

Report prepared for:

Department of the Environment and Energy

# Assessment of Australian recycling infrastructure - Glass packaging

## Updated





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# 1 GLASS PACKAGING USE

Glass has been used as a packaging medium in Australia for well over 150 years. In the 19<sup>th</sup> and 20<sup>th</sup> centuries it was the dominant packaging format for beverages, and commonly used for food and other applications. During this period, a lot of the glass packaging was returned, washed and reused. To encourage high levels of return and reuse rates (trippage), the bottles often remained the property of the brand-owners/product manufacturers. Large scale product applications such as milk and beer and wine were all packaged almost exclusively in reusable glass.

During the latter part of the twentieth century, consumer patterns changed with less home delivery of milk, more at home consumption of alcohol. There was also competing packaging materials with steel and aluminium cans for food and beverage, and cartons and plastic for milk. The glass industry responded with light weighting of glass containers and a switch to single use glass where the material was crushed and remade from the recycled glass (known as cullet).

Over the past twenty-five years glass packaging production has dropped slightly due to both lighter containers and loss of market share to other materials. It was widely expected that glass would disappear from consumer packaging, but it has retained strong markets in wine and beer and developed new food packaging markets.

Glass has been equated with quality for many product lines and this has led to its selection by many brands. Many premium brands choose glass over alternatives in applications from jams to cooking oil to cordials. The technical properties and prestige image of glass have also helped it to retain the wine market and an increased share of the beer market.

There are applications where glass has been replaced or reduced such as pharmaceuticals, sauces, chemicals, soft drink. It is also banned as a packaging format at many sporting and cultural venues based on safety concerns related to potential for being thrown and for breakage.

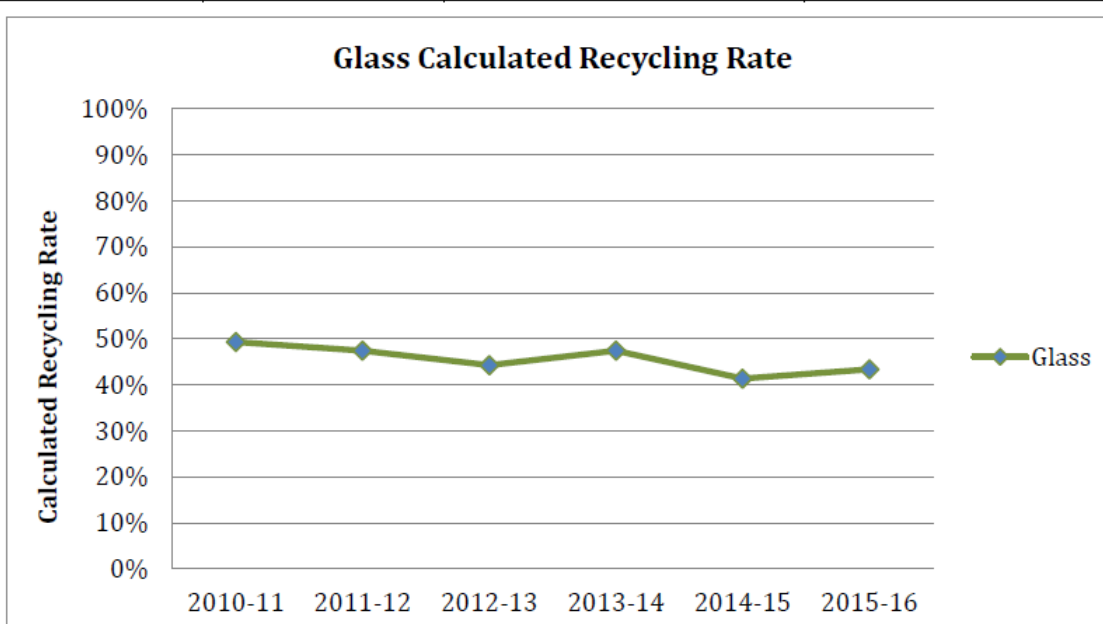
Estimates of the consumption of glass packaging in Australia vary. For the 2017-18 financial year the Australian Packaging Covenant Organisation report on packaging consumption and recycling provides an estimate of total glass consumption of 1.29 million tonnes, with recovery of 0.58 million tonnes and a 46% recovery rate (i.e. waste glass recovered over waste glass generated).



The chart below shows glass consumption and recovery over the 2010-16 period

**APCO reported glass recycling rates 2010–11 to 2015–16 (IndustryEdge, 2018 p. 7)**

Financial Year	Total Consumption (kt)	Total Recycled (Processed & Exported) (kt)	Calculated Recycling Rate
2010-11	1 054	520	49%
2011-12	1 210	552	46%
2012-13	1 248	552	44%
2013-14	1 259	597	47%
2014-15	1 364	564	42%
2015-16	1 253	543	43%
% +/- pa	3.5	0.9	



During 2015–16, the trend towards the importation of empty glass packaging increased sharply. Compared with the prior year, imports were up 15.6% in 2015–16 (SRU, 2018). This is an important trend, because the growth in imports potentially displaces domestic production, thereby reducing demand for recovered glass for use in local packaging production. Much of the import is in goods imported in glass rather than empty packaging.

Glass packaging is imported into Australia as packaging around goods such as: beer, sauces, wine and oils. There is no precise data on the total quantities of glass entering Australia related to these imports.

Glass packaging is reported by industry to slowly be continuing to lose market share to plastics packaging. For example, Coles has indicated that it intends to reduce or eliminate glass packaging from its own brands. With this decline, in recent years, the major manufacturer of glass packaging, Owens Illinois (O-I) closed some furnaces at its glass plants in Melbourne, Adelaide, Sydney and Brisbane. Glass packaging is also manufactured in Adelaide by Orora.

It seems likely that glass will maintain some ‘prestige’ applications but may see its market continue to decline as more brand-owners switch to plastics and other materials.



## 2 END OF LIFE OUTCOMES

According to the available sources the total amount of glass packaging collected for recycling in Australia in 2017-18 was around 0.58 million tonnes (Envisage Works, APCO, 2019). According to the National Waste Report this is a reduction of 200,000 since 2006–07. The current rate of glass recycling is around 46%, with indications that the recovery rate has fallen over the last five years. There is some concern that historic recycling rates were calculated by comparing total glass recovered to consumption of glass beverage packaging, which would overstate the recycling rate.

Across all materials, recycling is highest for large packaging and beverage packaging over food and other product applications. This is partly due to the product residue and washing requirements. The higher beverage recovery is also due to high recovery levels in pubs and restaurants where glass beverage packaging is widely recycled.

The recycling rate also benefits from container deposit schemes with higher return rates by consumers and businesses. Currently South Australia, NSW, Queensland, WA and the Northern Territory have a deposit system in place.

Most of these states have introduced a state-wide container deposit scheme. Consumers can get a 10-cent refund on all eligible beverage containers – plastic and glass bottles, paper-board cartons, and steel and aluminium cans between 150 millilitres and three litres. This generally includes:

- soft drink cans and bottles
- bottled waters – both plastic and glass
- small flavoured milk drinks
- beer and cider cans and bottles
- sports drinks and spirit-based mixed drinks.

Under these schemes, glass packaging for wine and food does not carry a deposit for redemption as these applications are excluded from the scheme.

This leaves Victoria as the only major state without beverage container deposits and there is a strong likelihood that the Victorian Government will soon follow the other states in introducing deposits.

Currently, an estimated 126,000 tonnes of glass is returned through container deposit schemes. There has traditionally been no export of glass cullet from Australia for recycling. This changed in 2017-18 with 23,000 tonnes exported. This has continued into 2018-19 at a similar level.

Most glass coming through commingled kerbside collections is going to beneficiation and cullet feed at Owens Illinois' glass plants. Some quantities are going into lower grade construction applications and some is being stockpiled. The Orora glass plant in Gawler, South Australia, utilises glass from container deposit sources in that State.

The recovery rate of 46% is considered an average performance given the relatively low commodity value of glass per tonne compared to plastic or cardboard, and the difficulty of recovery from mixed waste loads. On the other hand, a material that is used mainly for beverages with a lower Away from Home consumption pattern, should expect high returns through household kerbside systems and commercial collections.



Highly mechanised commingled recycling collection and sorting tends to break glass into small pieces that are not easily recoverable. These fragments can get lost to landfill or be sorted with other materials. They can also be at a size that prevents detection from stone and ceramic fragments. The larger recycling sorting plants increasingly have technologies to deal with these small fragments. It has been estimated that a third of glass presented for recycling is lost in the collection, sorting and beneficiation process.

The glass packaging from container deposit systems remains intact until sorted manually from other materials with each colour being generally kept separate.



### 3 SORTING AND RECYCLING INFRASTRUCTURE

Most glass packaging is collected in commingled collections from households or commercial sites such as pubs, clubs, sporting venues, hotels and restaurants. Some glass is collected separately from other materials. This is often done with an onsite glass crusher to reduce volume.

In addition, there is glass collected through container deposit depots and allied return routes. The commingled material is sent to material recycling facilities in capital city and regional centres where the glass is sorted from paper grades, plastics and metals.

The glass is in a mixed colour form with tops and labels included. This material is then sent to one of seven beneficiation plants. These are:

- Visy – Adelaide and Melbourne
- SKM – Sydney and Melbourne
- Polytrade – Melbourne and Sydney
- Brisbane Cullet (O-I) – Brisbane.

These plants also receive some loads sent and paid for by O-I from regional locations where freight costs are high. This includes a small amount of glass into Adelaide from Western Australia and the Northern Territory, and into Melbourne from Tasmania. O-I pays these suppliers a rate that recognises the extra cost of freighting.

Much has been made in the media over the last few years of the stockpiled ‘mountains’ of glass. Some of these are historic and were created before state-of-the-art optical sorting equipment was available in beneficiation facilities in each packaging production capital.

For most of the past twenty years, recyclable packaging has been collected at the kerbside in mechanised, bin-based, fully commingled systems. Many stakeholders have pointed out that, while this delivers collection efficiencies, mixing materials and compaction result in cross contamination and reduced quality of the material collected.

Of concern, is the impact of glass fragments on other materials, particularly paper grades. The glass itself is of much lower value when collected through commingled kerbside systems. This has prompted some stakeholders to suggest either a separate paper and cardboard collection or a separate glass collection. This would represent a significant shift in approach, and the costs and benefits would need to be assessed to inform the review of options.

The Northern Beaches municipality in Sydney collects paper grades separate from glass and other materials and may offer a model. In New Zealand, around 30% of the population is served by a system that collects glass at kerbside in a crate separate from other materials. This material is colour sorted and is of a higher quality than the material from fully commingled systems and therefore is more valuable. This approach also offers an option for consideration.

Several councils have resolved to trial or introduce glass separate collections. The results of these trial show strong results for the collection of clean glass with little glass remaining in the commingled stream. There is generally a gate fee to MRF operators for glass collected,





to cover beneficiation costs. This is currently a gate fee of around \$30. Some of the same companies (Visy, SKM, Polytrade) operate MRFs and beneficiation in some capital cities. This can lead to a strong influence on pricing and access for beneficiation, including for CDS sourced glass.

Glass collected from kerbside recycling is recycled back into glass packaging at O-I plants in Brisbane, Sydney, Melbourne, and Adelaide. Glass from NT and Tasmania is shipped to Adelaide or Melbourne.

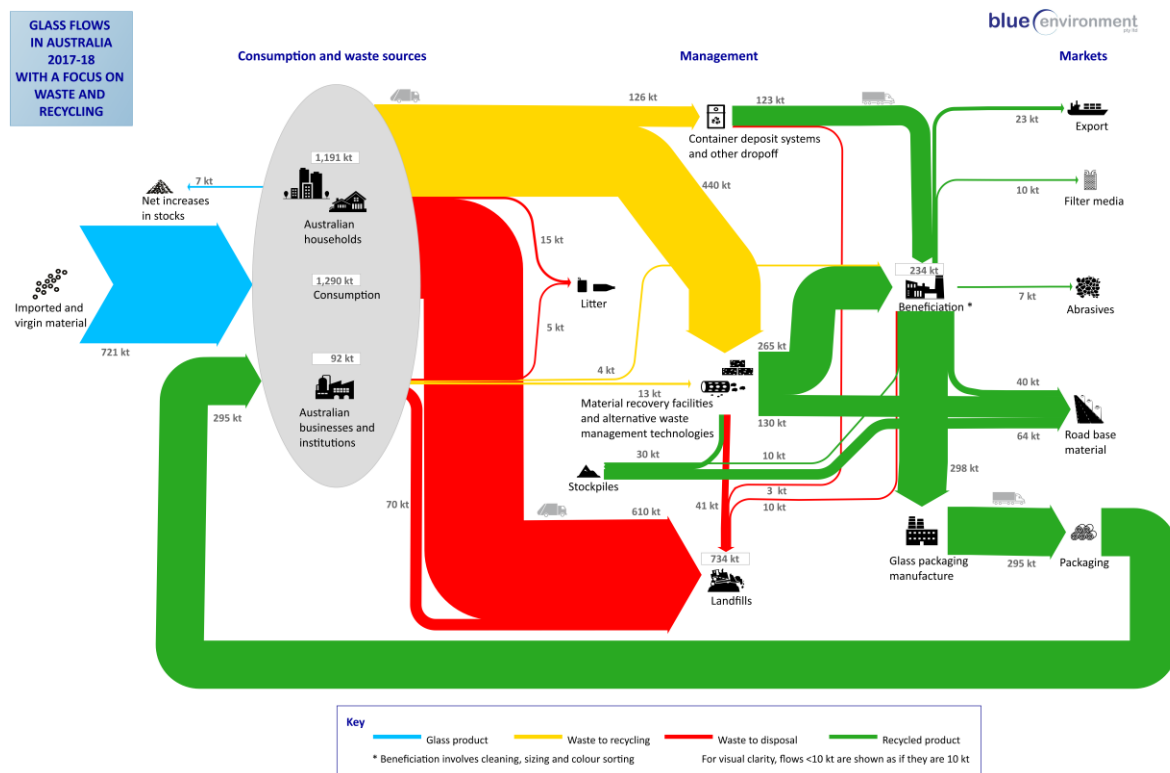
Glass collected in WA is almost entirely used in civil construction projects such as in road base applications. Increasingly, glass unsuitable for packaging manufacture is being used as a sand substitute in road base and in road asphalt in other centres. Alex Fraser Group has opened a high throughput glass recycling plant in Melbourne which can process 150,000 tonnes per year. They are currently struggling to keep up with demand for the material.

O-I receives the glass cullet from beneficiators in each city. The price paid for the glass cullet by O-I to beneficiators has remained largely unchanged in recent years. Green glass is sometimes in oversupply in Sydney and Melbourne so some of it is shipped to Adelaide where it is needed for wine bottle production.

The quality of kerbside collected glass, and the relatively low price received for this material, has been an issue in kerbside recycling collection, sorting and sale for many years.



# 4 GLASS PACKAGING FLOW DIAGRAM





## 5 RECYCLED PRODUCT TYPES AND MARKETS

Glass packaging is produced in three different colours; amber (brown), green and flint (clear). To produce new glass packaging from recycled cullet, there are restrictions on what colours can be blended. Amber packaging (used mostly for beer) can utilise flint and green cullet, green can use flint and green cullet, while flint glass packaging requires clear cullet. The demand for different colours varies around the country. There is much greater demand by the wine industry in South Australia for green glass so sometimes cullet needs to be shipped from other capitals to Adelaide.

Virgin glass is made essentially from a combination of silica and soda ash. Cullet can be blended with these materials in quite high proportions. Having cullet blended at over 60% is possible if the quality is good. Currently the cullet content is 30-37%, much lower than it could be.

Prices for glass from kerbside are currently low, and as a result this is not a major revenue source despite the significant quantities recovered through kerbside recycling. The price has been steady throughout the past year and is unaffected by Chinese import restrictions.

The price received for cullet is often locked into 3–7-year contracts between glass producers and beneficiaries. It is likely that the price for cullet is close to the long-term average of \$72 /tonne. Currently cullet makes up almost 40% of the input to O-I glass manufacture. They are targeting 60% input and can accept an even higher ratio, particularly for amber and green production.

Based on quality and volumes, gate fee rates for MRFs sending material for beneficiation can vary. An average gate fee of -\$30 /tonne (EXW) has been assumed for this analysis, unchanged over 2018-19. It may be that some MRFs are being charged by beneficiaries in the order of \$40–\$60 /tonne, but this is not verified and if it is occurring could be linked to the provision of poor quality of material.

Beyond taking glass packaging waste back into packaging production, there are a range of other secondary markets that can be used. The glass can be used as a filter media for water quality projects. This application is specialised and per tonne, does not offer a high market price.

Similarly, it can be used as an abrasive material in sandblasting of ships and similar targets. This has been tried but, competing with widely available sand, does not offer a broad market outlet.

Cullet can also be used in a range of road base and sub-base applications. This market is also low value. It has the advantage of being able to absorb large volumes of material, and a second advantage of not requiring the same quality of cullet, with ceramics and metals and mixed colours not a market barrier. For this reason, it is an outlet for stockpiles of glass that have contaminant levels higher than packaging production can tolerate. Road material suppliers such as Alex Fraser and Downer.

Beyond packaging glass, there is sheet glass used in a range of application including automotive windows and windscreens and in windows and skylights for buildings. Glass is also used for household and commercial durable applications such as drinking glasses, plates, cookware, vases etc. These different forms of glass melt at different temperatures to packaging glass. Due to this, they are generally not compatible with packaging glass recycling systems. Active education programs are used in commercial and household settings to keep packaging glass free from these other glass forms. There are recycling systems operated by Potters Industries for the recovery and recycling of window and windscreen glass into road marking paint and some medical and military applications.



## 6 REFERENCES

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