



GLASS RECYCLING

A QUICK STUDY

Glass food and beverage containers have been part of recycling programs across the U.S. for more than half a century. Glass is the ultimate recyclable and is used in making new glass containers, building materials like fiberglass, concrete, tile, and drainage aggregate, and as an industrial abrasive, sandblasting media, and reflective paint filler. How glass food and beverage containers can be recycled varies across the country, ranging from drop-off glass recycling programs, curbside glass recycling at home, and in some states, container deposit return systems. The guidance in this document can help glass champions determine how to improve local and regional glass recycling systems to build sustainable, robust glass recycling solutions for their community.

1

COLLECTION

In some regions across the country, the glass recycling system is effective and efficient. In other places, there are gaps in the recycling supply chain, making glass recycling more challenging. Like all recyclables, volume and reliability is key to moving glass to market. The first step in creating reliable volume is providing convenient recycling opportunities as close to the point of generation (i.e., where the glass is used before disposal) as possible, and preferably as convenient as the alternative – the trash can.



CURBSIDE

Curbside recycling programs provide the most convenient form of recycling collection for residents through either subscription services where a resident (or group of residents, like an HOA) contracts with their own service provider or receives service directly from a local government program. Curbside collection programs for glass includes single stream (one bin for all recycling), dual stream (one recycling bin for containers and one for paper), or glass on the side (one bin specifically for glass).



MULTI-FAMILY

Multi-family residences typically offer dumpsters, roll-off containers, or carts for their residents to conveniently recycle. Glass on site at these residences can be collected through a single stream container with other recyclables, dual stream containers, or separately through a glass-only container.



DROP-OFF

Drop-off recycling sites, also known as convenience centers, super drop-offs or just recycling drop-offs, are convenient when located within a reasonable distance from the point of generation.

The glass might be collected at the drop-off as single stream, dual stream, or a separately collected glass stream. Although some drop-offs even have separate containers for different colored glass, this is not a common practice anymore



COMMERCIAL

Commercial glass recycling systems are usually located in dense, urban areas where businesses that use a lot of glass, like bars, restaurants, theaters, stadiums, are concentrated closely together. Dedicated glass-specific containers are used for glass-only collection routes, and glass is picked up at regular intervals through a contract with a private or public service provider. Typically, enough participating entities who are efficiently clustered to ensure proper route density must be in place. Successful commercial glass recycling programs exist in Phoenix and Chicago (Don't Trash Glass program), and Europe and the British Commonwealth have regulated environments for commercial collection.



DEPOSIT

Container deposit systems allow glass to be returned for a small cash refund at grocery and food/beverage stores, typically as part of a statewide regulated container deposit return system. Ten states in the U.S. currently have a bottle bill: California, Connecticut, Hawaii, Iowa, Maine, Massachusetts, Michigan, New York, Oregon, and Vermont.

2

VOLUME

To create volume and reliability, communities can look to aggregation capacity – pulling together sufficient quantities of clean glass in one location to cost-effectively transport the glass in bulk to the next stage in the glass recycling supply chain, the glass processor. Bulk loads of recyclable glass typically are hauled in large side-tilt or back dump gravel/scrap train trailers that can carry 20-30 tons or more (unprocessed glass weighs close to a ton per yard). Glass is then loaded with a hopper-fed conveyor that is fed by a bucket loader or directly with a tilt bucket front wheeled loader. Some smaller capacity sites may ship via roll-offs (10-15 tons per load) if the glass processor is within 30 miles. Some larger aggregation sites can ship similar loads by train. Before the glass is loaded for shipment, it is stored in large bunkers often made with modular concrete blocks and fitted with a roof to keep water and ice out of the mix.

AGGREGATION COLLABORATION

The following types of aggregation sites are usually part of the recycled glass supply chain:



THE MRF

A material recovery facility is a processing facility where single stream and/or dual stream recyclables collected from residential and commercial sources are tipped and sorted into separate material streams. Glass is separated from the other recyclables and cleaned of non-recyclable material, like bottle caps, shredded paper, and other small items. Most modern MRFs are designed to remove the glass very early in the processing system to prevent the contamination of the other recyclables downstream. MRFs can fetch a higher value for the glass they are producing by investing in a glass cleaning system to help remove contaminants before sending it to the next stop, a beneficiation plant that makes furnace-ready glass cullet.



GLASS AGGREGATION AND TRANSFER POINTS

Glass that is collected separately from commingled recyclables can be aggregated at a recycled glass transfer point (hub, station, laydown site, central bunkers), which is fed by many smaller drop-off sites and glass-only collection routes. Glass aggregation and transfer hubs have simpler site requirements than traditional multi-material MRFs. These sites have a smaller footprint, minimal building requirements, and low-capital processing equipment in most cases. They can often be co-located with other bulk stored materials (gravel, sand, concrete, scrap metal, etc.) with private operations or public works yards where the required site infrastructure (road network, entry gate, storage bunkers, wheel loader, on-site staff, etc.) can be shared with those other uses. For instance, in rural settings, aggregation sites can be co-located with MSW transfer convenience centers often used by counties that do not have the population to maintain their own landfill.



DEPOSIT CONTAINER PROCESSING FACILITIES

Glass that is part of the returnable container system in a bottle deposit state will be routed back to the same regional deposit container processing facility where PET bottles and aluminum cans are processed. Deposit glass containers are usually not delivered as 3-mix but as flint (clear) and gramber (green/amber) glass. These facilities, which handle the required deposit tracking tasks that are required of deposit states, process glass to go to glass beneficiation or, in some cases, directly to a glass or fiberglass manufacturer.

3

QUALITY

The third step in creating volume and reliability is attention to quality so that glass supplied to end markets can be processed cost-effectively. A glass collection system that results in either 3-mix or color-separated, clean (contaminant free) glass is the easiest way to ensure that high-quality glass can be sold to a beneficiation facility for the highest value.

MRFs, however, can also produce high quality, relatively clean recycled glass if they follow best practices for MRF glass cleaning equipment described in the Glass Recycling Coalitions MRF Glass Recycling Certification Program ([link here](#)). Updating a MRF to include a modern glass cleaning system requires an investment in equipment provided by the major MRF equipment suppliers (Machinex, CP, BHS, Bollegraaf/Van Dyk, Green Machine, and others). MRFs that do not adopt these best practices will have a tougher time moving glass to secondary processing and could end up supplying the low-grade 3-mix glass to lower quality end uses (e.g. landfill road construction aggregate, alternative daily cover, etc.), and have higher net costs for doing so.

Creating volume and reliability is made easier through collaboration, especially at the regional level – the glass recycling sweet spot. Companies can work across the supply chain to achieve the benefits of aggregation; public private partnerships can improve MRF and aggregation site infrastructure; public agencies and or non-profits/co-ops can work together to sponsor and/or operate collection routes and aggregation sites; and groups like the Glass Recycling Coalition can be tapped to support regional collaboration including technical assistance, communication tools, and engagement techniques. A strong regional glass recycling supply chain requires stable long-term working relationships codified in operating agreements, buyer/supplier agreements, and intergovernmental agreements. They also require, in most cases, local recycling champions who support and advocate for the program through the appropriate political channels.

A glass processor is the key link for any region to produce quality, clean cullet for manufacturing. Sometimes referred to as a glass beneficiation plant or secondary processor, these are the facilities, both large and small, that use highly advanced crushing, pneumatic and optical sorting techniques and advanced cleaning equipment to prepare end market-ready glass feedstocks. Reliable supply and volume of quality recycled glass can feed end markets that make new glass containers, manufacture building materials like fiberglass, concrete, tile and drainage aggregate, and also can be used as an industrial abrasive, sandblasting media, or reflective paint filler.

Though most high population regions in North America have glass manufacturing capability, some regions do not. In these regions, alternative uses for glass, from cement to abrasives, have become more important. Reuse markets can ensure a local supply of glass is reclaimed, like decorative glass bedding and drainage medium.

If a gap in the recycling supply chain exists in a region, it is typically due to the absence of a regional glass collection aggregation network, glass processing capacity, or an end market.

GLASS PROCESSING FACILITIES



The largest, requiring \$20M to \$35M investments, are usually located in or near major population centers across the country, handling more than 90,000 tons of recycled glass. The number of companies currently in the U.S. market are few. The largest glass processor is Strategic Materials, Inc. (SMI), with other companies providing cleaning services like SMR, CAP Glass, Halo Glass Recycling, and a few others. They are equipped with advanced optical sorting equipment supplied by companies like Red Wave, Binder, Machinex, and others and have the capacity to remove impurities and produce both color separated as well as mixed grades of glass of various sizes- from the larger glass cullet (-3") to the micro particle sizes (-1/8"). Large processors have consolidated considerably in the last 10 years (e.g. SMI acquisitions of Reflective, eCullet, WM's glass business, etc.). Conversely, smaller independent companies with regional pull (e.g. Urban Mining, CAP) have filled in some of the processing gaps in certain regions.



Smaller regional glass processors operate at lower capacity levels with equipment investments in the \$10M to \$20M range and handle 50,000 to 100,000 tons per year. These are regional solution providers like Rumpke, operating in the Midwest. Some, like Rumpke, have vertically integrated business operations – leveraging their waste and recycling collection businesses. Others, like O-I, operate a glass processing plant or two as part of their much larger global businesses.



On a similar and slightly smaller scale, some glass processing capacity has developed in the last decade as dedicated supply chain gap fillers for specific end markets to capture supply out of nearby larger metro areas. These are \$5M to \$20M investments to process 25,000 to 90,000 tons of glass a year. One example is Glass to Glass in the Denver Metro area, which receives MRF and drop-off glass from the region and processes it in a long-term supply arrangement for nearby Rocky Mountain Bottling Company, which is owned by O-I and MillerCoors. Another example is Ripple Glass (which was acquired by SMI in 2022), which uses an innovative drop-off collection network to provide glass recycling solutions to the Kansas City metro area to supply nearby fiberglass manufacturing facilities.



At the smallest scale, special operations, e.g., sandblasting media, and other rudimentary cleaning and consolidating "depots", have come in and out of business as needs dictate.

4

WORKING TOGETHER



The Glass Packaging Institute (GPI) has supported the development of a broad group of stakeholders across the glass recycling supply chains, from brands that use glass to the communities that supply glass from households and businesses and everything in between.



GLASS RECYCLING
COALITION

The Glass Recycling Coalition (GRC), established in 2016, provides technical assistance and support to build strong regional glass recycling supply chains. More information is available at www.glassrecycles.org. GPI also worked with these same partners to launch the Glass Recycling Foundation (GRF) in 2018 to channel financial support through grants to address critical gaps in regional glass recycling supply chains. More information is available at www.glassrecyclingfoundation.org. These three organizations work closely together to make glass



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