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Single Use Cups vs. Reusable Cups:

A Comparison of their Environmental Impact.

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All information is correct as of March 2025 and obtained via publicly available, cited resources. We welcome any questions or suggestions to further develop this resource to continue to support the elimination of single use plastics at events and venues in Australia.

Please email to **hello@bettercup.com.au** should you wish to make a suggestion or contribution to this resource.

Introduction.

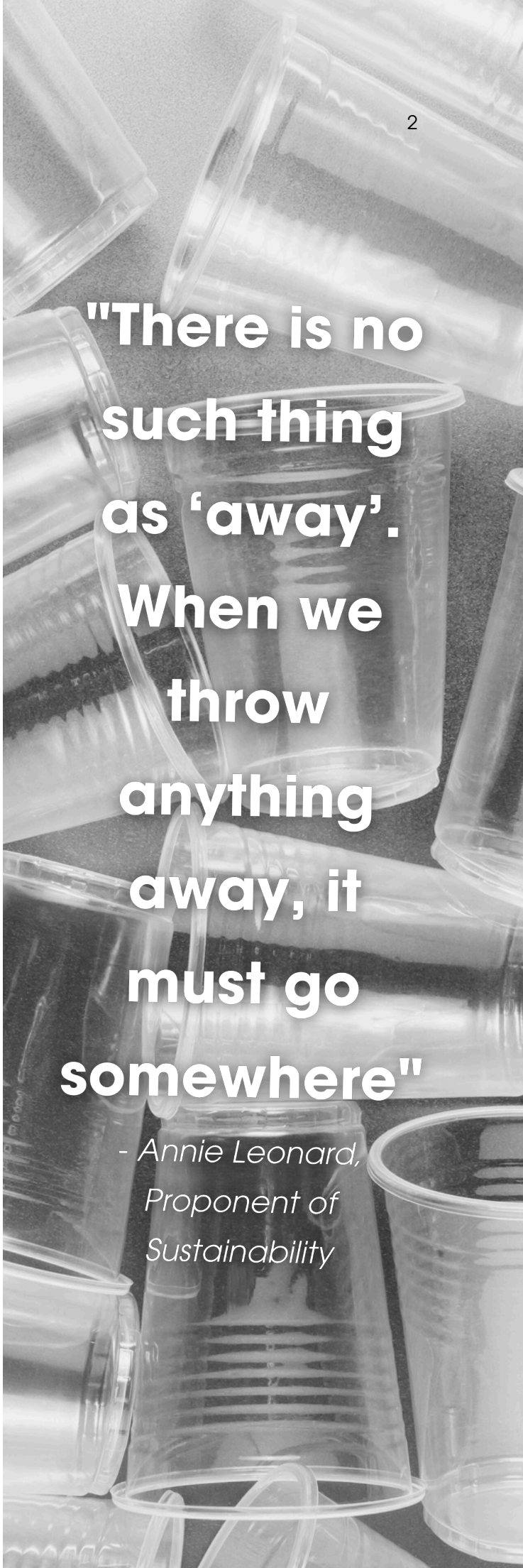
As a result of tightening regulations, increased reporting requirements and public sentiment, businesses in every industry are facing mounting pressure to investigate and adopt environmentally responsible practices.

In Australia, the events industry has historically been a significant contributor of single-use plastic waste. Large-scale gatherings including festivals, event venues and stadia generate millions of discarded cutlery, cups, plates, straws, water bottles and other packaging each year. As regulations tighten, organisations are searching for practical and scalable solutions to minimise environmental impact while maintaining operational efficiency.

Among these solutions, reusable cups can be considered as a replacement for single-use cups. Evaluation is required to ensure they deliver on both sustainability goals and operational efficiency.

To assist businesses in evaluating replacement options for single-use cups, we have compiled the below environmental and operational considerations:

1. Environmental Impact of Single-use Cups.
2. Environmental Impact of Reusable Cups.
3. Manufacturing and Material Composition of Reusable Cups.
4. Energy and Water Usage Associated with Washing of Reusable Cups.
5. Considering the Effect of Consumer Behaviour on the Environmental Impact of Reusable cups.



1.1 Environmental Impact of Single-use Cups.

The post-COVID resurgence of outdoor events across Australia – including music festivals, sporting tournaments and large cultural events – has led to an increased reliance on single-use plastic containers including cups, as many events reverted to single-use during the pandemic in order to overcome patron hygiene concerns. Single-use cups are one of the top ten items found littered on beaches around the world (2024). If they don't end up on the beach and make their way to landfill, single-use cups take approximately 450 years to break down.

Large events generate a staggering amount of waste across Australia. For example, in Queensland stadia alone, 1.5 million single-use cups are used per year, resulting in over 12 tonnes of waste. There were 538 music festivals in Australia between July 2022 and July 2023, at which each person generated an average of 2 kilograms of waste per day. Sadly, the result will be about the same for all those events using biodegradable (Polylactic Acid, or PLA) cups, as they do not break down faster than standard plastics when exposed to landfill conditions.

Most cups certified as biodegradable end up in landfill, as there are only 150 commercial composters in Australia that can handle them, compared with 1,168 active landfills. The majority of events also don't have the infrastructure or resources to separate compost waste from the landfill waste stream. Additionally, PLA cups are known to break down into microplastics which affects the product that commercial composters then pass on to end users (Ainali et al., 2022). Paper cups have a small recycling stream in Australia, where they are transformed into construction materials. Unfortunately the process of recycling paper cups is complex, involving shredding the paper and plastic or aqueous film that makes the cup waterproof, which means they are usually consigned to landfill.

1.2 Environmental Impact of Reusable Cups.

Addressing the environmental issues caused by single-use cups is critical for organisations striving to achieve sustainability targets.

While reusables are often positioned as the more environmentally friendly solution to single-use, their actual benefits depend on material composition, manufacturing processes, washing and consumer behaviour.

Determining whether reusable cups are more environmentally friendly than single use cups.

One of the most widely used methods to assess the environmental benefits of reusables is by determining their breakeven point. Breakeven point refers to the number of uses required for the environmental impact of a reusable product to equal the impact of producing and disposing of a single-use item.

In Australia, bettercup and Green Music Australia worked together to determine the breakeven point is 7 uses when comparing a 38g polypropylene reusable cup compared to a PLA biodegradable cup. This includes the energy and water used to wash the reusable cup.

(all data to 2 d.p.)		Reusable bettercup	Compostable PLA cup	Single-use polystyrene cup
Water Usage Comparison (L/Cup)	Manufacturing Consumption	-	0.38	-
	Water Required to Wash Cups	0.06	-	-
	Total	0.06 L / cup	0.38 L / cup	0.0 L / cup
Energy usage comparison (kJ/cup)	Manufacturing Consumption	249.23	434.27	207.6
	Energy Required to Wash Cups	60	-	-
	Total	309.32 kJ/cup	434.27 kJ/cup	207.6 kJ/cup

Table 1. Comparison for reusable, compostable and polystyrene cup.

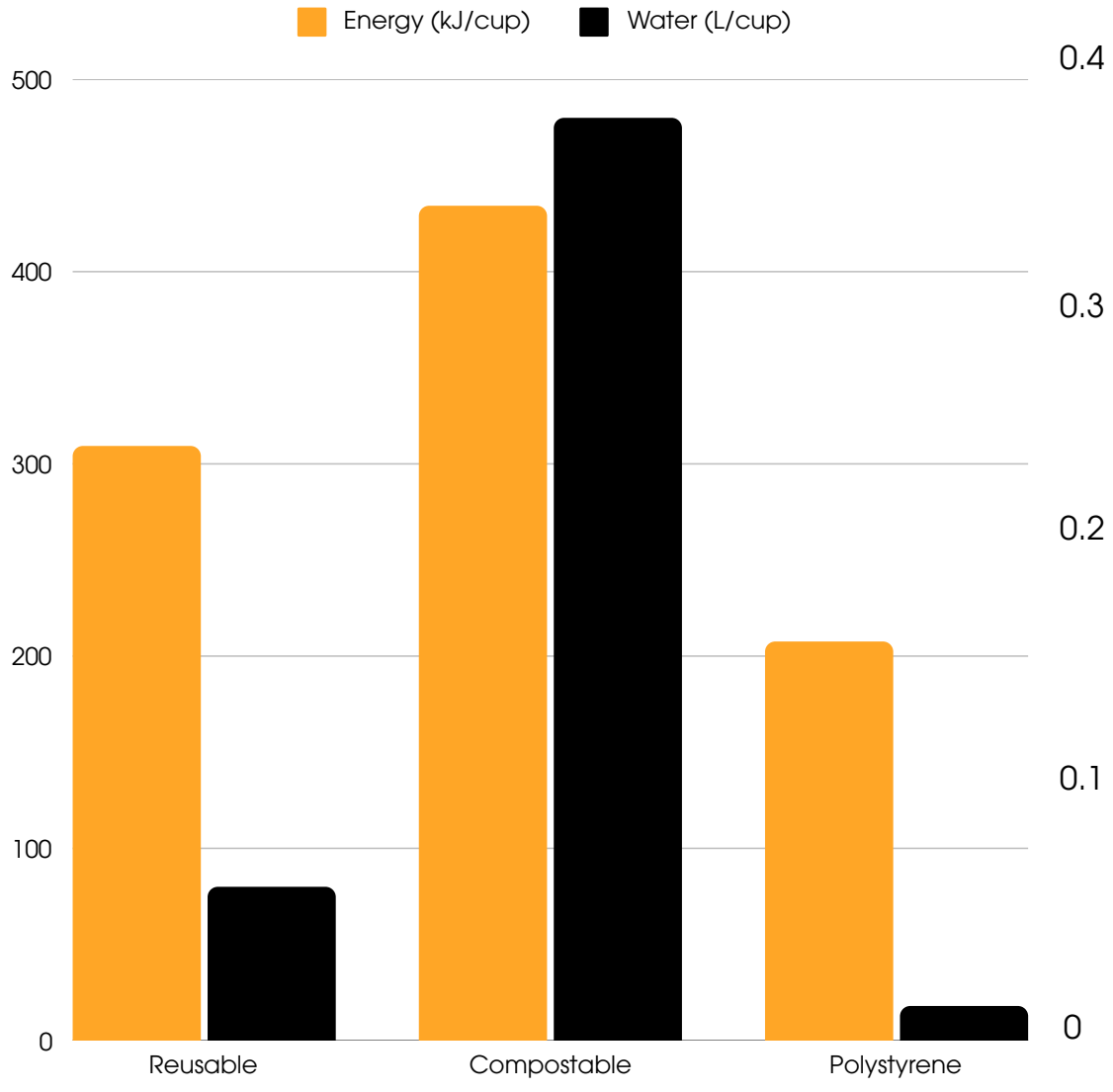


Figure 1. Comparison for reusable, compostable and polystyrene cup. (Source)

It should be noted that this study did not factor in the end of life impact of either the biodegradable cup or the reusable cup.

As mentioned earlier, the biodegradable cup is most likely to end up in landfill due to a lack of commercial composting facilities in Australia. By comparison, the polypropylene reusable cup is kerbside recyclable.

There are many studies comparing the different energy requirements of single-use cups made of different materials, and comparing them to reusable counterparts.

These studies support the breakeven point of reusables being between 3-9 uses for a large proportion of the materials compared.

2. Manufacturing and Material Composition.

How does the manufacturing process impact the cup's sustainability?

Manufacturing accounts for approximately 90% of a reusable cup's total environmental footprint.

This includes:

- The extraction and processing of raw materials (which is approximately 90% of the footprint associated with reusable cups and expanded on below)
- Water and energy consumption during thermoforming
- Emissions from long-distance transportation (eg. from a manufacturer to a supplier or customer).

Beyond production, other factors that contribute to the cup's overall environmental impact include:

- Local transport (eg. to and from an event)
- Washing
- End-of-life disposal, whether through recycling or landfill

Cups produced in countries reliant on coal-powered energy grids tend to have a much higher carbon footprint than those manufactured in regions powered by renewable energy sources (UNEP, 2020).

Additionally, ethical manufacturing factors are critical to ensuring that reusable solutions align with broader sustainability goals (Fair Trade Advocacy Office, 2021). These include:

- Fair wages
- Safe working conditions
- Responsible sourcing of raw materials.

Transport emissions further complicate sustainability assessments. Long-distance shipping, particularly air freight, can significantly increase a product's carbon footprint. A study by the International Transport Forum (ITF, 2021) found that importing reusable cups from overseas can add up to 30% to their total emissions, depending on distance and transportation mode.

Prioritising localised production and distribution can help reduce these emissions while also supporting regional economies.

What are the material options for reusable cups?

The material composition of reusable cups influences carbon footprint, recyclability and durability. Different materials undergo distinct manufacturing processes, with varying requirements for raw materials and energy consumption. Understanding these nuances is essential for assessing the overall sustainability of reusable cup systems, as the choice of material directly affects the environmental outcomes throughout the product's lifecycle.

Some materials that are commonly used in food packaging or are recycled materials have limitations making them unsuitable as material choices for reusable cups at large-scale events.

The table in the next page shows a summary of potential materials for reusable cups that are not suitable for reusable cups at scale.

Table 2. Potential materials for manufacturing of reusable cups and the reasons why they are not suitable for large-scale applications.

Material:	Commonly used for:	Reasons this material is not suitable for reusable cups at scale:
Bamboo Melamine	Reusable foodware and coffee cups	• No clarity meaning it is not possible to print or use pour lines effectively. • Thickness required means they don't stack as well as other materials i.e. stainless steel or plastics, making it not as suitable as other options. • Not recycled due to the combination of organic (bamboo) and synthetic (melamine) components.
Recycled Polypropylene (rPP)	Non food-grade application such as plant pots	• No certified food-grade rPP in Australia means it can currently not be used for food-grade products.
PET	Plastic bottles	• Will warp and discolour at standard commercial washing temperatures. • Releases antimony when exposed to high temperatures (such as sitting in hot storage containers or during washing).
rPET	Plastic bottles (recycled material)	• Will warp and discolour at standard commercial washing temperatures. • Releases antimony when exposed to high temperatures (such as sitting in hot storage containers or during washing).
Glass	Glassware	• Breakable and creates shards on breakage meaning it is too dangerous in crowded or outdoor settings. • Heavy and products made are usually not stackable/difficult to transport.

In Australia, the following materials are used for reusable cups at scale. The energy required to produce 1kg of the material is noted below, as well as the average cup weight and the location of raw materials and manufacturing. Materials need to be transported to their manufacturing location and then to Australia for use.

Table 3. Commonly-used materials for reusable cups in Australia (at scale).

Material	Average Cup Weight	Raw Material Location	Energy to Extract Raw Material / kg	Resultant Energy to Produce 1 Cup	Cup Manufacturing Location
Aluminium	40g	Bauxite ore mined in Australia, Guinea, China & Brazil	210MJ	8,400kJ	China
Stainless Steel	110g	Is manufactured from iron ore mined from Australia, Brazil & China	53MJ	5,830kJ	China
Polycarbonate Plastic #7	40g	China	112.95MJ	4,518kJ	Australia or China
Polypropylene Plastic (PP) #5	38g	China, Korea	73MJ	2,774kJ	Australia or China
HDPE	38g	China	76MJ	2,888kJ	New Zealand or China
Tritan Plastic #7	40g	China	114MJ*	4,560kJ	China

*Tritan is a copolyester developed by the Eastman Chemical Company. Energy required to extract raw material for Tritan plastic has been provided by Eastman Chemical Company and can be forwarded on request to hello@bettercup.com.au.

Observations on material composition comparison.

When reviewing and compiling this data, we observed:

- Most of the cups are a similar weight except stainless steel, which requires a greater thickness to achieve the strength required for reuse.
- The plastics materials and stainless steel have a reasonably similar range of energy required to extract and produce the material, however aluminium has a much higher energy usage to produce.
- The plastics are all largely produced in China, while the metals are mostly extracted from Australia, China or Brazil.
- Transport to the manufacturing destination should be considered as part of the environmental impact, notably with aluminium which can be mined in Australia (4 of the 10 largest mines in the world are Australian), sent to China to be fabricated into cups, and then shipped back for use.
- For the other options, the manufacturing destination is the end-use destination (i.e. for polypropylene cups made in Australia) or the material origin is the same as the manufacturing destination (i.e. polycarbonate cups which are made in China).
- Shipping raw material to the manufacturer will be more economical than shipping finished product because the raw material will take up less space.

What are the end-of-life options for reusable cups?

While reusable cups are designed for long-term use, breakage remains a reality, especially in high-traffic environments where they are handled frequently. Therefore the impact of the end of life options need to be considered (outside of repurposing, which is higher on the waste hierarchy) with consideration to whether recycling after breakage is practicable.

Almost all materials are technically recyclable, but the actual rates of recycling for some materials is much higher than others, due to the infrastructure, machinery and equipment required, energy required and demand for the recycled material.

Table 4. End of life options for reusable cups.

Material	Recyclable?	% Recycling Rate in Australia	Products Manufactured from Recycled Material
Polycarbonate.	• Not widely. • There may be small private programs within Australia	Unknown. Likely to be mostly exported if recycled	Construction materials
Polypropylene.	• Widely. • Recyclable in Australia through kerbside recycling programs.	9%. Able to be recycled onshore.	Containers, automotive parts, or other plastic goods.
Stainless steel.	• Widely. • Infinitely recyclable without loss of quality.	90%. Able to be recycled onshore.	70% recycled to make new stainless steel, 25% to make new carbon or special steel
Aluminium.	• Widely. • Infinitely recyclable without loss of quality.	Approximately 75% (based on worldwide figures), no onshore recycling capability (95% is exported for recycling)	Anything that is made of virgin aluminium
Tritan.	• Not widely. • There are very small private programs within Australia	Unknown. Likely to be mostly exported if recycled	Drink bottles and reusable food containers, appliances
HDPE.	• Widely. • Recyclable in Australia through kerbside recycling programs.	19.7%. Able to be recycled onshore.	Construction materials

3. Energy & Water Associated With Washing Reusable Cups.

What about the water & energy usage associated with washing single use cups?

Energy and water used to wash a reusable cup in commercial washers is generally consistent across similar cup sizes and machines. Water usage is between 60-95ml per cup and energy usage is between 15-60kJ per cup during normal operation.

This is around 4-7 times less water and around 7-30 times less energy than what is required to make one single use biodegradable PLA cup. This supports the breakeven point of 3-9 uses for reusables and suggests that those events who wish to achieve the greatest environmental outcomes should try to get as many uses out of their reusables as possible.

4. Considering the Effect of Consumer Behaviour on the Environmental Impact of Reusable Cups.

The role of consumer behaviour, especially in large-scale events, has a huge impact on achieving the reuse rates to allow the cups to reach their breakeven point.

High-turnover settings, such as festivals, sports events or corporate gatherings complicate efforts to manage materials sustainably. Consumer habits, such as improper disposal and limited engagement with reuse programs, can undermine even the most sustainable material choices. Therefore, a comprehensive sustainability strategy must also incorporate initiatives aimed at influencing consumer behaviour and improving return rates in these high-impact environments.

Successful case studies demonstrate how well-designed systems can drive sustainability outcomes. Australian events such as the Australian Open, Dark Mofo and WOMADelaide have implemented reusable cup programs with different incentives to encourage desired behaviour that they continue to refine each year. Observing, analysing and implementing insights based on consumer behaviour usually leads to increased return rates as patrons adjust to the reusable system and get a better understanding of the behaviour required of them. A Lithuanian study on different return models reports between 78% and 93% of cups being returned for washing, with the highest return rate being achieved with a fully refundable deposit.

Much of the research on sustainability focused behaviour change suggests building new habits through repeated messaging is crucial, posing a challenge for once-off or infrequent events who may only have their patron's attention for a short period of time. There are limited studies on return rates over time in events and venues, with much of the data being on coffee cups or takeaway food venues like McDonalds.

Conclusion.

While reusable cups can offer a more sustainable alternative to single-use cups, their environmental benefits depend on several factors, including material composition, manufacturing processes, and washing practices.

The impact of manufacturing—especially energy use, transport emissions, and ethical production—can significantly affect the overall footprint of reusable cups.

Reusable cups can be a powerful solution for reducing waste, but their success relies on thoughtful implementation, consumer behaviour change to maximise return rates and reach breakeven points, plus ensuring end of life recycling is in place.

Next Steps.

After the cup material and manufacturing options have been considered, the next factor to consider when choosing your reusable cup is the design; the weight, clarity and shape of the cup combined with possible printing options can all have an impact on patron behaviour and experience and consequently, overall environmental impact.

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Please email to **hello@bettercup.com.au** should you wish to make a suggestion or contribution to this resource.

Additional sources used:

- DCEE National Waste report
- Boomerang Alliance Reuse Report
- Berry Global Article
- Food Service Footprint Article