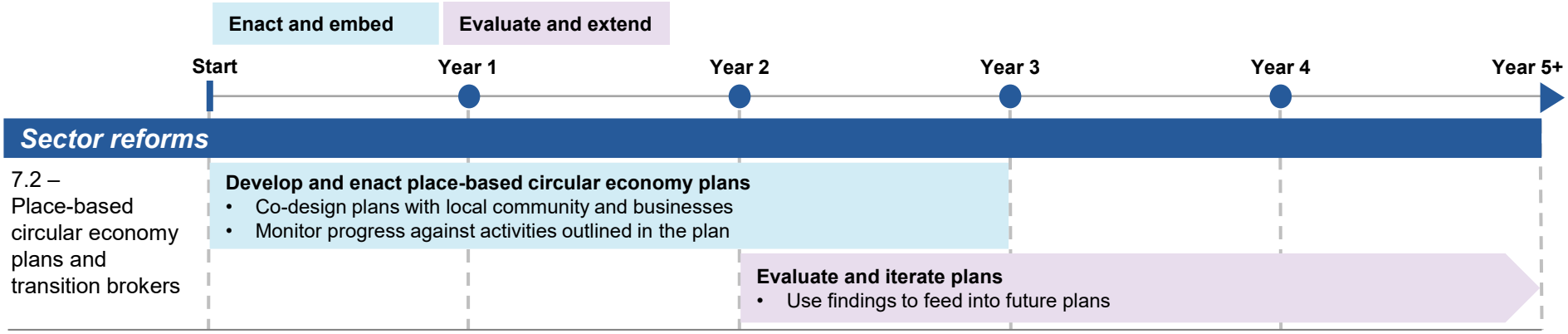


Figure 10.3 – Indicative actions for local governments



Appendix

A. Public engagement

This appendix outlines the engagement process undertaken for this inquiry and lists the organisations and individuals who participated.

The Productivity Commission received the terms of reference for this inquiry on 23 August 2024. A call for submissions was released on 16 September 2024 inviting public submissions and brief comments. The Interim report was released on 5 March 2025, and further submissions and brief comments were sought.

In total, the PC received 273 submissions (table A.1) and 38 brief comments. The submissions and brief comments are available online at: www.pc.gov.au/inquiries/current/circular-economy/submission.

During the inquiry, the PC met with representatives from Australian, state and territory government agencies, Aboriginal and Torres Strait Islander groups, local governments, regional development groups, advocacy groups, academics, researchers and regional and local community groups (table A.2 and A.3).

The PC would like to thank everyone who participated in this inquiry.

Table A.1 – Submissions

Participants	Submission no.
ACT NoWaste	16
Albemarle Lithium	268
Apple	124
Aquaculture Council of Western Australia (ACWA)	65
Arup	52
Association for the Battery Recycling Industry (ABRI)	27
Association of Mining and Exploration Companies (AMEC)	143, 248
AusKelp	163
Australasian Procurement and Construction Council (APCC)	74
Australasian Railway Association	97
Australia and New Zealand Recycling Platform Limited (ANZRP)	176, 195
Australia New Zealand Biochar Industry Group (ANZBIG)	173
Australia Post	249
Australian Academy of Science and ARC Centre of Excellence in Synthetic Biology	144
Australian Academy of Technological Sciences and Engineering (ATSE)	110
Australian Aluminium Council (AAC)	86
Australian Automotive Dealer Association (AADA)	91, 242

Participants	Submission no.
Australian Beverages Council Ltd (ABCL)	174
Australian Chamber of Commerce and Industry (ACCI)	76
Australian Chicken Meat Federation (ACMF)	111
Australian Communications Consumer Action Network (ACCAN)	146
Australian Competition and Consumer Commission (ACCC)	178
Australian Council of Recycling (ACOR)	75, 256
Australian Digital Inclusion Alliance (ADIA)	197
Australian Food and Grocery Council (AFGC)	105
Australian Gas Infrastructure Group (AGIG)	152
Australian Industry Group (Ai Group)	160
Australian Institute of Architects	117
Australian Library of Things Network	59
Australian Local Government Association (ALGA)	21
Australian Mobile Telecommunications Association (AMTA)	155, 221
Australian Packaging Covenant Organisation (APCO)	157
Australian Pipelines and Gas Association (APGA)	49, 258
Australian Pork Ltd	69
Australian Retailers Association (ARA)	165, 265
Australian Science Communicators (ASC)	43
Australian Small Business and Family Enterprise Ombudsman (ASBFEO)	270
Australian Tyre Recyclers Association (ATRA)	227
Australian Water Association (AWA)	23
Battery Stewardship Council (BSC)	140, 223
Baxter Healthcare	64
Bega Local Aboriginal Land Council (Bega LALC)	185
Bega Valley Shire Council	166
Bettercup	191
Blueprint Institute	70
Boomerang Alliance	2
Business Chamber Queensland	136, 213
Business Council for Sustainable Development Australia (BCSDA)	175
Business Council of Australia (BCA)	99
Cement Concrete & Aggregates Australia (CCAA)	55, 238
Cement Industry Federation (CIF)	78, 222
Centre for Smart Modern Construction	3

Participants	Submission no.
Centre of Decommissioning Australia (CODA)	46
Chamber of Minerals and Energy of Western Australia (CME)	251
Charitable Reuse Australia	18, 246
Chartered Accountants Australia and New Zealand (CA ANZ)	129, 211
Chartered Institute of Procurement and Supply (CIPS) Australia & New Zealand Pty Ltd	161
Christopher Wilson	102
Circuiti	198
Circular Australia	126
Circular Design Thinking	101
Circular Economy Asia Inc	158
Circular Economy Huon (CEH)	98
Circular Economy Research Network Asia-Pacific (CERN APAC)	215
Circular Economy Villages Co-operative Ltd (CEVCO)	35
Circular PV Alliance (CPVA)	62
Circular Textile Working Group WA (CTWG)	22, 196
City of Adelaide	107
Civil Contractors Federation (CCF)	42
Cleanaway	112
Closed Loop Environmental Solutions	137
Coca-Cola Europacific Partners Australia (CCEP)	170
COMFORTiD	177
Community Industry Group	93
Consumer Electronics Suppliers Association (CESA)	263
Consumer Healthcare Products Australia (CHP)	122
Consumer Policy Research Centre (CPRC)	141
Consumer Policy Research Centre (CPRC) and CHOICE	210
Container Exchange (QLD) Ltd	83
Cooperative Research Centre for Transformations in Mining Economies (CRC TiME)	224
Coreo	104
CropLife Australia	95, 235
CSIRO	57
CTS Tyre Recycling	229
Darcy W E Allen and Chris Berg	205
DeCarbonate Energy	179
Department of Health and Aged Care (DOHAC)	182

Participants	Submission no.
Dr Jack B. Hetherington (University of Adelaide CSIRO and End Food Waste Australia); A/Prof Adam J Loch (University of Adelaide); Dr Pablo Juliano (CSIRO); Francesca Goodman-Smith (End Food Waste Australia); and Prof Simon Lockrey (End Food Waste Australia)	188
Dr. Deepika Mathur	10
Dr. Guy Keulemans, Creative People, Products and Places Research Centre, University of South Australia	48
Dr. Paul Chad	19
Dubbo Regional Council	68
eBay Australia and New Zealand	151
Ecocycle	217
Edward Khoury	13
Elan Energy Matrix	116, 237
Ena Vejnovic, Professor Sharon Purchase, Dr Daniel Schepis and Dr Liudmila Tarabashkina	24
End Food Waste Australia	214
Engineers Australia	108
enviroMETS (Qld)	208
Federal Chamber of Automotive Industries (FCAI)	85
First Nations Economics	252
Forward Thinking Design	194
Gippsland Climate Change Network, Gippsland Circular Futures Initiative (GCCN)	11
Global Circular Network	186
Global Product Stewardship Council (GlobalPSC)	149
GoGet Carshare	38
Good Natured ESG	58
Good Sammy	25
Good360 Australia and Thread Together	96
Greater Whitsunday Alliance (GW3)	109
Green Building Council of Australia (GBCA)	255
Green Industries South Australia (GISA)	181, 245
GS1 Australia	114, 225
Helen Millicer	82
Hume City Council	20
Hunter Joint Organisation	172
Hunter Renewal	206
IKEA Australia	47

Participants	Submission no.
Impacts Renewable Energy	190
Infrastructure Victoria	28
Institute of Public Accountants (IPA)	131, 259
International Council for Local Environmental Initiatives (ICLEI)	45
Jack B. Hetherington	9
Jack Davenport	127
Jemena	106, 250
Joseph James Earl	228
Kara Reeves	189
Keith Noble and Jelenko Dragisic	192
Kylea Tink MP	142
Lisa Richert	273
Lithium Australia	17
Local Government Association of Queensland (LGAQ)	244
Local Government Association of the Northern Territory (LGANT)	132
Local Government Procurement (LGP)	67, 187
Logan City Council	61
Lumicare Pty Ltd	66
MALVA Sustainable Tasmania & B-alternative	37
Mansfield Advisory (MA) and the Bamboo Society of Australia (BSA)	207
MCi Carbon Pty Ltd	119
Mend It Australia (MiA)	218
Meriel Chamberlin	73
Michelle D. Smith	14
Minerals Council of Australia (MCA)	269
Monash University	138, 262
Ms. Kathryn Mamone, Eden Marine High School	128
National Farmers' Federation (NFF)	216
Northern Sydney Regional Organisation of Councils (NSROC)	154
Now + Future	123
NSW Chapter of the Centre for the Advancement of the Steady State Economy (CASSE NSW)	232
NSW Environment Protection Authority (EPA)	236
NSW Farmers	247
NSW Government	139
NSW Health	183

Participants	Submission no.
NSW Minerals Council (NSWMC)	200
NSW Small Business Commission	54
Orora Limited	184
OzHarvest	81
Pact Group	77
Penelope Turnbull	5
Peter Mulherin	121, 253
Pianos Recycled	241
Planet Ark	147, 199
Polar Enviro	29
Product Stewardship Centre of Excellence (PSCOE)	159, 267
Prof. Leanne Wiseman	40
Pyrocal	209
Queensland Water Directorate (qldWater)	51
Rebecca Cannon	271
Reconnect Project	134
Recovery Tasmania Pty Ltd	90
Recycling Technologies Group Pty Ltd (RTG)	164
Regional Australia Institute (RAI)	100, 203
Reloop	80
Renewable Gas Alliance (RGA)	50, 254
Requis Australia Pty Ltd and Requis Inc (US)	15
ResiLoop Ltd	84
Resource Work Cooperative	30
Reverse Garbage	113
Richard Jones	272
RMIT University	212
RMIT University - School of Fashion and Textiles	231
RMIT University Circular Economy Hub	31
Robert Gell	60
Ryan Mischkulnig	12
Salvation Army	53
Seamless | Clothing Stewardship Australia	240
SEATA Group	145
Sims Metal	171

Participants	Submission no.
Sircel Limited	153, 204
Social Justice Around the Bay	226
Soft Plastic Stewardship Australia (SPSA)	202
South Australian Department for Energy and Mining (SA DEM)	260
Southern Sydney Regional Organisation of Councils (SSROC)	26
Standards Australia	257
Sustainability Research Institute	125
Sustainable Aviation Fuel Alliance of Australia and New Zealand (SAFAANZ) and Cleaner Fuels Alliance (CFA)	115
Sustainable Electronics Recycling International (SERI)	92
Sustainable Infrastructure and Resource Management, University of South Australia (SIRM)	1
Swedish Australian Chamber of Commerce Sustainability Committee	94
Tasmanian Government	180
Taylor Granville	156
TCO Certified/TCO Development	63
Tetra Pak	41
Think Polymer Technologies | Think Fencing | Think Manufacturing	201
Third Pillar	219
TOMRA	118
Total Environment Centre (TEC)	79, 264
Toy Libraries Australia	130
Toyota Motor Corporation Australia	33
Tyre Stewardship Australia (TSA)	148, 220
Tyrecycle	261
University of Melbourne	36
University of Technology Sydney Institute for Sustainable Futures (UTS ISF)	120
UNSW SMaRT Centre	4
Urban Utilities	71
Veolia Australia and New Zealand	8, 193
Victorian Bioenergy Network	39
Vinyl Council of Australia Pty Ltd	32
WA Solar Recycling	34
Wannon Water	88
Waste and Resources Action Programme (WRAP)	56, 230
Waste Management and Resource Recovery Association of Australia (WMRR)	168, 233

Participants	Submission no.
WasteLess | SEE Change	239
Water and Catchments Group, Victorian Department of Energy, Environment and Climate Action (Water and Catchments Group DEECA)	72
Water Services Association of Australia (WSAA)	150
Western Australian Local Government Association (WALGA)	167
Western Australia Return Recycle Renew Limited (WARRRL)	87
Western Australian Circular Observatory	243
Will Rifkin	266
Woolworths Group	162, 234
WorkbenchX	133
WorkVentures	89
WWF Australia (WWF)	44
XFrame Ltd	6
Xseed	7
Zero Waste Victoria (ZWV)	169

Table A.2 – Consultations

Participants
Altogether Group
ANZ Biochar Industry Group
Association of Mining and Exploration Companies
AusKelp
Austrade
Australia and New Zealand Recycling Platform
Australian Bedding Stewardship Council
Australian Building Codes Board
Australian Capital Territory Directorate of the Chief Minister, Treasury and Economic Development
Australian Capital Territory Environment Protection Authority
Australian Capital Territory Transport Canberra and City Services
Australian Competition & Consumer Commission
Australian Government Department of Climate Change, Energy, the Environment and Water
Australian Government Department of Industry, Science and Resources
Australian Government Department of the Treasury
Australian Industry Group
Australian Local Government Association

Participants

Australian Packaging Covenant Organisation
Australian Retailers Association
Australian Sustainable Finance Institute
Australian Trade and Investment Commission
Australian Tyre Recyclers Association
Austroads
Battery Stewardship Council
Bega Chamber of Commerce
Bega Group
Bega Regional Circularity Cooperative
Bega Repair Cafe
Bega Valley Data Collective
Bega Valley Eggs
Bega Valley Shire Council
Bega Village
Behavioural Economics Team of the Australian Government
BINGO Industries
BlockTexx
Bower Reuse and Repair Centre
Broadwater Oysters
Calibre Group
Centre for Regenerative Design & Collaboration Resin8
Charitable Reuse Australia
Cherbourg Aboriginal Shire Council
Cherbourg Material Recovery Facility
Clean Energy Finance Corporation
Clean Energy Regulator
Climateworks Centre
Committee for Economic Development of Australia
Consumer Policy Research Centre
Cooperative Research Centre for Transformations in Mining Economies
Coreo
CSIRO
eBay
Elan Energy Matrix

Participants
Essential Energy
EV batteries
Food Recycle
Forestry Corporation of NSW
Frogs Hollow Brewing
Green Building Council of Australia
Green Industries South Australia
Grow the Future Bega
Heads of the EPA Australia and NZ
Housing Industry Association (HIA)
Hunter Joint Organisation
Hydro Tasmania
Infinitev
Infrastructure Australia
Infrastructure Sustainability Council
Infrastructure Western Australia
Jodie Bricout
Kwinana Industries Council
Leser Build
Lisa McLean
Local Government Association of the Northern Territory
Loop Upcycling
Major Road Projects Victoria
Minerals Council of Australia
Mint Innovation
Modscape
Ms. Kathryn Mamone, Eden Marine High School
New South Wales Department of Climate Change, Energy, the Environment and Water
New South Wales Department of Planning, Industry and Environment
New South Wales Environment Protection Authority
Northern Territory Department of Agriculture and Fisheries
Northern Territory Department of Housing, Local Government and Community Development
Northern Territory Department of Lands, Planning and Environment
Northern Territory Department of Logistics and Infrastructure
Northern Territory Department of Mining and Energy

Participants

Northern Territory Department of the Chief Minister and Cabinet
Northern Territory Department of Trade, Business and Asian Relations
Northern Territory Department of Treasury and Finance
Nous Group
NRM Regions Australia
Ocean2Earth
Office of Industry Innovation and Science Australia
Officeworks
OzHarvest Australia
Pact Group
Pentarch Group
PrefabAUS
Product Stewardship Centre of Excellence
Prof. John Thwaites
Prof. Ralph Horne
Prof. Leanne Wiseman
Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development
Queensland Department of the Environment, Tourism, Science and Innovation
Recycling Technologies Group Pty Ltd
Recycling Victoria
Regional Development Australia – Southern NSW and ACT
Renewable Cobargo
ResiLoop Ltd
Resources Victoria
Responsible Investment Association Australasia
Reverse Garbage
Richgro
Rino Recycling
Sapphire Community Pantry
Seamless
Soft Plastics Stewardship Australia
South Australian Department for Energy and Mining
South Australian Department for Infrastructure and Transport
South Australian Department of State Development
South Australian Department of Primary Industries and Regions

Participants
South Australian Department of the Premier and Cabinet
South Australian Department of Treasury and Finance
South Australian Environment Protection Authority
South Coast Fish
Southern Sydney Regional Organisation of Councils
Standards Australia
Sustainability Victoria
Sustainable Timber Tasmania
Tasmanian Department of Natural Resources and Environment
Tasmanian Department of Premier and Cabinet
Tasmanian Department of State Growth
Tasmanian Office of the Coordinator-General
Tasmania Renewables, Climate and Future Industries
Tasmania Water
Toyota Motor Corporation Australia
Tyre Stewardship Australia
United Nations Global Compact Network Australia
University of Technology Sydney Institute for Sustainable Futures
Victorian Department of Energy, Environment and Climate Action
Victorian Environment Protection Authority
Victorian Infrastructure Delivery Authority
Waste Management and Resource Recovery Association of Australia
Water Services Association of Australia
Western Australian Department of Energy, Mines, Industry Regulation and Safety
Western Australian Department of Finance
Western Australian Department of Jobs, Tourism, Science and Innovation
Western Australian Department of Planning, Lands and Heritage
Western Australian Department of Primary Industries and Regional Development
Western Australian Department of Transport
Western Australian Department of Water and Environmental Regulation (WA DWER)

Table A.3 – Roundtable

Participants
Business Chamber Queensland
City of Melbourne
Gippsland Climate Change Network
Hume City Council
Hunter Joint Organisation
NRM Regions Australia
Regional Development Australia Limestone Coast
Sydney Water

Abbreviations

ABCB	Australian Building Codes Board
ACCU	Australian Carbon Credit Unit
BRII	Business Research and Innovation Initiative
CEF	Australia's Circular Economy Framework
CRC TiME	Cooperative Research Centre for Transformations in Mining Economies
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Australian Government Department of Climate Change, Energy, the Environment and Water
EMM	Environment Ministers' Meeting
EPR	Extended Producer Responsibility
ERAC	Emissions Reduction Assurance Committee
ESG	Environmental, social and governance
EV	Electric vehicle
GDP	Gross domestic product
NCC	National Construction Code
NGER	National Greenhouse and Energy Reporting
NTCRS	National Television and Computer Recycling Scheme
NWI	National Water Initiative
OECD	Organisation for Economic Cooperation and Development
PC	Productivity Commission
PFAS	Per and polyfluoroalkyl substances
PMLU	Post mining land use
PSS	Product stewardship scheme
PV	Photovoltaic
RCC	Regional Circularity Cooperative
WARC	West Arnhem Regional Council
WEEE Directive	Waste Electrical and Electronic Equipment Directive

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