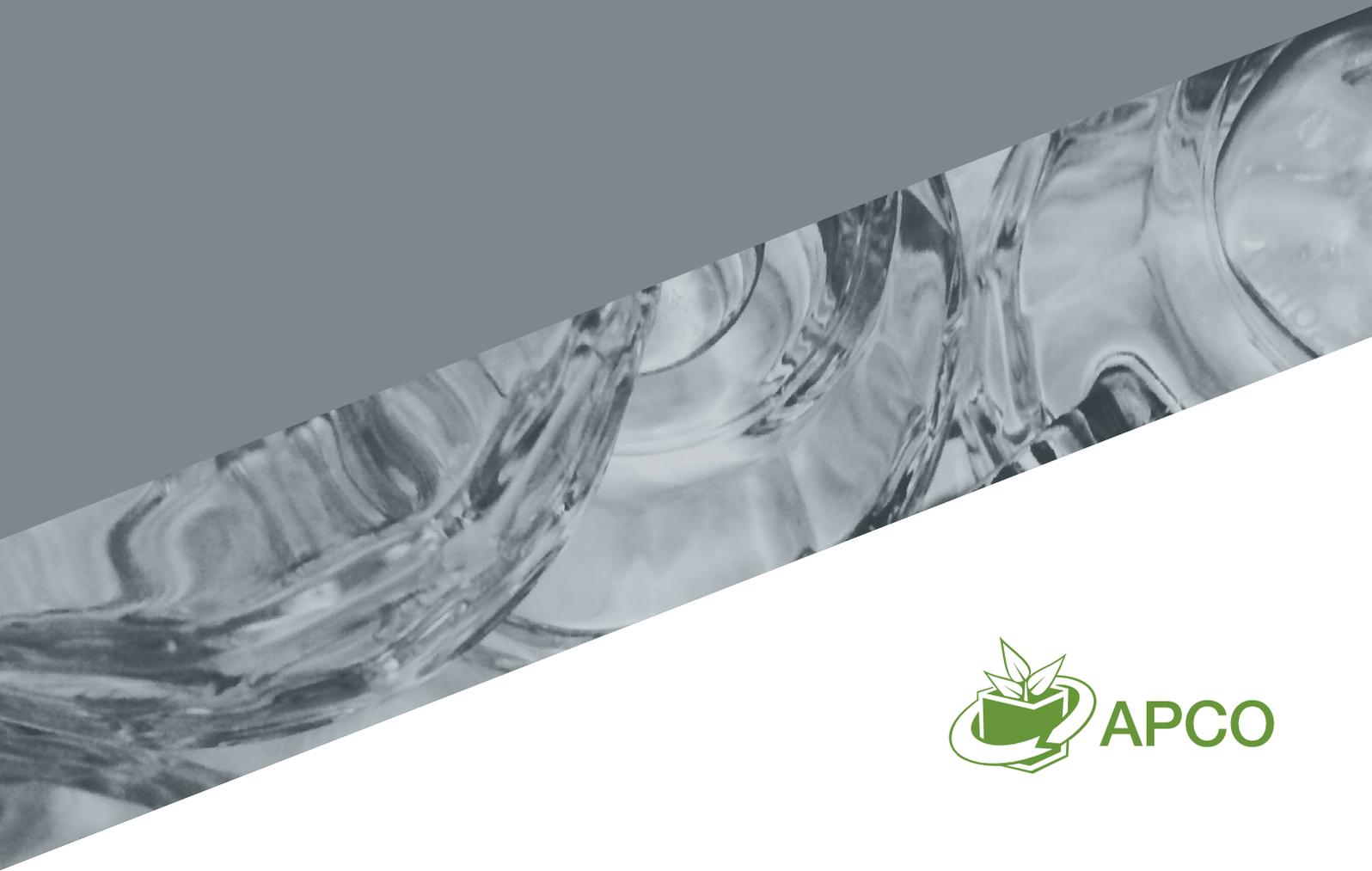


March 2019

# GLASS

WORKING GROUP 2018



# Contents

1. Executive Summary	3
2. Definitions	7
3. Scope	8
4. Stakeholder Identification	8
5. Materiality Statement	10
6. Key Priority Areas	10
7. Baseline Data	11
a. Consumption of Packaging in Australia	10
i. Main applications or sectors	11
ii. Local manufacturers	12
b. Recovery and Recycling	12
i. Reuse systems	12
ii. Collection and sorting	12
iii. Recyclers	13
iv. Recycling technologies and end markets	14
v. Recycling rate	15
8. Support for Glass Recovery	16
9. Lifecycle Approach	17
10. Conclusions	18
a. Conclusions	18
b. Knowledge and data gaps	18

## Disclaimer

APCO and the contributing authors have prepared this report with a high- level of care and thoroughness and recommend that it is read in full. This report is based on generally accepted definitions, data and understanding of industry practices and standards at the time it was prepared. It is prepared in accordance with the scope of work and for the purpose outlined in the introduction. Sources of information used are referenced in this report, except where provided on a confidential basis. This report has been prepared for use only by the APCO, and other third parties who have been authorised by APCO. APCO and the contributing authors are not liable for any loss or damage that may be occasioned directly or indirectly using, or reliance on, the contents of this publication. This report does not purport to give legal or financial advice and does not necessarily reflect the views of individual Working Group members or their organisations. No other warranty, expressed or implied, is made as to the professional advice included in this report.

# Executive Summary

APCO has been charged by Environmental Ministers in Australia to lead the 2025 National Packaging Targets. To progress towards these targets, the following areas will need to be addressed:

- **Packaging design** will need to ensure that it is suitable for recovery through either reuse, recycling or composting
- **Infrastructure** will need to be available for the collection and recovery of all packaging types through either reuse, recycling or composting
- **End markets** will need to be strengthened to support the recycling industry
- **Consumers** will need to be informed and educated about the correct recovery channel for all packaging.

In 2018 APCO convened five working groups to investigate barriers and opportunities to improve the recovery of five 'problematic' packaging materials: glass, polymer coated paperboard (PCPB), soft plastics, biodegradable and compostable packaging, and expanded polystyrene (EPS). The groups worked to establish a shared understanding of the problem and to identify projects to be undertaken by stakeholders in the packaging value chain to support achievement of the 2025 National Packaging Targets for each material category.

The identified projects have been reviewed, prioritised and combined with other initiatives to develop projects for implementation in 2019. Priority projects for implementation in 2019 are summarised in Table 1. The individual projects aim to support the achievement of the 2025 National Packaging Targets by addressing packaging design, consumer engagement, recovery systems and end markets.

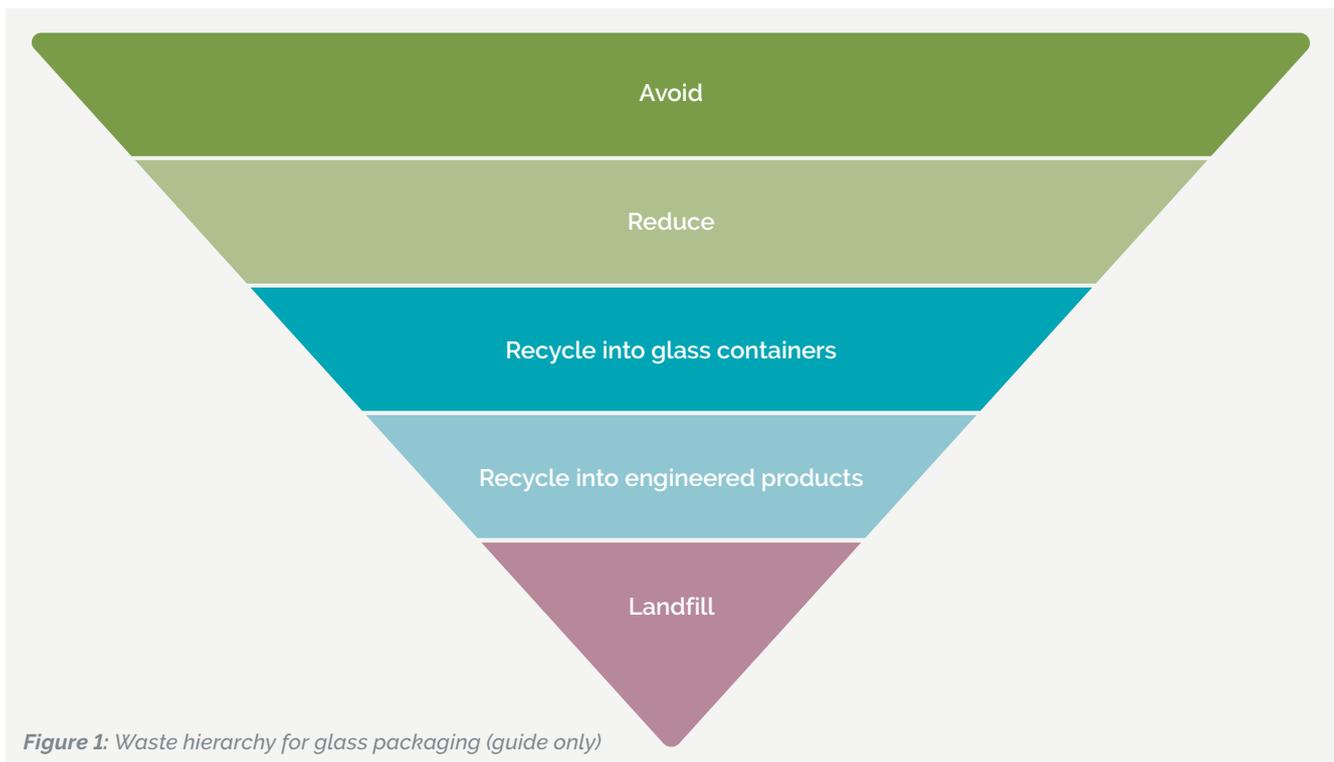
The issues for packaging glass include low recovery rates due to increasing levels of glass breakage in the kerbside system (~35- 50% breakage rates<sup>1</sup>), consumers disposing of glass with general rubbish (~23% placed into the red bin<sup>2</sup>), limited or low- value end markets for broken glass and increasing costs of recovery being borne by local councils and ratepayers.

At end- of- life, the highest value market for recovered glass is generally back into glass containers. This is reflected in the waste hierarchy shown in Figure 1<sup>3</sup>, adapted to support the 2018 Glass Working Group's (the Working Group) approach. It should be noted however, that individual circumstances vary, and in some cases a strict hierarchy may not apply. More data is required, for example, on the environmental costs and benefits of specific end markets. It is also acknowledged that markets for glass need to be efficient and economically feasible.

<sup>1</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.*

<sup>2</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.*

<sup>3</sup> NSW Environment Protection Authority (EPA), 2018. *Too Good to Waste: Discussion paper on a circular economy approach for NSW.* p.23.

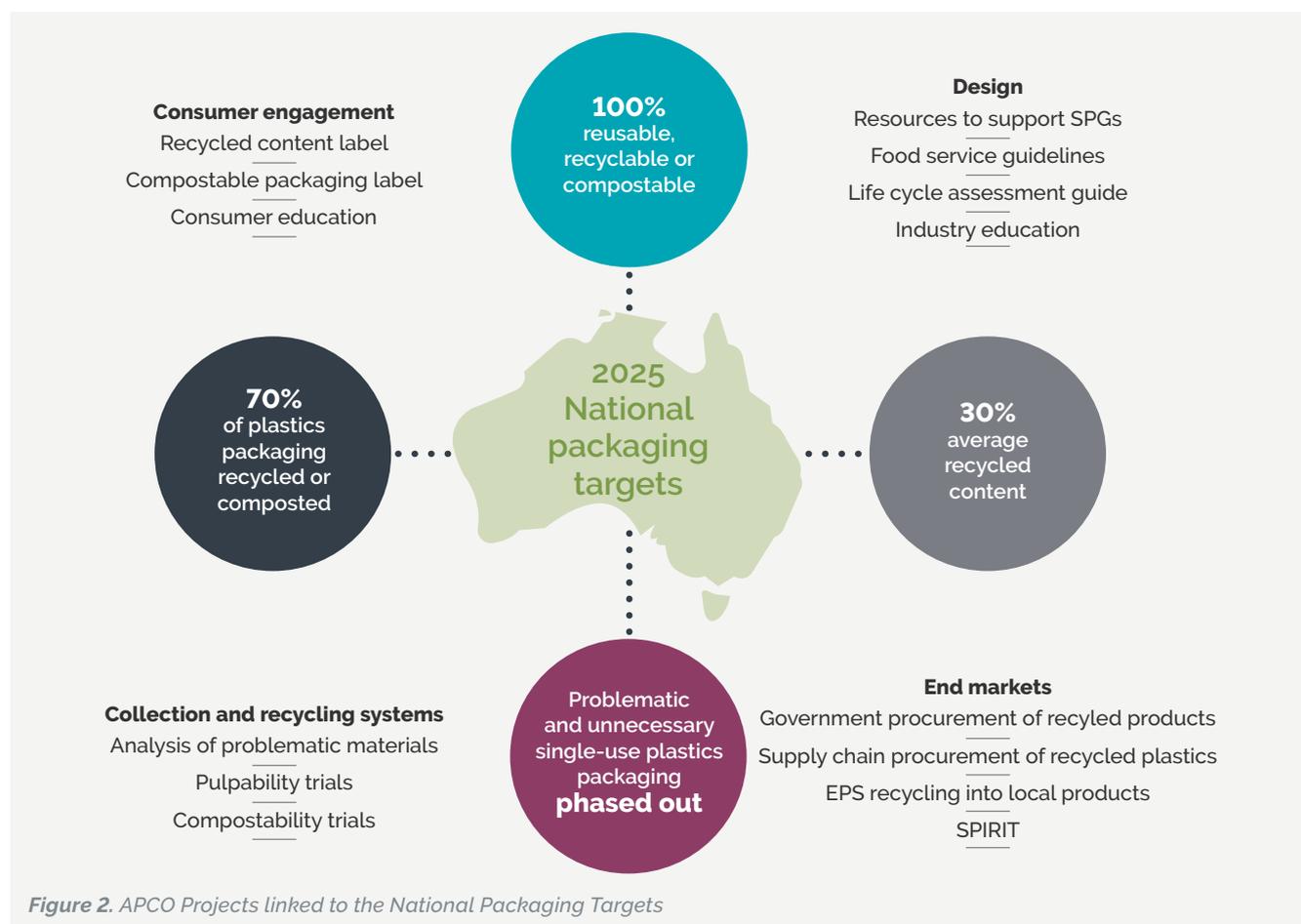


Glass packaging manufacturers have expressed that they would like to source more quality cullet to increase recycled content, however a high proportion of collected glass does not meet their quality specifications for colour and contamination levels. An increasing quantity of quality glass is being sourced from container deposit/refund schemes, this is projected to still be insufficient to meet potential demand for cullet. A priority for metropolitan areas, where feasible, is to improve the quality of collected glass and to divert it to nearby glass manufacturers. Any residual material unsuitable for glass manufacturing, or in geographic areas where transport costs to a glass manufacturing plant are prohibitive, should be recovered through secondary markets achieving highest potential environmental value. Any proposed changes to current systems need to achieve a system-wide benefit, i.e. they need to consider total costs and benefits and avoid cost shifting.

Key themes that emerged from the Working Group include:

- The need for more accurate and detailed data on packaging consumption and recycling
- Suggestions for reduction or elimination of problematic and unnecessary packaging
- Additional resources to support sustainable packaging design and procurement
- Consumer education on packaging reduction and correct recycling
- The need for targeted industry education on packaging design, procurement and recycling
- Collection and recycling infrastructure gaps and lack of local end markets
- Government procurement to support end market development.

This report has been prepared by APCO in collaboration with the APCO Glass Working Group 2018. The purpose of this document is to analyse the current status of glass packaging materials and propose projects to increase the recovery of these packaging materials.



**Table 1. Priority projects for 2019**

PROJECT NAME	DESCRIPTION	APCO 2019 WORKING GROUP
1. Packaging baseline data	1.1 Packaging consumption and recycling	National Packaging Targets Implementation (NPTI)
	1.2 Infrastructure mapping	NPTI
	1.3 Economic analysis of alternative collection systems and end markets	NPTI
2. Public statements on specific materials	Public statements on outcomes of previous 5 working groups	NPTI
3. White paper on problematic and unnecessary packaging	Paper to identify target products/materials and build the case for phase-out	NPTI
4. Options to standardise recycling systems	Modelling strategic options to facilitate achievement of the 2025 NPT	NPTI
5. Resources to support the Sustainable Packaging Guidelines	5.1 Quickstarts: (i) recovery pathways, (ii) glass, (iii) PCPB, (iv) EPS, (v) PET, (vii) labelling	Design
	5.2 Design for soft plastics packaging (build on CEFLEX)	Design
	5.3 Design for compostable packaging	Design
	5.4 Wine packaging guidelines	Design
6. Food service packaging guidelines	Engagement workshops, guidelines & case studies	Design
7. Compostable packaging label	New label to align with the Australasian Recycling Label (ARL)	Design

PROJECT NAME	DESCRIPTION	APCO 2019 WORKING GROUP
8. Recycled content label	New label to align with the ARL	Design
9. Life cycle assessment (LCA) guide	Database and guidelines	Design
10. Consumer education	How to recycle – including the ARL	Systems & Education
11. Analysis of problematic packaging materials	Trials to investigate specific issues	Systems & Education
12. Pulpability trials	Trials to investigate pulpability of polymer coatings, non- wood fibres etc	Systems & Education
13. Packaging supply chain training	Training in collaboration with AIP on PSF – including SPG, PREP/ARL	Systems & Education
14. Models for phase out of single use plastics	Working with Boomerang Alliance on council / community case studies to reduce/replace plastics	Systems & Education
15. Composting trials	Research to analyse compostability of different certified materials	Systems & Education
16. Regional model for soft plastics recycling	Working with Plastic Police to evaluate and document a regional collection and market development model	Systems & Education
17. Remote/regional waste collection partnerships	Workshop on potential partnership- based solutions to packaging waste collection in remote and regional Australia	Systems & Education
18. Government procurement of recycled products	Guide on buying recycled including case studies and technical information	Materials Circularity
19. Supply chain procurement of recycled plastic products	Case studies with APCO Members to identify end market opportunities for soft plastics	Materials Circularity
20. EPS collection and end market pilot	Working with EPSA to document and share a model to collect and reuse EPS in waffle pods	Materials Circularity
21. Sustainable Packaging Information and Resource Interactive Terminus (SPIRIT)	Resource to help industry and government make sustainable purchasing choices	Materials Circularity
22. Innovation Hub	Driving innovation in Australia to address the future of sustainable packaging	Materials Circularity

# Definitions

Broken packaging glass is often categorised as either 'cullet' or 'fines' but exact definitions of these terms vary depending on the capability of sorting

technology. Definitions relevant to glass packaging are presented in Table 2.

**Table 2.** Definitions relevant to glass packaging

TERM	DEFINITION
Cullet	Glass which has been recovered, sorted and crushed and is suitable for recycling through glass manufacturing (typically 8mm- 50mm). In some instances, sorting technology can recover cullet down to 3mm.
Fines	Glass which has been recovered but is considered unsuitable for use in glass manufacturing due to the particles being too small (typically 1mm- 8mm) or contaminated with ceramic, stoneware, Pyrex and plastic. <sup>45</sup> This is not always the case however as there is technology that can grind fines down to 1mm for glass manufacturing (grinding to this level allows contaminants to be incinerated).
Beneficiation	Is the process of sorting, cleaning, crushing and sizing glass to be either 'furnace- ready' for sale to bottle manufacturers or suitable for other markets such as civil construction.
Material Recycling	Reprocessing, by means of a manufacturing process, of a used packaging material into a product, a component incorporated into a product, or a secondary (recycled) raw material; excluding energy recovery and the use of the product as a fuel. <sup>6</sup>
Design	Includes choice of materials, additives, colours, labels, glues, inks, caps and closures, format, dimensions, etc.
Highest potential resource value	Recovery is occurring at the optimal level of the waste hierarchy, based on available recovery systems and sustainability impacts of alternative recovery options (e.g. composting vs. recycling, or recycling vs. energy recovery). Reuse is encouraged prior to recovery when there is evidence that it extends the life of the packaging and achieves positive sustainability outcomes.
Labelling	Can be in the form of a statement, symbol or graphic on a purchased product at any point in the supply chain, but most commonly used at the final point of sale (e.g. retail).
Packaging Recyclability Evaluation Portal (PREP)	An online tool that provides clear, consistent and validated information about the recyclability of specific packaging formats.
Recyclable	In a particular geographical area, at least 80% of the overall population has convenient access to a service that collects the packaging or packaging component, and that this item can be recovered and sorted in a stream where at least 70% of its weight can be recycled into another product. This should consider its design, manufacturing process and most likely way of using, disposing and collecting it.
Recycled content	The proportion, by mass, of pre- consumer and post- consumer recycled material in packaging (AS/ISO 14021). 'Pre- consumer' material is material diverted from the waste stream during manufacturing (excluding rework). 'Post- consumer' material is material waste generated by households or by commercial, industrial and institutional facilities. The amount of renewable or recycled material is expressed as a percentage of the quantity of packaging material put onto the market.
Recycling	Includes both material recycling (maintaining material structure) and chemical recycling (e.g. breaking materials down into more basic building blocks). It explicitly excludes technologies that do not reprocess materials back into materials but into fuels or energy.
Resource recovery rate	Total materials recovered (including material recycling, organics recycling and energy recovery), net of contaminants and residual wastes sent to disposal, divided by total packaging entering the waste stream.

<sup>4</sup> Sustainability Victoria, 2014. Fact Sheet: Market Summary – recycled glass.

<sup>5</sup> APC Waste Consultants, 2017. Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.

<sup>6</sup> Australian Packaging Covenant Organisation, 2018. Towards 2025 discussion paper.

TERM	DEFINITION
Waste hierarchy	Places the highest priority on avoidance (action to reduce the amount of waste generated) followed by reuse, material recycling, organics recycling and energy recovery, consistent with the most efficient use of the recovered resources; and finally, disposal in the most environmentally responsible manner.
Recycled packaging	Packaging is 'recycled' if at least 70% of its weight is recycled (as per Material Recycling definition) into a product, a component incorporated into a product, or a secondary (recycled) raw material; excluding energy recovery. <sup>7</sup>
Material Recovery Facility (MRF)	A facility that processes and separates kerbside recycling materials.

## Scope

The scope of this report includes the recovery and recycling of all container glass consumed in Australia (locally made or imported), including packaging for food, beverage, pharmaceutical and cleaning products. This includes glass packaging for food, beverage, pharmaceutical and cleaning products.

Other consumer and industrial sources of glass out of this scope include drink tumblers, glass panes and building and construction glass. These have not been considered due to their differing composition that inhibits their ability to be recycled through the existing kerbside recycling system.

## Stakeholder Identification

Table 3 depicts the key groups across the packaging value chain that will need to be engaged in the design or implementation of the identified projects.

**Table 3.** Key groups across the packaging value chain

STAKEHOLDER	DRIVERS	CHALLENGES
Householders	Generally, want to 'recycle right'.	Confusion about what is recyclable and what is not.
Collectors / MRF operators	Pressure to find markets for broken glass stockpiles. Drive to stay competitive. Landfill costs.	Compaction for collection efficiency. Lack of knowledge, expertise or interest in market development. Costs of new equipment e.g. for sorting or cleaning. Distance from markets.
Councils	Some leading the way in circular economy (e.g. local markets). Want to maintain viable recycling systems / meet residents' expectations.	Comingled collections reduce glass quality. Cost of introducing an alternative system e.g. source segregated glass.

<sup>7</sup> Australian Packaging Covenant Organisation, 2018. *Towards 2025 discussion paper*.

STAKEHOLDER	DRIVERS	CHALLENGES
Glass container manufacturers	Need to meet rigorous quality specifications. Costs of virgin raw materials, imported glass containers and alternative materials (e.g. PET) drive demand and price for cullet. Cullet reduces energy costs. Meeting sustainability / recycled content targets.	Access to recycled glass that meets quality specifications at right price. Investments in technology/NPD required to further lightweight bottles. Costs of transporting cullet to manufacturing plants.
Brand owners packaging in glass	Meeting sustainability / recycled content targets. Quality / performance specifications for packaging. Generally higher quality from CDS schemes compared to kerbside.	Some concern about increased recycled content causing breakage in filling lines, particularly in pressure filling. Lightweight impact of recycling.
Other glass product manufacturers	Meeting demand for recycled or superior products.	EPA classification of glass as 'waste'. NSW EPA regulations e.g. stockpiling limits, asbestos.
End consumers of recycled product e.g. civil construction	Superior performance of glass sand drives demand in some applications. Shortages of river sand. Interest in 'buying recycled' to support a circular economy.	Perceptions of risk e.g. safety, quality. Lack of awareness of potential applications, specifications, documented trials etc. Concerns about enough supply for major projects. Inertia – unwilling to disrupt status quo.
Industry associations representing and waste and recycling companies	Improved national recycling rates. Financial sustainability of recycling systems.	Some of the challenges experienced by members are listed above.
State and territory governments	Policies to support market development for recycled glass. Regulations to protect the environment, e.g. controlling contaminants in glass sand. CDS schemes to address litter.	Lack of knowledge of costs and benefits of different markets.
Australian Government	National Waste Policy.	Inconsistent policies and regulations between jurisdictions.
Container deposit/refund scheme operators	Legislative and financial support. Generate a higher quality clean stream.	Inconsistent schemes between jurisdictions, no scheme in Victoria or Tasmania.

# Materiality Statement

The national recycling rate for glass packaging is relatively low at around 50%. Challenges for glass include increasing levels of glass breakage in the kerbside system and consumers disposing of glass with general rubbish (~23% placed into the red bin). Around 30% of recovered glass is from fines, which represents an economic loss compared to cullet.<sup>8</sup>

While there is unmet demand for clean, colour-sorted glass to be remanufactured back into

containers; markets for broken, contaminated glass are more limited and some material is currently being stockpiled. There are also concerns that broken glass in commingled bins and trucks can become embedded in paper and paper making equipment, causing problems at the paper mill.

These issues are increasing the costs of glass recovery - costs that are primarily being borne by local councils and ratepayers.

## Key Priority Areas

The key priority areas to be addressed include:

1. **Supply chain collaboration:** Improve collaboration in the supply chain, between government jurisdictions, and between government and industry.
2. **Knowledge base:** Build a stronger knowledge base for system-wide decision-making including material flows, alternative end markets and their cost/benefit.
3. **Packaging design:** Improve packaging design to optimise weight, increase recycled content and remove materials and components that are problematic for recycling.
4. **Consumer education:** Change consumer behaviour to encourage correct recycling at home and away from home.
5. **Collection systems:** Improve collection systems to generate the highest quality of material possible, based on viable collection systems.
6. **Sorting systems:** Improve sorting systems to increase the quality of recycled glass and reduce ~23% of glass that is currently 'lost' in MRFs<sup>9</sup>
7. **End markets:** Increase processing capacity for recycled glass, particularly in alternative (secondary) markets, e.g. in civil construction.
8. **Procurement:** Encourage increased procurement of products made from recycled glass.

<sup>8</sup> Institute for Sustainable Futures, 2019. Final Report: APCO Packaging Material Flow Analysis 2018.

<sup>9</sup> Institute for Sustainable Futures, 2019. Final Report: APCO Packaging Material Flow Analysis 2018.

# Baseline Data

## a. Consumption of Packaging in Australia

Australia's consumption of glass packaging was estimated to be 1.29 million tonnes in 2017- 18, falling from 1.36 million tonnes in 2014- 15<sup>10 11</sup> and increasing from 1.25 million tonnes in 2015- 2016. Home to 32% of Australia's total population, NSW consumes an estimated 436,000 - 460,000 tonnes of glass per annum.<sup>12</sup>

The materials flow analysis (MFA) conducted for APCO in 2019 concluded that:<sup>13</sup>

- The municipal waste stream dominates the glass packaging waste system, accounting for almost 80% of total glass packaging waste flows
- Estimated recovery rate of the glass system is 50%±8%
- Approximately 80,000 tonnes of glass packaging waste was collected and sorted through container deposit collection systems. This amount is anticipated to increase as container deposit schemes are deployed across the country
- About 23% of glass waste is disposed directly to the residual stream, representing losses at the household through incorrect disposal practices. These losses are compounded by a substantial flow of sorting losses directed to landfill from MRFs after collection that is likely owing to rough handling (e.g. breakages owing to compaction in trucks and during sorting)
- There is significant potential to improve overall glass recovery performance by improving material sorting (and handling) where losses are high or diverting glass from the kerbside sorting channel to container deposit scheme collections. This may have benefits for other material streams affected by glass contamination at MRFs (i.e., paper)
- Approximately 30% of glass recovered is from recovered fines, which represent an economic loss when considering the higher value of cullet for packaging manufacturing.

## i. Main applications or sectors

The primary market for glass packaging is the food and beverage industry, for example food and oil jars, bottles including beer, cider, wine, spirits, soft drinks and juices. These sectors use clear, green and amber glass. The pharmaceutical and personal care industries use glass for medicines, vitamins, ointments, perfumes, liquids, creams and tablets, primarily in amber glass containers. Other applications include packaging for homewares, cleaning products and chemicals.

<sup>10</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.*

<sup>11</sup> Industry Edge and Equilibrium, 2017. *National Recycling and Recovery Survey (NRRS): Paper packaging, glass containers, steel cans and aluminium packaging.*

<sup>12</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.*

<sup>13</sup> Institute for Sustainable Futures, 2019. *Final Report: APCO Packaging Material Flow Analysis 2018. p.21- 23.*

## ii. Local manufacturers

There are two container glass manufacturers in Australia, utilising local and imported feedstock:

- O- I (Owens Illinois) – a dedicated glass container manufacturer supplying food, wine, beer, spirit and non- alcoholic beverage markets. With four sites across Australia (NSW, QLD, VIC and SA), O- I is the primary local producer of green beer bottles. The NSW plant is the largest glass container manufacturing facility in Australia, with output exceeding 1.37 billion units per year.<sup>14</sup>
- Orora – is a diversified packaging manufacturer with one site in SA that manufactures the majority of Australia's wine bottles<sup>15</sup>. With state- of- the- art facilities, more than 950 million bottles are manufactured a year for beer, wine, cider, alcoholic ready- to- drink beverages, carbonated soft drinks and juice.<sup>16</sup>

## b. Recovery and Recycling

### i. Reuse systems

Some glass containers can be reused multiple times for the same purpose if designed appropriately. There are limited examples of this in Australia (e.g. some refillable beverage bottles), although they tend to be in very niche markets. Re- filling in Australia is generally perceived as inefficient, both economically and environmentally, for logistical reasons. Glass containers can also be designed to encourage an alternative use by consumers. For example, in 2018, Moccona released a coffee jar with a Peter Alexander print and easily removable label to encourage consumers to keep them for reuse after consumption<sup>17</sup>. Additionally, Kraft designs some of its jars to serve a secondary purpose as a drinking glass<sup>18</sup>.

### ii. Collection and sorting

Collection systems fall into the following four main categories:

- **Kerbside:** Glass has been a foundation material in kerbside programs for over 25 years. These are mostly in commingled (mixed) yellow- lid bins. Typical recovery rates exceed 80% in most council kerbside container recycling programs.<sup>19</sup>
- **Source separated collection:** Ipswich Council in Queensland is currently running a trial to collect glass in a separate container at kerbside.<sup>20</sup> This trial is due to conclude in 2019, with the outcomes to inform this group. Several councils New Zealand have been collecting glass separately, including Dunedin City,<sup>21</sup> and Timaru District Council.<sup>22</sup>
- **Container deposit schemes/Container refund schemes (CDS/CRS):** In addition to kerbside collections, consumers can take glass containers to designated collection points to receive a refund or reward. Deposit schemes are in place in South Australia (SA), Northern Territory (NT) and New South Wales (NSW), and will be introduced in Queensland (QLD) by the end of 2018 and Western Australia (WA) in 2020. In 2016–17, the return rate for glass beverage containers in SA was 84.9% and approximately 34,667 tonnes of glass beverage containers were sent for recycling.<sup>23</sup> Concern has been expressed that the introduction of CDS in NSW will see additional tonnes of clean, whole glass containers favoured by O- I at the expense of MRF glass.<sup>24</sup> The percentage of glass collected through CDS in NSW is currently at 25%, and growing

<sup>14</sup> O- I Australia, 2018. O- I Australia Story: History. Available at: <http://recycleglass.com.au/o-i-australia/history/>

<sup>15</sup> Packaging Gateway, 2018. Amcor Wine Bottle Manufacturing. Available at: <https://www.packaging-gateway.com/projects/gawler/>

<sup>16</sup> Orora Group, 2018. What We Do: Glass Bottles. Available at: <https://www.ororagroup.com/what-we-do/products/glass-bottles>

<sup>17</sup> AltMedia, 2018. Peter alexander x Moccona. Available at: <http://www.altmedia.net.au/peter-alexander-x-moccona/130350>

<sup>18</sup> Ralph Moyle, 2018. Personal consultation.

<sup>19</sup> APC Waste Consultants, 2017. Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.

<sup>20</sup> City of Ipswich, 2018. Glass collection points ready to go in Ipswich. Available at: [https://www.ipswich.qld.gov.au/about\\_council/media/articles/2018/glass-collection-points-ready-to-go-in-ipswich](https://www.ipswich.qld.gov.au/about_council/media/articles/2018/glass-collection-points-ready-to-go-in-ipswich)

<sup>21</sup> Dunedin City Council, 2018. Glass recycling bins. Available at: <https://www.dunedin.govt.nz/services/rubbish-and-recycling/blue-recycling-bin>

<sup>22</sup> Timaru Herald, 2018. Stuff: Glass only bins trial proposed for Timaru. Available at: <https://www.stuff.co.nz/timaru-herald/news/105039009/glass-only-bins-trial-proposed-for-timaru>

<sup>23</sup> South Australia Environment Protection Authority, 2018. Environmental Info: Container Deposits. Available at: [https://www.epa.sa.gov.au/environmental\\_info/container\\_deposit#return](https://www.epa.sa.gov.au/environmental_info/container_deposit#return)

<sup>24</sup> APC Waste Consultants, 2017. Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.

as more collection points are rolled out. In 2017- 2018, it was calculated that glass collected through CDS across all states equated to 79,665 tonnes<sup>25</sup>.

- **Commercial collections:** Waste management companies collect glass containers from pubs, restaurants and other hospitality venues.

### iii. Recyclers

After collection, glass must be beneficiated to reach quality standards required for remanufacture back into glass or into alternate markets. There are limited local reproprocessors of glass, as outlined below, with 6 beneficiation plants located across Australia:<sup>26</sup>

- **O- I** - Most glass coming through commingled kerbside collections goes to beneficiation plants (sorting/crushing) and then to cullet feed at O- I's glass plants. Glass must be colour- sorted, with all contaminants removed. Material specifications allow for a maximum of 15grams of contaminant per tonne. Currently, cullet makes up ~40% of the input to O- I glass manufacture. The company is targeting 60% cullet input into manufacturing and can accept an even higher percentage.<sup>27</sup>
- **Orora** - Utilises glass primarily collected from container deposit sources in SA for manufacturing new glass bottles.<sup>28</sup> Glass received from the SA CDS for manufacture generally requires less cleaning or processing, as it is a cleaner, source separated stream. Regardless, bottle manufacturing requires beneficiated glass to meet strict contamination standards.
- **Glass Recovery Services (GRS)** - one of the newest waste glass recycling company of its kind in Australia, reprocessing glass received from MRFs into a variety of alternate applications, such as sands, rendering and non- slip paint applications. GRS is capable of processing up to 45 tonnes of recycled glass per hour.<sup>29</sup>
- **Re.Group** - Operate four advanced MRFs, including Townsville, with Krystelline Glass Implosion technology. This converts MRF glass into high quality sand products.<sup>30</sup>
- **Envirosand** - A processor of MRF glass in Brisbane that generates fine sands from 100% recycled glass.<sup>31</sup>
- **Benedict Industries** - Had been recovering glass (100,000 tonnes p.a.) in NSW that was outside of the O- I or GRS specification and turning this into glass sand. After years of testing and gaining market acceptance in civil construction markets, the glass site closed in 2015 due to asbestos contamination and regulatory uncertainty.
- **Alex Fraser** - Located in Victoria and Queensland, specialises in the use of recycled materials in civil works. Recycled glass has been used in a range of applications including as subsurface drainage, pipe embedment, engineered fill and in warm- mix asphalt.
- **Downer, Close the Loop and RED Group** - in partnership with councils, have been able to generate an asphalt product using recycled soft plastics, glass and toner from printer cartridges.
- **Local Councils** - for example:
  - > **Lake Macquarie City Council (LMCC)** - a local council that is collaborating with their recycling contractor to investigate alternate uses of stockpiled glass. LMCC's contractors are processing glass from the local MRF into glass sand that has been trialled in local civil works. The contractor is constructing a processing plant on the Central Coast to produce commercial quantities of both sand and drainage aggregate substitutes.<sup>32</sup>

<sup>25</sup> Institute for Sustainable Futures, 2019. Final Report: APCO Packaging Material Flow Analysis 2018.

<sup>26</sup> Institute for Sustainable Futures, 2019. Final Report: APCO Packaging Material Flow Analysis 2018.

<sup>27</sup> Australian Packaging Covenant Organisation, 2018. Market impact assessment report: Chinese import restrictions for packaging.

<sup>28</sup> Australian Packaging Covenant Organisation, 2018. Market impact assessment report: Chinese import restrictions for packaging.

<sup>29</sup> Glass Recovery Services, 2018. Glass Recovery Services: Glass Recovery Experts. Available at: <http://www.glassrecovery.com.au/index.html>

<sup>30</sup> Waste Management Review, 2018. Increasing recycled glass uptake. Available at: <http://wastemanagementreview.com.au/increasing-recycled-glass-uptake/>

<sup>31</sup> Envirosand, 2018. Home. Available at: <https://www.envirosand.com.au/home/>

<sup>32</sup> Waste Management Review, 2018. Lake Macquarie: Lake Macquarie City Council Push to Swap Sand with Recycled Glass. Available at: <http://wastemanagementreview.com.au/tag/lake-macquarie/>

- > **Lismore City Council** – opened a regional MRF and glass processing plant in order to manage recyclables in the local region. With a new imploder technology they are able to produce glass sand for roadbeds and pipe bedding. By producing a product that is fit for market, the council has gained significant interest locally, as well as from neighbouring council and private contractors.<sup>34</sup>
- > **Other MRFs** – Other MRFs not mentioned above, also have the capability to reprocess glass using similar technologies, for example Coffs Harbour, Wagga Wagga, Rockhampton, Mackay and Cairns. In addition, the NSW EPA provided grants for glass processing facilities in regional towns in 2012, but some of these have since ceased operating due to poor quality and limited markets.<sup>35</sup>
- **Others:** For example, Colmax (opened on 2011 and ceased trading in 2014) and Australian Glass Technology.

#### iv. Recycling technologies and end markets

In its pure form, glass can be reprocessed indefinitely<sup>36</sup>. Recycling glass saves 75% of the energy it takes to make glass from virgin raw materials<sup>37</sup>. There is little to no export of glass cullet from Australia for recycling, although there are some reports of cullet being exported as waste, for example, estimates of 5% of collected glass in NSW being exported to Malaysia<sup>38</sup>.

Glass stockpiling regulations and conditions are considered to inhibit recycle feedstock and competitiveness with virgin prices<sup>39</sup>. An estimated 16% of cullet is stockpiled at the beneficiation stage due to a lack of demand for recycle at the time of beneficiation. In 2015, NSW introduced Authorised Amounts (maximum tonnage limits) to all recycling facilities in order to reduce stockpiling. A consequence of this legislation is that facilities can only stockpile limited glass due to the high weight per cubic meter of glass. As a result, glass is now being transported interstate to stockpile, adding an unnecessary cost and environmental burden.<sup>40</sup> Authorised amounts are viewed to not only provide operational barriers for MRFs but for secondary processing and crushing facilities that are attempting to provide glass aggregate to the civil construction sector. In many cases, civil construction contractors require more glass per order than a reprocessing facilities is legally permitted to store on site.

Table 4 provides a brief description of some of the current recycling technologies used in Australia for glass.

<sup>34</sup> Kevin Trustum (Lismore City Council), 2018. *Glass recycling: trials and tribulations, the Local Government Experience*. Available at: <https://www.coffswasteconference.com.au/QuickEventWebsitePortal/2018/waste/Agenda/AgendaItemDetail?id=e20d0302-ad46-ea57-9b8c-39e0470f28db>

<sup>35</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA*.

<sup>36</sup> Sustainability Victoria, 2014. *Fact Sheet: Market Summary – recycled glass*.

<sup>37</sup> Townsville City Council, 2016. *Fact Sheet: Recycling Glass*. Available at: [https://www.townsville.qld.gov.au/\\_data/assets/pdf\\_file/0017/3923/Recycling\\_A4-Factsheet\\_Glass\\_web.pdf](https://www.townsville.qld.gov.au/_data/assets/pdf_file/0017/3923/Recycling_A4-Factsheet_Glass_web.pdf)

<sup>38</sup> New South Wales Environment Protection Authority, 2018. *Glass Recovery Data Report – Confidential*.

<sup>39</sup> APC Waste Consultants, 2017. *Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA*.

<sup>40</sup> Institute for Sustainable Futures, 2019. *Final Report: APCO Packaging Material Flow Analysis 2018*.

**Table 4. Glass recycling technologies in Australia**

RECYCLING TECHNOLOGY	DESCRIPTION AND END- MARKET
Beneficiation	An advanced sorting process to separate different colours of crushed container glass from contaminants to produce cullet for reprocessing. <sup>41</sup> This can include: magnets to remove metals, air- jets to remove non- magnetic metals, a vacuum to remove light weight contaminants and a laser to remove any remaining contaminants. <sup>42</sup>
Glass manufacture	Following beneficiation, 'furnace- ready' cullet is mixed in glass manufacturing furnaces with virgin material, such as sand, limestone and soda ash, to produce new glass. The proportion of cullet able to be used in glass manufacturing is limited as it can introduce impurities. Increasingly advanced technology allows glass fines to be mechanically processed through beneficiation for use in glass manufacture but this is generally not commercially viable. There are contamination allowances per tonne for glass manufacture (applicable to virgin and recycle). <sup>43</sup>
Glass fines into other markets	While the primary application of cullet is for glass bottle production, it can also be used in place of glass fines in aggregate mixes. Glass fines are a lower grade product which can be crushed for use in asphalt, sand/abrasive grit blasting, asphalt (glassphalt), construction and road aggregates, concrete aggregate, sports turf/drainage, brickmaking, water filtration, insulation batts and an alternate day cover for landfills. <sup>44 45</sup>

#### v. Recycling rate

The 2017 National Recycling and Recovery Survey (NRRS) states that 641,372 tonnes of glass, including exports and stockpiles were recycled in Australia in 2017- 18, resulting in a recycling rate of 50%.<sup>46</sup>

Sustainability Victoria estimates a total of 257,000 tonnes of glass waste is generated each year in Victoria. While 195,000 tonnes or 76% of glass is recovered, only 124,000 tonnes, or 48%, is recycled back into glass cullet for glass manufacturing<sup>47</sup>. The remaining 52% is comprised of glass fines and stockpiles. The stockpiles of recovered glass in Victoria are estimated to be over 300,000 tonnes and are largely contaminated with ceramic, stoneware, Pyrex and plastic. Each year, up to 62,000 tonnes of glass is estimated to be lost to landfill<sup>48</sup>.

In NSW, current data states that of the estimated 1.6 billion glass containers consumed every year, 42 percent is currently recycled<sup>49</sup>. Current NSW data states that 48% of glass generated in NSW is reprocessed in NSW, which is 75% of all glass collected<sup>50</sup>.

The demand for cullet from MRFs has been reduced due to a range of underlying factors including, the increased import of glass bottles, the light weighting design of bottles leading to increases in breakages into smaller pieces and more compacting through comingled recycling meaning glass is again broken into increasingly small pieces.<sup>51</sup>

<sup>41</sup> Sustainability Victoria, 2014. Fact Sheet: Market Summary – recycled glass.

<sup>42</sup> SUEZ, 2018. ANZ Glass Fact Sheet Available at: [http://www.sita.com.au/media/fact\\_sheets/01816\\_SUEZ\\_Fact\\_Sheet\\_Glass\\_A5\\_v1.pdf](http://www.sita.com.au/media/fact_sheets/01816_SUEZ_Fact_Sheet_Glass_A5_v1.pdf)

<sup>43</sup> Sustainability Victoria, 2018. Resource Recovery Technology Guide.

<sup>44</sup> Sustainability Victoria, 2014. Fact Sheet: Market Summary – recycled glass.

<sup>45</sup> APC Waste Consultants, 2017. Situational Analysis Report on Glass Recovery and Recycling in NSW for NSW WCRA.

<sup>46</sup> Institute for Sustainable Futures, 2019. Final Report: APCO Packaging Material Flow Analysis 2018.

<sup>47</sup> Sustainability Victoria, 2014. Fact Sheet: Market Summary – recycled glass.

<sup>48</sup> Sustainability Victoria, 2014. Fact Sheet: Market Summary – recycled glass.

<sup>49</sup> The Centre for International Economics (CIE), 2017. Final Report: NSW Glass Recycling, Issues and Options. Prepared for NSW Environment Protection Authority.

<sup>50</sup> New South Wales Environment Protection Authority, 2018. Glass Recovery Data Report – Confidential.

<sup>51</sup> The Centre for International Economics (CIE), 2017. Final Report: NSW Glass Recycling, Issues and Options. Prepared for NSW Environment Protection Authority.

# Support for Glass Recovery

Table 5 provides a breakdown of the current actions at a state and territory government level to support the increased recovery and recycling of glass.

**Table 5. Australian State and Territory Government support of glass recovery**

STATE	ACTION	DESCRIPTION
VIC	Research & Development (R&D)	<ul style="list-style-type: none"> <li>- Using recycled glass fines as aggregates and precursors to produce lightweight concrete foam.</li> <li>- Using recycled plastics and glass fines in concrete footpath construction.</li> <li>- Using recycled glass fines and crushed rock to create cemented- treated pavement bases.</li> <li>- Recycled glass and plastic in asphalt.</li> </ul>
	Container deposit scheme (CDS)	None - Investigated previously with state government arguing that the costs outweighed that of the environmental benefits.
	Grants	<ul style="list-style-type: none"> <li>- Resource recovery infrastructure fund (\$3 million available).</li> <li>- Recycling Industry Transition Support Grants (\$1m).</li> </ul>
SA	Legislation	<ul style="list-style-type: none"> <li>- Environment protection (scheduled premises) regulations 2017.</li> <li>- Glass processing requirements in place.</li> </ul>
	Grants	<ul style="list-style-type: none"> <li>- 2018 release of \$12.4 million support package for local government and recycling industry</li> <li>- \$300,000 available for the Recycling Market Development Grants Program in 2018- 2019.</li> <li>- Green Industries SA funding, loans and subsidies.</li> </ul>
	CDS	Introduced container deposit legislation in 1977. Collected 43,298 tonnes of beverage containers in 2016- 17. Captures widest range of glass containers.
NSW	Legislation	Guideline for stockpile management – glass considered under 'waste awaiting processing, recycling or reuse'. Key concepts: stockpiling is temporary and for a specific purpose.
	R&D	Lismore council and Lake Macquarie - processing of glass sand for use in roads and concrete.
	Grants	Waste less recycle more including the new Product Improvement Program. Recent \$5 Million grant to Polytrade.
	CDS	Rolled out December 2017 – use of automatic sorting over manual sort.
	Legislation	<ul style="list-style-type: none"> <li>- Stockpiling size and time limits on processed and unprocessed glass – with active penalties.</li> <li>- Recovered glass sand order 2014. Resource recovery exemptions.</li> <li>- Landfill levy.</li> </ul>
QLD	Other	Inter- governmental taskforce on recycling is addressing glass.
	R&D	Ipswich City Council trialing removing glass from kerbside – dedicated collection. A joint venture between five local councils to recycle and refine sand in Rockhampton which can be used in construction projects.
	Grants	'Love Queensland – let's keep it clean' campaign (illegal dumping and litter). A \$100 million program for industry development (business and local council) – opens late 2018.
WA	CDS	November 2018 to address the state's low recycling rate of 44%.
	Grants	Community grants scheme for small- scale community projects. Clean communities' initiative. Community and industry engagement grants.
	CDS	Set to be rolled out by 2020 to complement the WA Litter Prevention Strategy for 2015 – 2020.

STATE	ACTION	DESCRIPTION
	Legislation	10- year waste strategy from 2012.
NT	CDS	Launched in 2012, more than 35 million containers returned in first 12 months. CDS infrastructure grants to buy equipment and infrastructure.
	Legislation	Environment protection (beverage containers and plastic bags) Act. Environment protection (beverage containers and plastic bags) regulations.
ACT	R&D	2017 \$8 million upgrade to recycling facility to allow glass fines to be turned into sand for construction.
	CDS	In action - only 9 return points in operation, with aim to have 18 by July 2018. Similar to NSW collection and eligibility.
TAS	R&D	Use of glass sand - Tennis club use of recycled glass in new park (45 tonnes).
	Grants	Northern Tasmania Resource Recovery Grants Program.
	CDS	None - 2014 cost/benefit analysis indicated that the cost would be more than the gain - the cost to industry and consumers would net cost \$86 million over 21 years.

## Lifecycle Approach

In analysing the lifecycle approach, the Working Group discussed ten potential project opportunities. The proposed projects address issues across the glass packaging lifecycle and value chain to ensure system- wide engagement and collaboration (Figure

3).The identified projects have been reviewed, prioritised and combined with other priority initiatives to develop projects for implementation in 2019. Priority projects for implementation in 2019 are summarised in Table 1.

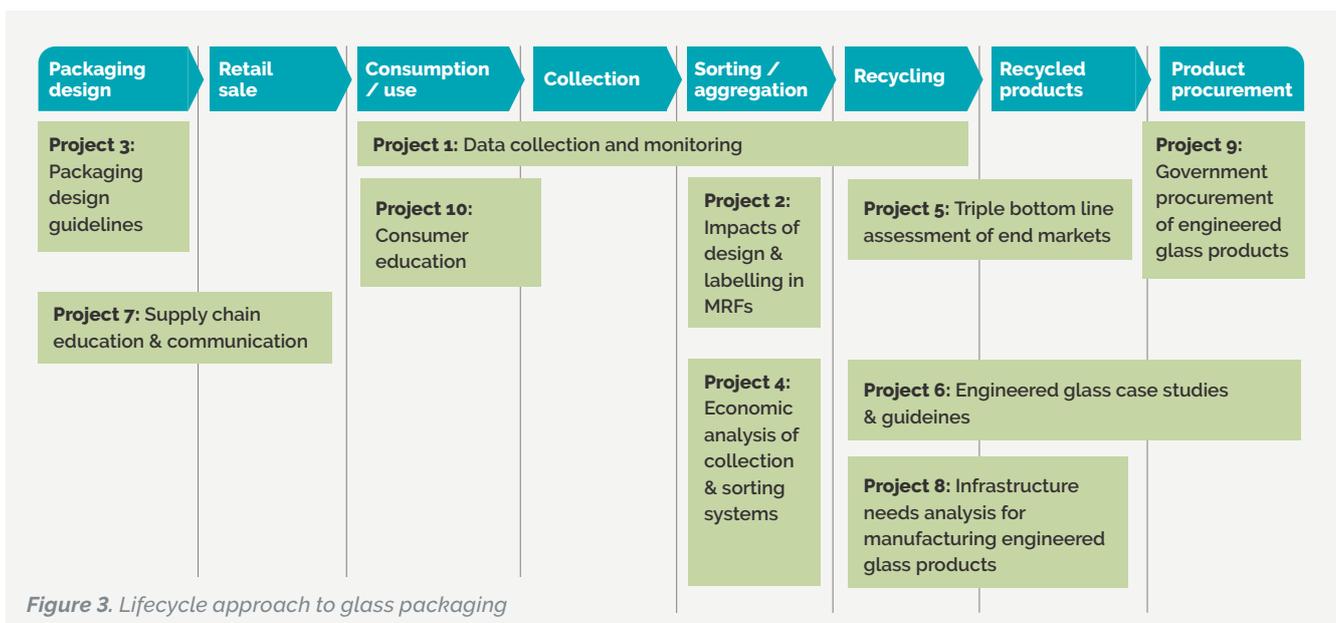


Figure 3. Lifecycle approach to glass packaging

# Conclusion

## **a. Conclusions**

1. The quality of recovered glass is falling as a result of breakage and contamination during collection and sorting.
2. There is potential for more recovered glass to be manufactured back into containers if quality standards are met. One option being trialled is source separation at kerbside. More research is required into best practices at MRFs to minimise losses and increase quality yield.
3. Private companies, MRF operators and state governments have invested in processing equipment to manufacture products such as glass sand and aggregate for civil construction. There are a number of technical, behavioural and regulatory barriers that need to be addressed to further build these end markets.
4. Secondary markets for glass would benefit from preferential procurement policies for civil works (sand, concrete, etc.).

## **b. Knowledge and data gaps**

- How to address issues faced in regional cities, in comparison to metropolitan
- The impact of differing sorting and processing technologies – what is best practice?
- A full understanding of what every state and territory government is doing to improve glass recovery
- Environmental and economic cost/benefit analysis for landfilling vs recycling glass
- Identifying all current Australian processors, innovators or technologies available
- The true impact of glass as a contaminant in a MRF and the impact of glass on MRF infrastructure when processing
- The impact of differing packaging labels and adhesives on the glass recycling process.



To contact APCO please visit our website  
[www.packagingcovenant.org.au](http://www.packagingcovenant.org.au)

