

Washington's "Glass"

Half Full or Half Empty?



An Examination of Glass Recycling in Washington State

Acknowledgments

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Executive Summary

Overview

Background

Effective July 1, 2019, the Recycling Development Center (Center) was created within the Department of Ecology (Ecology) in partnership with Department of Commerce (Commerce) by the Sustainable Recycling Act of 2019 ([Chapter 70A.240 Revised Code of Washington](#)). The purpose of the Center is to provide or facilitate basic and applied research and development, marketing, and policy analysis in furthering the development of markets and processing of recyclable materials into commodities and products.

This report was prepared to address Commerce's assignment to "undertake a study on the unmet capital and other needs of reprocessing and manufacturing firms using recycled materials, such as financing and incentive programs."¹

Focus of report

The focus of this report is on glass containers, jars, and bottles collected in Washington. Other types of glass, like windows, ovenware, Pyrex, and crystal, are not included in this report.

This report offers recommendations for glass recycling in Washington. Research conducted includes:

- Glass recycling in Washington.
- Compare to markets in other states and countries.
- Identify the needs of reprocessing and manufacturing firms using recycled glass.
- Examine capital needs and opportunities for financing and incentive programs.

Methods

Commerce conducted surveys and interviews, reviewed legislation and policy, and analyzed glass recycling market data trends. Specifically, this report is a result of surveys with the Recycling Development Center advisory board members and glass subject matter experts. Commerce analyzed glass recycling activities in the state of Washington and studied glass recycling markets in different states and around the world to compare to glass recycling in Washington.

¹ RCW 70A.240.030(4)(e)

Key Highlights

This report highlights the great variety in how different jurisdictions address glass recycling, throughout Washington and across the world. After conducting qualitative interviews with key stakeholders, analyzing data, and completing additional academic research, there is not one clear vision or direction for how to address the gaps in the glass recycling market. Some of the key findings of this report include:

- In Washington's current market, it can be more expensive to transport, clean, and process recycled glass than it would be to make new glass.
- Transportation cost is one of the biggest barriers to economical recycling of glass.
- Recycling facilities' unmet capital needs include facility and equipment updates.
- Successful glass recycling programs and markets exist in other states, and there is potential to mirror those programs in Washington.
- The most successful incentive programs involve both the consumers and producers of glass working together. One example is a container deposit program that has been shown to collect more and cleaner glass bottles.

Recommendations

- Implement glass improvement programs at collection and materials recovery facilities to shift focus from quantity to quality. Promote programs that have clearly demonstrated their ability to produce high-quality recycled glass suitable for reuse in the manufacture of new glass containers. One example is the separation of glass from other materials collected from curbside residences.
- Create agency partnerships to develop procurement guidelines with recycling stakeholders to promote use of recycled glass materials in projects. Ecology, Commerce and the Department of Transportation could partner to lead this effort.
- Implement policies to increase the use of recycled material in glass products and packaging produced in the state by setting minimum recycled content targets.
- Create an Extended Producer Responsibility (EPR) Program to transfer responsibility for end-of-life management for glass products and packaging to the producers using the glass packaging (bottles and jars).
- Increase awareness and education by developing partnerships between glass recycling companies and communities to improve the quality and amount of recycled glass collected, recycled, and made available for purchase. Promote consistent messaging throughout the state emphasizing the importance of glass recycling. Enforcement of new policies or programs without educating the public will not be as effective.
- Work in collaboration with stakeholders and the community to build on existing programs and establish new programs for collection and recovery of beverage containers, such as a container deposit program for beverage containers.

Recycling in Washington

Washington utilizes a predominantly commingled system for collection of residential recyclables, also referred to as mixed or single-stream recycling. In this system, residents place all recyclables into one bin at the curb. The materials in the bin are picked up by a solid waste hauling company and delivered to a material recovery facility (MRF). The MRF sorts the material into individual commodity streams such as glass, paper, plastics, and metals. At most MRFs, residentially collected materials can be mixed with commercial materials for sorting and processing. After the glass is separated from the other material, based on the quality it is either sent to a landfill or to processing facility to be crushed into cullet. Cullet can then be sent to manufacturers to create new products. Strategic Materials, Inc. in Seattle is the only glass processing facility in the state. Strategic Materials sends the usable cullet to Seattle based Ardagh Glass, Inc. to make new bottles. Both of these companies are examined later in this report.

Commingled recycling has increased in popularity because it is easy for residential customers to put all their recyclables in one cart, costs cities less money, and increases participation. It is also easier for collection companies to pick up materials in just one bin, using a robotic arm, instead of having workers manually empty many smaller bins into different compartments on a truck.

However, due to confusion about what is recyclable and what is not, residents often ruin recyclable material by placing non-recyclable items in the commingled bin. In some cases, accepted materials can even cross-contaminate other recyclables in the bin. Glass is a major source of this problem in single-stream bins. Unlike other recycled materials, glass can break, which then contaminates the paper material with glass bits and liquids. Glass can break during collection in the bin, during transport, or when being sorted at the MRF. Broken glass is problematic for the machinery and result in expensive repairs.

Residential Recycling in Washington State

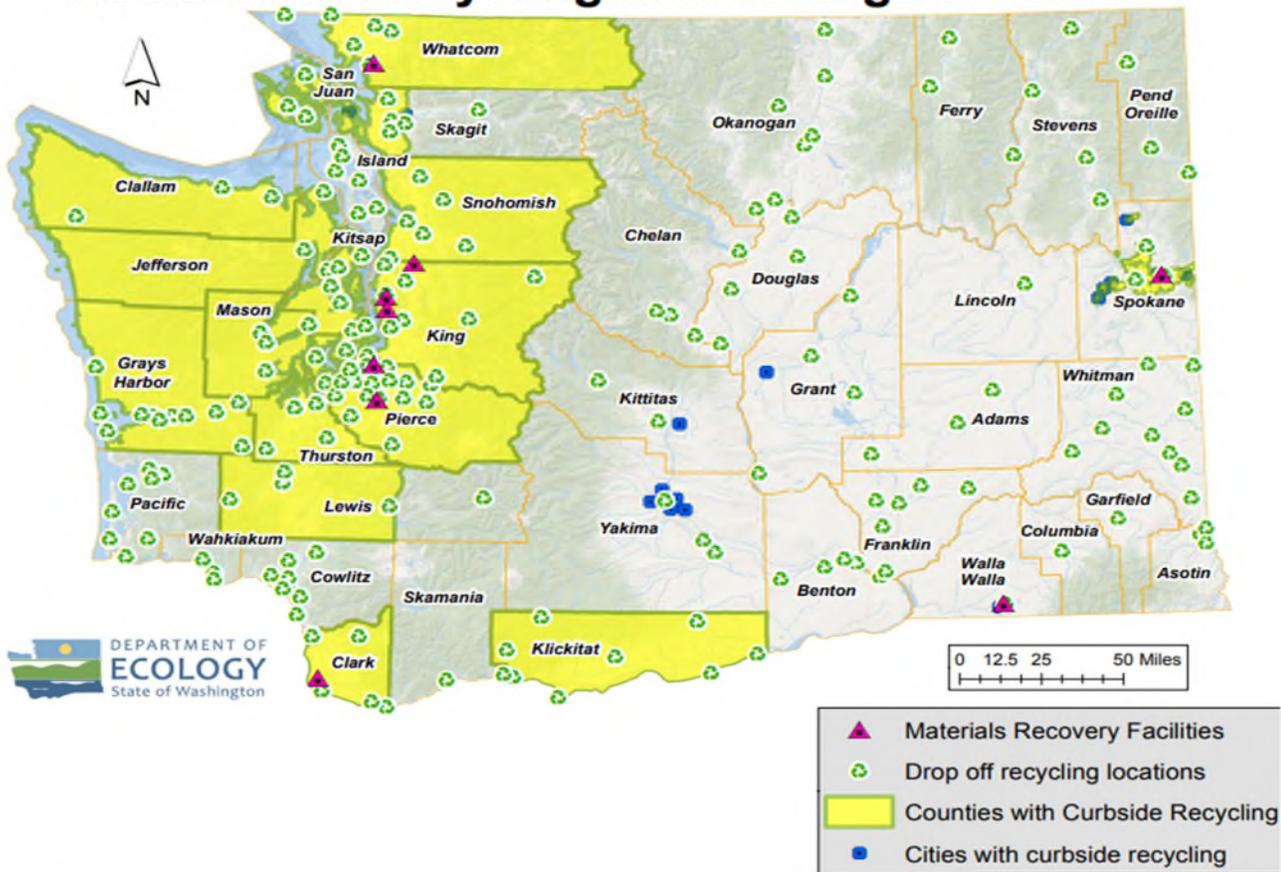


Figure 1: Washington Residential Recycling Map²

In some jurisdictions, glass is not accepted (including Pierce County) in the curbside bin and in others (such as Thurston County) glass is collected separately at the curb. High levels of contamination in commingled recycling programs have led to challenges in finding end markets for collected materials. This contaminated material is often sent directly to the landfill.

According to 2016 data, Ecology reports that 88% of people living in single-family homes and 77% of people in multi-family residences have access to curbside recycling. The remaining population is served by 192 recycling drop off locations.

² Ecology, "Residential Recycling in Washington State", https://fortress.wa.gov/ecy/ezshare/swm/SWMDData2017/WAResidential_Recycling_2016.pdf

Benefits of a commingled system

There are many benefits for choosing an automated "single bin" approach:

- The collection trucks can compact all the materials together, rather than having to leave their route to empty the entire truckload when only one material type has reached capacity.
- Commingled collection also reduces worker injuries and improves collection route time, which lowers costs for collection.
- Because there is less or no sorting required by residents, there is increased participation.
- The increased capacity of recycling bins in commingled systems allows for higher collection volumes and the ability for programs to add new types of recyclables without having to invest in multiple bins.
- Commingled bins have a lid and wheels, which improves public convenience and privacy, and prevents material from blowing out of the bins.
- Bins also keep pests from getting in, protects materials from weather moisture, and makes the recyclables easier to process and worth more in the marketplace.

Limitations of a commingled system

Glass bottles and jars have several drawbacks when included in the commingled collection system: they often break during collection and processing, liquids in the glass bottles or jars negatively impacts paper in the bin, and broken glass pieces in processed paper or plastic are unwanted by the end user. Glass is particularly damaging to MRF machinery. The major limitation of a commingled recycling system is that when items are mixed together, they must then be separated. Many of the benefits on the collection side of the system can cause problems for the processor and, in turn, the end-use manufacturers.

- Materials like glass, plastic film, and flattened containers are difficult to separate once mixed together, and can cause problems with equipment, and cross-contamination of other materials, especially paper.
- The increase in collection volumes and participation can overwhelm the processing system, causing cross-contamination, an increase in non-program materials, and ultimately, "lost" recyclables.
- Jurisdictions often have variations in what materials are considered recyclable. This causes confusion for residents and makes it more difficult for the MRFs to rely on a consistent mix which makes sorting more challenging.
- The savings achieved from the commingled collection system result in higher shifted costs to the processors and end users of the recyclable materials. It is more labor intensive to sort and produces a lower quality material.
- The capacity, shape and privacy of the cart might lead residents to use the recycling cart for excess garbage.
- Because commingled bins offer increased capacity, many jurisdictions that switch to commingled bins will often reduce garbage service to every-other-week, exacerbating the dumping issue.
- Residents often hold the mistaken belief that everything can go in the commingled recycling bin, and it will get sorted and recycled.
- Mistakes can be made due to the visual similarity of garbage and recycling bins. Either way, direct feedback to the resident is much more difficult with a commingled collection system.

Recyclables are separated at the MRF into glass cullet and bales of paper, plastic, or metal to sell to manufacturers who make them into new products or packaging. Improving the collection systems so that cleaner and higher quality materials enter the materials recovery facility is important. This would result in more recyclable materials being sent on to the manufacturers where the actual recycling occurs.

Any item that does not belong in the recycling process is a contaminant. Contamination occurs when non-recyclable material winds up in the recycling stream, or when a recycling bale ends up containing other materials. If plastic bags or lids are mixed with paper, they contaminate the paper and reduce its value. Likewise, if glass is placed in with other recyclables, it can break and contaminate the rest of the material. If the glass bottles contain liquids, that will negatively impact paper in the recycling bin.

Contamination is a serious issue; it reduces efficiency, destroys value, and leads to greater waste. Ecology and its partners have been tackling issues related to contamination for several years, with a particular focus on the single bin recycling system that most homeowners are familiar with.

While there are many ways to reduce contamination, one of the most important is education. What is accepted in one city many not be accepted in a neighboring city. Local governments, their collection companies, and their processors need to develop coordinated messages to educate residents on what does and does not belong in a commingled bin. Common items that can contaminate recyclable materials in the bins and at the MRF include plastic bags, plastic wrap and film, liquids, food, soiled packaging, garden hoses, wire hangers, diapers, electronics, lightbulbs, and batteries. Many of these items can be recycled separately – but not in a commingled bin.³

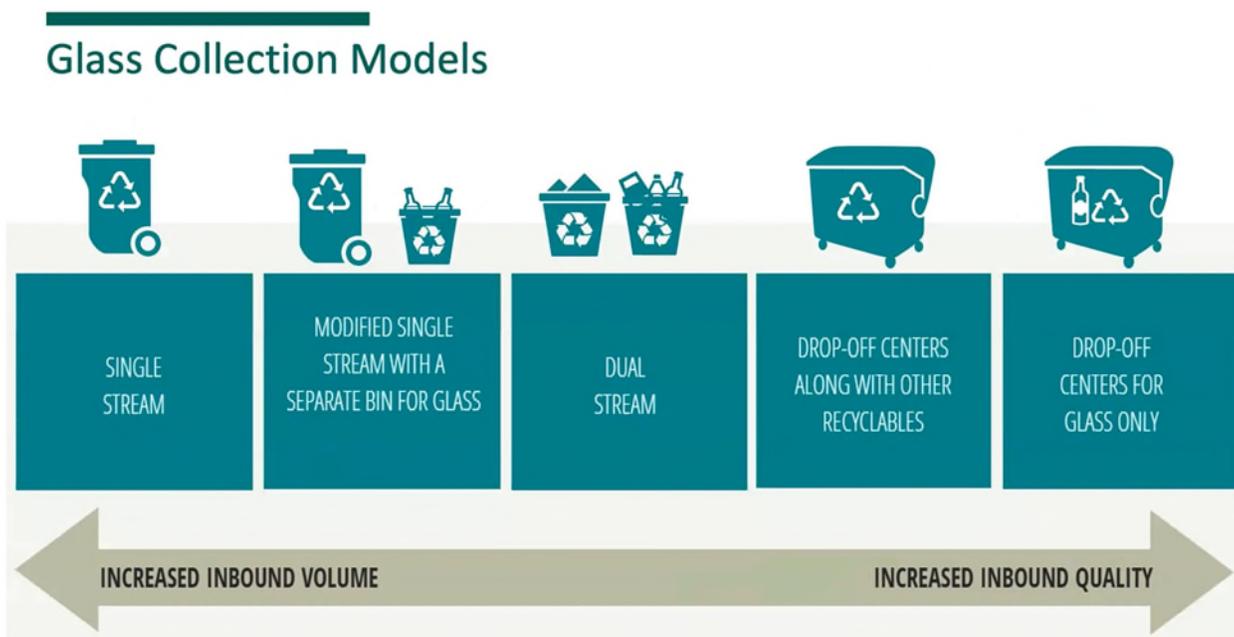


Figure 2: Quantity versus Quality in Glass Collection⁴

³ Ecology, "Recycling Export Restrictions", <https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/China-s-recycling-ban>

⁴ GPI, Northeast Glass Forum Presentation on Community, <https://www.gpi.org/community-recycling>

Ban on exported recyclables

In recent years, more than 60% of Washington's recycled material was exported to China or other Asian markets. Although glass was not sent to China, other materials contaminated by glass were. In 2018, the Chinese government implemented new regulations – known as "National Sword." This policy was later rebranded as "Blue Sky." These regulations restrict the import of low-grade and contaminated recyclables. China accepted more than 50% of the world's exported recyclables for almost two decades. While recyclable material fuels China's industries, contamination in the imported material has caused high levels of waste and environmental pollution. The policy includes a strict 0.5% limit on the amount of contamination allowed in imported recyclables. In addition, China severely limited the number of import licenses issued for recyclable materials. While glass was not exported to China, glass contamination impacted the exported paper and plastic bales. The new restrictions caused worldwide impacts in recycling markets. West coast states are particularly impacted due to the reliance on Chinese markets because of the close proximity, relatively low cost, and ease of shipping recyclable materials to China. More recently, other Asian nations have followed China's lead by limiting imports of recyclables from the US.

The new regulations on contamination levels created an immediate crisis. Asian import bans created a major disruption in Washington and throughout the region. Material recovery facilities in Washington, which receive mixed recyclables and sort them for resale to commodities brokers, have been drastically slowing down their processing of recyclable materials in an attempt to reduce contamination in the bales of recyclable materials. This slowdown has reduced the amount of material that can be processed. The amount of material collected in Washington currently exceeds the processing capacity at these slower processing rates. In the short term, some materials may not be able to be processed and recyclable materials be disposed of in a solid waste handling facility.⁵ As bales of sorted material pile up, local governments and solid waste companies have faced rising costs. When no markets can be found, much of the materials collected for recycling is landfilled.

Glass processing

Many recovered glass facilities use impact crushing, air classification, screening, metal separation, vacuum extraction, and dust control to remove contaminants and then crush the glass. Optical sorting and ceramic detection equipment can also be used. This equipment is expensive to purchase and maintain.

Landfills

Municipal solid waste landfills are regulated under Chapter 173-351 Washington Administrative Code (WAC). Over the past 40 years, solid waste disposal has become much safer and far more protective of public health, habitat, and natural resources. There are 15 operating municipal solid waste landfills in Washington. Glass collected at MRFs often has a negative value due to the costs of cleaning and processing before it can be reused to make new glass products. Unfortunately, disposing of glass at a landfill is less expensive than recycling. At some landfills, crushed glass is used as road base materials or as alternate daily cover on the landfill. In reality, materials sent to a landfill are a loss of the value of that material and lost revenue from potential goods or services utilizing the waste material. Recycling and reuse are estimated to create between 9 to 30 times more jobs compared to landfilling and incineration.⁶

⁵ Ecology, "Recycling Export Restrictions", <https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/China-s-recycling-ban>

⁶ EcoCycle, "Zero Waste Creates Jobs", <http://www.ecocycle.org/zerowaste/jobs>

Manufacturing and Recycling Glass

Glass is made from several raw materials depending on the product type:

- Pure silica: silicone comprises 70-74% of the weight of glass
- Sodium carbonate: lowers the melting point of silica to make it more manageable but makes the glass water soluble
- Limestone, magnesium oxide, and aluminum oxide: added to prevent glass from being water soluble and to increase chemical structure
- Sodium sulfate, sodium chloride, or antimony oxide: can be added to prevent air bubbles in the glass
- Iron: can be added to strengthen ability to absorb infrared energy and heat
- Cerium oxide: added to create a UV radiation ability
- Boron oxide: added to strengthen the structure of glass and protect it from thermal expansion, cracking and thermal shock (Pyrex glass)

Manufacturing glass is a three-step process. Raw glass material is housed in large silos at a location called the batch house. After leaving the batch house, the raw materials are fed into a furnace or tank where it is melted into glass. Once the glass is created, it goes through the forming process.

Glass Facts⁷

Glass is 100% recyclable and can be recycled endlessly without loss in quality or purity.

- Glass is made from readily-available domestic materials, such as sand, soda ash, limestone and “cullet,” the industry term for crushed, furnace-ready, recyclable glass.
- Recycled glass can be substituted for up to 95% of raw materials.
- Recycled glass containers are always needed because glass manufacturers require high-quality recycled container glass cullet to meet market demands for producing new glass containers. Glass containers include beer and soft drink bottles, wine and liquor bottles, as well as bottles and jars for food and juices, cosmetics, and other products.
- Recycled glass is always part of the recipe for glass, and the more that is used, the greater the decrease in energy used in the furnace. This makes using recycled glass profitable in the long run, lowering costs for glass container manufacturers—and benefiting the environment.
- Glass containers for food and beverages are 100% recyclable, but not other types of glass. Other kinds of glass, like windows, ovenware, Pyrex, crystal, etc. are manufactured through a different process. If these materials are introduced into the glass container manufacturing process, they can cause production problems and defective containers.
- Furnace-ready cullet must also be free of contaminants such as metals, ceramics, gravel, stones, etc.
- Color sorting makes a difference, too. Glass manufacturers are limited in the amount of mixed color-cullet (called “3 mix”) they can use to manufacture new containers.
- Some recycled glass containers are not able to be used in the manufacture of new glass bottles and jars or to make fiberglass. This may be because there is too much contamination or the glass pieces are too small to meet manufacturing specifications. Or, it may be that there is not a nearby market for bottle-to-bottle recycling. This recovered glass is then used for non-container glass products. These “secondary” uses for container glass can include tile, filtration, sand blasting, concrete pavements and parking lots.

⁷ Glass Packaging Institute, “Glass Recycling Facts”, <https://www.gpi.org/glass-recycling-facts>

National Glass Recycling Statistics

- Over a ton of natural resources are saved for every ton of glass recycled.
- Energy costs drop about 2-3% for every 10% cullet used in the manufacturing process.
- One ton of carbon dioxide is reduced for every six tons of recycled container glass used in the manufacturing process.
- In 2017, 39.1% of beer and soft drink bottles were recovered for recycling, according to the Environmental Protection Agency. Over 39% of wine and liquor bottles and 15.1% of food and other glass jars were recycled. In total, 33.9% of all glass containers were recycled.
- States with container deposit legislation have an average glass container recycling rate of just over 63%, while non-deposit states only reach about 24%, according to the Container Recycling Institute.
- Beverage container deposit systems provide 11 to 38 times more direct jobs than curbside recycling systems for beverage containers. (Source: The Container Recycling Institute, "Returning to Work: Understanding the Jobs Impacts from Different Methods of Recycling Beverage Containers")
- About 18% of beverages are consumed on premises, such as a bar, restaurant, or hotel. And glass makes up to about 80% of that container mix.
- In 2008, North Carolina passed a law requiring all alcohol beverage permit holders to recycle their beverage containers. Since then, they have boosted the amount of glass bottles recovered for recycling from about 45,000 tons each year before the law went into effect, to more than 86,000 tons in 2011.
- Glass bottles have been reduced in weight approximately 40% over the past 30 years.
- According to the Container Recycling Institute, recycling 1,000 tons of glass creates slightly over eight jobs.

Glass Container Recycling Loop

Glass bottles and jars are 100% and infinitely recyclable



Figure 3: Typical Glass Container Life Cycle in the U.S.⁸

⁸ Glass Packaging Institute, "Glass Recycling Facts", <https://www.gpi.org/glass-recycling-facts>

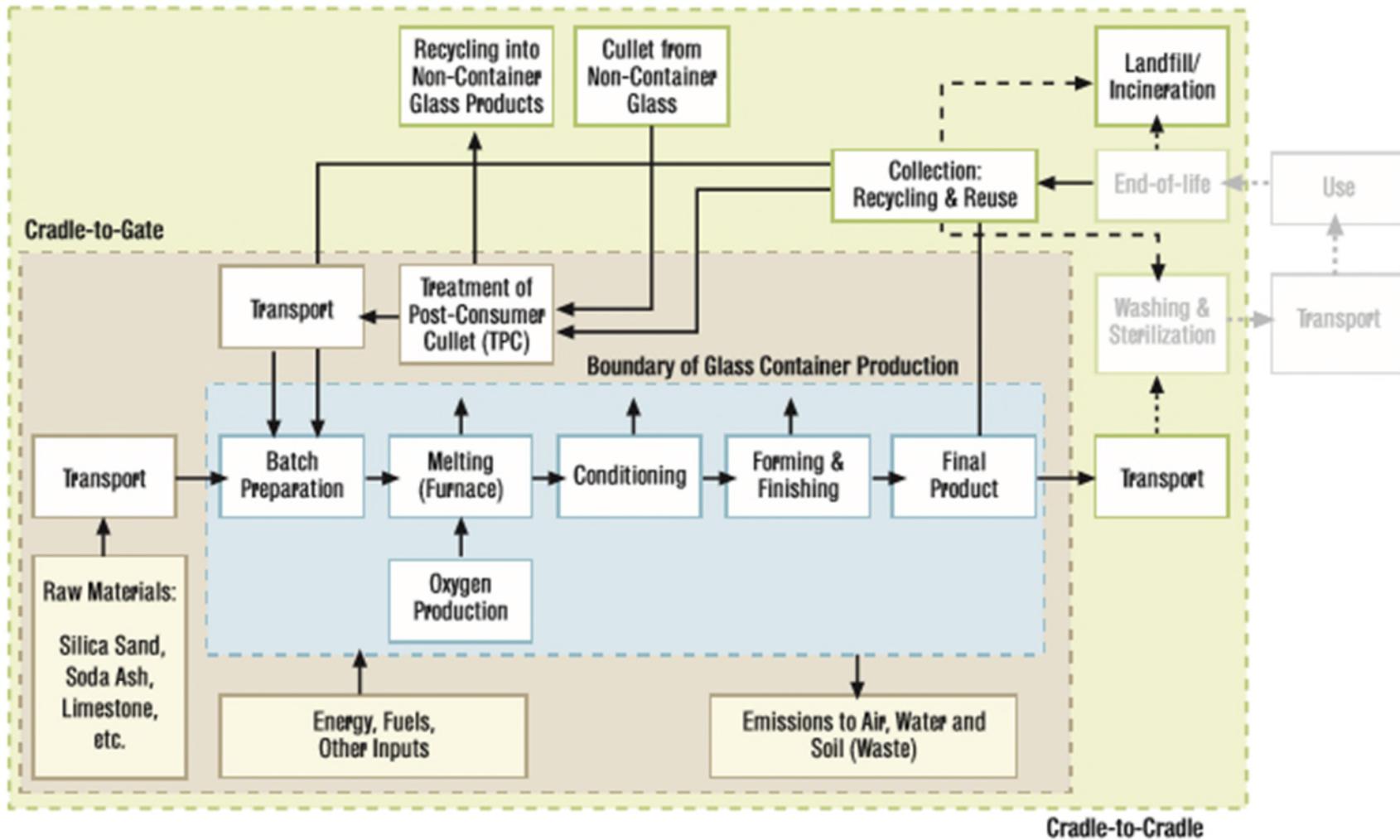


Figure 4: General Glass Life Cycle Flow Diagram in the U.S.⁹

⁹ Glass Packaging Institute, "Environmental Overview Complete Life Cycle Assessment of North American Container Glass" https://assets.noviams.com/novi-file-uploads/gpi/pdfs-and-documents/Learn_About_Glass/LCA_-_GPI2010_-_compressed.pdf

Once a glass bottle has been used for its original purpose, there are four options:

1. Refill: Refillable bottles can be used about 25 times. Sterilizing and refilling a bottle uses about 93% less energy and 47% to 82% less water than making a new bottle.
2. Recycle: Using recycled glass cullet to make fiberglass reduces the energy needed to make new fiberglass by about 25%. Making durable construction materials like glass Pozzolan and foamed glass aggregate conserves energy and material resources, but also reduces greenhouse gas emissions. Pozzolan is a very finely ground post-consumer glass that can be used as a supplementary-cementitious material (SCM)¹⁰ Foamed glass is post-consumer glass mechanically ground into a fine powder and mixed with an environmentally-friendly foaming agent before being kiln fired. As the glass powder and foaming agent reach 1650 degrees Fahrenheit in the kiln, a chemical reaction occurs, causing the glass to foam up. Once cooled it hardens into a substance resembling lava rocks.¹¹
3. Other uses: Glass can be substituted as aggregate for filtration, sand replacement, abrasives, road/highway bed or fill, and alternative daily cover for landfills.
4. Landfill: Glass is disposed as trash.

Current National Trends

- In 2017, glass generation in all products was 11.4 million tons in the United States, which was 4.2 percent of all material solid waste (MSW) generation. The amount of recycled glass containers was three million tons in 2017, for a recycling rate of 26.6 percent.¹²
- The total amount of combusted glass in 2017 was 1.5 million tons. This was 4.3 percent of all MSW combustion with energy recovery that year.¹³
- In 2017, landfills received approximately seven million tons of MSW glass. This was 4.9 percent of all MSW landfilled that year.¹⁴
- In the U.S. it is estimated that 66% of glass is not recycled, of which 43% ends up as trash at a landfill.¹⁵
- In 2017, states with a glass deposit collection system had a glass recycling rate of close to 70% compared to the 12% rate in non-deposit states.¹⁶

10 Department of Civil Engineering, University of Sherbrooke, "Ground Glass Pozzolan in Conventional, High, and Ultra-High Performance Concrete" https://www.matec-conferences.org/articles/mateconf/pdf/2018/08/mateconf_cmss2018_01005.pdf

11 Glavel, "Definitive Foam Glass Guide" https://www.glavel.com/definitive_foam_glass_aggregate_guide/

12 Environmental Protection Agency, "Glass: Material- Specific Data" <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/glass-material-specific-data>

13 Environmental Protection Agency, "Glass: Material- Specific Data" <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/glass-material-specific-data>

14 Environmental Protection Agency, "Glass: Material- Specific Data" <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/glass-material-specific-data>

15 Glass Packaging Institute PowerPoint, Northeast Recycling Council Glass Forum 2020

16 Container Recycling Institute, "2017 Beverage Market Data Analysis Report", 2019

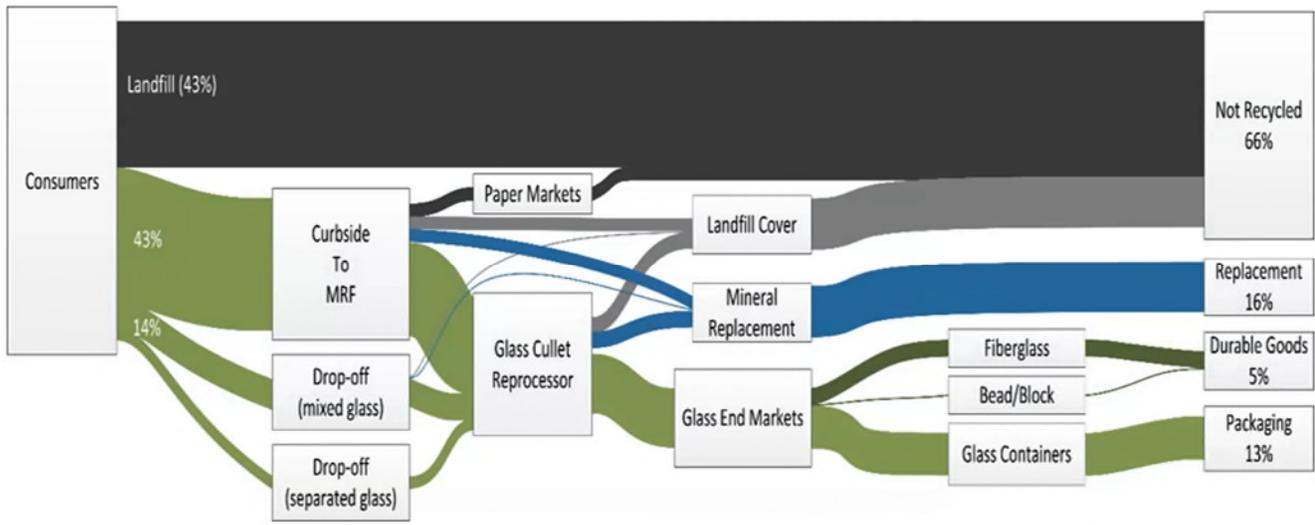


Figure 5: Flow across the Value Chain for Non-Redemption States¹⁷

¹⁷ Glass Packaging Institute PowerPoint, Northeast Recycling Council Glass Forum 2020

U.S. Market Information for Recycled Glass

Recycled glass cullet can be used in a wide variety of products and manufacturing materials. The most popular uses around the United States are examined below.

Containers

Glass container companies represent a \$5.5 billion dollar industry, and employ about 18,000 skilled workers in 49 glass manufacturing plants across 22 states. There are only two in Washington state and are discussed in the Case Studies section of this report. There are over 80 recycled glass processors in 35 states. On average, a typical glass processing facility can handle 20 tons of color-sorted glass per hour.

Glass manufacturers require high-quality recycled container glass to meet market demands for new glass containers. Cullet is always part of the recipe for glass, and the more that is used, the greater the decrease in energy used in the furnace. This makes using cullet profitable in the long run, lowering costs for glass container manufacturers and benefiting the environment.

Glass containers, such as those for food and beverages, can be recycled. Because other types of glass are manufactured through a different process, they can cause production problems and should not go through the same recycle process as containers. Furnace-ready cullet must also be free of contaminants such as metals, ceramics, gravel, stones, etc. Color sorting makes a difference, too. Glass manufacturers are limited in the amount of mixed cullet they can use to manufacture new containers. Separating recycled container glass by color allows the industry to ensure that new bottles match the color standards required by glass container customers.

Cullet that doesn't meet container manufacturing standards and non-container glass are used in tile, filtration, sand blasting, concrete pavements and parking lots, decorative items, and landscaping.¹⁸

Fiberglass

The use of glass cullet to manufacture fiberglass rises each year. The use of cullet in fiberglass manufacturing includes building insulation, or glass wool, and textile fibers for the reinforcement of plastics and other materials. Fiberglass is used in car bodies, boats, insulation for homes, waterpark slides, and even furniture.

Currently, between 10% and 40% of raw materials used by fiberglass insulation manufacturers is recycled glass. The fiberglass sector is the largest secondary market for post-consumer and industrial waste glass.¹⁹

The container and fiberglass industries collectively purchase three million tons of recycled glass annually, which is melted and repurposed for use in the production of new containers and fiberglass products.

Currently, there is not a fiberglass market for recycled glass in Washington, but the opportunity should be explored.

18 Glass Packaging Institute, "Benefits of Glass Packaging", <https://www.gpi.org/benefits-of-glass-packaging>

19 Sioneer, "Bottle and Fiberglass Manufacturing", <https://www.sioneer.com/industries/bottle-and-fiberglass-manufacturing/>

Roadway Bead/Construction Application

Cullet offers a more cost-effective alternative to virgin glass in bead manufacturing.

Once the cullet has been melted into rounded glass pellets, the resulting beads are sold for use in reflective paints for highway striping, as well as for use in peening and cleaning metals.²⁰

General Construction Backfill	Roadway Construction	Utility Construction	Drainage
Stationary loads	Base course	Pipe bedding	Retaining wall backfill
Landscaping fill	Subbase or subgrade layer	Trench backfill	Foundation drainage
	Embankment		Septic field media
			Sand fillers
			Drainage blanket
			French drains

There is no construction market for recycled glass in Washington, but it should also be considered an opportunity to explore.

Fillers

Recycled glass makes an excellent filler in powder form. Glass powders are used in lubricants, core additives and fluxes in metal foundry work and fabrication, chemical compounds, and ceramics. These fillers can be used in making borosilicate, tile, plastics, aluminum castings, caulks, adhesives, coatings, paints, and flooring.

There are many other uses for glass cullet including replacing abrasives like sand, making specialty glass, ceramics, bricks, Astroturf, landscape applications, countertops, and as filtration media.

These potential markets for recycled glass are not currently being utilized in Washington, but should be considered.

²⁰ Strategic Materials, "Recycled Glass Cullet: a Cost-Effective Solution for Bead Manufacturing" <https://www.strategicmaterials.com/bead/>

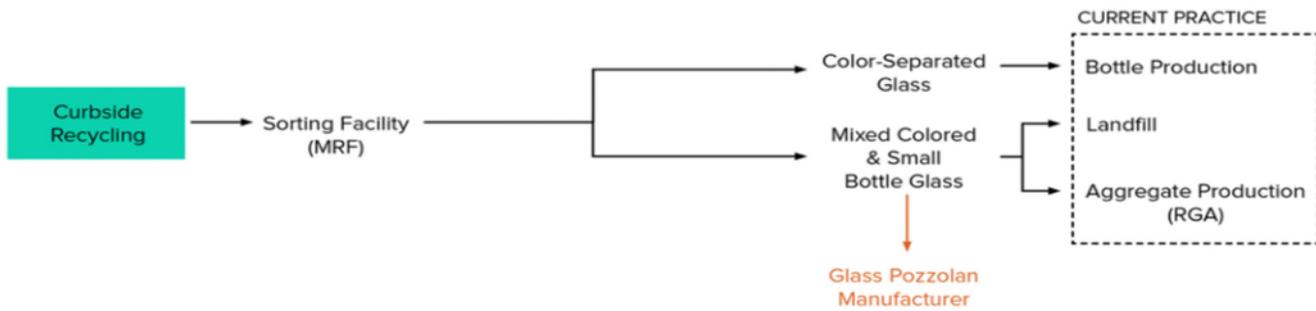


Figure 6: Points of Diversion in Consumer Glass Recycling

Environmental Benefit	Reuse	Recycle			Beneficial use
	Refill bottles	Make glass containers	Make fiberglass	Make construction materials	Crush for use as aggregate
Greenhouse Gas Savings	√	√	√	√	
Energy Savings	√	√	√	√	
Recyclability	√	√			
Water Savings	√				
Material Savings	√	√	√	√	*
Landfill Diversion	√	√	√	√	√

Figure 7: Environmental Benefits of Recycled Glass²¹

21 Northeast Recycling Council, "Glass Hierarchy", https://nerc.org/documents/Glass/glass_hierarchy_oct_15_2019.pdf

Washington Data: Impacts and Challenges

What is a Material Recovery Facility (MRF)?

A "typical" MRF in 2018:²²

- It is likely to be a single-stream system. A single-stream recycling is a system where all recyclables, including paper, cardboard, plastic, metals, glass, etc., are placed in a single bin or cart for recycling.
- If it is single-stream, it may be confronting high residue rates. Trash, or residue, contaminates recyclable materials, turning the whole bin into trash. Not only can co-mingling of trash and recyclables ruin a batch, but it can also contaminate other materials if it is dumped into a truck meant only for recyclables. If not removed before it goes to the processing plant, the trash can damage expensive machinery used to separate recyclables.²³
- It is likely to process more than 100 tons per day.
- Over the past several years, it has accepted more materials, particularly with respect to fiber and plastics.
- It is relying on highly mechanized sort systems with optical sorting equipment.
- It is most likely owned and operated by a private firm.

Single stream MRFs are challenged with upgrading technology to process more efficiently and effectively. Technology is continually evolving with robots, new types of screens, and improved separators being developed. While improved technology can make processing better, it is costly to upgrade. Without strong markets for recycled glass, the upgrades are not practical.

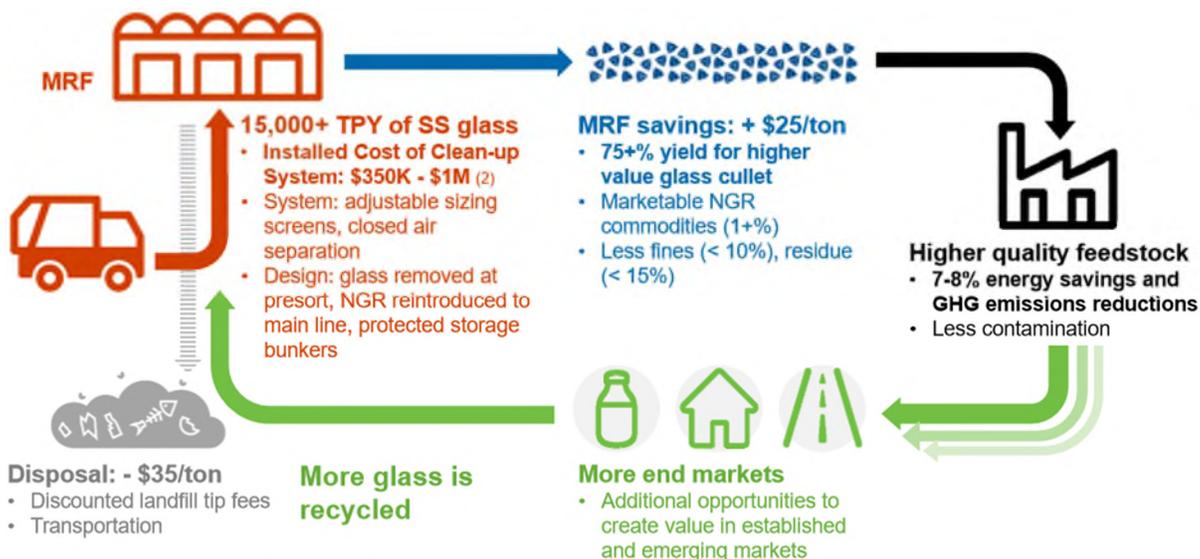


Figure 8: Return on Investment on Improving Glass Clean-up

22 Northeast Recycling Council, "Is the Glass Half Empty of Half Full: The State of Glass Recycling at U.S. MRFs", https://nerc.org/documents/Webinars/Finding%20Opportunity%20in%20MRF%20Glass/Eileen%20Berenyi_GAA%20Presentation.pdf
23 Waste Management, "Recycling Residue", <https://www.wm.com/location/california/north-county/oceanside/env/recycle-residue.jsp>

Washington MRFs

Pioneer Recycling

Facility details

The Tacoma, WA facility accepts commingled recyclables from 15 counties. It features a modern integrated sort system, optical sorts, two balers, two truck scales, two loaders and a dedicated staff. The plant not only processes residential and office comingled mix, but separated loads of cardboard, plastics and metals.

Materials processed

This is a full-service recycling company which offers processing services for the sorting of comingled residential and office recyclables, loose and baled, as well as grade separated recyclables for customers throughout both Washington and Oregon states.²⁴

According to Washington's only recycled glass processing facility, Strategic Materials, Pioneer Recycling transferred 2,540 tons of unprocessed mixed single stream bottle glass to them in 2019. Pioneer was contacted for specific data regarding their production volume and unmet capital needs, but did not respond in time to be included in this report.

The map below provides a general overview of where commercial and residential recyclable materials are collected that are processed at Pioneer Recycling Services.

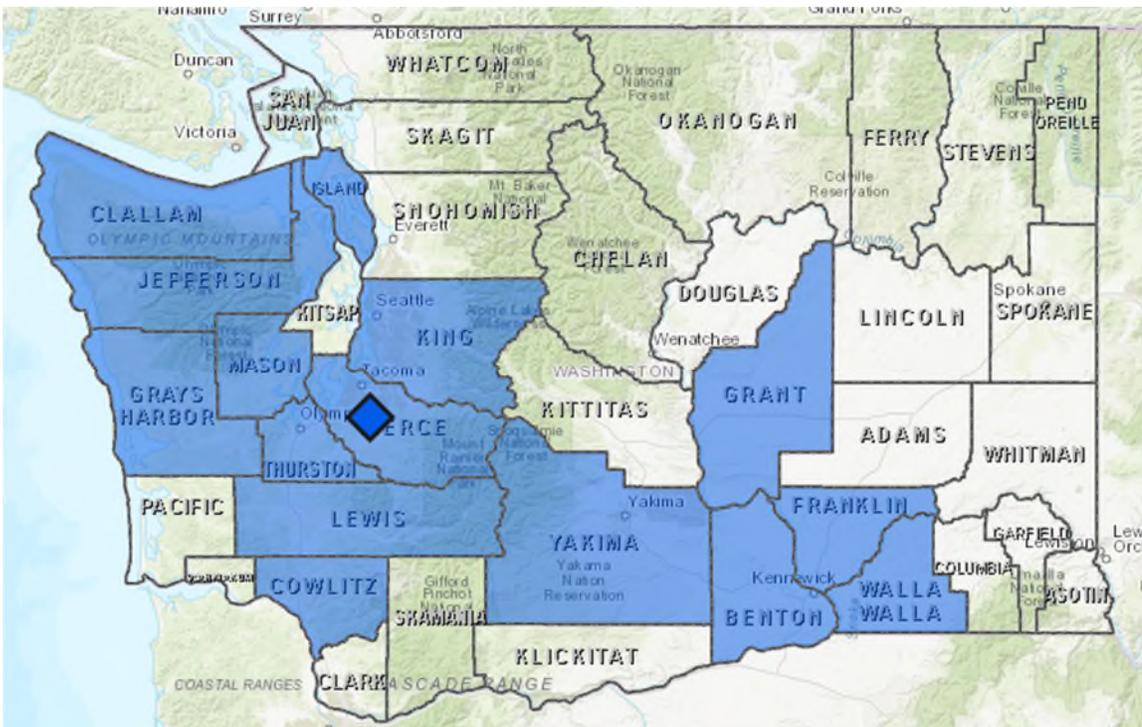


Figure 9: Pioneer Recycling Territory²⁵

24 Pioneer Recycling Services, "Home Page", <http://www.pioneerr.com/>

25 Ecology

Waste Management Recycling and Recovery Centers (WM)

Waste Management is a national company with a large network of landfills, transfer stations, and recycling facilities. It has three separate operations in Washington: Spokane Materials and Recycling Technology (SMaRT) Center, JKM Fibers, and Cascade Recycling Center (CRC). Each are discussed below.

According to Matthew Stearn, Area Director of Recycling Operations in the Pacific Northwest BC area, Waste Management collects roughly 3,000 tons of glass a month at all of its facilities in Washington. He stated that the greatest challenge that Waste Management has in terms of glass recycling is a lack of markets for low quality glass material. Limited amounts of glass can be accepted by Strategic Materials, the rest must go to landfill or beneficial use. In 2019, roughly 2/3 went to bottle-to-bottle markets and 1/3 went for beneficial use as an aggregate substitute for construction at the landfill.

"Waste Management supports the effort to strengthen markets for all recycled materials, including glass, and would be glad to participate in any financial incentive programs that would enhance the processing capabilities at our MRFs." Matt Stearn, Area Director of Recycling Operations in the Pacific Northwest BC area

Spokane Materials and Recycling Technology (SMaRT) Center

Facility Details

Waste Management accepts commingled recyclables from seven counties. The company invested \$18 million in its single stream recycling facility located on an eight-acre site in the City of Spokane. The SMaRT Center can process 100,000 tons of recyclables per year and is the centerpiece of a regional strategy aimed at dramatically reducing waste and boosting recycling in the area. The 62,000-square-foot, single-stream facility allows residents and businesses to recycle a broader assortment of materials, resulting in dramatically higher recycling and diversion rates.

Materials Processed

The site accepts many types of materials including single-stream "all in one" recyclables as well as mixed residential and commercial recyclables. The site is not open to the public for drop off. It should be noted that all glass received at this facility goes to landfill.²⁶ When asked about redirecting this glass to other facilities so it could be transferred to Strategic Materials for recycling, Matt Stearn replied, "There are several reasons the glass doesn't go to Strategic Materials. Due to lack of market demand, Strategic Materials does not have the capacity to handle all the glass created in WA and the Pacific Northwest. Very long haul distances/times make for a costly, inefficient, and environmentally-unfriendly transport."

The map below provides a general overview of where commercial and residential recyclable materials are collected that are processed at Waste Management Spokane.

²⁶ Waste Management, "Spokane Materials and Recycling Technology (SMaRT) Center", <http://wmnorthwest.com/smartrecycling/index.html>

Waste Management JKM Fibers

Facility Details

Waste Management JMK Fibers accepts commingled recyclables from five counties. It operates in a 90,000 square foot building located on a 10-acre site within the Port of Tacoma. The facility has 24 shipping/receiving docks.

WM JMK invested several million dollars in 2019 to meet the challenges in global recycling. Using technology to efficiently and effectively sort out garbage and non-recyclable items ensures the recyclables that leave WM JMK will be made into new products.

Shipping Capabilities

WM JMK Fibers is located at the Port of Tacoma, a transportation logistics hub with access to domestic and international markets. Located next to Interstate 5, WM JMK is positioned to serve domestic markets via long haul trucks and also has barge or rail capacity.²⁷

According to Strategic Materials, JKM transferred 9,556 tons of unprocessed mixed single stream bottle glass to them in 2019.

Cascade Recycling Center (CRC)

Facility Details

Waste Management CRC accepts commingled recyclables from five counties. The company processes recyclables collected from over 250,000 households in Washington. The facility is 82,000 square feet on 6.25 acres. CRC processes 12,000 tons of commingled recyclables every month, and with advanced sorting capabilities, less than 5% of the material that enters the facility ends up at the landfill.

Materials Processed

WM CRC utilizes a single stream sorting system allowing residents and businesses to combine all of their recyclables in one container. Paper, metals, glass and plastic bottles are collected together and specially designed technology and quality control employees sort the materials and create bales of various commodities ready for shipment and their second life.²⁸

According to Strategic Materials, Pioneer Recycling transferred 2,540 tons of unprocessed mixed single stream bottle glass to them in 2019.

27 Waste Management, "Waste Management JMK Fibers", <http://wmnorthwest.com/otherservices/jmkfibers.html>

28 Waste Management, "Cascade Recycling Center", <http://wmnorthwest.com/cascaderecycling/index.html>

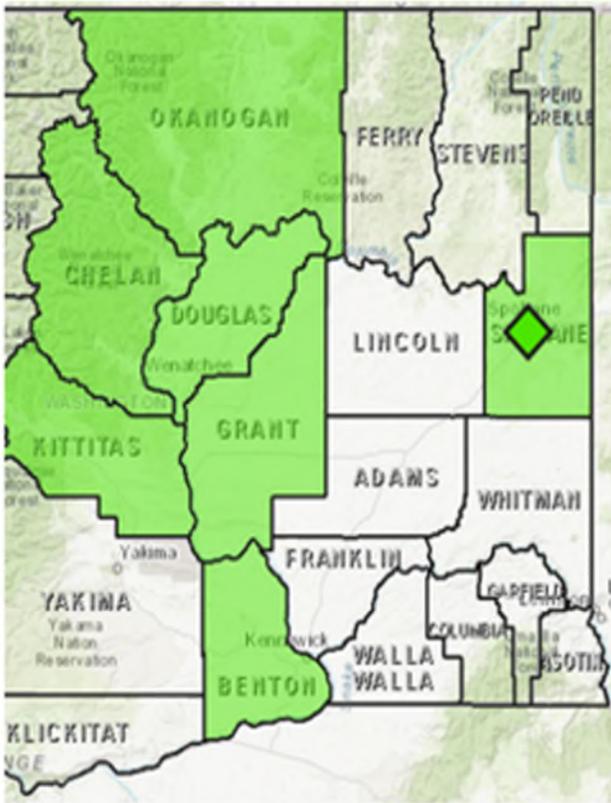


Figure 10: WM SMaRT Territory



Figure 11: WM JKM Fibers Territory

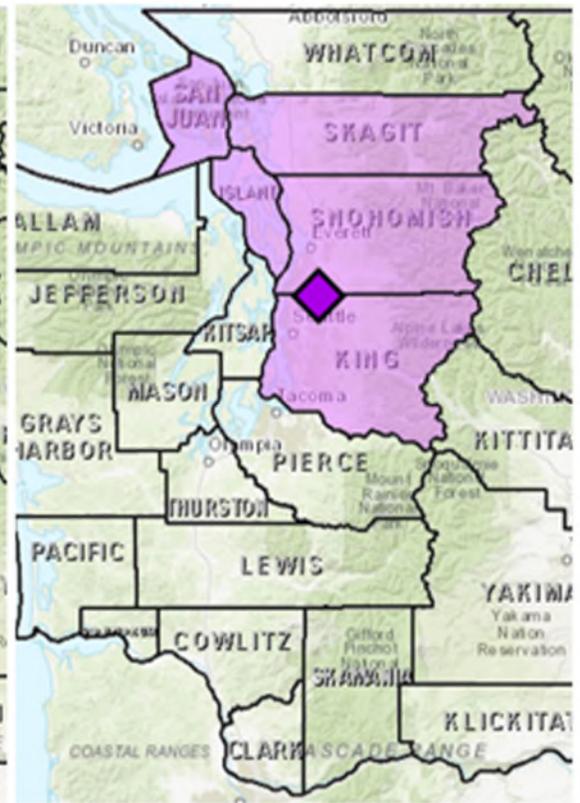


Figure 12: WM CRC Territory²⁹

²⁹ Ecology

Rabanco Recycling (Republic Services) Material Recovery Facility

Facility Details

Republic Services, Inc. accepts commingled recyclables from four counties.³⁰

Materials Processed

According to Strategic Materials, Rabanco Recycling transferred 21,455 tons of unprocessed mixed single stream bottle glass to them in 2019.

Rabanco Recycling was contacted for specific data regarding their production volume and unmet capital needs, but did not respond in time to be included in this report.

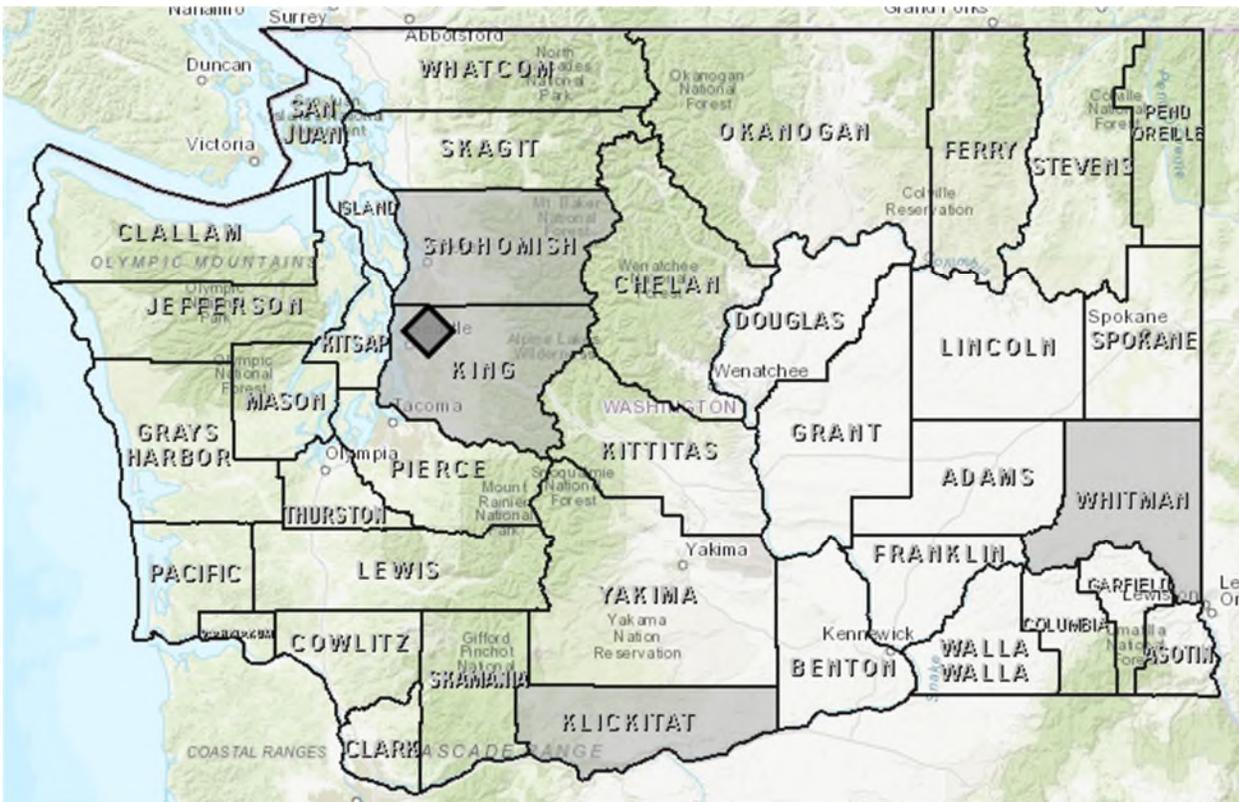


Figure 13: Republic Services MRF Territory³¹

30 Republic Services, "Home", <https://www.republicservices.com/>

31 Ecology

NW Recycling

Northwest Recycling accepts a variety of recyclable commodities from Whatcom County. The company is committed to providing recycling solutions that keep recyclable materials out of landfills and getting it into the hands of processors that create new materials out of used materials.³²

Kevin Moore, the CEO of NW Recycling, stated, "In Bellingham, we have source separated curbside recycling (three bin system). We have been selling our glass to the same glass recycler (Washington-based) for more than 10 years. We actually are paid a small amount per ton but it is basically only enough to cover the trucking costs. We have not made any changes in the way we handle glass for many years."

According to Strategic Materials, NW Recycling transferred 4,095 tons of unprocessed mixed single stream bottle glass to them in 2019.

NW Recycling was contacted for specific data regarding their production volume and unmet capital needs, but did not respond in time to be included in this report.

REcology Cleanscapes

REcology accepts a variety of recyclable commodities from King and San Juan counties. The Washington operation is one of over 45 operating companies that provide integrated services to more than 889,000 residential customers and 112,000 commercial customers in California, Oregon, and Washington.³³

According to Strategic Materials, Cleanscapes transferred 7,349 tons of unprocessed mixed single stream bottle glass to them in 2019.

REcology was contacted for specific data regarding their production volume and unmet capital needs, but did not respond in time to be included in this report.

Waste Connections West Vancouver Materials Recovery Center (A Columbia Resource Company)

Columbia Resource Company accepts a variety of recyclable commodities from Clark County. It is a member of the Waste Connections family, serving over six million customers nationwide. It provides safe, reliable, environmentally conscience residential, commercial trash, and recycling services.³⁴

Waste Connections was contacted for specific data regarding their production volume and unmet capital needs, but did not respond in time to be included in this report.

32 Northwest Recycling, Inc. "Home" <https://nwrecycling.com/>

33 REcology, "Home" <https://www.rEcology.com/>

34 Columbia Resource Company, "Home" <https://www.columbiaresourcecompany.com/>

Recycled Glass Processing/Manufacturing Facilities

Strategic Materials

In the Northwest, MRFs separate glass from commingled collection systems and send it to Strategic Materials, Inc. in Seattle. Strategic Materials uses optical sorters and XRF technology to remove materials that are contaminants and sort the glass by color and size.

Strategic Materials started operation in Seattle in May 2014. Its facility received about 131,000 tons of glass in 2019³⁶. About 60% of it was from Washington and the rest was from out of state. Approximately 80% to 90% of their material comes from MRFs serving commingled markets. Ten to 20% comes from other sources, including drop-off and dual-stream recycling systems.

Overall, Strategic Materials considers the glass they receive from MRFs to be of good quality. Approximately 74% of the glass that Strategic Materials received in 2019 was processed and sent to manufacturers. Of this, about 73% went to Ardagh Glass, Inc. in Seattle, 8% to Knauf Fiber Glass in California, 11% to Owens Illinois in Kalama, and 8% went to Vidriera Guatemalteca, S.A. in Guatemala. The remaining residual, mostly contaminants such as paper, plastic, and organics with a very small amount of glass, goes to the landfill. In 2019, Strategic Materials sent 16,135 tons of residual to Cowlitz Co. Dept. of Public Works and 18,139 tons to United Concrete and Gravel, Ltd. Metal residual in 2019 comprised less than 1% of the total amount received. The metal was sent for processing to Enroe Recycling and Recycle Resources.

In addition, medical sharps are a contaminant found in glass loads. Some people are under the misconception that the best way to dispose of medical needles is to put them into a glass jar, close the lid and put them in the recycling bin. While Strategic Material's system adequately removes the sharps, they are a significant concern because of employee safety.

Strategic Materials tests all loads of incoming glass from MRFs for quality, and uses a pricing matrix to determine how much they pay or charge based on the amount of contamination in the glass (the percent of glass in the load versus the percent of non-glass residue). Strategic Materials can process all incoming loads to quality specifications. However, they charge for more contaminated loads because of increased costs to landfill non-glass residue, longer processing time for contaminated loads, and lower percentages of marketable glass.

Ardagh Glass, Inc.

Glass cullet used for container glass goes to Ardagh Glass Inc. in Seattle. Ardagh manufactures glass packaging containers, primarily wine bottles but also beer, spirits, and food containers. They use a combination of virgin materials (sand, limestone, and soda ash) and recycled glass cullet for feedstock. Almost all their glass cullet comes from Strategic Materials in Seattle. Ardagh also recycles their own glass. The amount of recycled cullet used depends on a number of variables, such as quality of cullet and availability of certain color cullet (e.g. amber glass).

³⁶ Cite the Strategic Materials report this is from.

Ardagh has high quality standards and incoming glass cullet quality is important. Ardagh rejects occasional loads of cullet because of contamination. The rejected loads go back to Strategic Materials to go through the processing system again.³⁷

Ardagh was contacted for specific data regarding their production volume and declined to provide it. However, a spokesperson for Ardagh provided the following information:

- Ardagh is a leading global manufacturer of glass food and beverage packaging, with a manufacturing facility in Seattle serving the consumer brands we see on retail store shelves every day. Glass packaging is "infinitely recyclable" and a model of sustainability and environmental excellence, meaning it can be made into a glass bottle again and again without any loss in quality or purity.
- Ardagh tracks with the industry average in that their products are made of 30-40% recycled content.
- Strategic Materials is their main supplier for glass cullet, but may use others as needed.

When asked about unmet capital needs or future incentive programs, Ardagh provided the following response:

"Regarding your question on unmet capital needs, our business is functioning effectively, even throughout the pandemic as glass packaging is an "essential business." And if we had any unmet capital or financial needs, we would not announce them. Our capital expenditures are planned appropriately to serve customer volume needs, including upgrading machinery, increasing production, implementing innovations, etc. If we were to look at expansion projects, we would involve local authorities to explore incentives and opportunities to strengthen our position in the local community.

"In the meantime, as we analyze where to invest, we do look at such considerations as taxes, where glass packaging growth is occurring, proximity to our customer filling locations, etc. But the bottom line is that any plans to increase our production capabilities is determined with our customers and we work with them to decide the best location to serve their needs.

"On determining steps of improvement in Washington for our glass business, the key is recycling. The higher the glass recycle rate, the better availability of "cullet" (recycled glass) there is for us to then manufacture glass packaging at a lower cost and higher recycle content rate, which supports carbon reductions and associated sustainability characteristics for our business and communities."

When asked about useful programs or incentives to improve glass production, Ardagh responded:

"Our answer would be to improve glass recycling. That means local municipal investments in single stream glass recovery facilities. Most of the recycled glass our industry receives is from one of the 10 deposit states (states that assign a 5 cent or 10 cent deposit to each beverage package for redemption) across the country. In non-deposit states such as Washington, we rely on local recycling facilities. These facilities, in the absence of a deposit law, need local help in infrastructure investment and educating and motivating consumers to recycle. So, as you put together local input on improving glass manufacturing, this would be our strong recommendation: improve glass recycling."

³⁷ Ecology, "Northwest Region Report: Optimizing the Commingled Residential Curbside Recycling Systems in Northwest Washington" <https://fortress.wa.gov/ecy/publications/documents/1607028.pdf>

Challenges to Improving Glass Recycling Processes

This research revealed a noteworthy challenge to improving the glass recycling market in Washington: achieving consensus among stakeholders. Survey respondents included representatives from Washington state universities, local public works and utilities departments, MRFs, companies that use recycled goods, and other organizations concerned with recyclables, raw materials and packaging. The stakeholders surveyed and interviewed as part of the research process for the report indicated very little consensus as to the current key issues in the glass recycling market. For example, some stakeholders emphasized the importance of consumers in sorting, cleaning, depositing and appropriately recycling glass containers. Other stakeholders maintained that consumer actions had very little impact on the glass market, and the key issues were more with technology, transportation, and the material's market value. While having diversity in perspective among stakeholder perspectives is a strength when seeking ideas and problem solving, it can also be a challenge when it comes to advancing policy.

For example, despite several attempts over the past 50 years, Washington has been unable to pass a beverage container deposit law, otherwise known as a bottle bill. According to the National Conference of State Legislatures (NCSL), a bottle bill is a policy designed to reduce litter and capture bottles, cans, and other containers for recycling.³⁸ When a retailer buys beverages from a distributor, a deposit is paid to the distributor for each container purchased. The consumer then pays the deposit to the retailer when buying the beverage, and receives a refund when the empty container is returned to a supermarket or other redemption center. The distributor then reimburses the retailer or redemption center the deposit amount for each container, plus an additional handling fee in most states. Unredeemed deposits are either returned to the state, retained by distributors, or used for program administration.

These bottle bills can be great ways to put some responsibility for recycling on producers of containers, including glass bottles, as well as provide funding to the state or program to continue improving recycling systems. However, the Washington Beverage Container Deposit was proposed on the November 6, 1979 ballot as Initiative 61, and the initiative was rejected.³⁹ Since then, the Washington Legislature has not passed a container deposit law, and a similar initiative has not been on the ballot, because there has not been enough consensus among all stakeholders to support such a bill.

In 2019, HB 1795 was introduced which would also have made changes to the recycling system, including eliminating glass recycling collection from curbside bins.^{40,41} This bill did not move after introduction into the House of Representatives. Therefore, glass recycling stakeholders continue to struggle with forming a consensus to enact change in legislation.

38 National Conference of State Legislatures, "State Beverage Container Deposit Laws", <https://www.ncsl.org/research/environment-and-natural-resources/state-beverage-container-laws.aspx#:~:text=How%20Do%20Bottle%20Bills%20Work,supermarket%20or%20other%20redemption%20center>.

39 Washington Secretary of State, "Elections Search Results: November 1979 General", https://www.sos.wa.gov/elections/results_report.aspx?e=34

40 Washington Legislature, "House Bill 1795, 2019 Regular Session" <http://lawfilesexet.leg.wa.gov/biennium/2019-20/Pdf/Bills/House%20Bills/1795.pdf?q=20200929114330>

41 Container Recycling Institute, "RE: In Oppoition to House Bill 1795" http://www.container-recycling.org/images/vip/HB_1795_WA_CRI%20comments2_Feb0619.pdf

In 10 states, glass bottles are collected through a mandatory beverage container deposit program. Residents pay a deposit on glass bottles and other containers and then return them to a collection center for redemption. Producers are made responsible for administering and facilitating the program beverage deposit programs, as well as funding the costs of these operations. However, the degree to which producers are responsible varies from program to program. According to the Container Recycling Institute, states with bottle bills have an average glass container recycling rate of just over 63%.

Laws and deposit amounts differ from state to state, but all tend to:

- Improve the quality of glass collected for recycling.
- Increase the percentage of containers going to bottle-to-bottle recycling.
- Exclude some glass containers (like wine and liquor bottles)

Recycling Markets Outside of Washington State

Recycling markets vary greatly outside of the state of Washington. Several states in the US have beverage container deposit laws, or bottle bills. In addition, while Washington has some markets for glass manufacturers, the markets are more developed in other states with more glass manufacturers, glass recycling processors, and fiberglass plants. However, there are some issues with recycling markets that are consistent throughout the entire country, and (to some degree) throughout the world.

Many states and organizations have attempted to address the gaps in recycling markets across the country. For example, one such organization is the New York based investment firm Closed Loop Infrastructure Fund (CLIF), which invests in recycling infrastructure to return valuable recyclable materials to supply chains.⁴² CLIF provides project financing to private companies and municipalities, creating economic value for cities by reducing landfill expenses and increasing revenue generated from recycled commodity sales. The firm is comprised of venture capital, growth equity, private equity and project-specific financing as well as an innovation center focused on building the circular economy. CLIF has deployed \$58 million into 27 projects, with an additional \$220 million contributed by co-investors. Through this work, CLIF has recovered and returned 269,778 tons of glass to supply chains to date.

In addition to the work being done by organizations like CLIF, individual states and cities across North America implemented policies and programs to improve recycling markets; some over several decades, and some very recently.

Oregon and California

Oregon was the first state in the US to have a bottle bill in 1971, and its neighbor California enacted a bottle bill in 1987. However, the programs are somewhat different in how they operate.

Oregon's bottle bill puts recycling responsibility on the beverage industry itself, requiring a cooperative of the state's beverage distributors and grocery retailers to run the program.⁴³ The bill requires require stores and distributors to accept certain empty beverage containers and pay a 10-cent refund value for each container.⁴⁴

The reclamation system for California's bottle bill includes state-certified recyclers such as MRFs, redemption centers, registered curbside operations, drop-off sites, and retailers, so more of the responsibility is on the state.⁴⁵ In addition, California beverage containers all have the California Refund Value (CRV), a deposit on each container which is added to the price of a container when a consumer buys it, and is "refunded" when a consumer brings the container to part of the reclamation system.

As of January 2020, California legislators were discussing shifting the California program towards Oregon's to put more responsibility on the beverage industry. Legislators cite the decline in reclamation of recycled

42 Closed Loop Partners, "Building the Circular Economy: Closed Loop Partners 2019 Impact Report"

<https://www.closedlooppartners.com/wp-content/uploads/2020/02/Closed-Loop-Partners-2019-Impact-Report-1.pdf>

43 Statesman Journal, "California looks to Oregon in can, bottle recycling plan handled by beverage makers"

<https://www.statesmanjournal.com/story/news/2020/01/15/california-looks-oregon-bottle-recycling-plan-handled-companies/4476499002/>

44 Oregon Liquor Control Commission, "Oregon's Bottle Bill & Redemption Centers"

https://www.oregon.gov/olcc/pages/bottle_bill.aspx

45 Bottle Bill Resource Guide, "California", <http://www.bottlebill.org/index.php/current-and-proposed-laws/usa/california>

materials in recent years as reasoning for this potential shift.⁴⁶ However, the Oregon bottle bill does not innately include MRFs in the reclamation system. A bill modeled after Oregon's would remove highly valued commodities (such as glass) from the inbound recycling material to the MRF, resulting in a lower value of inbound material.⁴⁷

Therefore, while Oregon and California both have forms of Extended Producer Responsibility (EPR) programs in place, and their programs have continued to evolve in recent years, these programs still have room for improvement and may not necessarily translate exactly to another state's recycling market.

Northeastern United States

Glass recycling infrastructure is stronger and more interconnected in the northeastern region of the United States. Maine, Vermont, New York, Massachusetts, and Connecticut all have beverage deposit container laws.⁴⁸ These states enacted their bottle bill programs in the 1970s or 1980s, but the programs have changed and adapted to market demands over time, and the programs differ somewhat from their west coast counterparts. In many of these states, the portion of the unredeemed deposits go to the state (sometimes to the general fund, and sometimes to specific environmental funds or programs). Fortunately, redemption rates for all beverage containers have been high, if not consistently improving, in recent years.

US Glass Infrastructure

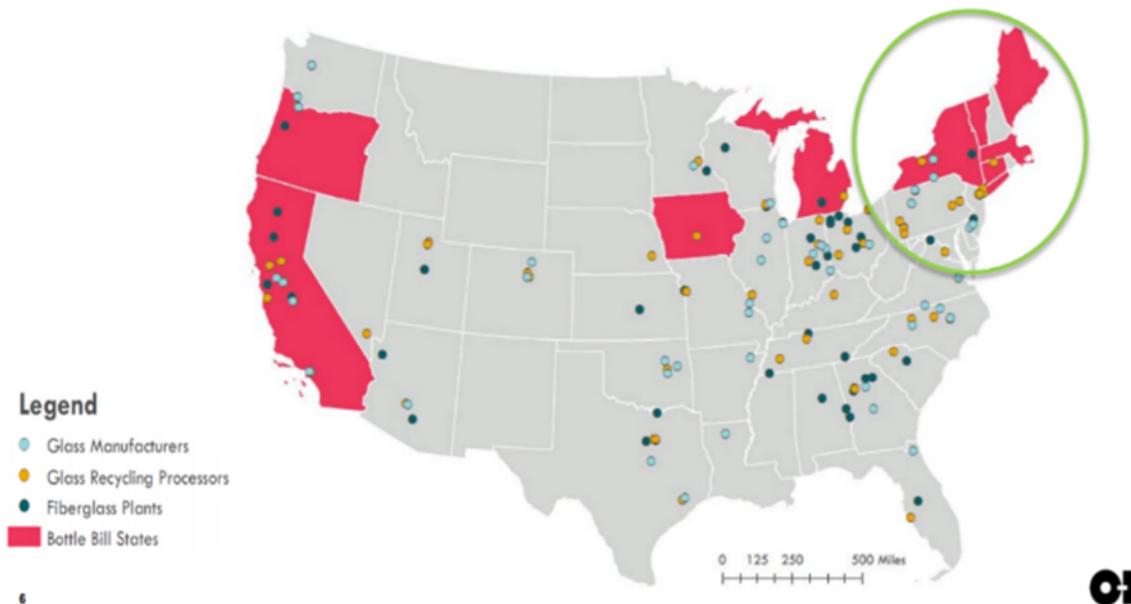


Figure 15: Glass Recycling Infrastructure for the U.S.⁴⁹

46 Bottle Bill Resource Guide, "California", <http://www.bottlebill.org/index.php/current-and-proposed-laws/usa/california>

47 Statesman Journal, "California looks to Oregon in can, bottle recycling plan handled by beverage makers" <https://www.statesmanjournal.com/story/news/2020/01/15/california-looks-oregon-bottle-recycling-plan-handled-companies/4476499002/>

48 Bottle Bill Resource Guide, "All States Table" <http://www.bottlebill.org/index.php/current-and-proposed-laws/usa/additional-links>

49 Northeast Recycling Council, O-I NERC Glass Forum PowerPoint

State	Date Enacted	Beverages Covered	Containers Covered	Amount of Deposit	Program Success	Proposed Changes
EXISTING CONTAINER DEPOSIT LAWS IN NERC STATES						
CT	5/31/05	Beer, malt, carbonated soft drinks, bottled water	Glass, metal, or plastic bottle, can, jar or carton containing a beverage. Excludes containers over 3L containing noncarbonated beverages and HDPE containers	5 cents	2017 Redemption rate Rate: 51%	Expansion proposed in 2019.
VT	1972	Beer, malt, carbonated soft drinks, mixed wine drinks, liquor	Glass, metal, or plastic bottle, can, jar or carton containing a beverage. Excludes	Liquor 15 cents All others 5 cents	2017 Redemption rate: 75%	Expansion proposed in 2019.
ME	5/29/05	All beverages except dairy products and unprocessed cider and blueberry juice produced in Maine.	Glass, metal, or plastic bottle, can, jar or carton containing a beverage less than 4 liters. Excludes aseptics	Wine/liquor 50mL+ 15 cents All others 5 cents	2017 Redemption rate: 84%	Expanded in 2018 to include "nips;" handling fee increased in 2019; reporting of redemption rates now required.
MA	6/3/05	Beer, malt, carbonated soft drinks, and mineral water	Glass, metal, or plastic bottle, can, jar or carton containing a beverage. Excludes biodegradables	5 cents	2017 Redemption rate: 57%	Expansion proposed in 2019.
NY	1983	Beer, malt, carbonated soft drinks, bottled water (which does not	Glass, metal, or plastic bottle, can, jar or carton containing a beverage less than 1	5 cents	2017 Redemption rate: 65%	Expansion proposed in 2019.
PROPOSALS FOR NEW CONTAINER DEPOSIT LAWS IN 2019						
NJ		Carbonated and noncarbonated drinks excluding milk, alcoholic beverages and nutritional supplements	Glass, plastic, aluminum, and other metal bottle, jar, or carton. Excludes refillables	10 cents under 24 fl oz, 20 cents above 24 fl oz		Smart Container Act would establish bottle bill, filed 2018
PA		Carbonated soft drink, water, tea, sports drink, beer, other malt beverages, isotonic drinks. Does not include milk	Bottle, can, jar, carton made of glass, metal, or plastic. Excludes refillables	5 cents		Returnable Beverage Container Act would establish bottle bill, referred to Committee of Finance 4/29/19
Go to bottlebill.org for more information						Container Recycling Institute © 2019

Figure 16: Existing and Proposed Container Laws in Northeast States⁵⁰

⁵⁰ 50 Northeast Recycling Council, "Existing and Proposed Container Laws in Northeast States: Fact Sheet" <https://nerc.org/documents/Webinars/Bottle%20Bills--Benefits%20and%20Challenges/Existing%20&%20Proposed%20Container%20Laws%20in%20Northeast%20States%20Fact%20Sheet.pdf>

However, there is more to the northeast recycling market than bottle bills. According to Owens-Illinois Inc.(O-I), the northeast region has a relatively high concentration of glass recycling infrastructure, making glass recycling more cost effective due to reduced transportation costs. Nevertheless, the northeast has been dealing with the same issues as other states (including Washington): contamination of recyclables in MRFs and other recycling locations.

In the northeast, some companies (such as Van Dyk Recycling Solutions) specialize in examining local glass recycling markets, determining the cleanliness and contamination of glass collected in the market, and evaluating the return on investment for recycling glass products. Then, municipalities decide how to address recycling in their area. In addition, some states are willing to transport materials to localities in which recycling infrastructure is already present, such as Quebec. 2M Resources has glass processing facilities that serve Quebec, Ontario, and northeast states (Vermont, Maine, New Hampshire, Massachusetts, and upstate New York).⁵¹

Finally, some northeast states have enacted new legislation or have proposed new legislation in response to glass recycling:

- **Maine:** Recent Maine EPR Legislation has established fairness and equity for brand packaging fees for recyclable packaging and assessments on brands. The legislation stated that glass should always be considered a "readily recyclable" package.
- **Maryland:** For many years, most recently in 2015, stakeholders have been proposing a bottle bill or bottle bill study in Maryland, with particular emphasis on the high recovery rates of glass, and improved quality for remaining recycled materials when a glass bottle is recovered.
- **New Jersey:** In June 2020, the New Jersey legislature introduced a bill establishing recycled content requirements for plastic containers, glass containers, paper carryout bags, reusable carryout bags made of plastic film, and plastic trash bags. For glass specifically, the bill would require at least 35% of glass containers be recycled content. However, the bill did not make it through the legislature in the most recent session.
- **New York:** New York's bottle bill has been a great success since its inception⁵², and in 2013 the program was amended to improve the implementation of the law and enhance compliance. In addition, in 2019, Governor Cuomo announced plans to expand the bottle bill to include wine and spirits bottles. A study released by the Rochester Institute of Technology's Pollution Prevention Institute shows that expanding New York's bottle bill to offer a 5-cent deposit on wine and liquor bottles would increase those items' recycling rates by 65% and eliminate low-value material from more than 160 MRFs. However, the expansion could also cost the state's wine and liquor sellers a collective \$36 million.⁵³

51 Northeast Recycling Council, 2M Resources (NERC Glass Forum PowerPoint)

52 New York Department of Environmental Conservation, "New York's Bottle Bill: Returnable Container Act"
<https://www.dec.ny.gov/chemical/8500.html>

53 Waste Dive, "New York bottle bill expansion could boost glass container recycling by 65%: study"
<https://www.wastedive.com/news/new-york-bottle-bill-expansion-glass-recycling/568679/>

Canada

While every province in Canada has some sort of beverage container recycling program, there are a handful of provinces with noteworthy EPR programs: Ontario, Quebec, Manitoba and British Columbia.

According to the Product Stewardship Institute, Canadian EPR for Packaging and Paper Products (PPP) programs are either fully or partially financed by producers. The Recycle BC program is the only full producer responsibility system in place in Canada, with producers entirely financing and operating the program. EPR for PPP programs implemented in Ontario, Québec, Manitoba, and Saskatchewan are all managed by local governments with either full or partial reimbursement from producers. Notably, these programs are all transitioning to EPR systems that provide greater operational authority to producers. Ontario and Québec are both transitioning to full producer responsibility.⁵⁴

In particular, the Recycle BC program has an innovative EPR structure with a lot of versatility. On behalf of producers, Recycle BC is responsible for residential collection services across the province, as well as materials processing and marketing collected materials to end users. Recycle BC's EPR for PPP program currently serves more than 1.8 million single- and multi-family households. Under the Recycle BC framework, local governments and First Nations are provided flexibility to choose from among three options for participation in the EPR program: opt for Recycle BC to directly manage collection ("Full Opt-in"); participate as collectors under contract to recycle BC ("Partial Opt-in"); or opt-out.⁵⁵

European Union

While the US averages 35% glass recovery, the European Union (EU) captures double that amount with a variety of different techniques and programs. Different countries utilize forms of EPR, bottle banks, and some deposit programs. If similar strategies were employed in the U.S., nearly two times the amount of glass would be available for recycling than all glass currently collected by state deposit programs.

Many countries in the EU have bottle deposit programs, and more countries are considering this course of action. In addition, Europe was the birthplace of EPR with Germany's program in 1991.⁵⁶ Germany's EPR program influenced comprehensive regional legislation through the EU's Directive on Packaging and Packaging Waste, known as the Packaging Directive, introduced in 1994. The Packaging Directive set all EU member states on a path to target significant portions of packaging for recycling. The latest update to the EU's Packaging Directive in 2018 mandated that EU countries adopt EPR programs for all packaging by December 31, 2024, and set a goal of 65% of all household, industrial, and commercial packaging by weight recycled by the end of 2025.

While these kinds of recycling goals may seem far out of reach for a community in the U.S., it is worth acknowledging that the EU has something that Canada and the U.S. do not have which laid the groundwork for such successful recycling programs: the European Landfill Directive.

54 Product Stewardship Institute, "Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance" https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/1/2020.03.17_PSI_EPR_for_PPP_F.pdf

55 Product Stewardship Institute, "Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance" https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/1/2020.03.17_PSI_EPR_for_PPP_F.pdf

56 Product Stewardship Institute, "Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance" https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/1/2020.03.17_PSI_EPR_for_PPP_F.pdf

The European Landfill Directive was enacted in 1999 to prevent or reduce negative effects on the environment, in particular on surface water, groundwater, soil, air, and on human health from the landfilling of waste by introducing technical requirements for waste and landfills.⁵⁷ Regulations on landfills are extremely stringent, and there are significant penalties if waste is disposed incorrectly, establishing incentives to sort and treat waste appropriately. As a result, there are now fewer landfills in the EU. In addition, on July 2 2014, the European Commission adopted a legislative proposal to review waste-related targets in the Landfill Directive as well as recycling and other waste-related targets. The proposal aims at phasing out landfilling by 2025 for recyclable waste (including plastics, paper, metals, glass and bio-waste) in non-hazardous waste landfills, corresponding to a maximum landfilling rate of 25%.⁵⁸

57 European Commission, "Waste: Landfills" https://ec.europa.eu/environment/waste/landfill_index.htm

58 European Commission, "Waste: Landfills" https://ec.europa.eu/environment/waste/landfill_index.htm

Recommendations

1. Implement glass improvement programs at collection and materials recovery facilities to shift focus from quantity to quality. Promote programs that have clearly demonstrated their ability to produce high-quality recycled glass suitable for reuse in the manufacture of new glass containers, such as those that separate glass from other materials collected from curbside residences.
2. Create agency partnerships to develop procurement guidelines with recycling stakeholders to promote use of recycled glass materials in projects. Ecology, Commerce and Department of Transportation could partner to lead this effort.
3. Implement policies to increase the use of recycled material on glass products and packaging produced in the state by setting minimum recycled content targets.
4. Create an Extended Producer Responsibility (EPR) Program to transfer responsibility for end-of-life management for glass products and packaging to the producers using the glass packaging (bottles and jars).
5. Increase awareness and education by developing partnerships between glass recycling companies and communities to improve the quality and amount of recycled glass collected, recycled, and made available for purchase. Promote consistent messaging throughout the state emphasizing the importance of glass recycling. Enforcement of new policies or programs without educating the public will not be as effective.
6. Work in collaboration with stakeholders and the community to build on existing programs and establish new programs for collection and recovery of beverage containers. One example would be to establish a container deposit program for beverage containers.

Further Research Opportunities

- Provide more detailed Washington state data and analysis: Summarize (or provide in detail if possible) the collection and processing of glass at Washington's MRFs. Where and how much is delivered to Strategic Materials? Collection of glass by county would be informative. If there is glass collected in jurisdictions without easy access to a glass end user, it could lead to a market opportunity. For example, the City of Spokane collects glass (used at the landfill for road bed/alternate daily cover), but it's too costly to transport across the state to Strategic Materials. Would there be an opportunity in eastern Washington for a glass recycler? If Spokane County were to start collecting glass, would that support an eastern WA glass recycler?
- Examine manufacturing usage of recycled glass material: This report was compiled with information that was, largely, already publically available. Specific uses of recycled glass material after they are transferred to a manufacturer are not readily available. In the future, researchers could gain a more detailed understanding of how glass could be relevant to producers of recycled glass products by learning what glass manufacturers need, for which products, and which consumers are demanding these products.
- Follow up on recent changes to other states' legislation/system improvements: In recent years, several states proposed changes to their recycling systems that would affect the glass recycling market. Unfortunately, many halted these changes to redirect state funds during the COVID-19 pandemic. Future researchers should follow up to see if states still think the recycling system changes are worth making, and if so, see what effects those changes have on different glass recycling markets.
- Examine trends and challenges pertaining to non-recyclable glass: Light bulbs, windows, ovenware, Pyrex, crystal, and ceramics are manufactured through different processes and contain contaminants; therefore they cannot be recycled into glass cullet. Further research is needed to explore alternative uses for these types of glass.
- Research current landfill practices and possible improvements: In some instances, it is more cost effective to send contaminated glass to a landfill as trash rather than to clean and process it as a recyclable material. Financial deterrents like fines or tax penalties could discourage landfill usage. Research examined from the European Union shows the benefits of imposing penalties for landfilling too much recyclable material.
- Explore alternative transportation methods or incentives: One of the challenges to making glass recycling profitable is transportation costs. In some areas, MRFs are not in close proximity to the glass recycling facilities. Transportation of these recyclables can be costly, especially if the material arrives contaminated (in which case the transportation costs could exceed the profits from recycling the material). Future researchers should explore possible alternative transportation methods, systems that are more cost effective, or adding a glass processor/recycler to another area of the state (where there is sufficient glass quantity to operate).