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The Aluminum Can Advantage: Sustainability Key Performance Indicators

DECEMBER 2024

The
Aluminum
Association



Can
Manufacturers
Institute



Introduction

The Aluminum Association and Can Manufacturers Institute (CMI) are committed to providing up-to-date, complete and accurate information on aluminum beverage can industry sustainability. The Aluminum Association and CMI member companies collectively represent the vast majority of aluminum beverage can production and used beverage container (UBC) recycling in the United States. To that end, our associations jointly release a comprehensive report on key sustainability performance indicators (KPI) for one of our best-known and widely used consumer products – the aluminum beverage can. The following KPIs, as well as comparative information about other beverage packaging types, provide a complete picture of the aluminum beverage can’s sustainability performance. Aluminum beverage can recycling is vital to the nation’s recycling system and overall economy. Using recycled aluminum to make a beverage can is economically efficient and saves about 80%¹ of the energy needed to produce a beverage can with new, or primary, aluminum.

In addition, aluminum’s recycling profile means that most recycled cans are turned into new cans – unlike glass and plastic bottles, which are most often recycled once, if at all. This makes the aluminum beverage can a textbook example of a truly circular product. Aluminum beverage cans are the most sustainable beverage package on virtually every measure. This closed-loop process drives a virtuous cycle of elevated recycling rates, a large percentage of recycled content in the average aluminum beverage can and an economically sustainable process that effectively subsidizes municipal recycling programs nationwide.

Major opportunities for improvement remain. Recycling rates for beverage cans in the United States have been in decline in recent years. In 2021, our organizations endorsed ambitious targets, including a [target](#) to achieve a 70% aluminum beverage can recycling rate by 2030, 80% by 2040 and 90% by 2050. The current state of U.S. recycling systems and policies fall far short of what is required to make these targets achievable. The Aluminum Association, CMI and other groups have endorsed and advocated for new recycling infrastructure spending and proven programs like recycling refund (or deposit return) systems in recent years to grow aluminum beverage can recycling. But these efforts have so far had limited success.

Dramatically increasing aluminum beverage can recycling – which is essential to achieving industry carbon reduction goals – will only be possible with the support of the full industry value chain. Sheet producers, can makers, metal recyclers, beverage brands, retailers, distributors and others must come together to support new models and approaches to aluminum recycling.

Historically, the Aluminum Association has released a KPI report annually. Due to inaccuracies in official UBC export volumes published by the Census Bureau, issuing reports in 2022 and 2023 became problematic. Recently completed investigations to correct the data revealed significant issues, including misclassification and data validation errors, that dramatically overstated export volumes, leading to artificially inflated consumer and industry recycling rates. The two-year data revision process is a testament to the Aluminum Association’s mission to publish accurate and complete information, which is crucial for informed decision-making and effective policy implementation in our increasingly sustainability-focused economy.



Key Performance Indicators

Consumer Recycling Rate

Measures the amount of aluminum beverage can scrap recycled domestically as a percentage of cans available for recycling in the United States. In order to provide a more accurate representation of U.S. consumer recycling behavior, the consumer rate excludes imported can scrap and also accounts for the movement of unfilled cans into/out of the U.S. The rate is one indication of how well municipal recycling programs are performing nationwide, though it can still be impacted by year-to-year fluctuations in metal flows and commodity prices. Additionally, the rate provides an indication of how much aluminum beverage can scrap is either landfilled, held in inventory or has otherwise fallen outside the association's tracking system. It is worth noting that this rate for aluminum beverage cans is similar to a "net recycling rate" (as opposed to "gross recycling rate") since the numerator represents quantities of clean shredded scrap charged into melting furnaces.

Industry Recycling Rate

Measures the amount of used aluminum beverage can scrap recycled (melted to make new products) by U.S. aluminum producers as a percentage of cans shipped. This rate provides a measure of industry efficiency relative to overall can shipments. This rate includes both domestic and imported can scrap from foreign countries that is reclaimed by U.S. producers as well as used cans that are exported and recycled overseas. The rate is unique to the aluminum industry.

Closed-Loop Circularity Rate

A KPI introduced in 2021, this rate measures the percentage of recycled material used to go back into the same product – in this case a new beverage container. This number captures the “closed loop” nature of aluminum beverage can recycling as compared to competing packaging types. When products are recycled, the recovered materials can be used to make the same product (closed-loop recycling) or a new product (open-loop recycling). Open-loop recycling will often lead the material to be changed to the level that it can no longer be recycled. For example, when recycled, a PET bottle most often ends up in a new product – often into a carpet or textile, both of which are unlikely to be recycled at the end of their useful life. In contrast, an aluminum beverage can most often ends up on the shelf as a new can – a process that can happen infinitely.

Recycled Content

Measures the proportion of recycled aluminum versus virgin aluminum in the average aluminum beverage can. High recovery rates for aluminum, along with the closed loop nature of can recycling, drives a large amount of recycled content in the average aluminum beverage can, in notable contrast to glass and plastic bottles.

Value of Material

Measures the dollar value per ton of aluminum beverage can scrap. The value of material measure indicates the relative importance of different materials commonly found in the recycling bin to sustaining the financial viability of municipal recycling programs. The data is based on a two-year rolling average of commodity prices.



Key Performance Indicators Across Industries

	Aluminum Beverage Cans	Glass Bottles	Plastic Bottles (PET)
Consumer Recycling Rate	43%	39.6% ²	20.0% ^{3*}
Industry Recycling Rate ⁴	57%	N/A	N/A
Closed-Loop Circularity Rate	96.7%	30-60% ⁵	34.0% ^{6**}
Recycled Content	71%	23% ⁷	3-10% ⁸
Value of Material ⁹	\$1,338/ton	-\$23/ton ^{***}	\$215/ton

*PET bottle's net recycling rate, which is comparable to the Aluminum Association's aluminum beverage can recycling measurement, was estimated based on historical data in free, downloadable reports from NAPCOR's website. NAPCOR reports a 2022 PET bottle gross recycling rate of 29%. Looking at similar gross rates in recent years, the net rate would be roughly 20%. The gross recycling rate represents the total weight of collected PET bottles before processing, including non-PET components like caps and labels. The net recycling rate measures the actual quantity of PET material recovered and available for further processing to make new products.

**Calculated to be 34% for 2020 based on data available in NAPCOR's free, downloadable [report](#). Such data for 2022 was not accessible due to a \$4,000 charge for the report.

***Includes value of 3-mix which does not represent deposit-grade glass. The Glass Packaging Institute anecdotally stated certain types of deposit-grade glass in specific regions is valued up to \$50/ton.



Consumer Recycling Rate

Background

The consumer recycling rate provides a measure of the amount of domestic aluminum beverage can scrap recycled as a percentage of cans available for recycling in the United States during a one-year period. This rate excludes can scrap imported from foreign countries to provide a more accurate representation of consumer recycling behavior in the United States. The rate provides a snapshot of how well municipal recycling programs are performing nationwide though it can still be impacted by year-to-year fluctuations in metal flows and commodity prices. It also indicates the amount of aluminum beverage can scrap that either finds its way to the landfill every year, was held in inventory or otherwise fell outside the Aluminum Association's tracking system. This rate for the aluminum beverage can is similar to a "net recycling rate" since the numerator represents quantities of clean shredded scrap charged into melting furnaces.

The consumer recycling rate for aluminum beverage cans fell 0.5% from 2020 to 2021 (42.1% to 41.6%), remained nearly constant from 2021 to 2022 (41.6% to 41.8%) and increased by 1.2% from 2022 to 2023 (41.8% to 43.0%). Since 2017, the consumer recycling rate has been below the 20-year average of around 50%. This is unfortunate given aluminum packaging represents only 3% of the weight but nearly 30% of the economic value of recyclable material generated by a single family home¹⁰. Further, multiple independent studies have concluded that aluminum is the only beverage container type in the bin that more than covers its cost of collection and processing in municipal recycling programs.¹¹

More than 61 billion cans – around \$1.18 billion worth of aluminum – were diverted from the recycling stream in 2023 that could have otherwise been responsibly recycled and made into new cans. This loss has a significant negative impact on the environment through wasted energy and resources, and on the economy through lost jobs.

Methodology

The consumer recycling rate is based on survey input from can sheet producers, can manufacturers and secondary producers of aluminum, as well as Census Bureau trade data, representing nearly all can recycling activity in the United States.

THE CALCULATION TO DETERMINE THE RATE IS AS FOLLOWS:

$$\begin{array}{r}
 \text{(Pounds of UBC Melted Domestically + Pounds of UBC Exports - Pounds of} \\
 \text{UBC Imports)} \\
 \hline
 \text{(Pounds of Cans Shipped by U.S. Producers - Pounds of Exported Unfilled} \\
 \text{Cans + Pounds of Imported Unfilled Cans)} \\
 \hline
 \text{Pounds of Cans Recycled by U.S. Consumers} \\
 \hline
 \text{Pounds of Cans Shipped Corrected for Imports and Exports} \\
 \hline
 \text{1.327 Million Pounds of Cans Recycled} \\
 \hline
 \text{3.088 Million Pounds of Cans Shipped Corrected for Imports and Exports}
 \end{array}
 = 43\%$$

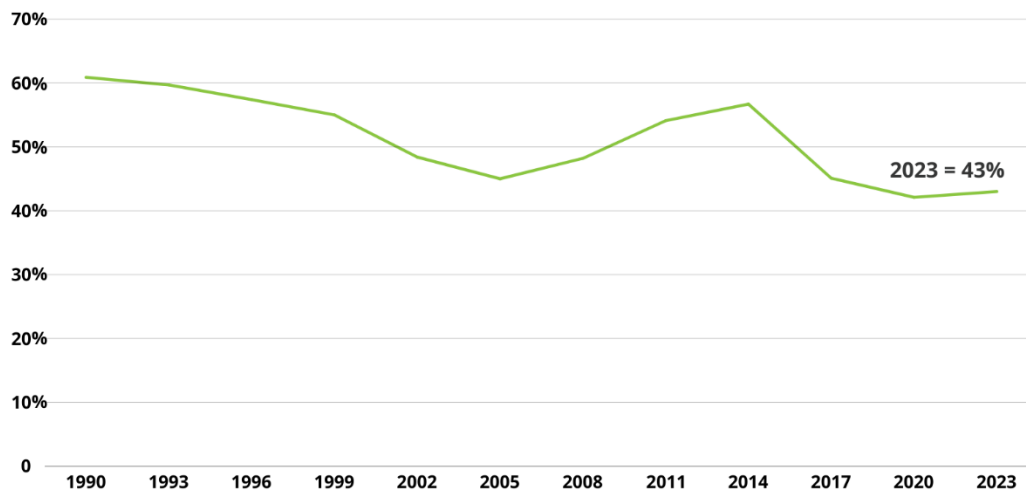


Consumer Recycling Rate History

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pounds of UBC Melted Domestically (MMlbs)	1664	1658	1637	1480	1542	1616	1577	1417	1371.2	1599	1528	1511
+Pounds of UBC Exports (MMlbs)	108.7	62.9	62.1	145.1	89.6	58.8	91.6	85.7	228.5*	137.4	138.2	219.1
-Pounds of UBC Imported (MMlbs)	367.8	333.1	286.8	291.8	383.7	475	367.9	239.4	313	429	431.7	403
= Pounds of Cans Recycled by U.S. Consumers (mmlbs)	1405	1388	1413	1333	1248	1200	1301	1263	1286*	1307	1234	1327
/Pounds of Cans Shipped by U.S. Producers (MMlbs)	2644	2581	2556	2529	2529	2646	2623	2690	2839	2809	2841	3036
-Pounds of Exported Unfilled Cans (MMlbs)	70	67	82	101	61	11	6	7	7	6	9	7
+Pounds of Imported Unfilled Cans (MMlbs)	20	15	17	17	26	23	54	59	224	343	121	59
= Pounds of Cans Shipped Corrected for Imports and Exports (MMlbs)	2594	2529	2491	2445	2494	2658	2670	2741	3056	3146	2953	3088
= Consumer Recycling Rate	54.2%	54.9%	56.7%	54.5%	50.4%	45.1%	48.7%	46.1%	42.1%*	41.6%	41.8%	43.0%

*Numbers have been revised since the [2021 version](#) of the KPI report due to data inaccuracies reported by the Census Bureau.

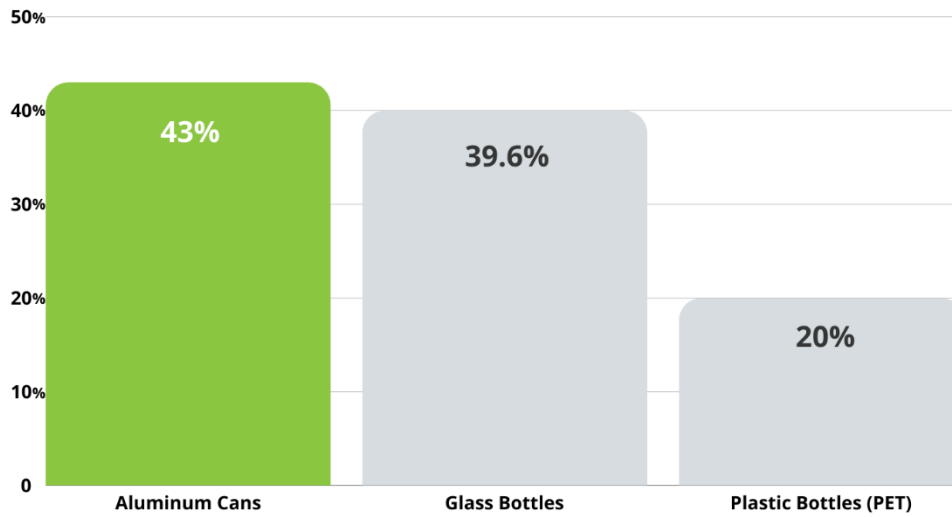
Consumer Aluminum Beverage Can Recycling Rate Through the Years





Consumer Recycling Rate for Competing Packaging Types

The aluminum beverage can is the most recycled beverage container by consumers. The closed-loop nature of aluminum beverage can recycling, and the metal's inherent high value in the recycling stream, drive a virtuous economic and environmental cycle.





Industry Recycling Rate

Background

The industry recycling rate indicates the amount of aluminum beverage can scrap recycled by U.S. aluminum producers as a percentage of finished cans shipped by the industry during a one-year period. In basic terms, the rate provides an indication of industry stewardship and efficiency in managing the metal. This rate includes imported can scrap as well as used beverage cans that are exported and recycled overseas. Imports in particular have become an increasingly important feedstock for U.S. can recyclers in recent years. The quantity of scrap recycled is measured directly at the point where processed (e.g., contamination removed) UBCs are fed into melting furnaces. This means that the aluminum is truly recycled, not simply “available for recycling” – the standard for some material recycling rates.

The industry recycling rate increased in 2021 from the 2020 level but declined to 57% in 2023. This rate is lower than the 20-year average industry recycling rate of 61.9%.

Methodology

The industry recycling rate is based on survey input of UBC melting facilities including can sheet producers, can manufacturers and secondary producers of aluminum, representing nearly all can recycling activity in the United States.

THE CALCULATION TO DETERMINE THE RATE IS AS FOLLOWS:

$$\begin{array}{r}
 \text{Pounds of UBC Melted Domestically + Pounds of UBC Exports} \\
 \hline
 \text{Pounds of Cans Shipped by U.S. Producers} \\
 \\
 \text{Pounds of Cans Recycled by U.S. Industry} \\
 \hline
 \text{Pounds of Cans Shipped by U.S. Producers} \\
 \\
 \text{1.730 Billion Pounds of Cans Recycled by U.S. Consumers} \\
 \hline
 \text{3.036 Billion Pounds of Cans Shipped Corrected for Imports and Exports}
 \end{array}
 = 57\%$$

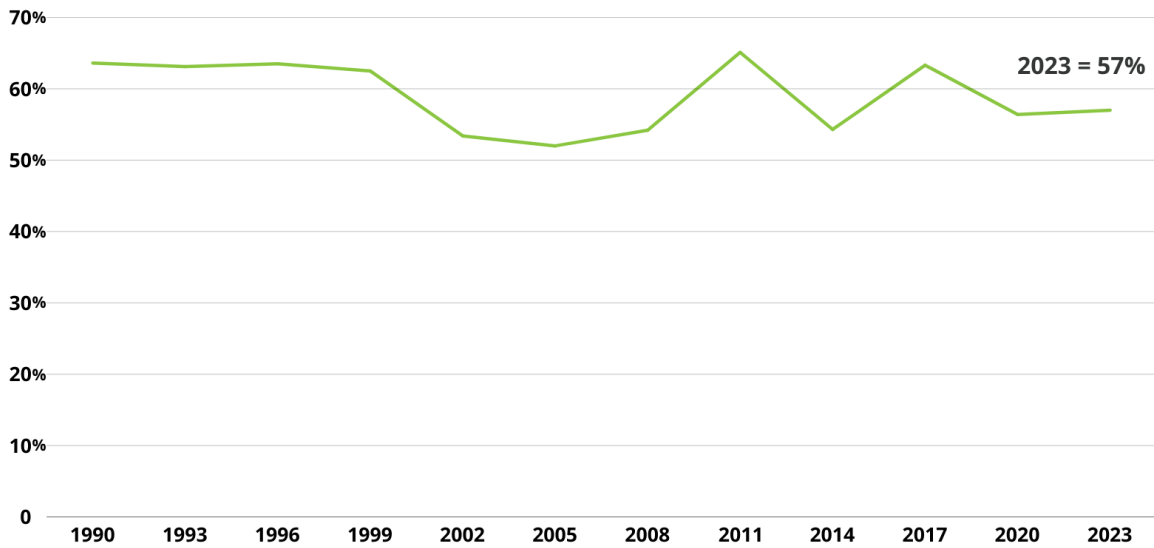


Industry Recycling Rate History

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pounds of UBC Melted Domestically (MMlbs)	1664	1658.4	1637.2	1480.1	1541.6	1615.8	1577	1416.5	1371.2	1598.9	1527.6	1511.3
+ Pounds of UBC Exports (mmlbs)	108.7	62.9	62.1	145.1	89.6	58.8	91.6	85.7	228.5*	137.4	138.2	219.1
= Pounds of Cans Recycled (mmlbs)	1,772.80	1721.4	1699.4	1625.2	1631.2	1674.6	1668.6	1502.2	1599.7*	1736.3	1665.8	1730.3
/ Pounds of Cans Shipped by U.S. Producers (MMlbs)	2644	2581.3	2555.7	2528.7	2529.2	2645.7	2622.6	2689.5	2838.6	2808.9	2840.9	3035.7
= Industry Recycling Rate	67.0%	66.7%	66.5%	64.3%	64.5%	63.3%	63.6%	55.9%	56.4%*	61.8%	58.6%	57.0%

**Numbers have been revised since the [2021 version](#) of the KPI report due to data inaccuracies reported by the Census Bureau.*

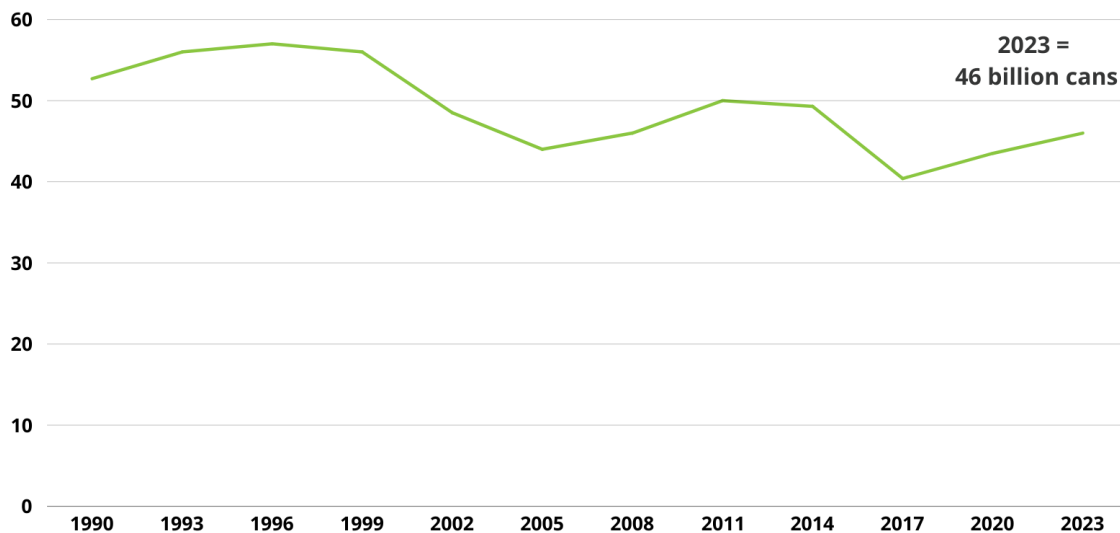
Industry Recycling of Aluminum Beverage Cans Through the Years





Number of Aluminum Beverage Cans Recycled by U.S. Aluminum Industry

Since tracking began in 1972, the aluminum industry has recycled more than 2 trillion aluminum beverage cans.



Closed-Loop Circularity Rate

Background

The closed-loop circularity rate in this KPI report reflects the percentage of recycled material used to go back into the same product - in this case new beverage containers. It is partly a measurement of the quality of recycling. When products are recycled, the recovered materials can be used to make the same (closed-loop recycling) or a different and sometimes lower grade product (open-loop recycling). Closed-loop recycling is preferred because typically the recycled product maintains similar quality with the primary material and the process can be repeated over and over again. In contrast, open-loop recycling can lead to compromised material quality through either a change in chemistry (e.g., shortening of fibers, change of molecules) or an increase in contamination (e.g., addition of unwanted elements, change of material color, etc.) in the new product.

Further, the material could be recycled into a different product that is not recyclable or is unlikely to be recycled again (e.g., a plastic bottle into carpet fiber or a t-shirt), which is referred to as downcycling. In short, closed-loop recycling can help close the material loop to achieve a



more circular economy, while open-loop recycling will often lead the material to be downgraded to the level that it can no longer be recycled. Consequently, open-loop recycling typically requires the production of more primary material to replenish society's demand for new products.

The Aluminum Association incorporated this indicator for the first time in the 2021 KPI report. We believe this is an important data point because higher closed-loop recycling means improved recycling quality and a greater likelihood that recycled material will continue its life over multiple cycles, benefiting society from a resource, environmental and economic perspective. The closed loop circularity rate rose from 92.6% in our 2021 report to 96.7% today, an indicator that the industry is using nearly all of the cans it has access to in order to make new cans.

Methodology

The data for calculating the closed-loop circularity rate for the aluminum beverage can comes from the Aluminum Association's latest survey on aluminum beverage can recycled content for the production year of 2022.¹ Data for PET bottles comes from the National Association for PET Container Resources (NAPCOR) *Postconsumer PET Recycling Activity in 2020* report.³ Industry data for glass bottles was not available but is estimated based on Metabolic's *Recycling Unpacked* report to estimate a closed-loop circularity rate for glass bottles.¹²

THE CLOSED-LOOP CIRCULARITY RATE IS CALCULATED BY THE FOLLOWING FORMULA FOR ALL THREE MATERIALS:

$$\frac{\text{Pounds of Recycled EOL Beverage Containers Used to Make New Beverage Containers}}{\text{Total Pounds of EOL Containers Recycled Domestically}} \times 100\%$$

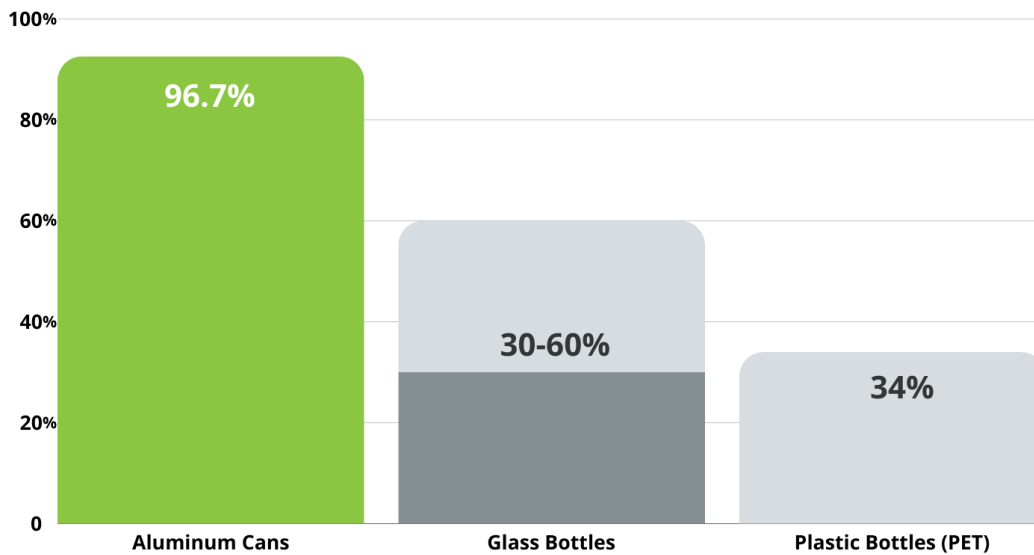
2022 ALUMINUM CAN CLOSED-LOOP CIRCULARITY RATE

$$\frac{1.48 \text{ billions pounds}}{1.53 \text{ billion pounds}} \times 100\% = 96.7\%$$



Closed-Loop Circularity Rates for Competing Packaging Types

Of the three material types, aluminum beverage cans have the highest circular performance in the current U.S. recycling system. This higher rate means there is less need for primary material production, which results in decreased greenhouse gas emissions, less material in landfills and a greater preservation of natural resources.



Recycled Content

Background

Recycled content data measures the proportion of recycled aluminum versus new or virgin aluminum in the average aluminum beverage can. High recovery rates for aluminum along with the closed-loop nature of can recycling truly set the aluminum beverage can apart as a sustainable package type. In contrast to glass and plastic bottles, a large percentage of the average aluminum beverage can is made from recycled material. The high recycled content in the average aluminum beverage can is an indicator of environmental stewardship of the package.

The recycled content of the can contains metal from both post-consumer and post-industrial scrap sources. However, the calculation excludes internal run-around scrap metal (i.e., scrap generated during a can sheet rolling process that is subsequently recycled on-site).



The association's recycled content figure follows the guidelines and definitions laid out by the Federal Trade Commission (FTC) "Green Guides" as well as UL Environment, an environmental label certification company. The approach also aligns with International Organization for Standardization (ISO) compliance according to the 14021 standard in section 7.8.1.

Methodology

The latest recycled content figure for the aluminum beverage can is based on a survey of the six main producers of aluminum beverage can sheet in the United States – Arconic, Constellium, Kaiser Aluminum, Logan Aluminum, Novelis and Tri-Arrows Aluminum. These companies provide data to determine the composition of an average aluminum beverage can. The survey is conducted every 4 to 5 years and is also part of the Aluminum Association's beverage can life cycle assessment (LCA) studies. Data is collected by asking the responders to report the total annual quantities of different metal input sources into can sheet ingot and can sheet productions as well as other inputs of material and energy, and releases of environmental emissions and wastes. The previous figure was calculated using 2016 data and found a 73% total recycled content figure for the average aluminum beverage can.

The latest survey was conducted in 2024 targeting the production year 2022, and the resulted recycled content number is 71%, down slightly from 73% last reported based on production year 2016/2017. This compares to an average of 23% recycled content for glass⁷ and 3-10% recycled content for plastic (PET) according to EPA estimates.⁸

RESULTS FROM THE LATEST ALUMINUM CAN RECYCLED CONTENT SURVEY ARE REFLECTED BELOW (WHEN SCALED IN TO A FULL CAN WITHOUT COUNTING THE INTERNAL SCRAP AS A METAL SOURCE):

12.99 grams (metallic weight of an average aluminum can):

3.80 grams = Primary aluminum¹³ = 29%

4.34 grams = Used beverage can (UBC) scrap = 33%

2.51 grams = Non-UBC post-consumer scrap¹⁴ = 19%

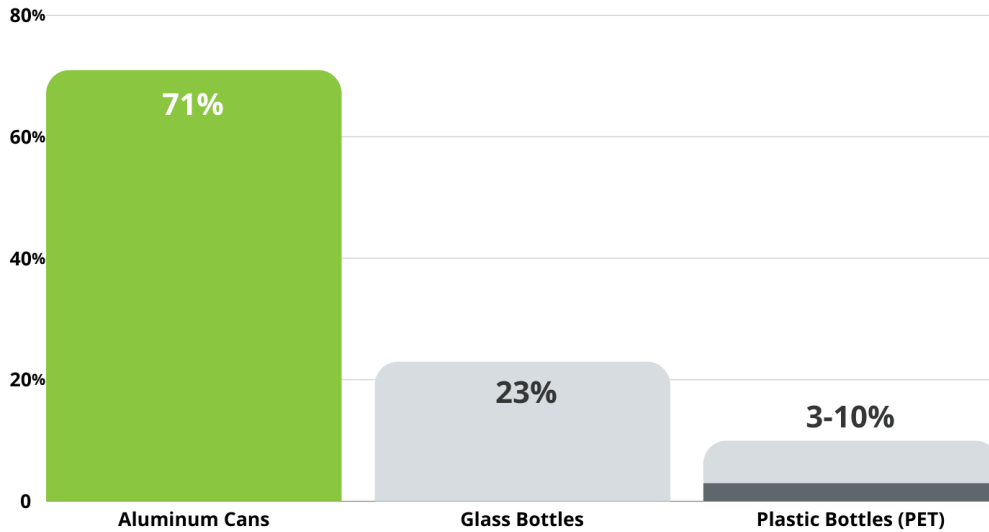
2.35 grams = Post-industrial scrap¹⁵ = 18%

Recycled Content = 71%



Recycled Content for Competing Packaging Types

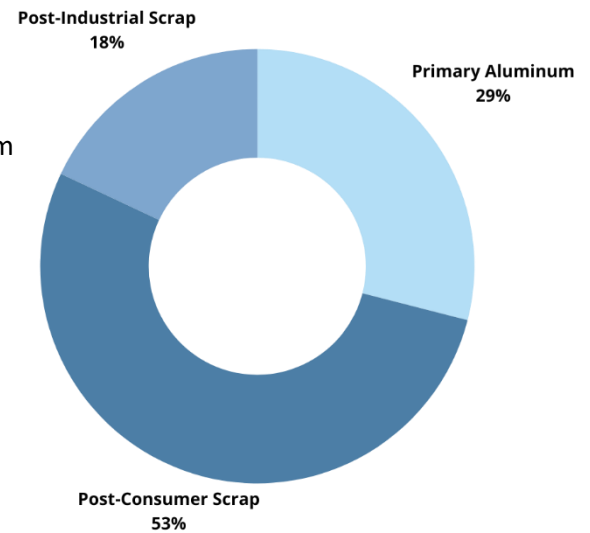
The high recycling rates and closed-loop nature of aluminum beverage can recycling mean that aluminum beverage cans contain far more recycled content than competing packaging types. Unlike other package types, aluminum beverage cans are most often recycled directly back into themselves, not downcycled into new products that often end up in landfills.



Recycled Content of the Average Aluminum Beverage Can

Background

By far the largest percentage of material in the average aluminum beverage can is post-consumer scrap generated from the UBC recycling stream and other scrap sources. Another large percentage of recycled content comes from scrap generated during manufacturing processes.





Value of Material

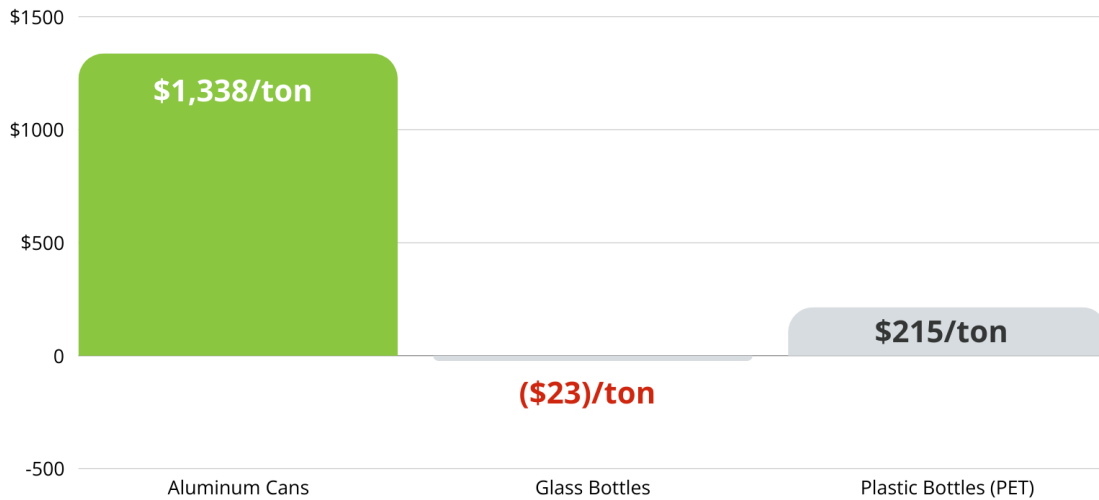
Background

The value of material data measures the dollar value of aluminum beverage can scrap. Many municipal recycling programs rely on re-selling the material collected in curbside bins to help subsidize their programs. The high value of aluminum in the scrap stream means that, without it, very few curbside pickup programs would be financially viable.

Methodology

This data is based on a two-year rolling average of commodity prices from January 2022 – February 2024 for various material types via <http://recyclingmarkets.net/>, consistent with past reporting.

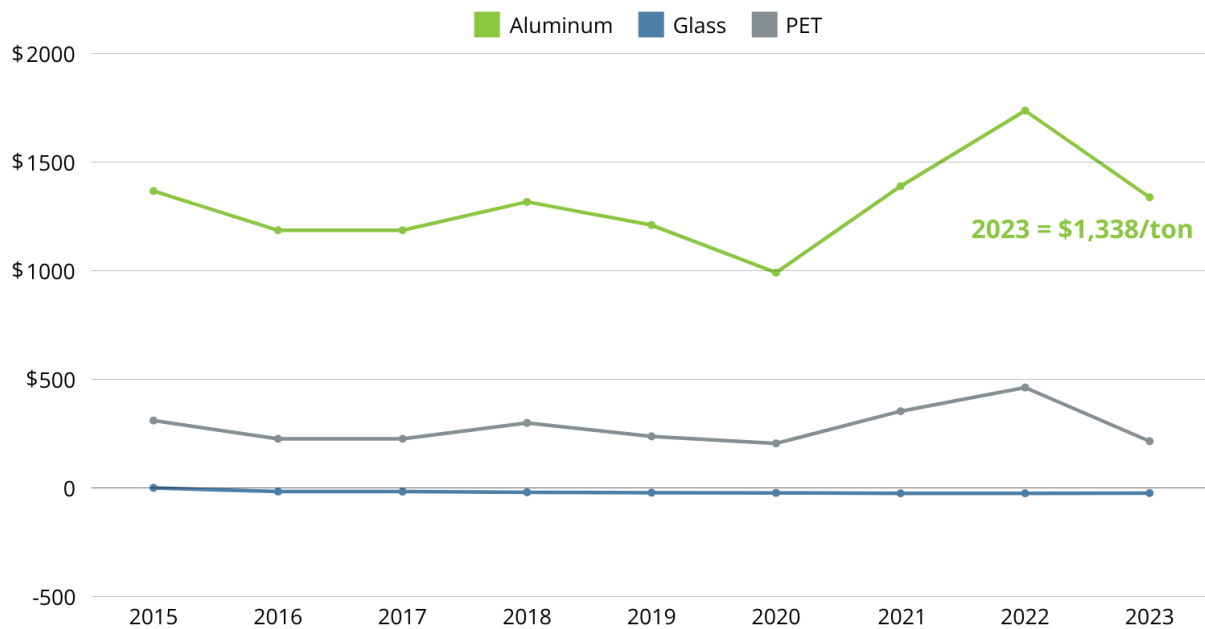
Value Per Ton of Competing Packaging Types





Beverage Container Recycling Value Per Ton Through the Years

Aluminum is by far the most valuable item in the recycling bin on a per-ton basis. It effectively subsidizes less valuable items like glass and plastic. Many municipal recycling programs would not be viable without aluminum in the recycling stream. Aluminum scrap value declined significantly during the COVID-19 economic disruptions but has recovered significantly since that time.





Citations

- 1 <https://www.aluminum.org/sites/default/files/2021-10/2021AluminumCanLCAReportFullVersion.pdf>
- 2 Data for glass beer and soft drink bottles via the Environmental Protection Agency (EPA) Advancing Sustainable Materials Management: https://www.epa.gov/sites/default/files/2021-01/documents/2018_tables_and_figures_dec_2020_fnl_508.pdf (p. 7)
- 3 Data for PET bottles via National Association for PET Container Resources (NAPCOR) 2023 PET Recycling Report: https://napcor.com/wp-content/uploads/2023/12/NAPCOR_2020RateReport_FINAL.pdf (p. 7)
- 4 No equivalent data available for glass or plastic bottles
- 5 Data range for glass bottles estimated via Can Manufacturers Institute/Metabolic Recycling Unpacked report: https://www.cancentral.com/wp-content/uploads/2023/01/Metabolic_Report_RecyclingUnpacked.pdf (p. 36)
- 6 Data for PET bottles via National Association for PET Container Resources (NAPCOR) Postconsumer PET Recycling Activity in 2020 report: https://napcor.com/wp-content/uploads/2023/12/NAPCOR_2020RateReport_FINAL.pdf (Table 8, page 21))
- 7 Data for glass bottles via the Environmental Protection Agency (EPA) Individual Waste Reduction Model (WARM) v16, 2023: https://www.epa.gov/system/files/documents/2023-12/warm_containers_packaging_and_non-durable_goods_materials_v16_dec.pdf (Exhibit 1-8)
- 8 Data for PET bottles via the Environmental Protection Agency (EPA) Individual Waste Reduction Model (WARM) v16, 2023: https://www.epa.gov/system/files/documents/2023-12/warm_containers_packaging_and_non-durable_goods_materials_v16_dec.pdf (Exhibit 5-5)
- 9 Data based on a two-year rolling average of commodity prices from January 2022 – February 2024 for various material types via <http://recyclingmarkets.net/>, which is how we have consistently measured value of material in the past
- 10 Estimate provided by The Recycling Partnership
- 11 Recycled content for PET bottle is from a June 2022 Waste 360 article based on data from the NAPCOR and APR report for 2021. In 2021, the recycling rate for PET bottle was only 26.6%: <https://www.waste360.com/circular-economy/new-recycling-coalition-improve-recovery-plastic-packaging-and-enhance-circularity>
- 12 “RECYCLING UNPACKED Assessing the Circular Potential of Beverage Containers in the United States.” <https://www.cancentral.com>, METABOLIC, Oct. 2020, https://www.cancentral.com/wp-content/uploads/2023/01/Metabolic_Report_RecyclingUnpacked.pdf
- 13 Newly produced virgin aluminum and added alloying elements
- 14 Non-UBC scrap from end-of-life products from other market sectors
- 15 This includes scrap generated from the can manufacturing process and recycled back into the manufacturing process, as well as manufacturing scrap from other market sectors such as building and transportation