GLOBAL GREEN USA

BEAR

BUSINESSES AND ENVIRONMENTALISTS ALIIED FOR RECYCLING

STAGE 1

Understanding Beverage Container Recycling

A Value Chain Assessment prepared for the Multi-Stakeholder Recovery Project

Executive Summary

UNDERSTANDING BEVERAGE CONTAINER RECOVERY

A Value Chain Assessment prepared for the Multi-Stakeholder Recovery Project, Stage 1

Background

Businesses and Environmentalists Allied for Recycling (BEAR), a project of Global Green USA, is a coalition dedicated to significantly increasing the national recycling rate for beverage containers. BEAR's members include recycling collection, processing and end-use corporations and environmental advocacy organizations. BEAR has partnered with other stakeholders, including beverage and container producers, waste haulers and others, to launch the Multi-Stakeholder Recovery Project (MSRP) a three-stage initiative to evaluate options for moving towards BEAR's 80 percent beverage container recycling goal. Stage One began in May 2001 with the objective of identifying an industry-wide beverage container recovery program satisfying eleven guiding principles that can be supported by the groups most critical to its success. A 13-member MSRP Task Force was formed to oversee research and seek agreement on this objective. The Task Force was comprised of members of BEAR's Steering Committee as well as representatives of a major beverage producer, a container producer, a waste management firm, a plastics processor and local and state government. A 24-person Advisory Committee provided an even broader range of input from all types of stakeholders representing perspectives of the entire beverage container value chain.

The Value Chain Assessment was prepared to support the MSRP Stage One by providing an objective, unbiased source of information on U.S. beverage container recovery programs as they operated in the study year of 1999. The study does not attempt to project the costs and impacts of expanding or replicating existing or newly designed programs in the future. The research consulting team included R.W. Beck, Inc. (as lead), Franklin Associates Ltd., the Tellus Institute and Sound Resource Management Group, Inc. Boisson & Associates managed the project and coordinated the research consulting teams.

Key Conclusions

The following conclusions were developed by the MSRP Task Force in conjunction with the consulting team.

Generation and Recovery of Discarded Beverage Containers

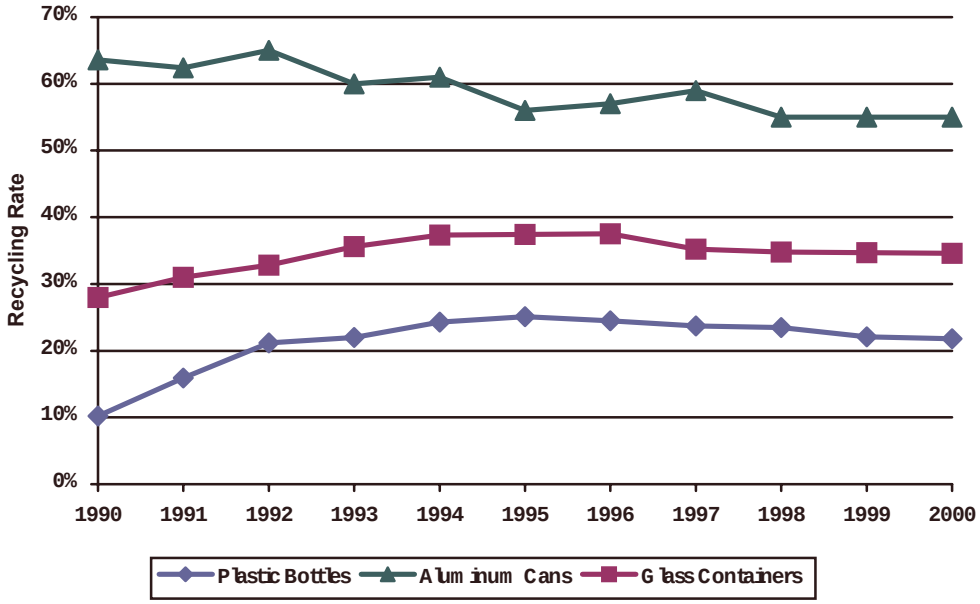
Beverage container recycling rates are likely to steadily decline in future years in the absence of new recovery and market development initiatives. During 1999, an estimated 192.5 billion aluminum, PET, HDPE and glass beverage containers were generated (equivalent to 11.1 million tons or 684 containers per capita). Of this amount, 78.1 billion beverage containers were recycled (3.4 million tons or 277 containers per capita) and 114.4 billion beverage containers were disposed (7.7 million tons or 407 containers per capita).

For generation, recycling and disposal, glass dominates when measured by weight and aluminum dominates when measured by the number of containers.

The estimated 1999 recycling rate for aluminum, glass and plastic beverage containers was 41 percent when measured by units and 30 percent when measured by weight. As shown in Figure ES-1 below, recycling rates have stagnated or, in some cases, declined in recent years. Recycling rates are declining, even though the tonnage recovered is relatively flat. Reasons for this include: the fact that growth is dominated by PET containers (with an emphasis on single-serve beverages often consumed away-from-home); increasing range of beverage types (that may complicate recycling education and/or may not be covered in recovery programs); the maturation of curbside and drop-off collection programs (i.e., few new programs are being added); declining support and funding for recycling; and the declining relative value of deposit amounts adopted in past years.

Figure ES - 1

Trends in Container Recycling Rates[1]



Source: Aluminum Association, American Plastics Council, Glass Packaging Institute. (See end note #1.)

Effectiveness of Discarded Beverage Containers Recovery Programs

Measurements of the effectiveness of any beverage container recovery programs must consistently account for differences in containers accepted and other program variables. Table ES-1 presents two measures that account for key variables that can be used to compare programs on an apples-to-apples basis. *The overall recovery rate* is a measure of the percentage of all containers generated that are recovered in a given region covered by the program. The *normalized per capita recovery* is based on the national average annual generation figure (684 containers per capita), allowing program comparisons that are unbiased by differences in regional beverage consumption. The factors included in these measures are: the population potentially covered by the program; the container types accepted, the access, participation and capture rates, the ability to target residential and

non-residential generators; the effect of deposit systems in reducing the containers available to other programs; and the yield loss during intermediate processing.

Deposit systems result in the highest level of recovery. In 1999, traditional deposit systems had an average redemption rate of 78 percent (varying from a high of 95 percent in Michigan to a low of 72 percent in Massachusetts), and targeted on average 79percent of all container types[2], for an overall recovery rate of 61.6 percent (422 containers per capita). About 30 percent of these redemptions occurred through reverse vending machines. In the study year of 1999, California's unique redemption system achieved a redemption rate of 69percent and targeted 79 percent of container types, for an overall recovery rate of 54.5 (373 containers per capita). California's program was greatly expanded in 2000 and the percentage of containers redeemed has initially declined. It should be watched closely as it continues to adjust to this expansion. Deposit systems recover containers from all generators and have little if any yield loss in the recovery stage. As a region, the ten deposit states achieved through all types of recovery programs an overall recovery rate of 71.6 percent, compared to 27.9 percent in non-deposit states.

Curbside programs result in the second highest level of recovery. Curbside programs typically accept all plastic, glass and aluminum beverage containers but are limited almost entirely to containers generated in residences (estimated at 75.7 percent of all containers in this study). Access rates for curbside programs vary from 76 percent in the deposit states to 61 percent in non-deposit states, and the typical participation and capture rate is about 50 percent. Yield loss during intermediate processing is assumed to be 13 percent across the board for beverage containers. In deposit states on average 61.6 percent of containers are unavailable to curbside programs because they have already been redeemed. Adjusting for these variables, curbside programs have an overall recovery rate of 9.5 percent in deposit states and 18.5 percent in non-deposit states (with per capita recovery of 65 and 127, respectively).

Residential drop-off programs result in the third highest level of recovery, far less than deposit and curbside programs. Like curbside, drop-off programs typically accept all types of plastics, glass and aluminum beverage containers and are limited almost entirely to containers generated in residences (estimated at 75.7 percent of all containers in this study). About 60 percent of the population in deposit states and nearly 65 percent in non-deposit states have access to residential drop-off programs. They recover between 5-10 percent of the beverage containers generated in targeted residences. The yield loss assumed in this study is 5 percent during intermediate processing. And, in deposit states approximately 61.6 percent of all containers are unavailable because they have already been redeemed. Adjusting for these factors, drop-off programs achieve overall recovery rates of 1.6 percent in deposit states and 4.5 percent in non-deposit states (with per capita recovery of 11 and 31, respectively).

All other programs not covered above combine to recover slightly more containers than residential drop-off programs. Other programs include non-residential and buy-backs. Non-residential is defined in this study as a catch-all category for recovery programs operated in commercial businesses, schools, universities, work places and public venues. Buy-back centers are typically privately operated facilities that pass on a portion of a material's market value to people who bring materials to their facility. (Many buy-back centers in California operate as certified redemption centers and are covered in this report under that program.). Due to a lack of data and the high variability of non-residential

programs, these programs could not be compared on many of the program variables. However, overall recovery rates were estimated by assuming that they account for all remaining, known national recovery not accounted for by deposit, curbside, drop-off programs. Using this method, the category of "other" recovery programs achieves a combined overall recovery rate of about 1.8 percent in deposit states and 4.8 percent in non-deposit states (with per capita recovery of 13 and 33 respectively).

Cost of Recovery Programs

Table ES-1 lists three distinct, alternative measures for comparing program costs: gross costs, net costs including material sales revenue and net costs less funds from unredeemed containers in deposit systems. The figures presented are typical costs per-container recovered by recovery programs as they operated in the study year of 1999. Recovery program gross costs are defined in this study to include operational costs associated with collection and intermediate processing for sale to markets. Although costs vary among specific facilities and programs, the reported costs were determined to be typical. Net costs less funds from unreclaimed containers in deposit systems (arising through consumers' decision not to redeem containers) is shown separately since these funds are an inherent part of all deposit programs. Other transfer mechanisms such as processing fees, handling fees or local funding mechanisms are not recognized in this analysis. Material sales revenue is based on two-year average prices. Costs and revenues vary significantly for different material types, but the results presented here are a weighted-average system cost reflecting all material types. Costs associated with consumers transporting containers to a recycling center are not included. The methodology used for each program is further explained in Chapter Three of the report.

Beverage container recovery has a net cost that must be covered by some type of funding mechanism. ("Aluminum cans" is the only category for which material revenue can completely offset collection and processing costs.) After accounting for revenue from the sale of recovered materials, the U.S. beverage container recovery system has a net cost of approximately 1.39 cent per container, or $1.1 billion. This is a weighted average of all program types and container types. The weighted average net unit costs in deposit states is 1.53 cents per container, compared to 1.25 cents in non-deposit states.

Traditional deposit systems have the highest gross cost. Traditional deposit systems also have the highest overall recovery rate at 61.6 percent**.** Gross costs for traditional deposit systems are about 3.61 cents per container. Net costs including revenue from material sales are about 2.21 cents per container. In this study, 70 percent of all redemptions in traditional deposit systems are assumed to be through "manual" systems, with the remaining 30 percent through reverse vending machines. Manual deposit systems that require handling and redeeming containers in retail stores, and sorting containers by distributor and/or by brand are relatively costly, with gross costs of 4.07 cents per container and net costs including material sales of 2.67 cents. Using reverse vending machines can reduce the gross cost of traditional deposit systems to 2.53 cents per container and the net cost including material sales to 1.13 cents. Deposit systems yield the highest quality materials with the highest market values.

Curbside recovery programs have the second highest gross costs. Curbside programs also achieve the second highest overall recovery rates at 18.5 percent in non-deposit states and 9.5 percent in deposit states. Typical curbside programs collecting commingled beverage containers have a gross cost of 2.48 cents per container, and a net cost of 1.72 cents per container including revenue from material sales.[3]

The system operating costs of the California Redemption System are among the lowest identified. The overall recovery rate of the California redemption system is approximately 54.5 percent in the study year of 1999. In the California Redemption System, consumers may redeem containers at "old line recyclers" (buy-back centers that existed prior to the 1987 redemption law, which some argue are unique to California) and convenience zone recyclers affiliated with retail stores. The old line recyclers in particular have extremely low collection and processing costs. Unlike traditional deposit systems, the program does not require sorting by brand or distributor. The gross operating cost of collection and intermediate processing in this system is about 1.62 cents per container, or 0.55 cents per container, including revenue from material sales. These are system operating costs based on a weighted-average for all material types, including the operations of redemption centers and administrative costs. It must be noted that the California system requires producers to pay a processing fee based on unique material specific costs. This report's analysis allows revenue from aluminum to help offset the costs of other materials. Because processing fees transfer costs from one party to another, they are not recognized as a cost in this analysis. Also, because programs are compared in this report as they operated in the study year of 1999, the comparison does not address impacts related to the significant expansion of the California program that occurred in 2000. Some of these impacts are discussed in the report, in Section 2.3.2.

If unredeemed deposits are included as revenue source, the comparison of program costs changes drastically. Some argue that unredeemed deposits, resulting from consumers' decision not to redeem covered containers, should be "counted" as a revenue source when reporting the net costs of deposit programs. In seven of the nine traditional deposit systems, these funds are allowed to remain with distributors to offset their costs of implementing the program and in the California system they are distributed to recyclers by the state administrating agency. Based on a comparison of net costs that includes revenue from material sales and (for deposit systems) revenue from unredeemed containers, curbside programs are most costly (1.72 cents per container), followed by manual traditional deposit systems (0.80 cents per container) and residential drop-off programs (0.30 cents per container). On average, the California redemption system and reverse vending machine based deposit systems show a surplus when unredeemed deposits are included (0.42 and 0.28 cents per container, respectively).

Residential drop-off programs have the lowest gross cost. These programs also have the lowest overall recovery rate at 4.5% in non-deposit states and 1.6% in deposit states. The gross cost of these programs is about 1.1 cents per container and the net costs including material sales revenue are about 0.3 cents per container. The net cost of drop-off programs is particularly sensitive to the quality of materials, which is extremely variable.

Because of their wide variability, no specific cost estimates were derived for non-residential programs. These programs vary considerably, with some operated on a purely

volunteer basis (e.g., in schools) or being bundled with garbage or janitorial service contracts (e.g., in certain office buildings or other work places).

Funding responsibility varies for different recovery programs. Curbside and residential drop-off programs are funded by local governments with revenue derived from tax and rate payers. Deposit systems are funded by unredeemed deposits derived from consumers, from handling or processing fees paid by distributors and/or brand owners and by retailers.

Benefits of Recovery Programs

Recycling beverage containers yields significant environmental benefits. The data in Table ES-2 show the following:

- Energy use is reduced and greenhouse gas emissions (which contribute to global warming) are avoided. Other harmful emissions to air and water are also avoided.
- Use of land for disposal of waste and for the extraction of virgin materials is reduced
- Litter is reduced, as shown in deposit states, leading to reduced human injuries and avoided harm to farm machinery and animals.

These benefits are significant. For example, the energy saved is equivalent to over 32 million barrels of oil per year. These environmental benefits are currently dominated by those associated with aluminum can recycling. However, there are also environmental benefits associated with recycling plastic and glass. The reduced energy use and pollution resulting from recycling accrues when recovered containers are recycled in manufacturing new products. Recycling beverage containers also results in avoided garbage collection and landfill costs. This report did not attempt to quantify the costs and benefits associated with these environmental externalities.

Recycling beverage containers yields significant economic benefits. The development and operation of a beverage container recycling infrastructure creates a significant number of jobs and has been shown to improve U.S. competitiveness.

Table ES-1
Comparison of Program Effectiveness and Cost (1999)

Recovery Program and Targeted States	Population in Covered States (millions)[4]	Effectiveness Measures Uniformly Accounting for Differences in Containers Accepted and Other Variables.		Alternative Cost Comparisons (cents/ unit recovered)[5]			Funding Responsibility
		Overall Recovery Rate[6]	Normalized Per-Capita Containers Recovered[7]	Gross Cost[8]	Net Cost (Including Material Sales Revenue) [9]	Net Cost less funds from Unredeemed Deposits[10]	
Deposit States[11]							
Traditional Deposit System (Manual)	47.7	43.1%	295	4.07	2.67	1.26	Consumers (unredeemed deposits), beverage distributors (handling fees) & retailers
Traditional Deposit System (RVM)		18.5%	126	2.53	1.13	(0.28)	
Weighted Average, 9 Traditional Deposit States		61.6%	422	3.61	2.21	0.80	
CA Redemption System	33.9	54.5%	373	1.62	0.55	(0.42)	Consumers (unredeemed deposits) & producers (processing fee)
Curbside [12]	81.6	9.5%	65	2.48	1.72	1.72	Local governments, tax payers, rate payers
Residential Drop-Off	81.6	1.6%	11	1.10	0.30	0.30	
Other (e.g., non-residential and buy-backs)	81.6	1.8%	13	Unknown	Unknown	Unknown	Varies
Subtotal, 10 Deposit States	**81.6**	**71.6%**	**490**	**2.69**	**1.53**	**0.53**	
Non-Deposit States							
Curbside	199.9	18.5%	127	2.48	1.72	1.72	Local governments, tax payers, rate payers
Residential Drop-Off	199.9	4.5%	31	1.10	0.30	0.30	
Other (e.g., non-residential and buy-backs)	199.9	4.8%	33	Unknown	Unknown	Unknown	Varies
Subtotal, Non-Deposit States	**199.9**	**27.9%**	**191**	**1.91**	**1.25**	**1.25**	
Total U.S.	**281.4**	**40.6%**	**277**	**2.32**	**1.39**	**0.88**	

Sources: MSRP Consulting Team based on numerous sources detailed in end notes #4 through 12.

Table ES-2

Select Environmental Benefits Due to Beverage Container Recycling in 1999

	Glass	Aluminum	Plastic		Total
			PET	HDPE	
Baseline Recycling Statistics					
Recycled in 1999 (thousands of tons)[13]	2,000	840	333	220	3,393
Reduced Greenhouse Gas Emissions					
Avoided GHG Emissions (MTCE per ton)[14]	.16	4.09	.72	.44	
Avoided GHG Emissions (Thousands of MTCE)[15]	320	3,436	240	97	4,093
Energy Savings					
Avoided Energy per Ton (Million Btu)	1.37	158.19	26.25	15.17	
Avoided Energy (Billion Btu)	2,740	132,880	8,741	3,337	147,698
Equivalent (Thousands of Barrels of Oil)[16]	472	29,910	1,507	575	32,464
Avoided Litter					
Containers Per Ton	4,581	66,225	26,702	26,702	
Avoided Litter (Millions of Containers)[17]	91.6	556.3	88.9	58.7	795.5
Avoided Landfill Space					
Volume (Cubic Yard Per ton)[18]	3.0	8.4	9.8	15.6	
Avoided LF Space (Millions Cubic Yards)	6.0	7.0	3.3	3.4	19.7

Source: Tellus Institute and Sound Resource Management Group based on sources detailed in end notes #13 through 18.

Notes

[1] Source: Aluminum Association, American Plastics Council, Glass Packaging Institute. Rates shown are for all product types within each container type – not just beverages. Aluminum Association recycling rate data were adjusted by subtracting imports from the numerator.

[2] In 1999 only Maine's deposit program covered non-carbonated beverage containers, and only Iowa, Vermont and Maine covered liquor and/or wine containers.

[3] This study did not estimate a separate cost of curbside programs in curbside and deposit systems. It should be noted that the California Redemption System is the only U.S. deposit system that compensates curbside programs for the estimated number of covered containers they handle (based on statewide surveys).

[4] Source: Statistical Abstract of the United States, 2001.

[5] All cost figures are justified in detail in Chapter Three.

[6] The overall recovery rate calculation is thoroughly explained and justified in Section 2.4 of the report. For all programs except "other" the overall recovery rate is calculated by multiplying: a) the percentage of all beverage container types that are accepted in the program; b) The percent of all containers remaining after redemptions in deposit states; c) A factor to account for the generator sectors targeted (i.e., at home or away from home); d) The access rate; e) The participation and capture rate; and f) a factor to account for yield loss in intermediate processing. The "other" category was calculated by allocating the remaining known recovery to deposit and non-deposit states, adjusting for the lower availability of containers in deposit states due to redemptions.

[7] Normalized per capita recovery figures are thoroughly explained and justified in Section 2.4 of the report. The calculations are based on allocating this study's estimate of national beverage container generation (192.5 billion) to each region based on population and deriving containers recovered using the overall recovery rates (see previous note). This normalizes the figures for consistent comparison, but the resulting figures do not reflect differences in beverage consumption patterns, and therefore may not be consistent with state-reported recovery figures.

[8] Gross costs include all operations costs associated with operating collection and intermediate processing activities, as well as administrative costs. Cost figures listed for deposit states and non deposit states as a whole are a weighted average based on population and do not reflect the cost of programs in the "other" category since no data were available. A crucial "reality check" on the cost figures was provided by the consulting team and MSRP participants, who scrutinized these figures and agreed they are reasonable. Gross cost figures for traditional deposit system (manual) are based on a confidential Franklin Associates study adjusted for consistency. Reverse vending machine gross cost estimates are from Tomra North America, as adjusted by Franklin Associates Ltd. for container mix. California redemption system gross costs are based on cost survey data from the California Department of Conservation, Division of Recycling. They include recycler and processor costs, administrative costs and handling fee payments. DOC data were adjusted to conform with the scrap values and material densities used in this report, and to subtract out curbside recovery impacts. Gross costs for curbside programs are an average of three sources: American Plastics Council, National Solid Waste Management Association and a confidential waste hauling industry source. Drop-off gross costs are from an R.W. Beck study for Ocala, FL.

[9] Material sales prices used are 24-month averages based on survey data from R.W. Beck. Differences in the unit revenues of each program are related to differences in the mix of containers handled. The same per ton values are used for each program.

[10] Unredeemed deposit for traditional deposit systems is derived based on assumed average redemption rate of 78% and a "typical" 5-cent deposit amount.

[11] Ten states have adopted deposit systems. "Traditional deposit systems" operate in Connecticut, Delaware, Iowa, Maine, Massachusetts, Michigan, New York, Oregon and Vermont. California's redemption system is a hybrid deposit system with distinct differences from traditional deposit systems. These terms are defined in detail in Section 2.3 and Appendix C.

[12] The study analysis did not generate separate cost estimates for curbside and drop-off programs in deposit and non-deposit states. The analysis used data from non-deposit states.

[13] The tonnage recycled in 1999 is taken from Table 2-1 of this report.

[14] Avoided GHG emissions are from the EPA's *GHG Emissions From Management of Selected Materials in MSW* (GHG Report). The avoided emissions per ton recycled instead of landfilled are taken from Table 8-6, adjusted to "as marketed" from "as collected," using loss data in Table 4-3 for aluminum and plastic and a Tellus estimate for glass of 44 % losses.

[15] Avoided Energy is based on the difference in energy consumption between recycled and virgin feedstock. It is based on the "Franklin Data" in Tables 2-3 to 2-6 of the GHG Report, adjusted for losses using Table 4-3 and a Tellus estimate for glass as above. Franklin data were used because it provided data on all four materials.

[16] Computed using 5.8 million Btu's per barrel, as shown on page 581 of the *1999 US Statistical Abstract*.

[17] Avoided Litter is based on estimates of containers per pound in Table 2-1 and an assumption that 1 % of containers which are not recycled are littered. The "1 % litter rate" is used for illustrative purposes.

[18] Avoided landfill space is based on loose material densities, compaction factors and a 13 % addition for cover. This calculation was taken from the Tellus analysis used in *Recycling For The Future - Consider the Benefits*, White House Task Force on Recycling, November 1998.