

# 2011 Impact Analysis of a Beverage Container Deposit Program in Maryland



Prepared for the Waterfront Partnership of Baltimore, Inc. and the Abell Foundation

*Prepared by the University of Maryland Environmental Finance Center (EFC)  
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This document was prepared by the following partners:

### **Environmental Finance Center**

The Environmental Finance Center (EFC) is located at the National Center for Smart Growth Research and Education at the University of Maryland in College Park. The EFC is a regional center developed by the Environmental Protection Agency to assist communities and watershed organizations in identifying innovative and sustainable ways of implementing and financing their resource protection efforts throughout the Mid-Atlantic region. The EFC is nonadvocacy in nature and has assisted communities and organizations in developing effective sustainable strategies for specific watershed protection goals for a variety of clients including state and local governments, watershed organizations, and land trusts.

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## Section 1: Summary Findings

In October 2011, the Environmental Finance Center (EFC) at the University of Maryland was asked to investigate the feasibility of a beverage container deposit program in the state of Maryland. The objective of the study is to quantify a beverage container deposit program's contribution to Maryland's goals to reduce greenhouse gas (GHG) emissions and stormwater related trash. In addition, the EFC project team was asked to determine what monies might be available to the state as a result of unredeemed beverage container deposits.

Beverage container deposit programs currently exist in ten states across the country and are under consideration in several others. The unique nature of disposable beverage containers provides the opportunity to use a fee-based system to incentivize the proper handling and disposal of these items. Though virtually all of the existing programs have been successful at achieving their stated goals, deposit programs remain highly controversial and are vigorously challenged by a number of industry groups. Our goal was not to advocate either for or against these deposit systems, but rather to inform decision-making within the state of Maryland as it considers legislation in the future. The following are the team's key findings associated with our research:

**The impact on litter reduction.** Litter reduction is clearly the primary benefit of beverage container deposit programs. Though beverage containers are only a fraction of the litter stream, deposit programs have proven highly effective at reducing the amount of litter in the communities that have adopted these programs. In fact, there is little evidence that any other program, in and of itself, is nearly as effective as deposit programs at reducing litter rates. That said, some beverage deposit programs are better than others at reducing litter rates. Ultimately, the impact on litter is determined by two factors: **1)** the redemption rate; and **2)** the number of container types addressed by the deposit system. There is little evidence that deposit programs lead to significant reductions in other components of the litter stream.

**The impact on recycling.** One of the key features of deposit programs is that they move beverage containers out of the waste stream into the recycling stream. In fact, the states that have implemented deposit programs have experienced a marked improvement in recycling rates. However, the long-term sustainability of beverage deposit systems requires a market for the scrap materials that are produced as a result of increased recycling rates. The market price for scrap materials fluctuates based on economic conditions; as a result, the value of scrap materials is currently not high enough to support the costs of running deposit programs. However, it is likely that the market price of scrap materials will increase in the future, thereby creating greater opportunities to support deposit programs through recycling program revenue.



**The impact on local recycling programs.** Though beverage container deposit programs have a demonstrated positive impact on recycling rates, these benefits come with costs. Specifically, local recycling programs may see a reduction in the number of beverage containers collected through curbside pick-up. And, because aluminum beverage containers in particular represent some of the more valuable sources of scrap materials, local recycling systems could see a reduction in revenue. Therefore, though recycling rates and efficiencies will almost certainly improve statewide, it may come at a cost to local programs.

**The impact on jobs and the economy.** There is little evidence to suggest that beverage container deposit programs have any significant impact on job creation and the economy. In fact, the most efficient systems employ technologies such as reverse vending machines that ultimately reduce the labor needed to administer the program. That said, research does show that the recycling industry may experience significant job growth in the future. Therefore, in so far as deposit programs contribute to the expansion of recycling programs, they may have a positive impact on the economy in the future.

**The paradox of revenue generation.** One of the more popular selling points of deposit programs is the creation of revenue through unclaimed deposits. Deposit programs create market incentives that encourage the appropriate disposal of empty beverage containers. When the deposit rate is set high enough (at a level of around 10 cents per container) redemption rates increase to around 90 percent. This means that the program is achieving its primary goal of maximizing litter reduction rates. However, the lower the deposit charged, the lower the redemption rates; therefore, the lower the reductions in litter and the higher unclaimed deposit revenue.

Deposit rates of 5 cents per bottle—the most common deposit amount among existing deposit programs—results in redemption rates of around 75 percent. As a result, there is a significant amount of revenue that goes unclaimed. This revenue is often used to address program costs including handling fees and other litter reduction and recycling programs. In some cases, the revenue is used to support other unrelated social and environmental programs. This of course creates tension among competing community priorities. For those that view the role of deposit programs as a tool to reduce litter, unclaimed deposits can result in lower litter reduction rates (though it is likely that many of the containers that go unclaimed do not end up as litter). For those who are relying on unclaimed deposits to fund other programs, more success in litter reduction means less revenue. As a result, these two motivations for implementing beverage deposit programs—litter reduction and revenue generation—are at odds. In other words, a community cannot reasonably expect to maximize both litter reduction and revenue generation with a deposit program.

**The impact of handling costs.** Handling costs appear to be one of the most contentious issues associated with beverage deposit programs. Handling costs are associated with collecting containers

that are redeemed by consumers, and these costs are the most significant of all the costs associated with running a deposit program. Even the most effective and efficient systems incur operational costs and the ability to control handling costs in particular will impact the sustainability of the program in the long-term. The average handling cost in the ten states with deposit programs is 3.3 cents per container. Keeping costs low, however, must be balanced with the need to provide consumers with convenient access to redemption centers and opportunities.

With the exception of Oregon<sup>1</sup>, states have employed two basic approaches to address these costs: **1)** cover the costs with unclaimed deposit revenue; or **2)** assess a non-refundable fee on each beverage sold. There are administrative costs and barriers associated with each approach and each can be implemented in a variety of ways thereby impacting different stakeholder interests. Regardless of how these costs are addressed, there is little evidence that the costs associated with deposit programs will negatively impact beverage sales, especially if the program applies to multiple container types. The demand for beverages impacted by the program is inelastic, which makes any potential impact on sales minimal.

**Impact on greenhouse gases (GHG).** Maryland has made reducing greenhouse gas emissions a critical environmental priority. To that end, beverage container deposit programs are looked to as a possible integral component of the state's GHG reduction strategy. Though there are some reductions in GHG emissions associated with deposit programs, they are relatively modest and will almost certainly not be a major contributor to the state's GHG program. However, there are genuine GHG benefits associated with the expanded use of recycling scrap materials. Therefore, as the market for scrap materials increases in the future, the GHG impact of deposit programs will increase.

Again, our goal with this report was not to advocate whether or not a beverage container deposit program should be implemented in Maryland. Rather, we sought to assess the impacts these programs have on communities, identify potential barriers and opportunities for maximizing benefits to communities generated by these programs, and help inform the decision-making process as state leaders continue to debate the potential merits of these types of policy tools in the future.

Section 2 of our report assesses the impacts of beverage container deposit programs on key environmental and waste management issues such as litter, landfilling, incineration, and recycling. In Section 3, we describe the basic structure of deposit programs and how that structure might work in the state of Maryland. Finally, in Section 4, we provide some recommendations for moving forward.

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<sup>1</sup> Oregon does not address handling costs directly in their program. Instead, it is our understanding that the costs are built into the system by manufacturers.

## Section 2:

# The Impacts of Beverage Container Deposit Programs

Every day throughout the state of Maryland, millions of beverage containers are purchased and discarded. The fate of these containers, whether they end up as litter, in landfills, incinerated, or recycled, has directly influenced the development, implementation, and debate associated with beverage container deposit programs (deposit programs). Deposit programs are market-like mechanisms that create incentives for consumers to properly dispose of many types of plastic, aluminum, and glass containers. When designed appropriately, deposit systems have a demonstrated success in reducing litter and rechanneling waste to the recycling system. In this first section of the report, we address the problem of litter and the tools, policies, and processes that have been employed across the country to mitigate the impacts of litter in our communities. We then assess how deposit programs impact the waste management system and the associated economic, environmental, and fiscal benefits and impacts on communities.

### The problem of litter

So what happens to the bottles that we purchase and discard? Many of them suffer the least appealing of the potential fates: they end up on the ground in the form of litter. Litter consists of inappropriately discarded waste into the natural environment. As population and consumption have increased over the last century, the amount of food wrappers, cigarette butts, and beverage containers littering America's roadways, streams, parks, and communities has increased as well. The modern American public first became aware of litter as a significant environmental and public health concern in the 1960s when Keep America Beautiful launched a series of public service announcements depicting the dangers of consumer waste.<sup>2</sup> Behavioral studies suggest

*In 2005, the Georgia Department of Transportation reportedly spent \$14 million just to clean up roadsides in the state. It is suggested that local cleanup costs, when combined with the costs absorbed by other state agencies, would top \$20 million per year or more in that state.*

*Keep America Beautiful. Georgia 2006 Visible Litter Survey: A Baseline Survey of Roadside Litter, January 2007*

that people tend to litter where they feel no sense of ownership or responsibility, or where a norm of trash accumulation has already been established. As a result, litter tends to accumulate in transitional areas, including roadways, public spaces (such as parks or storefronts), and waterways.

Litter is a local problem the impacts of which can reach far beyond the community of origin. Litter not only decreases the aesthetic appeal of communities, which depresses business and local property values, but travels via wind and water to pollute critical waterways and ecosystems. Traditional stormwater systems, which tend to result in high velocity

<sup>2</sup> Keep America Beautiful. "KAB: A Beautiful History." Keep America Beautiful, Inc. 2006. [www.kab.org/site/PageServer?pagename=kab\\_history](http://www.kab.org/site/PageServer?pagename=kab_history).



flow of rainwater, exacerbate the problem. As a result, local and county governments and communities across the state and the country continue to invest in surveys, cleanups, and litter reducing technologies, like litter traps, in an attempt to reduce the impacts.

Litter is costly to clean up with negative impacts on tourism and property values. Litter also degrades the ecology of land and water systems. A 2009 Keep America Beautiful report estimated that the US spends nearly \$10.8 billion annually on litter cleanup and prevention alone, with state and local governments picking up 11.5 percent of the cost, or about \$1.3 billion. Businesses reportedly pay the brunt of litter cleanup - \$9.1 billion or about 80 percent of the total cost.<sup>3</sup>

Though statewide data are unavailable for the direct costs incurred by Maryland counties, businesses, and individuals due to litter, the table below demonstrates the relationship between a given county's waste stream in 2009, the amount of litter recovered, and the cost of litter cleanup.

County	Waste Generated (2009) <sup>4</sup>	Litter Recovered	Cost of Litter Cleanup (per year)
Anne Arundel	232,210 tons	---	\$150,000 <sup>5</sup>
Baltimore City	1,287,942 tons	144 tons (2010) <sup>6</sup>	\$10 million <sup>7</sup>
Frederick	365,964 tons	13.04 tons (2002) <sup>8</sup>	---
Harford	357,104 tons	45.6 tons <sup>9</sup>	---
Montgomery	1,356,600 tons	---	\$3 million <sup>10</sup>
Prince George's	1,239,628 tons	3,900 tons (estimated, 2008) <sup>11</sup>	\$2.72 million <sup>12</sup>

**Table 1:** Annual Cost of Litter Cleanup in Maryland Counties

<sup>3</sup> MSW Consultants. "2009 National Visible Litter Survey and Litter Cost Study." Keep America Beautiful. September 18, 2009. [www.kab.org/site/DocServer/Final\\_KAB\\_Report\\_9-18-09.pdf?docID=4561](http://www.kab.org/site/DocServer/Final_KAB_Report_9-18-09.pdf?docID=4561).

<sup>4</sup> Maryland Department of the Environment. "Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data)." Technical Services and Operations Program. November 2010.

<sup>5</sup> "Litter/Debris Removal." Anne Arundel County, Citizens Information Center. Department of Public Waste Highways and Litter Pickup. 2008. [www.aacounty.org/DPW/Highways/LitterPickup.cfm](http://www.aacounty.org/DPW/Highways/LitterPickup.cfm).

<sup>6</sup> Vuoto, Loredana. "Mayor's Spring Cleanup Generates Baltimore's Green Pride." Greenhandsusa. May 5, 2011. [www.greenhandsusa.com/central/page:10346](http://www.greenhandsusa.com/central/page:10346).

<sup>7</sup> Baltimore Commission on Sustainability. "The Baltimore Sustainability Plan." Baltimore City Planning Commission. February 3, 2009. [www.reservoirhill.net/publications/rroom/Baltimore\\_Sustainability\\_Plan.pdf](http://www.reservoirhill.net/publications/rroom/Baltimore_Sustainability_Plan.pdf).

<sup>8</sup> Versar, Inc. "An Assessment of Road Maintenance Activities in Frederick County and their Effect on Stormwater Runoff Quality." Prepared for Division of Public Works, Frederick County Maryland. May 29, 2002. [www.watershed-alliance.com/publications/Road%20Maintenance%20Report/roadmaint.pdf](http://www.watershed-alliance.com/publications/Road%20Maintenance%20Report/roadmaint.pdf).

<sup>9</sup> "Roadside Litter Control." Harford County Government, Environmental Services. 1997-2011. [www.harfordcountymd.gov/dpw/envaffairs/index.cfm?ID=421](http://www.harfordcountymd.gov/dpw/envaffairs/index.cfm?ID=421).

<sup>10</sup> "Carryout bag charge to make gains in the County's litter control efforts." Montgomery County, Department of Environmental Protection. October 18, 2011. [www.montgomerycountymd.gov/apps/News/Blog/pioBlog.asp?blogID=21&Cat=litter](http://www.montgomerycountymd.gov/apps/News/Blog/pioBlog.asp?blogID=21&Cat=litter).

<sup>11</sup> Environmental Finance Center, University of Maryland. "Prince George's County Waste Management Review: Final Report." February 2008. [www.efc.umd.edu/pdf/PGCntyWasteMgmtRev.pdf](http://www.efc.umd.edu/pdf/PGCntyWasteMgmtRev.pdf).

<sup>12</sup> Hyslop, Margie. "County's costs for roadside cleanup are highest in state: Litter removal from roads in Prince George's accounts for a quarter of the SHA trash budget." Gazette.net. July 31, 2008. [ww2.gazette.net/stories/073108/prinnew185442\\_32358.shtml](http://ww2.gazette.net/stories/073108/prinnew185442_32358.shtml).

In terms of tourism and property values, as noted in Table 1, the City of Baltimore spends approximately \$10 million per year on litter cleanup, including litter pickup in business districts (\$2.3 million) and mechanical street sweeping (\$3.8 million).<sup>13</sup> These services are critical to maintaining a competitive hub for the city's \$3 billion tourism industry.<sup>14</sup> Other tourism hotspots throughout Maryland spend significant portions of their budgets on litter cleanups as well. And, the economic impacts of litter can be even greater than the direct costs of cleaning it up. For example, the National Association of Home Builders estimates that the presence of litter decreases property values by approximately 7.4 percent.<sup>15</sup> For those communities that have significant litter problems, this drop in property value can have a devastating impact.

Of course the costs associated with litter go beyond the economic impacts. Litter also has significant environmental and ecological impacts. These include effects on habitat and wildlife, as well as degradation of waterways. According to the Ocean Conservancy's 2010 International Coastal Cleanup report, wildlife may become entangled in or consume debris, leading to sickness or death. Additionally, buoyant plastic bottles become carriers for invasive species, ranging from bacteria, viruses, and fungi to insects and small animals. Invasive species may not only cause sickness or death in plants and animals, but can also overwhelm an ecosystem via competition or overpopulation.<sup>16</sup>

In terms of waterway degradation, plastics persist for several hundred years before biodegrading. As part of this process, plastics first break into smaller pieces – called microplastics – that can be ingested by humans directly or via the consumption of seafood. Plastic debris is known to contain organic contaminants such as polychlorinated biphenyls (PCBs), petroleum hydrocarbons, organochlorine pesticides, and other such trace toxins linked to endocrine disruption in mammals. As plastics are exposed to light and water, they have the potential to leach these toxins into the natural environment, impacting entire ecosystems.<sup>17</sup>

## **Beverage containers as part of the litter stream**

A beverage container that remains on the ground is eventually blown or washed into the watershed where it remains as litter. Decomposition rates for plastic bottles are about 450 years. Aluminum beverage cans have a decomposition rate of 200 years and glass containers have a decomposition rate of 1 million years.

Many attempts have been made to quantify the component of litter comprised of beverage containers. However, variability in methodology makes it difficult to ascertain a precise percentage and estimates vary widely. We can, however, report a range of data across many studies.

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<sup>13</sup>2010 Annual Report: Baltimore City Office of Sustainability. [www.baltimoresustainability.org/metrics/2010/Cleanliness-Goal-1.pdf](http://www.baltimoresustainability.org/metrics/2010/Cleanliness-Goal-1.pdf).

<sup>14</sup>Letter from "Visit Baltimore" Partners. May 13, 2010. [baltimore.org/media/happy-place/](http://baltimore.org/media/happy-place/).

<sup>15</sup> Litter in America Fact Sheet, Keep America Beautiful. January 2010. [www.kab.org/site/DocServer/LitterFactSheet\\_COSTS.pdf?docID=5183](http://www.kab.org/site/DocServer/LitterFactSheet_COSTS.pdf?docID=5183).

<sup>16</sup> Ocean Conservancy. "Trash Travels: From Our Hands to The Sea, Around the Globe, and Through Time." International Coastal Cleanup. 2010. [act.oceanconservancy.org/images/2010ICCRReportRelease\\_pressPhotos/2010\\_ICC\\_Report.pdf](http://act.oceanconservancy.org/images/2010ICCRReportRelease_pressPhotos/2010_ICC_Report.pdf).

<sup>17</sup> Ibid.

- A July 2007 report published and funded by Keep America Beautiful reviewed 30 litter surveys conducted across the country between 1989 and 2006. This report shows that beverage containers were **8.5 percent of the litter** composition across all studies. In two of these studies, beverage container litter ranked first or second.<sup>18,19</sup>
- In 2009, the Ocean Conservancy reported plastic bottles, aluminum beverage containers, and glass containers in the top ten of marine debris collected and recorded at more than 6,000 sites all over the world on a single day during the International Coastal Cleanup. In fact, 9 percent of the debris collected were plastic beverage bottles (883,737 bottles), 4 percent were glass beverage bottles (459,531 bottles), and 4 percent were aluminum beverage cans (457,631 cans) for a total of **17 percent of debris collected**.<sup>20</sup>
- One of the most comprehensive and current data sets available for Maryland comes from the April 2011 Potomac River Watershed Cleanup sponsored by the Alice Ferguson Foundation. The 23rd annual cleanup cleared 48.4 tons (193,600 individual containers) of recyclable aluminum, glass, and plastic bottles from the watershed. In total, 228 tons were removed from the watershed from 613 sites located in Maryland, Virginia, West Virginia, Pennsylvania, and the District of Columbia.<sup>21</sup> 48.4 tons represents about **21 percent of all waste collected**.
- Another Keep America Beautiful report, which surveyed Georgia's roadside litter, found beer and soft drink containers comprising **4.4 percent of all roadside litter** (beer and soft drink containers 3.4 percent; juice, wine, liquor, and other containers 1.0 percent).<sup>22</sup>
- In 1999, Solid Waste Coordinators of Kentucky published data indicating that beverage containers comprise **58 percent of litter**.<sup>23</sup>
- The Northeast 2010 Litter Survey looked at 288 sites in Maine, New Hampshire, and Vermont. This survey found that, for each of the three states, miscellaneous paper and plastic comprised the two largest components of litter; candy, snack wrappers, and fast food packaging together accounted for about 30 percent of litter, and **beverage containers accounted for 5.6-7.9 percent**. It was noted that beer and carbonated soft drink containers comprised about 50 percent of all beverage containers found.

Thus, various sources maintain that anywhere from 4.4 percent to 58 percent of litter is comprised of beverage containers. Omitting the questionable report from Solid Waste Coordinators of

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<sup>18</sup> Keep America Beautiful. Literature Review – Litter, A Review of Litter Studies, Attitude Surveys and Other Litterrelated Literature. July 2007. [www.kab.org/site/DocServer/Litter\\_Literature\\_Review.pdf?docID=481](http://www.kab.org/site/DocServer/Litter_Literature_Review.pdf?docID=481).

<sup>19</sup> The two studies were from North Carolina and Mississippi.

<sup>20</sup> Trash Travels. International Coastal Cleanup. 2010 Report. [act.oceanconservancy.org/images/2010ICCRReportRelease\\_pressPhotos/2010\\_ICC\\_Report.pdf](http://act.oceanconservancy.org/images/2010ICCRReportRelease_pressPhotos/2010_ICC_Report.pdf).

<sup>21</sup> From [potomaccleanup.org/trash\\_initiative/trash\\_cleanup.shtml](http://potomaccleanup.org/trash_initiative/trash_cleanup.shtml), last accessed November 30, 2011.

<sup>22</sup> Keep America Beautiful. Georgia 2006 Visible Litter Survey: A Baseline Survey of Roadside Litter. January 2007. [www.dca.ga.gov/development/EnvironmentalManagement/publications/2006GeorgiaLitterReport.pdf](http://www.dca.ga.gov/development/EnvironmentalManagement/publications/2006GeorgiaLitterReport.pdf).

<sup>23</sup> While this is cited on the <http://www.bottlebill.org/about/mythfact.htm#ref3> we are unable to find the original source of the article. Thus, we did not include this number in the table below.



Kentucky (see footnote), the range becomes 4.4 percent to 21 percent. The Table below summarizes these data.

Survey	Year	Beverage Containers Found in Litter Survey	Container Deposit Legislation?
Mississippi	2000	10.5%	
North Carolina	2001	9%	
New Jersey	2004	8.9%	
New Hampshire	2010	7.9%	
Vermont	2010	6.4%	X
Maine	2010	5.6%	X
Tennessee	2006	5.4%	
Georgia	2006	4.4%	

**Table 2:** Beverage Container Litter (Recent Surveys)<sup>24,25,26</sup>

A comprehensive review of these and other surveys also reveals that beverage containers and beverage-related waste comprise an average of 13 percent of litter by weight. This is an impressive percentage considering that the average plastic water bottle weighs 12.7 grams.<sup>27</sup>

### Beverage containers in Maryland’s litter stream

Though data for Maryland are fragmented and largely incomplete, a series of litter surveys and cleanups provides insight into the scope and composition of litter in the state. Using the estimate suggested in proposed House Bill 839<sup>28</sup> that 9-24 percent of litter (by weight) in Maryland is made up of bottles, and using a plastic PET bottle weight as a proxy,<sup>29</sup> we can estimate a lower and upper bound for the weight of the total litter collected at recent cleanups that can be attributed to beverage containers alone. Please refer to the above information on the 2011 Alice Ferguson Foundation Potomac River clean up event(s) for more on aluminum, glass, and plastic beverage containers in the watershed.

<sup>24</sup> Keep America Beautiful. Georgia 2006 Visible Litter Survey: A Baseline Survey of Roadside Litter. January 2007. [www.dca.ga.gov/development/EnvironmentalManagement/publications/2006GeorgiaLitterReport.pdf](http://www.dca.ga.gov/development/EnvironmentalManagement/publications/2006GeorgiaLitterReport.pdf).

<sup>25</sup>Northeast 2010 Litter Survey. Environmental Resources Planning, LLC. [www.njclean.org/DOCUMENTS/2010-Northeast-Litter-Survey-Final-Report.pdf](http://www.njclean.org/DOCUMENTS/2010-Northeast-Litter-Survey-Final-Report.pdf).

<sup>26</sup> Keep America Beautiful. Literature Review – Litter, A Review of Litter Studies, Attitude Surveys and Other Litter-related Literature. July 2007. [www.kab.org/site/DocServer/Litter\\_Literature\\_Review.pdf?docID=481](http://www.kab.org/site/DocServer/Litter_Literature_Review.pdf?docID=481)

<sup>27</sup> R.W. Beck, Inc. “Literature Review: Litter. A Review of Litter Studies, Attitude Surveys and Other Litter-related Literature.” Keep America Beautiful. July 2007. [www.kab.org/site/DocServer/Litter\\_Literature\\_Review.pdf?docID=481](http://www.kab.org/site/DocServer/Litter_Literature_Review.pdf?docID=481).

<sup>28</sup> House Bill 839 was proposed by Delegate Peter Hammen, et al. during the 2007 Session of the Maryland General Assembly. The bill proposed the establishment of a container deposit law that would collect a five cent (or more) deposit on specified beverage containers. The bill did not make it out of committee in the House and no action was taken in the Senate. No similar bottle deposit legislation has been proposed in Maryland since the 2007 Session. A similar bill, *Recycling – Bars and Restaurants – Beverage Containers* was proposed in 2010 and again introduced in Maryland early in 2011. More on this legislation – which was ultimately withdrawn – is available in Section 2.

<sup>29</sup> A 16.9 oz PET bottle weighs 12.7 g.

It should also be noted that litter cleanups are largely a retroactive solution to a community's trash situation. They have been likened to mopping up from a sink that is still overflowing – the cleanups may effectively address existing litter, but do little to stop it from reoccurring. Without a more proactive solution for litter reduction, cleanups along the Potomac and Anacostia and community “Green Days” will be necessary to supplement the work of state and local governments to meet federal total maximum daily loads (TMDLs), preserve the integrity of residential and business property values, and protect the tourism industry.

Source/Location	Total Material collected	Estimated lower bound (9% beverage containers)	Estimated upper bound (24% beverage containers)
Maryland SHA (2010) <sup>30</sup>	24,092 lbs of debris	2,168.2 lbs	5,782.1 lbs
Assateague Coast (2010) <sup>31</sup>	11,162 units plastic 3,207 units glass		312.5 lbs (actual) 1,343.3 lbs (actual)
Baltimore Inner Harbor (2006-2007) <sup>32</sup>	16 tons of debris	2,880 lbs	7,680 lbs
Baltimore Community Cleanup (2011) <sup>33</sup>	144 tons of debris	25,920 lbs	69,120 lbs
Anacostia Bandalong Trap (2010) <sup>34</sup>	6,000 lbs annually (500 lbs debris/month)	540 lbs (annually)	1,440 lbs (annually)
Potomac Spring Cleanup (2011) <sup>35</sup>	228 tons of debris	41,040 lbs	109,440 lbs
Patapsco Cleanup (2007) <sup>36</sup>	71,272 lbs	6,415 lbs	17,105 lbs

**Table 3:** Litter Collected at Recent Cleanup Events in Maryland

## Litter reduction program options

In 2006, approximately 4.1 billion beverage containers were sold in the state of Maryland.<sup>37</sup> Approximately 913 million of these were recycled. While a significant portion of the remaining beverage containers were processed through the waste stream as trash, many containers end

<sup>30</sup> “Maryland Thanks Pick Up America Volunteers for Litter Removal and Education Efforts.” April 29, 2010. Maryland Department of Transportation State Highway Administration. [www.roads.maryland.gov/pages/release.aspx?newsId=637](http://www.roads.maryland.gov/pages/release.aspx?newsId=637).

<sup>31</sup> Ocean Conservancy. “Trash Travels: From Our Hands to The Sea, Around the Globe, and Through Time.” International Coastal Cleanup. 2010.

<sup>32</sup> Waldron, Tom. “An Urban Trash Collage Speaks Volumes.” Urbanite Baltimore. August 1, 2007. [www.urbanitebaltimore.com/baltimore/netscape-an-urban-trash-collage-speaks-volumes/Content?oid=1247200](http://www.urbanitebaltimore.com/baltimore/netscape-an-urban-trash-collage-speaks-volumes/Content?oid=1247200).

<sup>33</sup> Vuoto, Loredana. “Mayor’s Spring Cleanup Generates Baltimore’s Green Pride.” Greenhandsusa. May 5, 2011. [www.greenhandsusa.com/central/page:10346](http://www.greenhandsusa.com/central/page:10346).

<sup>34</sup> “Bandalong Litter Trap Case Study: Washington, D.C.’s Anacostia River.” Stormwater Systems. 2010. [www.dogrivers.org/uploads/6/2/5/2/6252936/bandalongcasestudy\\_anacostia.pdf](http://www.dogrivers.org/uploads/6/2/5/2/6252936/bandalongcasestudy_anacostia.pdf).

<sup>35</sup> “23rd Annual Potomac River Watershed Cleanup:2011 Final Results.” Alice Ferguson Foundation. 2011. [potomaccleanup.org/trash\\_initiative/trash\\_cleanup.shtml](http://potomaccleanup.org/trash_initiative/trash_cleanup.shtml).

<sup>36</sup> “2007 Stream Cleanup Stats.” The Patapsco Valley Heritage Greenway, Inc. April 2007. [www.google.com/url?sa=t&rct=j&q=patapsco%20cleanup%2071%2C272&source=web&cd=3&ved=0CCwQFjAC&url=http%3A%2F%2Fwww.patapscoheritagegreenway.org%2Fenviron%2F2007%2520Cleanup%2520Statistics.xls&ei=CP7UT0TJJ8X20gHvwJn2AQ&usq=AFQjCNE4545eVT3wL1sR0qJ43jy5R2m7wA](http://www.google.com/url?sa=t&rct=j&q=patapsco%20cleanup%2071%2C272&source=web&cd=3&ved=0CCwQFjAC&url=http%3A%2F%2Fwww.patapscoheritagegreenway.org%2Fenviron%2F2007%2520Cleanup%2520Statistics.xls&ei=CP7UT0TJJ8X20gHvwJn2AQ&usq=AFQjCNE4545eVT3wL1sR0qJ43jy5R2m7wA).

<sup>37</sup> “2006 Beverage Market Date Analysis,” The Container Recycling Institute, 2008. Sales derived from: Beverage Packaging in the U.S., 2007 Edition, Beverage Marketing Corp., December 2007.



up as litter. There are a number of practices that states may use to address litter. These programs include Adopt-a-Highway programs, paid litter pickup, comprehensive litter control programs, litter fees, paid targeted advertising, extended producer responsibility programs, and beverage container deposit programs. Following a brief synopsis of each practice, we spotlight how Delaware, Columbia, MO, and North Carolina have employed a suite of

alternative practices in an effort to target litter control and encourage recycling. These alternative practices have been met with varying levels of success but the lessons learned from each can add to our knowledge of what litter reduction strategies should be considered by Maryland.

**Adopt-a-Highway:** The Adopt-a-Highway program, also known as Sponsor-a-Highway, is a promotional campaign undertaken by local and state governments to encourage volunteers to keep a section of a highway free from litter. In exchange for regular litter removal, an organization has its name posted on a sign in the section of the highways they maintain. The program originated in the 1980s in Texas, and has since spread to 49 states, Puerto Rico, Canada, New Zealand, Australia, and Japan.<sup>38</sup>

Some states, such as Nevada, allow both Adopt-a-Highway and Sponsor-a-Highway programs. In both programs, an organization that contributes to the cleanup is allowed to post its name. However, while an adopting organization provides the volunteers who do the litter pickup, a sponsoring organization instead pays professional contractors to do the work. Because of safety concerns, the latter is more typical along highways with high traffic volumes.<sup>39</sup>

The 2004 New Jersey Litter Survey states that the Adopt-a-Highway program litter reduction cost is 18 cents per container.<sup>40</sup> In addition to this relatively significant per unit cost, Adopt-a-Highway programs have several limitations when it comes to litter reduction. The first limitation of Adopt-a-Highway programs is their limited reach. These programs typically cover, at best, 35 percent of state maintained highways.<sup>41</sup> Frequency of cleanups impacts the effectiveness of Adopt-a-Highway programs, as well. After a cleanup event, which may only

<sup>38</sup> From [en.wikipedia.org/wiki/Adopt\\_a\\_Highway](http://en.wikipedia.org/wiki/Adopt_a_Highway) last accessed November 23, 2011.

<sup>39</sup> Ibid.

<sup>40</sup> Stein, S. R., & Syrek, D. B. (2005). New Jersey Litter Survey: 2004. Gershman, Brickner & Bratton, Inc. [www.njclean.org/2004-New-Jersey-Litter-Report.pdf](http://www.njclean.org/2004-New-Jersey-Litter-Report.pdf).

<sup>41</sup> Ibid.



happen once a year, litter quickly returns to pre-pickup levels. According to the New Jersey Litter Survey, Adopt-a-Highways sites would need at least three more cleanings per year in order to achieve a consistent 50 percent litter reduction.

Lastly, Adopt-a-Highway programs, because they are a retroactive approach to litter, have minimal impact on litter reduction. Adopt-a-Highway sites averaged only 9 percent less litter than non-adopted sites between February and April of the survey period and 15 percent less litter between June and July.<sup>42</sup> It has been suggested by some that these types of programs unintentionally imply to consumers that a system is in place to deal with litter and do little to encourage behavior change.

**Paid litter pickup:** The 2004 New Jersey Litter Survey found the cost of paid litter pickup programs to be \$1.29 per container.<sup>43</sup> In addition to being an extremely costly litter reduction tool, paid litter pickup programs have disadvantages very similar to the Adopt-a-Highway programs, such as limited reach. According to the 2004 New Jersey Litter Survey, paid litter pickup programs achieve litter reduction levels of 90 percent. Although highly effective at removing litter from the area served by the program, this is often a small fraction of the area in need of litter removal, severely limiting the extent of litter reduction.

In addition, any reductions achieved are short-lived. Litter in areas served by these programs tends to build back to near pre-cleaning levels within 7 to 31 weeks.<sup>44</sup> Therefore, unless paid litter pickup activities are carried out regularly for all affected areas, this practice does not produce sustained litter reduction. And again, similar to the Adopt-a-Highway programs, the visual of paid litter pickup taking place may suggest to consumers that a system is in place to deal with litter, resulting in little if any behavior change on their part.

**Comprehensive litter control plan:** A comprehensive litter control program incorporates a variety of activities and measures aimed at reducing litter, often a combination of education, public awareness, roadside cleanup, anti-litter legislation and litter law enforcement, and beautification programs. In other words, the primary focus of comprehensive programs is to prevent litter, rather than remove it.

Stein and Syrek (2005) found states with “successful” comprehensive state-run litter programs, such as Washington and Hawaii, demonstrate that funding local programs alone does not work, and that this approach benefits from an experienced state-level litter program manager and staff to effectively direct, monitor, and evaluate local litter programs.<sup>45</sup> Comprehensive litter control programs reduced total litter by as much as 74 percent in Hawaii and 76 percent in

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<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

<sup>45</sup> Stein, S. R., & Syrek, D. B. (2005). New Jersey Litter Survey: 2004. Gershman, Brickner & Bratton, Inc. [www.njclean.org/2004-New-Jersey-Litter-Report.pdf](http://www.njclean.org/2004-New-Jersey-Litter-Report.pdf).

Washington; beverage container litter was reduced by 90 percent in both states. One major drawback of these programs is timeline. It took 15 years for Hawaii's program to reach this level of reduction and eight years for Washington, which involved large staffing turnover and other programmatic costs in the process. When analyzed in combination with younger programs in Kentucky, Alaska, and Nebraska, Stein and Syrek (2005) found that comprehensive litter programs incur a cost of 23 cents per item recovered.

Stein and Syrek (2005) also found that comprehensive litter programs require continuous funding to maintain effectiveness. For example, once Washington achieved its litter reduction rate of 76 percent, it cut program funding and shifted efforts toward recycling. Subsequent population and traffic growth caused the litter rate to climb over the following years, thus wiping out one-third of its previous litter reduction gains.

**Litter control fee:** New Jersey instituted a Litter Control Fee in 2002 as an altered continuation of the Litter Control Tax that was in effect in the state from 1986 to 2000. The fee is applicable to manufacturers, wholesalers, distributors, and retailers who sell litter-generating products within or into New Jersey.<sup>46</sup> There are 15 categories of litter-generating products to which the fee applies.<sup>47</sup> Exemptions are made for retailers with less than \$500,000 in annual sales of litter generating products, an increase from \$250,000 in sales under the previous litter control tax; restaurants whose food and beverage sales are more than 50 percent for on-premise consumption; and paper product sales of roll stock produced by paper product manufacturers and wood pulp.<sup>48</sup> Revenue from the fee funds litter cleanups and municipal recycling programs.

The effectiveness of the litter programs funded by the litter control fee is debatable. Litter rates in New Jersey are close to the national average.<sup>49</sup> Urban litter rates are 41 percent higher than the national average.<sup>50</sup> Regardless, food and beverage industries support this method instead of a deposit law. They have lobbied to repeal deposit programs in other states and replace them with a similar program to New Jersey.

**Paid targeted advertising:** Paid target advertising attempts to reach the groups identified as the primary cause of littering. This strategy appears to be extremely cost-effective at a rate of

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<sup>46</sup> From [www.state.nj.us/treasury/taxation/littaxex.shtml](http://www.state.nj.us/treasury/taxation/littaxex.shtml), last accessed December 2, 2011.

<sup>47</sup> The fee applies to groceries, non-drug drugstore sundry products, food for human or pet consumption, soft drinks and carbonated waters, beer and other malt beverages, wine, distilled spirits, cigarettes and tobacco products, cleaning agents and toiletries, paper products and household paper except books, roll stock and wood pulp, newsprint and magazine paper stock, motor vehicle tires, glass containers, metal containers, and plastic or fiber containers made of synthetic material [www.state.nj.us/treasury/taxation/littaxex.shtml](http://www.state.nj.us/treasury/taxation/littaxex.shtml).

<sup>48</sup> Ibid.

<sup>49</sup> [www.njclean.org/2004-New-Jersey-Litter-Report.pdf](http://www.njclean.org/2004-New-Jersey-Litter-Report.pdf).

<sup>50</sup> Franklin, Pat. "Litter things cost a lot." *Resource Recycling*. July 2005. Accessed November 18, 2011.

2 cents per container.<sup>51</sup> Paid targeted advertising programs are flexible and quick to achieve results. According to the 2004 New Jersey Litter Survey, these programs can reach up to a 70 percent reduction in litter; however, the effectiveness on litter reduction resulting from paid targeted advertising decreases if not adequately supported and sustained.

**Expanded/extended producer responsibility programs:** Expanded Producer Responsibility (EPR) is a policy tool used by governments to shift the responsibility for recycling and safe disposal of products and packaging to producers rather than taxpayers and local governments.<sup>52</sup> Because of the shift in responsibility, producers are forced to take a comprehensive look at the full life cycle of their products and packaging rather than just the initial production phase. The goal is for producers to adjust their product and packaging design in order to decrease their environmental impact. This approach is commonly used to offset the costs of recycling e-waste from local governments to producers.

In Vermont, House Bill 696 was proposed in 2010 to repeal the current beverage deposit and replace it with an EPR program. The Beverage Association of Vermont, which represents regional soft drink bottlers of Coca-Cola, Pepsi, Snapple, and Polar Beverages, was supportive of the bill.<sup>53</sup> Under this program, the financial burden for recycling would not just be on manufacturers of beverage containers, but also the manufacturers of packaging and printed material. Manufacturers would be required to pay a fee to the state based on the volume of their product packaging and how easily it can be recycled.<sup>54</sup> Supporters of the existing deposit program are concerned over a possible increase in litter and decrease in available recyclable material for end markets if the program is repealed in favor of an EPR program.

In 2007, Maryland Governor Martin O'Malley signed the Statewide Electronics Recycling Program into law creating a permanent EPR program to handle e-waste. Manufacturers are required to pay a registration fee of \$10,000 each year to the Maryland State Recycling Trust Fund.<sup>55</sup> This is used to give grants to municipalities to implement e-waste recycling programs. Manufacturers that create their own take-back program are able to pay a reduced fee.<sup>56</sup>

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<sup>51</sup> Franklin, Pat. "Litter things cost a lot." *Resource Recycling*. July 2005. Accessed November 18, 2011.

<sup>52</sup> From [www.productpolicy.org/content/about-epr](http://www.productpolicy.org/content/about-epr), accessed November 18, 2011.

<sup>53</sup> From [www.7dvt.com/2011/vermonts-bottle-bill-ready-recycling](http://www.7dvt.com/2011/vermonts-bottle-bill-ready-recycling), accessed November 18, 2011.

<sup>54</sup> Ibid.

<sup>55</sup> From [www.campaignforrecycling.org/states/maryland/ewaste](http://www.campaignforrecycling.org/states/maryland/ewaste), accessed November 18, 2011.

<sup>56</sup> Extended Producer Responsibility: Part A, A Foresite White Paper Series on The Environmental Policy Principle that is Re-Shaping Manufacturing, [www.foresitesystems.com/pdfs/ExtendedProducerResponsibility-PartANorthAmerica.pdf](http://www.foresitesystems.com/pdfs/ExtendedProducerResponsibility-PartANorthAmerica.pdf), accessed November 18, 2011.



**Beverage container deposit programs:** When compared to the other litter control options discussed here, beverage container deposit programs have proven to be the most effective tool for reducing litter. Beverage deposits, in essence, create an incentive to dispose of a container properly instead of leaving the container to pollute the environment as trash.

The states that have enacted deposit programs report significant reductions in beverage containers in the litter stream. Hawaii, for example, saw a 60% reduction in beverage containers as a percentage of total litter from 2005 (the year the beverage deposit program was implemented) and 2008.<sup>57</sup> (This trend reversed slightly in subsequent years with 2010 data showing a 1.5% increase in beverage containers as a percentage of total litter.)<sup>58</sup> And, while there is some literature that indicates that other forms of litter are reduced as a result of deposit programs as

***Beverage container deposit programs have proven to be the most effective tool for reducing litter.***

***The states that have enacted deposit programs report significant reductions in beverage containers in the litter stream.***

well (see table below),<sup>59</sup> in EFC's opinion, the litter reduction benefits of deposit programs can only be quantified to any degree of certainty with regards to beverage container litter.

The table below shows the self-reported litter data by several states with bottle deposit legislation. Note that pre and post litter surveys of seven states currently implementing a beverage container deposit bill have reportedly reduced beverage container litter by a range of 69 to 84 percent.<sup>60</sup> Again, the total litter reduction data, as reported to the US Senate Committee on

Environment and Public Works in 2002, does suggest correlation, this is based on data collected from studies conducted between 1977 and 1987. To our knowledge no more recent data have been collected to substantiate such a connection.

<sup>57</sup> Report to the Twenty-Fifth Legislature, State of Hawaii, 2009, Prepared by: State of Hawaii, Department of Health, November 2008.

<sup>58</sup> [http://act.oceanconservancy.org/images/2010ICCReportRelease\\_pressPhotos/2010\\_ICC\\_Report.pdf](http://act.oceanconservancy.org/images/2010ICCReportRelease_pressPhotos/2010_ICC_Report.pdf)

<sup>59</sup> From [www.bottlebill.org/about/mythfact.htm#src5](http://www.bottlebill.org/about/mythfact.htm#src5).

<sup>60</sup> Recycling and Climate Change, <http://www.bottlebill.org/about/benefits/litter/bbstates.htm>



State	Beverage Container Litter Reduction	Total Litter Reduction
New York	70-80% <sup>61</sup>	30% <sup>62</sup>
Oregon	83% <sup>63</sup>	34.7% <sup>64</sup>
Vermont	76% <sup>65</sup>	35% <sup>66</sup>
Maine	69-77% <sup>67</sup>	34-64% <sup>68</sup>
Michigan	84% <sup>69</sup>	41% <sup>70</sup>
Iowa	76% <sup>71</sup>	39% <sup>72</sup>
Massachusetts	N/A	30-35% <sup>73</sup>

**Table 4:** Litter reductions after implementation beverage container deposit bill<sup>74</sup>

Following the establishment of the Oregon deposit program, studies showed a clear reduction in litter. Estimates of the extent of litter reduction varied from a 66 to 88 percent decrease in beverage container litter.<sup>75</sup> In addition, there was a 42 percent decline in beverage container litter within the first year of the California program.<sup>76</sup>

Beverage container deposit programs do not completely eliminate containers from the litter stream. For example, a small study analyzing roadside waste in ten towns in Vermont, a state with beverage container deposit legislation in place since 1973, revealed that almost 20 percent of the items collected were beverage containers. Of these, 267 containers found were covered by current deposit legislation while 183 containers found were not.<sup>77</sup> Nonetheless, deposit

<sup>61</sup> Final Report of the Temporary State Commission on Returnable Beverage Containers, March 27, 1985.

<sup>62</sup> Projection from Center for Management Analysis, School of Business and Public Administration of Long Island University. New York State Returnable Container Act: A Preliminary Study. 1984.

<sup>63</sup> Oregon Department of Environmental Quality, Oregon's Bottle Bill: The 1982 Report, p. 26.

<sup>64</sup> Ibid.

<sup>65</sup> U.S. General Accounting Office. Report to the Congress by the Comptroller General of the United States, Potential Effects Of A National Mandatory Deposit On Beverage Containers, December 7, 1977, p. 54.

<sup>66</sup> Ibid.

<sup>67</sup> U.S. General Accounting Office. Report by the Comptroller General of the United States, State's Experience With Beverage Container Deposit Laws Shows Positive Benefits, December 11, 1980, p. 9.

<sup>68</sup> Ibid.

<sup>69</sup> Michigan Department of Transportation, Maintenance Division. Michigan Roadside Litter Composition Survey, Final Report, December 1979.

<sup>70</sup> Ibid.

<sup>71</sup> Iowa Department of Transportation, Highway Division. Litter Survey, April 1980.

<sup>72</sup> Ibid.

<sup>73</sup> Environmental Action Foundation. Bottle Bills in the 1980's: A Handbook for Effective Citizen Action, August 1987.

<sup>74</sup> Full table was reported in the proceedings of the July 11, 2002 Hearing Before the Committee on Environment and Public Works of the US Senate found at [www.access.gpo.gov/congress/senate/pdf/107hr/83716.pdf](http://www.access.gpo.gov/congress/senate/pdf/107hr/83716.pdf).

<sup>75</sup> GAO. 1977.

<sup>76</sup> California Department of Conservation, Division of Recycling. 2007. California Beverage Container Recycling Program History and Fund Management Options. DRRR-2011-026. February 28. [www.calrecycle.ca.gov/Publications/default.asp?pubid=1390](http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390). p. 28

<sup>77</sup> Northeast 2010 Litter Survey, Environmental Resources Planning, LLC, [www.njclean.org/DOCUMENTS/2010-Northeast-Litter-Survey-Final-Report.pdf](http://www.njclean.org/DOCUMENTS/2010-Northeast-Litter-Survey-Final-Report.pdf).

programs have demonstrated success at reducing litter. Table 4 shows the self-reported litter data by several states with bottle deposit legislation. Note that pre and post litter surveys of seven states currently implementing a beverage container deposit bill have reportedly reduced beverage container litter by a range of 69 to 84 percent.<sup>78</sup>

In spite of their success at reducing litter, critics of deposit programs consider them to be too costly. According to a 2002 study by the Businesses and Environmentalist Allied for Recycling (BEAR)<sup>79</sup>, the “weighted average net unit costs in deposit states is 1.53 cents per container, compared to 1.25 cents in non-deposit states.” A 2004 New Jersey Litter Survey suggests a higher per unit cost under a deposit program of 2.5 cents but offered no evidence to substantiate this.<sup>80</sup>

As previously stated, the primary benefit of deposit programs is diversion of trash from the litter stream to a landfill, an incinerator, or a recycling facility. Of the potential fates of a bottle after it is purchased, ending up in the recycling stream is the most desirable.

### **Spotlight – Litter Reduction Alternatives in Delaware, Missouri, and North Carolina**

In lieu of adopting a bottle bill, some jurisdictions have instituted alternative programs to reduce litter and encourage the recycling of beverage containers. As discussed, New Jersey, as well as Nebraska, Ohio, Virginia, and Washington, have put a litter tax or fee in place. Both Delaware and Columbia, Missouri repealed their bottle bills in exchange for other programs, and North Carolina and other locations have programs that target specific industries related to beverages.

**Delaware:** Delaware enacted its deposit program on June 30, 1982. It provided a 5 cent deposit on any airtight non-aluminous container holding less than two quarts of a beverage under pressure of carbonation.<sup>81</sup> However, in 2010 the legislature repealed the bill by enacting Senate Bill 234, the Universal Recycling Law. According to the Delaware Division of Waste and Hazardous Substances, the Universal Recycling Law was enacted to address two major issues: the low recycling rate in Delaware in relation to the surrounding states and the concern over the impacts of reaching landfill capacity.<sup>82</sup> Landfills in all three counties in Delaware have been expanded, costing residents and businesses millions of dollars per year in higher disposal costs.<sup>83</sup> The Universal Recycling Law was proposed to redistribute and reduce this burden to residents and businesses.

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<sup>78</sup> Recycling and Climate Change, <http://www.bottlebill.org/about/benefits/litter/bbstates.htm>.

<sup>79</sup> “Understanding Beverage Container Recycling. A Value Chain Assessment prepared for the Multi-Stakeholder Recovery Project.” Businesses and Environmentalist Allied for Recycling. January 16, 2002.

<sup>80</sup> “New Jersey Litter Survey:2004. A baseline survey of litter at 94 street and highway locations.” Gershman, Brickner & Bratton, Inc., Solid Waste Management Consultants. January 28, 2005.

<sup>81</sup> From [www.dnrec.delaware.gov/whs/awm/Recycling/Pages/Recycling\\_FAQs.aspx](http://www.dnrec.delaware.gov/whs/awm/Recycling/Pages/Recycling_FAQs.aspx), accessed November 18, 2011.

<sup>82</sup> From [www.dnrec.delaware.gov/whs/awm/Recycling/Pages/Recycling\\_FAQs.aspx](http://www.dnrec.delaware.gov/whs/awm/Recycling/Pages/Recycling_FAQs.aspx), accessed November 18, 2011.

<sup>83</sup> Ibid.

The Universal Recycling Law instituted a 4 cent nonrefundable fee that applies to the same containers as the previous deposit program, but requires retailers to collect the fee and pay the Division of Revenue on a monthly basis. In addition, all retailers that sell containers carrying the 4 cent fee must obtain a no-cost State of Delaware Retail Beverage Container Business License.

The 5 cent deposit officially switched to a 4 cent nonrefundable fee on December 1, 2010, but consumers still had the opportunity to redeem bottles purchased prior to that date until January 31, 2011.<sup>84</sup> The fee was used to create the Delaware Recycling Fund (DRF) to expand recycling in the state. Depending on which is reached first, the fee will expire when the DRF collects \$22 million or on December 1, 2014.<sup>85</sup> The DRF, through the Delaware Department of Natural Resources and Environmental Control, will provide low-interest loans and grants to private trash haulers and municipalities to fund start-up costs. The goal of the program is to provide curbside, single-stream recycling to all single-family homes, bars, and restaurants by September 15, 2011, all multi-family residences by January 1, 2013, and all commercial businesses by January 1, 2014.

The program has been in effect for about a year and is already facing problems. The state anticipated to collect \$4.5 million in revenue this year, but anticipates falling short by \$1.5 million. It is possible that either retail operations are not accurately reporting fees collected to the state or perhaps are not paying altogether.<sup>86</sup>

**Columbia, Missouri:** On April 2, 2002 voters in Columbia, Missouri repealed the only municipal container law in the country. The law was enacted in April 1977 and created a 5 cent deposit on all beer, malt, carbonated and mineral water, and soft drink containers. The beverage and grocery industry lobbied to repeal the law four times and were successful the fifth time. Their main argument was that Columbia's municipal recycling system was losing money from lost revenue on aluminum products.<sup>87</sup>

The voter referendum replaced the beverage deposit with a Blue Bag recycling system. Vouchers, redeemable at local retailers, are distributed to residents three times a year for both black garbage bags and blue recycling bags. Residents put glass bottles and jars, aluminum cans, metal food cans, and #1 and #2 plastic containers in the blue bags to be recycled and trash in the black bags, both of which are picked up curbside. If residents run out of blue bags, they can request additional vouchers at no cost. In addition to the blue bags, beverage containers can be recycled at 40 local convenience stores that have blue receptacles donated by Businesses United for a Cleaner Columbia.<sup>88</sup>

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<sup>84</sup> Ibid.

<sup>85</sup> From [www.delawareonline.com/article/20111027/NEWS08/110270341/Bottle-fee-revenue-lagging](http://www.delawareonline.com/article/20111027/NEWS08/110270341/Bottle-fee-revenue-lagging), accessed November 18, 2011.

<sup>86</sup> Ibid.

<sup>87</sup> From [www.bottlebill.org/legislation/usa/missouri-columbia.htm](http://www.bottlebill.org/legislation/usa/missouri-columbia.htm)

<sup>88</sup> From [www.gocolumbiamo.com/PublicWorks/Solidwaste/beveragecontainerrecycling.php](http://www.gocolumbiamo.com/PublicWorks/Solidwaste/beveragecontainerrecycling.php)

In February 2010, Columbia began a pilot program to test the difference in the amount of recycling collected using bins versus bags. The city distributed a blue recycling bin for plastic, glass, and metal products and a green recycling bin for paper to 1,900 homes.<sup>89</sup> The rest of the city continued to use blue bags for recycling. A grant from the Mid-Missouri Solid Waste Management District covered most of the \$30,000 cost to purchase and distribute the new bins.<sup>90</sup> Within one year, the program showed a 50 percent increase in recycling for the homes using recycling bins.<sup>91</sup> Many believe the success of the program is due to the increase in convenience for residents. However, the additional recycled products took waste haulers two extra hours to collect and may result in a need for additional staffing if the program is expanded in the future.<sup>92</sup>

**North Carolina Industry Targeted Program:** On January 1, 2008 a law went into effect in North Carolina that requires holders of Alcoholic Beverage Control (ABC) permits to separate, store, and recycle all recyclable beverage containers, including glass bottles, aluminum cans, and plastic bottles.<sup>93</sup> The law only pertains to holders of on-premise malt beverage, on-premise unfortified wine, on-premise fortified wine, and mixed beverage permits, and only containers sold for on-premise consumption must be recycled. The program is also applied to beverages that do not contain alcohol, such as plastic water bottles and soda cans, as well as both beverages sold for individual consumption and larger containers that individual drinks are poured from like wine bottles.<sup>94</sup>

The ABC Commission, which is housed in the Department of Commerce, manages the program. However, businesses hold the responsibility of finding a recycling service to pick up their containers.<sup>95</sup> Each business must create a plan to illustrate how they will manage their recycling and report it to the ABC Commission. It is estimated that the cost to each business is \$100 per month.<sup>96</sup> If the Alcohol Law Enforcement inspectors find that a business is not complying with the law, they can give warnings and fines; however, they cannot revoke a business' ABC permit.

While the main goal of the law was to increase recycling, the materials available to end markets are also expected to increase. Ninety percent of the containers collected under the law are made of glass.<sup>97</sup> There are three glass plants located in North Carolina: an Owens-Illinois plant in Winston-Salem and two Saint-Gobain plants in Wilson and Henderson. There are also two Owens-Illinois plants nearby in Virginia. It is expected that at least 10,000 tons of glass will be

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<sup>89</sup> From [www.columbiatribune.com/news/2011/mar/18/recycling-project-boosts-use-costs/](http://www.columbiatribune.com/news/2011/mar/18/recycling-project-boosts-use-costs/)

<sup>90</sup> Ibid.

<sup>91</sup> Ibid.

<sup>92</sup> Ibid.

<sup>93</sup> Does your Bar or Restaurant Recycle? Recycling Requirements for North Carolina Bars and Restaurants, [www.co.guilford.nc.us/abcrecycle.php](http://www.co.guilford.nc.us/abcrecycle.php).

<sup>94</sup> Ibid.

<sup>95</sup> Recycling Today, On the Bar's Tab [www.recyclingtoday.com/Article.aspx?article\\_id=21536](http://www.recyclingtoday.com/Article.aspx?article_id=21536) last accessed November 18, 2011.

<sup>96</sup> Ibid.

<sup>97</sup> Ibid.

<sup>98</sup> Ibid.



made available to the three Owens-Illinois plants and will increase their production of cullet by 10 percent.<sup>98</sup>

A similar bill, *Recycling - Bars and Restaurants - Beverage Containers*, was proposed in 2010 and again introduced in Maryland early in 2011. This legislation would require, by 2014, specified distributors to establish a program approved by the Maryland Department of the Environment (MDE) for the collection and recycling of specific beverage containers and bar and restaurant owners and managers to separate, sort, and arrange for the collection of these containers.<sup>99</sup> MDE opposed a failed 2010 version of this bill due to the resource burden it placed on the agency.<sup>100</sup> The bill as proposed directed the agency to cover their expenses with the Recycling Trust Fund, which restaurants and bars do not currently pay into, and at current funding levels, MDE estimated that management and enforcement activities would account for more than half of that fund annually. A 2011 version of the bar and restaurant recycling bill was ultimately withdrawn as well.<sup>101</sup>

### **The impact of beverage container deposit programs on recycling efforts**

In the long-term, the revenue generated from the sale of recycled scrap material is the basis of the sustainability of deposit programs. Therefore, the costs, benefits, and structure of recycling programs and the recycling industry have a direct impact on the long-term impact of deposit programs.

**Benefits of recycling programs:** Recycling is the process of separating, collecting, and remanufacturing or converting used or waste products into new materials.<sup>102</sup> For many communities, a robust recycling program is part of its “green identity”. The process is considered to have multiple benefits to society in general and local communities specifically.

### **For example:**

**Recycling creates jobs:** According to the nonprofit organization Waste to Wealth, on a per-ton basis, sorting and processing recyclables alone sustains ten times more jobs than landfilling or incineration. In addition, making new products from recycled scrap materials offers the largest economic pay-off in the recycling loop. New recycling-based manufacturers employ even more people and at higher wages than does sorting recyclables. Some recycling-based paper mills and plastic product manufacturers, for instance, employ on a per-ton basis 60 times more workers than do landfills.<sup>103,104</sup>

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<sup>98</sup> Ibid.

<sup>99</sup> Full Fiscal and Policy notes available at [mlis.state.md.us/2011rs/fnotes/bil\\_0009/hb0389.pdf](http://mlis.state.md.us/2011rs/fnotes/bil_0009/hb0389.pdf).

<sup>100</sup> The written testimony provided to the House Environmental Matters Committee by MDE can be found in full at [mde.maryland.gov/programs/ResearchCenter/LawsandRegulations/MDETestimonies/Documents/HB944.pdf](http://mde.maryland.gov/programs/ResearchCenter/LawsandRegulations/MDETestimonies/Documents/HB944.pdf).

<sup>101</sup> Bill history can be found at [mlis.state.md.us/2011rs/billfile/hb0389.htm](http://mlis.state.md.us/2011rs/billfile/hb0389.htm).

<sup>102</sup> From [www.epa.gov/osw/conserva/rrr/recycle.htm](http://www.epa.gov/osw/conserva/rrr/recycle.htm)

<sup>103</sup> From [www.ilsr.org/recycling/recyclingmeansbusiness.html](http://www.ilsr.org/recycling/recyclingmeansbusiness.html). Last accessed December 7, 2011.

<sup>104</sup> It should be noted that the organization’s web site indicates that focusing on reusing materials generates even more jobs than recycling.

**Recycling reduces the need for landfilling and incineration:** Perhaps the most important local benefit of deposit programs is the impact on waste management and trash collection and disposal systems. Waste management at the local level is delegated to municipalities and counties. Each local government is responsible for finding a way to collect, transport, and handle waste, which may include a variety of contracts with different waste management service providers and facilities. Currently, waste in Maryland is managed in one of four ways at Maryland permitted solid waste acceptance facilities:<sup>105</sup>

***According to the Maryland Department of the Environment the state will meet total landfill capacity in 34 years if waste continues at its current rate.***

- **Exportation:** collected refuse can be transported out-of-state for recycling processing or landfilling -- 35.9 percent in 2009.<sup>106</sup>
- Landfilling: collected refuse can be landfilled in one of Maryland's 24 landfill facilities -- 27.2 percent in 2009.
- **Incineration:** collected refuse can be incinerated at one of Maryland's five incinerator landfill sites (3 are medical waste-specific, 2 are for municipal solid waste) -- 17.3 percent in 2009.
- **Recycle/Reuse:** collected recyclables can be sorted, bundled, and sold on the open recycling market at one of Maryland's recycling facilities -- 19.6 percent in 2009.<sup>107</sup>

Landfills serve to centralize waste and reduce the impact of trash and debris on cities and communities. By moving the majority of generated waste to a single setting, the notorious smell, presence and proliferation of vermin, and danger of contamination or exposure to unsanitary or hazardous materials is roughly confined to the area containing the landfill. Reducing the trash pileup in residential and commercial areas not only protects the population from related public health risks but also increases property values and improves quality of life.

In spite of impressive advances in landfill technology and engineering, landfills still pose a series of risks to Maryland's environment, public health, and financial security. The impermanence of landfill structures inevitably leads to breakdowns that threaten the air, water, soil, and surrounding wildlife, as well as the long-term financial sustainability of waste management operations. Though the centralization of refuse allows for sanitary living conditions in Maryland's more densely populated areas and even provides an energy benefit to some localities, the environmental, financial, and public health risks are considerable.

<sup>105</sup> Maryland Department of the Environment. "Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data). Technical Services and Operations Program. November 2010. <http://www.mde.state.md.us/programs/Land/SolidWaste/PermittedFacilities/Documents/%2710%20mswmdr.pdf>

<sup>106</sup> In addition to exporting waste, Maryland Department of the Environment states that 206,698 tons were imported in Calendar Year 2009. Maryland Department of the Environment. "Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data). Technical Services and Operations Program. November 2010.

<sup>107</sup> These numbers are percentages of the 7,507,014 tons of waste accepted at Maryland permitted solid waste facilities and transported out of state, landfilled, incinerated, or recycled/reused in Maryland.

In addition to the environmental, financial, and public health impacts of these facilities, according to MDE the state will meet total landfill capacity in 34 years if waste continues at its current rate.<sup>108</sup> Creating new landfills would mitigate this, but would require considerable financial resources, as well as the use of land that could perhaps serve other state or local priorities. An alternative is to extend the life of current landfills by encouraging waste diversion behaviors such as recycling, composting, and reduced consumption.

It is unclear the extent to which a beverage container deposit program could extend the life of Maryland's landfills. Although it is likely that the opportunity to redeem a deposit may incentivize behavior change in some consumers who currently opt to throw their beverage containers into the trash rather than recycle, these programs are most effective as a litter reduction tool and would be addressing containers that already do not make their way into the waste management stream, landfills, or incinerators. In addition, Maryland is already shipping more than 35 percent of its refuse out-of-state for processing. It is possible that increasing this percentage could prove to be a more efficient and economical way of extending the life of the state's landfills than establishment of a deposit program. While an analysis of the transportation infrastructure (including fuel costs) that would be needed to make exportation an even more feasible alternative was outside the scope of this project, the issue should be the focus of further study.

**Recycling in Maryland:** As with all other components of the waste management system, municipal and county governments are responsible for the management of curbside recycling programs in Maryland. In addition, minimum performance standards are required by law. The Maryland Recycling Act (MRA) of 1988 requires all counties and Baltimore City to recycle 15 percent or 20 percent of the waste generated depending on population.<sup>109</sup> State and local

***[Bottle deposit] programs are most effective as a litter reduction tool and would be addressing containers that already do not make their way into the waste management stream, landfills, or incinerators.***

authorities can refuse to issue building permits for new construction for jurisdictions that do not meet these goals.<sup>110</sup>

Aluminum cans, mixed glass, and mixed plastic bottles are included in the materials used to calculate the MRA recycling rate along with 16 other materials.<sup>111</sup> Each jurisdiction is able to select which materials their local recycling program will focus on and the manner in which these materials will be separated and processed.

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<sup>108</sup> Ibid.

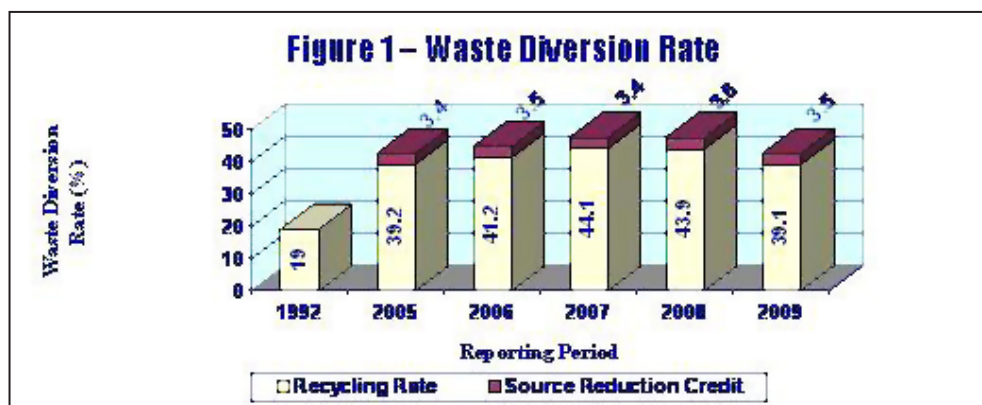
<sup>109</sup> Jurisdictions with a population larger than 150,000 are required to recycle 20%, and jurisdictions with a population smaller than 150,000 are required to recycle 15%. [www.mde.state.md.us/programs/Land/Recyclingandoperationsprogram/Pages/Programs/LandPrograms/Recycling/index.aspx](http://www.mde.state.md.us/programs/Land/Recyclingandoperationsprogram/Pages/Programs/LandPrograms/Recycling/index.aspx)

<sup>110</sup> From [www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/FAQs/Pages/Programs/LandPrograms/Recycling/faqs/index.aspx#1](http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/FAQs/Pages/Programs/LandPrograms/Recycling/faqs/index.aspx#1)

<sup>111</sup> From [www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/FAQs/Pages/Programs/LandPrograms/Recycling/faqs/index.aspx#2](http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/FAQs/Pages/Programs/LandPrograms/Recycling/faqs/index.aspx#2)

The Voluntary Statewide Waste Diversion Goal was set at 40 percent by 2005.<sup>112</sup> According to the Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data), Maryland generated 12,422,018 tons of solid waste, representing a 5.2 percent decrease from 2008. Of this waste, only 6,513,445 tons are considered Maryland Recycling Act (MRA) waste. 2,568,310 tons of MRA waste was reportedly recycled in 2009 resulting in a total Waste Diversion Rate for the year of 42.6 percent (39.1 percent recycling rate + 3.5 percent source reduction credit). Source reductions credits were earned by 14 jurisdictions for source reduction activities such as utilizing Internet resources, demonstration sites (i.e., backyard food waste and yard waste composting), and publications on reuse practices and yard waste reduction.<sup>113,114</sup>

Maryland’s recycling rate (better classified as the “waste diversion rate”) is reported below for 1992 and 2005-2009<sup>115</sup>:



**Figure 1:** Maryland Waste Diversion Rates

In 2009, all Maryland counties successfully met the goals set by the MRA.<sup>116</sup> The total MRA Recycling Rate in 2009 was 39.43 percent.<sup>117</sup> By comparison, in 2008, San Francisco’s diversion rate was the highest in the nation at 69 percent. Long Beach, California had a rate of 64 percent and New York City had a rate of 61.5 percent.<sup>118</sup>

<sup>112</sup> Maryland Department of the Environment, State, County, and City Recycling Rates, [www.mde.state.md.us/programs/Land/Recyclingand-operationsProgram/Pages/Programs/LandPrograms/Recycling/index.aspx](http://www.mde.state.md.us/programs/Land/Recyclingand-operationsProgram/Pages/Programs/LandPrograms/Recycling/index.aspx)

<sup>113</sup> “Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data).” Maryland Department of the Environment. Technical Services and Operations Program Land Management Administration. November 2010. [mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf](http://mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf)

<sup>114</sup> “Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data).” Maryland Department of the Environment. Technical Services and Operations Program Land Management Administration. November 2010. [mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf](http://mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf)

<sup>115</sup> “Maryland Solid Waste Management and Diversion Report: 2010 (Calendar Year 2009 Data).” Maryland Department of the Environment. Technical Services and Operations Program Land Management Administration. November 2010. [mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf](http://mde.maryland.gov/programs/Land/Solid-Waste/PermittedFacilities/Documents/%2710%20mswmdr.pdf)

<sup>116</sup> See [County Recyclables by Commodity in Tons for Calendar Year (CY) 2009] here: [www.mde.state.md.us/programs/Land/SolidWaste/PermittedFacilities/Documents/recyclables%20by%20commodity%20in%20tons%202009.pdf](http://www.mde.state.md.us/programs/Land/SolidWaste/PermittedFacilities/Documents/recyclables%20by%20commodity%20in%20tons%202009.pdf)

<sup>117</sup> County Recyclables by Commodity in Tons for Calendar Year 2009, [www.mde.state.md.us/programs/Land/SolidWaste/PermittedFacilities/Documents/recyclables%20by%20commodity%20in%20tons%202009.pdf](http://www.mde.state.md.us/programs/Land/SolidWaste/PermittedFacilities/Documents/recyclables%20by%20commodity%20in%20tons%202009.pdf)

<sup>118</sup> From [www.sustainlane.com/us-city-rankings/categories/waste-management](http://www.sustainlane.com/us-city-rankings/categories/waste-management)



**Costs of recycling programs:** Recycling clearly has significant benefits, and deposit programs would maximize these benefits by redirecting more waste to the recycling stream. However, it costs money to run a recycling program, and the responsibility to cover those costs lies with local governments. The cost-versus-revenue bottom line for recycling programs is a hotly debated topic, due in part to whether the analysis is strictly fiscal or includes externalities such as reductions in air pollution, energy use, and environmental degradation. In looking solely at program costs, the expenses related to operating a recycling program are tied to a host of factors including transportation, collection costs, and end markets. Collection costs include costs associated with how materials will be sorted (for example, separate containers for glass, paper, and cans), the frequency of collection, and the level of community participation. By adjusting the variables that affect collection costs, communities may be able to lower these costs.

According to the EPA, in general, the per-ton or per-household cost of collecting recyclables:

- Increases with the number of streams into which materials must be separated, with singlestream being the least costly to collect, then dual-stream, etc.
- Increases with the frequency of collection. Assuming the traditional dual-stream collection process, collecting half as frequently, for example every other week instead of weekly, can reduce collection costs by approximately 25 percent.
- Are inversely related to the amount of materials collected. The fewer the participating households and the fewer the recyclables collected, the more the per-household cost soars due in large part to the cost of servicing routes with few pickups.<sup>119</sup>

These costs can have a significant impact on local programs. For example in 2002, New York City, an early pioneer in municipal recycling efforts, discovered its recycling program was losing money. Glass and plastic recycling were eliminated, since city leaders had determined that the costs of recycling glass and plastic was almost twice as much as disposal.<sup>120</sup>

Other communities are having similar experiences. Cedar Rapids, Iowa is also reportedly considering ending curbside collection of glass, following the trend of other municipalities in the state (Iowa City, Marion, Dubuque). The city is charged \$10 per ton for clear glass and \$40 per ton for colored glass by City Carton Recycling. City Carton, in turn, ships the glass to a glass refinery in St. Louis, Missouri. The glass refinery pays less for the recycled glass than City Carton spends on transportation costs. The change will allow the city to run a more efficient recycling program by eliminating special compartments for glass on its trucks and enabling the addition of an automated arm that allows the truck to pick up garbage, yard waste, and other recyclables.<sup>121</sup>

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<sup>119</sup> From [www.epa.gov/osw/consERVE/tools/localgov/economics/collection.htm](http://www.epa.gov/osw/consERVE/tools/localgov/economics/collection.htm). Last accessed on December 7, 2011.

<sup>120</sup> "Do the Benefits of Recycling Outweigh the Costs? Some Argue Recycling Uses More Energy than It Saves". From Earth Talk. [environment.about.com/od/recycling/a/benefit\\_vs\\_cost.htm](http://environment.about.com/od/recycling/a/benefit_vs_cost.htm). Last accessed on November 18, 2011.

<sup>121</sup> The Gazette. August 17, 2011. [thegazette.com/2011/08/17/is-it-time-for-curbside-glass-recycling-to-end/](http://thegazette.com/2011/08/17/is-it-time-for-curbside-glass-recycling-to-end/).

In the long run, New York City had a change of heart, due primarily to the fact that the city closed its last landfill, and private out-of-state landfills raised prices due to the increased workload of hauling and disposing of New York's trash. As a result, the benefits of recycling glass and plastic increased and glass and plastic recycling became economically viable for the city again. New York City reinstated the recycling program accordingly, with a more efficient system and with more reputable service providers than it had used previously.<sup>122</sup>

According to *Chicago Reader* columnist Cecil Adams, the lessons learned by New York City are applicable everywhere. "Some early curbside recycling programs...waste resources due to bureaucratic overhead and duplicate trash pickups (for garbage and then again for recyclables).

But the situation has improved as cities have gained experience."<sup>123</sup> Adams also says that, if managed correctly, recycling programs should cost cities (and taxpayers) less than garbage disposal for any given equivalent amount of material.<sup>124</sup>

In addition to costs, the market for recycled scrap materials can have a significant impact on the sustainability of local recycling programs. For example, Greenbelt, Maryland is currently paid between \$3-\$18 per ton for recyclable materials (commingled) brought to the Prince Georges County Materials Recovery Facility (MRF). However, the city is charged \$1 per ton for an "environmental fee" and \$1.12 per ton for a fuel fee by the MRF. It should also be noted that, in the recent past, Greenbelt has had to pay to get the Prince Georges County MRF to accept the recycling (about \$35 per ton) but this was still a cost savings compared to the tip fee of \$56 per ton.<sup>125</sup>

### **The impact of deposit program costs on beverage prices**

A major concern often expressed in the debate over beverage container deposit programs is whether these programs cause an increase in the price of the beverages included. Earlier this year, in response to Real Recycling Massachusetts' claim that an "expanded bottle bill would cost consumers almost \$120 million per year at a grocery store,"<sup>126</sup> the Massachusetts Department of Environmental Protection conducted a survey examining beverage pricing, consumer choice, and redemption system performance in Massachusetts and neighboring

***[Massachusetts Department of Environmental Protection survey] findings showed no discernible difference in price between beverages in deposit states versus non-deposit states. The impact of a deposit program on beverage consumption is essentially zero.***

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<sup>122</sup> Ibid.

<sup>123</sup> Ibid.

<sup>124</sup> Ibid.

<sup>125</sup> Personal Communication. Luisa Robles. City of Greenbelt Public Works. 10/21/2011.

<sup>126</sup> [www.realrecyclingmass.com](http://www.realrecyclingmass.com)

states. Their findings showed no discernible difference in price between beverages in deposit states versus non-deposit states. The survey also found that there was no difference in consumer choice, demonstrating that despite the fact that water drinks are included in the Maine program, product diversity still exceeded that of Massachusetts where these beverages are not included in the program.<sup>127</sup>

A University of Florida study by the Economic Analysis Program states that the impact of a deposit program on beverage consumption is essentially zero. The study maintains that such a deposit is low relative to the price of the beverage and that consumers cannot easily avoid a price increase by substituting one beverage for another, particularly when the majority of beverage containers are covered under the deposit program.<sup>128</sup> And, a California study found no evidence of a decline in the sale of non-carbonated beverages after those drinks were added to the state's deposit program in 2000.<sup>129</sup>

### **The impact of deposit programs on GHG emissions**

Reducing Maryland's greenhouse gas emissions 25 percent by 2020 is one of the Governor's 15 Strategic Policy Goals. As a part of this examination of potential beverage container deposit program impacts, researchers at the University of Maryland's Center for Integrative Environmental Research (CIER) conducted an investigation of possible impacts to greenhouse gas emissions in the state.

***Adoption of a beverage container deposit program will likely lead to increased recycling rates and subsequent energy savings and avoidance of GHG emissions.***

While CIER's analysis does indicate that adoption of a beverage container deposit program in Maryland would impact GHG emissions and energy consumption, specifically in terms of avoided GHG emissions and energy savings, the extent of these impacts are small relative to the state's overall (or even waste sector) emissions. However, material recycling is a very costeffective means for reducing greenhouse gases in terms of dollars per unit of GHG reduced.

Regardless of how a beverage container deposit program is structured or the pace of implementation, adoption of a beverage container deposit program will likely lead to increased recycling rates and subsequent energy savings and avoidance of GHG emissions. The magnitude and timing of these benefits, however, will depend on the details of the legislation. Specifically, inclusion or exclusion of aluminum cans will have significant impacts; including aluminum cans will more than double the expected energy savings and avoided GHG emissions. In addition, based on the experience of other deposit program states, a high deposit value for containers

<sup>127</sup> [www.mass.gov/dep/recycle/reduce/bbsurv11.pdf](http://www.mass.gov/dep/recycle/reduce/bbsurv11.pdf)

<sup>128</sup> Jim Dewey; Dave Denslow; Belen Chavez; Henrique Romero; Lynne Holt. "Analysis of Florida Beverage Container Deposit Refund System". March 15, 2011. Economic Analysis Program; Bureau of Economic and Business Research; University of Florida.

<sup>129</sup> Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>. p. 3.



would be expected to result in significantly higher recycling rates and rates would increase rapidly within the first few years of adoption. Avoided GHG emissions and energy savings would rise as a result.

The scale of emissions reductions resulting from a beverage container deposit program, however, will be relatively small compared to Maryland's overall GHG profile. In 2005, Maryland emitted 4.3 million metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) from its waste sector or 3 percent of total GHG emissions.<sup>130</sup> Adoption of a beverage container deposit program could be expected to result in the avoidance of approximately 200,000 additional MTCO<sub>2</sub>e.<sup>131</sup> It is important to understand that conventional GHG accounting procedures dictate that only a portion of the GHG emissions reductions could be claimed by Maryland, meaning the totality of the reductions and energy savings anticipated would not accrue solely to the state, primarily because not all stages of a container's life cycle occur in Maryland. For example, extraction of raw aluminum and aluminum manufacturing is unlikely to occur in the state. Taken together, these facts indicate the total impact of a beverage deposit program on Maryland's GHG inventory would be minimal.

However, every container recycled mitigates the effects of global climate change and conserves energy, and does so cost effectively.<sup>132</sup> Although explicitly measuring all costs and benefits associated with increased recycling was outside the scope of CIER's research, findings from previous studies demonstrate that recycling is a "no-regrets" mitigation policy with net savings for each unit of GHG emissions avoided; in other words, when the full suite of costs and benefits are considered, the overall benefits of a deposit program typically outweigh the costs. Recycling should not be discounted as a GHG strategy as it is highly cost competitive. A full accounting of CIER's literature review, model runs, and findings is included as Appendix A of this report.

<sup>130</sup> Maryland Commission on Climate Change (MCCC). 2008. Maryland Climate Action Plan, Appendix C: Inventory. Retrieved from: [www.mdclimatechange.us/](http://www.mdclimatechange.us/).

<sup>131</sup> Maryland's current bottle management practices, including recycling of glass, plastic and aluminum bottles, prevents GHG emissions. Assuming adoption of a deposit program subsequently increases the recycling rate above current levels, additional GHG emissions would be prevented or avoided. Additional details on the specifics of this estimate can be found in Appendix A of this document.

<sup>132</sup> Citation: Hogg, D., Baddeley, A., Ballinger, A. & Elliot, T. 2008. Development of Marginal Abatement Cost Curves for the Waste Sector. Report for Committee on Climate Change Defra and Environment Agency. Retrieved from: [www.theccc.org.uk](http://www.theccc.org.uk).



## Section 3:

# How Could a Litter Prevention Container Deposit Program Work in Maryland?

As manufacturing process and product development evolved, the once refillable beverage containers of the 1950s and 1960s were quickly replaced by single-use, throw-away containers, which has had measurable impacts to both resource consumption and the prevalence of litter. Ten states, as introduced above, currently attempt to address these issues through beverage container deposit programs.<sup>133</sup>

Due to differences in state priorities, local geography, program structure and other factors, each of the existing deposit programs differ slightly; the specific parameters of each are well documented.<sup>134</sup> The drivers behind the establishment of these programs include state-specific goals tied to waste diversion, improved recycling, greenhouse gas reductions, and energy conservation, but the vast majority of these programs cite litter control as one of the most, if not the most pressing driver for the program.

### Structure of existing beverage container deposit programs

As discussed in previous sections, the primary motivation for implementing beverage container deposit programs is to reduce litter rates, and to some extent landfill and GHG reduction rates, through increased recycling. Though there are a variety of deposit program alternatives that compel recycling, these programs are based on either public education, regulation, or paid cleanup efforts.

In contrast, a deposit program is based on market incentives. Though deposit programs are relatively simple in concept, the revenue flows and transaction costs associated with these programs can be complex. And, how these costs and revenue flows are accounted for will determine the long-term sustainability of the program and the responsibilities of each participant in the marketplace.

**The deposit system:** In effect, a beverage container deposit program rewards consumers for recycling using a mechanism that mimics market incentives and behavior.<sup>135</sup> That reward comes in the form of the deposit. To encourage proper disposal of beverage containers, a refundable deposit is placed on each beverage container. In most cases, this is a 5 cent charge and although there is

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<sup>133</sup> The ten states are California, Connecticut, Hawaii, Iowa, Maine, Massachusetts, Michigan, New York, Oregon and Vermont.

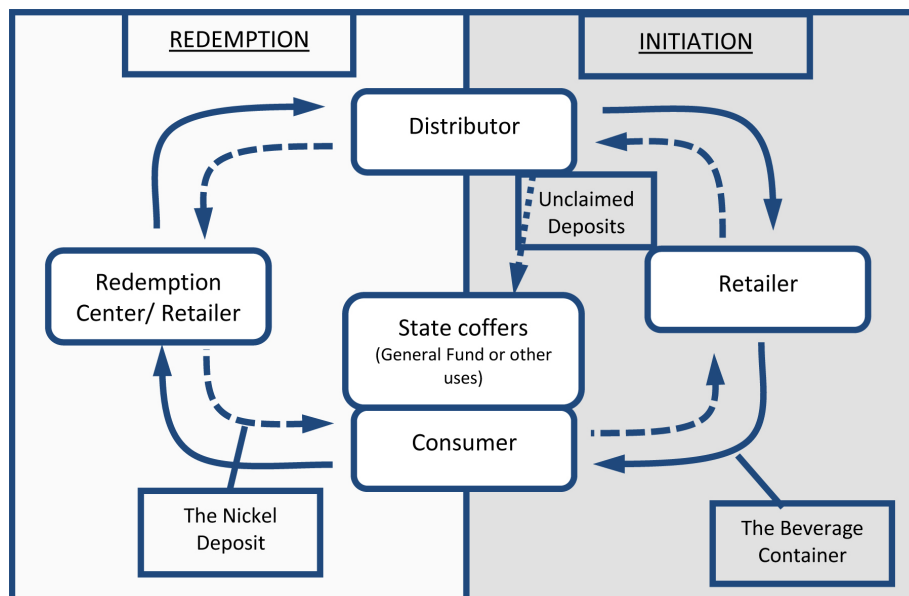
<sup>134</sup> Detailed compilations of the beverage container deposit programs currently operating in the US can be found at [www.packaginglaw.com/2595\\_shtml](http://www.packaginglaw.com/2595_shtml) accessed October 18, 2011, [www.bottlebill.org/legislation/usa/allstates.htm](http://www.bottlebill.org/legislation/usa/allstates.htm) accessed November 7, 2011, or [www.flsenate.gov/PublishedContent/Session/2012/InterimReports/2012-122ep.pdf](http://www.flsenate.gov/PublishedContent/Session/2012/InterimReports/2012-122ep.pdf) accessed October 20, 2011.

<sup>135</sup> Jim Dewey; Dave Denslow; Belen Chavez; Henrique Romero; Lynne Holt. "Analysis of Florida Beverage Container Deposit Refund System". March 15, 2011. Economic Analysis Program; Bureau of Economic and Business Research; University of Florida.

variation from one program to the next, the fee is typically applied to a variety of carbonated and noncarbonated beverages sold in glass, plastic, or aluminum containers typically with the exception of dairy products.<sup>136,137</sup>

Figure Two shows the flow of deposits (solid lines) and bottles (dotted lines) in a bottle deposit program. First, consider a bottle that is purchased and then redeemed. In most states, the process begins with the distributor. The distributor ships beverages to retailers, and includes the deposit – 5 cents, for this example – in the price it charges the retailer. When a consumer buys the beverage, he or she is charged the retail price plus the 5 cent deposit. The consumer takes the empty bottle to a collection center (oftentimes a retail establishment, but not exclusively) to redeem the bottle and retrieve the 5 cent deposit. The redemption center then ships the empty bottle to the distributor in return for the 5 cent deposit. The 5 cents has now worked its way through the entire system and all accounts balance; in other words, for each bottle redeemed no participant in the process has gained or lost money in regards to the deposit.

Now consider a bottle that is purchased but not redeemed. The distributor ships the beverage to the retailer and charges them the 5 cent deposit. The retailer sells the beverage to the consumer and charges the retail price plus the 5 cent deposit amount. At this point, the bottle is either thrown into the trash and sent to a landfill (or incinerated), ends up as litter, or is recycled curbside. As a result, the distributor now has an extra 5 cents, which he or she received when he or she charged the retailer for the shipped beverage. The distributor either keeps the 5 cents, or in the case of most existing programs, returns the unclaimed deposit to the state.



**Figure 2:** The flow of deposits and containers in a typical deposit program

<sup>136</sup> Exceptions to the 5 cent fee level include California which charges 10 cents for containers over 24 ounces and Maine and Vermont where 15 cents is charged for some wine and/or liquor bottles.

<sup>137</sup> It should be noted, however, that although a 5 cent charge is more prevalent, a strong correlation has been shown to exist between the value of the deposit and redemption rates. Higher fees have been associated with higher redemption rates, which can be expected to result in greater levels of litter reduction.

**Program costs:** Even with an effective redemption process, the deposit program is not without cost. Every time a beverage container or deposit changes hands there is a transaction taking place and each of these transactions come with its own cost. The combined average costs for retailers, redemption centers, and recyclers were 4.1 cents.<sup>138</sup> These costs are in addition to



Photo Credit: Waterfront Partnership

the deposit amount and must be either passed to the consumer, supported through government revenues and/or sales of scrap materials, or incorporated by manufacturers, retailers or distributors. Regardless of how the program is structured, there are upfront costs associated with establishing bottle deposit programs, as well as the long-term expense of operating the program.

**Upfront costs:** Upfront costs include the capital costs to set up redemption centers, to purchase and install reverse vending machines, and to acquire all necessary equipment. There are also upfront administrative costs, primarily associated with establishing the necessary capacity to run the program. The extent to which these costs fall on the public or private sector is dependent on the structure of the program.

Under the structure proposed in Maryland House Bill 839 in 2007, Prince George's County reported that construction and operation of a redemption facility at the Brown Station Road Landfill was approximately \$5,000, with an additional \$25,000 to staff it.<sup>139</sup> While these costs seem relatively low, extrapolating this to other local governments assumes appropriate facilities exist to either add on to or repurpose. By comparison, when considering a deposit program of its own, Rhode Island estimated that leasing the space for 50 centers, making any renovations necessary for redemption center operations, and employing the 12 staff members they anticipated needing to manage program start-up activities at \$3.6 million.<sup>140</sup>

**Operating costs:** As with almost any business enterprise, the primary costs associated with beverage container deposit programs are related to operating the program. For deposit programs these costs tend to span three areas: (1) the handling cost of collecting and transporting redeemed bottles to recycling centers, which have been reported to average 3.3 cents per container;<sup>141</sup> (2) processing costs, which are the subsequent cost of recycling the

<sup>138</sup> Container Recycling Institute, Letter to Assembly Member DiNapoli, April 6, 2006, [www.bottlebill.org/assets/pdfs/campaigns/newyork/2006-Rebuttals.pdf](http://www.bottlebill.org/assets/pdfs/campaigns/newyork/2006-Rebuttals.pdf)

<sup>139</sup> Prince George's County as cited in the Department of Legislative Services Fiscal and Policy Notes for HB 839 from the 2007 session which can be found at [mlis.state.md.us/2007RS/fnotes/bil\\_0009/hb0839.pdf](http://mlis.state.md.us/2007RS/fnotes/bil_0009/hb0839.pdf).

<sup>140</sup> DSM Environmental Services, Inc., *Analysis of Beverage Container System Options to Increase Municipal Recycling in Rhode Island*, prepared for Rhode Island Resource Recovery Operation, 2009.

<sup>141</sup> *Understanding Beverage Container Recycling. A Value Chain Assessment prepared for the Multi-Stakeholder Recovery Project.* Businesses and Environmentalist Allied for Recycling. January 16, 2002, as found at the [corr.org/Bear.pdf](http://corr.org/Bear.pdf).

materials; and (3) administrative costs, which are the expenses associated with running the program, such as administrative staff for bookkeeping and information flow, enforcement personnel to ensure compliance, and program staff to manage outreach, education, and community engagement efforts. According to a 2008 report, the annual cost of operating 90 independent, industry-run centers in Oregon was approximately \$156,000 per site, with an additional \$27,000 in administrative costs.<sup>142</sup> In the proposed Rhode Island program, annual operating costs for each redemption center were estimated at \$165,000.<sup>143</sup>

Montgomery County, in response to Maryland's 2007 proposed legislation, suggested that it would cost an estimated \$300,000 for the county to hire a contractor to facilitate redemption center processes. In addition, the county anticipated hiring fiscal assistants to handle reimbursements to customers to cost approximately \$150,000.<sup>144</sup>

California's program, which boasts a system of 2,000 redemption centers, has the lowest handling fee among all the states. Existing legislation states that one certified recycling center shall be located within every convenience zone, with specific guidelines for rural areas. This relieves retailers from collecting containers on site.<sup>145</sup> A 1991 Ernst and Young report concluded the California system is "significantly more cost-effective than traditional deposit legislation, saving California consumers and businesses between \$245 million and \$390 million annually."<sup>146</sup>

**Program revenue:** Because of the popularity of bottled beverages in the US, hundreds of millions of dollars flow through deposit programs every year. Accounting for these revenues, and structuring programs to ensure that surplus revenue is invested appropriately, are essential for maintaining sustainable systems.

**Deposit revenues:** The primary source of revenue in a beverage container deposit program

***Because of the popularity of bottled beverages in the US, hundreds of millions of dollars flow through deposit programs every year.***

is the deposit itself. In theory, the deposit is benign in the system; in other words, the deposit is enough of an incentive for every consumer to return the empty bottle to a redemption center. In this case, there is no gain or loss in the system associated with the deposit itself. In reality, however, a large portion of containers are never redeemed; they either end up as landfill, litter, or find

<sup>142</sup> Container Recovery, Inc. 2008. "Appendix C: Presentation to the Oregon Bottle Bill Task Force: The Industry Approach. May 13, 2008." In *Bottle Bill Task Force Final Report*. October. p. 15

<sup>143</sup> DSM Environmental Services, Inc., *Analysis of Beverage Container System Options to Increase Municipal Recycling in Rhode Island*, prepared for Rhode Island Resource Recovery Operation, 2009.

<sup>144</sup> Montgomery County as cited in the Department of Legislative Services Fiscal and Policy Notes for HB 839 from the 2007 session which can be found at [mlis.state.md.us/2007RS/fnotes/bil\\_0009/hb0839.pdf](http://mlis.state.md.us/2007RS/fnotes/bil_0009/hb0839.pdf).

<sup>145</sup> California Beverage Container Recycling & Litter Reduction Act, Revised October 2010, [www.calrecycle.ca.gov/Publications/BevContainer/2011031.pdf](http://www.calrecycle.ca.gov/Publications/BevContainer/2011031.pdf)

<sup>146</sup> Bottle Deposits: Interim Report 2012-122. Committee on Environmental Preservation and Conservation; Florida Senate. September 2012.

an alternative route to a recycling center. In these cases, the unredeemed deposits become a source of revenue for the community.

**Redemption rates and unclaimed revenues:** Redemption rates represent the number of deposit beverage containers returned as a percentage of the deposit beverage containers sold in a state. Across the ten states with existing programs, the average redemption rate is 76 percent, with a low of 60 percent in Connecticut and a high of 97 percent in Michigan. There is a strong correlation between the value of the deposit and the redemption rate. Michigan has the highest deposit at 10 cents, which results in the highest redemption rate of 97 percent. In addition,

### **RVMs at MIT**

*RVMs were recently placed at locations throughout the Massachusetts Institute of Technology (MIT) campus. In the first four months of operation, there were more than 15,000 containers returned, with an estimated 2,779 kWh of energy saved. Deposits are returned to students via direct deposit to a PayPal account or a student ID cash account. Students also have the option of designating their deposit(s) go to a charitable organization. Additional machines are planned for other academic institutions including Tufts, Northeastern, Brandeis, and Holy Cross. The intent is to encourage the schools to compete for eco-bragging rights and possibly sponsored prizes such as tickets to sporting event and gift cards.*

London, Jay. "New Recycling Machine Offers Easy Refunds, Bragging Rights." Slice of MIT. Nov 16, 2011. [alum.mit.edu/pages/sliceofmit/2011/11/16/new-recycling-machine-offerseasy-refunds-bragging-rights-2/](http://alum.mit.edu/pages/sliceofmit/2011/11/16/new-recycling-machine-offerseasy-refunds-bragging-rights-2/).

California increased their refund value in 2007 to 5 cents for containers under 24oz and 10 cents for containers over 24oz. In the six months that followed, the redemption rate increased 6 percent from the same time period in the previous year.

Redemption rates are also impacted by the convenience of return processes and facilities, as well as the types of materials collected. Some redemption processes rely heavily on reverse vending machines (RVM), automated devices that can collect used beverage containers and return a deposit. These machines have proven to be an efficient and effective tool in the redemption process. RVM systems have lower operating costs than staffed, manual redemption centers, provide the opportunity to reduce fraud through state-specific barcoding, treat containers more gently resulting in a higher quality scrap end-product, and can

relieve some of the burden that falls on retailers and distributors. Perhaps most importantly, RVMs are highly convenient, making the redemption process simpler in meeting litter reduction goals.

Revenue from unredeemed containers can reach the tens of millions of dollars in most states, ranging from \$1.2 million in Maine to approximately \$200 million in California. Obviously the level of unredeemed deposits is directly associated with the number of beverages purchased in the state; therefore, large states like California will have higher revenue levels. However, revenue from unredeemed bottles is also impacted by the redemption rate itself. Therefore,



states with lower deposit levels, and therefore lower redemption rates, have higher unclaimed deposit revenues. In most cases, the funds that revert to the state are added to general government accounts or are used to cover programmatic expenses.

By example, the New York program once had distributors retaining all unclaimed deposits. Now, due to a recent change in the legislation, 80 percent of these funds revert back to the state, while distributors may still keep 20 percent. This totaled \$103.4 million in revenue to the state’s general fund in 2007 and \$120 million in 2010.<sup>147</sup>

Michigan diverts 75 percent of unclaimed deposits to a Cleanup and Redevelopment Fund within the state treasury which is spent on state environmental programs. This totaled \$17.5 million in 2001 and just over \$12 million in 2010.<sup>148</sup> Having a specific funding mechanism in place has enabled the state to both define how these dollars will be spent and establish a nexus between what activities funds are collected from and the purpose they serve when reinvested in the community. In Massachusetts, where 30 percent of deposits go unclaimed, \$35 to \$40 million reverts to the state annually. These funds were originally set aside in a Clean Environment Fund; however, a recent state administration eliminated all state trust funds and these monies are now funneled directly to general government accounts.

State	Deposit Amount	Redemption Rate	Unclaimed Deposit Revenue
California <sup>1</sup>	5 cents	84%	\$200 million
Connecticut	5 cents	70%	\$23 million
Hawaii <sup>2</sup> (2009)	5 cents	79%	\$21.5 million
Iowa	5 cents	86%	\$23 million
Massachusetts	5 cents	71%	\$39.2 million
Maine <sup>3</sup>	5 cents	90%	\$1.2 million
Michigan	10 cents	97%	\$12 million
New York	5 cents	67%	\$120 million
Oregon <sup>4</sup>	5 cents	75%	\$16 million
Vermont <sup>5</sup>	5 cents	85%	\$2 million
1. 10 cents for bottles over 24 oz, 2. Plus 1cent to 1.5 cents nonrefundable fee, 3. 15 cents for some wine bottles, 4. Reverts to distributors; Oregon Department of Environmental Quality estimate, 5. 15 cents for some liquor bottles.			

**Table 5:** Unclaimed Deposit Revenue in Existing Deposit Program States

<sup>147</sup> Personal communication with Jennifer Kruman. Environmental Program Specialist for the New York Bureau of Waste Reduction & Recycling. November 9, 2011.

<sup>148</sup> Personal communication with Thomas Patchak-Schuster. Michigan Department of Treasury’s Office of Revenue and Tax Analysis. November 10, 2011.

Although on the surface beverage container deposit programs seem to operate as a revenue generating tool, there are a host of handling, administrative, and programmatic costs at play, as well as market forces, which often tip the balance sheets in the other direction. Closing a budget gap should not be the driver for instituting such a program, nor should it be the sole financing mechanism to support the program. As redemption rates improve, unredeemed deposits shrink leaving a state with an expanded program and fewer funds to run it. The California program, in particular, is facing this challenge. A recent legislative analysis of the program predicts that without major changes to how the program operates, it is likely to become insolvent by 2014.<sup>149</sup>

**Revenues from sales from scrap materials:** In the long-term, the foundation of sustainable, self-supporting beverage container deposit programs is the recycling process and the sale of scrap materials. Without the possibility of recycling, collected bottles would be disposed of in a landfill, which is not a desirable outcome.<sup>150</sup> The price that recyclers can charge for scrap materials is directly associated with the price of virgin materials. As the price of virgin materials rises, the price that a recycler can charge also rises. When the price for scrap materials is sufficiently high, the revenue from sales is sufficient to cover handling, administrative, and transaction costs associated with running the deposit programs. When the price recyclers can charge for scrap material declines, revenues decrease, therefore requiring the establishment of handling fees.

The global recession that began in 2008 had a significant depressive effect on commodities' prices, which resulted in the collapse in the value of recycled scrap materials. Prices for recycled commodities such as cardboard, newsprint, paper, and film plastic have dropped dramatically. And the export market, principally China, essentially closed in terms of buying certain commodities like film plastic.<sup>151</sup> As states like Maryland are pushing to expand waste diversion programs through the use of policies like deposit programs, the price for recycled scrap materials is still struggling to recover. However, collection and processing costs have stayed relatively stable. As a result, local governments are often required to subsidize curbside collection programs through other revenue sources.<sup>152</sup>

**Revenue generated by handling fees:** Several existing container deposit programs generate an additional source of revenue to cover handling costs through a non-refundable handling fee. These fees, which generally range from 1 to 3 cents, are primarily assessed on beverages and

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<sup>149</sup> Overview of the Beverage Container Recycling Fund, prepared by California's Legislative Analyst's Office, February 3, 2011.

<sup>150</sup> Though it could be considered desirable if the only other outcome were litter.

<sup>151</sup> Guy Crittenden. "Market for recycled materials collapsing". Solid Waste and Recycling. November 11, 2008. [www.solidwastemag.com/news/market-for-recycled-materials-collapsing/1000086432/?issue=11022008](http://www.solidwastemag.com/news/market-for-recycled-materials-collapsing/1000086432/?issue=11022008). Last accessed on December 8, 2011.

<sup>152</sup> It should be noted that, while scrap prices hit a historic low in 2008, they hit a historic high in 2010 for some materials. California's Beverage Container Recycling & Litter Reduction Program, Fact Sheet, CA Natural Resources Agency, Department of Resources, Recycling, & Recovery, Division of Recycling, June 2011.

help cover the cost of handling the containers.<sup>153</sup> Figure 2 (above) shows the flow of deposits (solid lines) and beverage container (dotted lines) in a typical beverage deposit program.

## Current state of existing beverage container deposit programs

Although certainly not an indicator of the economic soundness of a public policy, in the majority of cases, beverage container deposit programs have ultimately proven popular with the general public. In New York, a 2004 study showed widespread support for the existing program, as well as overall support for expanding the program. The study surveyed a random sample of 800 New York registered voters and found that 84 percent supported the current program and 78 percent felt that it made the state much cleaner. Eighty percent agreed “strongly” or “somewhat” that curbside recycling alone was not enough to control litter in the state.<sup>154</sup> In Hawaii, a 2008 telephone survey prepared for the state’s Department of Health indicated that

***Beverage container deposit programs have ultimately proven popular with the general public.***

more than half of those polled (60 percent) had a positive opinion of the program.

While two beverage container deposit programs have been repealed, (Delaware has opted for a flat fee and Columbia, Missouri has shifted to a curbside voucher system) many of the existing programs, including Maine, Vermont and Iowa, have survived repeal attempts. In Maine, in particular, repeals have been estimated to be opposed 5 to 1.<sup>155</sup> More than two dozen other states are in the process of investigating or developing similar programs, and the US Territory of Guam is set to begin their deposit program this year.<sup>156</sup>

Conversations with program staff in Connecticut suggest that states considering deposit programs make the program as comprehensive as possible from the beginning, rather than expect to add container types or increase fees once the program is in place. The proliferation of bottled water, flavored waters, and sports drinks since the existing beverage container deposit programs were established in the 1970s and 1980s has proven a setback to litter control and has led many states to attempt to expand their programs to include these items. California, Oregon and others have expanded the breadth of beverages covered under their deposit programs, but these expansions can be difficult to achieve. New York, by example, discovered that 27 percent of the containers sold in the state are sports drinks, however, their attempts to have these beverages included in a recent revision to their program was ultimately defeated by the sports beverage industry.<sup>157</sup>

<sup>153</sup> [www.bottlebill.org/about/whatis.htm](http://www.bottlebill.org/about/whatis.htm).

<sup>154</sup> From Survey of New York Registered Voters: Attitudes Toward New York’s Bottle Bill and Proposed Reforms, as found on [www.nypirg.org/pubs/enviro/solidwaste/bottlebill/SurveyResults\\_Final.pdf](http://www.nypirg.org/pubs/enviro/solidwaste/bottlebill/SurveyResults_Final.pdf), accessed November 18, 2011.

<sup>155</sup> Personal communication with Steve Giguere. Inspection Program Manager for the Maine program. November 8, 2011.

<sup>156</sup> From [www.guamcourts.org/compileroflaws/GCA/10gca/10gc044.pdf](http://www.guamcourts.org/compileroflaws/GCA/10gca/10gc044.pdf), accessed November 2, 2011.

<sup>157</sup> Personal communications with Jennifer Kruman, Environmental Program Specialist for the New York Bureau of Waste Reduction & Recycling, November 9, 2011.

In Massachusetts, where noncarbonated beverages are not included in the deposit program, a 2009 Community Clean Up Litter Study indicated that non-deposit beverage containers were three times as prevalent in waste receptacles as deposit containers. An additional review focused on waste receptacles in public areas such as parks and ballfields. In parks, non-deposit containers accounted for 64% of container waste, with more than half of this coming from water bottles; and, at ballfields, non-deposit containers made up a staggering 85% of the containers in waste receptacles, with water bottles accounting for more than two-thirds of this total.<sup>158</sup> As a result, Massachusetts is currently trying to expand their program to include noncarbonated beverages such as water, juice, and sports drinks. Notably, according to the Massachusetts Department of Environmental Protection, in 2005, non-deposit containers were about 29% of all containers sold.<sup>159</sup>

### Compatibility with local recycling programs

The compatibility of deposit programs with existing curbside and drop-off programs is frequently questioned as well. In Maryland, most residents have access to curbside recycling or centralized drop-off locations, leaving some to wonder whether a beverage container deposit program would duplicate these efforts while incurring the cost of additional recycling infrastructure. While it is true that there are programmatic costs of varying levels associated with establishing and maintaining beverage container deposit programs, much of which is detailed elsewhere in this report, curbside and drop-off programs are not designed to serve the same purpose as beverage container deposit programs, and as a result, these programs have

***Curbside programs, while very effective at addressing residential recyclables, oftendo not capture the containers most likely to end up as litter – those used at work, school, or on the road.***

been found to be complimentary to one another in many of the current deposit states.

According to the Container Recycling Institute, states with deposit programs experience beverage container recycling rates in excess of approximately 60 percent, while states without tend to reach about 25 percent.<sup>160</sup> In fact, despite the number of curbside recycling programs in the US tripling in the decade between 1990

and 2000, aluminum cans wasted increased approximately 25 percent, and the amount of plastic beverage bottles landfilled and incinerated nearly tripled from 359,000 to 943,000 tons per year.<sup>161</sup>

<sup>158</sup> Study can be found at [www.mass.gov/dep/recycle/reduce/flitter.htm](http://www.mass.gov/dep/recycle/reduce/flitter.htm), accessed November 22, 2011.

<sup>159</sup> Massachusetts Department of Environmental Protection, Beverage Containers in Litter & Public Waste Receptacles, [www.mass.gov/dep/recycle/reduce/flitter.htm](http://www.mass.gov/dep/recycle/reduce/flitter.htm), Retrieved 11/21/11.

<sup>160</sup> Based on a 2006 data set as displayed at [www.container-recycling.org/facts/all/data/recrates-depnon-3mats.htm](http://www.container-recycling.org/facts/all/data/recrates-depnon-3mats.htm)

<sup>161</sup> Tripling of curbside access in last decade from "The State of Garbage in America," BioCycle, December 2001. Rising tide of [container] waste in last decade: 1.21 million tons of containers and packaging were landfilled or incinerated in 2000, up from 1.17 million tons in 1990. Source: Table 17 "Products Discarded in the Municipal Waste Stream, 1960 to 2000 (with detail on nondurable goods)," Environmental Protection Agency, Office of Solid Waste and Emergency Response (5305W) EPA530-R-02-001, June 2002. As found at [www.container-recycling.org](http://www.container-recycling.org).

Curbside programs, while very effective at addressing residential recyclables, often do not capture the containers most likely to end up as litter – those used at work, school, or on the road. Unlike deposit programs, curbside and drop-off programs do not have a demonstrated ability to reduce litter from public areas. However, curbside and drop-off programs can collect a broader spectrum of materials, and therefore can work in conjunction with deposit programs to achieve a greater overall improvement in recycling.

Both the Maryland Association of Counties and the Maryland Municipal League have expressed their concern that a beverage deposit program would pull the most valuable part of the recycling stream—aluminum—out of local programs and that the resulting loss of scrap value would force municipalities to subsidize recycling even more than they already do, meaning an additional burden to the local taxpayer served by curbside and/or drop-off services.<sup>162</sup> Montgomery County, by example, has indicated that the resale of recyclable materials processed at the county’s recycling center generated more than \$3.3 million in revenue for the county in 2006.<sup>163</sup>

***Although a deposit program could be expected to improve litter control efforts and recycling rates, it is likely to come with a cost borne by local governments to operate waste management systems.***

Massachusetts municipalities had similar concerns, but a survey conducted by the state found reduced collection costs to municipalities across the state totaled \$1 million, primarily due to the removal of low value glass and plastics from the municipal recycling stream, and close to 200 cities and towns in the state now support expansion of the program.<sup>164</sup> Another study conducted in Washington State (with funding from the City of Tacoma Environmental Services Division) also indicates savings to local governments in terms of reduced litter and waste collection costs.<sup>165</sup>

Reductions in collection and disposal costs, however, do not address the decreasing value of recycled scrap materials. Although a deposit program could be expected to improve litter control efforts and recycling rates, it is likely to come with a cost borne by local governments to operate waste management systems. Some current and proposed programs attempt to address this. California and Hawaii both use a portion of unredeemed deposits to support local-level recycling programs and, in Minnesota, the proposed legislation recommends that 90 percent of unclaimed deposits go to a state environmental fund while the remaining 10 percent be set aside to help support county-level recycling programs.

<sup>162</sup> Personal communication with various members of the Maryland Association of Counties and the Maryland Municipal League legislative and government relations staff, November 16, 17, and 21, 2011.

<sup>163</sup> Montgomery County as cited in the Department of Legislative Services Fiscal and Policy Notes for HB 839 from the 2007 session which can be found at [mlis.state.md.us/2007RS/fnotes/bil\\_0009/hb0839.pdf](http://mlis.state.md.us/2007RS/fnotes/bil_0009/hb0839.pdf).

<sup>164</sup> Personal communications with Greg Cooper, Deputy Division Director at the Massachusetts Department of Environmental Protection, October 28, 2011.

<sup>165</sup> Morris, Jeff, Smith, Bill, and Rick Hlavka. Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington. April 2005.



## Addressing fraud

Beverage container deposit fraud occurs when containers purchased in non-deposit states are returned for cash value in states with a deposit system in place. Several of the states with existing beverage deposit programs recognize that fraud exists but have not found it to be prevalent enough to spur major anti-fraud efforts. However, fraud has proven to be a major problem in Maine and Michigan in particular and these states have taken measures to analyze and reduce the problem.<sup>166</sup>

The beverage deposit program in Maine has been experiencing significant levels of fraud, particularly from neighboring non-deposit state New Hampshire. Maine issued a report for their 123rd Legislature that attempted to estimate the total number of beverage containers illegally redeemed in Maine each year. The Maine Department of Agriculture, which administers the program, however, found it difficult to verify the information on fraud because of insufficient survey data collected.<sup>167</sup>

Fraud has reportedly been significant enough in Maine to prompt a state-specific water bottle. Poland Spring, which sources bottled water from a handful of springs in Maine, has taken steps to reduce redemption fraud of their containers by adding a colored stripe to any bottle sold in Maine. Though some cases of fraud are well-publicized, such as a case attributed to a redemption center in Kittery, Maine, the extent or locations of existing fraud is generally not well documented.<sup>168</sup> To discourage fraudulent redemptions in the state, Maine imposes a fine of \$100 for attempting to return containers purchased from out-of-state and requires anyone redeeming more than 2,500 containers to provide their name and photo identification for verification of residency.<sup>169</sup>

Similarly, Michigan is unable to document with certainty the amount of fraud that exists in their beverage container deposit program. However, as a state with non-deposit neighbors and a redemption rate that rarely drops below 95 percent and has, in fact, exceeded 100 percent in the past, fraud is clearly a factor.<sup>170,171</sup> Looking ahead, the *Michigan Bottle Bill Report to the Michigan Great Lakes Protective Fund* for 2000 reported that although it was probably not possible to completely eliminate fraud in the deposit program, there were measures that could be taken that could reduce the incidence. These include imposing large fines for offenders,

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<sup>166</sup> Interviews conducted include representatives from Connecticut, Hawaii, Massachusetts, Maine, Michigan, and New York. See appendix for complete names of contacts

<sup>167</sup> "A Report Prepared for the 123rd Legislature Joint Standing Committee on Business Research and Economic Development, Response to Chapter 40 Resolve, To Estimate the Annual Value of Uncollected Bottle Deposits, Fraud, and Total Costs under Maine's Bottle Bill." Maine Department of Agriculture. [www.bottlebill.org/assets/pdfs/legis/usa/ME-redemption.pdf](http://www.bottlebill.org/assets/pdfs/legis/usa/ME-redemption.pdf).

<sup>168</sup> [bangordailynews.com/2011/02/11/business/alleged-scam-spurs-criticism-of-bottle-bill/](http://bangordailynews.com/2011/02/11/business/alleged-scam-spurs-criticism-of-bottle-bill/)

<sup>169</sup> Personal communications with Steve Giguere, Inspection Program Manager for the Maine program, November 8, 2011.

<sup>170</sup> "Michigan Bottle Bill, A Final Report to: Michigan Great Lakes Protective Fund." Stutz, J., and C. Gilbert. July 10, 2000. [www.michigan.gov/documents/deq/deq-ogl-mglpf-stutz\\_249882\\_7.pdf](http://www.michigan.gov/documents/deq/deq-ogl-mglpf-stutz_249882_7.pdf).

<sup>171</sup> Personal communication with Thomas Patchak-Schuster, Michigan Department of Treasury's Office of Revenue and Tax Analysis, November 10, 2011.

limiting the number of containers returned by a single party per day, and changing the markings on containers to be state specific.<sup>172</sup>

In 2008, although still unable to quantify the scale of the fraud problem, Michigan put some of these measures in place when they passed six Public Acts that sought to address the deposit fraud problem.<sup>173</sup> These specifically target fraudulent redemptions made at RVMs and introduced much stiffer penalties to further limit the incidence of fraud. Although Maine did not believe that a similar practice would be worth pursuing, Michigan's legislation requires a state-specific mark in the barcoding on Michigan beverage containers. This can be read by RVMs and more easily determines the purchase origin of a beverage container.<sup>174</sup>

In 2011, the state made an initial attempt to follow up on the Public Acts by conducting an analysis to measure the impact of the first three years of the legislation. Although again there was difficulty in estimating the exact level of fraudulent redemptions, the limited available data did show that recent anti-fraud technology was serving to reduce fraud.<sup>175</sup>

Many of the existing beverage container deposit states are less concerned with fraud for a variety of reasons -- Hawaii's isolation from the mainland limits the issue, for example, and states with deposit program neighbors tend to experience less fraud. Most have found some combination of reporting requirements, high fines, reporting hotlines, rewards, and audits and inspections as sufficient enforcement measures to minimize fraudulent returns.



<sup>172</sup> "Michigan Bottle Bill, A Final Report to: Michigan Great Lakes Protective Fund." Stutz, J, and C. Gilbert. July 10, 2000. [www.michigan.gov/documents/deq/deq-ogl-mglpf-stutz\\_249882\\_7.pdf](http://www.michigan.gov/documents/deq/deq-ogl-mglpf-stutz_249882_7.pdf)

<sup>173</sup> Public Acts 384 through 389

<sup>174</sup> Personal communication with Steve Giguere. Inspection Program Manager for the Maine program. November 8, 2011.

<sup>175</sup> "Reducing the Redemption of Nonreturnable Containers: Progress Report 2011." Office of Revenue and Tax Analysis Michigan Department of Treasury.

## Section 4: Recommendations and Conclusion

### Recommendations

Should the state choose to move in the direction of a deposit program, there are a number of characteristics and lessons learned from other states that would likely improve the potential for an efficient and effective program.

**Establish the most effective deposit rate.** Given that the litter reduction benefits of deposit programs outweigh all others, the deposit rate should be set at a level that maximizes this benefit. Empirical and statistical evidence suggest that a deposit level of 10 cents per container will lead to redemption rates over 90 percent, thereby achieving the highest litter reduction rates. In addition, GHG emissions reductions can be expected to rise in parallel to redemption rates.

**Do not rely on unclaimed deposit revenues to support unrelated programs.** States that rely on unclaimed deposit revenues run the risk of reducing the impact of deposit programs on litter reduction rates or jeopardizing programs that are supported by deposit program revenues. If Maryland implements a deposit program, it should limit the use of unclaimed deposit revenues to covering container handling and administrative costs, supporting complementary litter reduction programs, or supporting local recycling programs. It is strongly recommend that the state NOT use the revenue to support unrelated funding needs.

**Implement the deposit on multiple beverage types.** The long-term effectiveness of beverage deposit programs at reducing litter rates relies on applying the deposit to as many different

***The long-term effectiveness of beverage deposit programs at reducing litter rates relies on applying the deposit to as many different container types as possible.***

container types as possible. Since many states have a difficult time expanding a program once it is established, Maryland should consider being as comprehensive as possible as to which beverage containers are included in a deposit program.

**Mandate convenience and efficiency into the system.** In addition to deposit levels, redemption rates are impacted by the convenience to consumers to return empty containers. The more convenient the system, the more likely consumers will be to return bottles, which in turn increases litter reduction rates. Therefore, it is essential that bills are designed, and legislated, with convenience in mind. However, it is also essential that the programs are designed with efficiency and cost-effectiveness in mind. Those states that rely on reverse vending machines rather than labor-intensive redemption centers are more cost-effective (as measured by costs per redeemed beverage container),

have lower incidences of fraud, and tend to be gentler than manual or curbside collection resulting in a higher quality, more readily used scrap end product.

**Establish clear program goals and requirements from the beginning.** It is important the state be very clear in regards to its expectations from industry. As with any other regulated environment, lack of clarity from the public sector creates transaction costs within an industry sector, and will

***There is no question that the industry is best positioned to understand what actions are necessary for reducing program costs and improving the effectiveness of deposit programs.***

almost certainly lead to program inefficiencies. Therefore, the state should clearly spell out responsibilities for collecting deposits, establishing redemption centers, defining penalties for fraud, and creating program exemptions. In addition, the responsibility for administering the program should reside within the agency with the greatest capacity to reduce these transaction costs. In the state of Maryland, that would most likely be MDE.

**Use the marketplace to reduce handling and administrative costs.** If Maryland implements a deposit program, we recommend requiring the industry, either through the bottlers and distributors or through the retailers, to absorb all handling and administrative costs associated with the program. This system would be implemented in lieu of a non-refundable handling fee. Beverage container deposit programs are by definition market-based tools designed to incentivize litter reduction and to improve recycling rates. These market tools correct an existing failure in the beverage market to properly account for the costs associated with litter and the improper disposal of beverage containers. And, as a market-based tool, deposit programs are extremely efficient and effective at achieving the desired community outcome. Therefore, by requiring the industry to absorb the costs of the program, the costs are put into the marketplace, thereby incentivizing industry participants to aggressively pursue options to reduce costs to the greatest extent possible.

Of course, it will almost certainly be argued that such a market-based system will require increasing the costs of beverages in addition to the deposit amount. This is certainly true, and entirely the point. To the consumer, there is no difference between an increase in the cost of a beverage as a result of a non-refundable handling fee versus an increase in the cost of the beverage as a result of the industry covering its own costs. The difference lies with the incentives built into the system. In short, there is no incentive in a fee-based system to improve efficiencies and reduce costs. In the market system, the industry will be relentless in employing a system that reduces the impact on its bottom line. That is good for the industry, the citizens of Maryland, and the environment.

**Link unclaimed deposit revenues to program performance.** In addition to implementing a market approach to reducing costs, we suggest that the state consider using the unclaimed





Photo Credit: National Aquarium

deposit revenue as an incentive to improve program performance. Specifically, we would recommend allowing the industry to keep most if not all of the unclaimed deposit revenue if it meets particular goals such as maintaining redemption rates at a particular level.<sup>176</sup> In addition, the state should consider linking the unclaimed deposit revenue to the ultimate goal of the program: reducing litter. The state should investigate using a “pay

for success” type program that allows the industry to keep unclaimed revenue if overall litter rates are significantly reduced. In addition to incentivizing the reduction in program and handling costs, it would create a powerful market-based system for improving the environment through reduced litter.

There is no question that there will be industry opposition to the market approach we are recommending. There is also no question that the industry is best positioned to understand what actions are necessary for reducing program costs and improving the effectiveness of deposit programs. In fact, the very premise of beverage container deposit programs is that they use market incentives to encourage appropriate disposal of beverage containers, and by all accounts, these programs are highly effective in this regard. It is reasonable to assume that the same sort of market incentives would result in the most efficient administration of these programs.

## Conclusion

The recommendations above are based on an assessment of the successes and challenges of bottle deposit programs in a number of states. Ultimately, a review of the available literature and discussions with managers in many of the bottle deposit states lead us to believe that a beverage container deposit program presents one way for Maryland to attempt to address its litter reduction goals. Ancillary benefits through increased recycling rates and decreased greenhouse gas emissions are possible though not guaranteed. As discussed throughout this document, deposit programs have distinct benefits and drawbacks that will require careful consideration from the state to determine whether investing the resources and political capital to establish a deposit program is worthwhile.

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<sup>176</sup> We recognize that there will be pressure to use these monies to support other programs, including local recycling programs. The decision to address these needs will be political in nature, and therefore outside the scope of this report. However, if it is necessary to subsidize other programs, we suggest that the amount of revenue that stays with industry be high enough to act as an effective incentive to achieve program goals.



# Project Team

## Environmental Finance Center Team

**Joanne Throwe, Director** – Hired in 2005 as the EFC’s Agricultural Program Leader, Joanne Throwe became Assistant Director in 2007, Associate Director in 2008, and Director in 2009. In addition, she completed an 18-month assignment working with USDA/CSREES as shared-faculty to assist in the coordination of special agriculture projects. Ms. Throwe works with communities in the Mid-Atlantic region implementing innovative financing solutions for environmental protection. Her work experience includes extensive knowledge about agriculture, green infrastructure, biofuels, ecosystem services and solid waste management. Prior to joining the EFC, Ms. Throwe spent several years as a Development Resource Specialist at USDA’s Foreign Agriculture Service and two years as an Agriculture Extension Agent for Peace Corps in the South Pacific. She holds a M.A. in Public Policy and Private Enterprise from the University of Maryland.

**Jennifer Cotting, Assistant Director** – Ms. Cotting joined the Environmental Finance Center (EFC) in 2004 to manage an EPA funded program designed to help communities and organizations in Region 3 overcome barriers to implementing and financing their watershed protection efforts. As a Program Manager she coordinated a number of the EFC’s core programs, with a particular focus on urban greening, tree canopy, and green infrastructure. Her current work as Assistant Director includes these program management tasks, as well as responsibilities for the day-to-day operations of the center and the management of staff and student employees. Prior to joining the EFC, Ms. Cotting worked as an independent consultant developing and implementing environmentally based education and outreach programs for nonprofit organizations and government agencies. She received her M.S. in Sustainable Development and Conservation Biology from the University of Maryland and her B.A. in Communications from Marymount University.

**Megan Hughes, Program Manager** – Ms. Hughes has been with the EFC since early 2008. From 2003 to 2007 she served as an Instructor and Internship Coordinator for the Center for Environmental Programs at Bowling Green State University in Bowling Green, OH. She also worked for two years with the Chapel Hill, NC, firm Environmental Consultants and Research (EC/R, Inc.) as a contractor to the Environmental Protection Agency Office of Air Quality Planning and Standards (OAQPS). Ms. Hughes received her Master of Environmental Management degree from Duke University’s Nicholas School of the Environment and Earth Sciences and a Bachelor of Arts Degree in Environmental Studies from the University of North Carolina at Wilmington. Her Master’s Project, entitled “Creating the Urban Toolshed: A case study of Durham children’s perceptions of nature and neighborhood,” was authored during her time as an environmental education consultant for Durham Parks and Recreation in Durham, NC. During graduate studies, she also held a series of positions in the Triangle region of NC with the North Carolina Solar Center, the Center for Environmental Education, and Triangle J Council of Governments.

**Dan Nees, Research Associate** – Mr. Nees recently rejoined the Environmental Finance Center in the role of Senior Research Associate, focusing on the research and analysis of a variety of pressing environmental finance issues. He had been director of the EFC from 2004 to 2007, assisting communities throughout the Chesapeake Bay watershed and the Mid-Atlantic region in their efforts to implement and finance environmental and sustainable development initiatives. Most recently, he was the Director of the Chesapeake Fund program at Forest Trends, an innovative program designed to demonstrate the value of water quality markets and performance-based financing in restoring and protecting the Chesapeake Bay. Mr. Nees also worked at the World Resources Institute (WRI), where he directed its water quality programs. Additional experience includes serving as Project Manager of Corporate Programs at The Nature Conservancy and Manager of Alternative Marketing at U.S. News and World Report. Dan holds a B.A. in Economics, a Master of Environmental Policy, and a Master of Business Administration, all from the University of Maryland, College Park.

### **The EFC also acknowledges the contribution of an exceptional team of University of Maryland graduate students:**

- **Jeremy Hanson**, School of Public Policy, MPP Candidate, 2012
- **Virginia Kotzias**, School of Public Policy, MPP Candidate, 2012
- **Allison Santacreu**, School of Architecture, Planning & Preservation, MCP Candidate, 2015
- **Steven Theroux**, School of Public Policy, MPP Candidate, 2012

### **Center for Integrative Environmental Research Team**

**Sean Williamson, Faculty Research Assistant** – As a faculty research Assistant with CIER, Mr. Williamson’s research focuses on energy patterns and GHG measurement and mitigation through use of dynamic modeling tools and stakeholder collaboration. He has led multiple GHG inventory projects with Maryland colleges and universities.

- **Ryan Bedford** is a Master of Public Policy candidate with a specialization in Management and Leadership.
- **Hanna Moerland** is working on an MPP at the University of Maryland School Of Public Policy, specializing in International Development.



Photo Credit: Back River Restoration





## **ECONorthwest Team**

**Terry Moore, FAICP** – Mr. Moore has been a vice president and project manager at ECONorthwest since 1979. He has managed more than 500 projects in transportation and landuseplanning, economic development, growth management, policy analysis, environmental assessment, and market and feasibility analysis for private and public clients. In 2007 and again in 2009-10, Moore worked as a senior research scientist at the National Center for Smart Growth at the University of Maryland, focused principally on the *Maryland Scenarios* and *Maryland Indicator* projects. He has authored two books—*Economic Development Toolbox* (2006) and a second edition of *The Transportation/Land Use Connection* (2007)—and contributed chapters to others. His articles on growth management, urban growth boundaries, project management, planning theory, and the land use/transportation connection have appeared in a number of professional journals.

**Kristin Lee, Senior Economic Policy Analyst** – Ms. Lee work in ECONorthwest’s Eugene, Oregon office. She specializes in the economic dimensions of policies and actions affecting the environment. Ms. Lee has also advised governmental agencies on the implementation and fiscal effects of proposed taxes and programs. Ms. Lee’s experience covers a broad range of topics in environmental economics including projects analyzing the economic consequences of groundwater pollution, evaluating the benefits and costs of proposals to clean up contaminated sites, and describing the economic benefits of wilderness protection. She has also evaluated the economic effects of a proposed water-bottling facility and identified trends in the demand and supply of recycled construction materials—particularly concrete and aggregate.

# Appendix A:

## CIER's Assessment of the Potential Greenhouse Gas Impacts of a Maryland Deposit Program

### A Study of Energy and Greenhouse Gas Impacts from a Maryland Bottle Bill

November 2011

Center for Integrative Environmental Research, University of Maryland

Authors: Williamson, S., Bedford, R., and Moerland, H.

#### Summary

Adoption of a beverage container deposit program in Maryland would have an impact on greenhouse gas (GHG) emissions and energy consumption. Accounting for these impacts in the full balance of costs and benefits will facilitate a comprehensive evaluation of a beverage container deposit program. We find that adoption of a beverage container deposit program in Maryland would result in avoided GHG emissions and energy savings.

Three critical findings/insights of importance to decision makers include:

- (1) The GHG and energy impacts of a beverage container deposit program will be predominately influenced by inclusion of aluminum as an eligible material;
- (2) The total GHG impact will be small relative to either Maryland's overall emissions or its waste sector emissions; and
- (3) Material recycling is a very cost effective means for reducing greenhouse gases (i.e., Dollars / unit of GHG mitigated).

**First**, regardless of how legislation is structured or the pace of implementation, adoption of a beverage container deposit program will likely lead to increased recycling rates and subsequent energy savings and avoidance of GHG emissions. The magnitude and timing of these benefits, however, will depend on the details of the legislation. Specifically, inclusion or exclusion of aluminum cans under a deposit program will have significant impacts. Including aluminum will more than double the expected energy savings and avoided GHG emissions. Additionally, based on the experience of other states with beverage container deposit program, a high deposit value for containers would be expected to result in significantly higher recycling rates and rates would increase rapidly within the first few years of adoption. Avoided GHG emissions and energy savings would rise in parallel.

**Second**, the magnitude of emissions reductions resulting from a beverage container deposit program will be relatively small compared to Maryland's overall GHG profile. In 2005, Maryland

emitted 4.3 million metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) from its waste sector or 3 percent of total GHG emissions. We find that adoption of this type of program would result in the avoidance of approximately 200,000 additional MTCO<sub>2</sub>e. However, it is critical to understand that the totality of GHG emissions reductions and energy savings forecasted in this analysis would not accrue in Maryland. Conventional GHG accounting procedures dictate that only a portion of the GHG emissions reductions could be claimed by Maryland. This is because not all stages of a bottle's life cycle occur in Maryland. For example, extraction of raw aluminum and aluminum manufacturing is unlikely to occur in the state. Taken together, these facts indicate the total impact of a deposit program on Maryland's GHG inventory would be minimal.

**Third**, every container recycled mitigates the effects of global climate change and conserves energy, and does so cost effectively. Although this study did not explicitly measure all costs and benefits associated with increased recycling, findings from previous studies demonstrate that recycling is a “no-regrets” mitigation policy with net savings for each unit of GHG emissions avoided. Recycling should not be discounted as a GHG strategy as it is very cost competitive.

## 1. Literature Review

This section presents background information relevant to Maryland's potential adoption of a beverage container deposit program. Specifically, we discuss (1) the relationship between container waste, greenhouse gas emissions and energy consumption; (2) Maryland's waste, greenhouse gas and energy profile; and (3) lessons from Maryland and other states relevant to the adoption of a beverage container deposit program. The information presented in this section is used to frame the methods for estimating greenhouse gas and energy impacts resulting from Maryland's adoption of a beverage container deposit program (see section 2).

### 1.1 Waste and Greenhouse Gas Emissions

Raw material extraction, container manufacturing, transportation, and end-use processing contribute to the greenhouse gas (GHG) emissions of containers. At each stage in the life cycle of a container, and waste products in general, there are opportunities to emit more or less GHGs depending on energy inputs, fuel combustion and material decomposition processes (USEPA, 2010a). Carbon dioxide and nitrous dioxide from fuel combustion, carbon dioxide from deforestation and methane from decomposition collectively contribute to GHG emissions from the waste sector.

In 2000, waste disposal and treatment accounted for 3.4 percent of global greenhouse gas (GHG) emissions (IPCC, 2007). Worldwide GHG emissions from landfills totaled 730.3 million metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) in 2000. This figure is expected to rise to 816.9 million MTCO<sub>2</sub>e by 2020 (USEPA, 2011). The U.S. emitted 130.7 million MTCO<sub>2</sub>e in 2000 or about 18 percent of the world total; by 2020, the U.S. is anticipated to emit 123.5 million



MTCO<sub>2</sub>e or a little over 15 percent of the global share (USEPA, 2010b). The U.S. alone produced and is projected to produce more GHG emissions from landfills than any other country and more than all of the EU-15 or China (USEPA, 2011).

Solid waste like that in landfills naturally produces gas as anaerobic breakdown of organic material occurs. This gas is usually composed of roughly 50 percent methane and 50 percent carbon dioxide along with a small amount of other gases. Methane has 23 times the global warming potential of carbon dioxide due to its long residence in the atmosphere and its ability to trap radiation (IPCC, 2007). In turn, methane is a particularly significant contributor to the waste sector's total GHG impact. Globally, more than 12 percent of methane emissions came from landfills in 2000 (USEPA, 2011).

There are ways that methane emitted from waste decomposition can be captured and utilized, diminishing the warming effect. Landfill gas can be used as fuel, as it is similar to natural gas, or flared prior to release, which converts methane into less harmful carbon dioxide. There are 11 landfills in Maryland that flare or capture methane, two of which are gas-to-energy facilities (MCCC, 2008). In addition to methane capture and flaring, other landfill characteristics influence GHG emissions. The composition of gases as well as the timing of release varies with the composition of the waste matter, amount of moisture, and design of the landfill. Landfills with more organic matter and with higher moisture content will produce greater quantities of methane at a faster rate (USEPA, 2010a). If there is a soil cover on top of the waste, this may oxidize some of the methane before it is released, instead releasing carbon dioxide (USEPA, 2010a). The subsection below describes in more depth the upstream and downstream factors that contribute to GHG emissions from waste, including beverage containers.



## 1.2 Factors Influencing GHGs and Energy Use

GHGs from beverage containers can be managed through source reduction, recycling and waste management. Source reduction, or consuming less material, is generally the most effective method of reducing GHGs. A prominent example of source reduction in the context of beverage containers is light-weighting or using less material to make each container. Resource extraction and container manufacturing are energy-intensive processes; by reducing the need for these processes through source reduction, GHGs are reduced in parallel (USEPA, 2010a; USEPA, 2010b). Source reduction also eliminates the need to transport beverage containers and process them in a landfill or incinerator. When beverage container material is source reduced, all associated GHG emissions are typically avoided.

After source reduction, recycling is the next best method for reducing GHGs. Recycled products are less carbon-intensive than new products because raw material extraction and manufacturing processes are displaced. Collecting, sanitizing and re-manufacturing containers requires energy and creates GHG emissions, which contrasts from source reduction. Like source reduction, however, recycled material does not enter the waste stream and emissions associated with incineration and landfilling are avoided (USEPA, 2010a).

Behind source reduction and recycling, trashing containers and placing them in the waste stream is the worst option in terms of GHG emissions and energy consumption. Bottle waste is typically directed towards a landfill or incinerator, although materials may be sorted prior to this stage as a means of recovering a valuable commodity (e.g., aluminum and steel). In terms of incineration, or burning waste for energy, glass and metal have little fuel value; plastic, because it is derived from petroleum, has significant fuel value. Emissions from incineration come from transportation and material combustion; emissions are avoided, however, from the electric utility sector and from any material recovery (e.g., metals) that might occur at the incinerator. The net impact incineration has on GHG emissions depends on the mix of municipal solid waste, the type of incinerator and material recovery technology. Most bottle material creates a net increase in GHG emissions with plastics emitting about 1.4 MTCO<sub>2</sub>e per short ton combusted, and aluminum and glass emitting about .04 MTCO<sub>2</sub>e per short ton combusted. Because steel burns at a high temperature and can usually be recovered and recycled post-combustion, there is a net avoidance of GHG emissions when steel is directed towards incineration, as opposed to a landfill (USEPA, 2010c).

For most types of waste, reducing the amount that is decomposed and/or capturing the methane before it is released into the atmosphere can have significant GHG reduction benefits. However, most container materials are non-biogenic, which means they are not readily decomposed and therefore do not create methane emissions when landfilled. Aluminum, glass, steel and plastic can reside in landfills for centuries without significant decomposition. For



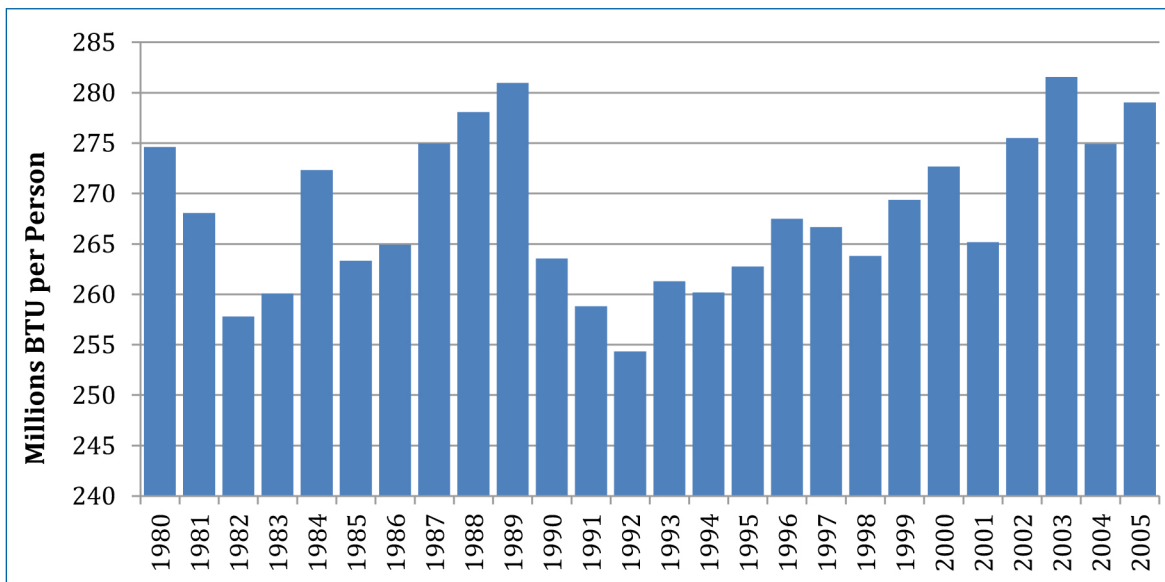
Photo Credit: Friends of Bread and Cheese Creek



beverage containers, it is insignificant whether or not a landfill has methane capture technology such as flaring or a waste-to-energy facility (USEPA, 2010d).

The U.S. EPA's Waste Reduction Model (WARM) is a decision-support tool for managing greenhouse gas emissions from waste. The WARM model provides a broad perspective of the GHG emissions attributed to a product by considering the product's entire life cycle. This includes the extraction of raw materials, its processing and manufacturing, the transportation involved, and the eventual disposal via landfill, incinerator, recycling or composting. The model was developed primarily for municipal solid waste managers; by using WARM, waste managers can analyze scenarios for reducing GHG emissions and deriving energy savings (USEPA, 2010a).

The WARM model considers three distinct stages of the life cycle: material acquisition, manufacturing and waste management. The model does not consider the period when the product is being used, so the final stage of the life cycle is disposal. WARM modifies calculations across the life cycle stages in accordance with the amount of recycling and source reduction (USEPA, 2010a). During the raw material extraction stage, WARM tracks fossil fuel consumption from machinery as well as the carbon impact from deforestation. Next, in the manufacturing stage, WARM captures the GHG emissions from the fossil fuel used to create the product as well as the raw energy embodied in the product. Last, WARM considers waste management, including transportation of material and waste processing (i.e., incineration vs. landfilling). Some of these emissions are offset by the storage of carbon in soil and landfills, in addition to the reduced emissions from using waste-to-energy facilities at landfills and incinerators (USEPA, 2010a).



**Figure 3.** Maryland per capita energy use (1980—2005) (Source: USDOE, 2009)

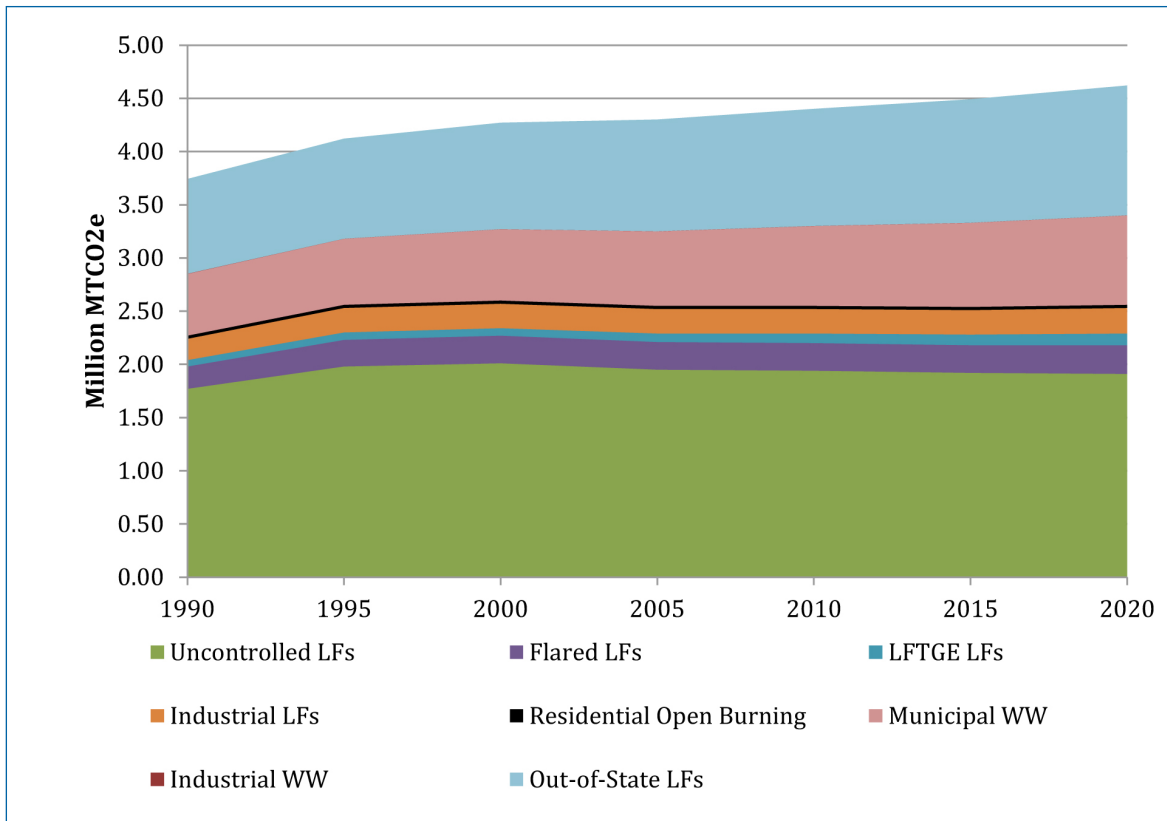
### 1.3 Maryland's Energy and GHG Profile

Maryland's current energy and GHG profiles are important context for considering the implications of a beverage container deposit program. In 2009, Maryland energy use was 403.7 trillion BTU in the residential sector, 403.5 trillion BTU in the commercial sector, 155.3 trillion BTU in the industrial sector, and 466.9 trillion BTU in the transportation sector (USDOE, 2009). From 1980 to 2005, Maryland experienced population growth and total energy consumption growth equal to 1.1 percent annually (USDOE, 2010). In the same time period, Maryland experienced economic growth at an average annual rate of 4.9 percent. During the 1980-2005 period, average annual per capita energy consumption remained relatively constant (see figure 1) (USDOE, 2010).

Figure 1 explains how during the 1980-2005 period of increasing population and economic output, GHG emissions in Maryland and the U.S. as a whole decreased per unit of state economic product (MCCC, 2008; USDOE, 2010). In 2005, Maryland's gross annual per capita GHG emissions was 19.7 tons of carbon dioxide equivalent or a slight increase from 19.3 in 1990 (MCCC, 2008). Nationally, gross annual GHG emissions per capita dropped between 1990 and 2005 from 24.6 to 24.0 tons of carbon dioxide equivalent (MCCC, 2008; USDOE, 2010).

In 2005, net Maryland GHG emissions were 97.8 million MTCO<sub>2</sub>e; a 16 percent increase from 1990 levels (MCCC, 2008). This is comparable to Maryland's population growth during the same time period. GHG emissions are projected to rise to 119.2 million MTCO<sub>2</sub>e by 2020, a 41 percent increase over 1990 levels. However, the 2008 economic downturn has likely diminished the accuracy of these projections.

Compared to the highest contributing sectors of Maryland’s GHG profile, output from waste is relatively small at around 4.3 million MTCO<sub>2</sub>e or about 3 percent of overall Maryland GHG emissions (MCCC, 2008). Similarly, GHG emissions from the entire U.S. waste sector account for 3 percent of the total. In 2005, Maryland’s GHG profile consisted of 45.9 million MTCO<sub>2</sub>e from electricity use (42 percent of gross GHGs), 32.5 million MTCO<sub>2</sub>e from transportation (30 percent), and 20.0 million MTCO<sub>2</sub>e from residential, commercial, and industrial fuel use (18 percent) (MCCC, 2008).



**Figure 4.** Maryland GHG emissions from waste management; LF = Landfill, WW = Waste Water, LFTGE = Landfill Gas to Energy (Source: MCCC, 2008)

“Waste Management,” as defined in the 2008 Maryland Commission on Climate Change GHG Inventory, includes municipal and industrial landfill, wastewater, and residential burning emissions. Note industrial wastewater treatment and residential open burning make up a very small portion of the total emissions with most waste-related GHG emissions coming from landfills and wastewater (MCCC, 2008).

Projected GHG emissions, especially concerning waste, have a significant level of uncertainty. Growth trends from 1990-2005 were used to predict future trends in the 2008 Maryland Commission on Climate Change analysis, but the availability of data in 2005 and the economic events since caution against extrapolating growth rates. Namely, the 2008 economic downturn has likely skewed Maryland’s waste generation trajectory and waste emplacement rates are susceptible to larger economic circumstances.



Additionally, policy could influence waste generation and recycling rates in Maryland. For example, the Maryland Recycling Act requires that 15-20 percent of municipal waste be reused, repurposed or recycled (discussed further below). This policy led to less waste being directed towards landfills over the past two decades, which resulted in lower levels of GHG emissions. Further complications to future waste GHG emission estimates include very limited data on industrial landfills and waste emplacement (MCCC, 2008). There are also technology dynamics at-play; as more landfills install material recovery technology and/or methane capture technology, emissions from waste would be expected to decrease. Last, methane emissions projections rely on EPA emission factor estimates that are highly contested (MCCC, 2008).

### *1.4 Maryland's Waste and Recycling Profile*

Established in 1988, the Maryland Recycling Act (MRA) directs the Maryland Department of the Environment to use management, education, and regulation to cut the state's solid waste disposal through increased recycling. One of the MRA's requirements is that each jurisdiction create and enforce a recycling program: governments with over 150,000 residents must recycle 20 percent of their waste and those with a population under 150,000 must recycle at least 15 percent. Under no circumstances can the recycling rate fall under 10 percent. Each jurisdiction is free to develop the details of its recycling program, but risks not receiving building permits for new construction if that jurisdiction fails to reach the minimum recycling requirements (MDE, 2008a). In addition to recycling requirements placed on local governments, the MRA also directs the state government to reduce its solid waste generation by 20 percent via recycling. Over the past two decades, the MRA has changed the profile and trajectory of Maryland's waste and recycling habits.

In 2006, Maryland accepted about 8.2 million tons of municipal solid waste into its permitted solid waste (MSW) facilities. This is not equivalent to the total amount of waste generated in Maryland, because some waste is disposed through littering, dumping, and other such means that are not reflected in the permitted waste facilities' numbers. Moreover, businesses working in Maryland are not required to disclose how much waste they generate (MDE, 2010). There are a total of 81 facilities in Maryland that handle solid waste: 24 MSW landfills, 14 non-MSW landfills, 9 incinerators, and 34 other transfer stations, processing facilities or special waste processing facilities. Not all facilities are in unique locations, however, as some locations provide different ways of handling waste. Fort Detrick, for example, manages a MSW landfill and a federal waste incinerator (MDE, 2010).

The MRA recycling rate in 2006 was 41.2 percent (MDE, 2007). Combining the 2006 source reduction rate of 3.5 percent with the recycling rate, the waste diversion rate equals 44.7 percent. Waste diversion is a more comprehensive measure of waste management that takes into account recycling and source reduction measures such as printing on reused paper. The

44.7 diversion rate surpassed the 40 percent goal for 2005 established by the MRA and improves upon previous years' diversion rates (MDE, 2007).

Maryland waste facilities disposed about 6.7 million tons of solid waste in 2006. This includes approximately: 4.5 million tons of MSW; 1.8 million tons of construction and debris waste; 26 thousand tons of land-clearing debris; 101 thousand tons of industrial waste; and 217 thousand tons of other waste such as medical waste, asbestos, scrap tires, sewer sludge, and non-MSW ash. The ash created from incinerated waste totaled about 10 thousand tons (MDE, 2007). The MRA legislation excludes from its scope, "scrap metal, land-clearing debris, construction and demolition debris, sewage sludge, and hospital waste" (MDE, 2008b, pg. 1).

Fifteen county governments in Maryland improved their waste diversion rates between 2005 and 2006. The counties adopted source reduction strategies such as digitizing processes, implementing compost sites, and promoting reuse practices in official publications. These jurisdictions also partnered with non-profit organizations for additional methods of increasing awareness of source reduction and the benefits of reuse over disposal (MDE, 2007).

Maryland has four general methods of handling its solid waste, including: exporting to another state, landfilling, recycling or reusing, and incineration. In 2006, Maryland exported about 2.8 million tons out of the state, 2.6 million of which was sent to Virginia. In 2006, Maryland landfills had a total capacity of 78.5 million tons and landfilled 2.5 million tons. At that rate of waste acceptance, a yearly disposal rate of about 2.3 million tons, and with no change in population or waste habits, there are 36 years available for solid waste landfilling in Maryland (MDE, 2007).

In 2006, the state's total weight of recycled or reused waste was 1.5 million tons, which amounts to 18.6 percent of the total waste accepted at state permitted facilities. However, as noted above, in 2006 the state's total recycling rate was 41.2 percent and its diversion rate 44.7 percent. This discrepancy stems from the former only including material accepted at permitted facilities, while the latter includes materials collected separately for recycling (MDE, 2007).

Maryland incinerated about 1.4 million tons of waste in 2006 (MDE, 2008a). Waste disposed of in this manner is sent to one of the state's nine furnaces or combustion facilities. The controlled heat destroys the waste, but leaves behind incinerator ash that also requires waste management. Ash may be used as an alternative material for covering landfills, especially convenient when the incinerator and landfill share the same location. Some incinerators harness the heat generated from this process via waste-to-energy facilities, providing an additional environmental and economic benefit (MDE, 2007).

There are two overall trends appearing in Maryland's waste and recycling profile: (1) the amount of waste generated annually is slowly decreasing, and (2) out-of-state waste exportation, as a



Photo Credit: Center for Watershed Protection

share of total waste processing, is growing. A number of factors may be contributing to the first trend including economic conditions, adoption of environmental norms among Maryland's citizenry, or the Maryland Recycling Act. Exporting waste is influenced by the fact that large out-of-state landfills can achieve greater efficiency than Maryland's smaller landfills; also, local governments may want to save their available landfill space. Whether waste exportation continues to grow, however, will depend on future fuel and transportation costs (MDE, 2007).

### *1.5 Maryland Beverage Container Deposit Experience*

In 2007, beverage container deposit legislation, with a 5¢ deposit value, was introduced to the Maryland House, but deemed unfavorable by the Environmental Matters committee. The bill's scope was more expansive than most, as it included all airtight beverage containers

less than one gallon and made of glass, aluminum, or plastic. Each container sold would include a 2¢ handling fee and all unredeemed deposits would return to the state for a Recycling Trust Fund (CRI, 2011a). Redemption centers would be certified by the state and each county would be required to set up and run at least one center (CRI, 2008a).

Maryland deposit program supporters altered their strategy in 2008 by proposing a bill for a feasibility study concerning a beverage container deposit system. The bill was reported unfavorable in both the state House and Senate. Similar bills were proposed in 2009 and 2010 with the same eventual result. In 2011, the state legislature passed a bill establishing a research task force composed of the Maryland Department of the Environment and the Department of Legislative Services. The task force will last from June 1, 2011 until December 31, 2011 and report its findings concerning the feasibility and best option for a Maryland beverage container deposit (Mock, 2011).

### *1.6 Lessons from Other States*

Ten states currently have deposit programs. Below we explore in-depth the experience from three states and highlight lessons of potential importance to Maryland.

## Michigan

After the success of deposit programs in Oregon and Vermont in the early 1970s, legislators in Michigan decided to implement their own beverage container deposit bill. The bill, implemented in 1978, placed a 10¢ deposit on beverage containers, double the predominant 5¢ deposit used elsewhere (CRI, 2009). One year after its implementation Michigan saw an 85 percent decline in “beverage-container roadside litter. . . as a result of mandatory deposits” (Porter, 1983, p. 178). Recycling participation was nearly universal, with an initial return rate of 95 percent in 1979. The reduction of beverage containers from the municipal solid waste stream amounts to a nearly 4.5 percent decrease from the annual 7 million tons of solid waste generated (Porter, 1983).

Michigan’s legislation initially provided for a deposit on plastic, metal, or glass containers of carbonated and mineral water, beer, and soft drinks. A 1989 amendment included wine coolers and canned cocktails (CRI, 2008b). Retailers are required to accept the return of any brand of beverage that their establishment sells, but only up to a daily \$25 refund per person (Legislative Council, 2009). Since the 1989 amendment, revenue earned by unclaimed deposits has been divided between the state and retailers: 75 percent goes to Michigan state environmental programs and 25 percent remains with the retailers (Committee on Environmental Preservation and Conservation, 2011). A 2004 law prohibits beverage containers “from being disposed of in a landfill” (Granholm & Humphries, 2010, p. 3). In addition, two laws were passed in 2008 to prevent fraudulent return of containers from out of state (Granholm & Humphries, 2010).

As the state with the highest deposit value and container return rate, Michigan has demonstrated a strong correlation between container deposit value and recycling rates. It is not the only factor, however, as Porter’s report shows that requiring retailers to accept the return of containers enabled the rapid growth in recycling rates throughout the state (1983). The convenience of every retailer being a beverage container return center may be the strongest explanatory factor for the high return rate, as the added accessibility makes even lesser deposits profitable to consumers.

## California

The California Legislature passed the Beverage Container Recycling and Litter Reduction Act in 1986, with the goal of recycling 80 percent of its beverage containers (Nelson, 2002). With the knowledge gained from other states’ experience, the California deposit program encompassed a wider range of beverages: all aluminum, glass, plastic or bi-metal containers of soft drinks, beer, malt, sports drinks, fruit drinks, water, coffee, tea, wine, and distilled spirits coolers were covered (CRI, 2009). All containers received a 1¢ deposit, which was amended three times: in 1990 containers less than 24 oz. received 2.5¢ and those above 24 oz. received 5¢; in 2004 the two deposits increased to 4¢ and 8¢; and in 2006 they again increased to 5¢ and 10¢ (CRI, 2009).

Beverage recycling growth rates were initially slow, as 1988 and 1989 saw 52 percent and 56 percent beverage container recycling rates, respectively. The next year, however, the recycling

rate jumped to 70 percent and until 1999 varied between 74 percent and 82 percent (Nelson, 2002). Facing declining recycling rates in the 2000s, California strengthened its deposit program with the aforementioned deposit increases plus an amendment that expanded the bill to all non-alcoholic beverages except for milk. California's 2010 container redemption rates include an overall rate of 82 percent, 94 percent of aluminum, 95 percent of glass, and 68 percent of PET plastic bottles (CRI, 2009).<sup>177</sup>

California is unique in its two deposit value system based on container size, although Maine and Vermont do have different deposit values for alcohol and non-alcoholic beverage containers (CRI, 2009). Another distinct feature is its redemption system: California uses a public-private partnership that includes a state oversight agency and private redemption facilities (Nelson, 2002). Unlike Michigan, California retailers are not required to accept containers, but Michigan's requirement does provide more places to recycle per citizen. This was likely a concession for California businesses, but may serve as a negative factor in the state's recycling rate. All of the state's unclaimed deposit revenue is used for program administration and for grants to non-profit organizations (CRI, 2009).

In 2009, California recycled 17.3 billion beverage containers. Although California provides the most recycling in the U.S. in terms of the total amount of beverage containers, the state could still improve its recycling rate by increasing the number of available recycling centers and raise its PET bottle-recycling rate.

## Delaware

Delaware was one of the last states to initiate a deposit program during the period of adoption between 1970 and the early 1980s. Its 1983 implementation was unique in that it excluded aluminum cans; all other containers under two quarts that contained beer, ale, malt, soft drinks, mineral water, or soda water received a 5¢ deposit (CRI, 2011b). The distributors retained all unredeemed deposits. Recycling rates, however, did not match the rates seen in other states with deposit programs. Vermont, a state with over one hundred thousand fewer residents, recycled 334 billion containers in 2006 compared to Delaware's 143 billion (Hoy, 2009). In 2010, the recycling rate for bottles in Delaware was just 12 percent (Carini, 2010). Even surrounding states without deposit programs had higher recycling rates (State of Delaware, n.d.).

In 2010, with unsatisfactory results and political pressure to improve recycling rates, Delaware became the first state to repeal its deposit program (Lou, 2010). Replacing the 5¢ deposit was a 4¢ fee, levied on the same containers as the deposit program. Revenue generated from the fee – which will remain until December 1, 2014 – will be used in a universal recycling program. It is not yet certain whether this change from a deposit to a fee will improve recycling rates, as there

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<sup>177</sup> PET is polyethylene terephthalate; the other common plastic bottle type is HDPE or high-density polyethylene



is now no financial incentive for consumers to recycle. Furthermore, the continued exclusion of aluminum cans under the new law is a feature that may suppress recycling rates. The scrap value for a container of aluminum is 2.48¢ compared to 0.11¢ with glass and 1.23¢ for plastic (Chavez, et al., 2011). By withholding aluminum from the container deposit system and the beverage fee, Delaware excludes the largest revenue generating material from its bottle bill.

### *Overview of Lessons*

Studying the history of deposit programs in Michigan, California, and Delaware provides several findings that could prove useful for Maryland legislators as they consider whether a beverage deposit program makes sense for the state. **First**, there is a strong correlation between deposit value and the container-recycling rate. Michigan has the highest overall deposit value as well as the highest container recycling rate. California experienced higher recycling rates after increasing its deposit value three times since its initial 1¢ value. However, a high deposit value may encourage fraud and abuse, especially by nearby states that do not have a deposit programs. Fraud prevention measures include Michigan's individual daily limit of \$25 deposit redemptions and California's state oversight agency.

**Second**, a comprehensive list of acceptable beverage types the deposit is applicable to improves the recycling rate. An inclusive list of acceptable beverages will encourage recycling because citizens do not have to distinguish among recyclable and non-recyclable containers. In general, most states began with a small set of acceptable materials and strengthened their legislation over time to include new beverage types and materials. Maryland legislators should



be comprehensive in any initial bill and be prepared to add new beverage types to the deposit program as they emerge on the market.

**Third**, as indicated by Delaware's deposit program, its eventual end, and its conversion to a recycling fee, aluminum is critical. Excluding aluminum allows recycling centers to retain the lucrative scrap metal and lessens the political burden of a deposit program to these entities. Nonetheless, without aluminum containers, Delaware experienced a lower recycling rate than its neighbors without a deposit program. Delaware's experience with a failed program is not solely due to aluminum exclusion, but is surely a prominent factor. As the results in section 3 demonstrate, inclusion of aluminum in a deposit program will have significant implications for energy consumption and GHG emissions.

**Fourth**, requiring vendors to accept the return of beverage containers is important. This requirement increases the ease and convenience of recycling, which may explain Michigan's increase to 95 percent recycling of beverage containers immediately following bill implementation. California, on the other hand, did not have this requirement and instead relies on private recycling facilities monitored by a public oversight agency. California saw slower growth in recycling rates, a lower maximum recycling rate of 82 percent, and a fluctuating recycling rate between 74 and 82 percent. The added costs to businesses associated with installing and maintaining a redemption center must also be considered.

**Fifth**, unredeemed deposits will create a new revenue stream for a state implementing a deposit program. It should be emphasized, however, that revenue does not equate to profit, as program establishment and operational costs must be considered. Many states use unredeemed bottle deposit revenue to cover the costs of administering the recycling program, while others return these funds to the distributors (CRI, 2009). Michigan, California, and Hawaii use the revenue for environmental and non-profit initiatives, respectively. Any new revenue expected to accrue from a Maryland deposit program must be balanced against program costs. In addition to the need to balance programmatic costs against the potential for unclaimed deposit revenues, reliance on these funds to support other programs is in discord with any goal of reducing GHGs. GHG reduction is maximized with higher redemption and, in turn, recycling rates, while revenue generation is maximized with lower redemption rates.

## *1.7 Summary*

Maryland's adoption of a deposit program will have an impact on GHG emissions and energy consumption. Accounting for these impacts in the full balance of costs and benefits will facilitate a comprehensive evaluation of a possible deposit program.

The life cycle of a container includes extraction of raw resources, manufacturing, transportation, and proper disposal. GHG and energy impacts vary depending on each of these life cycle stages and the particular processes adopted. In general, GHG emissions from containers are a product of fuel combustion (e.g., for transportation or manufacturing), with negligible GHGs from material decomposition, as most container material is non-biogenic (USEPA, 2010a). Some amount of GHG emissions will be created as a result of deforestation, which may be performed during the course of mineral extraction.

Worldwide, GHGs from waste disposal are a little over 3 percent of total emissions and this figure is expected to increase in the coming decade (IPCC, 2007). In Maryland, emissions from waste disposal also account for about 3 percent of the state's overall emissions; recycling and source reduction in Maryland has been steadily increasing over the past two decades, and with a continuation of this trend, waste related GHG emissions in the state should decrease (MDE, 2010). Maryland's waste sector interacts with energy on several fronts: (1) fuel is needed to transport waste; (2) incinerators and waste to energy facilities displace the need for conventional fuels from utilities; and (3) energy is needed in manufacturing processes to make consumer goods, including bottles and cans.

Container material is an important factor in the context of GHGs and energy. For example, aluminum requires significant energy to manufacture and among common bottle materials, only plastic can be combusted in an incinerator (USEPA, 2010a). Market dynamics and government policy, such as the Maryland Recycling Act, dictate the mix of bottle material will not be fixed and neither will the processes for manufacturing, transporting and disposing of containers. Factors such as scrap metal prices, adoption of material recovery technology and citizen norms in favor of recycling can have indirect impacts on GHG emissions and energy consumption. The dynamic context in which Maryland container management occurs complicates measurement of potential deposit program impacts on GHGs and energy.

In general, assuming all collected materials are recycled as intended, deposit programs lead to higher recycling rates because of the deposit return value. In turn, more recycling leads to displacement of energy-intensive extraction and manufacturing processes and avoidance of GHG emissions (USEPA, 2010a). However, the precise manner in which recycling rates will change over time and across material types is uncertain. Lessons from other states indicate that high deposit values lead to higher return rates (Porter, 1983) and that aluminum and glass are often recycled at higher rates than plastic in states with a deposit program (CRI, 2011c). Drawing from the lessons of other states, and Maryland's own recycling and waste profile, we present methods for determining GHG and energy impacts resulting from Maryland's adoption of a beverage container deposit program in the following section.

## 2. Methods

The following analysis examines how Maryland’s adoption of a deposit program will influence energy consumption and GHG emissions. The analysis looks at five types of materials commonly used in beverage containers including aluminum, steel, PET plastic, HDPE plastic and glass. Additionally, the analysis assumes all carbonated, non-carbonated alcohol and non-alcoholic beverage containers are eligible for redemption.

### 2.1 Scope and Summary

Using a baseline scenario consisting of no Maryland deposit program (current situation) and alternative scenarios where a deposit program is in place, we quantify the incremental change in GHG emissions and energy consumption. Estimation of GHG impacts accounts for the entire life cycle of containers including raw material acquisition, manufacturing, transportation, and waste management. Estimation of energy impacts accounts for the entire life cycle as well including embedded and transportation energy (discussed further below). It should be emphasized that because we consider the entire life cycle of containers, and some life cycle stages such as material extraction and manufacturing occur outside of Maryland, a portion of the GHG and energy impacts will fall outside of Maryland (see section 4 for more information).

Our analysis is static in that we assume constant beverage consumption, transportation distance, material costs, and mix between landfill and incinerator processing, among other factors. Maryland-scale, material-level data are available for 2006 only, and these data serve as the foundation for both baseline and alternative scenarios. The only variable across scenarios and the key factor influenced by the deposit program is the material-specific recycling rate. A summary table of scenarios and parameters of analysis appears below (scenarios discussed in more detail below).

	<b>Beverage Sales/ Consumption (Tons)</b>	<b>Recycling Rate (Percent by weight)</b>	<b>Non-recycled Waste Mix (Percent towards method by weight)</b>
Baseline Scenario	264,000	Varies by material type	61 landfill; 39 incinerator
Alternative Logistic Scenario	264,000	Varies by material type and over time	61 landfill; 39 incinerator
Alternative High Scenario	264,000	85 percent for all materials	61 landfill; 39 incinerator
Alternative Middle Scenario	264,000	75 percent for all materials	61 landfill; 39 incinerator
Alternative Low Scenario	264,000	65 percent for all materials	61 landfill; 39 incinerator

**Table 1.** Summary of parameters and analysis scenarios (highlight of recycling rate variance)

## 2.2 Data

The weight of containers sold and recycled in Maryland by material type – including, aluminum, steel, PET plastic, HDPE plastic and glass – were attained from the Container Recycling Institute (CRI). Data are available for 2006 and were generated via the Beverage Market Data Analysis (BMDA), performed by the CRI. The BMDA compiled Maryland-level sales figures through data acquired from the Beverage Marketing Corporation and the Beer Institute; Maryland recycling and waste generation rates for 2006, by individual material type were estimated based on the national recycling rates, state population figures and sales figures (CRI, 2008c).

In addition to sales and recycling data provided by CRI, waste diversion publications from the Maryland Department of the Environment are used in this analysis. Namely, annual Maryland Solid Waste Management and Diversion Reports (MSWMDR) are used to corroborate CRI data, identify levels of source reduction and characterize Maryland waste disposal practices. Two key metrics were derived from the 2010 MSWMDR. First, the mix of disposal methods for nonrecycled materials in the state is estimated to be 61 percent by weight towards landfills and 39 percent by weight towards incineration (MDE, 2010). Second, the average source reduction credit across all Maryland counties is 3.5 percent for the period 2006-2009 (MDE, 2010).

## 2.3 Estimation of Container Diversion

Beginning with the CRI data, we adjust total sales weight figures to account for the Maryland average source reduction credit. Each county earns the source reduction credit independently with credit levels fluctuating depending on the adoption of source reduction activities (MDE, 2010). The Maryland source reduction credit is not included in the CRI-provided data. By accounting for the source reduction credit we expect to approximate Maryland's waste diversion rate, as opposed to simply its recycling rate. For our purposes, an across-the-board reduction of 3.5 percent is applied to all container sales (see table 2).

Next, using CRI-provided Maryland recycling rates for each material type, we estimate the total weight of containers going towards recycling (see table 2). According to the 2010 MSWMDR, the statewide recycling rate for all materials (including beverage containers) was 41 percent in 2006, 44 percent in both 2007 and 2008, and 39 percent in 2009 (MDE, 2010). However, beverage containers account for a small portion of the overall recycling rate due to their relative light weight – “containers comprise approximately 3.5% of the municipal waste stream (MDE, 2008b, pg. 2).” The Maryland Department of the Environment estimated the total recycling rate for all containers was equal to 47 percent in 2005, but data are unavailable at the level of material types (MDE, 2008). Divergence between the CRI-provided recycling rates and the MDE overall rate signals one potential source of error in the analysis (see section 4 below).



With estimates of total beverage container weight going towards recycling, we allocate how non-recycled beverage containers are diverted upon entering the waste stream. We adopt an assumption that 61 percent of the containers entering the waste stream go into a landfill and 39 percent of containers are incinerated, which parallels the statewide average mix of waste disposal (MDE, 2010). A critical assumption of this methodology is that all beverage container recycling occurring in Maryland is captured by the overall material recycling rate calculation and that any material recovery and subsequent recycling performed at transfer sites, landfills or incinerators is included in that overall recycling rate. Also, note that we do not consider how containers are processed at landfills (e.g., methane capture, waste-to-energy facilities) because all of the materials under analysis are non-biogenic. Table 2 shows the total baseline weight of materials sold and how materials were directed towards recycling, landfills and incineration.

	Aluminum Cans	Steel Cans	PET Bottles	HDPE Bottles	Glass Bottles
Quantity sold (Tons)	24,601	125	59,360	4,765	184,715
Quantity sold, adj. for source reduction (Tons)	23,740	121	57,282	4,599	178,250
Post-Consumption					
Baseline Recycling Rates (%)	35.1%	63.4%	13.6%	20.6%	12.4%
Quantity Recycled (Tons)	8,328	76	7,788	947	22,161
Quantity Incinerated (Tons)	5,992	17	19,242	1,420	60,682
Quantity Landfilled (Tons)	9,420	27	30,253	2,232	95,407

**Table 2.** Baseline (2006) Maryland beverage container sales, recycling rates, and waste pathways

Maryland exports a significant portion of its waste out of state. In 2009, 1.9 million tons of municipal solid waste or 36 percent of the waste generated in Maryland was processed outside of Maryland (MDE, 2010). Exported waste is Maryland’s responsibility and as such is included in its greenhouse gas inventory (MCCC, 2008). For the purposes of the current analysis we assume that all waste exported out of Maryland, including non-recycled beverage containers, is processed in a manner identical to waste processed within the state.

### 2.4 Beverage Container Deposit Program Impact on Recycling Rates

As indicated in section 1, we expect adoption of a deposit program in Maryland to influence recycling rates, which will in turn significantly influence greenhouse gas emissions and energy consumption. The impact of a Maryland deposit program on recycling rates is uncertain. Depending on how the legislation is constructed (e.g., deposit value), market dynamics (e.g., price of scrap aluminum) and consumer receptivity, the deposit program could result in a range of recycling rate changes. Moreover, the change in recycling is unlikely to be uniform across

time or material types. Although changes in recycling rates are difficult to predict, at least three general patterns gleaned from other states' experiences are expected to manifest in Maryland:

1. Assuming the US average deposit value (~ 5¢), recycling will increase at a slower rate in the short-term and a faster rate in the intermediate-term, (Porter, 1983; CRI, 2009);
2. In the long-term, recycling rates will level-off; the level at which recycling rates stop increasing is likely correlated with the deposit value (e.g., Michigan has a 95 percent return rate and a deposit value equal to 10¢ per container) (Porter, 1983; CRI, 2009);
3. The level at which recycling rates level-off varies by material-type; high-value materials such as aluminum and steel typically see a higher rate of recycling than relatively low-value materials such as plastic. This occurs whether or not a deposit program is present (see baseline recycling rates in table 2) (CRI, 2011c).

As a result of these assumptions, we expect the change in recycling rates to be S-shaped with slow early increases in recycling rates, followed by rapid increases, and concluding with a leveling off as the policy matures. We develop a mathematical model to forecast changes in recycling rates over time and across materials that corresponds with the above assumptions. To do so we assume logistic growth in the recycling rates and apply the following equation:

$$RR_m = [K * B_0 * e^{R * t}] / [K + B_0 * (e^{R * t} - 1)]$$

Where  $RR_m$  is the recycling rate for a given material,  $K$  equals the upper limit or the level at which the recycling rate plateaus,  $B_0$  equals the baseline material recycling rate or the current recycling rate,  $R$  equals the average growth rate, and  $t$  equals years after bill adoption. We assume an average growth rate equal to 1 and estimate  $RR_m$  for each  $t$  equal to 1-12; in other words, we estimate recycling rates over a twelve-year period.  $K$  and  $B_0$  vary by material with  $K$  equal to .75 for aluminum

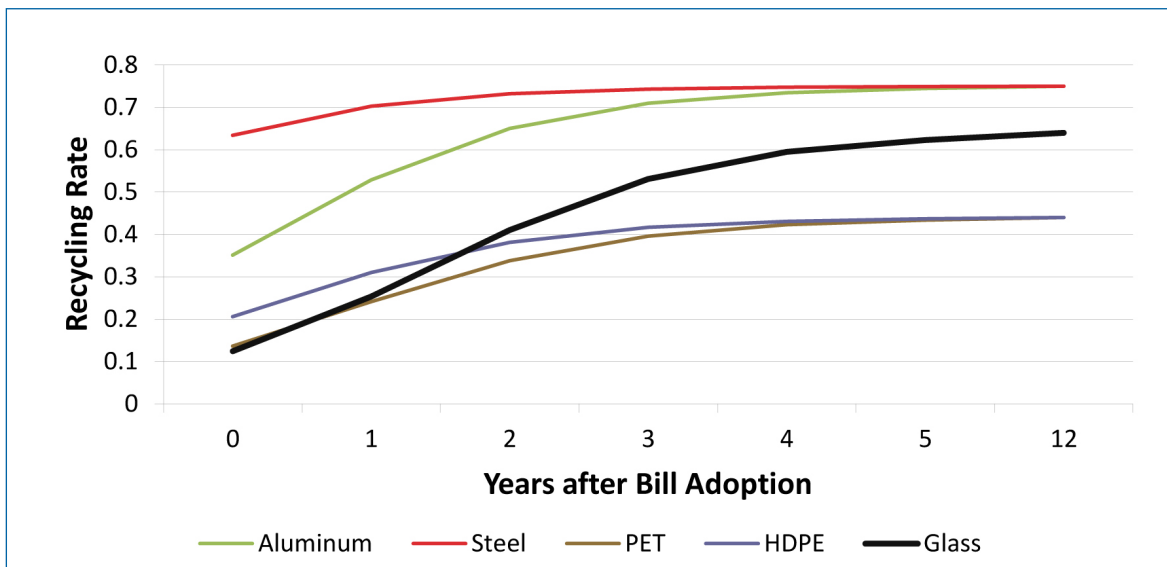


Figure 3. Forecasted recycling rates over time by material

and steel, .44 for PET and HDPE plastic and .64 glass, and B0 equal to the baseline recycling rates presented in table 1. The values for K represent the average recycling rates by material across the 10 states with deposit programs (CRI, 2011c). The results of this model are demonstrated in figure 3.

We anticipate logistic growth will closely resemble changes in Maryland's beverage container recycling rates should a deposit program be adopted. However, as a point of reference, we examine three additional recycling rate scenarios. Specifically, we consider low, middle and high recycling rates equal to 65, 75 and 85 percent, respectively, across all materials. Under these alternative scenarios we do not consider gradual changes over time or variability across materials, but simply assume an instantaneous transition where all container materials are recycled at the new alternative rates.

## *2.5 Estimating Greenhouse Gas Emission and Energy Impacts*

To estimate impacts on GHG emissions and energy consumption resulting from adoption of a deposit program and subsequent changes in recycling rates, we rely on the U.S. Environmental Protection Agency's Waste Reduction Model (WARM) (see section 1 for more information). WARM is a decision-support tool for managing GHGs from waste. The model, recently updated in 2010, accounts for all material types relevant to the current analysis; the model inputs are total material weight directed towards each waste management pathway (i.e., recycled, incinerated, landfilled). Outputs of the WARM model include greenhouse gas emissions in metric tons of carbon dioxide equivalent or  $\text{MTCO}_2\text{e}$  per material type (USEPA, 2010a). WARM accounts for GHG emissions from the entire life cycle, including:

- Raw material acquisition
- Product manufacturing
- Product use, reuse and recycling
- Waste pick-up and transportation
- Methods of waste management (i.e., composting, incinerated and landfilled)

The WARM model offers multiple options for adjusting waste management processes as a means for evaluating impacts on GHG emissions. For example, the WARM model allows users to adjust the average transportation distance for waste and to modify methane capture practices (e.g., flaring vs. waste-to-energy). However, due to a lack of data and the fact that the materials under consideration do not create methane emissions in decomposition, we do not use these supplemental options and instead run the model under its default settings for all scenarios.

We assume the deposit program does not directly lead to source reductions of any sort; the total quantity of beverage container material sold (consumed) is constant across all scenarios. Nonetheless, increased recycling rates impacts how containers are produced – from virgin or recycled material inputs – and in turn, impacts emissions from raw material acquisition and product manufacturing (USEPA, 2010a). Using recycled aluminum, as opposed to mining and producing virgin aluminum inputs,

has a significant impact on energy consumption and GHG emissions. The WARM model accounts for these upstream changes in greenhouse gas emissions. To estimate changes in GHG emissions under the baseline and alternative scenarios we input total weight figures, by material, going towards recycling and other waste pathways, into the WARM model, which generates MTCO<sub>2</sub>e outputs.

To estimate changes in energy consumption under the baseline and alternative scenarios, we use WARM-developed energy factors. Energy factors are based, “primarily on the amount of energy required to produce one ton of a given material (USEPA, 2010b, pg. 1).” The total energy required to manufacture a material, also known as the embodied energy, includes the energy used in transportation and extraction, as well as the embedded energy. “Embedded energy is the energy inherently contained in the raw materials used to manufacture the product (USEPA, 2010b, pg. 1).” We apply the energy factors associated with recycling one ton of material, expressed in millions of BTU per ton of material recycled, to calculate energy savings in the baseline and alternative scenarios (see table 3).

	<b>Aluminum Cans</b>	<b>Steel Cans</b>	<b>PET Bottles</b>	<b>HDPE Bottles</b>	<b>Glass Bottles</b>
Quantity Recycled (Tons)	8,328	76	7,788	947	22,161
Energy Factor (Million BTU/Ton Recycled)	206.42	19.97	.83	50.9	2.13
Energy Savings (Billion BTU)	1,719.0	1.5	411.4	48.2	47.2

**Table 2.** Baseline (2006) Maryland beverage container sales, recycling rates, and waste pathways

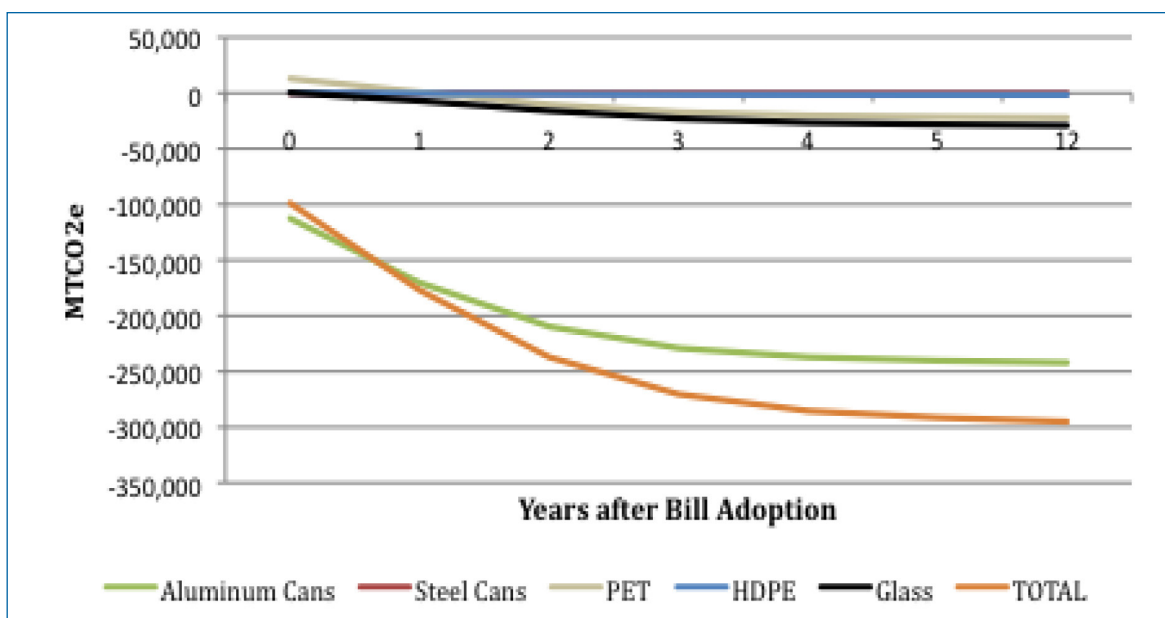
### 3. Results

We find that adoption of a beverage container deposit program in Maryland, and a subsequent increase in container recycling, will result in GHG reductions and energy savings.

#### 3.1 GHG Impacts

Maryland’s current beverage container recycling patterns, or the baseline for this analysis, creates significant avoided GHG emissions. Under adoption of a deposit program, and applying the logistic scenario described above, we find an additional 295,000 MTCO<sub>2</sub>e/year of GHG emissions will be avoided after 12 years, relative to the baseline.

As indicated by figure 4, aluminum heavily influences changes in GHG emissions. Aluminum is very energy-intensive to produce and it contains significant embedded energy. As recycling rates increase, and scrap aluminum displaces the need to manufacture virgin aluminum, a substantial decrease in energy consumption and GHG emissions occurs. Maryland’s potential deposit program GHG impacts will be dominated by aluminum, which accounts for more than 80 percent of the avoided emissions 12 years after adoption of a deposit program. Compared to the influence aluminum has on GHG emissions, steel, plastic and glass materials have an almost negligible effect (see table 4).



**Figure 4.** Forecasted GHG emissions (MTCO<sub>2</sub>e) over time, by material; negative values indicate avoided emissions while positive values indicate actual emissions

	Aluminum Cans	Steel Cans	PET Bottles	HDPE Bottles	Glass Bottles	Total
<i>Baseline</i>						
Emissions (MTCO <sub>2</sub> e)	-112,663	-163	12,974	498	404	-98,950
<i>Logistic – Year 1</i>						
Emissions (MTCO <sub>2</sub> e)	-170,340	173	793	-399	-6981	-177,101
Difference from Baseline (MTCO <sub>2</sub> e & % Change)	-57,677 (-51%)	-10 (-6%)	-12,181 (-94%)	-897 (-180%)	-7,385 (-1,828%)	-78,151 (-79%)
<i>Logistic – Year 3</i>						
Emissions (MTCO <sub>2</sub> e)	-229,068	-179	-17,058	-1,312	-22,836	-270,454
Difference from Baseline (MTCO <sub>2</sub> e & % Change)	-116,405 (-103%)	-16 (-10%)	-30,032 (-231%)	-1,810 (-363%)	-23,240 (-5,752%)	-171,504 (-173%)
<i>Logistic – Year 5</i>						
Emissions (MTCO <sub>2</sub> e)	-240,258	-180	-21,397	-1,486	-28,109	-291,429
Difference from Baseline (MTCO <sub>2</sub> e & % Change)	-127,595 (-113%)	-17 (-10%)	-34,371 (-265%)	-1,984 (-398%)	-28,513 (-7,058%)	-192,479 (-195%)
<i>Logistic – Year 12</i>						
Emissions (MTCO <sub>2</sub> e)	-242,107	-180	-22,150	-1,514	-29,104	-295,055
Difference from Baseline (MTCO <sub>2</sub> e & % Change)	-129,444 (-115%)	-17 (-10%)	-35,124 (-271%)	-2,012 (-404%)	-29,508 (-7,304%)	-196,105 (-198%)

**Table 4.** Greenhouse gas emissions per year under baseline and logistic scenario (Years 1, 3, 5 & 12); highlight in **red** indicates actual emissions, otherwise avoided GHG emissions



Photo Credit: Waterfront Partnership



Similar results emerge for the additional alternative scenarios, which apply a 65, 75 and 85 percent recycling rate across all materials (see table 1). Avoided GHG emissions for the three scenarios totals approximately 290,000, 340,000, and 390,000 MTCO<sub>2</sub>e, for the low, middle and high scenarios, respectively. The 65 percent recycling rate (low) scenario is comparable to the logistic scenario in that final GHG emissions are about 191,000 MTCO<sub>2</sub>e below the baseline or slightly less than a 200 percent increase in avoided emissions from beverage containers.

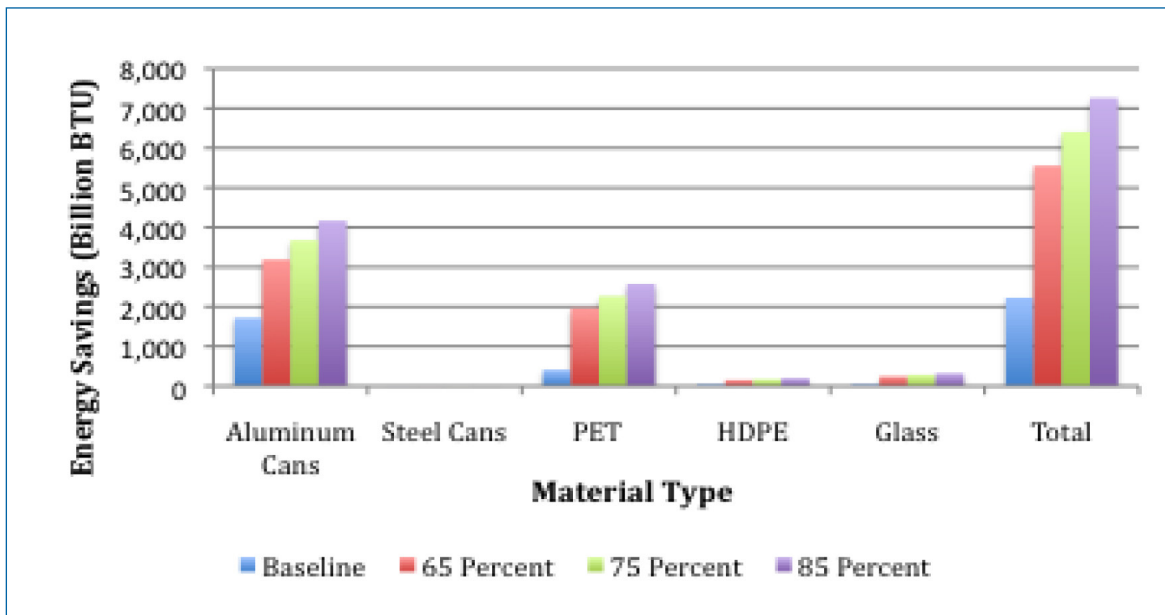
### *3.2 Energy Impacts*

Maryland currently saves about 2.2 trillion BTUs of energy per year as a result of its recycling practices. Under adoption of a deposit program, and applying the logistic scenario, we find an additional 3.1 trillion BTUs of energy or 5.3 trillion in total, could be saved after 12 years of implementation (see table 5). Energy savings are primarily dictated by aluminum recycling. Small increases in the amount of aluminum recycled can have significant impacts on energy consumption. After aluminum, PET plastic bottles have the greatest influence over energy savings. Together, aluminum and PET plastic account for approximately 31 percent of total container material by weight sold in Maryland. Glass, which has an energy factor of just 2.13 million BTUs saved per one ton recycled, accounts for 68 percent of the container weight sold in Maryland.

Under each of the alternative scenarios consisting of 65, 75 and 85 percent recycling rates, the total energy savings exceed both the baseline and the logistic scenario. Total energy savings are 5,500, 6,400, and 7,200 billion BTU/year for the 65, 75 and 85 percent recycling rate scenarios, respectively (see figure 3).

	Aluminum Cans	Steel Cans	PET Bottles	HDPE Bottles	Glass Bottles	Total
<i>Baseline</i>						
Energy Savings (Billion BTU)	1,719.0	1.5	411.4	48.2	47.2	2,227.3
<i>Logistic – Year 1</i>						
Energy Savings (Billion BTU)	2,590.7	1.7	730.5	72.6	96.2	3,491.7
Difference from Baseline (Billion BTU & % Change)	871.7 (50.7%)	0.2 (13.3%)	319.1 (77.6%)	24.4 (50.6%)	49.0 (103.8%)	1,264.4 (56.8%)
<i>Logistic – Year 3</i>						
Energy Savings (Billion BTU)	3,478.2	1.8	1,198.1	97.5	201.4	4,977.0
Difference from Baseline (Billion BTU & % Change)	1,759.2 (102.3%)	0.3 (20.0%)	786.7 (191.2%)	49.3 (236.4%)	154.2 (326.7%)	2,749.7 (123.5%)
<i>Logistic – Year 5</i>						
Energy Savings (Billion BTU)	3,647.3	1.8	1,311.8	102.2	236.4	5,299.5
Difference from Baseline (Billion BTU & % Change)	-1,928.3 (112.2%)	0.3 (20.0%)	900.4 (218.9%)	54.0 (112.0%)	189.2 (400.8%)	3,072.2 (137.9%)
<i>Logistic – Year 12</i>						
Energy Savings (Billion BTU)	3,675.2	1.8	1,331.5	103.0	243.0	5,354.5
Difference from Baseline (Billion BTU & % Change)	1,956.2 (113.8%)	0.3 (20.0%)	920.1 (223.7%)	54.8 (113.7%)	195.8 (414.8%)	3,127.2 (140.4%)

**Table 5.** Energy savings per year under baseline and logistic scenario (Years 1, 3, 5 & 12)



**Figure 3.** Energy savings under the baseline and 3 alternative recycling scenarios

## 4. Discussion

This section summarizes findings, restates important assumptions, and considers future research related to Maryland's recycling patterns and the potential adoption of a deposit program.

### *Key Findings*

Maryland's adoption of a deposit program would have GHG and energy saving impacts. Regardless of how legislation is structured or the pace of implementation, adoption of a deposit program will likely lead to increased recycling rates and subsequent energy savings and avoidance of GHG emissions. The magnitude and timing of these benefits, however, will depend on the details of the legislation. Specifically, inclusion or exclusion of aluminum cans under the deposit program will have significant impacts. Including aluminum will more than double the expected energy savings and avoided GHG emissions. Additionally, based on the experience of other deposit program states, a high deposit value for containers would be expected to result in significantly higher recycling rates and rates would increase rapidly within the first few years of adoption. Avoided GHG emissions and energy savings would rise in parallel.

It is critical that decision-makers understand that the totality of GHG emissions reductions and energy savings presented in this analysis would not accrue in Maryland. Only a portion of the GHG emissions reductions and energy savings would actually show up on Maryland's ledger. Life cycle stages performed outside of Maryland, for example, resource extraction, would not influence Maryland's GHG inventory or overall energy consumption. Because resource extraction and manufacturing of aluminum significantly influences energy use and GHG emissions, and assuming these processes primarily occur outside of Maryland, the state will receive only a portion of the overall energy and GHG reduction benefits. Nonetheless, every container recycled in Maryland will help mitigate global climate change and conserve energy.

Although the magnitude of GHG reductions resulting from an increase in beverage container recycling would be small relative to Maryland's overall waste emissions, recycling remains a highly cost-effective measure for GHG abatement. A comprehensive study of GHG mitigation costs in the United Kingdom's waste sector found that recycling metal and glass was the most cost effective option in terms of its marginal cost (e.g., \$/MTCO<sub>2</sub>e avoided) (Hogg et al., 2008). This outcome is due to the fact that recycling often results in social benefits external to GHG mitigation such as energy savings, waste reduction, and decreased air pollution; there are also private benefits such as more low-cost recycled material. In other words, recycling is a no-regrets GHG mitigation policy in that the overall benefits typically outweigh the costs (Hogg et al., 2008).

Last, we present differences between the current study and the 2010 CM Consulting study, *Quantifying Potential Impacts of a Bottle Bill in the State of Maryland, USA* (Morawski, 2010). Overall, the current study and the 2010 study are very similar as both rely on data from the

Container Recycling Institute and utilize the U.S. Environmental Protection Agency's WARM model. Furthermore, both the current study and the 2010 study conduct multiple scenarios evaluating how variable recycling rates, induced by a deposit program, could impact GHG emissions. A major difference between the studies is that the current study considers the logistic scenario, which forecasts gradual changes in material-specific recycling rates over time. The 2010 study presents only static models characterized by a before and after snapshot of GHG emissions; the current study attempts to model the intermediate GHG impacts along the path to full implementation. Additionally, the 2010 study assumes uniform recycling rates across all materials before and after a deposit program (i.e., 30 percent status quo recovery rate) while the current study applies variable recycling rates depending on the material. The results of the current study are not dissimilar from those of the 2010 study. Specifically, both studies find that the incremental increase in avoided GHG emissions would be in the range of 195-270 thousand MTCO<sub>2</sub>e per year depending on the scenario.

## *Assumptions*

Due to data limitations, we made a number of assumptions as part of our beverage container deposit program analysis. The results of our research are subject to these assumptions and we would expect the results to change along with modifications to the assumptions. In turn, it is critical that we restate a few critical assumptions, including:

1. Adoption of a deposit program in Maryland will change container recycling in a logistic manner where the rate slowly increases at first, then accelerates and finally reaches a limit;
2. The peak recycling rate varies by material; the aluminum and steel recycling rate is highest, followed by plastic, and finally glass;
3. The share of container waste going towards incineration and landfills is 39 and 61 percent, respectively, under a baseline and deposit program scenario;
4. Waste containers transferred out of Maryland are accounted for as if they were in the state;
5. Across years of analysis and scenarios, we assume constant beverage container sales, transportation patterns, and upstream manufacturing and extraction practices per the WARM model.

## *Future Research*

There are multiple avenues for expanding knowledge into the impacts, limitations and opportunities of a Maryland beverage container deposit program on energy consumption and GHG emissions. Of critical importance, more data including time series and geospatial data from Maryland and throughout the U.S. should be collected and used to more accurately estimate the relationship between deposit programs and recycling rates. With high quality data,



insights into the effectiveness of deposit programs and elements for making a potential Maryland deposit program as successful as possible could be explored. For example, this analysis might take into account the price of scrap metal as it fluctuates in the market and its corresponding influence on recycling in deposit and non-deposit states alike.

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Photo Credit: Anacostia Watershed Association



## Appendix B: ECONorthwest Framework



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To: Jen Cotting, Environmental Finance Center  
From: Kristin Lee and Terry Moore  
Date: December 13, 2011  
Re: Task 1: Framework for Economic Analysis of a Maryland Bottle Bill

### Overview

The State of Maryland wants some assessment of the effects of a statewide beverage-container deposit program. The Environmental Finance Center (EFC) at the National Center for Smart Growth Research and Education of the University of Maryland is helping the state with that evaluation. EFC asked ECONorthwest to assist with the assessment of the environmental and economic effects.

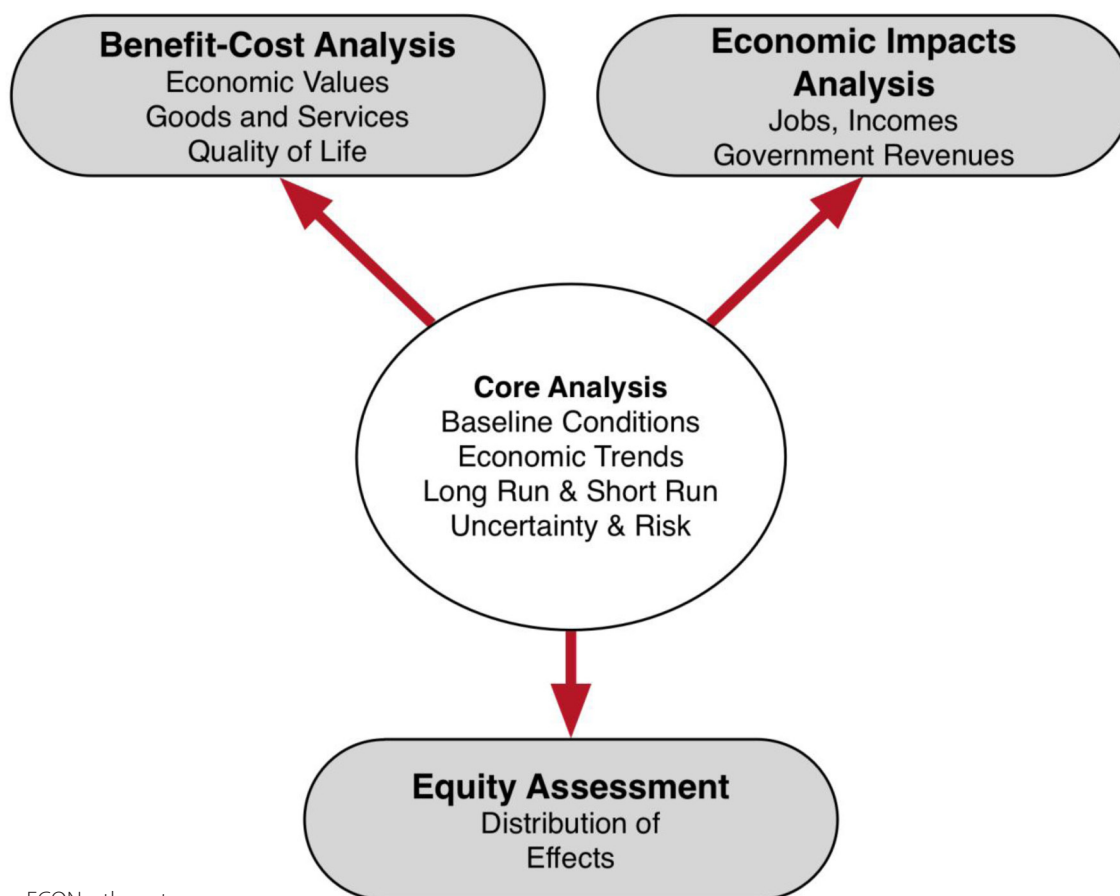
The economic dimensions of proposals to protect or conserve natural resources are frequently described in terms of some, but not all, of their economic effects. For example, some economic costs may be relatively straightforward to identify and quantify, and some analyses focus on the costs to the exclusion of the more dispersed and difficult to quantify benefits. Decisions made based on a narrow analysis of economic effects are not necessarily the ones that would be made based on a more complete evaluation of economic effects.

The first step toward conducting a more complete evaluation is to identify and explain what it should contain. This memorandum describes an overall framework for identifying the economic effects of implementing a bottle bill in Maryland. Although a full economic analysis is beyond the scope of our work, the framework is the basis for analysis we do provide. This framework may help guide other analysts, decision makers, and stakeholders in understanding both the overall social effects of the bill as well as the effects on specific parties. At a minimum, it provides context for our approach to the economic analysis. We apply this framework in Task 3 to outline the overall economic effects, identify gaps in information, and highlight key questions based on case studies of similar bills in Oregon and California (Task 2).

## Economic Framework

There are many different ways we could describe the economic effects of a Maryland bottle bill. The economic framework we outline in this section is based on a longstanding effort by the U.S. Environmental Protection Agency to provide guidance on analyzing the economic outcomes of environmental policies.<sup>178</sup> It provides a systemic approach for organizing the various consequences of any action.<sup>179</sup>

As Figure 1 shows, the framework describes a complete economic analysis as the combination of three separate analyses: (1) a benefit-cost analysis, (2) an economic impacts analysis, and (3) an equity assessment. We describe each of these analyses below.



Source: ECONorthwest

**Figure 1.** Components of a Complete Economic Analysis

<sup>178</sup> National Center for Environmental Economics. 2010. Guidelines for Preparing Economic Analyses. Office of Policy, U.S. Environmental Protection Agency. December 17. From [http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/\\$file/EE-0568-50.pdf](http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf).

<sup>179</sup> Throughout this memorandum, we use the term “economic effect” or simply “effect” to refer broadly to any outcome from the implementation of a bottle bill. We use the term “economic impact” or “impact” to refer specifically to the effects examined in an “economic impact analysis,” which examines the specific entities that gain or lose under a policy in terms of employment, income, revenues, etc.

## 1. Benefit-Cost Analysis

The first type of analysis, a Benefit-Cost Analysis (BCA), would describe differences in net economic values—economic benefits minus economic costs<sup>180</sup>—with a Maryland bottle bill and without. Benefits and costs are presented in common units, usually dollars, to facilitate comparison. Benefits and costs that cannot be monetized should still be presented and described.<sup>181</sup> Benefits and costs would materialize, for example, as reduced litter and pollution lead to improvements in environmental quality and increase the economic benefits derived from Maryland’s stock of natural resources. Benefits and costs would also arise from changes in the market for beverages through (1) the costs of implementing and operating a container-return system, and (2) the addition of a container deposit.

## 2. Economic Impact Analysis

The second type of analysis, an Economic Impacts Analysis (EIA), would measure the gains and losses of specific entities. This differs from a benefit-cost analysis in that a BCA would examine effects at a societal level. Individual impacts may cancel each other out at that level, so an EIA provides a way to examine individual effects of interest. These may include changes in jobs and incomes for workers, costs or revenues for private firms, and expenditures or tax revenues for governments.<sup>182</sup> These impacts would occur directly, as workers are employed in container collection and recycling positions, for example. They would also occur indirectly, as dollars are spent locally on goods and services, dollars that multiply through the local economy, supporting additional jobs and incomes. Economists frequently describe some of these changes using what is known as multiplier or impact analysis. Depending on the design of the bottle bill program, other impacts would include revenues and expenditures for government (often referred to as “fiscal” impacts) and industry in the form of fees, unredeemed deposit revenues, and administrative expenses.

## 3. Equity Assessment

The third type of analysis, an Equity Assessment (EA), would describe the distribution of the effects—the costs, benefits, and impacts—across income brackets of households, ethnicities, geographic areas, or other attributes that differentiate households and stakeholders in ways that matter to policy decisions.<sup>183</sup> Such an assessment is of particular interest when, say, groups of households who enjoy the benefits, jobs, and incomes, differ from those who bear the costs.

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<sup>180</sup> An economic benefit is a “favorable effect society gains.” Costs are the “dollar values of the resources needed to produce a good or service.” U.S. Environmental Protection Agency. 2010. *Guidelines for Preparing Economic Analyses*. December 17. p. xi.

<sup>181</sup> Mishan, E.J. *Elements of Cost-Benefit Analysis*, 3rd Edition. 1972. p.11-13; Turner, R., D. Pearce, and I. Bateman. 1993. *Environmental Economics*, p.93-4; Teitenberg, T. and L. Lewis. *Environmental and Resource Economics*, 8th Edition. 2008. p.28.

<sup>182</sup> Pearce, D.W. 1992. *The MIT Dictionary of Economics*, 4th edition. Cambridge, MA: The MIT Press. p.192-193.

<sup>183</sup> Samuelson, P.A. and W.D. Nordhaus. 2005. *Economics*, 18th edition. New York, NY: McGraw-Hill Irwin. p.38-39; Pearce, D.W. 1992. *The MIT Dictionary of Economics*, 4th edition. Cambridge, MA: The MIT Press. p.130-131.

#### 4. The Core Analysis

The center of Figure 1—the Core Analysis—shows the tasks common to characterizing or calculating all three categories of economic effects:

1. By describing the Baseline Conditions, the analyst can describe conditions without the changes that a bottle bill would yield.
2. By taking economic trends into account, the analyst can apply a with-versus-without approach, which isolates the economic effects (benefits and costs, impacts, equity) caused by the bottle bill from changes that would probably occur even without its implementation.
3. By addressing both the short-term and long-term effects, the analyst can help inform decision makers and stakeholders regarding the timing of costs, or investments, and the resulting benefits.
4. By describing the relevant geography or geographies, the analyst can help ensure that the BCA includes all major economic changes important to decision makers and stakeholders.
5. By describing the relevant risks and uncertainty, the analyst can help ensure that stakeholders and decision makers understand the extent to which the actual economic outcomes may differ from the calculated outcomes, and the reasons why.

#### 5. Results of the Economic Analysis

The results of the three analyses, taken together, would provide an understanding of the economic effects of a Maryland bottle bill. The Benefit-Cost Analysis would identify the net social benefits (or costs) of the bill, which would indicate its overall economic efficiency. The Economic Impacts Analysis and the Equity Assessment would disaggregate the effects, providing insights into the effects on specific groups and sectors of the economy.

#### Next Steps

In Task 2 we collect and report information on the bottle bills in Oregon and California. In Task 3, we use the economic framework we present here, combined with the information from the experience in Oregon and California, to describe the potential economic effects of a Maryland bottle bill.



## Appendix C: ECONorthwest Case Studies of California and Oregon



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To: Jen Cotting, Environmental Finance Center  
From: Kristin Lee, Terry Moore, and Michael Weinerman  
Date: December 13, 2011  
Re: Task 2: Case Studies of Oregon and California Container-Deposit Programs

### I. Overview

The State of Maryland wants some assessment of the effects of a statewide beverage-container deposit program. The Environmental Finance Center (EFC) at the National Center for Smart Growth Research and Education of the University of Maryland is helping the state with that evaluation. EFC asked ECONorthwest to assist with the assessment of the environmental and economic effects.

For this task, EFC asked ECONorthwest to prepare case studies of the Oregon and California bottle bill programs to provide information on the design of the programs and to help specify the economic effects that are most significant and likely.

Oregon's bottle bill has been in existence for over 40 years, making it the oldest in the country. California's bottle bill is younger at just 25 years, but it is the largest such program in the country. Both programs have evolved over time. The purpose of the case studies is to provide an overview of each state's program, including a summary of the history of the bottle bills. We also describe the extent to which the effects of the bills in each state have been studied. Together, the experiences in each state should provide useful insights into the potential effects of a bottle bill in Maryland.

## II. Case Study 1: Oregon<sup>184</sup>

### History of Oregon's Bottle Bill

Oregon became the first state to pass container-deposit legislation known as a “bottle bill” in 1971. The bill was spurred by public opposition to excessive litter on highways, beaches, and public hiking trails. The program led to significant reductions in litter. And, many attribute the bottle bill to establishing a broader recycling-oriented culture in Oregon.

The original Oregon bottle bill covered only carbonated beverages and beer in bottles and cans. It was virtually unchanged until the Oregon Legislature expanded it twice in the last five years. In 2007, the Legislature added bottled water and flavored water to the list of covered beverages (effective 2009). Then, in 2011, the Legislature expanded the bill to cover almost all beverages except milk, liquor, and wine (effective no later than 2018).<sup>185</sup> The 2011 update also included the beginning of a possible shift away from in-store collection of returned containers and paved the way for possible increases in the deposit and refund value to 10 cents in the future.

### Overview of Oregon's Bottle Bill Program

The idea behind the bottle bill is that consumers have an incentive to recycle their empty containers because they receive a direct monetary payment for doing so. The payment is simply a refund of the deposit paid by the consumer at the time of purchase. In Oregon, several entities are involved in the process.

**Consumers:** pay a 5-cent deposit per container and receive 5 cents in return for each container returned.

**Retailers:** pay deposits to and receive refunds from distributors; collect and refund the consumer deposits; receive, sort, and store returned containers. Recent changes to the Oregon bottle bill may lead to a shift from retail-based redemption to independent redemption centers.

**Distributors:** receive all deposit revenue from retailers and refund deposits to retailers for all redeemed containers. In addition, distributors keep all revenue from the unredeemed deposits. The distributors remove the returned containers from the retailers, process them for recycling, and sell them to recyclers.

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<sup>184</sup> This section draws on information from numerous sources, including Oregon Liquor Control Commission. 2011. *Bottle Bill & Redemption Center Info*. [http://www.oregon.gov/OLCC/bottle\\_bill.shtml](http://www.oregon.gov/OLCC/bottle_bill.shtml); Oregon Department of Environmental Quality. undated. Oregon's Evolving Bottle Bill. Retrieved November 10, 2011, from <http://www.deq.state.or.us/lq/sw/bottlebill/>; Bottle Bill Task Force. 2008. Final Report. State of Oregon. October. [http://www.leg.state.or.us/comm/commsrvs/Bottle\\_Bill\\_Final\\_Report.pdf](http://www.leg.state.or.us/comm/commsrvs/Bottle_Bill_Final_Report.pdf); and Spendelow, P. 2011. Personal Communication. Oregon Department of Environmental Quality. November; and Oregon Beverage Recycling Cooperative. 2011. OBRC. The Bottle Bill. A Cleaner Oregon. from <http://www.obrc.com/default.aspx>.

<sup>185</sup> House Bill 3145, Enrolled. Sponsor: Berger, Cannon. 76th Oregon Legislative Assembly -- 2011 Regular Session. <http://www.leg.state.or.us/11reg/measpdf/hb3100.dir/hb3145.en.pdf>.

**Recyclers:** purchase processed containers from distributors and convert the recyclables into usable materials: aluminum for new cans, glass recycled into new bottles, and plastic converted into new bottles or other products.<sup>186</sup>

**Government:** the Oregon Liquor Control Commission administers the program and the Oregon Department of Environmental Quality tracks data; the state receives no funds from the deposit system.

## Summary of Recent Events Related to the Oregon Bottle Bill

**1996** – Ballot measure to expand the bottle bill to include water, juice, and other noncarbonated beverage containers. This measure was defeated by Oregon voters.

**2007** – Oregon Senate Bill 707 expanded the 1971 bill to include all water and flavored water bottles. This bill also created the Bottle Bill Task Force.

**2008** – The Bottle Bill Task Force produced a report and recommendations.

**2011** – Oregon House Bill 3145 expanded the bill to include almost all beverage containers except those containing milk, liquor, and wine. It included a pilot project for a large redemption center, set statewide redemption goals, and included provisions for a possible increase in the deposit to 10 cents.

## Updates to Oregon’s Bottle Bill

A number of factors led to the recent updates in Oregon’s Bottle Bill. These included changes in the market for beverages and ongoing concerns with some aspects of Oregon’s bottle bill. Several of the changes stem from the recommendations of the 2008 task force, and they represent lessons learned over the many years of experience with the Oregon bottle bill.

### Expansion of Beverages Covered

The original Oregon Bottle Bill covered only carbonated and malt beverages (essentially, soda and beer). In the years since 1971, consumption of non-carbonated beverages has expanded significantly. And, recycling rates for beverage containers not covered by the bottle bill, such as plastic water bottles, have been persistently lower than for those that are covered. Responding to concerns about the falling recycling rates and consequent rise in litter and use of landfill space, Governor Kulongoski signed into law an expansion of the bottle bill in 2007 to include all types of bottled water. The Oregon Legislature returned to the issue in 2011. With House Bill 3145, the Legislature expanded the list of beverages even further to include almost all glass, metal, and plastic beverage containers excluding those for milk, wine, or liquor, with some size restrictions.

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<sup>186</sup> Oregon Beverage Recycling Cooperative. 2011. OBRC. The Bottle Bill. A Cleaner Oregon. From <http://www.obrc.com/default.aspx>.

## Deposit/Redemption Value

Since its passage in 1971, the Oregon bottle bill has required a 5-cent deposit and a corresponding 5-cent refund value. Given inflation, these monetary values provided a greater incentive for recycling in the 1970s than today, and container-return rates have fallen in Oregon over time.

The 2011 legislation (HB 3145) keeps the 5-cent rate. It stipulates, however, that if the return rate drops below 80 percent for two years in a row, then the deposit and refund values will increase to 10 cents no earlier than 2017. The most current return rate is 75 percent. Oregon's return rate, however, remains higher than in most states with similar redemption values.

## Retail-Only Redemption vs. Redemption Centers

Grocers and other retailers that sell groceries currently absorb many of the handling costs associated with Oregon's redemption program. They dedicate space to redemption, hire employees to process the bottles, collect and return deposits, clean redemption areas, and sort and store containers until distributors retrieve them. Retailers receive no funds through the bottle bill program to cover their costs, although they may pass the extra costs on to consumers. Many retailers have expressed concerns about the long-standing redemption system.

With the expansion of the bottle bill to include water and other non-carbonated beverages, the variety of containers and number of distributors in the program both increase. This results in an increase in both the number of containers that must be sorted at the point of redemption and the total number of sorts required to return the containers to the appropriate distributor. Sorting these containers by hand requires training and time. Reverse vending machines (RVMs) automatically sort containers by UPC, making complex sorts by distributor less tedious.

Distributors have also formed cooperatives to reduce the burden on both retailers and distributors. In 2009, the distributor cooperatives merged into a single entity, the Oregon Beverage Recycling Cooperative (OBRC). The OBRC is the primary entity handling the overall collection and disbursement of deposits, and it collects and processes nearly all containers from across the state, eliminating the need for extensive sorting by distributor.<sup>187</sup>

In the interest of improving the efficiency of the collection system, the 2011 legislation included the concept of non-retail redemption centers. Centralized and independent redemption centers provide efficiencies of scale and reduce the costs of processing containers. Two redemption centers currently exist in the state, with a third, larger center planned. The beverage industry would like to shift away from retail redemption to a network of industry-run redemption centers across the state. One estimate is that 90 centers would eventually be built, with annual expenses of approximately \$16 million.<sup>188</sup>

<sup>187</sup> Oregon Beverage Recycling Cooperative. 2011. OBRC. The Bottle Bill. A Cleaner Oregon. From <http://www.obrc.com/default.aspx>.

<sup>188</sup> Container Recovery, Inc. 2008. "Appendix C: Presentation to the Oregon Bottle Bill Task Force: The Industry Approach. May 13, 2008." In Bottle Bill Task Force Final Report. October. p. 15



## Unredeemed Deposit Revenue (UDR)

Historically, distributors have accrued all the unredeemed deposit revenue (UDR)—from containers that were disposed without being redeemed for their deposit—in Oregon. Distributors also accrue “float” income, which is the interest earned while consumers hold onto containers and distributors hold onto deposits, and they receive proceeds from the sale of the processed beverage containers to recyclers. The Oregon Department of Environmental Quality estimates that \$16 million accrues to distributors each year from UDR.<sup>189</sup> Some states instead require distributors to turn over deposits to the state, as is the case in California, Hawaii, Maine, Massachusetts, and Michigan.<sup>190</sup> Although there has been discussion of the state collecting the UDR, no such action has been taken in Oregon.

Because distributors keep the UDR, distributors have an inherent incentive to push down return rates to maximize UDR. But this incentive has mixed effects as these distributors also have an incentive to develop methods for combating fraudulent deposit claims (attempts to redeem containers purchased in other states) as fraud also cuts into their UDR. This may emerge as more of an issue if the Oregon redemption rate increases to 10 cents as early as 2017, as fraudulent claims would be expected to increase.<sup>191</sup>

State accrual—rather than distributor accrual—of UDR would remove distributor interest in minimizing fraudulent returns, which may lead to increases in fraudulent claims as the state might struggle to coordinate efforts with industry.<sup>192</sup> The Oregon Bottle Bill Task Force recommended that these revenues remain in the hands of industry as long as the redemption centers are successful and do not need to be replaced by state-run redemption centers.

## Existing Research on the Effects of Oregon’s Bottle Bill

The most extensive research conducted on the economic effects of the Oregon Bottle Bill was completed in the approximately 10 years after the original bottle bill was enacted. Researchers were interested primarily in litter reduction, beverage sales, energy use, and job impacts.<sup>193</sup> Researchers found that the Oregon bottle bill led to a 66-88 percent reduction of beverage

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<sup>189</sup> Bottle Bill Task Force. 2008. Final Report. State of Oregon. October. [http://www.leg.state.or.us/comm/commsrsvs/Bottle\\_Bill\\_Final\\_Report.pdf](http://www.leg.state.or.us/comm/commsrsvs/Bottle_Bill_Final_Report.pdf).

<sup>190</sup> *Redemption Program Financing Options*. Financing Subcommittee. Appendix F of *Bottle Bill Task Force Final Report*. State of Oregon. (2008)

<sup>191</sup> Michigan, the only state with a 10¢ redemption value, has experienced fraud from neighboring states that do not have bottle bills in place. See, for example: AR November 2007 Recycling and Waste News, “Operation Can Scam,” Nov. 2007, <http://www.americanrecycler.com/1107/operation.shtml>. This is also the case in the states surrounding New Hampshire, all of which have bottle bills while New Hampshire does not. See, for example: Wickenheiser, Matt. “Alleged \$10K bottle redemption scam spurs criticism of system.” Bangor Daily News. February 11, 2011. <http://bangordailynews.com/2011/02/11/business/alleged-scam-spurs-criticism-of-bottle-bill/>

<sup>192</sup> Michigan is currently involved in litigation with beverage manufacturers as a recent law required a Michiganspecific marking on beverages sold in the state in an effort to combat fraudulent redemptions. Agar, John. “Beverage industry sues Michigan over new bottle deposit law.” mlive.com. March, 09 2011. [http://blog.mlive.com/news\\_impact/print.html?entry=/2011/03/beverage\\_industry\\_sues\\_michiga.html](http://blog.mlive.com/news_impact/print.html?entry=/2011/03/beverage_industry_sues_michiga.html)

<sup>193</sup> For example, Geurts, M. D. and G. E. Wheeler (1980). “Converging conflicting research findings: The Oregon Bottle Bill case.” *Journal of Marketing Research*: 552-557.

containers in roadside litter.<sup>194</sup> And, a 1977 GAO study concluded that the Oregon law in its first few years had, on net, added between 348 and 410 jobs to the state's economy.<sup>195</sup>

Another period of heightened interest in the Oregon Bottle Bill followed the passage of the 2007 expansion of the program. The legislation established a task force to make recommendations about how the bottle bill could be improved. This task force included participants from a range of interests, and they reviewed many aspects of the program.<sup>196</sup> They highlighted concerns with the then-current system and recommended a number of changes, several of which were incorporated into the 2011 law (as described above, under "Updates to Oregon's Bottle Bill").

The effect of the Oregon bottle bill on the state's modern-day job market has not, to our knowledge, been studied. Much of the research attention given to the bottle bill today focuses on tracking recycling rates and capturing efficiencies in the program.

## II. Case Study 2: California<sup>197</sup>

### History of California's Bottle Bill

California's bottle bill—the California Beverage Container Recycling and Litter Reduction Act—was passed in 1986 and went into effect in 1987 with an initial redemption value of 1 cent; coverage of soft drinks, beer, and sparkling water; and a goal of attaining an 80 percent recycling rate. One study found that in the first year of California's bottle bill program, beverage-container litter declined by 42 percent.<sup>198</sup>

Bottle bill programs vary across states, but California's is distinguishable in several ways. California has made extensive use of privately-run recycling centers, has set different redemption values on beverage containers according to size, and has gradually increased the redemption values over time.

The bill's scope has expanded, and it currently covers beer, malt, wine coolers, distilled-spirits coolers, and all non-alcoholic drinks except milk and infant formula, with some size

<sup>194</sup> U.S. General Accounting Office. 1977. *Potential Effects of a National Mandatory Deposit on Beverage Containers*. Report to the Congress by the Comptroller General of the United States. PAD-78-19. December 7. p. 51.

<sup>195</sup> U.S. General Accounting Office. 1977. *Potential Effects of a National Mandatory Deposit on Beverage Containers*. Report to the Congress by the Comptroller General of the United States. PAD-78-19. December 7. p. 52.

<sup>196</sup> This included elected representatives, agency personnel, manufacturers, distributors, retailers, recyclers, and others. *Bottle Bill Task Force Final Report*. State of Oregon. (2008). [http://www.leg.state.or.us/comm/commsrvs/Bottle\\_Bill\\_Final\\_Report.pdf](http://www.leg.state.or.us/comm/commsrvs/Bottle_Bill_Final_Report.pdf)

<sup>197</sup> This section draws upon numerous sources, including CalRecycle. 2011. *Beverage Container Recycling*. from <http://www.calrecycle.ca.gov/BevContainer/>; Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>; California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390>; CalRecycle. 2011. *Calendar Year 2010 Report of Beverage Container Sales, Returns, Redemption, & Recycling Rates*. DRRR-2011-019. California Department of Resources Recycling and Recovery. July. <http://www.calrecycle.ca.gov/publications/default.asp?pubid=1383>.

<sup>198</sup> Citation to the original study in California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. p. 28.

restrictions.<sup>199</sup> The California legislature has amended the bottle bill several times over the bill's 25-year history, primarily to increase the redemption value and add additional beverages. This value has increased in steps to its current value of 5 cents for containers under 24 ounces and 10 cents for containers of 24 ounces or larger. The recycling rate for covered beverages was 82 percent in 2010.<sup>200</sup>

## Overview of California's Bottle Bill Program

Although there are similarities with the Oregon bottle bill, the California program differs from the Oregon program in several ways. A key difference is the extensive reliance on independent recycling centers rather than retail stores as the primary location where containers are returned. In addition, the State collects and pays the deposits (known in California as the CRV, which refers to both the California redemption value and the California refund value),<sup>201</sup> makes handling and processing payments to certain entities involved in the process, and retains the unredeemed deposit revenue (UDR) and additional fees to administer the program.

**Consumers:** pay 5- or 10- cent CRV (depending on the size of the container) and receive CRV for containers recycled, although the CRV is generally paid by weight rather than by container

**Retailers:** pay CRV to distributors; collect CRV from consumers; process returns only in areas without a nearby Recycling Center

**Distributors:** pay a CRV to the state and collect CRV from retailers.

**Beverage Manufacturers:** pay a processing fee to the State

**Recycling Centers:** receive container returns from consumers; pay CRV to consumers; receive payments from processors for the recyclable containers

**Processors:** pay recyclers for containers, receive payments from the state; sell containers or scrap to end users.

**Government:** pays refund values and processing fees to processors, receives deposit and other fee revenues; makes various other payments to participants, and administers state recycling programs.

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<sup>199</sup> Specifically, it includes all carbonated and noncarbonated beverages: soft drinks, water, fruit juice, vegetable juice, fruit drinks, etc.) except milk and 100 percent fruit juice in containers 46 ounces and over, and vegetable juice in containers over 16 ounces.

<sup>200</sup> Biannual Report of Beverage Container Sales, Returns, Redemption, and Recycling Rates. CalRecycle. Sacramento. 2011.

<sup>201</sup> The redemption and refund values are typically the same, but they do differ at times. California Department of Conservation, Division of Recycling. 2007. California Beverage Container Recycling Program History and Fund Management Options. DRRR-2011-026. February 28. [p.http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390](http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390)

The funds collected by the state are deposited into the California Beverage Container Recycling Fund. Payments are then made out of this fund for handling fees, processing fees, CRV payments, competitive grants to foster greater levels of recycling, public education, and other supplemental recycling programs. Over its history, the Fund has had a surplus in many years. In some years the Fund's balance (reflecting accumulated surpluses) has exceeded \$200 million. By 2006, there was an effort in the state to reduce the Fund balance through a number of expenditures, including increased funding for a number of recycling programs.<sup>202</sup> In FY 07/08, overall program revenues into the beverage fund equaled \$1,197.7 million plus \$19.2 million in interest totaling \$1.216 billion in revenue. Total expenditures were \$1.226 billion, for a net program cost of about \$10 million. \$915.9 million went to CRV pay outs, processing fee offsets of \$90.5 million, administration at \$50.6 million, handling fees of \$35 million, and the remaining \$134 million into recycling programs.<sup>203</sup> These other programs include direct public education, competitive community grants, and recycling market development programs. Even with a net annual cost, the Fund maintained a net positive balance.

The California system is further distinguished from other states' programs by a number of other factors. Curbside recyclers are eligible to receive CRV values for beverage containers that they recycle, and they also receive other payments from the Fund. Demand for recycled materials is also stimulated by minimum content requirements the state establishes on containers. For example, glass food and beverage containers are required by state law to contain 25-35 percent post-consumer content.<sup>204</sup> The state also awards funding each year to promote end-markets for the recycled materials and improve the efficiency of the container-collection system.

## Updates to California's Bottle Bill

California's program originally covered soft drinks, beers, and sparkling water. The CRV was low compared to Oregon's deposit amount at its outset at just 1 cent, but it has increased over the years. The legislature has made a number of changes to the bottle bill. These are some of the major updates to the law.

**1986** – (original bill) 1-cent CRV on beer, malt beverages, and carbonated soft drinks, including carbonated water

**1990** – Changed the CRV from 1 cent to 2.5 cents for containers less than 24 ounces, 5 cents for containers of 24 ounces or more.

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<sup>202</sup> California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. p. 1. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390>

<sup>203</sup> R3 Consulting Group, Inc. and C. Morawski. 2009. *Evaluating End-of-Life Beverage Container Management Systems for California*. California Department of Conservation. May 15. <http://www.r3cgi.com/DOC/FINAL%20REPORT.pdf>. pp. 4-10 – 4-11.

<sup>204</sup> California Beverage Container Recycling & Litter Reduction Act. Public Resources Code Division 12.1. 14549 (b) <http://www.calrecycle.ca.gov/Publications/BevContainer/2011031.pdf>

**2000** – Expanded the list of covered beverages to include most non-alcoholic beverages excluding milk.

**2004** – Increased CRV to 4 cents for containers less than 24 ounces and 8 cents for containers of 24 ounces or more.

**2007** – Increased CRV to 5 cents for containers less than 24 ounces and 10 cents for containers of 24 ounces or more. Increased processing fees.

## Research on the Effects of California's Bottle Bill

Research on the California program is much more extensive than that for Oregon. Indeed it appears to be the most-studied bottle bill in the country. Recycling rates, redemption rates, and other data are much more readily available for California than for other states.

Similar to our findings in Oregon, the California studies focus more on improving the program rather than identifying the overall economic effects. Some studies have focused on other states' and international container-redemption programs to provide insights on how to improve the California system.<sup>205</sup> These studies found that the California system would be more effective if it increased refund values, increased public education campaigns, and increased the number of public recycling bins. Other researchers have analyzed the economics of the California system and proposed changes that would make it more efficient and effective.<sup>206</sup> In 2007 one researcher estimated that the California bottle bill reduced greenhouse gas emissions by 600,248 tons.<sup>207</sup>

### Research on the Response of Redemption Rates to Changes in CRV

Because the CRV has increased several times over the history of the bottle bill, California's experience provides useful insights into the effect of the level of the CRV on recycling rates. As Figure 1 shows, the recycling rate of beverage containers increases with each increase in the refund value. The CRV was increased in 1990, 2004, and 2007. In 2000, the bill was expanded to include more beverages, which corresponded to a decline in the recycling rate.

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<sup>205</sup> R3 Consulting Group, Inc. and C. Morawski. 2009. *Evaluating End-of-Life Beverage Container Management Systems for California*. California Department of Conservation. May 15. <http://www.r3cgi.com/DOC/FINAL%20REPORT.pdf>; and Nelson, C. and J. Gonzalez (2002). "Improving California's Beverage Container Recycling Rates: A Case for Structural Program Changes."

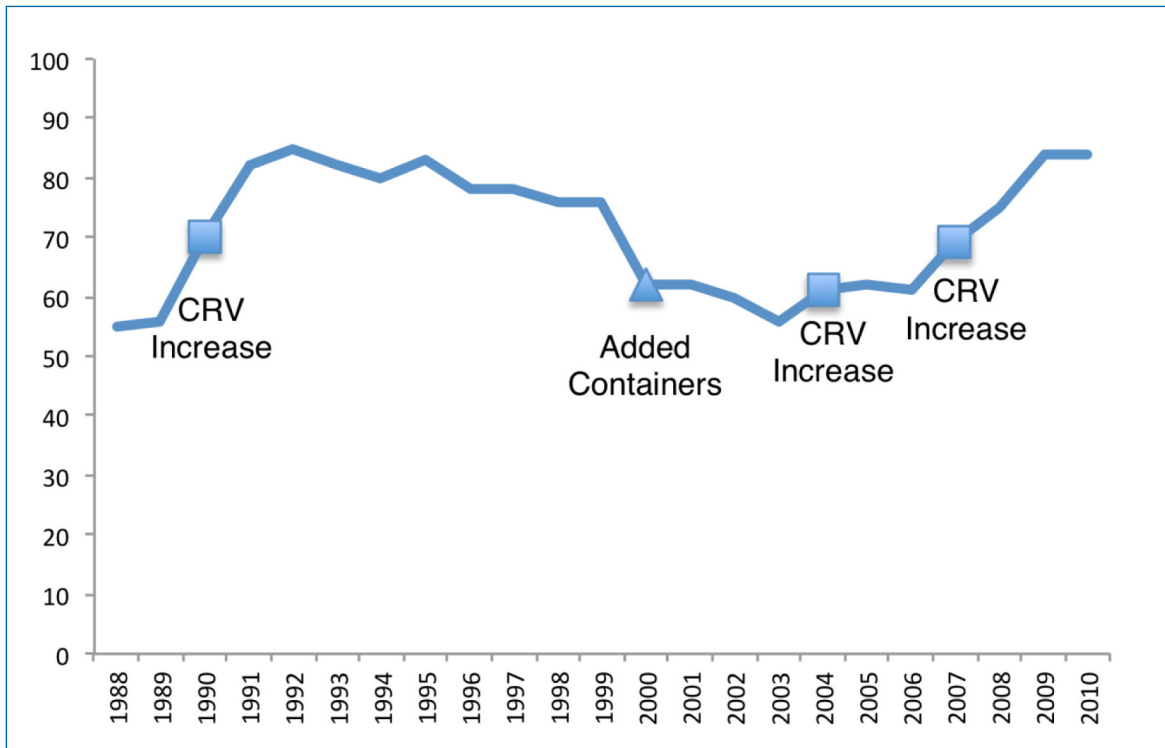
<sup>206</sup> California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390>; and Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>.

<sup>207</sup> R3 Consulting Group, Inc. and C. Morawski. 2009. *Evaluating End-of-Life Beverage Container Management Systems for California*. California Department of Conservation. May 15. <http://www.r3cgi.com/DOC/FINAL%20REPORT.pdf>. p. 4-19.



## Social and Cultural Effects

One economist has found a range of effects of the bottle bill in California. Ashenmiller has found that bottle bills increase recycling above what would be collected curbside. Furthermore, he found that deposit refunds are an important component of many of the poorest populations' income streams.<sup>208</sup> Additional research showed that petty crime at the city level decreases by roughly 11 percent with the implementation of a bottle bill, as the deposit refunds provide a legal means to obtain income.<sup>209</sup> Income from returnable containers amounted to 7 to 9 percent of the poorest households' incomes.<sup>210</sup>



**Figure 5.** Percentage of Containers Redeemed, 1988-2010

**Source:** ECONorthwest, based on data obtained from Biannual Report of Beverage Container Sales, Returns, Redemption, and Recycling Rates. CalRecycle – Department of Resources Recycling and Recovery. Sacramento: 10. 2011.

Note: Square markers indicate increases in the CRV. Triangle marker indicates expansion of the list of coverage beverages.

<sup>208</sup> Ashenmiller, B. (2009). "Cash Recycling, Waste Disposal Costs, and the Incomes of the Working Poor: Evidence from California." *Land Economics* 85(3): 539-551.

<sup>209</sup> Ashenmiller, B. (2010). "Externalities from Recycling Laws: Evidence from Crime Rates." *American Law and Economics Review* 12(1): 245-261.

<sup>210</sup> Ashenmiller, B. (2011). "The Effect of Bottle Laws on Income: New Empirical Results." *American Economic Review* 101(3): 60-64.

### **III. Conclusions**

The Oregon and California case studies provide contrasting approaches to the implementation of a bottle bill. Oregon's longstanding bill leaves the daily administration of the program in the hands of industry, and California's program is managed by the state. Whereas Oregon provides no handling fees to retailers or any others involved in the process—other than permitting the distributors to keep the unredeemed deposit revenue—California handles the finances and provides incentives to most parties in the form of assessing fees on them or making payments to them. California has emphasized the establishment of functioning recycling markets and provides funding for research and development. In recent years Oregon distributors have taken strides to improve the efficiency of the collection process. Both programs are achieving relatively high recycling rates. California's current rate of 82 percent is notable because it includes a broader range of beverages than is currently covered by Oregon's program. In Task 3 we combine the information from Oregon and California with the economic framework outlined in Task 1 to describe the overall potential economic effects of a Maryland bottle bill.

# Appendix D: ECONorthwest Economic Analysis



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To: Jen Cotting, Environmental Finance Center  
From: Kristin Lee and Terry Moore  
Date: December 13, 2011  
Re: Task 3: Potential Economic Effects of a Maryland Bottle Bill

## I. Overview

The State of Maryland wants some assessment of the effects of a statewide beverage-container deposit program. The Environmental Finance Center (EFC) at the National Center for Smart Growth Research and Education of the University of Maryland is helping the state with that evaluation. EFC asked ECONorthwest (ECONW) to assist with the assessment of the environmental and economic effects.

ECONW's scope of work had three tasks, each concluding with a memorandum:

- Task 1, Framework for an Economic Evaluation, describes broad categories of economic effects one might expect from the Maryland bottle bill.
- Task 2, Case Studies, examines information from two states that have adopted bottle bills (Oregon and California) to help specify the economic effects that are most significant and likely.
- Task 3, Potential Economic Effects (this memorandum), uses the results of Tasks 1 and 2 to discuss effects using three separate analyses: a benefit-cost analysis, an economic impacts analysis, and an equity assessment.<sup>211</sup> The remainder of this memorandum has three main sections:

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<sup>211</sup> A full economic analysis is beyond the scope of our work, but in this memorandum we apply the economic framework from Task 1 to outline the overall economic effects of a Maryland bottle bill. Our analysis is based primarily on information from Oregon and California case studies from Task 2.

- II. Defining the Scope of the Analysis
- III. Economic Analysis
- IV. Conclusions

## II. Defining the Scope of the Analysis

Before describing the likely effects of a Maryland bottle bill, this memo begins by defining two possible futures (the Baseline Case with no Bottle Bill and the Bottle Bill Case), the economic trends affecting both, and the geographic and temporal scope of the analysis.

### Baseline Case: No Bottle Bill

The baseline against which the economic effects of a Maryland bottle bill would be measured is *Maryland without a bottle bill*. Although Maryland does not have a bottle bill now, the baseline is not simply today versus a bottle bill. The baseline case must account for likely conditions and trends into the future.

### Bottle Bill Case

This analysis focuses on the effects of a bottle bill in Maryland. As the Oregon and California case studies indicate, a bottle bill could be implemented in any number of ways. For the bottle bill case, we do not have the precise details of a possible Maryland bottle bill. Therefore, our analysis identifies key features of different bottle bill approaches and their effects. Major unknowns about a potential Maryland bottle bill include:

- **Beverages:** inclusion or exclusion of beverages by contents, container material, or size
- **Deposit:** the amount of a deposit and refund per container
- **Redemption:** the process and location of redemption activities (retail stores, redemption centers, etc.)
- **Finances:** the process for collecting deposits and disbursing refunds, whether additional fees would be assessed or handling fees paid, and the recipient of unredeemed deposits.

### Economic Trends

Relevant economic trends should be taken into account to isolate the economic effects produced by the bottle bill from changes that would probably occur even without its implementation. Relevant trends include:

**Recycling trends.** Because the key benefits of a bottle bill stem from an increase in recycling, an important consideration is whether recycling would increase anyway, without implementing a bottle bill. Although the amount of waste recycled is trending upward, states with bottle bills

tend to recycle more beverage containers than other states. An examination of recycling rates and trends in Maryland would lay the groundwork for projecting the recycling rates with and without a bottle bill.

**Beverage market trends.** Because a bottle bill affects the beverage market, an understanding of trends in the market for beverages is important for projecting the effects of the bottle bill. Over the history of the bottle bills in both California and Oregon, the mix of beverages changed. Bottled water and other non-carbonated drinks grew in market share, especially during the 1990s. Both states have expanded the types of beverages covered by their bottle bills.

**Environmental trends.** Because many of the benefits of a bottle bill flow from improvements in environmental quality and avoidance of environmental harms, understanding these trends would help in quantifying the benefits.

## Geography

The relevant geography for examining the effects of a Maryland bottle bill depends on the interests of the decision makers. There are several options, each with a rationale supporting its use. We expect that the State of Maryland is primarily interested in effects inside the state, but some key effects would probably materialize outside the state. Whatever the ultimate geographic scope of the analysis, any effects of interest that occur outside of the scope could be noted separately.

- **Maryland.** Because the bill's scope would be imposed in Maryland, by Maryland elected officials, for the benefit of Maryland citizens, an analysis also focused on the effects within the state would be a natural choice.
- **Multi-state region.** Because of Maryland's proximity to urban areas in other states and the District of Columbia, it is likely that the effects of a bottle bill would spill over in the rest of the region and also be influenced by that region. It is not common, however, for state's to look at impacts beyond their boundaries.

There could be effects at a U.S. or international scale (e.g., changes in greenhouse gas emissions and reductions in mining or drilling for virgin materials). Although these effects may be small relative to the totals at that scale, stakeholders may be particularly interested in these effects. Even if the primary analysis is limited to the state or a multi-state region, these external effect could be noted separately.

## Time

Because we do not know when a Maryland bottle bill would be implemented, we do not identify a particular time period. Instead, we limit our temporal descriptions of the effects to distinguishing between short-term and the long-term effects.



### III. Economic Analysis

#### A. Benefit-Cost Analysis

In this section, the memo describes major categories of benefits and costs from a broad societal perspective. Note that this section aims at identifying what economists might refer to as direct economic benefits and costs. The bottle bill may use new resources, cause resources to be reallocated, or reduce the use of some resources. Some people will be better off and would arguably be willing to pay real money for the benefits they receive, and others will be worse off by having to incur net new costs that can be measured. A benefit-cost analysis tries to identify and estimate the main changes in primary effects. Other effects may stem from those primary effects but are secondary in the sense that they may be different aspects of the primary effects (e.g., transfers and distributional issues). Those effects are covered in Sections B and C.

#### Benefits

The two obvious and direct benefits of a bottle bill are more recycling and less litter. The case studies show that these intended effects are more than theoretical: they have been substantiated empirically.

**Litter Reduction.** The deposit provides an incentive for consumers to recycle the containers. This incentive is especially important for beverages consumed away from home. Without convenient recycling bins or a container deposit, beverages consumed away from home are more likely to be placed in garbage cans or littered than saved to be recycled. The deposit also provides an incentive for others to collect littered containers. Studies in Oregon following the implementation of the bottle bill showed a clear reduction in litter. Estimates of the extent of litter reduction varied from a 66 to 88 percent decrease in beverage-container litter.<sup>212</sup> Within the first year of California's bottle bill, there was a 42 percent decline in beverage-container litter.<sup>213</sup> With a decrease in litter along roadways, in urban areas and in natural areas such as Chesapeake Bay and other waterways, there would be a number of economic benefits:

- A reduction in litter cleanup costs.
- Decreases in public health risks from injuries due to broken beverage-container glass.<sup>214</sup>
- Increases in the aesthetic value of urban and natural areas.

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<sup>212</sup> U.S. General Accounting Office. 1977. *Potential Effects of a National Mandatory Deposit on Beverage Containers*. Report to the Congress by the Comptroller General of the United States. PAD-78-19. December 7. p. 51.

<sup>213</sup> California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390>. p. 28

<sup>214</sup> See, for example, Stutz, J., C. Gilbert, Michigan. Dept. of Environmental Quality, and M. G. L. P. Fund. 2000. *Michigan Bottle Bill: A Final Report to Michigan Great Lakes Protection Fund*. Michigan Dept. of Environmental Quality. July 10. p. 10.

- Increases in the value of ecosystem services. To the extent that litter currently impairs the value derived from the state's ecosystems—for example, by disturbing wildlife habitat or clogging waterways—a reduction in litter may improve natural conditions and lead to subsequent increases in the value of the ecosystem services these areas provide.<sup>215</sup>

**Increased Recycling.** In general, states with a bottle bill have higher recycling rates for covered beverages than states without a bottle bill. As the California case study indicates, the deposit (and redemption) value influences the recycling rates—each increase in the redemption value in California led to an increase in the recycling rate. Increases in recycling yield a number of economic benefits:

- A decrease in the overall costs for solid waste disposal.
- Increases in the supply (and quality) of scrap materials. Scrap materials—particularly aluminum—have monetary value. In Oregon, the distributors, who retrieve the empty containers from the retailers, are able to sell the scrap and retain the proceeds. In California, the processors receive the proceeds from the sale of the empty containers, but the state closely monitors scrap prices. Where scrap prices are less than the price of recycling, the state assesses fees on the beverage manufacturers and makes payments to the processors based on the price difference.
- Decreases in the use of virgin materials. A steady supply of scrap materials may increase the use of recycled materials rather than virgin materials. This leads to a reduction in energy use and greenhouse gas emissions in the manufacturing of the recycled-content containers. It also avoids the environmental effects from obtaining those virgin materials, such as mining bauxite for aluminum. These effects would be located where container manufacturing and materials extraction occur, mostly outside of the state of Maryland.
- Increase in awareness of recycling, possibly extending to an increase in recycling of other types of materials.

## Costs

**Price Increases.** The addition of a deposit represents an immediate price increase to the consumer, although the deposit is refunded to the consumer when the container is returned. Beverage prices may also rise if cost increases or fees are passed on to the consumer. Price increases leave consumers with less money to purchase goods or services. Given a relatively small deposit (as a percentage of the price of a beverage) and the refund of that deposit upon

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<sup>215</sup>For an overview on ecosystem services and their values, see National Research Council, Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems. 2004. *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*. National Academies Press.

return of the empty container, the overall effect of a beverage deposit is not clear. One study in California found no evidence that sales of non-carbonated beverages declined after those beverages were added to the state's bottle bill in 2000.<sup>216</sup> Based on a review of the economic literature, another study concluded that a five-cent deposit would have little effect on the demand for beverages.<sup>217</sup>

**Container Collection.** Whether containers are collected at retailers or independent redemption centers or both, there would be costs involved in the construction, operation, and maintenance of the redemption facilities.

- At individual retailers, there would need to be enough space for collection and storage, perhaps the purchase and maintenance of reverse-vending machines, and personnel to run the operation. A California study estimated the costs of an Oregon-style system requiring (1) returns at each retail store and (2) the sorting and return of containers to the original distributor and compared it to the California system, which is composed mostly of redemption centers and doesn't require sorting by distributor. The study found that the Oregon-style system was six times more expensive than California's system.<sup>218</sup>
- Independent redemption centers would need to be built, and siting them appropriately to optimize returns would be key. In Oregon, a 2008 report estimated the annual cost of operating a network of 90 independent, industry-run redemption centers at approximately \$16 million (\$156,000 per site plus \$2.4 million—approximately 20 percent of the total site costs—in administrative costs).<sup>219</sup>

**Transportation.** There would be costs involved in transporting empty containers for return and recycling. These costs would depend on the design of the program.

- Consumer returns at retailers are generally assumed not to result in additional trips, as consumers may make their returns as part of normal shopping trips.
- Consumer returns to independent centers may or may not result in additional trips. Any such increase would yield additional transportation costs for the consumer and additional vehicle emissions.

<sup>216</sup> Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>. p. 3.

<sup>217</sup> Dewey, J., D. Denslow, B. Chavez et al. 2011. *Analysis of a Florida Beverage Container Deposit Refund System*. Bureau of Economic and Business Research, University of Florida. March 15. <http://www.bebr.ufl.edu/content/bottle-bill-report>. pp. 4-5

<sup>218</sup> Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>. p. 42.

<sup>219</sup> Container Recovery, Inc. 2008. "Appendix C: Presentation to the Oregon Bottle Bill Task Force: The Industry Approach. May 13, 2008." In *Bottle Bill Task Force Final Report*. October. p. 15

- Transporting the empty containers from the point of collection (whether a retailer or independent center) to the recycler or materials processor would also involve costs. These costs would be offset, at least in part, by lower transportation costs for curbside recyclers and waste haulers.

**Other Program Costs.** A number of other costs would be incurred in administering the bill.

- **Administrative Costs.** The flow of deposits and containers would require bookkeeping and the exchange of information among parties.
- **Enforcement Costs.** The state would likely be involved in ensuring compliance with the bill.
- **Outreach Costs.** Upon implementation, the state would need to educate consumers and industry members about the requirements of the bill.

## Summary

In general, economic benefits will be higher the more containers that are recycled under the bill. There are two primary ways to increase recycling: (1) cover a broader range of containers under the bill, and (2) provide stronger incentives for consumers to recycle: both a deposit high enough to encourage consumers to return the containers and a convenient return system. Reducing the costs boils down to designing an efficient return system, so that the costs of transportation and handling are reduced.

## B. Economic Impacts Analysis

Employment and fiscal effects are often referred to by economists as secondary effects. For a benefit-cost analysis, labor is a cost, and products can be delivered less expensively if labor costs are reduced (other things being equal). But for workers, unions, economic development specialists, politicians, and others, policies that reduce jobs in some industry or create them in another are of importance.

## Employment Effects

**Container collection and recycling employment.** Handling the stream of empty beverage containers requires labor. The labor requirements will depend on the structure of the bottle bill program. In Oregon, returns are handled mostly by individual retailers. Some retailers process all returns manually, and others make use of reverse-vending machines. Both processes require some personnel time. In California, returns are handled primarily through redemption centers and reverse-vending machines, although other collection processes such as curbside recycling also play a role. Again, all collection processes require personnel.

With an increase in the supply of scrap materials, the employment effects may also be apparent at materials processors or recyclers, who would handle a greater quantity of materials. In California, recycling employment is further boosted as the state uses some of its bottle-bill related revenues to promote end markets for recycled-container materials directly by awarding grants in a number of areas, including improving the quality of the recycled materials and developing products using recycled materials.<sup>220</sup>

**Beverage industry employment.** Beverage industry employment may be affected if the bottle bill reduces the demand for beverages. This would happen if the prices of beverages rise, and if consumers respond to that price increase by purchasing fewer beverages. As the economic cost section indicates, the studies reviewed for this task did not find declines in beverage purchases due to bottle bills.

**Net employment effects.** Studies after the implementation of the Oregon bottle bill in 1972 found a net increase in employment of approximately 300-400 jobs.<sup>221</sup> Other analysts have concluded that a bottle bill would generate both job gains and losses, changing the composition of employment but with no significant overall changes in employment levels.<sup>222</sup>

### Income/Revenue/Fiscal Effects

**Government.** The fiscal impact on government will depend on the ultimate design of the program. In Oregon, three agencies are involved in administering the bottle bill. The Oregon Liquor Control Commission is the main agency charged with overall administration of the program. The Oregon Department of Environmental Quality provides support through research and analysis. The Oregon Department of Agriculture provides inspections of the containerreturn areas. Even with these three agencies involved, the program is largely in the hands of industry. The state collects no revenues from the program, and it pays no processing fees to any of the industry participants.<sup>223</sup> We found no study on the fiscal impacts on the State of Oregon.

The State of California administers its bottle bill differently. The California Department of Resources Recycling and Recovery (CalRecycle) administers the program, and it oversees the entire process from beverage manufacturer all the way to materials processor. It collects the CRV (deposits) and fees and disburses payments. The balance of the Fund after disbursements (including UDR) is used to fund both the administration of the bottle bill program as well as

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<sup>220</sup> See, for example, NewPoint Group. 2009. Market Analysis for Recycled Beverage Container Materials: 2009 Update; Recycling Market Development and Expansion Grant Program. DRRR-2011-024. California Department of Conservation, Division of Recycling. June. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1388>. p. 1-4.

<sup>221</sup> U.S. General Accounting Office. 1977. *Potential Effects of a National Mandatory Deposit on Beverage Containers*. Report to the Congress by the Comptroller General of the United States. PAD-78-19. December 7. p. 52.

<sup>222</sup> Dewey, J., D. Denslow, B. Chavez et al. 2011. Analysis of a Florida Beverage Container Deposit Refund System. Bureau of Economic and Business Research, University of Florida. March 15. <http://www.bebr.ufl.edu/content/bottle-bill-report>. pp. 15-16

<sup>223</sup> Oregon Liquor Control Commission. 2011. *Bottle Bill & Redemption Center Info*. [http://www.oregon.gov/OLCC/bottle\\_bill.shtml](http://www.oregon.gov/OLCC/bottle_bill.shtml).



related recycling programs. Over its history, the Fund has accumulated surpluses in many years, at times the Fund's year-end balance exceeded \$200 million. By 2006, specific efforts to reduce the Fund balance and support more recycling programs were underway. In FY 07/08, overall program revenues into the beverage fund equaled about \$1.2 billion (including interest, about 1 percent of the total). Total expenditures were slightly greater, for a net program cost of about \$10 million but an overall positive balance in the Fund.<sup>224</sup>

**Industry.** The effects on industry depend on the structure of the program. In Oregon, the distributors keep all UDR and receive income from the sales of scrap materials. Oregon retailers, however, handle the bulk of the returns but receive no compensation. As of 2008, the UDR was estimated to be \$16 million per year in Oregon.<sup>225</sup> In California most industry participants pay fees to or receive payments from the Fund with the general goal of maintaining an efficient recycling marketplace and providing appropriate incentives for all parties. California explicitly assesses processing fees on manufacturers using containers that cost more to recycle than they are worth in scrap value—an application of the “polluter pays” principle.<sup>226</sup> In Maryland, the effects on industry will depend on a number of factors, including: (1) who handles the container returns, (2) the costs of handling returns, (3) whether any processing or handling fees are collected or paid, (4) who keeps the unredeemed deposit revenue, (5) the transportation and other costs involved in preparing empty containers for materials processing, (6) the prices of scrap materials, and (7) who receives the revenue from scrap materials.

Another potential fiscal effect involves the potential shift of empty aluminum beverage containers from curbside or other recyclers to the bottle bill system. Because aluminum is valuable as scrap, the curbside recyclers or other parties that collect the scrap value would experience a reduction in income as consumers opt to collect their deposits by returning the containers through the bottle bill system. In both Oregon and California, some consumers opt to forego receiving the deposit and recycle their containers through curbside bins.<sup>227</sup> A California study estimated that eliminating the bottle bill would increase curbside collection of aluminum containers by only a couple percentage points.<sup>228</sup> This suggests Maryland curbside recyclers would still collect some aluminum beverage containers.

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<sup>224</sup> R3 Consulting Group, Inc. and C. Morawski. 2009. *Evaluating End-of-Life Beverage Container Management Systems for California*. California Department of Conservation. May 15. <http://www.r3cgi.com/DOC/FINAL%20REPORT.pdf>. pp. 4-10 – 4-11.

<sup>225</sup> Bottle Bill Task Force. 2008. Final Report. State of Oregon. October. [http://www.leg.state.or.us/comm/commsrsvs/Bottle\\_Bill\\_Final\\_Report.pdf](http://www.leg.state.or.us/comm/commsrsvs/Bottle_Bill_Final_Report.pdf). p. 14.

<sup>226</sup> California Department of Conservation, Division of Recycling. 2007. *California Beverage Container Recycling Program History and Fund Management Options*. DRRR-2011-026. February 28. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1390>. p. 3

<sup>227</sup> In addition, California has made provisions for curbside recyclers to receive deposit revenue and other payments—in addition to the value of the aluminum and other scrap they do collect—for any deposit containers recycled through the curbside programs.

<sup>228</sup> Berck, P. and G. Goldman. 2003. *California Beverage Container Recycling & Litter Reduction Study: A Report to the California State Legislature*. DRRR-2011-025. University of California at Berkeley. <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1389>. p. 38.

## Summary

The economic impacts on employment and revenues for government and industry depend on the design of a Maryland bottle bill. There may be both job gains and job losses, with the net effect impossible to determine at this point. In addition, the financial aspects of a Maryland bottle bill could be designed in a number of ways. On one hand, there is a relatively simple but imperfect structure in Oregon that places the monetary flows in industry's hands, although it does so without compensating the retailers. On the other hand, the California model is much more complicated and contains more extensive government involvement, but it seems to provide incentives through fees assessed on or payments paid to most involved parties.

### C. Equity Assessment

An Equity Assessment would evaluate the distribution of the costs, benefits, and impacts across any dimension that participants in the policy debate agree is important: for example, income brackets of households, ethnicity, geographic areas, and interest groups. Based upon the information we have reviewed on the bottle bills in Oregon and California, we identify one primary issue with regard to equity.

**Equity across income levels.** The bottle bill has the potential to have unequal effects across income levels. If the bill has the effect of increasing the price of beverages, that effect would fall most heavily on those with lower incomes. In general, lower-income households spend a higher percentage of their incomes on food, so one would expect the increased costs of deposits to be a higher percentage of their budgets. Each month in 2010, each Californian consumed, on average, approximately 45 beverages subject to the bottle bill.<sup>229</sup> As a rough range, the average amount a household might spend on deposits would be in the range of \$5 to \$12 per month, depending on the amount of the deposit.<sup>230</sup> Upon recycling, these funds would be returned to the consumer.

Other studies have found that the ability to collect returnable containers to receive the deposit provides an opportunity for lower-income individuals to earn income. A set of studies found that deposit refunds are an important component of many of the poorest populations' income streams.<sup>231</sup> Additional research showed that petty crime at the city level decreased by roughly 11 percent with the implementation of a bottle bill, as the deposit refunds provide a legal means

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<sup>229</sup> Based on 2010 sales of 20,263,724,097 containers (annual) and a statewide population of 37,253,956; equals 544 per person per year, or 45 containers per person per month. For 2010 sales, see CalRecycle. 2011. *Calendar Year 2010 Report of Beverage Container Sales, Returns, Redemption, & Recycling Rates*. DRRR-2011-019. California Department of Resources Recycling and Recovery. July. <http://www.calrecycle.ca.gov/publications/default.asp?pubid=1383>. p. 13 and un-numbered source section. For 2010 population, see U.S. Census Bureau. 2011. *State and County Quickfacts*. <http://quickfacts.census.gov/qfd/states/06000.html>.

<sup>230</sup> Based on California data showing 45 containers per month per capita (see previous footnote) and Maryland household size of 2.6 (U.S. Census Bureau. 2011. *State and County Quickfacts*. <http://quickfacts.census.gov/qfd/states/24000.html>). A \$.05 deposit yields \$5.85 per month; \$.10 deposit yields \$11.70 per month.

<sup>231</sup> Ashenmiller, B. (2009). "Cash Recycling, Waste Disposal Costs, and the Incomes of the Working Poor: Evidence from California." *Land Economics* 85(3): 539-551.

to obtain income.<sup>232</sup> Income from returnable containers amounted to 7 to 9 percent of the poorest households' incomes.<sup>233</sup>

#### **D. Risks and Uncertainties**

Given that the design of a Maryland bottle bill is unknown, there are countless uncertainties about the effects of such a bill once enacted. In this section we identify two specific risks that are apparent at this time.

- A shift in beverage purchases across state borders. Given the location of Maryland's urban areas and their proximity to urban areas in other states and the District of Columbia, consumers may seek to avoid a beverage deposit on their purchases by purchasing beverages outside of the state rather than inside. This is a phenomenon common to all kinds of local or statewide taxes or fees. Any such shift in beverage purchases would affect the deposit revenue generated in the state.
- Fraudulent redemptions of containers purchased out of state. Because Maryland's neighbors do not have bottle bills and beverage containers are generally indistinguishable from state to state, consumers may attempt to return containers for which deposits have not been paid. These fraudulent redemptions occur to some extent in all states with bottle bills. Higher deposit values may lead to higher incidences of fraud.

### **IV. Conclusions**

The results of the three analyses, taken together, provide an understanding of the potential economic effects of a Maryland bottle bill. Given the undefined nature of a potential bill at this point, the findings are not conclusive. The findings do, however, indicate that the economic outcomes would vary in specific ways based on key features in the program's design. Based on this knowledge, policymakers would be positioned to design a program to meet policy goals while minimizing the unintended consequences.

By definition, designing a program to maximize overall economic efficiency from a societal perspective involves maximizing the benefits and minimizing the costs. Maximizing the benefits of a bottle bill depends on attaining high recycling rates. High rates are achievable with broad coverage of beverage containers, strong incentives for consumers to return containers, and convenient recycling locations. Minimizing the costs of a bottle bill depends on an efficient return system, so that the costs of transportation and handling are reduced.

A bottle bill involves a number of entities from consumers to industry participants to government agencies. Each of the entities would be affected in different ways. The design of the

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<sup>232</sup> Ashenmiller, B. (2010). "Externalities from Recycling Laws: Evidence from Crime Rates." *American Law and Economics Review* 12(1): 245-261.

<sup>233</sup> Ashenmiller, B. (2011). "The Effect of Bottle Laws on Income: New Empirical Results." *American Economic Review* 101(3): 60-64.

program would ultimately determine the financial flows and subsequent financial impacts on the parties. California and Oregon provide different examples of how the financial relationships can be structured. Employment effects would also be dependent on the design of the program—with possible increases in recycling employment. Effects on beverage-industry employment are less clear.

Low-income households spend more of their income on food, so they would be most affected by the addition of a beverage-container deposit. The overall effects on low-income households are not well defined, however, because (1) the deposits are refunded upon return of the containers and (2) the deposit system provides the opportunity for gaining additional income by collecting discarded containers.

## Appendix E: Beverage Container Deposit Program Contacts

State	Name	Position	Organization	Telephone	Email
CT	Jacquelyn Pernell-Holiday	----	Dept. of Env. Protection	860/424-3241	Jackie.pernell@ct.gov
HI	Jennifer Tosaki	Coordinator	Dept. of Health	808/ 586-4226	jennifer.tosaki@doh.hawaii.gov
ME	Steve Giguere	Program Manager	Dept. of Agriculture	207 287-3841	Steve.Giguere@maine.gov
MA	Greg Cooper	Deputy Director	Dept. of Env. Protection	617-292-5988	greg.cooper@state.ma.us
MA	Joe Kvilhaug	Director of Voc. Services	Town Line Redemption Center	508-384-5540	joe.kvilhaug@state.ma.us
MA	Sean Sylver	Program Specialist	Dept. of Environ. Protection	617-292-5988	sean.sylver@state.ma.us
MI	Alberto Martin	----	Dept of Treasury	517/636-4456	martina@michigan.gov
MI	Howard Heidi	----	Dept of Treasury	----	heidemanh@michigan.gov
MI	Thomas Patchak Schuster	----	Dept. of Treasury	517-373-0648	SCHUSTERT@michigan.gov
NY	Laura Haight	Sr. Environ. Assoc.	NY PIRG	518/436-0876 x 258	lhaight@nypirg.org
NY	Jennifer Kruman	Env. Program Specialist	NYDEC	518/402-8706	jxkruman@gw.dec.state.ny.us
OR	Peter Spendelow	Solid Waste Analyst	Dept. of Env. Quality	503/229-5253	spendelow.peter@deq.state.or.us
TN	Marge Davis	Coordinator	Pride of Place	615/758-8647	margedavis@comcast.net



## Appendix D: Breakdown of Beverage Container Deposit Programs

Existing Bottle Programs											Several Proposed Deposit Programs		
	California	Connecticut	Hawaii	Iowa	Massachusetts	Maine	Michigan	New York	Oregon	Vermont	Florida	Texas	Minnesota
<b>Established</b>	1986	1978	2002	1978	1983	1976	1976	1983	1971	1973	Proposed 2011	Failed 2010; proposed 2013	Failed 2008 and 2009; Proposed for 2011.
<b>Expanded/Roll Back</b>	Expanded in 2000 to include additional beverages.	Expanded in 2010 to include bottled water.	Expanded in 2007 to include 2-liter bottles.	Recent repeal attempt defeated.	Considering expansion to include water, juice, and sports drinks.	Expanded in 1989 to include juices, teas, sports drinks, bottled water	Expanded in 1989 to include wine coolers and canned cocktails; all containers 10¢.	Expanded to include bottled water in 2009.	Expanded in 2007 to include water and flavored water. In 2011 deposit from 5¢ up to 10¢ by 2017 if beverage container return rates fall below specified levels. Also increases accepted beverages.	Repeated repeals defeated 2007-2011.	N/A	N/A	N/A
<b>Driver</b>	Litter reduction.	Reduce litter and encourage recycling activity.	Beverage debris on beaches impacting tourism.	Reduce roadside litter and divert waste from landfills.	Litter reduction.	Reduce litter and solid waste generation, create incentives for recycling and reuse.	Reduce roadside litter, clean up the environment, and conserve energy and natural resources.	Reduce litter, ease burden on solid waste facilities and encourage recycling activity.	Reduce litter and increase recycling.	Conserve energy, reduce litter, increase recycling and create jobs.	Litter reduction and recycle rate goal.	Reduce trash and increase recycling.	Reduce trash and increase recycling
<b>Fee</b>	10¢ > 24 oz 5¢ < 24 oz	5¢	5¢, plus 1¢ to 1.5¢ non refundable fee for program admin.	5¢	5¢	\$0.05; \$0.15 for some wine bottles.	10¢	5¢	5¢	\$0.05; \$0.15 for some liquor bottles.	2.5¢ - 3¢	10¢ > 24 oz 5¢ < 24 oz	10¢
<b>Container Type</b>	All containers except milk, infant formula, wine, and 100% fruit juice in containers 46 oz or more, vegetable juice above 16 oz.	Beer, Carbonated soft drinks, noncarbonated beverages.	Nonalcoholic beverages, beer, malt, mixed spirits, wine.	Beverages of beer, wine coolers, wine, liquor, soda, mineral water.	Beer, malt beverages, carbonated soft drinks, and mineral water.	All sealed beverage containers except, dairy and unfiltered cider.	Beer, soft drinks, carbonated & mineral water, wine coolers, canned cocktails.	Beer, malt, carbonated soft drinks, water, wine coolers.	Beer, malt, beverages, carbonated mineral waters, carbonated soft drinks, water, flavored water.	Beer, malt, carbonated soft drinks, mixed wine drinks; liquor.	All bottles and cans except dairy.	Beer, malt, carbonated soft drinks, mineral water, coffee, tea, juices and flavored and non-carbonated waters. Dairy products excluded.	All liquid beverages excluding milk.
<b>Container Materials</b>	Aluminum, plastic, glass, and bi-metal.	Bottles, jars, and cartons made from glass metal or plastic.	Aluminum, bi-metal, plastic, glass up to 68 oz.	Bottles, cans, jars, or cartons made of glass, plastic, or metal.	Glass, plastic, metal, aluminum, and bi-metal containers.	Glass, metal, and plastic containers.	Any airtight metal, glass, paper, or plastic container, or a combination, under 1 gallon.	Airtight metal, glass, paper, plastic, or combination of the above, under 1 gallon.	Metal, plastic, glass containers that are 3 liters in size or less.	Glass, metal, or plastic containers.	Aluminum, glass, plastic, or steel containers.	All sealed containers made of glass, plastic or aluminum containing a beverage of 4 liters or less.	Metal, glass, plastic, or combination containers up to 3 liters.
<b>Consumption Rate</b>	20 billion	N/A	900 million	1.9 billion,	3.3 billion	1 billion	N/A	6 billion	N/A	290 million beverage containers/year.	36 mil	N/A	1.1 billion
<b>Beverage Portion of Litter</b>	N/A	N/A	N/A	N/A	4.4% of waste stream (excluding milk)	14% of total waste diversion.	N/A	N/A	N/A	6% of total waste diverted; 40-60% of total waste created	14% roadside 40% to 60% beach	18% on beaches	N/A
<b>Responsible Agency</b>	Department of Resources Recycling and Recovery	Connecticut DEP	Hawaii Dept of Health	Iowa DN, Waste Management Division	Massachusetts Department of Environmental Protection	Maine Department of Agriculture	Michigan Department of Treasury	Bureau of Waste Reduction and Recycling	Oregon Department of Environmental Quality, Oregon Liquor Control Commission	Vermont Agency of Natural Resources	TBD	Comptroller	Pollution Control Agency

Existing Bottle Programs											Several Proposed Deposit Programs		
	California	Connecticut	Hawaii	Iowa	Massachusetts	Maine	Michigan	New York	Oregon	Vermont	Florida	Texas	Minnesota
<b>Redemption Process</b>	System of 2000 redemption centers; NO retailers, although retailers w/> \$2 mil in sales must ensure redemption center w/in half mile; retailers < \$2 mil are exempt from this.	Redemption centers and retailers/grocers.	Redemption centers who weigh or hand count loads.	Redemption centers and retailers/grocers w/ exemption for retailers w/in 1 mile of centers.	Redemption centers and retail outlets (within 60 days of purchase).	There are 815 redemption centers; when a distributor, delivers to a retailer, they pick up returnables at the redemption center.	Retail stores.	Retail stores and redemption centers.	Retail stores and redemption centers (as of 2011 only 2 redemption centers in state).	There are 2000 "Certified Redemption Centers" where bottles are either sorted by hand onsite or returned to reverse-vending machines; containers can also be returned to where they were sold.	Retailers and redemption centers, within designated convenience zones.	Retail stores optional), redemption centers, reverse-vending machines, non-profit organizations.	N/A
<b>Handling/ Processing Fees</b>	.89¢	1.5¢ - 2¢	2¢ to 4¢	1¢	2.25¢	4¢, or 3.5¢ if part of commingling agreement	none	3.5¢	none	\$0.04 for brand-sorted containers \$0.035 for commingled containers.	est 1.5¢	TBD handling fee to be paid to retailers, redemption centers, and recycling centers.	1¢ - 2¢
<b>Redemption Rate</b>	84%	N/A	79%	86%	70.80%	90%	96.90%	66.80%	Cans: 83.92%, Glass: 79.86%, PET: 50.35%, Overall: 75.04%	85% overall; 72% for liquor bottles, 97% for beer containers, 90% for softdrink containers.	est 61% - 64%	TBD	est 80%
<b>Unclaimed Deposit Rate</b>	16%	N/A	21%	14%	29.20%	10%	3.10%	33.20%	Distributors hold the deposits and get to keep any unredeemed deposits.	15%	est 36% to 39%	TBD	20%
<b>Unclaimed Deposit Revenue</b>	N/A	less than \$24 mil	\$21.5 mil in 2009	\$13 mil in 2008	\$39.2 mil	\$1.2 million	2000 --\$23.5 mil 2001 -- \$17.5 mil	\$103.4 mil in 2007 \$110 in 2010	\$16 mil	\$2 mil	est \$70 to \$83 mil (net est assuming 1¢ per container removed to cover program costs handling fees).	est \$175 mil	\$90 mil
<b>Revenue Use</b>	Grants, supplemental payments to curbside programs, municipal reimbursements, outreach and education, handling fee reimbursements.	Goes to general fund.	Sustains program through centralized program fund.	Goes to distributors and bottlers.	Goes to general fund.	Goes to general fund.	75% goes to state for environmental programs, 25% to retailers.	80% to the state general fund; 20% retained by distributor.	Retained by distributors.	Retained by distributors.	TBD	Goes to general fund.	90% goes to state env. Fund while 10% goes back to counties.
<b>GHG Rate Change</b>	16.5 bil containers recycled is est 676,000 ton GHG reduction.	N/A	N/A	N/A	N/A	N/A	206,936 ton GHG reduction per year.	Reduce GHG by 281,000 tons per year.	Saved 3 trillion BTUs of energy, 200,000 tons of CO <sup>2</sup> .	N/A	TBD	TBD	TBD
<b>Jobs Created Claim</b>	N/A	N/A	N/A	N/A	1,800 jobs gained employed	1300 people produced	1,800 jobs produced	3,800 jobs	300-400 jobs	N/A	No net change anticipated from program itself; expect it could be significant if unclaimed revenue is used for job creation.	TBD	TBB
<b>Fraud Management</b>	inspection and enforcement	N/A	Not an issue.	N/A	N/A	People redeeming >2500 bottles are registered; limits on number of redemption centers per municipality.	Enforcement penalties and state-specific barcoding.	N/A	N/A	N/A	Reporting, daily limits, penalties.	TBD	State-specific deposit label.