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Does Glass Recycling Still Make Sense?

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Recyclers typically do not want glass for several reasons. First, the market for recycled glass is poor to non-existent in most parts of the country. Second, glass breakage and cross contamination at material recovery facilities leads to increased processing costs and increased contamination of other recyclable materials, thus lowering the value of these commodities. While many communities are continuing to instruct their residents to place glass bottles and jars in single-stream carts, some communities have opted to discontinue glass collection in their recycling programs. Currently, it costs from $10 to $40 a ton across the country to send collected glass materials to cullet processors. Given that glass accounts for almost 5% of the municipal solid wastestream and that state and local agencies have set ambitious zero waste goals, many agencies are not yet ready to give up on glass recycling and have developed other models.

The Facts About Glass
Glass, which has been in use for thousands of years, is a transparent substance, made primarily from sand, soda ash, and limestone. Glass containers are produced in three colors: clear (flint), brown (amber), and green. Of these colors, flint has the largest number of applications and is usually in greatest demand by glass manufacturers. Brown or green glass is used in products where exposure to sunlight may cause the product to degrade.

The primary glass produced in the wastestream is the glass container, which is mainly composed of soda bottles, beer bottles, and condiment jars. Other glass products such as cookware, dishware, ceramics, windows, and specialty glass also appear in the solid wastestream, but are considered contaminants due to their chemical composition or heat-resistant properties.

Most manufacturing facilities involved in glass recycling use only bottles and jars, i.e., container glass. These manufacturers also require collected glass to be separated by color, since the material is used to make glass of the same color. Mixing colors produces a low-quality glass container and, in many cases, an aesthetically unappealing end product.

If a manufacturer does not have appropriate processing equipment, the recycler (or middle processor) is required to remove metal, paper, and other glass contaminants from the container glass, as well as separate them according to color. Since glass furnaces operate at temperatures of 2,600°F, most metals will melt and corrode the furnace linings. Other metals such as aluminum form small balls that end up in finished products, making them unusable. Melting mixed colors of glass and glass of varying chemical compositions in the same batch can lead to a foaming action in the furnace, which produces off-color bottles with numerous air pockets within the glass. Ceramics and heat-resistant glass do not melt at the temperatures used in a glass container furnace and show up in the end product as "stones" or other defects.

The primary markets for recyclable glass containers are the 75 glass container manufacturing plants in the United States. Other secondary markets include road construction, either on the surface called "glassphalt" or as a road base aggregate, filler aggregate in storm drain and French drain systems, the fiberglass industry, glass beads for reflective paints, abrasives, foam glass, and other building materials.

In 1967, 40 container glass manufacturers produced glass from 112 plants in 27 states. Today, 17 companies operate 54 facilities in 27 states.

As glass containers lost market shares to aluminum cans, PET, and other plastic materials over the last

two decades, the glass container industry consolidated and reduced capacity. Three companies (Owens-Brockway, Gallo, and Saint-Gobain) supplied about 90% of glass container demand (9.36 million tons, or 60.6 pounds per person per year) in the US in 2010, estimated at approximately 25 million glass containers, with nearly 75% beer bottles, the remaining mostly food containers.

In recent years, factors that have contributed to the increase in glass recycling are preservation of natural resources, reduction in litter, energy conservation reduced waste quantities, disposal cost, and reduction of raw material use. The natural resources in glass manufacturing are sand, limestone, and soda ash. Although these resources are abundant in the US, they are geographically separated by long distances, which leads to high transportation costs in procuring these raw materials. Thus, using recycled glass helps conserve oil and gas.

The "bottle bill" legislation, passed by many states in the 1970s, encouraged glass manufacturers to use reclaimed ground glass called "cullet." Using cullet allows furnaces to operate at lower temperatures, which extend furnace life, reduce energy costs, and lower stack emissions. The use of cullet in the manufacture of glass has increased steadily from 22% in 1988, to 33.4% in 2012.

The price paid for glass containers is determined by color, quality, and the extent to which it has been prepared (i.e., crushed or whole). The prices paid for glass containers vary greatly depending upon proximity to glass manufacturing facilities. In some locations, collectors are paying $5–8 per ton to market their green glass. The unstable market for green glass cullet is in large part due to the manufacturers. The quantity of imported foreign liquors bottled in green glass exceeds the production capacity for green color containers.


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Credit: iStock/JohnnyWalker61
End of the trail

Probably the greatest influence on cullet and bottle prices in the late '80s was the supply of new material from communities with mandatory recycling programs. As more communities implemented recycling programs to extend the life of existing landfills, a new flood of glass caused prices to decrease. Because mandatory recycling was motivated by cost-avoidance, communities were willing to give glass away, if necessary.

For decades, intermediate and secondary processors produced cullet from natural resources and reclaimed materials, which was then sold to glass manufacturing facilities. However, in the '80s, due to the abundance of available container glass, many glass manufacturing plants spent millions of dollars on glass beneficiation facilities at their plants.

With cullet prices heading downward in most parts of the country, many communities are contemplating removing glass containers from their recycling programs. Communities have discovered that glass recycling is a labor-intensive and time-consuming endeavor, which can prove to be expensive with falling cullet prices.

In many cases, however, the public relations benefits and avoided tipping fees are felt to outweigh the collection and processing costs.

Current State of Affairs
As mentioned previously, solid waste agencies have encouraged residents to combine all of their recyclable materials into one cart, which is commonly referred to as single-stream recycling. Due to the ease of this process, recycling rates have generally increased in communities that have adopted single-stream recycling collection, while at the same time the cost of sorting these materials at the MRF has increased. According to many MRF operators, glass complicates the material recovery process, because it has a deleterious effect on their processing equipment and the other materials, such as fiber, in the wastestream. Some MRF operators have even decided that it is too expensive to separate out glass and ship these streams to nearby landfills to use as cover materials.

Given these circumstances, and the almost limited market for recycled glass, what are solid waste agencies planning for the near term? The following paragraphs highlight interviews of several solid waste agencies nationwide.

Sarasota County, FL
Sarasota County, which is located on the west coast of the state, is keeping glass in its recycling. The county has a source-separated, dual-stream collection program. Glass is a cost for them to have it

processed and recycled. According to Brian Usher, the County Solid Waste Collection Manager, there are four reasons they continue to collect glass in their program:

1. *Public perception:* Glass is still perceived to be one of the foundational "fruits" of recycling and a high value commodity.
2. *Cost:* Even though recycling glass is a cost to us, the cost of collecting and processing is still cheaper and more sustainable than landfilling. Our landfill is not excited about diverting all of this glass to the landfill where it has no LFG value, does not readily degrade, and will take up airspace.
3. *Diversion:* in an effort to meet diversion goals in Florida of 75% by 2020, glass is one of the few commodities that still has weight and contributes to tonnages diverted.
4. *Processing:* as a dual-stream collector, glass does not have quite the cross-contamination issues that it does for the single-stream recycling processing.

The County's processing contract is up in 2018, and its current processor is pushing for renegotiation of the agreement due to the changes in the recyclable materials commodity markets. The collections contract is also up in 2018, and the current status of recycling is going to weigh heavily on their decisions in 2018 in regards to single-stream collection and processing. But for now—glass is staying in the Sarasota County program.

Mecklenburg County, NC
In North Carolina, a separate ABC law requires those entities selling alcohol to recycle. That means solid waste agencies get a lot of glass from the establishments that have beer bottles. Jeff Smithberger, the County's Director of Solid Waste Management reported on their saga of glass issues and problems.

Briefly, the County owns its own MRF and contracts the facility operations through ReCommunity. The County's MRF is not the only one operating in the Charlotte area, but the only one willing to consistently accept glass from the ABC "haulers" of that material. That being said, the County has noticed issues in the operation of the MRF, as well as maintenance specifically related to glass such as damage to the concrete floor where the glass is stored, to reduced life of conveyor belts and separation equipment. Once the material is separated, the County then has the issue of finding a buyer of the glass? Smithberger indicated that the County, like nearly every other facility he is aware of in the Charlotte area, must pay to have the glass shipped out.

The County is in the process of raising the "glass only price" for incoming commercial loads to cover the costs associated with the material. Another problem the County is currently having with the ABC recycling program is that the bars and restaurants associated with recycling have a high turnover rate of waiters, waitresses, bartenders, and such, and they receive minimal training on acceptable materials. Thus, the incoming glass is frequently contaminated with food residues. That further complicates the separation process, and it affects glass cleanliness and quality. The County is launching a special outreach program to bars and restaurants this winter, but that just adds more cost to the overall program.

Rumpke Consolidated Companies
Rumpke is a vertically integrated solid waste firm in the Midwest, with recycling, collection, and disposal facilities in Indiana, Kentucky, Ohio, and West Virginia. Since the early 2000s, the company made investments in its MRFs to recover glass and make it into a fine-grind product, which could be sold to the fiberglass market. In 2010, Rumpke signed an agreement with Owen-Illinois and invested $4.1 million to upgrade its capabilities for glass processing. As a result, Rumpke is able to sell to a variety of markets, cullet to Owens-Illinois for new glass bottles, as well as Owens Corning and John Manville for fiberglass insulation. The Rumpke experience demonstrates that being located close to the ultimate end user for recycled glass can make the difference between making money and costing money to recycle this material.

Final Observations
Glass continues to be a difficult commodity for local solid waste agencies to cost-effectively recycle. Since it is a dense commodity, glass continues to make up a significant portion of landfill diversion rates. The limited markets in most regions makes it a "loss leader" for many recycling programs. Efforts by Rumpke to develop viable local markets is a glittering example of how one company can help push curbside glass collection by taking an integrated approach. Further, legislative efforts to promote extended producer responsibility in British Columbia and elsewhere can have significant glass recycling impacts. Time will tell if the glass recycling market is half full or half empty.

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