



Theoretical maximum recycling rate in Michigan from curbside recycling programs only (Jan. '15)

Background and Subject of this Memorandum: The Container Recycling Institute (CRI) estimates that the theoretical maximum (best case scenario) beverage container recycling rate achievable by curbside recycling alone in Michigan is 38%. This figure was derived by multiplying total beverage container waste generated (using the specific mix of packaging types sold in Michigan) by the proportion consumed in the residential sector, and then by accounting for material losses sustained in sorting and processing.

Methodology: A few generous assumptions were made in calculating this theoretical maximum curbside recycling rate. First, we assumed that curbside recycling programs are available to 100% of households (including single-family and multi-family). In reality, no more than 60% of Michigan residents currently live in areas with curbside recycling programs.ⁱ Second, it is assumed that participation and capture rates are also 100%. This would mean that every single resident of Michigan puts every home-generated beverage container in their curbside recycling bin, with no exceptions. Actual participation rates can be much lower for a number of reasons, including lack of mandatory recycling or local enforcement, resident ignorance or apathy, an inconvenient collection schedule, or the absence of a financial incentive to recycle at curbside (such as Pay-As-You-Throw garbage fees). Using data from the DEQ, CRI has estimated that the actual curbside recycling participation rate for Michigan is approximately 37%.ⁱⁱ

Voluntary recycling that may occur in the industrial, commercial, and institutional sectors were not included in this analysis, nor was public space recycling, as they are not residential curbside programs.

The process of arriving at the 38% theoretical maximum involved a number of steps. First, starting with 100% of beverage containers, almost two thirds (63%) of all containers (by weight) are generated at home, as column D in the table shows. Then, 14% by weight of these at-home containers are lost due to improper sorting at materials recovery facilities (MRFs), leaving 54% of the total beverage containers originally generated. Finally, losses due to cleaning materials at secondary processors are also accounted for (material specific processors, column G); this leaves us with the 38% theoretical maximum recycling rate for curbside alone.

Theoretical Maximum Curbside Recycling in Michigan								
A	B	C	D	E	F	G	H	I
Beverage Container Material Type (a)	Tons Generated Annually (b)	Residential (at home) generation (c)	Share of Tons Generated at Home (d)	Amount Properly Sorted at MRF (e)	Tons properly sorted at MRF (f)	Yield After Secondary Processing (g)	Yield After Secondary Processing, Tons (h)	Total % Yield After Secondary Processing (i)
Aluminum	2,671	76%	2,030	68%	1,381	94%	1,298	48.6%
PET	29,046	58%	16,847	84%	14,151	69%	9,764	33.6%
Glass	25,468	67%	17,064	90%	15,357	70%	10,750	42.2%
TOTAL	57,185		35,941		30,889	70.1%	21,812	38.1%
Proportion of total (B):	100%		63%		54%		38%	

(a) Includes carbonated soft drinks, beer, and sparkling water.
 (b) Source: Container Recycling Institute Beverage Market Data Analysis, 2013. Data is for 2010.
 (c) Source: The Beverage Packaging Environmental Council, 2006.
 (d) Calculated (= B x C)
 (e) Materials Recovery Facility sort data is from the State of Oregon, 2011.
 (f) Calculated (= D x E)
 (g) Assumes single-stream curbside collection. Source: Container Recycling Institute, 2012.
 (h) Calculated (= F x G)
 (i) Calculated (= H ÷ B)

Containers generated at home versus away-from-home: In 2006, the Beverage Packaging Environmental Council (BPEC) released data from a series of studies on beverage container recycling. They researched at-home and away-from-home beverage container consumption, and found that 76% of aluminum cans, 58% of PET bottles and 67% of glass bottles are consumed at home. The remainder is consumed at bars and restaurants, at the office, in cars, or in other locations. Considering all these container types together with a Michigan-specific sales mix, 63% of containers are consumed at home, and 37% are not. This analysis uses the weight of beverage containers, rather than measuring by units of containers (numbers of bottles and cans). In Michigan this amounts to just under 36 thousand tons of beverage container material.

Single-stream residential curbside recycling and incorrect sorting: Once materials are picked up at curbside, they are placed in a truck which compacts or crushes the materials. Single-stream materials are delivered to a materials recovery facility (MRF), dumped on the MRF floor, pushed onto a conveyor belt, and sorted by a combination of machine and manual sorting. It is well known that the sorting process is not perfect, and a small amount of material ends up being sent to the wrong secondary processing facility. Secondary processors include aluminum smelters, plastics reclaimers, and glass beneficiation facilities.

An example of incorrect sorting would be aluminum cans or PET plastic bottles that end up in bales of paper and are sent to a paper mill. A 2011 State of Oregon study quantified the extent of incorrect sorting, and found that only 68% of aluminum cans and 84% of PET plastic bottles were properly sorted (32% of cans and 16% of plastics bottles ended up in the wrong bales). There were no comparable data for glass, because in Oregon, glass bottles are collected separately from other curbside materials. We used the generous assumption that glass is correctly sorted 90% of the time—which is likely too high, because glass bottles break on the collection route and during sorting. At the end of collection and sorting, a maximum of 54% of beverage containers can be sent to processing at secondary processing facilities (column F). Again, this analysis is based on the overly-optimistic assumption that everyone has a curbside recycling bin and participates without fail.

Secondary processing: Contaminants—including caps; labels, paints, and glues; and the incorrectly sorted materials referred to earlier—must be removed during secondary processing. As shown in column G on the table on the previous page, the yield rate for curbside PET plastic is 69%, while aluminum recyclers and glass facilities report average yield rates of 94% and 70% respectively.

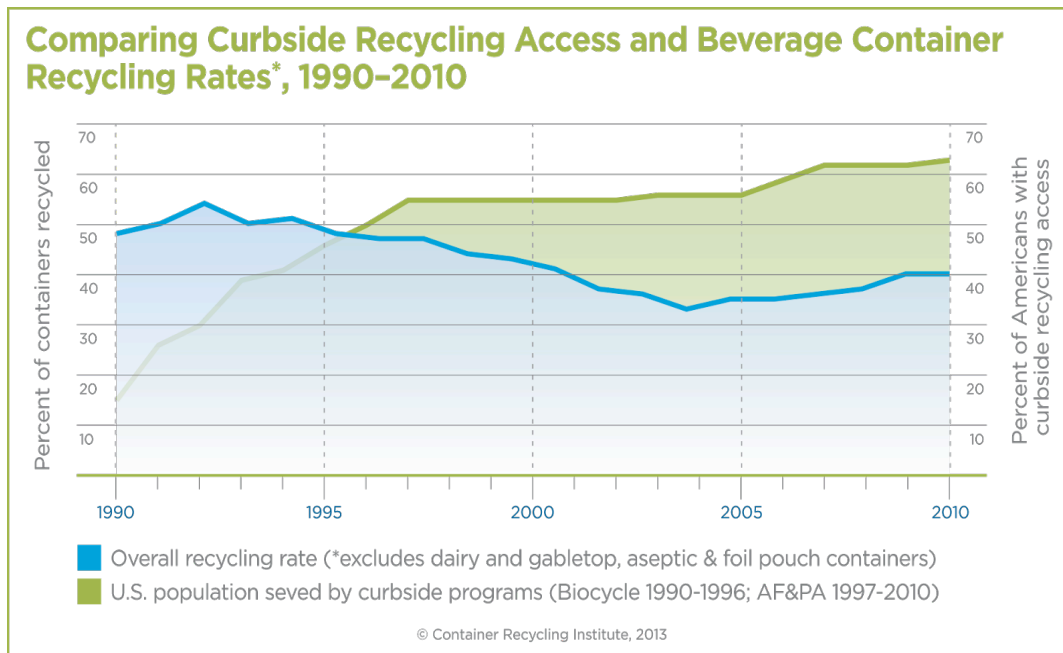
Column H shows the tonnage yields after secondary processing: just under 22 thousands tons for the state of Michigan.

Sum of consumption locale, and collection and processing losses: The calculated 21,812 tons remaining after collection and processing losses is 38%, by weight, of the 57,185 tons of beverage containers originally generated. In other words, an upper limit (or “theoretical maximum”) of 38% of beverage containers could theoretically be recycled through curbside recycling alone in Michigan: provided that the availability of curbside recycling programs is ubiquitous (available to 100% of residents), and that resident participation is perfect (100%).

Again, these are both ideal circumstances that are not achieved in practical terms—due to a combination of budgetary constraints, program inefficiencies, and human behaviors.

These theoretical findings are consistent with data aggregated in the past, wherein even under the best of circumstances—when national curbside recycling rates were peaking at over 60%—the combined recycling rate for the three major container materials hovered at 40%.

As the chart below shows, as the percentage of Americans with access to curbside recycling increased from 1990 to 2000, the percentage of beverage containers recycled decreased. In 1990, curbside recycling access was under 20% while beverage containers were being recycled at a rate of a little less than 50%. By the year 2000, curbside recycling access had grown to over 60%, but beverage container recycling had dropped to 40%, mainly as the result of the shift to drinking more beverages away from home.



It is important to also note that this 40% combined (national) beverage container recycling rate was not solely a result of the residential curbside access as shown in the chart above; rather, it included container recovery produced by beverage container deposit systems operating in 11 states which were home to about 30% of the national population.

Moreover, the away-from-home consumption trend shows no signs of abating, as a growing number of retail venues install beverage vending machines and mini-refrigerators—increasing the public’s access to on-the-go drinks. In the absence of a financial incentive to recycle such as a deposit, and in the absence of widely-available recycling bins in public spaces, these away-from-home containers will not make it back into the residential recycling stream, and beverage container recycling cannot surpass a 38% maximum.

ⁱ The overall 60% curbside access rate for Michigan, and the 37% estimated participation rate, were derived using U.S. Census population figures, the document “Residential Recycling in Michigan: Communities with more than 10,000 people,” Michigan Department of Environmental Quality (DEQ), Jan. 22, 2013, personal communication with the DEQ in December 2014, and CRI estimates. The 60% access rate includes over one million residents who have “subscription” service, meaning they have access to the service, but the Michigan DEQ estimates that fewer than 10% of them are actually purchasing the recycling service.

ⁱⁱ Ibid.