rawtec

NEXT MARKETS FOR UNWEARABLE CLOTHING TEXTILES

Report prepared for

Seamless

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Acknowledgment of Country

We acknowledge the Kaurna people of the Adelaide Plains as the traditional custodians of the land we live and work on. We respect their spiritual relationship with Sea and Country and acknowledge their Elders, past and present. We also pay our respect to the cultural authority of Aboriginal and Torres Strait Islander peoples from other areas of Australia.

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Executive summary

In 2024, Australia sent 229,000 tonnes of clothing to landfill. This is not just waste, it is lost value, missed economic opportunity, and avoidable emissions.

In a circular economy, unwearable clothing is a resource, not waste. Realising this potential requires building next markets for unwearable textiles, creating demand for recycled outputs and returning these materials to productive use in the economy.

Australia has growing capabilities and emerging infrastructure to recover and recycle these materials. But demand for recycled textile outputs is limited. Without stronger next markets with reliable demand, investment in clothing collection, sorting, processing and recycling will continue to lag, and landfill will remain the default for unwearable clothes.

The opportunity is significant. Developing next markets could generate between $250 and $380 million in revenue for Australian businesses annually, support between 1,200 and 2,300 direct jobs and divert large volumes of clothing textiles from landfill. Capturing this value requires coordinated action across markets, policy and infrastructure.

This report provides the first systemic assessment of next markets for unwearable Australian clothing textiles; where they exist now, where they're emerging, and what is needed to scale them.

Why next markets matter

Next markets for unwearable clothing textiles are essential for a circular clothing system. They create the demand that makes textile recovery and recycling viable. When demand is strong, materials flow, investment follows, and value is retained in the economy. Without it, even well-designed clothing collection and recycling systems are unable to scale.

Unwearable clothing moves through several stages: collection, sorting, pre-processing and recycling, before it reaches a next market.

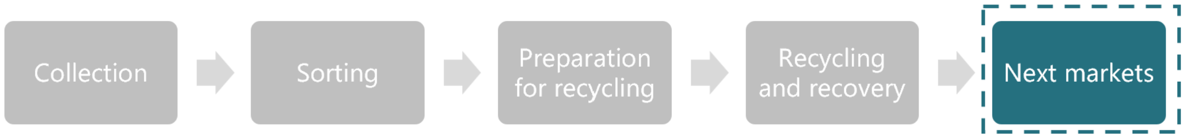

Figure 1: Movement of unwearable clothing textiles from collection through to next markets.[1]

In Australia, next markets are still underdeveloped. This limits investment across the entire system and restricts higher-value recycling pathways. Several structural challenges contribute to this:

- Most clothing is not designed for end-of-life recovery, with fibre blends, trims and treatments increasing processing complexity
- Recycling often costs more than landfill
- Demand for recycled textile content remains low relative to overall volumes generated

Addressing these barriers will require clear policy settings, commitments to reduce reliance on virgin materials, and targeted investment to encourage innovation and new next market applications.

[1] For simplicity, the diagram does not show manufacturing as a separate stage. Where it occurs, it sits between 'recycling and recovery' and entry into next markets. See Section 5 for a description of each step.

A portfolio of applications and markets

No single solution can handle the scale and complexity of unwearable clothing. A mix of recycling pathways, applications and markets is needed. This research identifies opportunities across consumer goods, the built environment, environmental uses and energy recovery.

Two opportunities for recycled clothing textiles are explored in detail:

1. **Fibre-to-fibre:** A high-value, closed-loop pathway that turns unwearable clothing into new textiles. There is early stage but growing use of clothing derived feedstock in fibre-to-fibre applications, particularly through overseas spinning mills. Its scale is constrained by feedstock quality, limited domestic spinning capacity, and a need to integrate into international textile and manufacturing supply chains.
2. **Thermal insulation:** A near-term and scalable opportunity. This is an open-loop pathway that incorporates recycled textiles into insulation products for the built environment, with growth dependent on feedstock supply, processing capacity and market demand.

Beyond these, other emerging applications show potential and warrant further research including:

- Mattress and furniture materials
- Acoustic insulation and construction panels
- Environmental uses such as biochar and geotextiles
- Underlay products for surfaces like carpet or artificial turf

Open-loop pathways are essential in the transition to a circular economy. They can absorb large volumes of mixed and lower-grade materials that cannot meet the quality requirements of closed-loop pathways.

Energy recovery also has a role for clothing textiles that can't be reused or recycled. While it isn't the highest-value outcome, it provides an alternative to landfill during the transition and assists in displacing fossil fuels.

Current infrastructure in Australia can process around 86,000 tonnes of unwearable clothing each year. As product design, recycling systems and next markets mature, more material can shift into higher value applications.

Australia's growing capabilities and capacity

Across Australia, momentum is building to recover and recycle unwearable clothing textiles:

- Charities, social enterprises and recyclers are developing recovery pathways for unwearable clothing and building practical expertise.
- Pilot programs are testing clothing collection and sorting systems for unwearable clothing, generating real-world data on feasibility, costs and performance.
- Clothing textiles pre-processing and recycling technologies are improving, including both open- and closed-loop solutions.
- Researchers and innovators are developing new, higher-value applications for recycled textiles.

Despite this progress, only about 14% of unwearable clothing is currently recovered. The remaining volume represents a major opportunity.

The economic case for action

Developing next markets can strengthen domestic manufacturing and provide jobs across the clothing value chain and beyond. This includes employment opportunities in clothing sorting and decommissioning which are suited to people facing barriers to work, as well as skilled jobs in engineering, materials science and advanced manufacturing.

At scale, this could deliver $250-$380 million in annual turnover and direct employment of 1,200-2,300 full-time equivalent jobs. [2]

However, without intervention, landfill will often remain the cheapest and easiest option. Realising this opportunity requires building demand for recycled clothing textiles, investing in infrastructure and technology, and establishing the policy settings needed to support long-term market confidence.

Recommendations

A coordinated, national approach spanning policy, investment and market development is needed to scale next markets for unwearable clothing textiles. The following actions are recommended:

1. Transition Seamless to a mandatory product stewardship scheme covering all clothing placed on the Australian market, with clear obligations for financial contributions, product design standards and reporting requirements.
2. Establish consistent reporting and data frameworks to track system performance, support evidence-based policy and maintain public trust, including recycling feedstock standards and traceability systems.
3. Introduce a staged circular procurement policy across government for domestically recycled textile content in products, beginning with the built environment, uniforms and workwear, to support domestic recycling and manufacturing.
4. Investigate building and construction standards as levers to grow private sector demand for recycled textile products.
5. Enable a financially sustainable and collaborative clothing recovery system.
6. Invest in research, development, commercialisation and workforce development for textile recycling.
7. Provide long-term policy certainty to encourage investment in the infrastructure and technology for managing post-consumer textiles.

These actions should be implemented in stages, starting with foundational policy and building toward a fully scaled system.

[2] Section 6 of this report outlines the potential economic benefits of developing next markets for recycled clothing textiles including industry development and increased job opportunities.

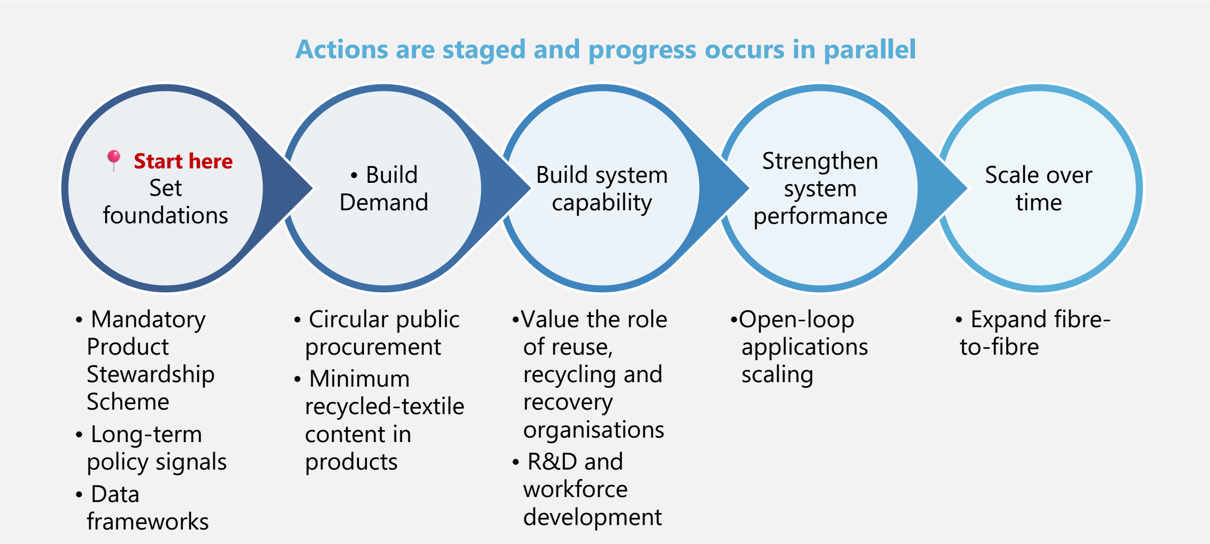

Figure 2: Recommendation for a staged pathway to scale solutions for unwearable clothing textiles.

Australia is at an important stage in this transition

The volume of clothing going to landfill is significant and growing. But the foundations for change are already in place: capabilities are building, innovation is accelerating, and markets are emerging.

Scaling next markets remains the critical challenge.

Next markets are what connect recovery efforts to real outcomes. Without them, progress stalls. With them, Australia can unlock economic value, support thousands of jobs and significantly reduce landfill volumes.

This is an achievable opportunity, but it requires coordinated, system-wide action. Australia can continue to treat unwearable clothing as waste. Or it can recognise it as a resource and develop the markets to realise its value.

1. Introduction

Background

Australia's clothing system generates large and increasing volumes of unwearable clothing – in 2024, 916 million clothing items (229,000 tonnes) were sent to landfill.[3] This creates an environmental burden, a cost burden and a missed opportunity to recover value.

This report focuses on the next markets for unwearable clothing textiles. While upstream interventions such as improved design, reuse and conscious consumption remain critical, they do not address the immediate and increasing volume of clothing textiles that have already become unwearable and will continue to increase without the right system settings.

These settings include viable next markets for unwearable clothing textiles. In the absence of these markets, these textiles typically default to landfill disposal. Developing next markets is therefore central to landfill diversion, unlocking value, and supporting a functional circular clothing system in Australia.

What are unwearable clothing textiles?

Unwearable clothing textiles are those which can no longer function in their original form for their original purpose. They may be deemed unsuitable for wear due to a range of commercial, functional, hygienic or aesthetic reasons. These are garments that are not suitable for reuse or donation and are often sent to landfill.

About the study

Clothing Stewardship Australia Limited (Seamless) engaged Rawtec to investigate the next markets for unwearable clothing textiles in Australia. The aim of this research is to support the development of, and evidence base for, a coordinated national clothing system that diverts textiles from landfill. It sits within the Seamless strategic priority to 'close the loop', and will inform future regulatory, investment, and product stewardship decisions.

Research scope

This project focused on identifying next market pathways for unwearable clothing textiles in Australia. It encompassed an assessment of current pathways for these textiles, including existing collection, sorting, pre-processing, and recycling operations and their current capacity and capabilities.

The project identified key challenges and barriers affecting recovery of unwearable clothing textiles and the enablers for next market development. Building on this understanding, the project identified and assessed potential next market opportunities for Australian unwearable clothing textiles.

Through this research, targeted recommendations have been developed to support improved diversion of unwearable clothing into next markets.

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[3] Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia

Methodology

This research report has been informed by three project stages outlined in the sections below. Stage 1 (Literature review and data gathering) was led by the Seamless team. Rawtec was engaged to deliver stage 2 (Stakeholder engagement) and stage 3 (High-level economic benefit assessment). Rawtec also developed this report.

The data collected through these stages is presented in Figure 3 below, including the results from the Seamless Circular Clothing Textiles Fund pilot projects and responses to a survey developed by Seamless, as well as other data sources.

Figure 3: Outline of data sources that informed this research.

Stage 1: Literature review and data gathering

A literature review was undertaken to map the Australian textile value chain, assessing current and emerging processing and recycling pathways, quantifying demand across recovery options, and reviewing global policy settings supporting circular economy outcomes. Findings are summarised in Appendices C, D and E.

Additional data supporting the project were drawn from the Seamless Circular Clothing Textiles Fund pilot project results and a survey produced by Seamless, 'Shaping next markets for clothing textiles'. The survey received 54 submissions from stakeholders across the Australian clothing value chain including clothing brands, collectors, sorters, reuse organisations, recyclers, researchers, and next market participants.

Together, these inputs provided insights into current systems, emerging technologies, and potential future pathways.

Stage 2: Industry consultation (focus groups and interviews)

During stage 2, four focus groups and ten interviews were held with industry representatives and subject-matter-experts to:

- Collect information on current capacity, capabilities, feedstock requirements, recycling outputs, costs, pricing, and potential next markets across relevant parts of the clothing supply chain.

- Develop a detailed understanding of key barriers and challenges across collection, sorting, pre-processing, recycling, and next markets.
- Validate project findings, address data gaps, and capture a diverse range of perspectives across stakeholder groups.

A selection of organisations that participated in the consultation process is provided in Table 1 below. The full list of participants is available in the Acknowledgements section of this report (page 2).

Table 1: Selected industry consultation participants.

Consultations completed [4]	• Australian Council of Recyclers (ACOR) members focus group • Australian Retail Council (ARC) members focus group • BlockTexx (interview) • Charitable Reuse Australia members focus group • Cleanaway (interview) • Insulation Australasia (interview) • Planet Protector (interview) • ResourceCo (interview) • Salvos Stores (interview) • Samsara Eco (interview) • Sector-wide focus group • Shred-X (interview) • Veolia (interview) • Waste Management Association of Australia (interview)

Stage 3: High-level economic benefit assessment

Finally, a high-level assessment was undertaken to estimate the potential economic benefits including revenue and employment potential, alongside key constraints and barriers. Data analysis involved synthesising validated insights, cross-checking findings, and filling gaps where required using publicly available data and assumptions.

[4] Full list of participating organisations in research is included in the Acknowledgements earlier in this report. This includes organisations involved in focus groups, interviews and/or the survey.

2. The challenge of unwearable clothing

Australia's clothing system generates a high volume of unwearable clothing textiles, most of which are sent to landfill. This outcome is driven by product design limitations, high consumption, and a lack of viable downstream recovery pathways. This section outlines the scale and drivers of unwearable clothing in Australia, and the resulting impacts across the system.

A high-volume clothing system

Australians are high consumers of clothing, purchasing 1.51 billion items nationally in 2024, which is equivalent to 55 items for every Australian. Most clothing (97%) is imported into Australia, while domestic production remains minimal at less than 3% of supply.[5]

Many consumers are purchasing lower-cost products from a growing availability of low-cost, high-volume retailers, including international online brands. This creates a high-throughput system, where large volumes of clothing enter the market each year but are not retained for long. These garments are often designed for shorter use cycles, with lower durability and quality, reducing their suitability for reuse and increasing the likelihood that they become unwearable faster.

The scale of clothing waste

As a result, a substantial share of clothing becomes unwearable. In 2024, an estimated 220,000 tonnes of clothing, equivalent to around 880 million items, were disposed of to landfill in Australia. A further 9,000 tonnes were landfilled overseas, bringing total landfill volumes to 229,000 tonnes.[5]

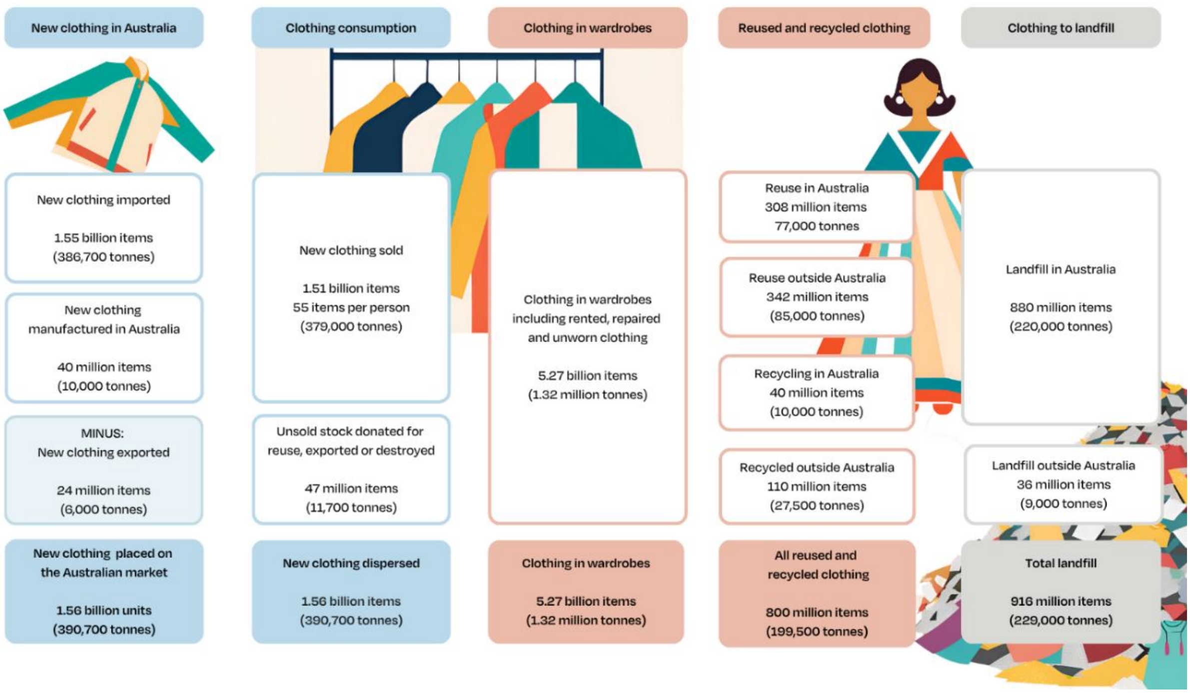

Figure 4: Flow of clothing in Australia in 2024 (Seamless 2024 National Clothing Benchmark for Australia)

[5] Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia

Environmental impacts of landfilling clothing

Sending clothing to landfill has environmental impacts. In 2024, clothing sent to landfill generated 0.48 million tonnes of CO_2 emissions, representing 3.5% of the sector's total emissions. If all clothing had been diverted from landfill through reuse and recycling, an estimated 2.1 million tonnes of CO_2 emissions could have been avoided.[6]

Diverting clothing from landfill through reuse, recycling and recovery pathways can significantly reduce these impacts by extending the life of products and displacing the need for virgin materials. Higher-value pathways such as reuse offer the greatest emissions reduction potential. Strengthening these pathways will be critical to reducing sector emissions and supporting the transition to a more circular clothing system.

Risk of increasing volumes to landfill

In Australia, reuse charities play a critical role in managing donated clothing. They sort and resell high-quality items locally through op shops, while sending other wearable items for export to international reuse markets where there is more demand. Currently, access to international reuse markets is being disrupted, generating a risk that volumes of clothing sent to landfill will increase.[7]

Australia relies on these export pathways to ensure that clothing which is not saleable domestically can still be reused. Charitable Reuse Australia reports that around 45,000 tonnes of clothing are typically exported each year, often via hubs in the United Arab Emirates, to support reuse in overseas markets.[8]

When these export pathways are disrupted, such as through recent shipping interruptions in the Middle East, this material remains in Australia despite being suitable for reuse elsewhere. This places pressure on local collection and storage systems. In the absence of scalable domestic recycling or alternative recovery options, surplus material may require disposal. Given the scale of material typically managed through export markets, even short-term disruptions can lead to significant increases in landfill volumes.

In addition to overseas pressures from export markets, Australian landfills are approaching capacity in some locations. The most immediate constraints are in Greater Sydney, where several landfills are projected to reach capacity in the near term.[9] Some other regions face longer-term pressures related to planning approvals, transport distances and infrastructure availability. This will continue to have upward pressure on costs to landfill, increasing demand for alternative circular pathways.

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[6] Seamless (2025). Environmental Impact of the Australian Clothing Industry 2024.

[7] Seamless (2026) Middle East crisis impacts Australia's clothing value chain.

[8] Waste Management Review (2026). 45,000-tonne landfill crisis for Australian textiles.

[9] WMRR (2024). NSW Government Action to Address WARR Challenge a Step in the Right Direction.

Costs to households, councils and reuse organisations

The financial burden of managing unwearable clothing textiles sits primarily with households, councils, and reuse organisations.

Across Australia, landfill disposal costs for unwearables are estimated at $46 to $70 million each year,[10] based on landfill fees and levies which vary by jurisdiction. This value excludes:

- Sorting and handling costs incurred by reuse organisations
- Waste collection costs borne by councils and reuse organisations

Financial pressures are increasing. Many reuse organisations are facing rising rent prices and utility bills.[11, 12, 13] When export or recycling pathways are constrained, the volumes and costs to landfill may increase, placing additional pressure on already stretched systems.

Australia's progress to date

Australia has made measurable progress in developing textile recycling pathways, supported by significant effort, innovation and collaboration across industry, government and the reuse sector. In 2024, approximately 150 million garments, equivalent to 37,500 tonnes, were recycled or recovered onshore or overseas. Of this, around 40 million garments (10,000 tonnes) were recycled domestically[14].

However, these volumes remain small relative to the total volume of clothing textiles sent to landfill in 2024, which was 916 million items or 229,000 tonnes.

System gap and opportunity

The system generates large volumes of unwearable clothing textiles, with limited management pathways. As a result, materials are typically sent to landfill. This has negative environmental impacts and places the cost of managing these waste items onto households, councils and reuse organisations.

At the same time, these volumes represent a missed opportunity. The current system lacks the market pull required to use these volumes productively at scale.

Capitalising on this opportunity requires a shift in focus. Rather than concentrating only on collection, sorting and recycling, attention needs to move to the end uses that create demand for unwearables as a resource. This shifts the framing from waste management to next market development.

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[10] Rawtec calculated estimate using clothing landfilled tonnes from 2024, and levies from FY 25/26.

[11] Charitable Reuse Australia (2024). NSW Reuse Impact Study, 2022-23: Technical Report.

[12] Charitable Reuse Australia (2025). Tasmanian Reuse Impact Study: 2023-24 Technical Report.

[13] Charitable Reuse Australia (2025). South Australian Reuse Impact Study: 2023-24 Technical Report.

[14] Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia

3. Identifying next markets for Australian unwearable clothing textiles

What are next markets?

Next markets use products or commodities derived from unwearable clothing textiles, providing the demand needed to retain value in a circular clothing system. To transform unwearable clothing textiles into products for next markets, recycling, recovery processes and technologies are required that alter the size, function, composition, and even material state, of clothing feedstocks.

While there has been much research documenting the transformation of clothing through recycling processes, significantly less has documented the next market applications for these recycled textile outputs. Recycling only creates value where there is demand for the resulting products. Without viable next markets, materials cannot be absorbed at scale, regardless of processing capability.

Next market opportunities exist in a range of sectors, including consumer goods, the built environment, environmental applications, industrial processes and energy. Across these sectors, recovered materials are used in place of virgin inputs, retaining value within the system.

How materials reach next markets

Before materials reach next markets, they move through a series of stages, as per Figure 5 below:

1. Collection
2. Sorting to separate wearable and unwearable items (if not already separated)
3. Preparation for recycling (including sorting by fibre and colour, decommissioning, and size reduction processes)
4. Recycling or energy recovery
5. Manufacturing new products (using recycled outputs)
6. Use through next markets

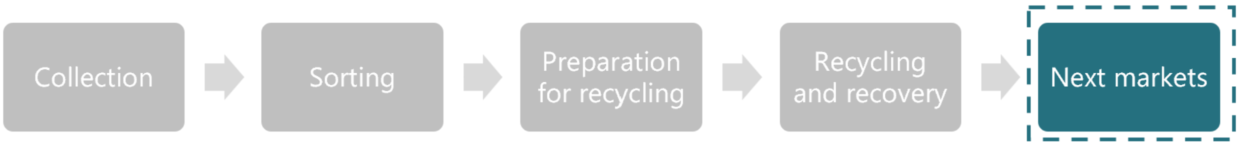


Figure 5: Movement of unwearable clothing textiles from collection through to next markets.[15]

Each stage, from collection through to recycling and energy recovery, is described in more detail in section 5 of this report, along with Australia's current capabilities and capacity.

Recycling and energy recovery are pathways that produce outputs. Next markets are where those outputs are ultimately used.

The following section outlines the next markets currently operating in Australia, emerging opportunities, and the system conditions required to scale them.

[15] For simplicity, the diagram does not show manufacturing as a separate stage. Where it occurs, it sits between 'recycling and recovery' and entry into next markets.

Existing next markets for Australian unwearable clothing textiles

Australian unwearable clothing textiles are processed into recycled products and commodities across domestic and export markets. Existing next markets include:

- **Consumer goods**, where recycled products and commodities are used in the manufacture of mattresses and textiles.
- **Environmental applications**, where recycled cellulosic clay (a product from recycling natural fibres) forms a base for soil amendments.
- **Energy and industrial fuel** including process engineered fuel (PEF) for high temperature industrial fuel use, and electricity generated through energy-from-waste (EfW).
- **Industrial processes**, where clothing textiles are recycled as rags for industrial and cleaning processes. This mostly occurs offshore rather than through onshore processors.

Pathways supplying these markets

Existing next markets are supplied with unwearable clothing textiles through different pathways:

- **Closed-loop pathways** retain materials within the textile value chain. For example, unwearable clothing items are converted into recycled plastic pellets, which are then spun into recycled content yarn for garment and textile production. Outputs such as recycled polyethylene terephthalate (rPET) and nylon pellets are also used in components like buttons and zips, enabling reintegration into garments.
- **Open-loop pathways** direct materials into other markets. Current applications include mattresses, rags, plastic products (not used on clothing), and soil amendments, linking unwearable clothing textiles to consumer goods, industrial processes and environmental applications.
- **Energy recovery pathways** use materials not suitable for higher value recycling, extracting their energy value. These pathways typically manage residual waste fractions.

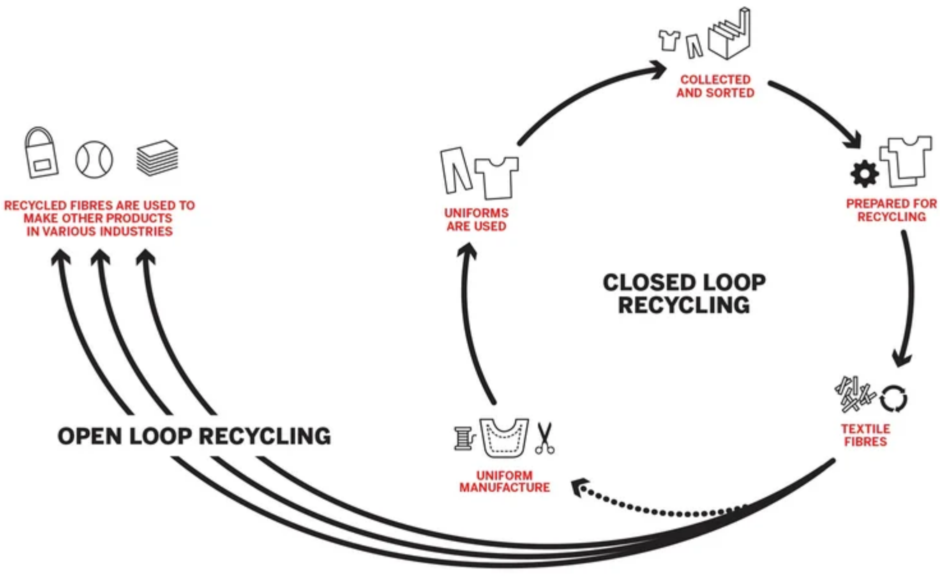


Figure 6: Closed-loop vs open-loop recycling pathways.[16]

[16] Total Uniform Solutions (N.D.). The future lies in closed-loop textile recycling.

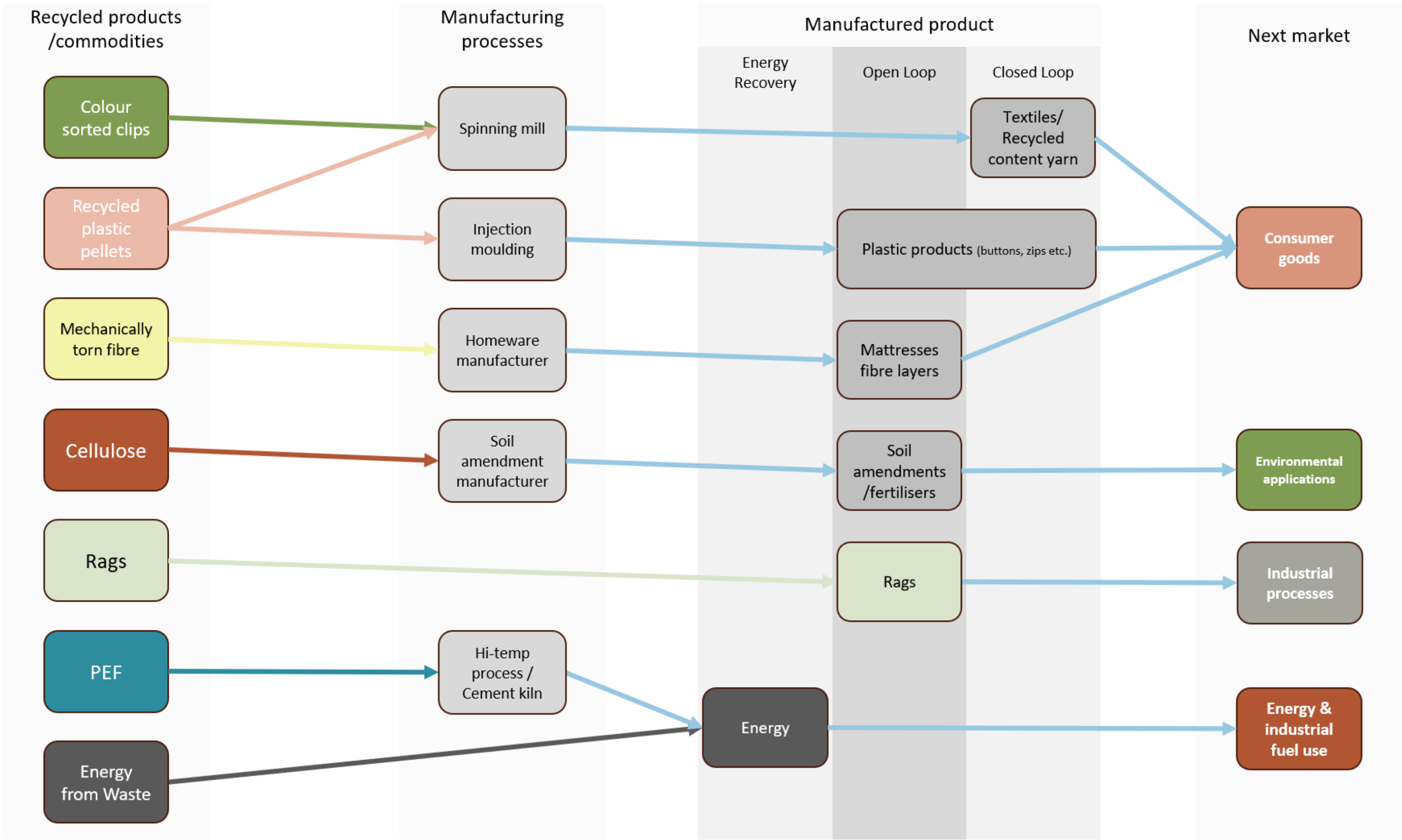


Figure 7: Existing next markets for recycled products/commodities derived from unwearables.

This diagram is intended to show existing next markets for Australian unwearables as identified in this research. These pathways and markets reflect current activity rather than a complete or fully mature system. It does not include markets using post-industrial recycled fibre.

Current fates and next markets for unwearable clothing textiles

Figure 8 shows the current fates of Australian unwearable clothing textiles.[17] Most unwearables (86% by weight) do not reach a next market and are sent to landfill. The remaining 14% are recovered for use across a range of next markets, both in Australia and overseas, including:

- Around 5% are processed into rags for industrial processes, mostly overseas.
- About 4% are used for energy or industrial fuel, including process engineered fuel and energy-from-waste. This share is likely to grow as Australia expands energy-from-waste capacity.
- Around 2% are used in consumer goods, including recycled products or commodities used in the manufacture of mattresses and textiles.
- Another 2% goes into environmental applications, including cellulose used in the manufacture of soil amendments.
- Around 1% is recycled overseas, although the specific next markets for these materials are not clearly visible in available data. This is represented as 'recycled overseas – unknown market' in the graph below.

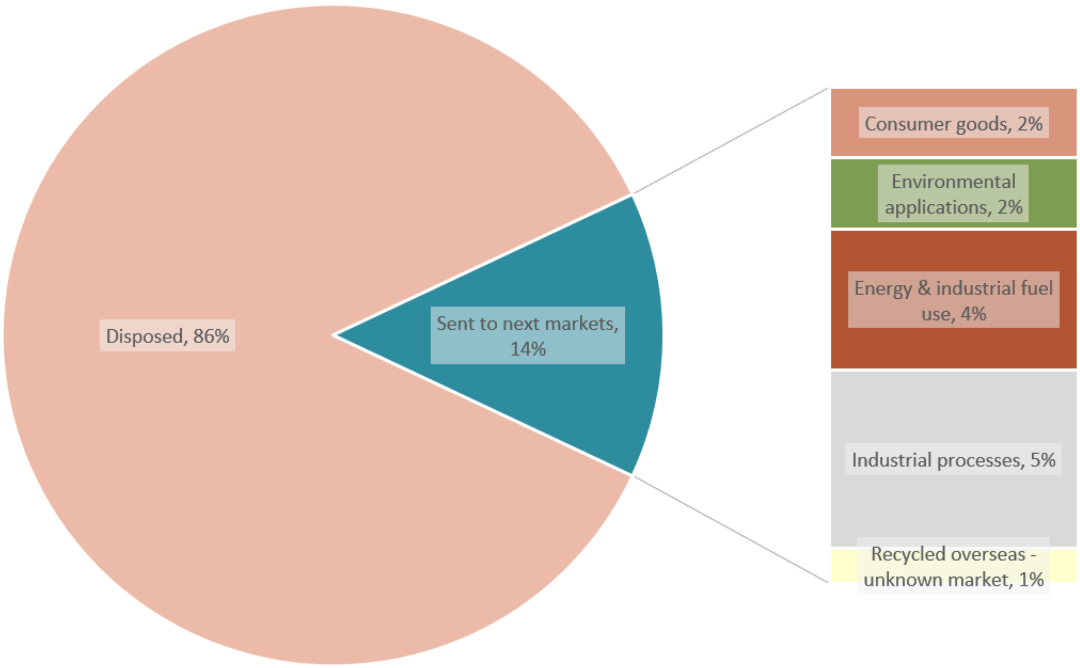


Figure 8: Current fate of Australian unwearable clothing textiles (% weight)[17]

The Seamless Circular Clothing Textiles Fund included pilots that produced recycled textiles outputs such as thermal insulation and textiles biochar. Consultations also identified emerging innovations, such as non-woven materials from unwearables used as algae nucleation sites in habitat rehabilitation, and the incorporation of textile waste into ceramic tiles for the built environment.[18] These are project-specific or specialist applications and are not shown in Figure 8 above.

[17] Rawtec high-level estimate using 2025 data sourced from consultations with industry, and data from Charitable Reuse Australia (2025). National Reuse Impact, and Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia.

[18] ReCo. Inside Kandui Technologies and UNSW SMaRT Centre's partnership turning waste into sustainable innovation.

Next markets currently using post-industrial textiles

There is also an opportunity to build scale from post-industrial textiles. In addition to unwearable clothing textiles, some Australian markets use textile-derived inputs from post-industrial materials. Some of these processes were identified through consultations, and include:

- Insulation, using post-industrial recycled textile fibre
- Packaging, using post-industrial wool
- Artificial turf underlay, using post-industrial recycled textile fibre

These next markets demonstrate existing demand but currently rely on post-industrial, rather than post-consumer, inputs.

Understanding post-industrial, pre-consumer and post-consumer

The following terms describe the stage in the supply chain at which textile materials are discarded and enter recovery or recycling pathways.

Post-industrial waste arises during manufacturing processes and can include offcuts and trimmings. This material is typically clean and consistent, making it easier to recycle.

Pre-consumer waste is often used interchangeably with post-industrial, though it can more broadly include any materials discarded before reaching the end user. For the purposes of this study, we refer to pre-consumer waste as unsold or surplus inventory.

Post-consumer waste occurs after use by the consumer, included discarded garments. This material is more mixed and contaminated, requiring additional sorting and processing.

Figure 9 illustrates where each category sits along the value chain.

Figure 9: Difference between post-industrial, pre-consumer, and post-consumer materials.

Potential next markets for unwearable clothing

Beyond the markets currently receiving recycled and recovered outputs from Australian unwearable clothing textiles, this research identified a broader suite of next markets with potential to use these materials over time.

Figure 10 presents next market opportunities already mentioned in this report, along with examples from the Fund pilots and others around the world that vary in maturity, scale and level of evidence. Some are already operating, while others are prospective opportunities identified through consultation and market analysis. Together, they indicate a wider set of possible destinations for recycled textile products and commodities derived from unwearable clothing textiles.

Section 4 of this report provides an assessment of next markets opportunities.

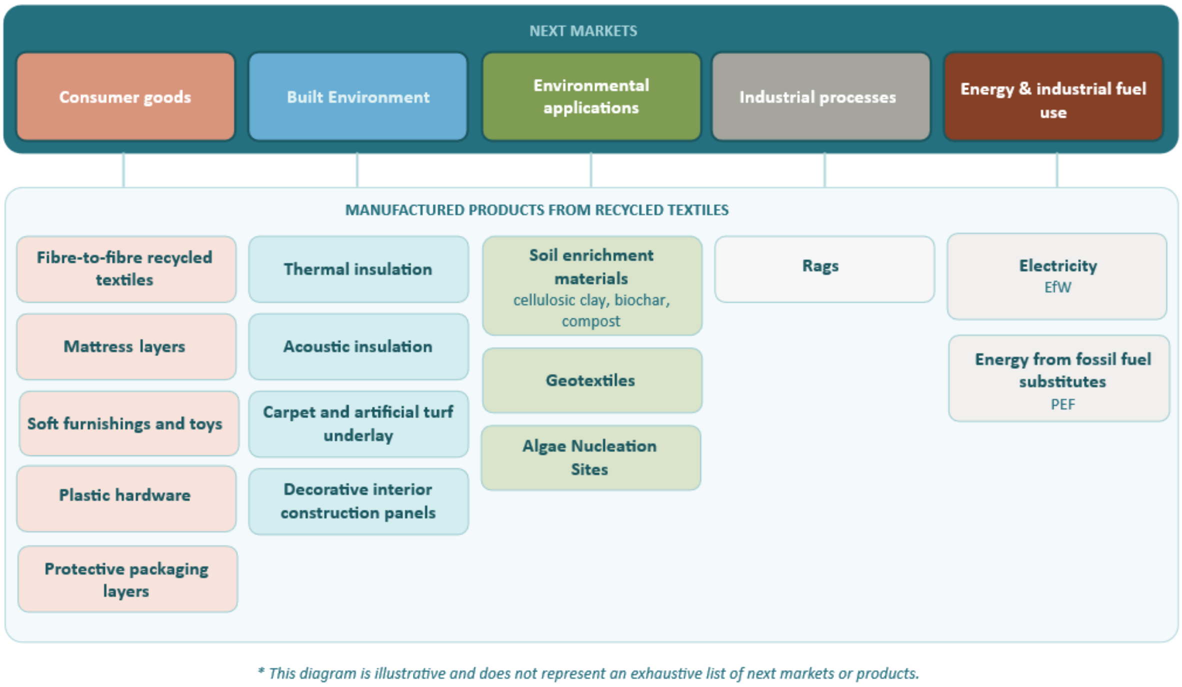


Figure 10: Potential next markets identified for Australian unwearable clothing textiles.

Australia's position in a global system

Realising these next market opportunities, both domestic and international, requires an understanding of where Australia sits within the global textile system. While domestic textile manufacturing is limited, Australia has emerging strengths across the value chain that position it to play a meaningful role. This role can be understood across three areas:

1. **Innovation and capability development**: Australia has growing capability in research, development and commercialisation of textile recycling technologies, alongside systems to collect, transport and process materials.
2. **Domestic market development**: There are opportunities to further develop local applications where manufacturing capability exists, such as the built environment, which has the potential to use recycled textile materials at scale.

3. **Global supply of recycled feedstock**: Australia can supply recycled textile feedstock into international manufacturing markets, where most textile production occurs and where demand from brands in Australia can help guide recycled feedstock use in international manufacturing.

Together, these roles position Australia to contribute to global textile supply chains while building capability in areas that can manage significant volumes of unwearable clothing textiles.

Economic benefits to Australia

Where these roles are realised at scale, they generate tangible economic value for Australia. High-level modelling[19] undertaken by Rawtec found that economic outcomes could include:

- Annual turnover of $250 million to $380 million
- Approximately 1,200 to 2,300 full-time-equivalent jobs.

These benefits are contingent on system change. Current cost structures and limited end-market demand continue to favour landfill over recycling, constraining investment and scale.

Conditions required to unlock scale

Consultations and analysis identify four system conditions required to scale next markets:

- **Demand creation**, through domestic procurement, recycled content requirements and industry commitments
- **Feedstock supply**, supported by improved collection, sorting and traceability
- **Cost competitiveness**, enabled through scale and policy mechanisms that address the price gap with virgin materials, and
- **Standards and market confidence**, including clear classification and verification of recycled outputs.

Next markets remain underdeveloped relative to the volume of unwearable materials generated. Without stronger demand to absorb recycled outputs at scale, recycling will remain constrained.

A mandatory product stewardship scheme could enable these conditions at scale. By providing a consistent funding mechanism and clear accountability across the value chain, a mandatory scheme can support investment in clothing collection and sorting systems, improve feedstock quality, build demand, and help close the cost gap with virgin alternatives.

These conditions underpin the recommendations in section 7 of this report and are required to move materials up the hierarchy over time.

[19] Data on employment and revenue associated with recovering and recycling unwearable clothing textiles was gathered through industry consultation. Where gaps existed, these were addressed using publicly available data and Rawtec industry estimates. The resulting figures are high-level and intended to provide order-of-magnitude estimates; detailed economic modelling is recommended to build on these findings. They are based on the following scenario: 20% of unwearables are recovered through energy recovery pathways, 30% of unwearables are recovered through mechanical pathways, 30% of unwearables are recovered through chemical and enzymatic recycling pathways and the remaining 20% of unwearables are sent to landfill.

4. Assessing next market opportunities

Australia's next markets for unwearable clothing textiles (unwearables) are diverse and remain underdeveloped. Some recycled textile applications are being adopted at commercial scale, while others are emerging, niche or still at proof-of-concept stage.

This section assesses these opportunities, drawing on the research insights obtained through industry consultation and Seamless Circular Clothing Textiles Fund Pilots. These markets are grouped by three pathways:

- **Closed-loop:** unwearables are recycled and then manufactured into new fibres, yarns and fabrics, for example, fibre-to-fibre recycling for garments and home textiles. This reduces demand for virgin materials in textiles manufacturing and closes the material loop.
- **Open-loop:** unwearables are recycled and then manufactured into inputs for other products and sectors, for example, insulation, mattress layers, construction panels, plastic products and geotextiles. These applications reduce demand for virgin materials in those sectors and can potentially use large volumes of textiles, including mixed and lower-grade material that is not yet suitable for closed-loop applications.
- **Energy recovery:** unwearables are used as a fuel or energy source when recycling is not feasible, for example, process engineered fuel and energy-from-waste. This pathway provides an outlet for residual materials and can support a transition away from landfill.

Section 4.1 on the following pages summarises the next market opportunities identified through this research.

Section 4.2 then provides a more detailed review of four opportunities:

1. Closed-loop textile manufacturing
2. Open-loop thermal building insulation
3. Other emerging open-loop innovations, and
4. Energy recovery: process engineered fuel.

4.1 Summary of next markets

The following tables provide an overview of next market applications for unwearable clothing textiles by pathway:

- Table 2: Closed-loop next markets for unwearable clothing textiles
- Table 3: Open-loop next market opportunities for unwearable clothing textiles
- Table 4: Energy recovery markets for unwearable clothing textiles

The tables identify where recovered textiles can be used (the product or next/end use), the form in which recycled material leaves the recycling process (the recycled output form), and key insights on status, feedstock suitability and constraints.

Table 2: Closed-loop next markets for unwearable clothing textiles

Manufactured products	Recycled products/commodities from unwearable clothing	Research insights
Next market: Consumer goods		
Fibre-to-fibre recycled textiles: Recycled content yarns and fabrics for clothing. **See section 4.3 of this report for further information.**	**Polymer pellets (for example, rPET, nylon66 resin)** produced from chemical or enzymatic recycling.[20] Can be suitable as replacement for virgin polymers. **Colour sorted clips:** guillotined textile pieces with known fibre and colour, hard points removed. Potential to be supplied to mills for mechanical recycling. **Mechanically torn fibre:** fibres that are mechanically shredded and/or torn, suitable for spinning and blending into yarn.	Consultations indicate early stage but growing use of clothing derived feedstock in fibre-to-fibre applications, particularly via overseas spinning mills. Feedstock is most suitable where fibre composition is known and consistent, and where trims and hard points have been removed. Scaling remains constrained by feedstock quality, limited domestic spinning capacity, and the need to integrate into international textile and manufacturing supply chains.

[20] The output from from chemical, enzymatic, and mechanical recycling processes vary.

Table 3: Open-loop next market opportunities for unwearable clothing textiles

Manufactured products	Recycled products/commodities from unwearable clothing	Research insights
Next market: Consumer goods		
Mattress layers: Comfort and support layers in mattresses and mattress toppers.	**Mechanically torn fibre:** mechanically shredded and torn mixed textile fibres suitable for nonwoven padding.	Consultations identified current use of pre-consumer textile waste in mattress manufacturing, with manufacturers indicating potential capacity to absorb greater volumes of suitable recycled fibre.
Soft furnishings and toys: Fill material and stuffing.	**Mechanically torn fibre** for filling.	Insights from the Fund pilots suggest that recycled textile fibres can be used as fill material in soft furnishings and toys. Post-consumer feedstock requires suitable decommissioning and basic contamination control. Opportunities are limited by competition from low-cost virgin polyester fill manufactured offshore.
Plastic hardware such as buttons, zips, hangers and other moulded-injected products.	**Polymer pellets:** rPET pellets and nylon-66 resin pellets derived from clothing textiles via chemical or enzymatic recycling.	Consultations indicated that polymers recovered from synthetic fibres can substitute for virgin feedstock in injection-moulded plastic products. In most cases, this represents an open-loop market (non-textile plastic products), with a potential closed-loop opportunity where outputs are used for hard points on new garments.
Protective packaging layers	**Post-industrial wool clippings** applied as non-woven textiles.	Consultations identified that current processes mostly rely on post-industrial materials as feedstock. The market in Australia for non-plastic packaging was described as strong (Seamless Circular Clothing Textiles Fund pilot).
Next market: Built environment		
Thermal insulation for use in the built environment. **See section 4.4 of this report for further information.**	**Mechanically torn fibre:** polyester-rich mixed textile fibres suitable for nonwoven insulation batts.	Consultation indicated recycled thermal insulation as a promising near-term next market with potential to absorb large volumes of unwearable clothing feedstock. Compared to virgin glasswool, recycled textile insulation offers several performance advantages.

Manufactured products	Recycled products/commodities from unwearable clothing	Research insights
Acoustic insulation and panels for use in buildings and interior fit outs. **See section 4.4 of this report for further information.**	**Mechanically torn fibre:** polyester-rich textile fibres for nonwoven acoustic batts and panels.	Consultations and the Seamless Circular Clothing Textiles Fund identified acoustic insulation as a related open-loop opportunity using similar feedstock and preparation processes to thermal insulation. Demand is expected to grow as buildings use more hard surfaces and as awareness of acoustic comfort and neurodivergence increases, particularly in schools.
Carpet and artificial turf underlay.	**Mechanically torn fibre:** mixed textile fibres blended into underlay products.	Consultations indicated limited current next market opportunities in Australia for clothing-derived fibres in carpet and turf underlay. However, application in international markets is expected to be larger.
Tiles: textiles combined with waste glass to make ceramic tiles.[21]	**Mechanically torn fibre** combined with other composite materials.	Waste textiles can be combined with waste glass to produce a green ceramic product suitable for use as tiles, benchtops and other architectural surface applications.
Next market: Environmental applications		
Cellulosic-clay soil additives: Soil conditioners and surface-stabilisation products, for example, hydromulch additives and erosion control treatments.	**Separated cellulosic fibre** processed into cellulosic-clay granules or slurry.	Through consultations, it was found that cellulosic clay is used as a soil amendment. Feedstock suitability depends on access to cellulosic-rich textiles such as cotton, and effective management of contaminants.
Textile-derived biochar used as a soil amendment and carbon rich additive in hydromulch and other soil health products. **See section 4.5 of this report for further information.**	**Shredded, decommissioned, mixed textile feedstock** is produced via textile pyrolysis, which is a process that breaks down textile waste using high heat in a low-oxygen environment. Instead of burning the material, the heat causes the fibres to thermally decompose and transform textile structures into a new carbon product.	A Seamless Circular Clothing Textiles Fund pilot implemented in Australia has demonstrated that hard-to-recycle clothing textiles, including workwear, can be converted into biochar through pyrolysis and used in environmental applications such as hydromulch. Textile-derived biochar offers a way to manage mixed fibre streams, including synthetics, while recovering carbon for productive use.

[21] UNSW Sydney, 2025. Veena Sahajwalla - Leading The Recycling Revolution.

Manufactured products	Recycled products/commodities from unwearable clothing	Research insights
Compost and soil amendment products.	**Shredded natural fibre textiles,** for example, cotton and wool.	Composting was identified as a potential pathway for natural fibre textiles, however, it is unlikely to be a market for post-consumer clothing in the near term due to high contamination risks. Scaling requirements depend on highly controlled, source-separated natural fibre streams and robust contamination management.
Geotextile products for erosion control, drainage, landscaping and civil construction.	**Mechanically torn fibre:** mixed polymer-natural fibres for nonwoven textile application.	Consultations identified geotextiles as a potentially large-scale opportunity. Most geotextiles are currently imported, particularly for more complex constructions, which creates both a potential market gap and competition on cost.
Algae nucleation site: Textile based substrates used to support algal growth in waterway rehabilitation projects.	**Mechanically torn fibre:** mixed fibres for nonwoven textile application.	A small, niche opportunity was identified where textile-based substrates were used as algae nucleation sites in a specific waterway rehabilitation project. In this case, demand originated from the project rather than from a manufacturer seeking to enter a broader market.
Next market: Industrial processes		
Industrial rags[22]	Decommissioned and cut absorbent textiles.	Consultations identified an established market for cleaning rags in mining, automotive and mechanical industries. Suitable feedstock is typically absorbent, high-cotton or other natural fibre-rich textiles that can be easily cut. Much of this material is currently exported for processing and then reimported as rags.

[22] Repurposing clothing as rags for industrial use represents a "repurposing" pathway, rather than a "recycling" pathway as it does not require material transformation to enter a next market.

Table 4: Energy recovery markets for unwearable clothing textiles

Manufactured products	Recycled products/commodities from unwearable clothing	Research insights
Next market: Energy and industrial fuel use		
Process engineered fuel (PEF): alternative fuel used in high temperature industrial processes, for example cement kilns, to displace fossil fuels such as coal and gas. **See section 4.6 of this report for further information.**	**Residual mixed waste** containing unwearables, engineered into fuel.	Converting textiles into PEF provides a pathway for a constrained fraction of unwearables, typically as part of mixed dry waste, rather than as a dedicated textile input. Textiles can contribute calorific value, but fillers and dyes increase ash content, and their fibrous nature can cause handling issues. Therefore, inclusion rates are limited and carefully controlled through batching and blending.
Energy-from-waste (EfW): electricity generated from combustion of mixed residual waste streams, including clothing textiles.	**Residual mixed waste** containing unwearables, combusted in EfW facilities.	Energy-from-waste (EfW) is an emerging technology in Australia, with a large-scale thermal plant recently commissioned in Western Australia (WA) and further facilities planned. EfW plants receive mixed residual waste and recover energy to generate electricity, with excess power exported to the grid. EfW provides an alternative to landfill, although it is a low-value form of recovery.

4.2 Detailed assessments

The following sections provide assessments of four applications for unwearable clothing textiles:

- Section 4.3: Closed-loop textile manufacturing
- Section 4.4: Open-loop thermal building insulation
- Section 4.5: Emerging open-loop innovations
- Section 4.6: Energy recovery - process engineered fuel

Not picking winners

These market applications were selected due to the depth of insight available through project research and consultation, and to ensure representation across different pathway types. This selection does not indicate prioritisation or preferred outcomes. Rather, it reflects where sufficient evidence and operating examples were available to support a more detailed assessment. Other identified markets may also play an important role in managing unwearables and may warrant further research.

Role in transition pathway

No single pathway can manage the volume, variety and complexity of unwearables on its own. A portfolio of complementary pathways will be required, spanning closed-loop recycling, open-loop recycling and energy recovery, with each playing a distinct role depending on the material, available infrastructure and market conditions.

Readiness assessment key

Closed-loop textile manufacturing and open-loop applications in the built environment are assessed using a four-point readiness scale to indicate their current position and readiness for scale-up.

Table 5: Key for four-point readiness scale.

(light green circle)	**Strong:** Favourable conditions with high availability, capability or demand, supporting scale with minimal constraint.
(yellow circle)	**Moderate:** Some favourable conditions are present, but further development or improvement is required to support scale.
(amber circle)	**Constrained:** Conditions are limited or uneven, with structural or material constraints that restrict scale.
(pink circle)	**Weak:** Significant limitations or barriers, with low availability, capability or competitiveness, presenting constraints to scale.

4.3 Closed-loop: textile manufacturing

Fibre-to-fibre recycling is a high-value, closed-loop pathway that retains unwearables within the textile system. The process transforms unwearables into recycled fibre or yarn suitable for use in textile manufacturing, reducing reliance on virgin materials.

Fibre-to-fibre recycling processes have strict feedstock requirements and a low threshold for contamination. Unwearables must be decommissioned to remove trims and hard points, and sorted by fibre type and/or colour, with the specific requirements varying by process.

Closed-loop recycling processes include:

- **Chemical recycling**, where fibres are broken down into basic components through chemical separation processes, so they can be used to produce new materials. For example, chemical recycling of polyester fibres yields an rPET pellet suitable for fibre production and spinning into yarn for use in textile manufacturing.
- **Enzymatic recycling** uses engineered enzymes to break down specific polymers into their original molecular building blocks. This approach has been demonstrated for difficult-to-recycle synthetic materials, such as nylon. After repolymerisation, outputs are suitable for fibre production and spinning into yarn for use in textile manufacturing.
- **Mechanical recycling**, where decommissioned clothing textiles or colour-sorted clips are torn into fibre that can be spun into yarn for use in textile manufacturing.

Interest in recycled textile content is growing, driven by mandatory climate reporting, a greater focus on reducing Scope 3 emissions[23], and broader corporate ESG commitments. However, most recycled content in clothing currently comes from bottle-derived rPET.

The following measures can support scaling of closed-loop recycling :

- Circular design: mono fibre constructions with fewer fixings and use of safer chemicals
- Improved capture of clean source-separated feedstock
- Further investment in research and development
- Development of standards and traceability
- Demand-side policy measures such as recycled content requirements and circular procurement
- A mandatory product stewardship scheme to help fund, coordinate and accelerate the measures above

Readiness scorecard

The readiness scorecard below assesses this pathway across key factors for scale, highlighting its current position and constraints.

Table 6: Readiness scorecard for closed-loop textile manufacturing.

Factor		Assessment
Potential volume of feedstock		Large volumes of unwearable clothing textiles are generated in Australia, but only a small proportion undergoes fibre-to-fibre recycling. Traditional spinning mills require known fibre composition and very low contamination levels. Post-consumer unwearables often contain mixed fibres, trims and hardware, and may be contaminated. Consultations indicate that Australian feedstock for fibre-to-fibre recycling often comes from select, separately managed streams such as decommissioned uniforms and commercial linens, where fibre composition is known and consistent.
Feedstock capture and collection systems		Commercial collections exist for select streams, for example, decommissioned uniforms and linen, with potential to expand source-separated collection systems suitable for fibre-to-fibre recycling.
Technology maturity		A range of technologies are available for fibre-to-fibre recycling. Mechanical recycling is a mature technology, however the strict feedstock preparation requirements for fibre-to-fibre applications, combined with the potential for fibre degradation during processing, and contamination in mixed streams, can limit its suitability for some closed-loop applications. Chemical recycling of synthetics such as polyester can produce polymer feedstocks comparable to virgin quality. Enzymatic recycling for polymers such as nylon can handle more complex textile streams but is at early commercial scale.

[23] Scope 3 emissions are indirect greenhouse gases that occur across an organisation's value chain, including upstream activities such as raw material production and supply chain operations, and downstream activities such as product use and end-of-life disposal.

Factor		Assessment
Local capabilities and capacity		Australia has growing capabilities to recycle unwearables into materials suitable for fibre-to-fibre applications. This includes chemical recycling of polyester garments into rPET, enzymatic recycling of nylon, and production of colour sorted clips to be used in offshore spinning mills. However, domestic spinning and textile manufacturing capacity is limited. This means that recycled textile feedstocks generated in Australia will mostly enter fibre-to-fibre pathways via overseas mills, requiring close alignment with international quality specifications and supply chain requirements.
Demand potential		Demand for recycled fibres is growing as clothing brands seek to increase recycled content and reduce reliance on virgin materials. Recycled content in textiles is currently dominated by bottle-derived rPET, valued for its consistency and established supply chains. Clothing-derived fibre-to-fibre feedstocks are an emerging source of recycled fibre, where quality and traceability can meet mill requirements, supported by drivers such as mandatory climate reporting and increased focus on reducing Scope 3 emissions. Scaling this pathway will require clear demand-side drivers, such as recycled content requirements and circular procurement.
Cost compared to virgin materials		Fibre-to-fibre recycled textiles are typically more costly than virgin materials due to a range of factors, including intensive feedstock preparation requirements. When outputs are supplied into overseas mills, transport and integration into international supply chains can further impact overall cost competitiveness. Improving cost competitiveness and uptake will depend on policy and procurement measures that create stable demand and enable scale.
Performance compared to virgin materials		Performance varies by pathway. Mechanical recycling can reduce fibre length and strength, which may limit some applications. Chemical and enzymatic recycling can achieve polymer feedstocks comparable to virgin material quality.
Barriers to market		Barriers exist, as complex and contaminated post-consumer feedstock requires extensive pre-processing to meet mill specifications, adding time and cost. In addition, Australia's very limited domestic spinning and textile processing capacity means fibre-to-fibre pathways rely heavily on integration into international supply chains.

4.4 Open-loop: thermal building insulation

Recycling unwearable clothing textiles into thermal insulation is a potentially high-volume next market opportunity. Through this process, unwearables can be converted into insulation products that displace virgin materials such as glasswool and polyester, supporting domestic manufacturing and contributing to circular economy outcomes in the built environment.

Although an open-loop pathway, textiles remain in productive use within Australian buildings, extending material life and reducing reliance on virgin inputs. Thermal insulation represents a near-term, scalable opportunity if supported by feedstock supply, processing investment and appropriate policy and procurement settings.

A growing next market opportunity

Unwearable clothing can be mechanically recycled into torn fibre that meets the input specifications required by insulation manufacturers for thermal insulation products. Post-consumer garments must be decommissioned to remove hard components and sorted by fibre type. The prepared material is then torn into a fibrous consistency and incorporated into non-woven batts. These processing steps are technically proven but in Australia, currently operate at pilot scale, and capacity remains small relative to the potential volume of feedstock.

Australia's insulation market is large and growing, underpinned by building regulations that require insulation in many building types and government programs that promote energy efficiency upgrades. The market is dominated by glasswool, with polyester insulation products also in use, often made from bottle-derived recycled PET.

In principle, similar specifications could be met using fibres derived from clothing textiles. Polyester based insulation offers functional advantages over glasswool in some applications, including moisture resistance, recovery of performance after water exposure, and easier handling during installation, which can reduce installation complexity.

The role of public procurement

Public procurement could play an important role in enabling market development. Government investment in schools, social housing and public infrastructure creates an opportunity to support locally manufactured recycled content insulation products. Procurement policies that prioritise recycled content and Australian manufacturing, combined with phased targets, could help stimulate demand and support investment in the collection, processing and manufacturing infrastructure required to scale recycled textile insulation.

Readiness scorecard

The readiness scorecard below assesses this pathway across key factors for scale, highlighting its current position and constraints.

Table 7: Readiness scorecard for open-loop thermal building insulation.

Factor		Assessment
Potential volume of feedstock		Large volumes of unwearables are generated in Australia, providing significant potential feedstock for open-loop applications such as insulation. Consultation suggests current insulation manufacturing processes using recycled clothing textiles require a specific fibre blend, which is achievable with appropriate sorting and preparation. Excess organic content can increase the risk of moths and other vermin, making fibre composition and basic contamination control important.
Feedstock capture and collection systems		Collection systems for unwearables remain fragmented, with most material currently entering landfill via kerbside and commercial waste streams.
Technology maturity		Technologies to sort, decommission and mechanically recycle post-consumer unwearables into suitable insulation feedstock are technically proven and in use internationally, but remain at pilot or early commercial scale in Australia. Scaling will require investment in automated sorting, decommissioning and mechanical recycling infrastructure integrated with insulation manufacturing.
Local capabilities and capacity		Australia has an established thermal insulation manufacturing sector, including some existing products made from recycled fibres, such as recycled denim[24] and wool offcuts[25], but current production largely relies on post-industrial textile feedstock, rather than post-consumer textiles. Capacity to process unwearables into insulation grade fibre is emerging.
Demand potential		The total Australian insulation market is estimated to be worth around $1.63 billion[26], including thermal, acoustic and other types of insulation. Recycled textile insulation can tap into this demand and may offer performance and handling advantages compared to glasswool. However, market uptake will depend on procurement policies and industry specifications that recognise and value recycled content and local manufacturing.
Cost compared to virgin materials		Recycled textile insulation is currently higher cost than conventional insulation, reflecting the additional sorting, decommissioning and processing required to convert mixed post-consumer textiles into suitable feedstock. Recycled textile insulation must also compete with imported products with lower price points in a cost competitive market.

[24] Bowens (2025). Introducing Planet Protector's denim insulation.

[25] Planet Protector (N.D.). Packaging: Thermal Solutions.

[26] IMARC (2025). Australian Insulation Market Overview.

Factor		Assessment
Performance compared to virgin materials		Recycled textile insulation can offer several performance advantages over conventional glasswool. It is typically hypoallergenic, resistant to moisture and able to recover its insulating performance after water exposure, making it well suited to applications such as underfloor insulation. Consultations also suggested it is easier and safer to cut, handle and fit, which can reduce installation time, labour costs and onsite waste. At end of life, glasswool can be difficult to recycle, whereas insulation made from recycled clothing textiles may offer better potential for future material recovery.
Barriers to market		Recycled textile insulation currently competes with low-cost imported glasswool and virgin polyester products in a cost competitive market, making it difficult to recover higher sorting and processing costs. Products must also meet strict fire safety and performance standards, which add treatment, testing and certification costs, particularly when feedstock composition varies. Industry consultation also highlighted additional issues that warrant further investigation, including preferences for neutral (non-coloured) insulation and concerns about possible volatile organic compounds (VOC) emissions from dyes and textile treatments.

Acoustic insulation opportunity

Consultations identified acoustic insulation as a related opportunity for mechanically torn fibres. Similar to thermal insulation, this represents an open-loop pathway, where recovered textile fibres are processed and incorporated into acoustic panels and insulation products used in buildings.

Feedback from industry suggests that both applications rely on comparable feedstock preparation processes, including sorting, removal of hard components and conversion into fibre, and can utilise similar material types, particularly polyester-rich clothing textiles. As with thermal insulation, these products can displace virgin materials in the built environment while providing functional benefits such as sound absorption. Stakeholders noted demand for acoustic insulation is expected to grow as the use of hard building materials becomes more prevalent. Rising awareness of neurodivergence, particularly in school environments, is also contributing to demand for quieter, more acoustically controlled spaces.

Clear specification requirements and procurement signals, particularly in public infrastructure, were identified as potential enablers to support uptake of recycled-content acoustic products.

4.5 Emerging open-loop innovations

This report reflects the best available evidence on next markets for Australian unwearable clothing textiles (unwearables) at the time of writing. Emerging opportunities, ongoing research, technological innovation and increased demand are likely to expand the range of viable pathways over time.

Consultations highlighted several opportunities in early-stage development with the potential to use unwearables in manufactured products, including:

- Bedding and soft furniture applications, such as mattress layers and cushioning materials
- Built environment uses, including decorative construction panels
- Environmental applications, including biochar and geotextiles
- Surface underlay products, including carpets

Open-loop pathways across these areas are particularly valuable because some can absorb textile feedstocks that are challenging to direct into closed-loop, fibre-to-fibre pathways. At the same time, ongoing investment in closed-loop technologies remains critical to improve circularity, expand the range of textiles that can be processed, and reduce reliance on virgin fibres over the longer term.

The case for research and development

Further research, development and demonstration will be needed to determine the viability and scalability of emerging applications. These efforts should consider:

- **Strategic contribution to circularity**: the extent to which the application diverts textiles from landfill and displaces virgin materials.
- **Feedstock suitability and availability**: whether unwearable clothing textile streams can reliably meet input specifications.
- **Technology maturity and scalability**: whether processes are proven beyond lab or pilot scale and can be integrated into industrial systems.
- **Local capability and demand potential**: the strength of Australian manufacturing and market demand in the target sector, including whether demand is arising domestically or internationally.
- **Cost and performance compared with existing virgin materials:** including product quality and consistency, availability and price, and suitability for product standards.

The case study on the following page for textile-derived biochar illustrates an innovative pathway for managing hard-to-recycle clothing textiles and recovering value from them.

Case study 1: Project ReCarbon led by Vital Chemical

In an Australian first, Project ReCarbon converted hard-to-recycle clothing textiles into biochar for use in soil applications, demonstrating how end-of-life clothing textiles can be diverted from landfill and transformed into a valuable resource.

The pilot, led by Vital Chemical and supported by the Seamless Circular Clothing Textiles Fund, produced biochar from textile waste for use as a soil amendment in hydromulch.

Delivered in partnership with Textile Recyclers Group, Salvos Stores, and Earth Systems, the pilot focused on diverting unwearable hi-vis workwear and other unwearables collected from Georgiou Group construction sites.

After collection, wearable items were separated from the donated garments and provided to Salvos Stores for resale and reuse. The remaining unwearables were decommissioned removing hard components (such as zippers) and then shredded by Textile Recyclers Group.

Using advanced pyrolysis technology delivered by Earth Systems, the prepared unwearable clothing feedstock was exposed to high heat in a low-oxygen environment, breaking down fibres into a stable carbon product known as biochar. This process significantly reduces the volume of textile waste and can break down certain contaminants commonly found in workwear, without the need for additional chemical inputs.

In a circular model, the biochar product was incorporated into hydromulch to support soil health and regeneration and returned to the same Georgiou Group construction sites the clothing originally came from.



Adapted from: Seamless (2026). How Project ReCarbon is helping old workwear grow new plants.

4.6 Energy recovery: process engineered fuel

Process engineered fuel (PEF) is produced by processing mixed dry residual waste streams, including unwearable clothing textiles (unwearables), to meet specific fuel specifications suitable for use in high temperature industrial processes, such as cement kilns. In this pathway, unwearables are not recycled into new materials but are used to recover energy, displacing fossil fuels such as coal and gas.

PEF provides an interim and transitional pathway to divert unwearables from landfill, particularly for materials that are not suitable for recycling. It can displace fossil fuels in high-temperature industrial processes during a period of decarbonisation where electrification is not yet feasible, with established demand in cement production. However, material constraints and restricted inclusion rates mean its role is inherently constrained, positioning PEF as a complementary, rather than scalable long-term solution.

Textiles as process engineered fuel feedstock

Unwearable clothing can enter PEF systems with minimal preparation compared with recycling pathways. Garments are typically accepted with zips, buttons and trims in place and are processed as part of a broader residual mix, rather than as a dedicated feedstock. This makes PEF suitable for difficult-to-recycle items and for residuals from recycling processes. In practice, most textile inputs to PEF come from shredded uniforms and leftover fractions from textile recycling operations.

PEF production technologies are well established and commercially mature in Australia, with facilities already processing mixed wastes into fuel blending to maintain consistent calorific value and ash content. Within these systems, textiles must be carefully managed because fillers and dyes increase ash content and their fibrous nature can cause handling issues. This limits the proportion of clothing that can be incorporated.

Australian demand for process engineered fuel

Demand for PEF in Australia is primarily driven by a number of cement kilns that use alternative fuels to support decarbonisation, where high operating temperatures make electrification challenging. International markets such as Japan and South Korea demonstrate strong use of waste-derived fuels in cement production providing demand for PEF, although shipping costs significantly affect viability.

Overall, PEF offers a useful outlet to divert some unwearables from landfill and displace a portion of fossil fuel use in high-temperature industries. However, it will remain a residual focused pathway with the transition to a circular economy requiring higher-value open-loop and closed-loop recycling options.

5. Capabilities and capacity for managing unwearables

The viability of next markets for unwearable clothing textiles depends on effective systems to collect, sort and prepare materials. Each stage in this value chain influences material quality, cost and scalability, and weaknesses at any point reduce feedstock consistency and limit what recycling pathways can reliably supply. This is compounded by the mixed and complex nature of post-consumer clothing textiles, which are rarely designed with end-of-life recovery in mind, making consistent processing at scale inherently challenging.

Current capabilities and capacity in Australia

Recovering value from unwearable clothing textiles requires effective systems spanning collection, sorting, preparation and processing. This section examines Australia's current capabilities and capacity across these stages, drawing on both commercial operations and pilot activity, and identifies where system improvements are needed to support reliable feedstock supply and enable next markets to develop.

Three recycling and recovery pathways are currently operating in Australia, at varying stages of maturity:

1. **Chemical and enzymatic recycling** capabilities are growing in Australia, but facilities currently rely on consistent feedstock streams that are prepared specifically for chemical and enzymatic processes.
2. **Mechanical recycling** has an established presence in Australia through ragging and the use of pre-consumer clothing textiles in products such as mattress fibre layers. More recently, capability has expanded to process mixed post-consumer unwearable clothing, supported by investment in automated sorting and decommissioning infrastructure. The new Salvos Stores Textile Recovery Facility has an installed capacity to process up to 5,000 tonnes of clothing per year, deploying proven technology that is already operational in Amsterdam.[27, 28]
3. **Energy recovery** operates at scale, providing an outlet for mixed and residual materials (including clothing textiles), but with lower value retention, and is expected to grow with the expansion of energy-from-waste infrastructure, owing to declining landfill space in multiple jurisdictions.[29, 30, 31, 32, 33]

[27] Salvos Stores (2026). Salvos Stores Textile Recovery Facility.

[28] Salvos Stores (2024). Project Boomerang sets Salvos Stores on course for a Circular Economy.

[29] East Rockingham Waste to Energy (N.D.). East Rockingham Waste to Energy: Converting Perth's Waste into sustainable energy.

[30] Prospect Hill Infrastructure (N.D.). Prospect Hill Infrastructure: Energy from Waste.

[31] Parkes Energy (N.D.). Parkes Energy Recovery: Turning waste into energy.

[32] City of Gold Coast (2025). Advanced Resource Recovery Centre.

[33] Veolia (N.D.). Woodlawn ARC: Frequently Asked Questions.

The following sections of this report examine each stage of the value chain in more detail:

5.1 Collection: which influences how effectively materials are captured and the cost of supplying feedstock.

5.2 Sorting wearables from unwearables: which determines how materials are directed to reuse or recycling pathways.

5.3 Preparation for recycling: including sorting, decommissioning and size reduction to meet processor requirements.

5.4 Recycling: where materials are converted into recycled products or commodities for next markets.

Quantifying Australian installed capacity

Installed capacity relates to the current ability to process unwearable clothing items. It does not include planned facilities, or facilities that have not officially opened. Estimates for Australian installed capacity are provided in the table below.[34]

Table 8: Estimates for Australian installed capacity to prepare, recycle and recover clothing textiles.[34]

Category	Approximate capacity
Capacity to prepare clothing textiles for recycling	17,000+ tonnes per year
Capacity to recycle clothing textiles	22,000 tonnes per year
Capacity for energy recovery (textile attributable [35])	64,000 tonnes per year[35]
Total capacity in Australia	86,000 tonnes per year

[34] Rawtec high-level estimate using 2025 data sourced from consultations with industry as well as Waste Management Review (2025). ACCIONA powers up Australia's first energy recovery facility in Western Australia., Innovation in Textiles (2026). Added recycling capacity for Sealy., SMBtech (2025). Upparel unveils Australia's largest onshore textile recycling facility., and the assumption that textiles make up 3% by weight of MSW residual stream.

[35] The capacity stated represents an estimated allocation of energy recovery and process engineered fuels capacity attributable to textiles, based on the composition of waste processed through these facilities. This does not represent the total capacity of these facilities, which is significantly higher.

5.1 Collection

What is it?

Collection of unwearables is a critical step in capturing materials for further recovery, with the method varying by source and recycling method. Recycling pathways typically require source-separated streams, while energy recovery pathways can use materials collected within dry waste or residual waste streams.

Figure 11: Movement of unwearable clothing textiles from collection through to next markets.

Current capabilities and practices

There are a wide range of practices and capabilities for collecting unwearables across Australia, including established systems, niche collections and pilots. Most clothing is disposed of to landfill, as recycling pathways are typically more costly and limited in availability.

Disposal pathways

- **Kerbside waste bins (household):** Most unwearable clothing (150,000 tonnes in 2024)[36] is collected from homes through council kerbside waste services. This material is typically sent to landfill, with only one operational energy-from-waste facility receiving kerbside waste in Australia at the time of writing.
- **Residual waste bins (business):** An estimated 40,000 tonnes of landfilled unwearable clothing is generated by the business sector annually. [36] This material is typically collected through commercial waste services.
- **Commercial waste collections:** Clothing is sorted by reuse organisations, with unwearable items remaining after reuse opportunities are exhausted. These materials are typically collected through commercial waste services and landfilled (30,000 tonnes[36]).

Recycling pathways

- **Commercial recycling bins:** Some businesses have dedicated collection systems for recycling unwearable clothing, such as decommissioned uniforms and aged or damaged inventory. These unwearables are managed through closed-loop and open-loop recycling processes and are typically provided by businesses in bulk with similar material fibres and colours. This pathway can also support 'return to brand' programs, where brands collect used clothing from customers, which are then sent for recycling or recovery.
- **Pre-booked pickups**: Some recyclers offer collections for wearable and unwearable clothing items, where citizens schedule a pickup of used clothing for recycling.[37]

[36] Seamless (2025). 2024 National Clothing Benchmark for Australia

[37] Textile Recyclers Australia (N.D.). The Returnable Box.

- **Post to the recycler**: Some recyclers offer recycling of used clothing for citizens through pre-paid postal boxes and satchels. Citizens pack their used clothing into the pre-paid satchel and then post it to the recycler for recycling.[38, 39]

In addition, Seamless Circular Clothing Textiles Fund pilots trialled further collection methods[40]:

- **Designated bag-on-kerb:** Residents were provided with designated coloured bags to collect their unwearable clothing. Bags are placed on the resident's kerbside for collection, where it is manually collected and placed in the collection vehicle.
- **Satchels with online purchases:** Customers of an online retailer were provided with the option to include a pre-paid mail satchel with their purchase. Unwearables are placed in the satchel which is posted by the customer and collected by the mail service for further processing.
- **Public drop-off bins:** Citizens could take garments to a drop-off hub and placed unwearable clothing in a labelled bin.

Table 9 presents indicative costs for collecting clothing from citizens and businesses via various methods. It shows a wide cost range; lower-cost options are drop-off and business collections, and significantly higher cost options include bag-on-kerb and postal services.

Table 9: Indicative costs of different collection methods for unwearable clothing from citizens and businesses. [41]

Collection method	Collection cost ($/tonne) excludes processing/disposal costs
Collecting unwearable clothing from citizens	
Drop-off to a centralised collection point	$100 to $200/tonne[41]
Bag on kerb collection	$2,000 to $4,000/tonne[41]
Pre-booked pickup	No data
Postal service	No data[42]
Disposal via the kerbside residual waste bin	$200 to $300/tonne[41]
Collecting unwearable clothing from businesses	
Back-of-house collection of aged/damaged inventory	$100 to $200/tonne[41]
Return to brand collected unwearable clothing items	$100 to $200/tonne[41]
Disposal via a residual waste service	$100 to $200/tonne[41]

[38] Upparel (N.D.). Upparel website

[39] Textile Recycling Group (N.D.). Underwear only: Project Down Under.

[40] Bag-in-bin methods were identified as undesirable through consultations with industry, however, we understand that there is ongoing work in this space with other materials (NPRS Trials Review).

[41] Rawtec high-level industry estimate.

[42] Limited data is available on the cost of postal returns for clothing textiles. Based on publicly available parcel postage rates and estimated clothing weight per satchel, the cost per tonne is likely to be substantially higher than other collection methods.

Case study 2: WA Clothing Recovery Project led by Good Sammy

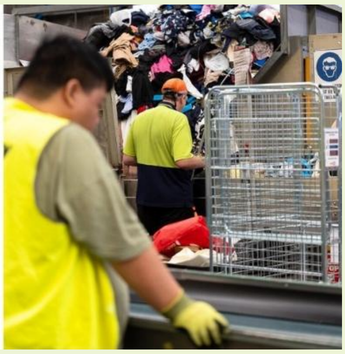
Good Sammy Enterprises led the WA Clothing Recovery Project to trial a local, collaborative system for keeping clothing out of landfill by improving collection, sorting and reuse. Supported by the Seamless Circular Clothing Textiles Fund, the project brought together local governments, recyclers and community organisations to demonstrate a pathway for managing end-of-life clothing within a single region.

Delivered in partnership with the City of Kwinana, the City of Vincent, ThreadUp Australia, Stewart & Heaton, and To the Power of You, the project focused on making clothing recovery easier for households while improving reuse and recycling outcomes.

Over a three-month period, more than 3,000 households participated in bag on kerb collections, donating over 11 tonnes of clothing. Residents were asked to separate wearable and unwearable clothing items into two separate coloured bags, to improve sorting efficiency.

All materials were processed locally at Good Sammy's Perth facility. Wearable items were resold through its op shop network, while unwearable clothing textiles were recycled into new products such as acoustic insulation. Components like zips were removed and refurbished for resale. The project found that nearly 80% of donated clothing could be reused, highlighting the value retained through effective sorting systems.

By establishing a clear, localised pathway for collection, reuse and recycling, the project demonstrates how coordinated systems and partnerships can keep clothing in circulation for longer and reduce textile waste to landfill.

Adapted from: Seamless (2026). [Western Australia's local answer to keep clothing out of landfill](#).

5.2 Sorting wearables from unwearables

Sorting by wearability vs by other criteria

This section focuses on sorting used clothing by wearability, separating items that are wearable and can be reused, from those that are unwearable and are managed through recycling or recovery processes.

Other types of sorting (e.g. by fibre or colour) also occur, but these are applied to the unwearable fraction and are considered part of preparation for recycling (see Section 5.3).

What is it?

Separating wearable items from unwearables is critical to ensure that garments suitable for reuse are directed to higher-value pathways. Wearable items retain greater value and can generate revenue when recovered, particularly for reuse organisations. Consultations identified that this process is typically manual, with outcomes depending on the judgement of sorters. Automation technologies are emerging, such as conveyor-based systems, but still require some manual input.

Figure 12: Movement of unwearable clothing textiles from collection through to next markets.

Current capabilities and practices

Australia's capabilities to separate wearables from unwearables is established but largely manual, with outcomes dependent on human judgement and constrained by labour-intensive processes. Separation occurs at multiple points across the value chain, including households, reuse organisations and dedicated sorting facilities, depending on the collection and next market pathways.

- **Separation by reuse organisations (typically manual sorting):** Staff and volunteers sort donated clothing to separate wearable items for resale from unwearable clothing. During consultation, one charitable reuse organisation indicated that unwearable garments can be up to 25% of total clothing donations.
- **Separation by businesses:** Businesses such as clothing brands and retailers separate aged and damaged inventory from wearable items. Similarly, organisations segregate commercial uniforms that are no longer in use.
- **Sorting at facility:** Conveyer-assisted sorting of wearables and unwearables occurs at sorting or pre-processing facilities as the first stage of the recycling process.

Sorting models vary across organisations. While some reuse organisations rely on paid staff, many charities and not-for-profits depend on volunteers or supported employment programs.

5.3 Preparation for recycling

What is it?

This stage involves processing collected unwearables into a form suitable for recycling. Preparation for recycling can be broadly divided into three stages:

1. Sorting by fibre and/or colour
2. Decommissioning, and
3. Size reduction

The specific steps required vary depending on the recycling process and end market requirements.

Figure 13: Movement of unwearable clothing textiles from collection through to next markets.

Sorting by fibre and colour	This stage involves further sorting of unwearable clothing items. Sorting can be undertaken based on two key categories: fibre type and fibre colour. Sorting methods may include: • Manual sorting, • Hybrid sorting (semi-automated), and • Automatic sorting (includes near infra-red and optical sorting technologies)
Decommissioning	This process involves removing hard points or different fibre types from unwearable clothing items, such as zippers, buttons, cuffs, collars, stitching and waistbands. Decommissioning can occur: • Manually, or • Automatically
Size reduction	This preparation process cuts or processes the garments into smaller pieces. This can occur through: • Ragging, where unwearables are cut haphazardly into a rough size useful for handheld applications such as cleaning • Guillotining/clipping the material to meet size requirements, or • Shredding material into textile ribbons

These processes can occur in different combinations and stages, depending on facility capabilities and recycler requirements. Feedstock specifications, and therefore preparation processes, vary based on several key factors, including:

- **Recycling process**: Different recycling processes (for example, mechanical, chemical, enzymatic or thermal recovery) have specific requirements for feedstock, including contamination levels, material size and fibre composition.
- **Recycled product or commodity**: Requirements also vary depending on the intended product or commodity being produced.
- **Next market**: Next market requirements, including how recycled outputs displace virgin materials, further influence feedstock specifications for unwearable clothing textiles.

Current capabilities, capacity and practices

Through consultations, we estimate that current installed capacity for preparing unwearable clothing items for recycling in Australia is more than 17,000 tonnes per year. Figure 14 below shows preparation for recycling processes that are operational in Australia. These pathways were identified through a combination of consultations, Seamless Circular Clothing Textiles Fund pilot data, and public sources.

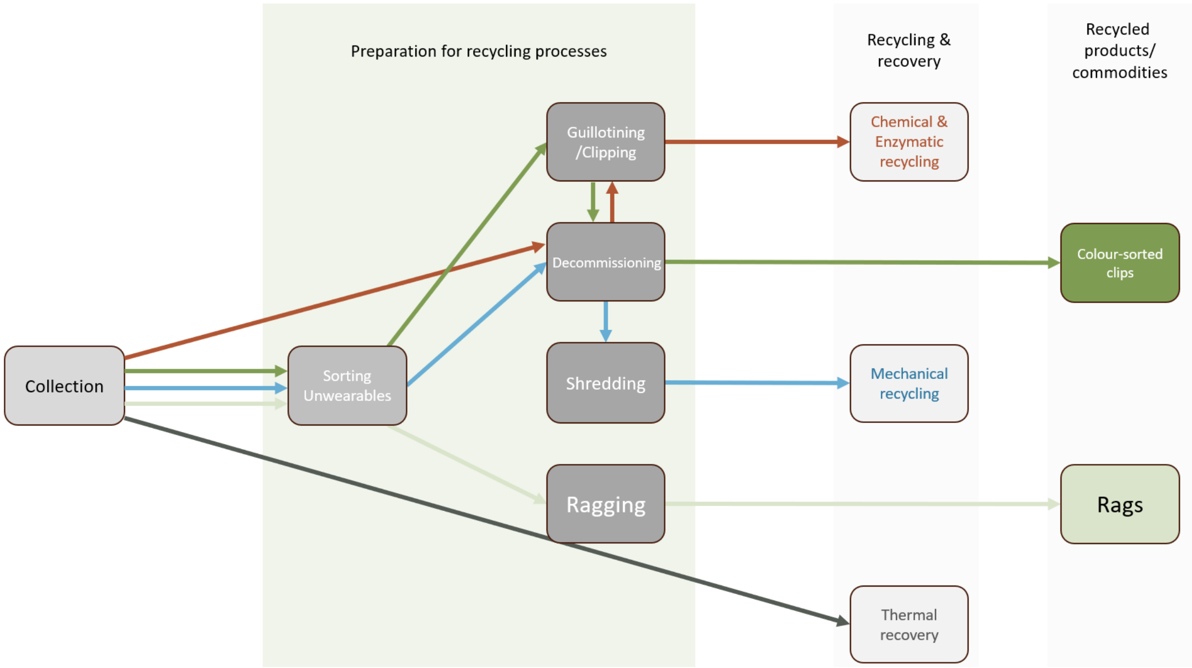


Figure 14: Current preparation requirements for recycling processes identified in Australia for unwearables.

This diagram shows the immediate outputs of each pathway and does not represent the full range of recycled products or downstream applications. Residual textiles arising from preparation processes are typically directed to thermal recovery, though this is not shown in the diagram.

Pathways of note in this diagram include:

- **Not all recycled products or commodities are shown**: Our focus is on preparation for recycling processes, and not all end products are shown. Only those directly produced through preparation processes, that is, without further recycling or recovery, are included. Additional diagrams in later sections of this report provide further detail on other recycled outputs.
- **Chemical and enzymatic recycling preparation does not require sorting**: Current Australian practices indicate that additional sorting is often not required, as fibre-type separation occurs during sourcing. Unwearables are typically sourced from commercial streams, such as uniforms and damaged retail stock, where materials are consistent and require minimal further processing.
- **Thermal recovery feedstock**: Thermal recovery processes generally have less stringent feedstock requirements[43]. As a result, they provide a pathway for contaminated or unsuitable materials from other preparation processes.
- **Preparation for recycling processes directly producing recycled products/commodities**: In some cases, preparation processes alone yield a marketable recycled product or commodity. In Australia, this includes outputs such as colour-sorted clips and rags.

[43] Consultations did identify that thermal recovery processes do not accept PVC materials, and some processes require feedstock to be shredded or clipped, but this is dependent on the facility.

Case Study 3: Salvos Stores Textile Recovery Facility

Salvos Stores has recently launched a Textile Recovery Facility, developed to support Australia to respond to the growing number of clothing textiles ending up in landfill and advance a more circular economy for clothing. It introduces Australia's first automated textile sorting and decommissioning facility, designed to process clothing unsuitable for reuse at scale.

Located in Brisbane and supported by the Queensland Government, the facility expands Salvos Stores' operations beyond reuse by enabling the recovery of value from donated items that cannot be sold.

The facility uses advanced automation and fibre-sorting technology to identify material composition and remove components such as zips, buttons and labels. The system has the capacity to process up to 5,000 tonnes of clothing textiles annually, including materials from donations and commercial take-back programs such as uniforms.

The Textile Recovery Facility has been designed to provide suitable, pre-processed, high-quality feedstock ready for recycling. It represents a significant step toward a more connected and circular clothing system in Australia, demonstrating how technology, partnerships and infrastructure can shift clothing textiles from landfill into a valuable commodity and keep materials in use for longer.

Adapted from: Salvos Stores (2024). One of a kind stories: Project Boomerang sets Salvos Stores on course for a circular economy and Inside Retail (2026). Salvos opens textile recovery facility in Brisbane.

5.4 Recycling

What is it?

Recycling is the process where prepared unwearable clothing textiles (that have been sorted, decommissioned and cut to size based on recycling input requirements) are converted into a recycled product or commodity that meets requirements to displace virgin material in a manufacturing process.

Figure 15: Movement of unwearable clothing textiles from collection through to next markets.

For clothing textiles, there are multiple recycling processes available in Australia.

- **Chemical recycling:** Processing that breaks down textile fibres into their chemical components, which can then be used to produce new materials.
- **Enzymatic recycling:** A form of chemical recycling that uses enzymes to break down fibres into their base components for reprocessing into new materials.
- **Mechanical recycling:** Physical processing of clothing textiles, for example, tearing or shredding, into fibres, which are then used to manufacture new products.
- **Pyrolysis:** A thermal recovery process that heats clothing textiles in low or no oxygen to produce outputs such as syngas, used for energy recovery, and biochar.
- **Process engineered fuel processing:** A thermal recovery process that converts waste into fuel products used as a substitute for fossil fuels in industrial processes.
- **Energy from waste:** A thermal recovery process where waste is combusted to generate heat, which is then used to produce electricity.

For simplicity, these processes are grouped into three categories: mechanical recycling, chemical and enzymatic recycling, and thermal recovery.

Current capabilities, capacity and practices

Australia has an estimated capacity to recycle 22,000 tonnes of unwearables per year and recover energy from a further 64,000 tonnes of unwearables, totalling 86,000 tonnes annually.[44]

Figure 16 shows the current flows of unwearable clothing items in Australia based on insights gathered through consultations, focus groups, Seamless pilots, and the Seamless literature review. Given recycling and preparation processes in Australia are still emerging, current processes and resulting products or commodities are likely to evolve as capacity scales.

[44] Rawtec high-level estimate using 2025 data sourced from consultations with industry as well as Waste Management Review (2025). ACCIONA powers up Australia's first energy recovery facility in Western Australia., Innovation in Textiles (2026). Added recycling capacity for Sealy., SMBtech (2025). Upparel unveils Australia's largest onshore textile recycling facility., and the assumption that textiles make up 3% by weight of MSW disposed to landfill.

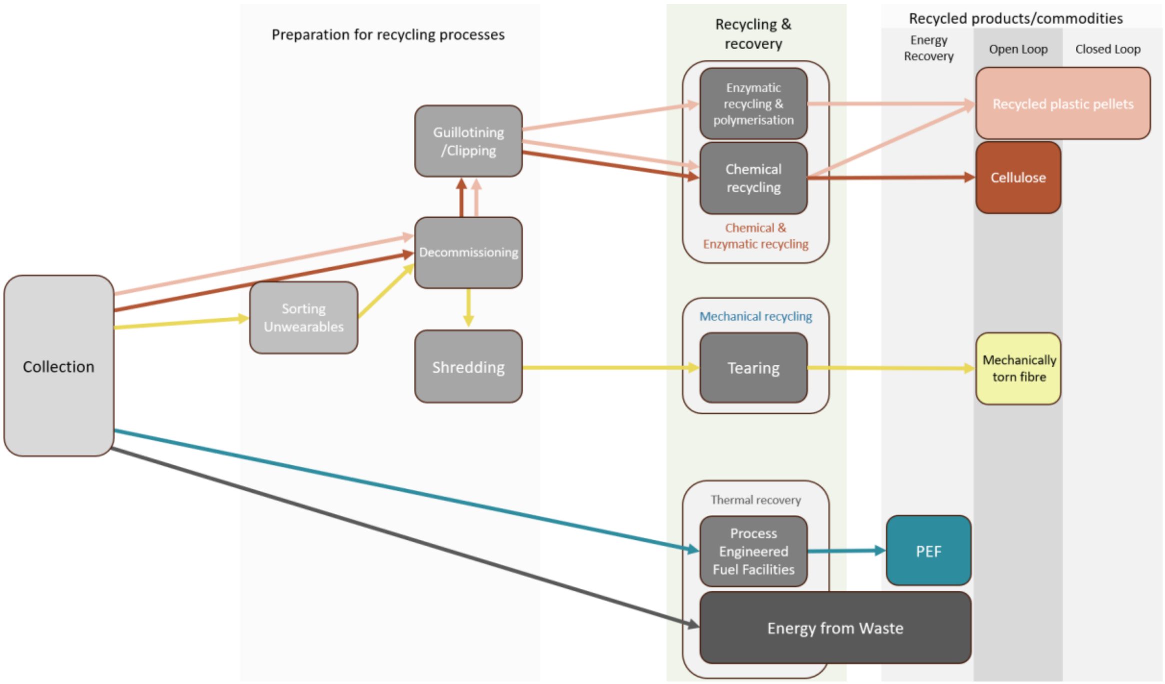


Figure 16: Current recycling processes identified for unwearables.

This diagram shows the immediate outputs of each pathway and does not represent the full range of recycled products or downstream applications. Residual textiles arising from preparation processes are typically directed to thermal recovery, though this is not shown in the diagram.

Items of note from this diagram are:

- **Energy from waste as a recovery process**: Energy from waste sits across both recovery processes and next markets. In these systems, the same facility processes the waste and generates a final output (energy), meaning it performs both the recovery step and production of the end product. It is shown across both stages to reflect this dual role.
- **Mechanical recycling into recycled fibre**: Various terms are used for the output of tearing processes, for example, shoddy, fluff and fibre. For consistency, this report uses the term 'recycled textile fibre'.
- **Recycled textile fibre**: Recycled textile fibre can have different specifications depending on its end use, particularly whether it is mono-material or mixed-material.
- **Energy recovery, open-loop and closed-loop recycling**: The classification of recycled outputs depends on the market they displace. For example, recycled plastic pellets may be used in injection moulding (open-loop) or textile manufacturing (closed-loop), depending on their application.

5.5 Challenges and barriers

The following challenges and barriers for managing unwearable clothing are based on insights obtained through consultations.

Challenge/Barrier	Detailed description
Inconsistent public behaviour and understanding **Sorting unwearables from wearables; Collection**	Public participation is a constraint across the system. Misclassification rates are high (20–50%)[45] when individuals are responsible for separating wearable and unwearable clothing items, particularly in low-traceability systems such as donation bins. This is exacerbated by differing perceptions of what constitutes 'unwearable', leading to misplaced items in both reuse and recycling streams, contributing to contamination and inefficiencies.
High costs and limited commercially viable pathways across the value chain **Collection; Preparation for recycling; Recycling**	Cost is a consistent barrier at every stage. Collection is typically more expensive than landfill disposal. Downstream, high capital investment requirements (for example, automated sorting), rising warehousing and insurance costs, and limited commercially viable pathways all constrain scalability. Recycling is further challenged by the need for price competitiveness with virgin materials, while some recyclers must pay for feedstock. The global investment landscape is increasingly favouring emerging technologies, such as AI, while more traditional manufacturing processes receive comparatively less attention, creating challenges for some recyclers.
Fragmented value chain and poor coordination **Collection; Preparation for recycling; Recycling**	There is limited collaboration between designers, recyclers and manufacturers, resulting in garments that are not designed for recycling. Often, there is also a lack of alignment across collection, sorting, processing and manufacturing stages. Collectors may lack clear guidance on downstream requirements, while processors face inconsistent input streams and varying feedstock specifications. This fragmentation increases inefficiencies, handling requirements and storage needs across the system.
Limited infrastructure, technology, and scalability **Collection; Preparation for recycling**	Recycling typically faces cost disadvantages relative to landfill. Manual processes to separate wearables from unwearables are inconsistent and labour-dependent, with declining volunteer availability further constraining the capacity of charities to undertake this work. In addition, diverse textile types require different decommissioning and processing methods, increasing complexity and highly specific limiting throughput.
Material quality, contamination, and feedstock constraints **Sorting unwearables from wearables; Preparation for recycling; Recycling**	Access to clean, consistent and high-quality material streams remains a key challenge. Poor source separation and contamination reduce the value and usability of collected clothing textiles. Recycling outcomes are highly dependent on input quality, with strict downstream requirements, such as low contamination and mono-material streams, increasing sorting and processing demands.
Regulatory and compliance barriers **Preparation for recycling; Recycling**	Regulatory frameworks are not always well aligned with textile recovery processes. Classification issues (for example, clothing textiles being defined as 'waste' after processing), international trade requirements, and emerging chemical regulations (for example PFAS restrictions) may constrain recycling activities. Export rules under the Recycling and Waste Reduction Act currently regulate glass, plastic, tyres and paper but do not extend to textiles. In some cases, compliance requirements (for example, secure destruction of branded items) limit reuse and recycling options.

[45] Aggregated findings from the WA Clothing Recovery Pilot and the Sort for Good Pilot undertaken with support from the Seamless Circular Clothing Textiles Fund.

Challenge/Barrier	Detailed description
Limited next markets and demand uncertainty **Collection; Recycling**	There are limited and underdeveloped markets for recycled unwearables in Australia. Uptake is constrained by inconsistent product quality, cost competitiveness, and cautious industry behaviour, where some opt for lower-cost disposal or energy recovery pathways in the absence of stronger demand signals or regulatory requirements.
Operational complexity and logistics challenges **Preparation for recycling; Recycling**	Processing unwearables is operationally complex. Different recycling technologies and downstream processes require specific material formats, increasing handling, sorting, and storage requirements. Transport is only cost-effective at scale, leading to stockpiling and additional warehousing.
Technology-specific and pathway constraints **Recycling**	Each recycling pathway faces unique limitations. Mechanical recycling requires highly sorted, mono-material inputs and faces contamination risks. Enzymatic processes are constrained by feedstock competition and sensitivity to dyes and additives. Pyrolysis lacks established markets and faces regulatory uncertainty, while composting is limited by material standards and legislation. These constraints reduce the range of viable large-scale solutions.

5.6 Opportunities and enablers

The following opportunities and enablers for recycling unwearable clothing are based on insights obtained through consultations.

Opportunity/Enabler	Detailed description
Leveraging existing infrastructure and systems **Sorting unwearables from wearables; Collection**	There is significant opportunity to leverage current infrastructure and networks. Existing reuse collection systems and facilities could be expanded, with appropriate funding and investment, to accept unwearables alongside wearable items. Commercial waste collectors could also expand services to include textile recycling, where supported by a viable business model. Leveraging existing assets can reduce costs and support scale, reducing the need for new infrastructure. Realising these opportunities will depend on sustained funding and policy support, including mechanisms such as a PSS.
Investment, funding mechanisms, and policy support **Sorting unwearables from wearables; Collection; Preparation for recycling; Recycling**	Sustained financial and policy support is a significant enabler across the value chain. A mandatory PSS presents a major opportunity to fund collection, sorting, and recycling activities while providing long-term market confidence. Additional mechanisms, such as government grants, landfill bans, and procurement policies requiring recycled content, can stimulate both supply and demand. Furthermore, adjustments to export settings for unwearables, such as limiting the export of whole garments, could support onshore recycling. Care is needed to ensure this does not constrain the role of existing accredited exporters in facilitating the reuse of wearable items internationally.
Improved sorting capability and technology adoption **Sorting unwearables from wearables; Preparation for recycling**	Enhancing sorting systems is critical to unlocking downstream opportunities. Investment in automated and conveyor-assisted sorting technologies can improve throughput, consistency, and material quality at scale. In the short term, lower-cost innovations such as handheld optical sorting tools can act as transitional solutions, particularly in regional areas.
Upstream intervention to reduce problematic materials **Collection; Recycling**	Reducing the volume of low-quality, hard-to-recycle clothing textiles entering the system presents a preventative opportunity. Potential measures include disincentivising high-volume, low-cost or low-durability garments and encouraging better product design. These upstream interventions can reduce pressure on collection and processing systems while improving overall system efficiency.
Improved feedstock quality and stream prioritisation **Sorting unwearables from wearables; Preparation for recycling; Recycling**	Focusing on higher-quality and more consistent material streams presents a strong opportunity to scale recycling. Prioritising clothing textiles such as uniforms, bed linen, and post-industrial offcuts can provide reliable, low-contamination feedstock for recyclers. Improved source separation and sorting will further enhance material quality, enabling higher-value recycling outcomes and supporting the development of next markets.
Standardisation and better information flow across the value chain **Sorting unwearables from wearables; Collection; Preparation for recycling; Recycling**	Clear, consistent standards for sorting, preparation for recycling, and recycling requirements would significantly improve system efficiency. Better communication between recyclers and upstream actors such as collectors and sorters, can reduce contamination, streamline processing, and minimise unnecessary storage and transport. Increased transparency across the value chain would also support coordination, investment decisions, and the development of reliable material flows.

Opportunity/Enabler	Detailed description
Market development and demand creation **Collection; Recycling**	There are multiple opportunities to strengthen next markets for recycled clothing textiles. Policy levers such as recycled content targets and government procurement requirements can drive demand, while rising landfill costs may shift materials toward recovery pathways.
Flexible and collaborative collection systems **Collection**	No single collection model will suit all contexts, creating an opportunity for diverse and complementary systems. Expanding existing pathways such as reuse collections, retail take-back, commercial services, and enabling collaboration across the value chain can improve accessibility and efficiency. As downstream markets mature, collection systems can be refined to better match specific feedstock requirements, such as fibre types.
Innovation in recycling pathways and residual solutions **Recycling**	Emerging and alternative recycling pathways offer opportunities to manage materials that are currently difficult to process. Thermal and residual solutions (for example, PEF) can recover value from non-recyclable components, while innovations such as textile-derived biochar present new market applications across agriculture, industry, and environmental remediation. Ongoing development of standards (for biochar for example) will be important to unlock these opportunities and address concerns around contaminants.

6. Potential economic benefits

The transition to managing unwearable clothing textiles as a resource rather than a waste stream presents an economic opportunity for Australia. While current systems are constrained by cost and market immaturity, the increased development of next markets for recycled clothing textiles has the potential to unlock new industries, provide jobs and drive innovation across the economy.

A growing circular economy

Australia's clothing system generates large and increasing volumes of unwearable clothing textiles. Much of this material is currently lost to landfill, creating both a cost burden and a missed opportunity to recover value. Redirecting these materials into productive use can displace virgin inputs and support the development of new domestic industries.

Textiles are complex and material-rich, creating opportunities across closed-loop, open-loop and energy recovery pathways. No single pathway will be sufficient. The opportunity lies in developing a mix of markets that can collectively manage volume while retaining value.

This aligns with the broader shift toward a circular economy, where materials remain in use for longer and waste is reduced. As policy settings strengthen and markets develop, the sector is expected to grow. Greater scale, improved technologies and stronger demand will support more competitive outcomes over time.

This opportunity spans multiple sectors, including waste management, manufacturing, retail, construction, agriculture and energy, and relies on coordinated action across charities, social enterprises, industry and government.

Potential industry size

The potential size of the industry was estimated based on high-level revenue and employment data associated with recovering and recycling unwearable clothing items. It is estimated that if 80% of unwearable clothing textiles generated in Australia were recycled or energy recovered, the associated turnover and local employment could reach:

- Annual turnover of between $250 million and $380 million
- 1,200 to 2,300 full-time-equivalent jobs

This estimate will need to be validated through more detailed economic modelling, as it is high-level and based on a scenario that:

- 20% of unwearables are recovered through energy recovery pathways
- 30% are recovered through mechanical pathways
- 30% are recovered through chemical and enzymatic recycling pathways
- 20% of unwearables are sent to landfill.

The estimates also assume that all pathways can scale with incoming tonnes.

Jobs of the future

Developing next markets for unwearable clothing textiles has the potential to expand employment across textile recovery, sorting, processing and manufacturing, forming a growing circular economy workforce. Across the value chain, there is strong potential to generate jobs in both labour-intensive and highly skilled roles.

Labour-intensive activities such as separating wearable from unwearable clothing items, and decommissioning complex garments for chemical recycling, are fundamental to managing textile materials. These roles are already delivered through charities, social enterprises and emerging recycling businesses, and provide accessible employment opportunities, including for people facing barriers to employment.

At the same time, the sector provides opportunities for skilled roles in operations, logistics, engineering, materials science and advanced manufacturing. These roles support the development and operation of recycling technologies, processing infrastructure and new product manufacturing.

Together, these activities support both inclusive employment and the growth of higher-skilled technical capability. A current example is presented in case study 4 below.

Case study 4: BlockTexx partnership with Help Enterprises

BlockTexx, an Australian textile chemical recycler, has partnered with Help Enterprises to deliver both environmental and social impacts through textile recovery. This collaboration is creating meaningful employment opportunities for Queenslanders living with disability, while also diverting unwanted textiles from landfill.

As part of the initiative, HELP's supported employees play a critical role in preparing clothing textiles for recycling. Garments are decommissioned through the removal of hard components such as buttons, zippers, and tags, ensuring the materials are suitable for BlockTexx's recycling process. Through this work, employees gain valuable skills and practical experience in textile recovery.

Supported employees have decommissioned more than 10 tonnes of unwearable clothing textiles. These materials are then processed by BlockTexx into new resources used across industries including construction, infrastructure, manufacturing, and agriculture.

Together, BlockTexx and Help Enterprises are contributing to a circular economy by diverting unwearable clothing textiles from landfill while also creating meaningful employment pathways. This partnership highlights the value of collaboration to deliver environmental and social outcomes.

Case study adapted from: Help (2023). Recycling partnership creates jobs for people with disability. Image sourced from BlockTexx.

In the future, sorting and decommissioning roles and advanced industrial functions are expected to develop in parallel as the sector matures.

Innovation and leadership

Managing unwearable clothing sits at the intersection of materials science, manufacturing and resource recovery. Addressing this complexity requires innovation.

Australia is already demonstrating capability in areas such as chemical and enzymatic recycling, with organisations developing technologies that can process complex textile streams. These innovations have global relevance, particularly as countries seek solutions for mixed and contaminated textile waste. Case study 5 below presents a local example of innovations offering global relevance.

Case study 5: Samsara Eco

Samsara Eco is an Australian company developing circular solutions for synthetic clothing textiles through enzymatic fibre-to-fibre recycling. Their commercial facility is in Jerrabomberra, NSW.

Samsara Eco's recycling process is underpinned by an AI-powered platform that designs enzymes capable of breaking down plastic materials at scale. Clothing textiles are collected and pre-processed before being exposed to plastic-specific enzymes, which depolymerise the material into its original molecular building blocks, called monomers. These monomers are then purified to remove dyes and contaminants, producing high-quality outputs such as nylon 6,6 and polyester. The purified materials can be repolymerised into resin pellets, which can act as direct substitutes for virgin materials in existing textile manufacturing supply chains. This enables fibre-to-fibre recycling without compromising on quality.

Synthetic fibres such as polyester and nylon account for approximately 60% of global fibre production, highlighting a significant opportunity to transition toward circular production. Global activewear brand Lululemon has partnered with Samsara Eco in a ten year agreement to support its transition toward more sustainable materials. Under this agreement, Samsara Eco will supply recycled nylon 6,6 and polyester, contributing to 20% of Lululemon's total fibre portfolio.

In 2024, the two companies developed a garment made from 90% enzymatically recycled nylon 6,6. The product matched the look, feel, and performance of existing Lululemon apparel, demonstrating the potential of this technology for high-performance clothing. Overall, the partnership highlights how cross-industry collaboration can help scale advanced recycling technologies and reduce reliance on virgin, fossil fuel-derived materials in textile production.

Adapted from: Lululemon (2025). Lululemon and Samsara Eco Announce 10-Year Plan to Advance Recycled Material Portfolio and Lululemon (2024). lululemon and Samsara Eco Unveil World's First Enzymatically Recycled Nylon 6,6 Product and Samsara Eco (N.D.). Our Story. Image sources: Samsara Eco and Lululemon

Further investment in research and development could strengthen Australia's position. Expanding applications for recycled textile materials across different industries will be critical to building viable next markets and supporting scale.

Innovation is not limited to recycling technologies. It extends to system design, including collection models, traceability systems and new business models that connect feedstock to next markets.

Building domestic industries

Next markets for unwearable clothing textiles can support the growth of domestic manufacturing and processing capability.

Open-loop applications, such as insulation and non-woven materials, present near-term opportunities to manufacture products within Australia, supporting local industry and supply chain resilience. These markets can use a broader range of feedstock and provide an outlet for large volumes of material.

Closed-loop pathways, such as fibre-to-fibre recycling, connect Australia into global textile supply chains. While much of the downstream textile manufacturing currently occurs offshore, there is an opportunity for Australia to further develop recycling capabilities and supply high-quality recycled feedstock into local (limited volumes) and international markets.

Energy recovery pathways also play a role, particularly in supporting industrial decarbonisation by displacing fossil fuels in high-temperature processes. Together, these pathways contribute to a more diversified and resilient resource recovery sector.

Unlocking value through system change

Despite these opportunities, current costs present a key barrier, with recycling pathways generally more expensive than landfill, and markets for recycled textile products still developing. Unlocking the economic potential of unwearable clothing textiles will require coordinated system change, including:

- Creating stable demand for recycled materials through procurement and policy
- Improving feedstock quality and consistency through better collection and sorting systems
- Investing in infrastructure and technology to scale processing capability
- Establishing clear standards and traceability to support market confidence

A mandatory product stewardship scheme will be critical in enabling this transition, providing a funding mechanism to support system development and shifting costs to those organisations placing products on the market.

Economic outlook

In the near term, a mix of pathways will be required to manage unwearable clothing textiles, including lower-value recovery options. Over time, as systems develop, higher-value recycling pathways are expected to expand and capture greater material value.

The opportunity is not only to divert clothing textiles from landfill, but to build a stronger domestic industry. One that provides employment, supports innovation, strengthens local capability and positions Australia within emerging global circular supply chains.

Realising this opportunity will require investment, coordination and long-term policy commitment. The foundations are already emerging. With the right settings, unwearable clothing textiles can shift from a growing waste problem to a driver of economic activity and circular industry development.

7. Recommendations for managing unwearable clothing textiles in Australia

Addressing the growing volume of unwearable clothing in Australia requires a coordinated system spanning product design, collection, sorting, recycling and the development of viable next markets for recycled textiles. No single intervention will be sufficient. Instead, a combination of policy reform, market development and collaboration across industry, government and community organisations is required to build a functioning circular clothing textiles system. The following table identifies how each of the recommendations aligns with strategic enablers required to achieve system level change.

Table 10: Recommendations and their alignment with strategic enablers for managing Australian unwearable clothing textiles.

No.	Recommendation	Producer responsibility	Building next markets	High value recovery	Systems approach	Investment certainty	Data and transparency
1	Transition Seamless to a mandatory product stewardship scheme covering all clothing placed on the Australian market, with clear obligations for financial contributions, product design standards and reporting requirements.	●	●	●	●	●	●
2	Establish consistent reporting and data frameworks to track system performance, support evidence-based policy and maintain public trust, including recycling feedstock standards and traceability systems.	●			●		●
3	Introduce a staged circular procurement policy across government for domestically recycled textile content in products, beginning with the built environment and uniforms and workwear, to support domestic recycling and manufacturing.		●	●		●	●
4	Investigate building and construction standards as levers to grow private sector demand for recycled textile products.			●	●		●

No.	Recommendation	Producer responsibility	Building next markets	High value recovery	Systems approach	Investment certainty	Data and transparency
5	Enable a financially sustainable and collaborative clothing recovery system.	●		●	●	●	●
6	Invest in research, development, commercialisation and workforce development for textile recycling.	●	●	●	●	●	●
7	Provide long-term policy certainty to encourage investment in the infrastructure and technology for managing post-consumer textiles.					●	●

Recommendations

Recommendation 1

Transition Seamless to a mandatory product stewardship scheme covering all clothing placed on the Australian market, with clear obligations for financial contributions, product design standards and reporting requirements.

While recycling of unwearable clothing textiles is beginning to emerge in Australia, current capacity and markets for recycled textiles remain limited.

Funding is needed to support and scale the development of next markets for recycled textiles, addressing several structural challenges:

- Recycling unwearable clothing textiles is typically more expensive than landfill, requiring mechanisms to help correct the market imbalance.
- There is limited demand for recycled textile outputs, constraining the development of recycling infrastructure.
- Achieving competitive cost and performance relative to virgin materials, particularly in terms of product quality, consistency and availability.
- Export markets for reuse are becoming increasingly fragile, and the charity sector cannot absorb the additional costs associated with large volumes of clothing with no domestic market.
- These challenges are compounded by the growing volume of low-quality, high-volume clothing, which is difficult to reuse and typically has a shorter lifespan.

Currently, the costs of managing textile waste are largely borne by local governments, charities, and the community, despite clothing brands and retailers placing the products on the market.

Applying a 'producer pays' principle through a well-designed product stewardship scheme would ensure that those placing clothing on the Australian market contribute to the costs of managing products at end of life, while also creating incentives to design more durable, reusable and recyclable clothing textiles.

The current Seamless scheme operates on a voluntary basis, resulting in limited industry participation and insufficient funding to support the full clothing lifecycle adequately.

It is therefore recommended that Seamless transition to a mandatory Product Stewardship Scheme (PSS) covering all clothing placed on the Australian market.

Key elements should include:

- **Mandatory participation** for all brands and retailers selling clothing into the Australian market, including online retailers.
- **Mandatory financial contributions** through a levy to cover the costs of managing unwearable clothing textiles. While the focus of this report is on unwearable clothing textiles, the scheme should provide funding across the full textile lifecycle, including sustainable design, repair, reuse and recycling, to support a more circular clothing textiles system.
- **Product stewardship requirements**, including meeting globally-aligned product design standards, such as fibre composition and repairability scores/information, with value chain obligations to report on volumes and material flow of clothing through to end of life.
- **Establishment of consistent data collection and reporting frameworks** to monitor clothing flows and system performance across the value chain, requiring reporting by obligated entities, and supported by public disclosure of key metrics such as clothing volumes placed on the market, clothing volumes reused, recycled and recovered, and recycled content uptake.
- **Eco-modulation of fees** to incentivise more sustainable clothing design, including consideration of durability for prolonged use and recyclability.

Recommendation 2

Establish consistent reporting and data frameworks to track system performance, support evidence-based policy and maintain public trust, including recycling feedstock standards and traceability systems.

Limited visibility of clothing composition and material treatments can constrain sorting, processing and textile recycling. Consultation findings identified improved traceability as a key enabler, supporting more reliable identification of material inputs. Clear feedstock standards, aligned with next market requirements, can then help define the specifications for recycled materials and improve the consistency of recovered textiles. Tools such as Digital Product Passports can support this by increasing transparency on material composition and provenance.

In Australia, traceability and digital transparency are being explored. Consultation indicated that formal requirements are likely to be several years away. In the interim, questions remain about how product data will be accessed, interpreted and managed locally, and how systems will interact across jurisdictions.

International developments are progressing, with the European Union introducing Digital Product Passports under the Ecodesign for Sustainable Products Regulation, alongside global initiatives such as the United Nations Transparency Protocol. Over time, textiles placed on the EU market will be required to carry product-level information, some of which may enter Australia through imports.

Traceability alone is not sufficient. It needs to sit within a broader system that supports material flows and enables recovered textiles to be reintegrated into manufacturing.

To support this, governments and industry may consider:

- Establishing data frameworks to capture and publicly report on textile flows
- Enabling data sharing across the value chain
- Aligning traceability approaches with emerging international frameworks
- Supporting the phased introduction of material passports or equivalent tools

These measures can improve system visibility, support more consistent recycling feedstock supply and enable more fibre-to-fibre recycling over time.

Recommendation 3

Introduce a staged circular procurement policy across government for domestically recycled textile content in products, beginning with the built environment and uniforms and workwear, to support domestic recycling and manufacturing.

This policy should prioritise the use of Australian recycled clothing textiles, helping to build domestic recycling and manufacturing capability by providing a clear next market for materials that would otherwise be sent to landfill.

Where feasible, recycling and manufacturing should occur within Australia to support local industry development and supply chain resilience. However, recognising current limitations in domestic spinning and textile manufacturing capacity, the policy should allow for intermediate export of recovered fibres or materials for further processing, provided that Australian unwearable clothing textiles remain the primary feedstock.

Procurement requirements should include:

- Minimum levels of domestically recycled textile content in government uniforms and workwear
- Minimum levels of domestically recycled textile content in government thermal and/or acoustic insulation needs
- Requirements for responsible end-of-life management and fibre recovery
- Clear compliance, reporting, verification and enforcement mechanisms to ensure recycled content requirements are met and system performance can be monitored.

Any targets or requirements should be phased in over time, recognising that industry will need time to scale recycling, fibre processing and manufacturing capacity to meet increased demand.

The reality is that unwearable clothing textiles currently generated in Australia are a highly mixed and often contaminated stream. These streams require significant sorting and pre-processing to be suitable for closed-loop recycling, constraining near-term scale outside of more controlled or consistent feedstock streams.

As a result, a functioning circular clothing textiles system requires viable open-loop pathways to absorb the volume of these materials.

One opportunity is the use of recycled textiles in built environment applications, such as thermal and acoustic insulation, where there is potential for sizable market demand.

Leveraging public procurement for the building and construction sector to support locally produced recycled content textile products will help drive demand for these products

Recommendation 4

Investigate building and construction standards as levers to grow private sector demand for recycled textile products.

Complementing the opportunity to drive demand through public procurement, there is also potential to expand new markets through private sector construction and development. A range of levers could be investigated, including green building rating schemes, rental standards and the building code.

Sustainability rating schemes such as Green Star offer a near-term opportunity, as they already reward the use of sustainable and recycled-content materials. Investigating whether recycled textile products could be explicitly recognised within existing credits or rating criteria could help drive demand without requiring regulatory change.

Rental standards offer a further entry point, particularly for existing housing stock not covered by new build requirements. Victoria's minimum energy efficiency standards for rental properties, for example, will require insulation where it is currently not installed to improve thermal performance from March 2027. However, these standards do not currently specify requirements for recycled content or domestically produced materials. Investigating whether recycled content thresholds could be introduced alongside existing thermal performance requirements could improve housing energy efficiency while also strengthening demand for locally manufactured recycled textile insulation products.

Amending the National Construction Code (NCC) to incorporate recycled content requirements would represent a more significant intervention, given the complexity of the code development process and the need for agreement across jurisdictions. However, given the scale of new construction activity governed by the NCC, it warrants consideration as a longer-term lever.

Recommendation 5

Enable a financially sustainable and collaborative clothing recovery system.

Charities, social enterprises and private sector operators each play an important and complementary role in managing post-consumer clothing and developing recycling and recovery pathways. Effective collaboration across these different types of operators supports a well-functioning system, and the contribution of each should be recognised in policy and stewardship scheme design.

For the system to operate effectively over the long term, the business models underpinning each of these roles must be financially sustainable. Where managing unwearable clothing represents a net cost, organisations should be adequately supported through the mandatory stewardship scheme funding proposed (see recommendation 1), co-investment in infrastructure and targeted partnerships.

Critically, any such arrangements must be carefully designed to honour the use hierarchy, rather than inadvertently reinforcing overconsumption or incentivising recycling over reuse. Reuse must remain the preferred outcome for wearable clothing, with recycling pathways reserved for textiles that are genuinely unsuitable for reuse. Furthermore, recognising that recycling markets for textiles are still developing, any such arrangements should be designed to build toward commercial viability over time, with support structured to evolve as markets mature.

Recommendation 6

Invest in research, development, commercialisation and workforce development for textile recycling.

Further investment in research, development and demonstration is needed to accelerate the development of scalable recycling pathways for unwearable clothing textiles.

While promising technologies are emerging in Australia and internationally, many recycling solutions remain at early commercialisation, particularly those addressing mixed fibres and complex textile products.

Local workforce capability and technical knowledge also present a barrier. The effectiveness of manual sorting and decommissioning depends on worker skill and training. Consultations also identified a limited pool of local expertise in textile processing, including fibre properties, spinning requirements and yarn manufacturing, which may constrain the ability to scale higher-value pathways such as fibre-to-fibre recycling.

Targeted co-investment by industry and government should provide support for pilot projects, research, commercial-scale demonstrations and workforce development to help overcome technical and economic barriers to domestic textile recycling.

Support mechanisms could include:

- Pilot and demonstration project funding
- Research grants and innovation funding
- Support for industry-research partnerships
- Access to research facilities and shared sorting and recycling infrastructure for prototyping
- Workforce development and training to build capability in sorting and pre-processing, such as material identification and garment disassembly

Importantly, policy settings should remain technology neutral. Support should focus on outcomes research which creates the enabling conditions for innovation, allowing a range of recycling approaches to be tested and scaled based on their environmental performance, economic viability and ability to process Australian textile waste at the rate at which it is generated annually.

Clear and consistent data on textile volumes, material efficiency, recovery outcomes and market demand will also play an important role in supporting investment decisions and informing infrastructure planning.

Recommendation 7

Provide long-term policy certainty to encourage investment in the infrastructure and technology for managing post-consumer textiles.

The successful implementation of the recommendations outlined above will require significant investment in clothing collection, sorting, processing and recycling infrastructure.

In particular, the transition to a mandatory product stewardship scheme (PSS) (Recommendation 1), and the development of new next markets through circular procurement policies (Recommendations 3 and 4) will create the foundation for a national circular clothing textiles system.

However, industry participants including charities, social enterprises, recyclers and private sector operators require clear and stable policy signals to support long-term investment decisions.

Governments should therefore provide long-term policy certainty by confirming the direction and timelines for these reforms, including the transition to mandatory product stewardship, the rollout of national collection systems and the development of recycled content markets.

Providing this certainty will help give industry the confidence to invest in new infrastructure, emerging technologies and additional processing capacity, enabling Australia to optimise domestic reuse, recycling and recovery.

Staged implementation of recommendations

The diagram below outlines a staged pathway, identifying where to start and how actions can progressively build toward a scaled solution for unwearables.

In summary, coordinated action is needed across policy, markets and infrastructure to support the transition to a circular clothing textiles system. With the right settings, what is currently treated as a waste problem becomes a driver of innovation, new jobs and a more circular clothing system for Australia.

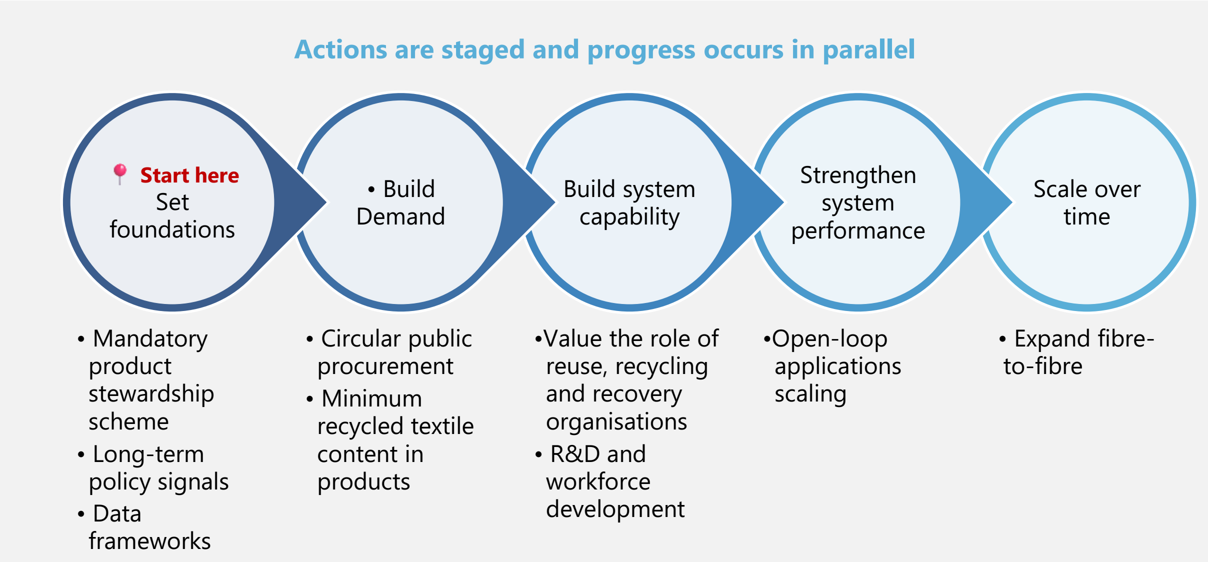


Figure 17: Recommendation for a staged pathway to scale solutions for unwearable clothing textiles.

APPENDICES

Appendix A: Acronyms and abbreviations

Acronym	Expanded meaning
C&I	Commercial and industrial waste
EfW	Energy from waste
ESG	Environmental, social and governance
FTE	Full-time equivalent
MSW	Municipal solid waste
PEF	Process engineered fuel
PET	Polyethylene terephthalate (also known as polyester when spun into a fibre)
PFAS	Per- and polyfluoroalkyl substances
PSS	Product stewardship scheme
PVC	Polyvinyl chloride
rPET	Recycled polyethylene terephthalate (also known as recycled polyester when spun into a fibre)
VOC	Volatile organic compounds
WA	Western Australia

Appendix B: Glossary

Term	Definition for this report
Aged inventory	Inventory that has not sold within its expected timeframe and is considered aged due to prolonged storage, often resulting in reduced value.
Biochar	A stable, carbon-rich material generated through the pyrolysis of organic matter in an oxygen-limited environment.
Chemical recycling	The process of chemically separating textile fibres into their basic components so they can be used to produce new materials.
Closed-loop recycling	A system in which a product's materials, substances or component parts are converted for productive use back into the same type of product.
Collection	The process of aggregating and transporting materials or items from generators (such as households or businesses) to another location for processing or disposal.
Decommissioning	The removal of hard components, such as zippers and buttons, and garment elements, such as cuffs and collars, from clothing.
Energy from waste	A thermal recovery process where waste is combusted for its calorific value, with the resulting heat used to generate electricity via boilers and turbines.
Energy recovery	Residual value from waste products and materials is extracted to generate energy.
Enzymatic recycling	The process of using enzymes to break down textile fibres into their original building blocks for reprocessing into materials that are recycled into new products.
Guillotining/Clipping	A size reduction process where materials are cut into specific sizes to meet requirements for further processing.
Mechanical recycling	The physical processing of textiles (for example, tearing) into fibres that can be further processed into new products (textile or other).
Next markets	Next markets are the product and commodity markets that use unwearable clothing textiles as inputs to create new textile-derived products, providing the new uses and demand pull-though needed to 'close the loop' in clothing economy.
Open-loop recycling	A system in which a product's materials, substances or component parts are converted for productive use in product systems different to the original.
Post-consumer	Refers to materials, products, or waste items that have been purchased, used, and are no longer needed by the original user, for example, worn clothing.
Post-industrial	Refers to materials, products or waste items generated by industrial processes including manufacturing, that are not used in a final product, for example, factory offcuts.
Pre-consumer	Refers to materials, or products that have not reached an end consumer, for example aged inventory.

Term	Definition for this report
Preparation for recycling	The process of preparing textile materials for a specific recycling method, which may include sorting, decommissioning, and size reduction.
Process engineered fuel processing	A thermal recovery process that converts waste materials into PEF products, which are used as an alternative to fossil fuels in industrial applications, for example, cement kilns.
Pyrolysis	A thermal recovery process that heats materials in low or oxygen-free conditions to produce outputs such as syngas and biochar, which can be used for energy recovery or other application.
Ragging	A size reduction process where materials are cut into rough, irregular sizes to produce rags for handheld applications such as cleaning.
Recycled product/commodity	An output of a recycling or recovery process that can substitute virgin materials in manufacturing.
Recycled textile fibre	A fibrous material produced from textiles, typically through mechanical processing (for example, tearing) to a specified quality, which can be used in a range of manufacturing processes, such as insulation (open-loop) or, where suitable, yarn production (closed-loop).
Recycling	The processing of materials to convert them into new products or secondary materials that are returned to productive use.
Reuse	The repeated use of a product for its intended purpose by the original user or others, extending a product's life and reducing the need to make more.
Shredding	A size reduction process where materials are cut into textile ribbons with no specific size or shape requirement, often used for secure destruction (for example, confidential uniforms).
Sorting	The separation of textiles into homogenised categories. This could include separating for wearable vs unwearable, separating by material type, or separating by colour.
Thermal recovery	The process of recovering energy from waste based on its calorific value, including methods such as process-engineered fuel (PEF), pyrolysis, and energy-from-waste processes.
Unwearable	Refers to textile garments that can no longer function in their original use for their original purpose and are not suitable for wear due to a range of commercial, functional, hygienic or aesthetic reasons.
Wearable	Refers to garments that can be worn again in their original form for their original purpose, including both pre- and post-consumer items. Wearables are graded based on condition and resale potential, ranging from high-value items suitable for resale to lower-value items that may require repair before reuse.

Appendix C: Mapping the value chain

As part of this project, Seamless mapped the value chain of used clothing. This is presented below.

Maps of the value chain

The value chain for garments, including unwearable garments is extremely complex. Many studies have documented the varied chains, depending on many factors including fibre type, garment type, and local and international manufacturing options, as well as the influence of policy. A simplified version of the clothing value chain is presented in Figure 18[46].

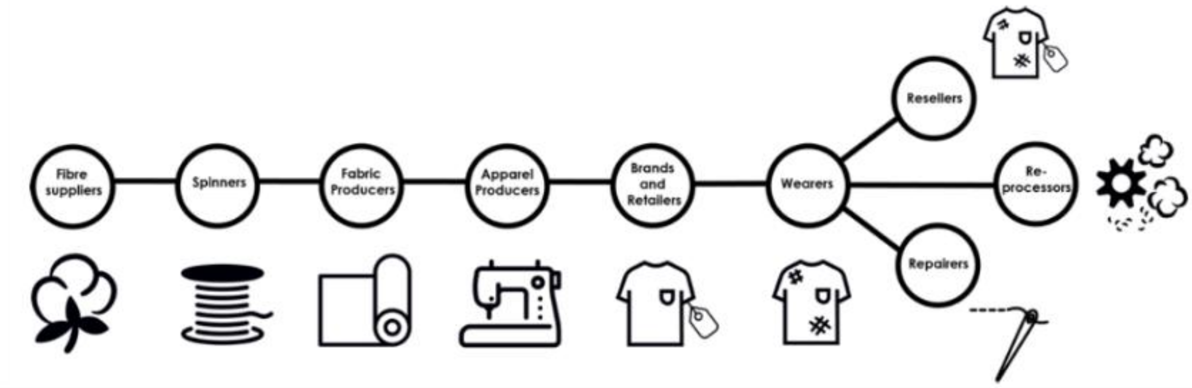


Figure 18: The clothing value chain.

In Figure 19 below, a more extensive clothing value chain is presented to highlight the complexity of the logistics and steps involved in getting the product to the wearer (consumer), as well as a more detailed view of the post-wearer garment journey.

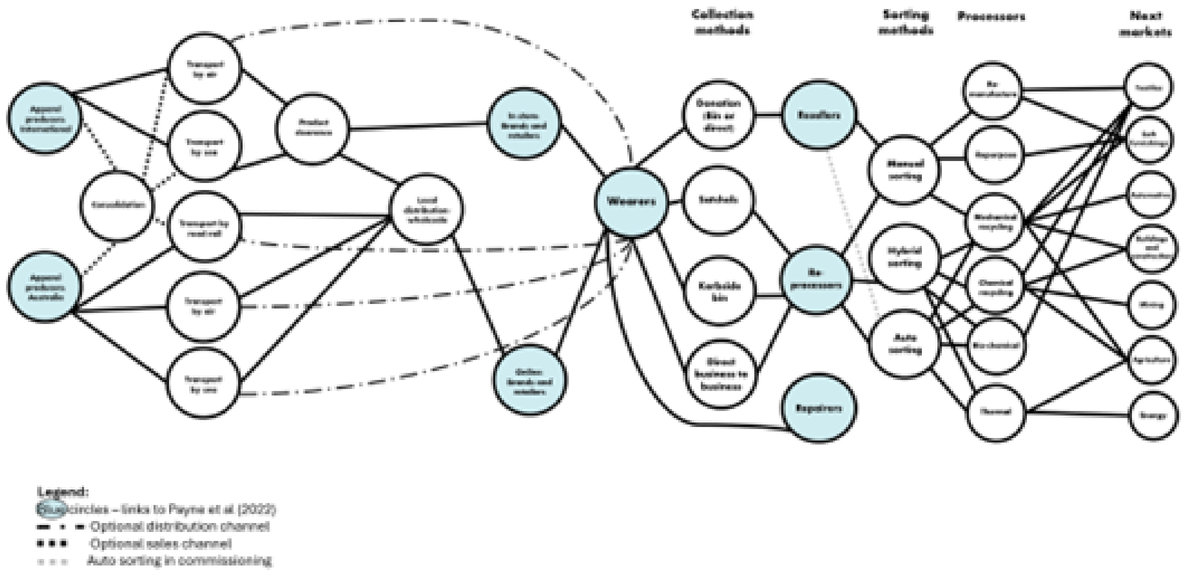


Figure 19: Value chain of actors involved in logistics of garments to wearer with post-wear steps of garments detailed.[47]

[46] Extract from Payne et al (2022)

[47] Adapted from Payne (2021); Payne et al (2022), MRA (2021), Garofano (2020)

In this research, the focus is on the end of the chain, post the wearer's experience, that is, the reprocessing of garments deemed to be unwearable and what opportunities arise for next markets. These steps are highlighted in Figure 20.

For alignment to Payne's diagram (2021), 'Repairers' are included in this figure. However, for the purpose of this research the 'Repairer' holds a relationship with the 'Wearer', with the intention to keep the garment in good working condition, thus, outside the scope of this research on 'unwearable clothing textiles'.

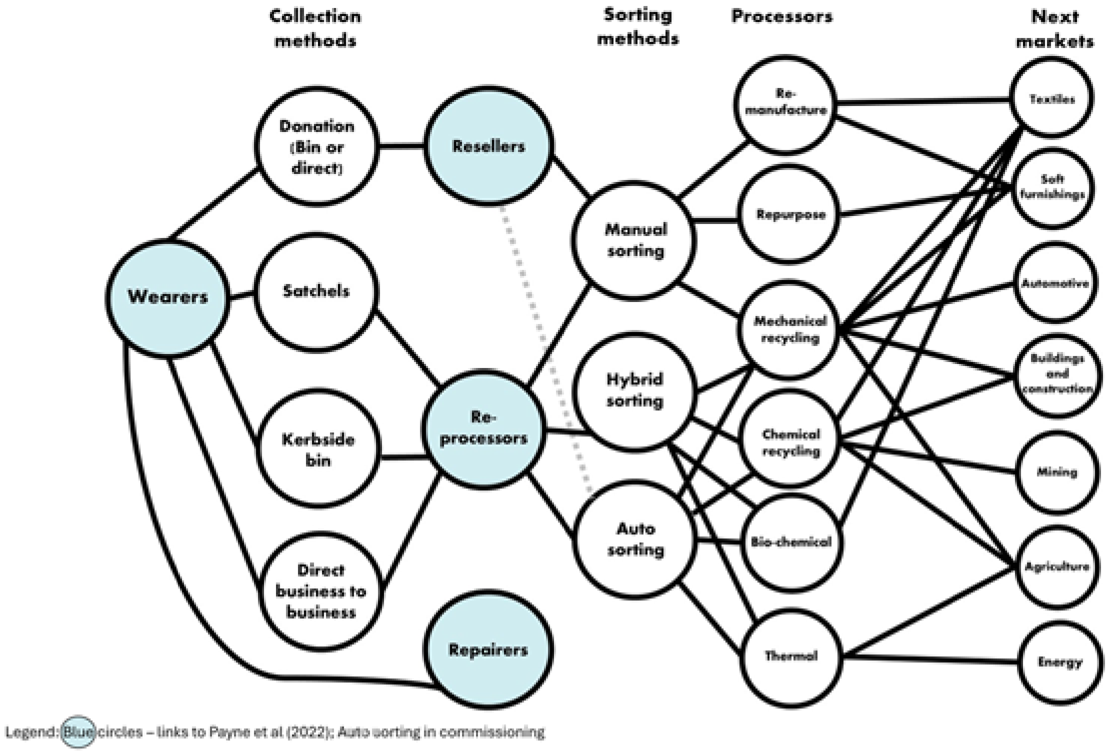


Figure 20: End of life steps for unwearable garments.

Insight: The breadth of processors documented to utilise unwearable garments offers promise for a range of possible next market products. However, the availability of collection systems and sorting options are critical to the ability for these processors to function.

Appendix D: Composition of unwearables

As part of this project, Seamless reviewed sources to determine the composition of the unwearable clothing textile stream in Australia. This is provided below.

Composition of unwearables

The composition of unwearable garments available for processing must be extrapolated from data that presents the fibres and garments available on the Australian market. As there is no current requirement for reporting on specific garment types or fibres for end-of-life products, assumptions must be used. For this, the following data is appropriate for consideration.

The 2024 National Clothing Benchmark for Australia[48] reports on the types of garments imported into the Australian market. These data are presented in table 11 below.

Table 11: Types of clothing imported into Australia in 2024 (measured by units and by weight).

Type of garment	Number of items	Estimated tonnage	% of tonnage
Shirts	382,000,000	116,000	30%
Pants	143,000,000	48000	12%
Jumpers and cardigans	93,000,000	47000	12%
Outerwear	73,000,000	39000	10%
Underwear	458,000,000	39000	10%
Nightwear	61,000,000	20,000	5%
Shorts	79,000,000	19,000	5%
Dresses and suits	23,000,000	17,000	4%
Clothing accessories	85,000,000	12000	3%
Children's wear	55,000,000	11000	3%
Other	42,000,000	11000	3%
Skirts	20,000,000	6000	2%
Sportswear and swimwear	29,000,000	1000	0%
Clothing parts	7,000	78	0%
Total	1,543,007,000	386,078	

Notably in this data, shirts are the most prominent garment by a multiple of 2.5 times. Pants, jumpers and cardigans, plus outer and underwear are of similar tonnages and collectively represent more than 40% of total tonnage.

[48] Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia

Imports by fibre type are presented in table 12 below[49]. However, due to the lack of distinction on import data requirements, some assumptions have been made. For example, 'cotton' is reflected as 57% of total tonnage imported, while in today's garments 'poly/cotton' blends are popular, however, there is no category to reflect this. There is also no category for 'polyester' rather, there is 'synthetics' - however, this is not a large enough proportion, noting global polyester fibre used in new garments is 59% while cotton is only 19%.

Table 12: Fibre type of new clothing imported into Australia in 2024 (measured in tonnes).

Type of fibre	Tonnage
Cotton	191,000
Man-made-fibres	71,000
Synthetic or plastic	7,000
Other fibre	38,000
Wool or other animal hair	5,500
Not listed	24,000
Silk	177
Total	**336,677**

For projections, one assumption is to allocate perhaps 50% of the total cotton tonnage to polyester or at least polyester/cotton to assist in understanding the volume of fibre types available from unwearable garments.

Insight: Despite this data, there are assumptions made to calculate the tonnage available from both garments and fibre types. A lack of required labelling, identification and/or traceability technology or coding could improve these datasets for end of life recovery.

Anatomy of a garment

In a study by Logan et al[50], the composition of garments included analysis of the 'anatomy of a garment'. Using this view, the decision of what types of garments to focus on for both improved design and end of life recovery becomes clearer.

The anatomy of a garment is determined by the internal or physical fibre composition (cotton, polyester, blend, etc) and the external construction of the garment including the types of sewing thread, findings (zippers, buttons, fastenings), trims (lace, ribbons, etc), other adornments, and layers used in the garment. This also includes the 'finishings' or the types of inks or other chemical coatings used in the garment.

[49] Seamless (2025). Seamless 2024 National Clothing Benchmark for Australia

[50] Logan et al 2025

Figure 21 is an extract of the garment structure documented in this study.

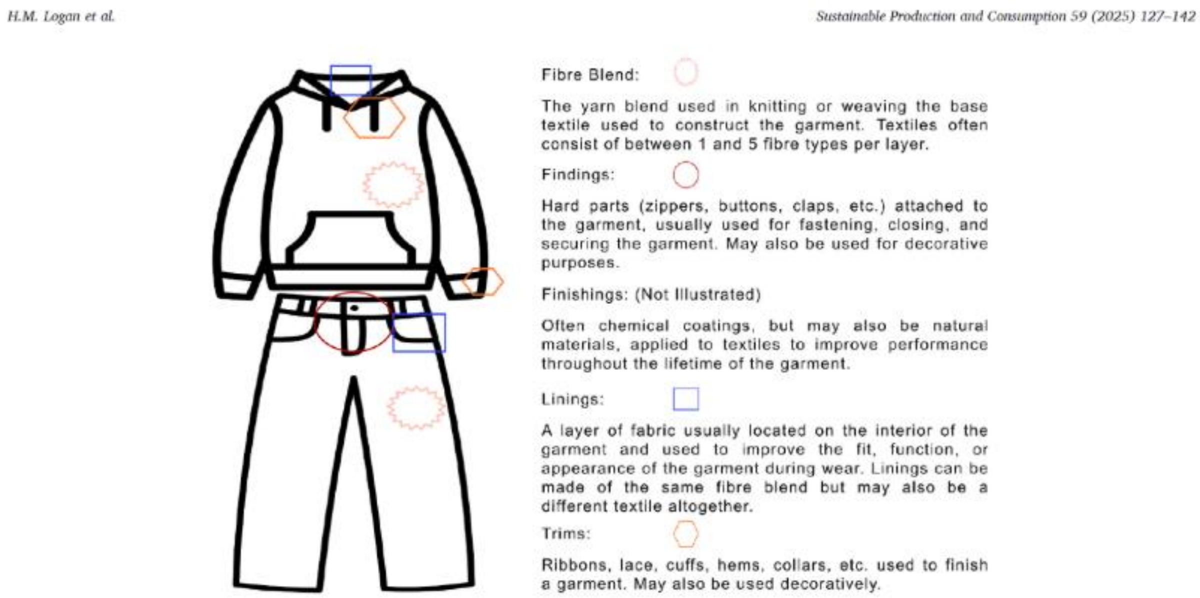


Figure 21: Extract from Logan et al (2025): Anatomy of a textile with is components.

The study highlighted that the design of the garment, not just the fibre or fibre blend composition, determine the ability for a garment to be recycled. As the authors show, understanding the fibre blends is insufficient. It's the 'findings' or the 'disruptors', such as the zippers, buttons etc, that represent the full picture of how a garment can be part of a recycling process. They offer the example of large metal adornments added to a garment that can break or damage shredding equipment. Fabric trims can disrupt the blend composition of a fibre batch. Prints and use of inks affect the optimisation of chemical processes used in recycling.

Through a more comprehensive analysis on the 'anatomy' of garments included in the study and the available scale of garment types, they found the focus for recovery should be on:

- T-shirts, singlets and vests, hoodies and crew necks that are unable to be reused, either through mechanical or chemical recycling.
- Sportswear and swimwear, which are useful for mechanical, polymer granulation or monomer recycling
- For municipalities, where investment in local recycling is available, the study suggested a focus on sweaters and cardigans, t-shirts, singlets, vests, hoodies and crew necks with shirts, blouses and tops also included, all of which are deemed not for reuse.

Improved anatomy of the garment results in a less complex deconstruction and pre-processing system being required.

Insight: Using these findings, an assumption is proposed that of the tonnage necessary to create next market opportunities for Australia, a focus on shirts (which includes T-shirts), pants, jumpers and cardigans would be appropriate. Additionally, cotton and the assumption of poly/cotton blends as two fibres of focus, which are commonly found in these garment types, are also recommended as focus fibres for next market uses.

Appendix E: Policy review

As part of this project, Seamless reviewed global policies for clothing more broadly. The findings are presented below.

Global policy benchmarking

Policies that support a circular economy transition have shifted from purely an environmental strategy to informing industrial strategies. Governments are using a toolkit of regulatory 'push' and market 'pull' measures to drive what has become a focus on resource efficiency and recovery across the value chain. While policies are forcing companies to act, by having to embed circularity business models into their operations, they are at the same time, able to address climate, pollution and biodiversity targets[51].

This section introduces global policy settings and their implications for textiles and apparel.

Context

The research shows policies that support the transition to a circular economy inform three principles from the Ellen Macarthur Foundation:

1. Design out waste and pollution: reducing resource consumption while extending product life
2. Keeping materials and products in use for longer and at their highest value to enable a longer life and higher-quality recycling and manufacturing; and
3. Regenerating natural systems: reducing virgin material consumption and supporting positive environmental outcomes.

The circular business models put forward by the OECD, Accenture and others address these principles and outcomes, adding technology through the use of 'product-as-a-service' models, enabled by sharing platforms.

Policy instruments

To achieve these outcomes, governments are developing and implementing policies that combine restrictions on linear options (landfilling, exporting waste, using hazardous substances) – or 'sticks' – with incentives that make circular options commercially attractive (recycled content mandates, public procurement, producer responsibility and subsidies) – or 'carrots'. The core policy instruments being used globally are presented next.

1. Bans on product destruction

Waste and resource management remains a focus for many territories. For example, the introduction of the Ecodesign Sustainable Products Regulation in the EU has placed a spotlight on textiles with a ban on the destruction of unsold clothes and shoes from July 2026 for large scale producers, while France has been leading the way since 2020.

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[51] Circle Economy (2026)

Table 13: Examples of bans on product destruction from around the world.

Country/Region	Application	Details	Source
EU Member States	Textiles and footwear	Separate collection mandatory by 2025; ban on destruction of unsold clothes and shoes from July 2026 under EcoDesign Sustainable Products Regulation (exemptions for small businesses <€2M turnover).	[European Environment Agency (.2024); European Commission (2026)
France	Unsold garments	Destruction of unsold textiles banned since 2020.	Ellen MacArthur Foundation (2022)

2. Waste export bans and controls

Like Australia, a number of nations have introduced restrictions or bans on low grade waste, including certain plastics, in response to environmental and social concerns in importing countries. These policies are designed to keep responsibility for waste management closer to the point of consumption and to force investment into domestic sorting and recycling capacity, rather than relying on offshore, often informal processing.

Table 14: Examples of bans on waste export and controls from around the world

Country/Region	Application	Details	Source
EU Waste Shipment Regulation	Textile waste	Prevents the shipment of textile waste to third countries with no guarantee of sound management.	ECOS and EEB (2025)
Basel Convention	Plastic/textile waste	The Convention is currently reviewing the movement of textiles and textile waste with decisions announced in June 2026.	Lexology (2025)

3. Bans and restrictions on chemicals of concern

Circular economy outcomes depend on recyclability as well as collection. Regions with advanced chemicals regulation have begun to phase out or restrict chemicals of concern (such as certain dyes, finishes, flame retardants and perfluoroalkyl and polyfluoroalkyl substances (PFAS)) that hinder high-quality recycling or create risks when recycled content re-enters consumer markets.

These bans are increasingly linked to product design rules, so that new textiles must be both less hazardous and more recyclable by design.

Table 15: Examples of bans and restrictions of chemicals of concern from around the world.

Country/Region	Application	Details	Source
EU Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)	Textile chemicals	The regulation applies to 33 CMR (carcinogenic, mutagenic or toxic for reproduction) chemicals. The regulation limits the concentration thresholds for use in clothing, textiles and footwear. Additionally, the PFHxA restriction bans the use of these substances in consumer textiles, such as rain jackets, effective 19 September 2024.	European Commission (n.d.); UNEP (2025) European Commission (2024)
California, United States	Textile chemicals	Bans the sale of new textile articles that contain PFAS and requires the use of less toxic alternatives.	California Legislature (2022)

4. Domestic recycled content targets

A growing number of policies specify minimum recycled content levels in targeted product categories, initially plastics and packaging, and now extending into sectors such as construction materials, automotive sectors and batteries. Such targets for textiles are limited, but examples from other sectors suggest the mandates have created guaranteed demand for secondary materials, improving investment certainty for recyclers and encouraging clothing brands to redesign products to accept recycled inputs. For textiles, such targets could improve both fibre-to-fibre and open-loop applications such as insulation or composites.

Table 16: Examples of recycled content targets from around the world.

Country/ Region	Application	Details	Source
Netherlands	Textiles	Circular Textiles Policy 2025-2030 – Policy objectives: By 2030, all textiles products on the Dutch market must have 15% post-consumer fibre-to-fibre recyclate (but not necessarily from locally sourced material). By 2035, all textiles products on the Dutch market must have 20% post-consumer fibre-to-fibre recyclate (but not necessarily from locally sourced material).	Govt of Netherlands (2024) (translated)

Country/ Region	Application	Details	Source
EU	Textiles	Recycling Europe suggest the need for targets of 10% recycled fibres by 2028, 15% by 2030 and 30% by 2035 (post-consumer EU waste prioritised) to keep recycled content demand and investment on track. "Mandatory recycled content targets are among the most powerful policy tools available to transform Europe's textile system." They are not in place at this time.	Recycling Europe (2026)
EU	Plastic packaging	EU Packaging and Packaging Waste Regulation (EU) 2025/40 Article 7 – other plastic packaging: 35% recycled content by 2030, 65% by 2040. This has implications for textiles whose recycled content has come from PET bottle recycling to date.	European Commission (2025)
South Korea	Plastic packaging	Starting in 2026, the government will require at least 10% of recycled plastic in PET bottle production (producers over 5000 tonnes); up to 30% by 2030 (producers over 1000 tonnes). Despite the requirement for recycled content to be 'certified' there is no obvious requirement for locally sourced, post-consumer recycled materials to be used.	Packaging Insights (2025)

5. Incentivised green procurement

Public procurement is being used as a demand lever by requiring or strongly preferring products with recycled content, reparability, leasing models or take-back schemes. This shifts a significant share of institutional purchasing, such as workwear, hospital textiles and furnishings, towards circular products, demonstrating markets at scale and helping early-stage technologies move from pilot to commercial deployment.

Table 17: Examples of green procurement incentives from around the world.

Country/Region	Application	Details	Source
New Zealand	Public procurement	Federal policy requires all new and renovated construction projects to "use woollen fibres where practical and appropriate in government buildings" effective 1 July 2025.	Procurement NZ (2025)
Netherlands	Public procurement	Ministry of Defence using recycled uniforms as a composite in construction panels.	Ministry of the Interior (2026)

Country/Region	Application	Details	Source
EU	Public procurement	The Implementing Act might require an annual or multiannual basis, a minimum percentage of 50% of procurement [...] [to procure] the most environmentally sustainable products.	EU 2024

6. Mandatory product stewardship schemes (PSS)

Mandatory PSSs are now central to circular policy for high-volume consumer goods. Under these schemes, producers (brands, importers and retailers) are legally responsible for the end-of-life management of their products, often paying fees per unit or per kilogram placed on the market. Those contributions finance clothing collection, sorting, reuse and recycling infrastructure. In more advanced models, fees are "eco-modulated" so that easier-to-recycle, less toxic products pay less, and problematic items pay more.

Table 18: Examples of mandatory product stewardship schemes (PSS) from around the world.

Country/Region	Application	Details	Source
EU	Textiles	Mandatory PSS by April 2028; producers (including online sellers) pay collection/sorting fees via product stewardship organisations (PSOs).	Verdant Law (2026); EU (2025) (Article 22a)
California	Textiles	EPR operational July 2026; producers pay eco-modulated fees per garment; register with PSO.	SGS (2024); California Legislature (2024)
France	Apparel/textiles	Fully operational since 2020; €1–5/kg producer fees. €0.01-0.17/garment based on garment type and recyclability (since 2020).	ReFashion (2025); Legifrance (2024)
Global case studies	Textiles	Latest mapping of global EPR schemes for textiles is available from Global Fashion Agenda.	Global Fashion Agenda (2026)

Alongside these core instruments, many frameworks also deploy:

- Tax credits or subsidies for recycling infrastructure, innovation and first-of-a-kind facilities, particularly chemical and advanced mechanical recycling.
- Reduced sales tax or other tax benefits for repair, reuse and second-hand clothing sales.
- Green finance and guarantees to de-risk private investment in circular business models.

7. Leadership in circular policy design including textiles

Arguably, the benchmark for an inclusive policy towards a circular economy with a focus on textiles is the European Commissions' Ecodesign for Sustainable Products Regulation (ESPR).[52] Adopted in 2025, the regulation focuses on:

- Substances of concern
- Provisions for 'dead stock' or unused garments
- Labelling
- Public procurement
- Funding
- Digital product passports
- Enforcement and market surveillance
- Verification and conformity

Furthermore, the policy impacts any product from any jurisdiction that sells into the European Union, regardless of where they are manufactured.

Various implementation dates are in place for textiles. From July 2026, the destruction of certain unsold consumer products, including articles of clothing, accessories and footwear, will take effect. This applies to larger brands initially, with small-to-medium enterprises requiring compliance by July 2030. The full suite of policies will be applicable to the textiles sector from 2027[53].

Also in 2025, the European Commission revised its Waste Framework Directive to introduce extended producer responsibility for textiles. Once the directive takes effect, member states have 30 months to set up PSS schemes in their jurisdiction to cover the cost of collection, sorting and recycling[54]. Member states are also required to incorporate the law into national legislation within 20 months of the directive taking effect. Starting with separate textiles collection, full implementation of the PSS is expected across the EU by 2028:

- **2025:** Separate municipal textile collection becomes mandatory in all EU Member States
- **2027:** Extended Producer Responsibility for textiles formally begins
- **2028:** Full enforcement expected across the EU

Longer implementation times will be offered to small to medium enterprises.[55]

Australia's current voluntary approach with Seamless lags significantly behind global leaders. For example, the Seamless levy is AUD 4 cents per garment for members, with a reduction to AUD 3 cents for garments that meet the eco-modulation criteria. In France (2020), in California (2026 forthcoming) and in the EU (2028 forthcoming), the fees are between €1 and 17 cents per garment. Furthermore, the schemes are mandatory.

[52] European Commission (2024) Ecodesign Sustainable Products Regulation

[53] New Zealand Foreign Affairs and Trade, EU Circular Economy: Ecodesign, Digital Product Passports, and Green Public Procurement

[54] European Commission (2025), Parliament adopts new EU rules to reduce textile and food waste

[55] Valpak 2025; Waste Framework Directive: EU Textiles – New Rules Are Coming

Australia's approach to textiles responsibility was highlighted in the Productivity Commission report released in January 2026.[56] There, the Commission signals a six month window for industry to demonstrate progress before a cost-benefit analysis is conducted to examine mandatory regulated models for PSS with a framework developed thereafter[57]. The timeframe suggested for the implementation of a regulated scheme is from 2029 to 2031.

Insight: Most advanced policies use PSS with variations of supporting policies within that structure, including recycled content targets (for example, the Netherlands). Fees vary and are as high as € 17 cents per garment in mandatory schemes, In comparison, Seamless is a voluntary scheme with a levy of AUD 4 cents per garment which is not sufficient to support the required systems and infrastructure.

Overview of policy gaps

The following table summarises the gaps in Australian policy settings.

Table 19: Gaps in Australian policy settings and suggested actions to address them.

Policy instrument	Global examples	Status in Australia
EPR	France (2020) California (2026) EU (2028)	Seamless is a voluntary clothing product stewardship scheme with a comparatively low AUD 4 cent levy per garment.
Public procurement	New Zealand (2026) use of wool in buildings	Australian Government Environmentally Sustainable Procurement Policy notes that "goods containing recycled content /recycled materials are used", with no target set.
Landfill bans	France unsold goods (2020) Chile textiles (2025) EU unsold garments (2026)	None

[56] Productivity Commission (2026) Australia's circular economy: unlocking the opportunities

[57] Seamless (2026), What the Productivity Commission report signals

Appendix F: Current recycling and recovery process capabilities in Australia

The following table provides an overview of known recycling and recovery capabilities for unwearable clothing textiles in Australia, as identified through this research.

Table 20: Outline of the known capabilities for managing unwearables in Australia, as identified through this research.

	Mechanical recycling	Chemical and enzymatic recycling	Thermal recovery
Source of material	• Mixed post-consumer unwearable clothing textiles • Unwearable uniforms • Aged or damaged inventory	• Post-industrial residuals • Used linen/other textiles • Shredded uniforms • Pelletised material • Aged inventory and post-consumer collected from retailers	• Shredded uniforms • Residuals from textile recyclers • Residual waste (mixed clothing textiles and other materials) • Mixed post-consumer unwearable clothing textiles (pilot stage only)
Collection methods	• Commercial and industrial collections • Collection from citizens (pilot stage only)	• Commercial and industrial collections	• Commercial and industrial collections • Residual waste collections (households)
Sorting unwearable clothing from wearable	• Source separation by commercial organisations for uniforms and aged inventory • Sorting by citizens for mixed post-consumer (pilot stage only) • Sorting at processing facility for donated post-consumer	• Source separation	• Source separation for some processes (pilot stage only) • Not sorted prior to some thermal recovery methods
Preparation for recycling	• Sorting by colour and fibre type • Decommissioning/hard point removal • Guillotining into clips	• Removing hems/cuffs and other non-desired elements • Decommissioning/hard point removal • Guillotining into clips, for some processes	• Shredding/pre-processing (some facilities require shredded items, others do not) • Decommissioning (for some processes) (pilot stage only)

	Mechanical recycling	Chemical and enzymatic recycling	Thermal recovery
Feedstock requirements	Varies by recycling process but can include: • Sorted depending on desired fraction/yield • Decommissioned/hard points removed • Colour-sorted clips with hardpoints removed • Shredded for some processes • Unable to receive leather or hi-vis clothing	Varies by recycling process but can include: • Material sorted to at least 80% accuracy and composition known • Mono-material/fibre • Decommissioned/hard points removed • Clipped polyester, polycotton, and cotton for some processes • Pelletised or agglomerated material for specialised technology	• No/ limited PVC • Decommissioned/hard points removed for pyrolysis processes
Capabilities	• Tearing lines with teeth turn material into a fibre • Tearing to a specification • Fire retardant treatment of materials used in insulation (pilot stage only)	• Chemical process to strip out elastane, colours and dyes • Separation of fibre into polyester and cellulosic fibre • Depolymerisation to produce monomers • Repolymerisation into polymer resin pellets	• Processing of textiles with other waste items to create a high-calorie fuel • Processing of residual waste, including clothing textiles, to generate heat, which is used to make electricity • Processing of carbon-based waste into biochar (pilot stage)
Recycled product or commodity	• Recycled textile fibre	• rPET • Polymer resin pellets (nylon 66) • Cellulosic clay	• PEF • Electricity • Biochar
Potential manufactured products	• Thermal insulation • Acoustic insulation • Mattress fibre layers • Underlay for carpet and artificial turf • Geotextiles • Algae nucleation site • Packaging • Textiles/ recycled content yarn • Dog beds, cushions, and other homewares	• Textiles/ recycled content yarn • Plastic products • Soil enrichment materials	• High temperature industrial processes • Energy from waste facilities • Soil enrichment materials
Potential next markets	• Built environment • Consumer goods • Environmental applications	• Consumer goods • Environmental applications	• Industrial processes • Energy and industrial fuel use • Environmental applications

Appendix G: Research process and data gaps

This report provides insights into Australia's current capacity for managing unwearable textile garments, as well as opportunities for developing next markets. These findings are informed by a literature review, survey and consultation with industry stakeholders, as well as the Seamless Circular Clothing Textiles Fund pilots, and Rawtec's synthesis of findings. However, several data gaps and opportunities for further investigation were identified.

Defining standard terminology

Through industry consultation, it became clear that terminology used to describe processes, materials, and products is not applied consistently across organisations. In some cases, different terms are used interchangeably to describe similar outputs such as 'recycled textile fibre' and 'shoddy', although these may carry different technical or historical meanings. In other cases, terms such as 'fluff' and 'fibre' may refer to distinct material grades or forms but are not clearly defined. Similarly, the term 'tearing' is used variably to describe a range of processes, including mechanical recycling, ragging, and shredding.

For the purposes of this report, a consistent set of definitions has been developed, informed by the terminology most used during consultations – they have been provided in the glossary at Appendix B. However, these definitions have not yet been formally validated by industry and should be reviewed prior to adoption in any finalised taxonomy.

Stage 1: Literature review

The literature review undertaken by Seamless provided insights that informed the development of this report. The review covered:

- Maps of the garment value chain and its complexities
- Garment types and volumes in the Australian market
- Fibre composition and autonomy of garments
- Recycling operations and processes and potential recycled outputs, including emerging operations
- Insights into global policy settings such as disposal management, waste export bans and controls, bans and restrictions on chemicals of concern, domestic recycled content targets, green procurement, and EPR or PSS schemes.
- High level assessment of available next markets

While the literature review identified a range of insights (summarised in Appendices C, D and E), some information was not available in published sources.

These gaps are summarised below.

Table 21: Data gaps identified in the Seamless literature review.

Criterion	Description of gap
Composition and current market size of resource inputs (unwearable clothing stock by tonne).	While the literature review identified total market size (including clothing consumption and waste tonnes), garment and fibre breakdowns were limited to consumption, with no detailed data on the material composition of unwearables.
Current and prospective key players (Australia and international, inputs accepted and potential).	The literature review identifies Australian processors, as well as some international examples. Inputs and outputs are included but some data was not available, including the input accepted for both Australian and international operators.
Market assurance protocols.	While some key standards were identified, information on market assurance protocols was not available or sufficiently detailed to enable an assessment.
Quantify domestic demand (closed-loop, by tonne).	Information to quantify demand separately was not available for the literature review.
Quantify domestic demand (open-loop, by tonne).	While domestic capacity and flow estimates were identified, information to quantify demand was not available through the literature review.
Quantify international demand.	Findings from the literature review did not provide sufficient data to quantify international demand.
Quantify by application.	The processes that support recycling within the unwearable clothing value chain (sorting, decommissioning, and pre-processing) are described in the literature, however, quantitative data for each application is not available in published sources. Mechanical recycling processes are well documented, and processing capacity has been identified, however, demand quantities for these outputs are not available in the literature. Chemical recycling technologies and key players are also covered in the literature review, however, demand quantities remain unquantified in published sources.
Taxes	Information on taxes have been included in the literature review in the form of disposal costs, however, examples of individual policies have not been included.

Stages 2 to 4: Consultations, economic benefits and reporting

Consultations with industry stakeholders were instrumental in gathering insights to inform this report. Through consultations, the following information was collected:

- Challenges for next market development from the perspectives of operators along the value chain
- Technical, market, and regulatory barriers
- Opportunities and enablers to support next market development
- Recycling outputs that can be produced from unwearable textile garments
- Feedstock requirements for identified recycling processes
- Capabilities across the value chain including skills, knowledge and processes
- Next markets for recycled outputs

However, some data gaps were identified, together with limitations on reporting due to confidentiality, as outlined in the table below.

Table 22: Data gaps identified in stages 2 to 4 of the project.

Criterion	Details
Assessment of current capacity (collection, sorting, processing, recycling by material and tonne).	Capacity data is included in the report and is presented at an aggregated level. In some cases, information obtained through industry consultations was provided on a confidential basis and therefore could not be reported.
Assessment of collection rates and material composition.	Collection rates ($/tonne) are presented as price ranges. Data gaps exist for the costs of booked collections and postal returns as shown in table 9 in section 5.1 of this report. Detailed data on the material composition of unwearables at different disposal points was not available. However, the analysis considered how variations in material streams, such as mixed residual versus source-separated unwearables, and sources, such as household versus commercial, influence collection methods, costs, and subsequent recycling and market pathways.
Identification of current market demand (three to five materials/products).	Market demand for three identified material products (fibre-to-fibre, thermal insulation, and process engineered fuel) is presented as semi-quantitative information in this report. This assessment is constrained by limited published data, with further limitations on reporting due to the confidentiality of information obtained through consultations.
Analysis of price dynamics.	Market pricing information was partially obtained through consultations where it could be shared and was used to inform high-level estimates of potential turnover. Given the commercial sensitivity of data, analysis of price dynamics was limited.
Economic analysis.	Potential annual turnover for the recycling and recovery of unwearables was modelled under a defined scenario using available data. This drew on public sources and confidential data received through consultations with regards to collection fees, gate rates, and sale of recycled commodities and products. Data gaps remain, particularly for chemical and enzymatic recycling. In the absence of this information, conservative, high-level assumptions were applied to revenues across pre-processing, chemical, enzymatic and thermal recovery pathways. As a result, overall turnover under this scenario is likely understated.

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