

Towards a Waste Free Future



The Australian Academy of Technology and Engineering (ATSE) sees huge potential for technology to positively disrupt the waste and resource recovery sector in Australia, and support the transition toward a circular economy.

Australians create around 67 million tonnes of waste each year, which equates to 2.7 tonnes per person.¹

It is critical for Australia to transition to a more circular economy. Humanity needs to reduce the consumption of finite resources by deliberately designing products, systems and infrastructure with the aim of creating less waste and by reusing, recycling and recovering valuable resources. By changing the linear model of consumption to a more circular model, we can shift to a more sustainable course in which production continues to meet demand, supporting economic productivity while reducing our impact on the environment.

Technology is not the sole pathway to a circular economy, but it is essential to support and guide the necessary systemic change. Technology and innovation will support the design of products that are more durable, reusable, repairable, and able to be remanufactured or disassembled once they reach the end of their first life. Advances in technology will enable materials to be identified, tracked, sorted and processed. Technology will underpin the entire circular economy system, creating feedback loops and generating data to support policy and investment decisions.

ATSE's research and consultations for this report revealed that lack of economic feasibility is a critical barrier to the technology transformation of Australia's waste and resource recovery sector.

Getting the policy and regulatory settings right is also a key barrier. Incentives to drive investment in infrastructure are largely dependent on the economic, policy and regulatory settings, and ATSE's analysis confirms that these are not optimally effective.

ATSE also found that Australia's skills and social readiness for technology-based solutions in the waste and resource recovery sector are high, indicating an opportunity for the country to move ahead quickly if the economic and policy settings are correct.

Technology can support the waste and resource recovery sector to survive and ultimately thrive through this disruption, and accelerate its transition to manufacturing resource providers, increasing resource productivity and enabling Australia to realise the benefits of a more circular economy. With the right policy and economic framework, the technology highlighted in this report can create new industry and employment, and elicit positive social, economic and environmental outcomes across many sectors, shifting the paradigm towards a waste free future.



Australia recovers just 58% of materials that go into our waste streams.



This leaves about 27 million tonnes going to landfill.²

For every 10,000 tonnes of waste that is recycled, 9.2 jobs are created.

Compared with 2.8 jobs if the same amount of waste is sent to landfill.³



The opportunity for industry growth and job creation this represents is enormous.

If we recycled all that it could create 35,000 jobs.

RECOMMENDATION 1

A paradigm shift to design for waste avoidance

A paradigm shift in design principles can avoid creating waste altogether – designing a product to be re-usable, to facilitate repair, upgrade, parts replacement, and trade-in for remanufacture.

Designers, manufacturers, retailers and consumers are faced with the reality that we must change consumption and waste habits, but inertia, policy uncertainty and market disincentives have led to slow progress. Government can tip the scales toward new and innovative business models, consumers can drive demand, and businesses must be required to shift.

To achieve this, ATSE recommends:

1. The Australian Government accelerates the paradigm shift towards design for reduced waste by:

- a. Targeting manufacturing grant programs and tax incentives toward innovative design for waste avoidance or minimisation (for example product as a service, and re-usable products), and sustainable use of recycled content.
- b. Creating standards and certification systems for reused and remanufactured goods to build consumer confidence and promote the design of products with reuse and refurbishment in mind.
- c. Creating a legislated consumer right to repair products, starting with electronics.
- d. Ensuring all costs and regulations apply equally to imports and Australian products, to disincentivise 'free rider' or dumping behaviour.

2. Manufacturers and retailers take advantage of circular economy principles to create more value from each unit of resource by:

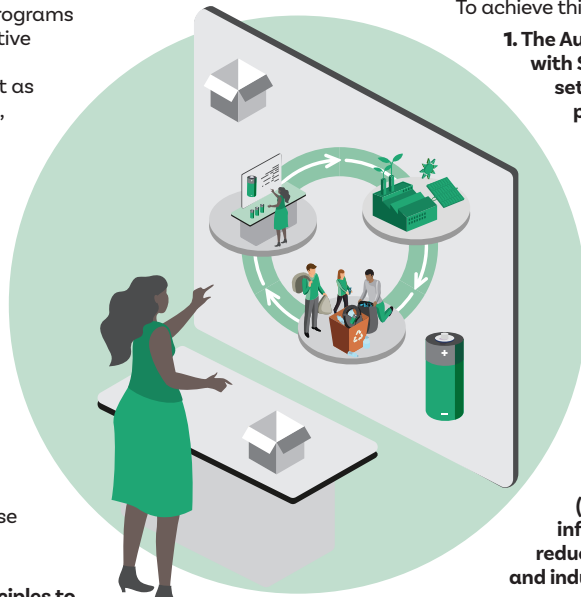
- a. Changing perspective to view waste as a design flaw, which if avoided will save material costs.
- b. Creating and marketing products as sustainable, high quality and durable, thus promoting these features to consumers as desirable characteristics.
- c. Designing products for recovery, and participating in product stewardship or extended producer responsibility schemes to retrieve valuable products and materials for reuse, remanufacture and sale of recovered materials.

3. Research and development by Australian manufacturers and researchers prioritise alternative materials to make everyday products more durable, materials that can be sustainably produced, and innovative design for material and product reuse and remanufacture.

- a. A co-operative research centre for advanced materials development could accelerate this work and provide new industries in Australia. More durable materials, self-healing materials, biodegradable materials and other innovative technologies could be commercialised and create an export industry.

4. Consumers use their immense market power to demand quality, accountability and sustainable business practices from manufacturers and retailers.

- a. Businesses provide transparent data and information about the sustainability and environmental impact of products and services, enforced by regulation if necessary.
- b. The Australian Government create national marketing campaigns aimed at changing consumer and industry behaviour to support the key principles of a circular economy.
- c. Social scientists prioritise research into measures to promote the integration of waste avoidance in consumer behaviour.



RECOMMENDATION 2

A systems approach to increase resource productivity and recovery

A systems approach acknowledges that all stakeholders in a product lifecycle have a role to play, facilitating greater resource productivity and creating demand for recovered materials.

A closed loop from design, to manufacture, retail, consumption and recovery has economic and environmental benefits for all stakeholders. Designers create efficiencies, manufacturers save on costs and expenditure on virgin materials, retailers can create customer loyalty through take-back schemes, consumers receive high quality products and services, and resource recovery is economic for the waste and resource recovery sector.

To achieve this, ATSE recommends:

1. The Australian Government, in collaboration with State and Territory governments, sets an ambitious national resource productivity target – double by 2030.

- 2. The Australian Government sets basic design standards and specifications for Australian-made and imported products, requiring clear manufacturing specifications, including post-consumer recycled content**
- a. These standards must be enforced through formal regulatory interventions, or bans of certain problematic materials.

3. University curriculum includes exploration of how to measure full lifecycle impacts of products (including disposal), services, and infrastructure, and how to design to reduce these – particularly in engineering and industrial design.

4. Manufacturers adopt design principles of low material diversity, standard components, and non-destructive dismantling to reduce complexity and facilitate material recovery.

- a. Product stewardship schemes to support and incentivise this shift, by facilitating resource recovery and enabling savings for manufacturers through reuse or sale of recovered materials.
- b. Plastics and packaging manufacturers to particularly focus on removing unnecessary complexities and using innovative labelling and sealing materials that reduce material diversity and thus facilitate efficient recovery.
- c. Designers and recovery facilities to collaborate on developing innovative methods to maximise the recovery of valuable materials in Australia.

5. The waste and resource recovery sector, which has the assets and footprint to act as the supply chain in a circular economy, transitions towards supporting resource recovery, and material trading and product stewardship schemes.

6. Targeted grants and research funding to promote advances in reducing the energy usage of advanced resource recovery technologies, such as chemical recycling.

RECOMMENDATION 3

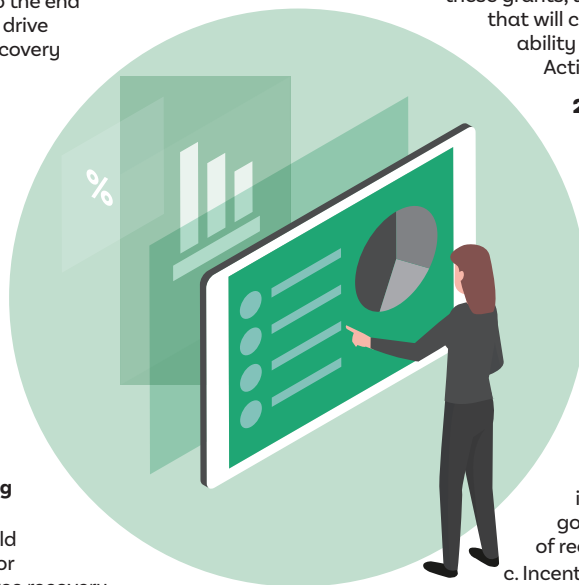
Big data and analytics to inform decision making by policy-makers, businesses and consumers

Government and industry to leverage technology to improve information quality, quantity, timeliness and transparency.

Technology underpins decision-making by supporting the collection and analysis of vast amounts of data to inform design and product innovation, material and energy efficiency, maintenance cycles and end of life treatments. Big data analytics can also provide system level feedback on interventions to improve waste reduction, and measure progress toward targets. Collecting and sharing information, starting at the beginning of a product's life and throughout the stages of its use to the end of its first life, will inform better design, drive accountability, and greatly improve recovery and remanufacturing opportunities.

To achieve this, ATSE recommends:

- 1. Interdisciplinary research into the potential and applications of smart systems and artificial intelligence in collecting, analysing, and learning from data about material flows.**
- 2. The Australian, State and Territory governments accelerate and prioritise work on National Waste Policy Action 7.2,⁴ to implement consistent national waste and material data and reporting, harmonised data classifications and definitions for reporting, and sharing arrangements across jurisdictions.**
 - a. Data collection and sharing should be mandatory and transparent for manufacturers, waste and resource recovery businesses, and governments.
 - b. Data collection and sharing should use the same meta-data parameters and units of measurement to support interoperability.
- 3. Manufacturers and designers lead at-scale integration of technologies such as markers, sensors, and nanotechnology to facilitate the tracking of critical valuable materials from manufacturing to first use, re-manufacture and eventual deconstruction and reuse.**
 - a. As these technologies reach scale, they should be leveraged to provide productivity gains and reduce regulatory burdens.
- 4. The Australian, State and Territory governments work with the waste and resource recovery sector to make publicly available comprehensive, economy-wide and timely data to inform consumers, businesses and policy makers.**
 - a. This information should be clearly available to consumers, for example through a database or labelling system, to provide information about the environmental and health impact of a product's lifecycle, promoting consumer awareness and sustainable consumerism.



RECOMMENDATION 4

Targeted government investment and regulatory reform and policy certainty

A long-term policy and regulatory framework and targeted government investment will provide clear signals and create certainty for investment.

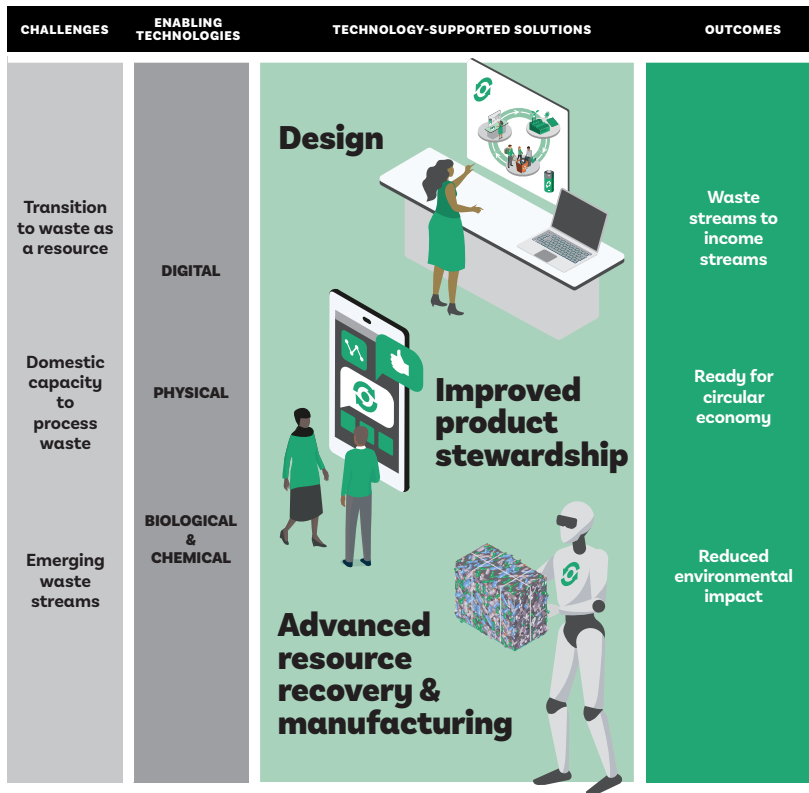
To achieve this ATSE recommends:

- 1. The Australian Government expands the \$190m Recycling Modernisation Fund, adding a new stream and funding to target projects that address problematic waste streams and those with low levels of resource recovery – particularly soft plastics and organics.**
 - a. The Australian Government to further set standards on the level and quality of resource recovery to be achieved through these grants, to ensure they are targeted at projects that will considerably accelerate Australia's ability to meet the National Waste Policy Action Plan's 80% resource recovery target.
- 2. The Australian, State and Territory governments to drive demand for recovered materials in infrastructure, products and packaging, particularly those that are able to be processed back to virgin quality specifications, or can supplant virgin materials, by:**
 - a. Amending regulations that classify high quality recovered materials as 'waste' to enable their incorporation into manufacturing, particularly packaging.
 - b. Creating demand for recycled materials and de-risking infrastructure investment through mandated government procurement of recycled materials.
 - c. Incentivise (including through the Modern Manufacturing Strategy) and support businesses to take materials out of the waste system as early as possible, or expand their use of recovered materials.
- 3. State and Territory governments to drive economic demand and infrastructure investment in waste avoidance and resource recovery through:**
 - a. Further landfill bans on problematic or high-value materials, such as unprocessed organic waste and e-waste.
 - b. Ensuring landfill levies are set at a level that ensures recovery and sale of materials is competitive with disposal. Resultant levy funds should be invested in supporting innovative resource recovery projects.
 - c. Investment in decentralised infrastructure to reduce the cost impact of distance, and create closed loops for distributed manufacturing in regional and remote areas.

1. National Waste Policy: Less waste, more resources, 2018. <http://www.environment.gov.au/system/files/resources/d523f4e9-d958-466b-9fd1-3b7d6283f006/files/national-waste-policy-2018.pdf> // 2. National Waste Policy: Less waste, more resources, 2018. <http://www.environment.gov.au/system/files/resources/d523f4e9-d958-466b-9fd1-3b7d6283f006/files/national-waste-policy-2018.pdf> // 3. Employment in waste management and recycling, 2009. <https://www.environment.gov.au/system/files/resources/5cc6a848-a93e-4b3f-abf7-fc8891d21405/files/waste-and-recycling-employment.pdf> // 4. Commonwealth of Australia, National Waste Policy: Action Plan 2019. National Waste Policy: Action Plan, 2019. <http://www.environment.gov.au/system/files/resources/5b86c9f8-074e-4d66-ab11-08bbc69da240/files/national-waste-policy-action-plan-2019.pdf>

ATSE PROJECT FRAMEWORK

Technology Readiness in the waste and resource recovery sector



SUMMARY

ATSE's technology readiness assessment of the waste and resource recovery sector

SCALE	NOT READY	MORE WORK REQUIRED			READY
READINESS INDICATOR SCALE					

ASSESSMENT					
	Infrastructure readiness	Skills availability	Social readiness	Economic feasibility	Policy & regulatory readiness
Design					
Improved product stewardship					
Advanced resource recovery					

This report is part of a major research project, supported by the Australian Research Council, aimed at identifying research and policy priorities for technology readiness in Australian industry. Together, the series of reports develop a decadal roadmap for Australian industry to maintain currency and fully integrate new technologies that maximise economic advantage. The project also highlights research priorities that will guide decisions and ensure investment is appropriately focused to promote the competitiveness of Australian industry.

The Australian Academy of Technology and Engineering (ATSE) is a Learned Academy of independent experts that helps Australians understand and use technology to solve complex problems. We bring together Australia's leaders in applied science, technology and engineering to provide impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

The full report will be available to download from 18 November 2020.

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