FACT SHEET

Market summary – recycled glass

In 2013–14 Sustainability Victoria commissioned market analysis into four waste materials identified as priorities for market development and four which are emerging materials of interest. This fact sheet summarises the findings for recycled glass.

Terminology

Glass is described in the following categories.

Glass waste: Post-consumer glass; predominately packaging waste (containers) and to a much lesser degree flat glass (windows) and other sources.

Glass cullet: Glass which has been recovered, sorted and crushed and is suitable for recycling through glass manufacturing.

Glass fines: Glass which has been recovered but is considered unsuitable for use in glass manufacturing due to the particles being too small or contaminated with ceramic, stoneware, Pyrex and plastic.

Volumes

An estimated 257,000 tonnes of glass waste is generated each year in Victoria and while 195,000 tonnes or 76 per cent is recovered, only 124,000 tonnes or 48 per cent is recycled back into glass cullet for glass manufacturing. The remaining 52 per cent is made up of glass fines and stockpiles.

The stockpiles of recovered glass in Victoria are estimated at 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 the table below provides further description of the volume and type of glass lost across the recovery process.

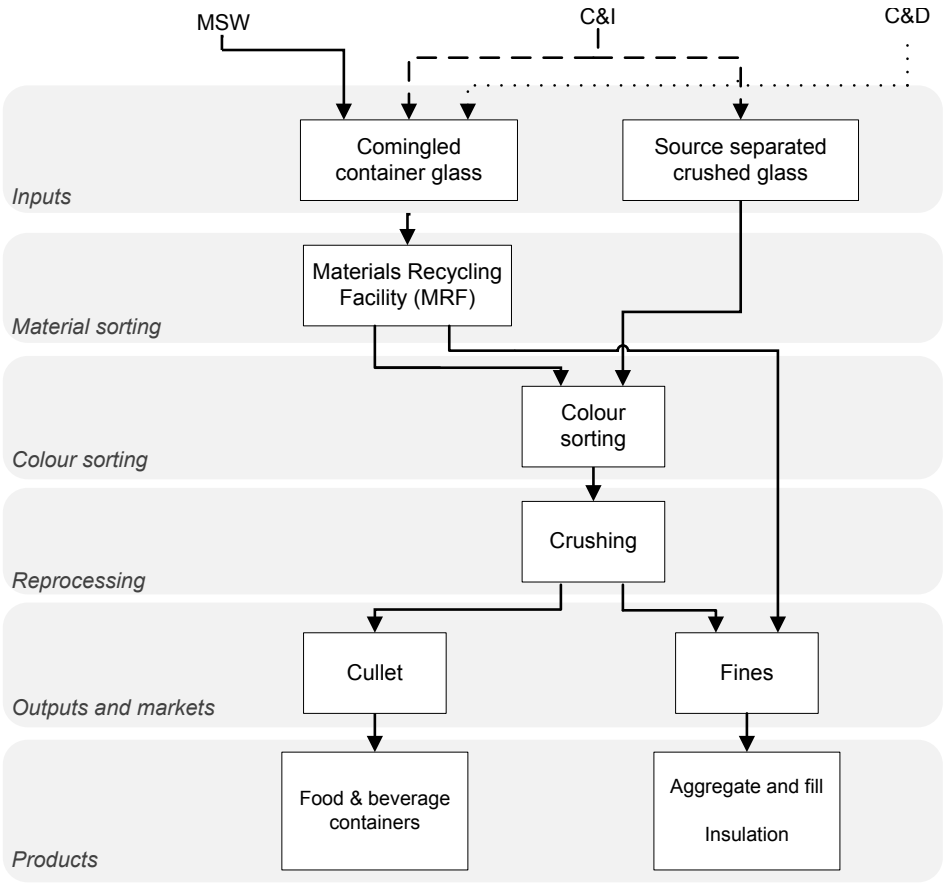
Table 1: Summary of glass losses across the recovery process

Recovery stage	Description of loss	Type	Significance
Generation of recycled material	Glass waste entering landfill stream	Loss to landfill	Very High (62,000 tonnes per annum)
Collection for recovery	Breakage during collection Breakage due to compaction	Uneconomic fines	High (66,000 tonnes per annum)
	Ceramic, non-packaging glass, flat glass entering recycling stream	Contamination	Medium (5-10,000 tonnes per annum)
Materials reprocessing	Breakage during beneficiation	Uneconomic fines	Medium (5-10,000 tonnes per annum)

Processing

Glass is a material that can be reprocessed indefinitely, and the use of recycled glass to manufacture products results in a reduction in the use of energy and raw materials. The generic process for glass cullet and glass fines recovery in Victoria follows the steps of recovery, sorting and reprocessing as outlined and discussed below.

Figure 1: Flow of glass through the recycling chain



Glass collected for recycling primarily comes from food and drink bottles and jars, and includes clear, green and amber glass. Glass not suitable for recycling include cookware glass, light globes, drinking glasses and window glass. These types of glass have different melting points compared to food and drink bottles and jars.

Plate or window glass, may be reprocessed in Australia into insulation. However, this is not widespread and a large quantity goes to landfill. Plate glass can also be used as aggregate and for blast cleaning.

Glass is typically sorted from mixed recycled waste at a Material Recovery Facility (MRF) and then further refined (beneficiated) to be suitable for reprocessing.

Comingled collection presents challenges for glass recycling. Waste Management, the Productivity Commission report (2006) identified the following.

- Glass is a marginal proposition in comingled collection systems, due to a combination of its relatively low value, its high sorting costs, its inertness in landfill and its contaminating influence on other recycled materials.
- While recycling rates for concrete, bricks and asphalt, paper, plastics and metal grew substantially in Victoria from 1994-95 to 2004-05, the recycling of glass actually fell (Sustainability Victoria 2005). The main reason for this decline appears to have been the replacement of crate-based recycling collection systems with comingled systems.
- Most glass that is recycled in a comingled collection system is broken during collection, compaction and transport. Mixed broken glass must be sent to a "beneficiation" plant if it is to be sorted by colour. There is currently only one such plant in Australia, in Laverton on the outskirts of Melbourne.

On-site bottle crushing equipment is used by some businesses in the hospitality sector for onsite bottle crushing, which allows for reduced transportation volumes, improved occupational health and safety standards and higher recycling yields. These machines reduce volume to at least 80 per cent of original bottle but the cullet is still suitable for beneficiation and provides a cleaner stream than MRF recovered glass due to less contamination. (Australian Food & Grocery Council, 2009).

Glass bottles and jars are separated by colour either by hand or using automated sorting equipment Glass can now be sorted down to 8 mm for use as cullet and fragments smaller than 8 mm are mixed together to produce glass fines for use in aggregate and abrasives.

The colour-sorted glass is transferred to a beneficiation plant where contaminants are removed and glass is crushed to produce what is called cullet which is sorted by size.

Products and applications

The two main outputs of glass reprocessing are cullet and glass fines.

Cullet is a higher grade product which 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 however limited as can introduce impurities. 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 is used 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.

Market overview

Indicative estimates of the financial value of recycled glass materials at various transactional points in the market are provided in the summary table and discussed below.

Collection and reprocessing

The average cost of collection, transport and recovery of C&I and municipal solid waste materials is in the region of $110 and $124 per tonne respectively[1] The price paid to reprocessors ranges between $0 to $49 per tonne.

End product

The market value of recycled glass product is not clear, as there is limited information available. Estimates are in the range of glass cullet: $100 and $149 per tonne delivered and glass fines: $0 to $49 per tonne delivered.

Table 2: Summary of estimated value and volumes of the recycling market for glass

Recycling market component	Estimated value ($ million)	Volume
Collection for recovery	~$22 million Based on collection price of $110 to $124 per tonne	~195,000 tonnes
Reprocessing	~5 million Based on an weighted average of approximately $25 per tonne paid for recovered glass into the processor	~136,500 tonnes glass cullet reprocessed ~58,500 tonnes glass fines reprocessed[2]
End product	~$18.5 million Based on $25 per tonne paid for glass fines and an average of $125 per tonne for other recycled glass products	~136,500 tonnes glass ~58,500 tonnes glass fines

1 WME, WMAA and Hyder (2012), Inside Waste Industry Report 2011-12.
2 Estimation of glass fines product extracted at typical MRF being around 30 per cent provided by http://www.colmax.com.au/products.html

Supply and demand

This section summarises the supply and demand conditions of the potential glass cullet and fines recycling markets.

Potential supply of glass cullet and fines

The recycling of glass waste to glass cullet or fines is mutually exclusive. As cullet is valuable and essentially a 'higher grade' product, the potential supply of cullet will draw on exisitng supplies of glass fines.

Table 3: Potential supply of recycled glass

Potential supply	Tonnes per annum	Description
Glass cullet		
Recovered glass fines	55,000	Glass currently recovered and reprocessed to fines. The recovery of glass waste to fines or cullet is primarily dependent on sorting technologies.
Stockpiled glass (fines)	16,000	
Glass cullet and fines		
Glass currently landfilled	62,000	Glass currently landfilled that could potentially be recovered as cullet or fines.
Stockpiles of glass fines	not known	Glass fines currently stockpiled.

Table 4: Potential demand opportunities for recycled glass

Potential demand	Tonnes per annum	Description
Increasing diversion from landfill	62,000	High
Increasing recovery of cullet	71,000	Neutral to high: cullet can be recycled indefinitely (as opposed to fines which are recycled once)
Increasing markets for glass fines	16,000 +	High (volume includes annual stockpile growth and existing stockpiles)

Considerations of economic viability and waste heirarchy

It is important that the following dynamics be considered.

- The excess demand for cullet means that markets exist for cullet that can be economically produced.
- Markets for glass fines are likely to be characterised by a pattern of inconsistent demand (i.e. transactions will be large but irregular, often as a result of large civil infrastructure projects).
- Increasing the production of cullet from glass waste will reduce the availability of glass fines.
- Although cullet has higher value than fines, its recovery is likely to be more costly (as the cost of sorting technology for example, must be considered).
- Cullet can be recycled indefinitely (e.g. as packaging glass), as opposed to fines that are essentially "downcycled" for an alternativeand ongoing use.

Market risks

Glass available for recycling currently exceeds the processing capacity of the recycling industry[3]. However, capacity constraints in Victoria cannot be alleviated by exporting glass for reprocessing, as stakeholders note that the cost of transport will make reprocessing uneconomic. These conditions suggest that the current market faces the following risks.

Stockpiling: The recycled glass market is typically very strong. However, the volume of reprocessing activity remains sensitive to price. When prices are low, it is common for materials to be stockpiled.

Failure to meet industry expectations: To ensure continued access to high quality glass cullet feedstock, manufacturers will favour medium- to long-term contracts for supply in order to hedge against price volatility. The concentration and size of these contracts mean that processor capacity must be adequate to meet both current and future demand.

3 Australian Food & Grocery Council (2009), Hospitality Pubs and Clubs Glass recycling Project Victoria: Final Report & Business Case. National Packaging Covenant.

Market barriers

The market barriers to increasing the recovery of cullet include the following.

Collection systems: Comingled kerbside recycling leads to breakages during collection due to the compaction in collection trucks. Lightweight glass packaging exacerbates breakage and creates glass pieces smaller than can be sorted with current sorting technology.

Colour sorting technology: Cullet needs to be colour sorted as clear (flint), green and amber for re-use in glass containers. New colour sorting technology is capital intensive.

Contamination: Contaminants such as ceramics and non-spec glass (not drinking containers) can have a severe effect on glass quality, potentially leading to failure of container and potential injury, and/or damage to furnaces and equipment.

Market opportunities

Potential exists to increase glass waste to the recycling stream, the proportion of high value glass cullet and the economic potential of lower value glass fines.

The opportunities include:

- consumer education about the value of glass recycling and what materials are not wanted (e.g. ceramics)
- increased glass recycling in public and work places
- trialling of alternative collection systems to improve recovery rates
- lower compaction rates in collection trucks
- investment in finer fraction sorting technology
- increased use of glass fines as bedding sand and in concrete
- improved quality assurance of glass fines to eliminate contaminants.

Further information

For more information contact
Jane Street on (03) 8656 6709
email jane.street@sustainability.vic.gov.au
or visit www.sustainability.vic.gov.au/marketanalysis

netbalance

This fact sheet summarises a more comprehensive market analysis report completed by NetBalance on behalf of Sustainability Victoria (August 2013).
Due to the confidential nature of some information provided by industry stakeholders, the full market analysis report is not publicly available.

Sustainability Victoria
Level 28, Urban Workshop,
50 Lonsdale Street, Melbourne VIC 3000
Phone (03) 8626 8700
sustainability.vic.gov.au

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