Seamless

Environmental impact of the Australian clothing industry

2024

Unravel Carbon

In the spirit of reconciliation, we acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community. We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples.

In Australia, we have the privilege of learning from incredible First Nations design traditions. First Nations people have been creating clothing for millennia with a focus on circular principles. As we continue on this journey towards circularity in our industry, we are committed to learning from the way things have always been done by First Nations creators in this Country.

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Executive summary

This study provides a country-level estimate of the impact of greenhouse gas emissions and water use associated with Australia's clothing value chain in 2024. Drawing on life cycle assessment (LCA) principles, it quantifies targeted environmental impacts of clothing from production through to end-of-life.

In March 2025, the Productivity Commission's interim report[1] on Australia's circular economy found that progress has been slow. Over the past decade, materials productivity and resource recovery have improved only marginally, and Australia's circularity rate is only 4.6%, which is half the global average.

These findings highlight the importance of the Federal Government's targets in Australia's Circular Economy Framework[2]. The framework sets out clear goals for 2035: doubling the national circularity rate, reducing the per-capita material footprint by 10%, increasing material productivity by 30%, and achieving an 80% resource recovery rate. According to the Framework, meeting these targets could add $26 billion to Australia's GDP each year, cut greenhouse gas emissions by up to 14%, and divert 26 million tonnes of material from landfill.

Net zero and the circular economy are closely linked. Both aim to decouple economic growth from environmental impact. This report provides the benchmark for tracking our progress. It measures the greenhouse gas emissions and water use generated across the Australian clothing sector—from production and transport through to retail, use, and end-of-life processing.

A circular clothing economy keeps clothes in use for longer, reduces waste, and encourages designs that support reuse, repair, repurposing and recycling. These strategies lower demand for virgin resources and avoid the energy-intensive processes required to extract and manufacture them, resulting in lower emissions.

For Seamless, Australia's national clothing product stewardship scheme, the priority is to help build a system that diverts clothing from landfill while reducing emissions and water use across the supply chain. Through this report and the 2024 National Clothing Benchmark for Australia[3], Seamless is setting a transparent baseline to track some initial metrics which reflect our collective progress towards a circular clothing industry and net zero.

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[1] Australia's circular economy: unlocking the opportunities

[2] Australia's Circular Economy Framework, Australian Government

[3] Seamless 2024 National Clothing Benchmark for Australia

Methodology

The environmental impacts of the garment life cycle stages shown at Figure 1 are examined in this report.

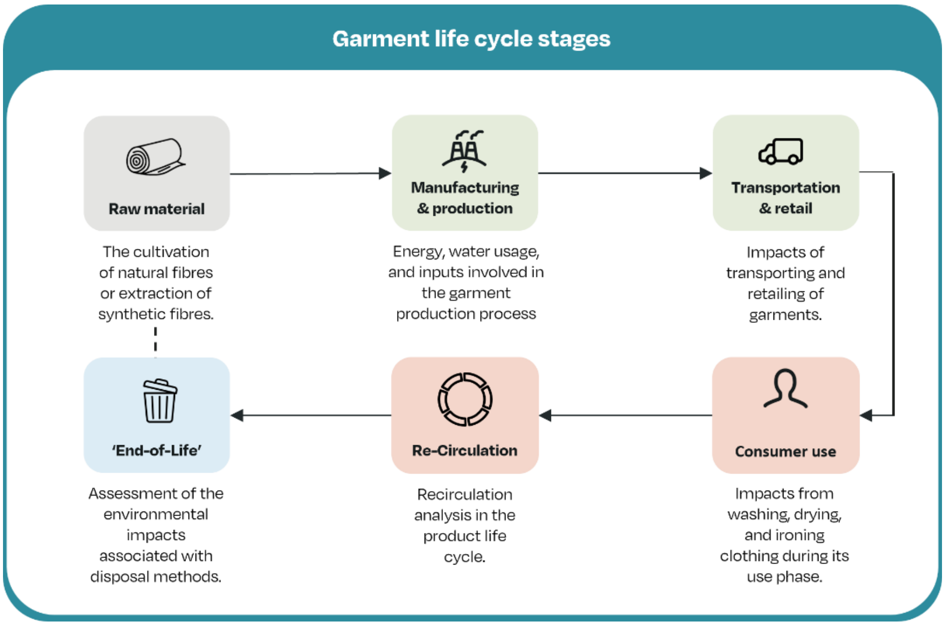


Figure 1: Garment life cycle stages

Using clothing import data from the Australian Bureau of Statistics and consumption and disposal metrics from the Seamless 2024 National Clothing Benchmark for Australia[4], this report models the impacts of producing one kilogram of garments. The impacts were then scaled up to reflect the total greenhouse gas emissions and water use associated with the 2024 National Clothing Benchmark shown at Figure 2.

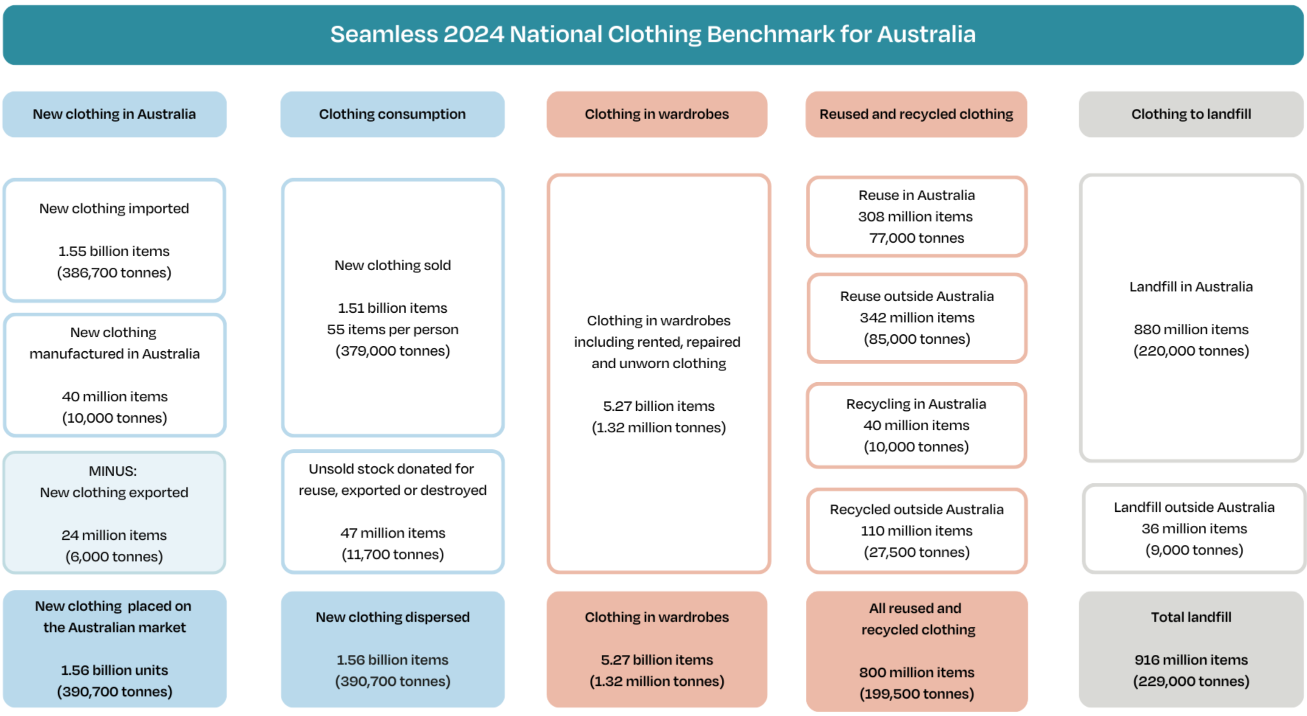


Figure 2: Seamless 2024 National Clothing Benchmark for Australia

[4] Seamless 2024 National Clothing Benchmark for Australia

This report estimates the 2024 impact of Australia's clothing industry by looking at two metrics — greenhouse gas emissions and water use. To manage the complexity of the system and available data, we had to make several assumptions, acknowledging that LCA involving natural systems is still an evolving science. Nonetheless, this report offers a valuable starting point to understand the scale of greenhouse gas emissions and water usage linked to clothing in Australia and provides a foundation for future updates as improved data and methodologies become available.

Key findings

14.5 million tonnes of CO_2-equivalent (CO_2e) emissions generated in 2024

In 2024, Australia's clothing production, consumption, use, and disposal were estimated to generate approximately 14.5 million tonnes of CO_2-equivalent (CO_2e) emissions as shown in Figure 3 below. The new clothing production phase is the most emissions-intensive, contributing 50% of total emissions. As the production phase has the most material emissions impact, it represents the greatest opportunity for abatement through reducing overproduction and investing in efficiency improvements.

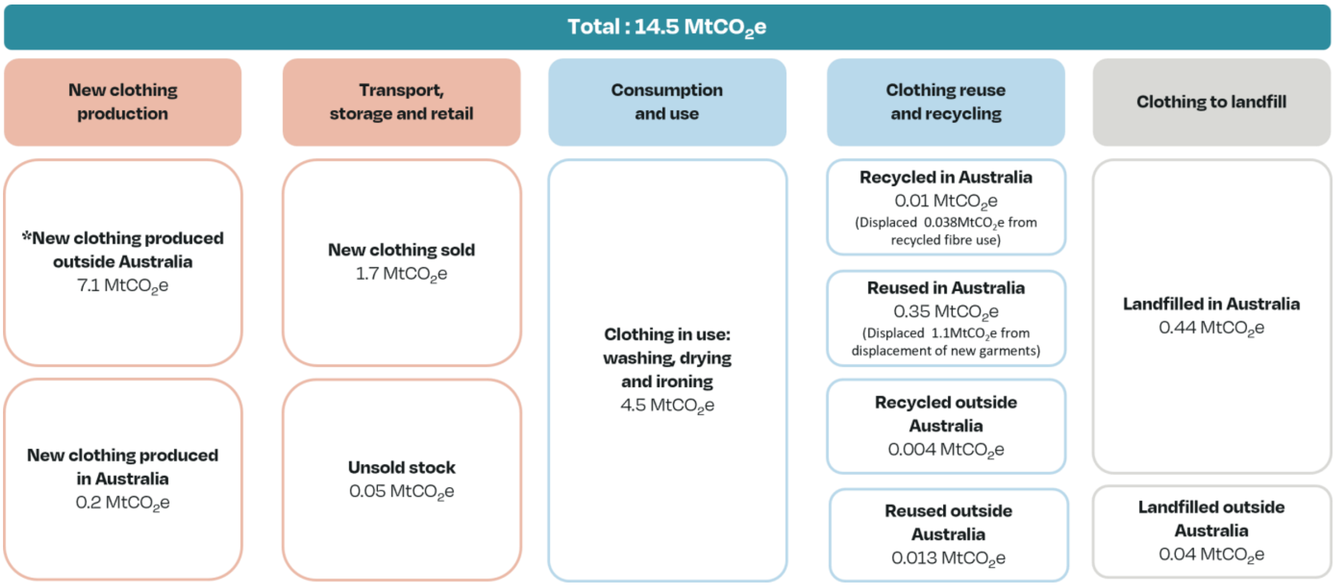


Figure 3: Greenhouse gas emissions impact of Australian clothing industry in 2024

On a per capita basis, the average Australian was responsible for generating around 530 kg CO_2e from clothing-related activities in 2024. That's equivalent to the amount of electricity used by an average sized home for two months or driving over 3,600 kilometres in a petrol-powered passenger car, which is further than the distance from Melbourne to Perth in Australia[5].

[5] Equivalent figures used in this report for CO_2e assume that the average Australian home uses 6,100 kWh per year (source: Ecoflow) and the average emissions intensity for electricity in Australia is approximately 0.503 kg of CO_2e per kWh (source: Carbon Positive Australia). Therefore, average Australian household emissions per year are approximately 3.0 t CO_2e. Additionally, new passenger cars in Australia average around 146.5 grams (0.1465 kg) of CO_2 per kilometre (National Transport Commission Australia).

1.8 billion cubic metres of water consumed in 2024

In addition to emissions, the water consumption associated with Australia's clothing value chain in 2024 was significant. Water usage is an important area for consideration as excessive consumption can reduce river and groundwater levels, which can cause habitat loss for plants and animals, increase pollution concentrations, and negatively impact water quality. This adds to the pressures which increased droughts and floods are already placing on water supplies and infrastructure.

It is estimated that 1.8 billion cubic metres of water were consumed across the clothing value chain in 2024, equating to an average of 66 cubic metres per person – this is equivalent to 132,000 bottles of water or 440 full bathtubs per person[6]. The majority (85%) of water use was linked to new clothing production.

Total : 1,800 million m^3		
New clothing production 1,537 million m^3	**Transport, storage and retail** 0.154 million m^3	**Consumption and use** 320 million m^3
New clothing produced outside Australia 1,500 million m^3	**New clothing sold** 0.15 million m^3	**Clothing in use: water use for laundry** 320 million m^3
New clothing produced in Australia 37 million m^3	**Unsold stock** 0.004 million m^3	

Figure 4: Water consumption potential impact of Australian clothing industry in 2024

Assessment of circularity strategies

This report also explores circularity strategies for clothing such as reuse and recycling, using system expansion to quantify the environmental impact which can be avoided by decreasing the production of new clothing. In 2024, these circular practices avoided an estimated 1 million tonnes of carbon dioxide equivalent, with the majority of reductions achieved by reusing 77,000 tonnes of clothing in Australia.

Emissions reduction strategies are also explored in this report, such as reducing overproduction, increasing production efficiency, shifting air freight to sea transport and using renewable energy.

What the findings mean for Australia's clothing industry

Overall, these findings make it clear that Australia must move quickly from a linear model to a circular clothing economy. Reducing the environmental impact of what we wear will take system-wide change: an increased focus on circular design and responsible production, greater investment in local reuse and recycling, stronger repair and resale pathways, and shifts in how we buy, use, and pass on clothing. Purposeful purchasing, extending the life of garments, and reselling or donating wearable items are all essential steps in creating a more circular future.

[6] Equivalent figures used in this report for water use are based on a 500 ml bottle of water and a bathtub which holds 150 litres.

Background and scope

The clothing industry has a substantial environmental impact, accounting for around 10% of global carbon emissions[7]. In addition, the United Nations Conference on Trade and Development (UNCTAD) reported in 2019 that the industry consumes approximately 93 billion cubic metres of water annually, highlighting its substantial strain on global freshwater resources (UNCTAD, 2019).

The clothing industry's reliance on high production and consumption patterns and a linear economic model intensifies its environmental impacts. In 2024, 1.51 billion items of clothing were sold in Australia, which equates to 55 items of clothing for every Australian. Additionally, 222,000 tonnes of clothes were discarded to Australian landfill[8]. These figures highlight the need for solutions to promote more sustainable practices, particularly in transforming the clothing industry from a linear model of production and consumption to a circular economy.

To get a clearer picture of the impact of clothing consumption in 2024, this study utilised Life Cycle Assessment (LCA). LCA is a methodology that looks at targeted environmental impacts at every stage of a product's life, from production to disposal. The greenhouse gas emissions and water usage impacts associated with the clothes Australians imported, manufactured, consumed, used and disposed of in 2024 were estimated using LCA methodologies[9].

Impacts associated with the production and use of garments within Australia were calculated. These impacts were then scaled using national data on clothing imports, usage patterns, and disposal practices to establish a benchmark for total greenhouse gas emissions and water use associated with Australia's clothing value chain in 2024. The study primarily focused on the greenhouse gas emissions of Australia's clothing value chain, examining end-of-life scenarios and selected initiatives aimed at reducing emissions impacts within this sector.

[7] UNEP (2018, November 12). **Putting the brakes on fast fashion**.

[8] **Seamless 2024 National Clothing Benchmark for Australia**

[9] The LCA followed a cradle-to-grave system boundary using an attributional LCA approach. Climate change and water use were selected as the impact categories. Life cycle inventory (LCI) data were sourced primarily from secondary datasets, including industry reports and databases such as EcoInvent v3.11 (cutoff).

Scope of this report

Goal	To understand the greenhouse gas emissions and water consumption impact of the current clothing value chain in Australia using life cycle assessment (LCA) principles.
Purpose	To generate a baseline for tracking greenhouse gas emissions and water usage to measure our progress towards a circular clothing economy in Australia by 2030. This report provides a publicly available source of baseline greenhouse gas emissions and water consumption estimates.
Objectives	1. Establish a 2024 baseline for the environmental impact of the Australian clothing industry in terms of greenhouse gas emissions and water consumption. 2. Identify key emissions sources across the clothing value chain. 3. Identify opportunities to reduce the environmental impact of the clothing industry in Australia. 4. Assess data availability and gaps and provide recommendations for improved reporting and future refinements of this report.

System description

This report investigates the greenhouse gas emissions and water consumption impact associated with the clothing value chain serving the Australian market in 2024. Life Cycle Assessment techniques were used to estimate the emissions impact and water footprint of one kilogram of garments. The results of the LCA were then applied to the 2024 Australian clothing value chain data to use as a baseline for benchmarking.

System boundary

A study of the 2024 Australian clothing system, from production to end of life, including:

- Imported clothing
- Locally produced clothing
- Transportation and retail of clothing
- Use of clothing
- Reusing and recycling clothing
- Clothing to landfill
- Avoided burden associated with reuse and recycling

Functional unit of baseline

The consumption, use and disposal of clothing in Australia in 2024.

Functional unit of LCA

The use of one kilogram of garments by consumers in Australia over an average garment lifetime, including end-of-life treatment.

Impact category

Global warming potential over 100 years (GWP100) (kg CO_2-e) and water consumption potential (WCP) (m3).

Life cycle assessment techniques

Life Cycle Assessment (LCA) techniques were used to estimate the emissions impact and water footprint of one kilogram of garments. The results of the LCA were then applied to the 2024 Australian clothing value chain data to use as a baseline for benchmarking.

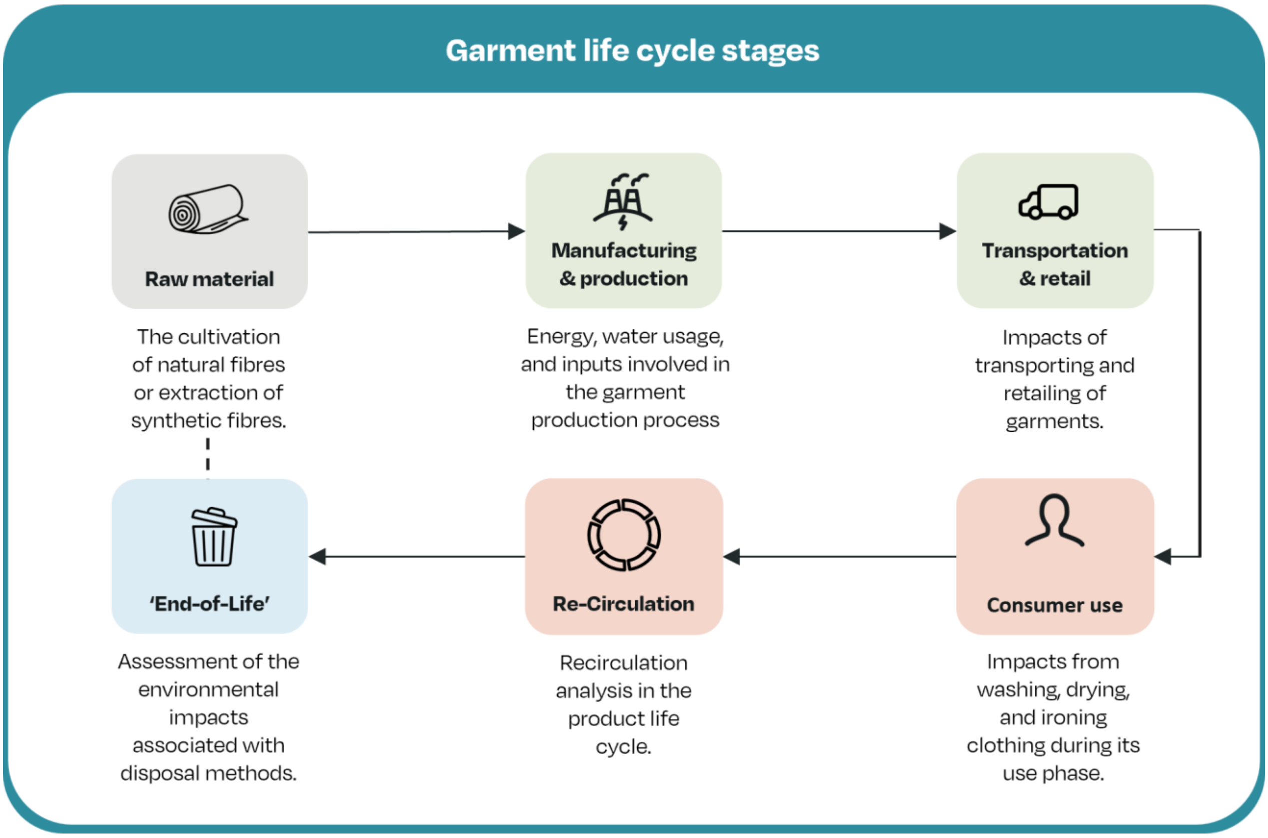


Figure 5: Garment life cycle stages

Australian clothing value chain boundary

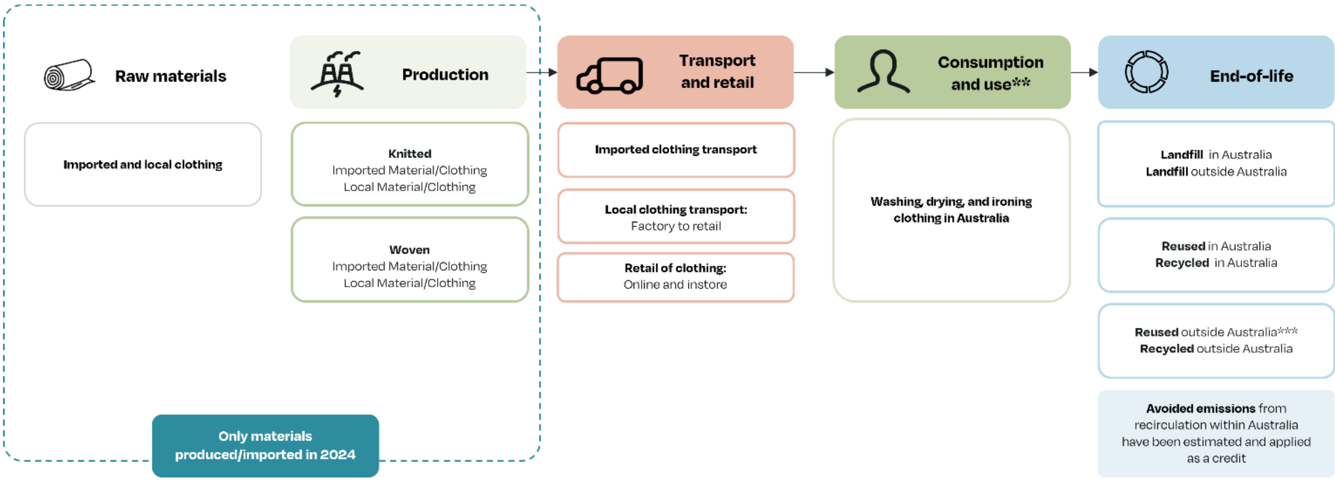


Figure 6: Australian clothing value chain boundary

Importantly, the following elements are excluded from the clothing value chain in this report: raw material origin and specific agriculture practices associated with natural raw materials, packaging, capital equipment, upstream waste/chemical disposal if not included in EcoInvent processes, bespoke garment processes (e.g. applying flame retardants), other processes that could be attributed to the clothing industry not included above (e.g. fashion events) and exported material impacts.

** Use phase only in Australia.

***Only impacts of transporting clothing internationally for recirculation are considered.

LCA system boundary and unit processes

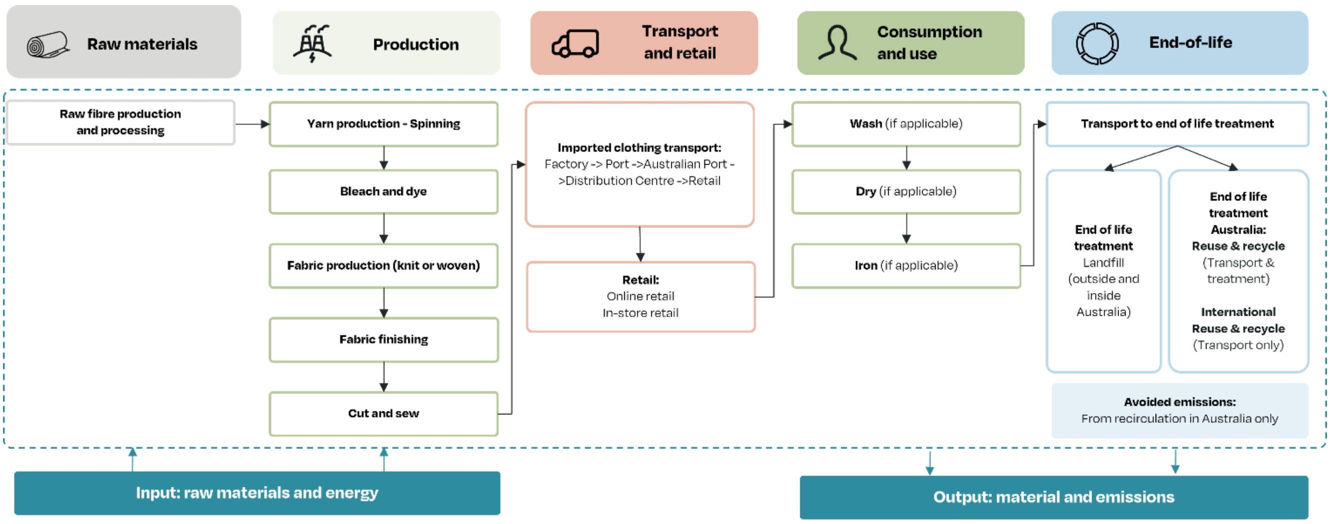


Figure 7: LCA system boundary and unit processes

The report studies one kilogram of garments. Importantly, the following elements are excluded: raw material origin and specific agriculture practices associated with natural raw materials, packaging, capital equipment, upstream waste/chemical disposal if not included in EcoInvent processes, bespoke garment processes (e.g. applying flame retardants), other processes that could be attributed to the clothing industry not included above (e.g. fashion events) and exported material impacts.

Key data source: Australian Bureau of Statistics Data

Data for this Life Cycle Assessment was derived from Australian import statistics for the year 2024, sourced through the Australian Bureau of Statistics (ABS).

Specifically, data related to Harmonised System (HS) Codes 61, and 62 were utilised:

- HS 61: articles of apparel and clothing accessories, knitted or crocheted
- HS 62: articles of apparel and clothing accessories, not knitted or crocheted

The data was disaggregated by import country of origin, manufacturing process and product category to support the life cycle assessment. Comprehensive details are available in supplementary material.

ABS 2024 IMPORT DATA – CATEGORISED BY PRODUCT CATEGORY AND COUNTRY OF IMPORT

Product categories were also assigned to the ABS import data, using the Product Environmental Footprint (PEF) category rules for apparel and footwear as the reference.

Assumptions were required to classify all imports appropriately. Country-of-origin data from ABS was also utilised, with the selected countries representing approximately 90% of total imported material. This allowed for more accurate estimation of transport related impacts and the application of country-specific electricity grid emission factors. For imports categorised under "Other," an average of the transport distances from the top five countries was used.

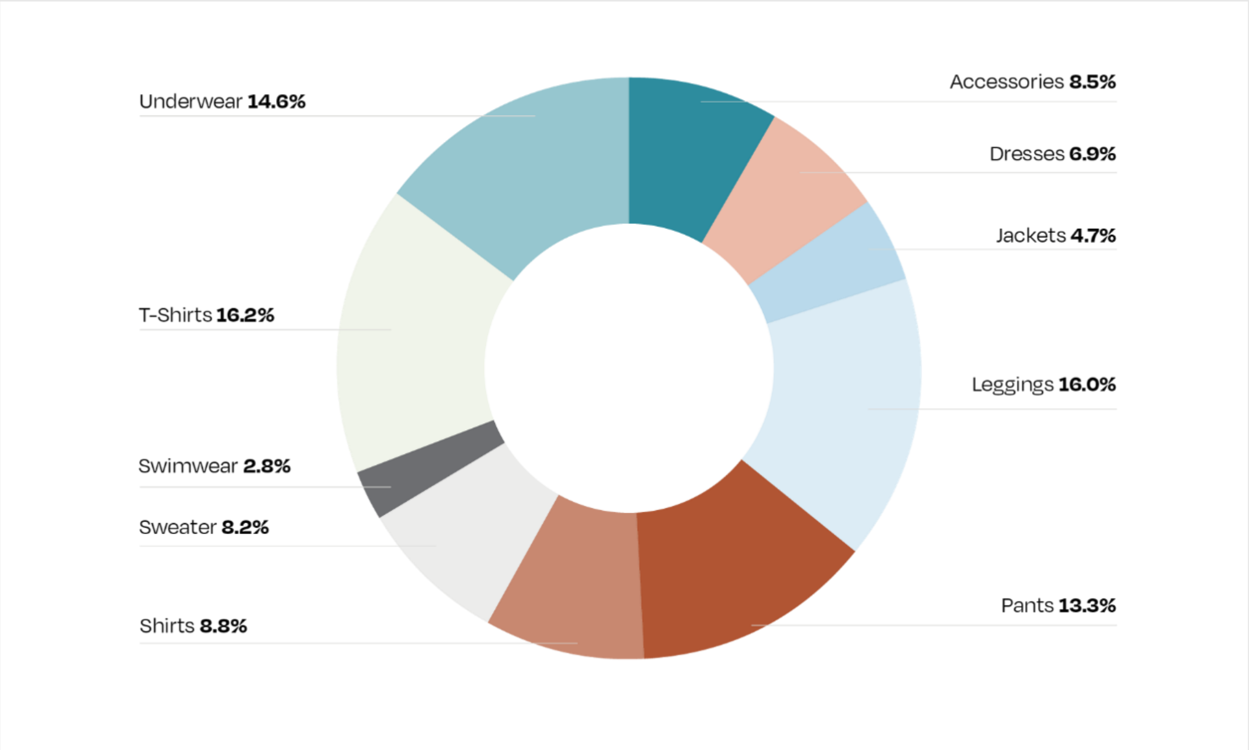


Figure 8: Breakdown of ABS data by product category

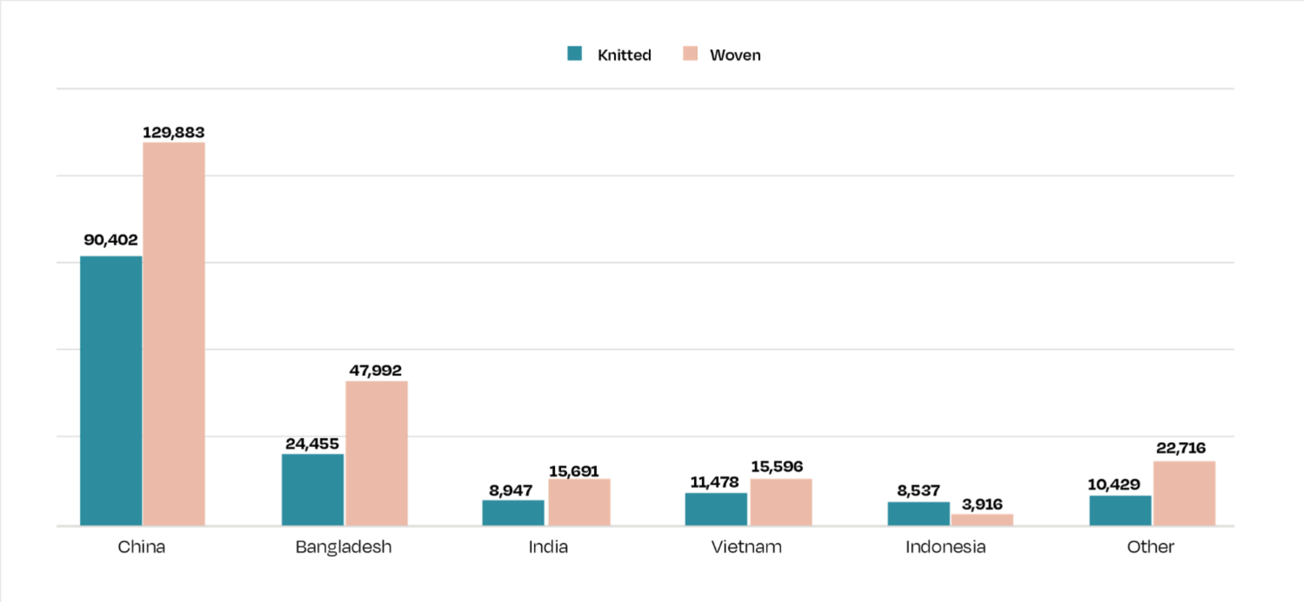
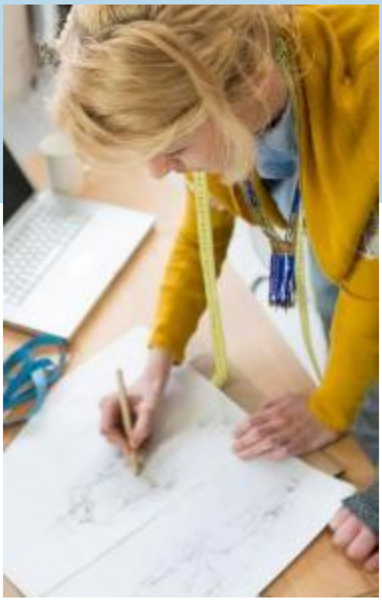


Figure 9: Breakdown of ABS data by country and manufacturing process (tonnes)

Methodology and modelling



This study draws on life cycle assessment (LCA) principles to quantify the environmental impacts from production through to clothing end of life. It provides a country level estimation of the greenhouse gas emissions and water use impact associated with Australia's clothing value chain in 2024.

The LCA followed a cradle-to-grave system boundary using an attributional LCA approach. Climate change and water use were selected as the impact categories.

Life cycle inventory (LCI) data were sourced primarily from secondary datasets, including industry reports and databases such as EcoInvent v3.11 (cutoff).

The assessment focused on two midpoint impact categories: Global Warming Potential (GWP100) and Water Consumption Potential (WCP), as shown in table 4 below.

Characterisation of inventory flows was developed in Excel. Supplementary material has been developed to capture all assumptions and LCA data for transparency, consistency, and reproducibility.

Table 1: The assessment focused on Global Warming Potential (GWP100) and Water Consumption Potential (WCP)

Impact category	Life cycle impact assessment method	Unit	Source for characterisation factors
Climate change	Global Warming Potential over 100 years (GWP 100), excluding biogenic CO_2	kg CO_2e	IPCC (2021)
Water consumption	Water Consumption Potential (WCP)	m^3	ReCiPe 2016

Key inventory data sources

EcoInvent v3.11 (cutoff) and IPCC 2021 were the main sources for emission factors (EFs) and ReCipe 2016 was the main source for water consumption factors. Factors that were not available in EcoInvent were sourced from published reports or LCAs from scientific journals such as Springer Nature or Sciendo.

Country-specific grid electricity EFs were used to make adjustments to reflect garment country of origin. EFs were obtained from government sources such as Australia's Department of Climate Change, Energy, the Environment and Water (DCCEEW). Table 2 shows the country specific Grid Emission Factors used.

Table 2: Country specific Grid Emission Factors used

Country of import	Percentage of total import weight	Grid EF (kg CO_2-e/kWh)	Grid EF source
Australia	N/A	0.63	Australian National Greenhouse Accounts Factors 2024
China	56%	0.850	IGES
Bangladesh	19%	0.641	IGES
India	6%	0.727	The Central Electricity Authority of India (CEA)
Vietnam	7%	0.659	Ministry of Natural Resources and Environment, Vietnam
Indonesia	3%	0.778	IGES

Modelling approach for measuring greenhouse gas emissions

The greenhouse gas emissions for one kilogram of clothing were estimated based on the life cycle system boundary outlined in Figure 1: Garment life cycle stages. All assumptions and data sources used in these calculations are documented in the reference material.

These values were then scaled to reflect the 2024 emission results presented above. For example, in the case of new clothing imports, the raw material, manufacturing, and transport emission results were based on the total import volumes.

Modelling approach for measuring water consumption

The water consumption potential (WCP) for one kilogram of clothing included in the study was calculated based on the life cycle system boundary outlined in Figure 1: Garment life cycle stages. All assumptions and data sources used in these calculations are documented in the reference material. These values were then scaled to reflect the 2024 results presented in this report. For example, in the case of new clothing imports, only the raw material and manufacturing water consumption values were included in the calculation. The impact was then scaled up by applying the total import volumes.

Emissions impact potential

In 2024, Australia's clothing consumption, use, and disposal were estimated to generate approximately 14.5 million tonnes of CO_2-equivalent (CO_2e) emissions. The production phase was the most emissions-intensive, contributing 50% of total emissions.

Emissions impact of the Australian clothing industry in 2024

In 2024, Australia's clothing production, consumption, use, and disposal were estimated to generate approximately 14.5 million tonnes of CO_2-equivalent (CO_2e) emissions as shown in Figure 10 below. The new clothing production phase is the most emissions-intensive, contributing 50% of total emissions.

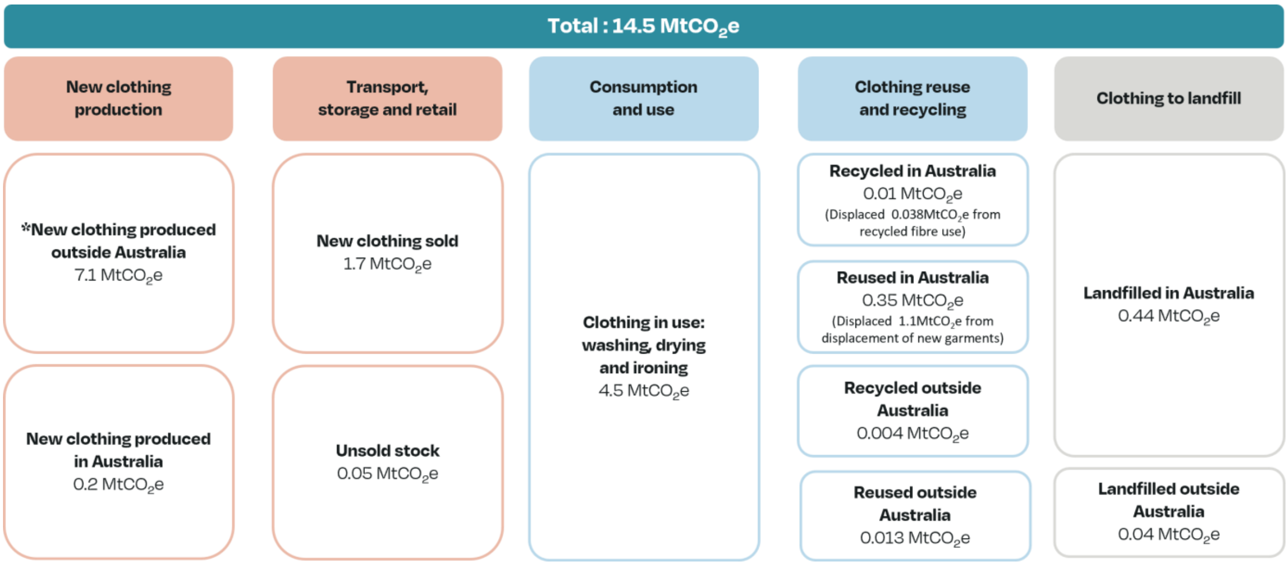


Figure 10: Greenhouse gas emissions impact of Australian clothing industry in 2024

*Based on ABS Import Data = 390,000 tonnes. All other clothing weight based on Seamless 2024 Benchmarking Data.

On a per capita basis, the average Australian was responsible for around 530 kg CO_2e from clothing-related activities in 2024. That's equivalent to the amount of electricity used by an average sized home for two months or driving over 3,600 kilometres in a petrol-powered passenger car, which is further than the distance from Melbourne to Perth in Australia[10].

[10] Equivalent figures used in this report for CO_2e assume that the average Australian home uses 6,100 kWh per year (source: Ecoflow) and the average emissions intensity for electricity in Australia is approximately 0.503 kg of CO_2e per kWh (source: Carbon Positive Australia). Therefore, average Australian household emissions per year are approximately 3.0 t CO_2e. Additionally, new passenger cars in Australia average around 146.5 grams (0.1465 kg) of CO_2 per kilometre (National Transport Commission Australia).

Highlighted results

In 2024, the clothing value chain in Australia resulted in an estimated climate impact of

14.5 $MtCO_2e$

That's equivalent to

the annual electricity consumption of roughly 4.8 million average households.

An estimated

2.4 $MtCO_2e$

could have been avoided if all landfilled clothing was recirculated in 2024

That's equivalent to

the annual electricity consumption of roughly 800,000 average households.

On average, every Australian emitted

530 $kgCO_2e$

from clothing purchased, used, and disposed of in 2024*

That's equivalent to

the amount of electricity used by an average sized home for two months

or

driving over 3,600 kilometres in a petrol-powered passenger car.

* Divided by 2024 Australian population of 27,309,396

Based on the results of this study:

Every time a standard mixed fibre t-shirt is responsibly recirculated through **reuse** an estimated

2.6 $kgCO_2e$

emissions are avoided

That's equivalent to:

driving nearly 18 kilometres in a petrol-powered passenger car

Every time a standard mixed fibre t-shirt is responsibly recirculated through **recycling** an estimated

0.6 $kgCO_2e$

emissions are avoided

That's equivalent to:

driving 4 kilometres in a petrol-powered passenger car

Based on a t-shirt weighing 250 grams and averaged across fibre types.

Key takeaways

New clothing production

In 2024, the most significant contribution to emissions from Australia's clothing value chain came from the production of imported garments, including manufacturing and transportation.

Imported clothing accounted for 50% of the sector's total emissions, contributing 7.1 $MtCO_2e$. With 390,700 tonnes of new clothing imported, this highlights the climate impact of new clothing production. Reducing overproduction, investing in efficiency improvements and preferencing sea freight over air freight offer major opportunities to reduce emissions.

Retail and storage for clothing

After import or local production, additional emissions arise from the retail phase of the clothing lifecycle. Greenhouse gas emissions for this stage account for 12% of the sector's total emissions. These are largely associated with electricity use during storage, handling, and display in physical stores, as well as the distribution process for online sales. Although this stage contributes a smaller proportion of total emissions, it still plays a role in the overall environmental impact of new clothing.

Market share assumptions were applied to allocate emissions between in-store (72%) and online (28%) retail pathways, based on data from Statista (2025). An emissions impact factor for online retail was derived from the "Is E-Commerce Good for Europe?" report by Oliver Wyman and adjusted using Australian grid electricity emission factors.

Clothing consumption and use

The processes contributing to emissions in this phase were washing, drying, and ironing clothes. This stage was also a significant source of emissions in 2024, contributing an estimated 4.5 $MtCO_2e$, which is 31% of the sector's total emissions. This figure was based on estimates of the number of 'active' garments in Australian wardrobes[11], typical laundry frequencies, and Australian's typical laundry patterns.

As this stage is strongly influenced by consumer behaviour, there is potential to reduce emissions by changing laundry practices. Actions such as using energy-efficient washing machines, avoiding unnecessary machine drying, and line drying where possible, can all lower the environmental impact. While these estimates carry a high degree of uncertainty due to behavioural variability and the assumptions required to estimate the impact, they still highlight how individual choices can contribute meaningfully to emissions reduction.

[11] Age trumps gender, income and postcode for consumers' clothing habits. RMIT University.

Clothing reuse and recycling

In total, 199,500 tonnes of clothing were diverted from landfill in 2024, a total emission impact of 0.377MtCO2-e. This is 3% of the sector's total emissions. Of this, 87,000 tonnes were reused or recycled within Australia, while over 112,500 tonnes were exported.

The emissions associated with diverting clothes from landfill within Australia included emissions from transportation, recycling processes and electricity use when sorting and reselling reused clothes. However, only the transportation emissions were calculated for exports, as the recirculation of clothes occurring outside of Australia is outside the scope of this report.

To reflect the impact of circularity, system expansion was applied to account for the avoided emissions from reused and recycled garments arising from the displacement of new clothing and virgin fibres. Reuse was estimated to avoid 1.1 $MtCO_2e$, based on an assumed displacement rate of 64.6% (WRAP)[12] and a weighted upstream avoided emission impact of 22.8 $kgCO_2e/kg$[13]. This means that, on average, around 64.6% of second-hand garment purchases are assumed to directly replace the purchase of new garments.

Landfill

229,000 tonnes of clothing were sent to landfill both within and outside Australia in 2024, resulting in 0.48 $MtCO_2e$, which is 3.5% of the sector's total emissions. In addition to the greenhouse gas emissions generated, clothing that ends up in landfill also has other significant detrimental environmental impacts such as toxic chemical leaching and microplastic pollution.

Avoiding emissions by diverting clothing from landfill

As an absolute measure, an estimated 2.1 $MtCO_2e$ would be avoided if all clothes were diverted from landfill in 2024 (inclusive of avoided emissions from recycled fibre/garment displacement and emissions from landfilling the garments).

It is unlikely that all landfilled textiles can be diverted through a single recirculation method. Many garments, especially those at the end of their wearable life, are not suitable for resale. Every year, there will be a proportion of garments which reach the end of their useful life and are not suitable for reuse. To account for these, a combination of recirculation strategies has been modelled.

Due to data limitations on the condition of clothing in landfill, assumptions were based on an RMIT survey of 3,080 Australians[14]. In response to the statement about why garments are discarded in bins: 29% strongly agreed with the statement, "Clothes are in such bad condition nobody would wear them again".

[12] **https://www.wrap.ngo/resources/report/displacement-rates-untangled**

[13] Weighting was based on the 2024 import split between fibre types

[14] **Age trumps gender, income and postcode for consumers' clothing habits**. RMIT University.

Based on this, 29% of disposed textiles are assumed unsuitable for reuse and are instead allocated to recycling. The remaining 71% is allocated to reuse. Repair of garments is not separately modelled due to the need for further research into its larger scale impact. [15]

Key takeaways

The results indicate that while the emissions associated with sorting and retailing reused clothing are higher than those from sending clothing to landfill, the climate benefits of reuse far outweigh these impacts. In addition to the greenhouse gas emissions generated, clothing that ends up in landfill also has other significant detrimental environmental impacts such as toxic chemical leaching and microplastic pollution which have not been assessed within the scope of this report.

Recirculating garments extends their lifespan and may also help to reduce demand for new garment production, which, as shown in the 2024 Australian clothing value chain emission results, is the most significant contributor to the total emissions.

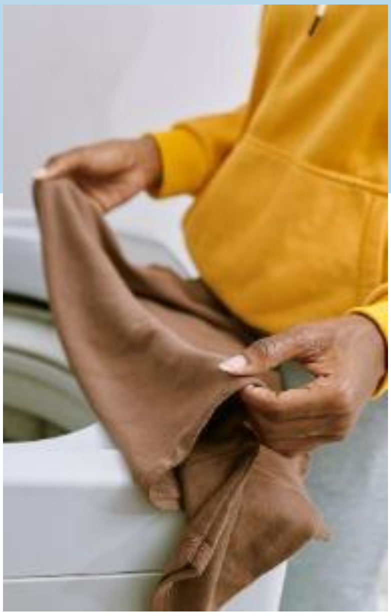
Switching from landfill to recycling also leads to emissions reductions. It is important to carefully consider designing for circularity at the beginning of the clothing lifecycle, as thoughtful application can enable increased recycling and keep clothing textiles in use over multiple lifecycles.

The emissions analysis also raises the point that the 112,500 tonnes of clothing currently exported to international markets for reuse or recycling could potentially offer greater value if retained within Australia.

Overall, the findings highlight the untapped potential of textiles currently sent to landfill within Australia.

[15] The values presented above are based on theoretical diversion scenarios. An important additional consideration is Australia's actual capacity to recycle and reuse this volume of clothing, which may present logistical and infrastructure limitations under current conditions.

Water consumption



In addition to emissions, the water consumption associated with Australia's clothing value chain in 2024 was also significant. It is estimated that 1.8 billion cubic metres of water were consumed across the clothing value chain that year, equating to an average of 66 cubic metres per person. That's equivalent to 132,000 bottles of water or 440 full bathtubs per person.[16]

Water usage impact of the Australian clothing industry in 2024

In addition to emissions, the water consumption associated with Australia's clothing value chain in 2024 was significant. Water usage is an important environmental impact as excessive consumption can reduce river and groundwater levels, which can cause habitat loss for plants and animals, increase pollution concentrations, and negatively impact water quality. This adds to the pressures which increased droughts and floods are already placing on water supplies and infrastructure.

Total : 1,800 million m^3		
New clothing production 1,537 million m^3	**Transport, storage and retail** 0.154 million m^3	**Consumption and use** 320 million m^3
New clothing produced outside Australia 1,500 million m^3	**New clothing sold** 0.15 million m^3	**Clothing in use: water use for laundry** 320 million m^3
New clothing produced in Australia 37 million m^3	**Unsold stock** 0.004 million m^3	

Figure 11: Water consumption potential impact of Australian clothing industry in 2024

[16] Equivalent figures used in this report for water use are based on a 500 ml bottle of water and a bathtub which holds 150 litres. Figures on the following page also assume that a standard Olympic-size swimming pool contains 2,500,000 litres of water (source: The Bureau of Meteorology, Australia).

Highlighted results

In 2024, the clothing value chain in Australia consumed an estimated

1.8 billion m^3

of water

That's equivalent to

720,000 Olympic sized swimming pools

An estimated

262 million m^3

could have been avoided if landfilled clothing were re-circulated in 2024

That's equivalent to

104,800 Olympic sized swimming pools

On average, an Australian emits

66 m^3

of water from clothing purchased, used, and disposed of in 2024*

That's equivalent to

132,000 (500ml) bottles of water or 440 full bathtubs per person

*Divided by 2024 Australian population of 27,309,396

Based on the results of this study:

Every time a standard mixed fibre t-shirt is responsibly recirculated through **reuse** an estimated

600 litres

of water consumption could be avoided

That's equivalent to

around four full bathtubs

Every time a standard mixed fibre t-shirt is responsibly recirculated through **recycling** an estimated

470 litres

of water consumption could be avoided

That's equivalent to

more than three full bathtubs

Based on an average t-shirt weighing 250 grams and averaged across fibre types.

Key takeaways

New clothing production

In 2024, the largest contributor to water consumption in Australia's clothing value chain was the production of imported garments. Imported clothing accounted for approximately 80% of the sector's total water use, with an estimated 1.5 billion cubic metres consumed. With 386,700 tonnes of new clothing imported during the year, this again emphasises the urgent need to focus on reducing the substantial impact of the production phase. Water use from transportation contributes minimally to the overall total.

Retail and storage for clothing

The retail phase of clothing, including both sales and storage of unsold stock, contributes minimally to the overall water consumption of the Australian clothing industry. Water use was only attributed to data centres supporting online retail, as in-store retail was assumed to involve negligible, or no water consumption related to garment storage and sales. To estimate water impacts across retail, market share assumptions were applied: 72% was allocated to in-store retail and 28% to online retail, based on data from Statista (2025).

Clothing consumption and use

In 2024, the use phase of clothing accounted for 18% of the total estimated water consumption. This calculation was based on the estimated number of garments in use, and the average number of wash loads per Australian annually. It was assumed that each wash consumes 90 litres of water, with an average load size of six kilograms. The same laundry patterns applied in the emissions potential use phase were considered and using an average of 2.5 wash loads per person per week, the total water consumption during the use phase was estimated at approximately 320 million cubic metres.

Clothing reuse and recycling

For this study, mechanical recycling was assumed, which involves minimal to negligible water consumption. Based on a weighted average water displacement factor of 2.58 m^3 per kilogram, mechanically recycling 10,000 tonnes of textile material in 2024 could avoid approximately 19 million m^3 of water use.

The reuse of 77,000 tonnes of clothing resulted in an estimated 0.03 million m^3 of water consumption from online sales but avoided around 262 million m^3. That is equivalent to 26 litres per Australian per day over one year. This estimate is based on a 64.6% displacement rate and a weighted average of avoided water consumption potential of 3.7 m^3 per kilogram of clothing.

Landfill

An estimated 220,000 tonnes of clothing was sent to landfill in Australia in 2024. Although textiles landfill contributes minimally to overall water consumption, clothing that ends up in landfill also has other significant detrimental environmental impacts such as toxic chemical leaching and microplastic pollution.

Emission reduction analysis

The production phase of the clothing lifecycle in Australia has the most significant emissions impact and offers the greatest opportunity for abatement through reducing overproduction and increasing production efficiency. Utilising renewable energy and preferencing sea freight over air freight can also reduce emissions.

Emission reduction potential for clothing pathways

Figure 12 shows the percentage split between different clothing pathways, including landfill, reuse and recycling for clothing in 2024, according to the Seamless 2024 National Clothing Benchmark for Australia.

Emission factors were assigned to each pathway based on sources including NGER's, EcoInvent, and studies by Khan et al (2025) and Golkaram and Heemskerk (2022) for recirculation emission factors.

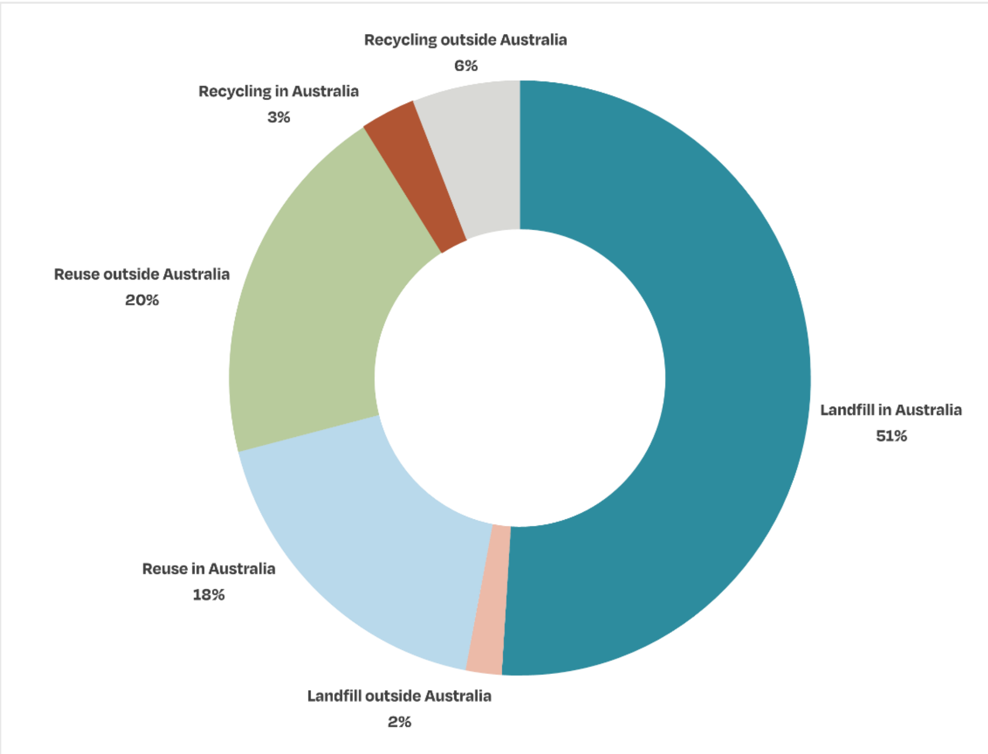


Figure 12: End of life pathways for clothing in Australia in 2024

If all the clothing imported into Australia in 2024 was:

- Landfilled in Australia this would result in an estimated 0.78 Mt CO_2e.
- Repaired at home, this could potentially displace 7.3 Mt CO_2e.
- Resold, this could potentially displace 4 Mt CO_2e .
- Mechanically recycled, this could displace 1 Mt CO_2e.[17]

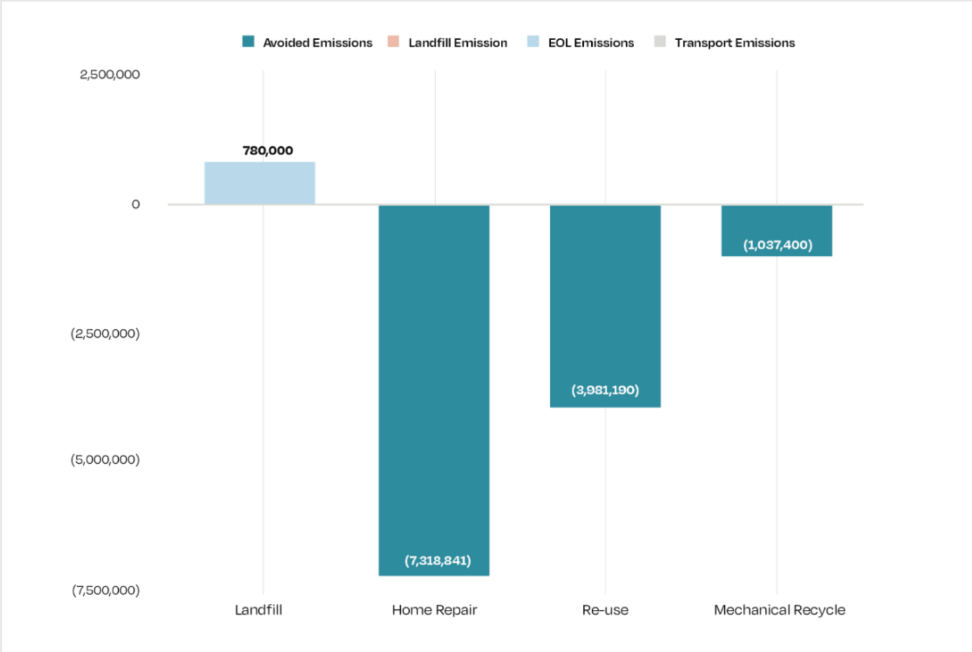


Figure 13: Total potential greenhouse gas emissions impact of clothing pathways in Australia 2024 (t CO_2e)

Increasing production efficiency

Clothing production, particularly the cut and sew process, generates waste in the form of fabric offcuts. As a result, producing one kilogram of finished garments requires a greater input of fabric. This additional material demand and the associated upstream emissions have been accounted for in this study. An 85% material efficiency rate was assumed for the apparel cut and sew process.

Improving the efficiency of this process can lead to an emissions reduction of 226,979 t CO_2e. This assumes an increased 90% efficiency rate by reducing the materials required for one kilogram of finished garments from 1.15kg to 1.10 kg of fabric.

This optimisation could be achieved through approaches such as implementing lean manufacturing principles, adopting automation technologies, and enhancing workforce training including circular clothing design training.

[17] Note that these estimates are based off one reuse/repair of garments. In reality, multiple re-circulation loops could occur and potentially displace more emissions, however, garments also eventually reach the end of their wearable life, and these emissions have not been considered in reuse/repair. The best option would be to recycle at the end of wearable life over landfill based on impacts of landfill vs recycling above.

Emission reduction from renewable energy use

Using renewable electricity for second hand sale operations

If renewable electricity were used in the sorting and retail operations of second hand sales, it would significantly reduce the emissions associated with reuse. This is because these emissions currently arise from electricity consumption in retail stores and data centres.

Switching to renewable electricity for retail operations

The retail of clothing consumes electricity in stores, distribution and data centres, resulting in an emissions impact. An increase in the percentage of online sales from 23% to 50% of the market would reduce the retail emission impact per kg of material by 1.05 kg CO_2e as online sales have a lower impact. However, if all stores in Australia utilised renewable energy there could be an estimated 1.7 million t CO_2e reduction in emissions arising from retail sales of imported garments.

Tier one suppliers switching to renewable energy

Renewable energy is becoming increasingly accessible to suppliers in the clothing industry. If 100% of tier one suppliers were to use renewable energy, emissions could be reduced by 764,519 t CO_2e, assuming that tier one suppliers are responsible for cutting and sewing garments.

As China is the top source of garment imports to Australia, the decarbonisation of its electricity grid is particularly impactful. An estimated 465,100 t CO_2e in emissions from tier one suppliers could be avoided through grid decarbonisation alone, with an even greater reduction possible when considering electricity use across the entire manufacturing process. This shift is already underway, with China significantly expanding its solar capacity and investing in renewable energy.[18]

Replacing air with sea freight

Transporting goods by air uses considerably more energy and produces significantly more emissions than transporting goods by sea. By replacing the shipment method from air to sea freight, the Australian clothing industry could reduce emissions by 278,286 t CO_2e. This is assuming 33,700 tonnes of clothing are imported by air[19] as reported in the Seamless 2024 National Clothing Benchmark for Australia.

[18] Source: The Guardian, 2025

[19] 337,000 tonnes is 9% of total new clothing imports into Australia in 2024, which increased by 16% compared to 2023.

Key takeaways from emission reduction analysis

The production phase of the clothing lifecycle in Australia has the most material emissions impact and offers the greatest opportunity for abatement through reducing overproduction, investing in efficiency improvements and preferencing sea freight over air freight.

When considering use phase and end of life scenarios:

- Repair and reuse deliver the greatest emissions reduction potential.
- Recycling offers substantial emissions benefits, which improve by 30–40% when powered by renewable electricity.
- Transitioning to renewable energy presents a major opportunity across the clothing lifecycle and could collectively reduce emissions by over 2.5 million t CO_2e.

Summary

This report highlights that transitioning from today's largely linear model to a circular clothing economy and net zero, offers a major opportunity to reduce greenhouse gas emissions and water use impacts of Australia's clothing value chain.

In 2024, Australia's clothing value chain produced 14.5 million tCO_2e, which is equivalent to the annual electricity consumption of roughly 4.8 million average Australian households. More than half of these emissions, 7.1 million tCO_2e, were linked to the production and transport of imported clothing. This stage of the clothing value chain offers the greatest opportunity for abatement through reducing overproduction, investing in efficiency improvements and preferencing sea freight over air freight.

Australia's clothing sector also has a substantial water footprint. In 2024, it consumed 1.8 billion m^3 of water, which is equivalent to 720,000 Olympic sized swimming pools. The production and transportation of imported new clothing accounted for approximately 80% of the sector's total water use, with an estimated 1.5 billion cubic metres consumed.

Additionally, if the clothing sent to landfill in 2024 had been recirculated instead, Australia could have avoided an estimated 2.1 million t CO_2-e. Reusing or recycling clothing that went to landfill could also have avoided roughly 262 million m^3 of water use, which is equivalent to almost 105,000 Olympic swimming pools.

Current export practices also represent a missed opportunity: in 2024, Australia exported 112,500 tonnes of clothing for recycling and reuse. Building the capability to keep and process more of these materials onshore would unlock new business opportunities and help grow a domestic circular clothing economy.

Consumer behaviour is also important for Australia's transformation to a circular clothing economy and net zero. The emissions and water savings from recirculating garments rely on second-hand or recycled items displacing at least some new purchases. Moving away from fast, trend-driven buying patterns and rapid shipping is essential to reducing production impacts and supporting a more circular system.

Limitations and future work

This Life Cycle Assessment provides a high-level baseline estimate of the emissions and water use impact associated with the clothing system in Australia for 2024. As with all LCAs, the results represent modelled estimates rather than precise measurements. Assumptions were applied across the LCA study which introduces a degree of uncertainty.

Additionally, the assessment has not yet incorporated detailed process-level data across all stages of each material life cycle. As data availability improves, future iterations of the study can incorporate greater detail and refinement to enhance accuracy and scenario modelling. All assumptions made have been detailed in supplementary material.

This study provides a benchmark and foundation for future work, such as exploring additional impact categories including social impact, refining the use phase impacts to account for differences between fibre types, their origins and production practices, and comparing the lifetime impacts of various natural and synthetic fibres. Future reports will be informed by consultation and data sharing with Seamless supporters such as Woolmark and Cotton Australia and by aligning with evolving international standards and research underway by organisations such as Textile Exchange.

Further research could also incorporate more primary data, improve the accuracy of recycling impact assessments for different fibre types, investigate large-scale garment repair, and evaluate the second life of recirculated garments.

Seamless

Appendices

Unravel Carbon

Glossary

Acronym	Term	Description
ABS	Australian Bureau of Statistics	Australia's national statistical agency responsible for collecting and publishing data.
CO_2	Carbon Dioxide	A naturally occurring greenhouse gas and a major contributor to climate change when emitted by human activities.
CO_2e	Carbon Dioxide Equivalent	A unit used to express the impact of different greenhouse gases as an equivalent amount of carbon dioxide, based on their Global Warming Potential (GWP) over a specific time period.
	Clothing/Garments	These terms refer to finished textile products intended to be worn, such as shirts, pants, dresses, and jackets. They are used interchangeably throughout this LCA study for simplicity, as both broadly describe the same category of consumer apparel.
DEFRA	Department for Environment, Food and Rural Affairs	UK government department responsible for environmental protection and policy.
EF	Emission Factor	A coefficient that quantifies emissions per unit of activity, material, or energy use.
EOL	End-of-Life	In LCA, this refers to the final stage of a product's life, including disposal, recycling, reuse, or energy recovery. It accounts for the environmental impacts and potential benefits associated with how a product is managed after initial use.
GWP	Global Warming Potential	A metric used in Life Cycle Assessment (LCA) to quantify the relative climate impact of different greenhouse gases by measuring the total amount of heat they trap in the atmosphere over a specific time horizon, expressed in terms of carbon dioxide equivalents (CO_2e). Note: "emissions" is also used throughout the study to refer to the global warming potential impact.
kg	Kilogram	A unit of mass equal to 1,000 grams.
kg CO_2e	Kilograms of Carbon Dioxide Equivalent	A metric expressing the climate impact of greenhouse gases in kilograms of CO_2-equivalent.
LCA	Life Cycle Assessment	A method to assess environmental impacts over the full life cycle of a product or process.

Acronym	Term	Description
NGER	National Greenhouse and Energy Reporting	An Australian legislative scheme for reporting greenhouse gas emissions, energy production, and consumption – managed by Australia's Clean Energy Regulator.
PET	Polyethylene Terephthalate	A type of plastic commonly used for textiles and bottles.
t CO_2e	Tonnes of Carbon Dioxide Equivalent	Same as above but measured in tonnes (1 tonne = 1,000 kg).
WC	Water Consumption	The total volume of water consumed throughout a product's life cycle or process.
WCP	Water Consumption Potential	An LCA indicator that measures the net freshwater use across a product's life cycle, focusing on water that is consumed (not returned to the same watershed).
kg CO_2e	Kilograms of Carbon Dioxide Equivalent	A metric expressing the climate impact of greenhouse gases in kilograms of CO_2 equivalent.
LCA	Life Cycle Assessment	A method to assess environmental impacts over the full life cycle of a product or process.

Data uncertainty

This study provides a high-level estimate of the emissions impact of Australia's clothing industry in 2024, aiming to establish a baseline of current emissions rather than a detailed product specific assessment. To manage the complexity of the system and available data, several assumptions were made.

Australian Bureau of Statistics (ABS) import data was categorised by fibre type, and emissions were calculated based on the production of one kilogram of clothing. The analysis relies on generic process data from sources such as EcoInvent and peer-reviewed literature, rather than supplier-specific or product-level information.

Consequently, the modelling approach is broad and does not account for detailed variations in garment types, fibre blends, or brand-specific practices. System boundaries include general manufacturing processes, while certain stages like dyeing and bleaching are generalised. These simplifications introduce uncertainty, meaning results should be viewed as indicative rather than exact.

Nonetheless, this methodology offers a valuable starting point to understand the scale of emissions linked to imported clothing in Australia and provides a foundation for future updates as improved data becomes available. It is important to note that key assumptions, such as end-of-life treatments, are based on 2024 data and should be revisited when applying the model to subsequent years.

Data representativeness

Ensuring data representativeness is key to producing meaningful results in this LCA. Where possible, country specific data has been used to reflect the origin of textile production and better align with Australia's actual import profile. Trade data identified major exporting countries, and emission factors were adjusted accordingly to reflect national electricity grid mixes.

For example, 2024 data were incorporated where available, including updated grid emission factors, to enhance the temporal accuracy of the analysis.

The results presented are specific to the Australian clothing industry in 2024. Where country-specific data were unavailable, the best available data from published LCAs were used. All such assumptions are documented.

Sensitivity analysis

Sensitivity analysis in life cycle assessment (LCA) is used to test how changes in key assumptions affect overall results, helping to identify which factors have the greatest influence on environmental impacts.

Sensitivity analysis is conducted for end-of-life (EOL) treatment assumptions and the number of washes during a garment's lifecycle, both of which are highly dependent on consumer behaviour. Other variables, such as the efficiency of apparel manufacturing, have been explored through separate reduction initiatives.

Also, transport emissions are based on import data and are therefore considered less uncertain. Although the transport and distribution phase is not insignificant in terms of the garment life cycle, the majority of emissions arise from electricity use in retail rather than transport, thus, sensitivity analysis in that area is not a priority for this assessment.

Table 3: High level garment life cycle processes

No.	Phase	Process	Description
1.	Raw material	Raw material production	Extraction and processing of raw materials like cotton, petroleum (for synthetics), or sheep (for wool).
2.		Fibre production	Transformation of raw materials into usable fibres (e.g., ginning cotton, spinning polyester).
3.		Yarn production	Spinning fibres into yarn suitable for weaving or knitting.
4.	Production	Bleaching and dyeing	Chemical treatments to clean and colour the yarn or fabric.
5.		Fabric production and finishing	Weaving or knitting yarn into fabric, and applying finishes (e.g., softening, waterproofing).
6.		Apparel makeup	Cutting and sewing fabric into finished garments.
7.	Distribution	Distribution and retail	Transporting garments from manufacturing to stores and selling them to consumers.
8.	Use	Use	The consumer phase, including washing, drying, and ironing of garments.
9.	End of life	Landfill, recycling, and reusing	End-of-life treatments for garments, including disposal and reprocessing.

Sensitivity analysis: end of life assumptions

A sensitivity analysis was conducted to assess the influence of end-of-life (EOL) treatment assumptions on the life cycle impacts of fibres.

The reference scenario was based on 2024 data provided by Seamless for textile waste treatment in Australia, with the following distribution: recycling in Australia (3%), reuse in Australia (18%), landfill in Australia (51%), landfill outside Australia (2%), reuse outside Australia (20%), and recycling outside Australia (6%).

To evaluate the effect of these assumptions, the model was adjusted to reflect 100% of textiles being directed to each individual EOL pathway (i.e. 100% reuse, 100% recycling, 100% landfill in Australia, and 100% landfill internationally).

As expected, the scenarios with 100% reuse or recycling showed significantly lower life cycle emissions compared to landfill, due to the benefits of avoided impacts from displacement of clothing production.

On average, shifting from the reference scenario to 100% landfill in Australia resulted in a 9% increase in emissions, while 100% reuse led to an average 34% reduction in emissions, thus the output is relatively sensitive to increasing recirculation at end of life.

These results indicate that the current EOL assumptions are relatively conservative, reflecting a more accurate representation of Australia's clothing industry, which remains predominantly linear rather than circular in practice.

Sensitivity analysis: use

A sensitivity analysis was conducted to explore how changes in the number of washes during a garment's life affect overall emissions. The model was adjusted to reflect a 50 percent increase and a 50 percent decrease in the number of washes. The results show that the use phase, particularly washing and drying, can significantly influence total emissions. This part of the life cycle is shaped by consumer behaviour, which introduces a high degree of uncertainty into the analysis.

While washing a garment more often increases emissions, keeping it in use for longer may still have a lower overall impact if it reduces the need to buy new clothing. Fewer washes may suggest a shorter garment lifespan, potentially leading to more frequent replacement and higher production impacts.

These findings highlight that the results are sensitive to assumptions about the use phase. They also show the importance of understanding real-world consumer habits.

Because clothing care varies widely between consumers, caution is needed when interpreting use phase impacts in life cycle assessments.

Table 4: Sensitivity analysis: use

Scenario	Impact per 1kg/wash (kgCo2-e)	Average lifetime impact of 1kg of apparel (kg CO2-e/kg) Including wash, iron, dry	Average number of washes (lifetime)
50% decrease in number of washes	0.46	15.20	33.23
Reference	0.46	10.10	22.00
50% increase in number of washes	0.46	5.10	11.08

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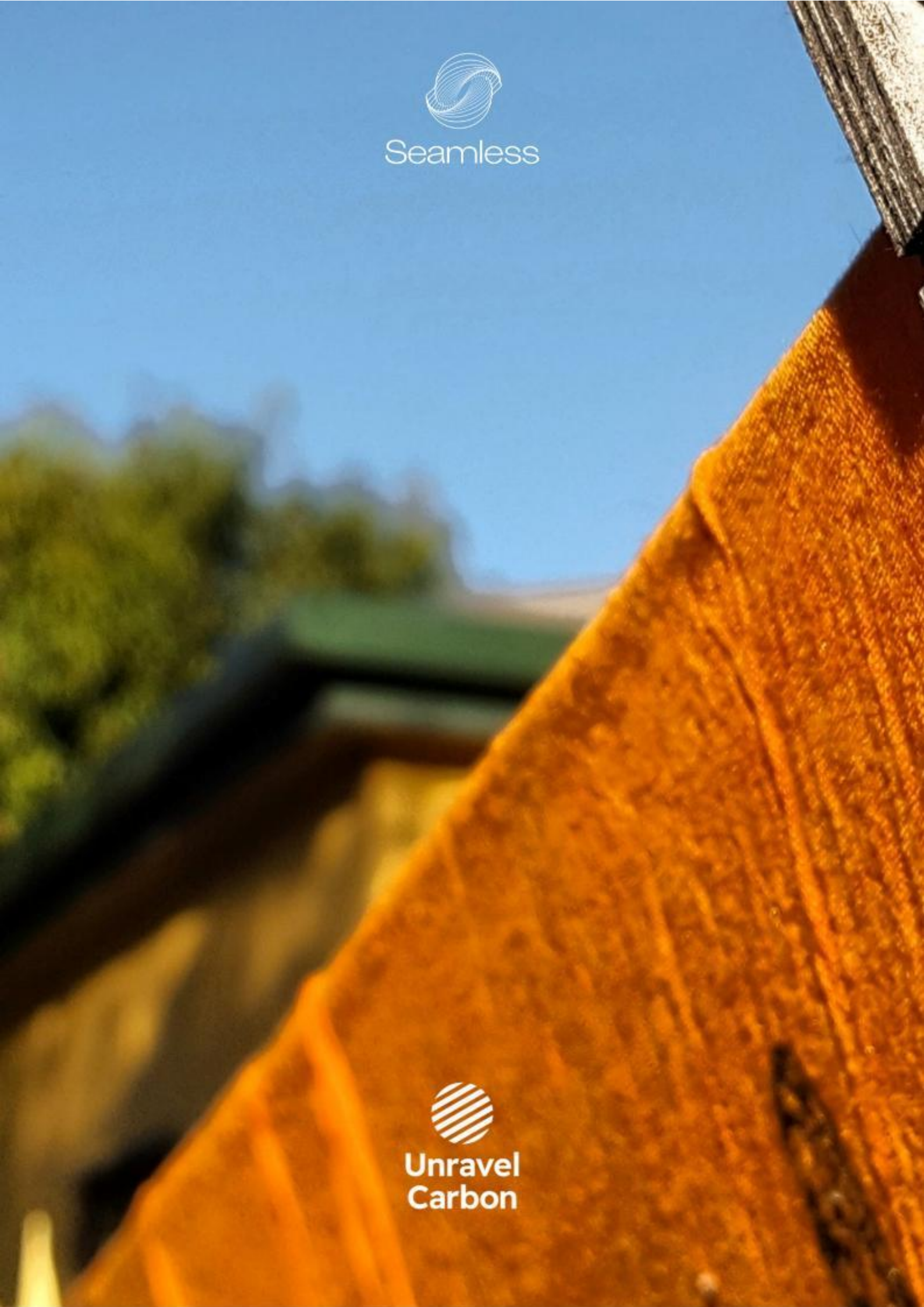
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