Glass Container Industry

- 18,000 JOBS
- 5.5 Billion Industry

Glass Bottles reduced in weight

- 40%
- 1970
- 2000

- U.S. glass container manufacturers operate 45 plants in 22 states
- Annual $5.5 billion industry
- Approximately 28 billion glass containers manufactured in 2016
2016 U.S. Glass Container Shipments by Category

- Beer (57%)
- Food (18%)
- Beverages (9%)
- Wine (9%)
- Liquor (4%)
- Ready to Drink (3%)
- Other (0.2%)

Source:
Glass Packaging Institute (GPI)
Glass Recovery Value Chain

- Beneficiator
- Glass manufacturer
- Fiberglass manufacturer
- CPG company
- Distributor
- Retailer: groceries, wine and spirits, craft brewers, restaurants & bars
- Consumer
- Local government programs
- Recyclers, haulers, drop off centers
- MRF
- Disposal
- Landfill cover
- Mineral markets
- Fiberglass markets
Consumers Want to Recycle Glass Containers

91% of consumers say that recycling is an important part of conserving natural resources.

90% say that it is important to recycle materials rather than sending them to the landfill.

95% of those who live in a community which recycles glass say glass should continue to be collected by recyclers.

91% say finding ways to avoid wasting our natural resources is important.

Glass is made from natural resources:
- Sand
- Soda ash
- Limestone

*Source: 2016 SurveyUSA poll*
Glass Recycling Helps Communities Reach Recycling Goals

Glass helps communities meet their recycling goals

Glass bottles and jars represent up to 25% of the total weight of the recycling stream.

It costs only less than .15¢ per person per pick up to recycle glass at the curb.

80% of Americans have access to single-stream recycling.

ZERO Waste recycling goals cannot be achieved without glass.
Indiana Glass Container Manufacturing Presence

Glass Plant Headquarters
Ardagh Glass – Muncie, IN

Glass Container Manufacturing Plants
Anchor Glass Container Corp. – Lawrenceburg, IN
Ardagh Glass – Dunkirk, IN
Ardagh Glass – Winchester, IN
O-I – Lapel, IN

Glass Machine Shop
Ardagh Glass Inc. – Marion, IN

Recycled Glass Sorting Plants
Strategic Materials, Inc. – Ashley, IN
Strategic Materials, Inc. – Indianapolis, IN
Strategic Materials, Inc. – Hartford City, IN
Strategic Materials, Inc. – Dunkirk, IN
Indianapolis Recycling Program Development

- Glass Processor in City
- Multiple End Markets for Recycled Glass
- Connect & Communicate with Local Officials

Ensure Glass Is Part of Future Program
Strengthening Glass Recycling Programs
Recycled Glass Specification

Voluntary Recycled Glass Standard – Improving quality and setting clear expectations for haulers, recyclers and communities
Partnerships to Improve Quality

North Carolina:

• Support two MRFs to improve glass recycling & recovery
• MRFs leveraged funding with NC DEQ grants, complementing significant company investment
• Market proximity: Nearby glass processing and manufacturing plants
Partnerships to Improve Quality

North Carolina Investments & Modifications:

• Move glass sorting equipment to MRF front end
• Install glass breaker screens
• Install 3-deck OCC screen
• Glass bunker storage
Partnerships to Improve Quality

Early results promising:

• 5%-9% increase in tons glass recovered
• Lower contamination & higher revenue for glass
• Additional cost savings from moving glass sorting & cleaning equipment to front end
• Reduced wear and tear on rubber discs, fiber separation screen & other MRF equipment
### TOPLINE
Available clean-up systems can produce higher quality cullet and generate significant savings for MRFs, 2-year ROI
Increase volume of glass recycled for best use by 33% to 1M tons annually, or nearly 5M tons over 5 years

### COST
Effective clean-up systems range from $350K to $1M per install

### WHO
MRFs generating 10K+ tons of glass/yr, located < 100 miles of a processor; 50-100 MRFs would benefit

### HOW WE ACHIEVE IMPACT
Create a $25m funding vehicle to invest in glass clean up equipment at MRFs
MAKING GLASS RECYCLING WORK

The Glass Recycling Coalition brings together a diverse membership of companies and organizations to make glass recycling work: glass manufacturers, haulers, processors, materials recovery facilities, capital markets, end markets, and brands that use glass to showcase their products.
## Glass Recycling Coalition Membership

<table>
<thead>
<tr>
<th>Consumer brands</th>
<th>Glass manufacturing</th>
<th>Waste hauling</th>
<th>Recycling processors</th>
<th>Trade organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heineken</td>
<td>DIAGEO</td>
<td>WM Waste Management</td>
<td>KnaufInsulation</td>
<td>OI</td>
</tr>
<tr>
<td>ArdaghGroup</td>
<td>Gallo Glass Company</td>
<td>Owens Corning</td>
<td>Sierra Nevada</td>
<td>BA Brewers</td>
</tr>
<tr>
<td>Strategic Materials</td>
<td>The Recycling Partnership</td>
<td>Rocky Mountain</td>
<td>Allagash Brewing Company</td>
<td>FETZER</td>
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<tr>
<td>NAIMA</td>
<td>Pegasus</td>
<td>Pernod Ricard</td>
<td>Rumpke</td>
<td>Balcones Resources</td>
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<td>Republic Services</td>
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</table>
Glass Recycling Coalition Focus

All glass containers are continuously recycled to the highest and best use, maximizing economic, environmental and social benefits.

- **Best practices**
- **Strengthening glass markets**
- **Providing solutions-oriented resources-public-sector**
- **Collaborating for success for glass recycling**
- **Partnering with Glass Champions**
Glass Recycling Decision Tool

Use the following tool to assist you in making informed decisions about glass in your recycling program. Answer questions and follow the links to learn how other communities are making glass recycling work.

Glass Recycling Considerations

Complete this short questionnaire and discover tools to help glass recycling in your community. Follow the suggested links to learn more.

* Required

How is glass collection performing in your community? *

- [ ] It's going well, no complaints
- [ ] We have some challenges
- [ ] Other: ____________________________

NEXT
2017 GLASS RECYCLING SURVEY

- 96% of consumers and residents expect to be able to recycle glass.
- 65% of the public-sector respondents had concerns with glass recycling.
<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Stream Curbside</td>
<td>49%</td>
</tr>
<tr>
<td>Dual Stream Curbside</td>
<td>9%</td>
</tr>
<tr>
<td>Glass separated Curbside</td>
<td>13%</td>
</tr>
<tr>
<td>Source-Separated Curbside</td>
<td>8%</td>
</tr>
<tr>
<td>Drop-off</td>
<td>65%</td>
</tr>
</tbody>
</table>
 Preferred End-Uses

Public Sector

1. Bottle-to-bottle recycling
2. Fiberglass
3. Road base (aggregate) - Any recovery option acceptable (no direct landfill)
4. Sandblast medium
5. ADC
6. We’re not concerned about landfilling

Most preferred

Least preferred
Top 5 Priorities:

1. Resident Satisfaction
2. Meeting Sustainability Goals
3. Reducing Contamination of Recyclables
4. Viable End-Markets
5. Less Need for Landfills

Lower Priorities

- Revenues from Recyclables
- Avoided Landfill Tipping Fees
- Transportation Costs
- Preventing Illegal Dumping
- Carbon Emissions/GHG Savings
- Processing Fees
## Public-Sector Glass Recycling Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>End markets (e.g. few/unreliable options)</td>
<td>82%</td>
</tr>
<tr>
<td>Contamination issues</td>
<td>60%</td>
</tr>
<tr>
<td>Cost-effectiveness</td>
<td>45%</td>
</tr>
<tr>
<td>Processing capability</td>
<td>22%</td>
</tr>
<tr>
<td>Hauler/MRF stopped accepting glass</td>
<td>16%</td>
</tr>
<tr>
<td>Hauler raised price to keep glass in the program</td>
<td>16%</td>
</tr>
</tbody>
</table>
Program Decision-Making Tool

Use the following tool to assist you in making informed decisions about glass in your recycling program. Answer questions and follow the links to learn how other communities are making glass recycling work.

Glass Recycling Considerations

Use the questions below to answer questions about keeping glass in your recycling program. Follow the suggested links to learn more.

* Required

How is glass collection performing in your community?

- It’s going well, no complaints
- We have some challenges
- Other: ___

NEXT

Never submit passwords through Google Forms.

Glass Recycling Considerations

Material Recovery Facilities Have Options for Cleaning Glass Single-Stream Glass

Watch this GRC webinar to find out how MRF’s are Making Glass Recycling Work through advanced cleaning systems.

NEXT
GRC TOOLS AND RESOURCES

• 5,600 website visitors since 1/2017 (9,000 since Sept.)
• Decision-making tool to guide public-sector to resources
• End-markets, MRFs, manufacturers & drop-off center map
• Recycling grant list
• Benefits of glass recycling by collection/processing method
• 40+ best practices featured GlassRecycles.org
• 10+ active members of Speakers’ Bureau
• 500+ webinar attendees (3 webinars)
• Government Advisory Committee
## How much glass can be recovered & turned into recycled glass?

<table>
<thead>
<tr>
<th>Collection System</th>
<th>Glass Collected from 5,000 HH (tons/year)</th>
<th>% Glass Yield at MRF</th>
<th>% Cleanup (Beneficiation) Yield</th>
<th>Glass Recovery Rate (Furnace-Ready)</th>
<th>Actual Glass Recovered after Yield Loss (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max.</td>
<td>Average*</td>
<td>Min.</td>
<td>Best Practice</td>
<td>Average Practice</td>
</tr>
<tr>
<td>Single Stream Carts - Weekly</td>
<td>385</td>
<td>209</td>
<td>58</td>
<td>90%</td>
<td>64%</td>
</tr>
<tr>
<td>Single Stream Carts - Bi-weekly</td>
<td>348</td>
<td>191</td>
<td>57</td>
<td>90%</td>
<td>64%</td>
</tr>
<tr>
<td>Single Stream, Glass Separate - Weekly</td>
<td>301</td>
<td>228</td>
<td>182</td>
<td>97%</td>
<td>95%</td>
</tr>
<tr>
<td>Dual Stream Bins - Weekly</td>
<td>284</td>
<td>149</td>
<td>80</td>
<td>92%</td>
<td>74%</td>
</tr>
<tr>
<td>Drop-off</td>
<td>182</td>
<td>104</td>
<td>78</td>
<td>97%</td>
<td>95%</td>
</tr>
</tbody>
</table>

## What are the environmental & landfill savings for recycling glass?

<table>
<thead>
<tr>
<th>Collection System</th>
<th>Carbon Emissions Avoided (MTCO2E)</th>
<th>Energy Demand Avoided (million BTU)</th>
<th>Avg. Landfill Tipping Fee ($49/ton)</th>
<th>Number of Cars Removed from the Road per year</th>
<th>Number of houses powered per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best Practice</td>
<td>Average Practice</td>
<td>Best Practice</td>
<td>Average Practice</td>
<td>Best Practice</td>
</tr>
<tr>
<td>Single Stream Carts - Weekly</td>
<td>44.2</td>
<td>24.3</td>
<td>379.2</td>
<td>208.7</td>
<td>$7,742</td>
</tr>
<tr>
<td>Single Stream Carts - Bi-weekly</td>
<td>40.4</td>
<td>22.2</td>
<td>346.6</td>
<td>190.7</td>
<td>$7,075</td>
</tr>
<tr>
<td>Single Stream, Glass Separate - Weekly</td>
<td>60.1</td>
<td>58.8</td>
<td>514.9</td>
<td>504.2</td>
<td>$10,512</td>
</tr>
<tr>
<td>Dual Stream Bins - Weekly</td>
<td>36.5</td>
<td>27.8</td>
<td>312.5</td>
<td>238.2</td>
<td>$6,381</td>
</tr>
<tr>
<td>Drop-off</td>
<td>27.4</td>
<td>26.8</td>
<td>234.8</td>
<td>230.0</td>
<td>$4,795</td>
</tr>
</tbody>
</table>

*Average glass collected from 5,000 HH1 used for actual recovery rate, environmental and landfill savings calculations.
MRF RESOURCES

MRF BEST PRACTICES: A DETAILED VIEW

GENERAL
The best glass handling practices will vary depending on your collection system, the equipment installed at your Material Recovery Facility (MRF) and end-markets.

PROCESS GOALS
Processes should minimize glass cross-contamination with other commodities:
- Non-glass residue (NGR) must be minimized for highest value/lowest cost of glass recovery from MRFs. Glass should have a minimum of moisture, organics, dirt, fines and light fraction materials (i.e. shredded paper, plastics, and other trash).
- For glass to be considered for further secondary processing into cullet:
  - Maximum allowable NGR is <35% for outbound MRF-derived glass for secondary processing.
  - <1/8" fines are not considered glass in most MRFs and are counted as disposable residue.
- Contaminants (paper, organics, dirt and fines) in glass held moisture after processing. These properties reduce the yield of the material, increasing subsequent disposal.
- No matter what equipment your MRF has installed, you can improve the quality of glass recovery by following best operator practices from the tipping floor, to good preventative maintenance systems, to minimizing glass breakage.

MATERIAL RECOVERY FACILITY DESIGN
The design and configuration of glass removal and cleaning systems have a big impact on their effectiveness.

LOADERS & TIPPING FLOORS
Before deciding on an equipment plan increase the MRF footprint and consider needs. Use a dedicated conveyor system to transport the glass from the tipping floor to the loadout area.

TYPICAL MRF FUNCTIONS

- Screening
- After Screening Separates Broken Glass from >2" containers /fiber/cardboard
- Glass Breakers, Trommels, Debris Screens
- Measuring glass against market and is critical to insure price for your input.
- Leave dedicated composition.
- Label areas of the plant for identification of glass e.g.
- Dust catchment/ remove particulate air quality by large-scale glass process
- Management and OSHA
- Location Analysis before beyond practicable point manufacturers. This is not a front line MRF service o
- Location analysis, long-term access transportation o
- If you have contamination impacts secondary glass consumption.

PRIMARY GLASS SEPARATION

SECONDARY GLASS CLEANING

TERtiary GLASS CLEANING

ADVANCED GLASS CLEANING

Further Removal of Paper, Plastics, Organics, Metals
Screen out Glass
tones from glass – 1/4" consider glass fines.
Use of Vacuum Systems, Air Chambers, Shaker screens/vibratory screens.
Removal of metals by suspended magnets and eddy currents.

COST OF SYSTEM

VALUE OF MATERIALS

HIGH RESIDUE, HEAVY CLEANING

DIRECT CULLET TO FURNACE
Thank You!

Learn more about GPI:

www.GPI.org

www.UpgradeToGlass.com

GlassRecycles.org