

Fact Sheet: Deposit Return Systems Reduce Litter

- Attaching a monetary value to beverage containers, in the form of refundable deposits, decreases the likelihood that the containers will be littered or remain as litter in the environment.
- The impact of a DRS on litter reduction depends on a number of factors, including the level of the deposit/refund and the program scope.
- There are different ways to measure beverage containers as a proportion of litter, each of which has its own advantages and pitfalls.

BACKGROUND

The eyesore that is litter is an all too familiar sight in our cities and countryside. Aside from being unsightly, litter can have serious environmental, human health, and social effects, including reduced visual amenity, harm to our terrestrial and marine wildlife, and injuries from broken glass. There is also the economic cost of cleaning up litter and improperly discarded material, which is mostly borne by governments (including local governments), not the producers of packaged goods. In Europe, the total cost of cleaning up litter on land alone is estimated at €10 billion (USD \$12.1 billion) to €13 billion (USD \$15.8 billion) per year.ⁱ In the U.S., Keep America Beautiful (KAB) estimates the annual cost to clean up litter to be around \$11.5 billion.ⁱⁱ



In addition to increasing recycling rates, one of the main benefits of deposit return schemes (DRS)—and one that cannot be accomplished without it—is litter reduction. Quite simply, this is because attaching a monetary value to a beverage container, in the form of a refundable deposit, decreases the likelihood that the containers will be littered or remain as litter in the environment, as consumers and other citizens will be motivated to return them for recycling so that they can claim the refund.

It probably does not come as a surprise then that litter concerns were a primary reason why legislated DRSs were invented and passed in the first place. The first legislated system, established in British Columbia (Canada) in 1970, began as “The Litter Act” and was aimed at encouraging consumers to recycle beverage cans and bottles instead of tossing them to the side of the road. Many other DRSs introduced in the 1970s and 1980s were also mainly passed as anti-litter laws, including those in South Australia, Oregon, Vermont, and California, the latter of which’s legislation is aptly titled the “Beverage Container Recycling and Litter Reduction Act”.

In New South Wales (NSW), the state government has identified DRS as one of the key actions it has implemented to achieve the objectives in the 2019-2022 NSW Litter

Prevention Strategy.ⁱⁱⁱ The state's decision to implement DRS in December 2017 was principally based on the results of a cost-benefit analysis where benefits to communities from litter reduction were estimated using their willingness to pay for decreased litter.^{iv} The discussion document for the DRS decision stated that "by providing a reward, [DRSs] create a disincentive to litter and an incentive to pick up littered items."^v Similarly, Queensland's DRS legislation (Queensland Waste Reduction and Recycling Amendment Act (2017) includes in its objects to "reduce the number of empty beverage containers that are littered or disposed to landfill."^{vi} The Tasmanian government's decision to implement a DRS (planned for 2022) was also influenced by its ability to reduce littering behaviour; Environment Minister Elise Archer has publicly stated that "the scheme will encourage positive, incentivised recycling and re-use behaviours that will help reach our target of becoming the tidiest state by 2023."^{vii}

The effectiveness of DRS at reducing litter has also been recognised by the European Union. In 2019, the European Parliament and Council passed the Single-Use Plastic Directive, which introduced a wide range of measures to tackle commonly littered plastic that includes a requirement for member states to collect at least 90% of all single-use plastic bottles by 2029. The Directive specifically references DRS as a measure that could be taken to achieve this.

POSITIVE IMPACTS ON LITTER REDUCTION



Of course, the impact of a DRS on litter reduction depends on a number of factors, including the level of the deposit/refund and the program scope. For example, if a country only includes beer and soft drinks in its DRS, littering rates for those containers will differ from littering rates for bottled water containers that are excluded from the program's scope. In the same way, littering rates will be higher in DRS jurisdictions with lower deposit values, as there is less of a financial incentive to do the right thing.

The most robust evidence of the impact of DRS on littering comes from the U.S., where government-funded studies examined beverage container litter pre- and post-DRS implementation in a number of states in the 1970s and 1980s. A review of these litter studies conducted by the Container Recycling Institute (CRI) found that beverage container litter reductions have consistently been between 70% and 84%, while total litter has been reduced by between 34% and 47%.^{viii} One study, which looked at beverage containers as a percentage of total litter in Hawaii, found a 60% reduction within three years of DRS implementation.^{ix}

There is also some robust evidence from Australia. According to the NSW Environmental Protection Authority^x, prior to introducing the Return and Earn scheme, drink container litter made up 44% of the volume of litter in the state. Exchange for Change, the system coordinator for NSW's DRS, reports that the program has contributed up to a 57% reduction of drink container litter by volume and an annual average of 40% reduction compared to pre-scheme litter levels.^{xi} Similar results have been reported in ACT (Australian Capital Territory) and Queensland, both of which introduced DRS in 2018. In ACT, an analysis conducted by Keep Australia Beautiful found that there has been a 40% decrease in the volume of eligible drinks container items in the litter stream since the scheme was launched.^{xii} In Queensland, it is reported that the scheme has been responsible for a 54% reduction in beverage container litter and the elimination of 3 billion containers

in the environment.^{xiii} Data has also shown a clear pattern of reduced beverage container litter in Northern Territory. In May 2012, just 5 months after Northern Territory introduced its DRS, there was some 39% less beverage container litter found than in November 2011 (before the DRS was introduced), and 46% less litter than in May 2011.^{xiv} There was an even greater reduction in beverage related items (e.g. bottle tops, plastic can holders, etc.) – a 52% reduction from November 2011 to May 2012.^{xv}

In Europe, we are only aware of one study that compared the amount of beverage containers in roadside litter before and after the implementation of DRS. Below is an excerpt from that report,^{xvi} which describes the impact of the introduction of a DRS in Estonia:

“Before the introduction of a deposit refund scheme in Estonia, the composition of litter along roadsides was analysed. It was done in the framework of a clean-up campaign that was organised in 2003. Beverage containers were up to 80 % of the litter collected. Plastic bottles and aluminium cans formed a major part of the beverage containers. After the deposit was introduced in Estonia (in 2005), the amount of litter along roadsides decreased significantly. The follow up roadside litter survey that was carried out two years after the DRS implementation in Estonia showed that the share of beverage containers had dropped below 10 % of all litter.”

In addition to pre- and post-DRS litter surveys, a number of studies have been carried out to quantify the additional litter reduction benefits that could be achieved if an existing DRS were expanded, for example, by including a wider range of beverage containers in the program or by increasing the deposit. One such study, carried out by Eunomia Research and Consulting^{xvii} estimated that introducing a best-in-class DRS in California could further reduce the combined tons of aluminum and PET beverage containers littered across the state every year by 1,740 tons. For aluminum specifically, the study found that the tons of containers littered each year would decrease by 71%, while PET bottle litter would decrease by 51%. A similar study, also by Eunomia, found that increasing the level of the deposit to 10-cents (up from 5-cents) and widening the scope of Vermont’s existing bottle bill would likely decrease the number of beverage containers littered by as much as 66%.^{xviii}

Various other studies have been undertaken to estimate the impact that a potential DRS could have on litter in countries or states without a deposit system currently in place. A study carried out by Government of Western Australia in August 2018, for example, estimated that the state’s future DRS (to be implemented in 2020), would result in 706 million fewer beverage containers being littered over a period of 20 years.^{xix} Another study undertaken by Eunomia in 2017 assumed that a DRS in England would lead to an 80% reduction in littering of beverage containers subject to a DRS, and a 32% reduction in litter overall.^{xx} Key findings from a cost-benefit analysis of a Tasmanian DRS found that over a 20-year period from 2014-15 to 2034-2035, a deposit system could reduce beverage container litter on the island state by an estimated 6,271 tonnes, a 35% reduction on baseline volumes.^{xxi} Based on expert opinions and results in other parts of Australia that had implemented DRS, a different study in New Zealand predicted that beverage container litter would fall by 70% after the introduction of a DRS, which would reduce overall national litter volumes in the country by between 8.9% and 13.6%.^{xxii}



Although less robust, other evidence that DRS has a positive impact on litter reduction comes from comparisons of litter amounts between deposit and non-deposit jurisdictions. A recent report by Keep South Australia Beautiful (KESAB) offers one such comparison. According to KESAB’s 2018-2019 CDL Containers and Plastic Shopping Bags in the Litter Stream Report, beverage container litter currently represents only 2.9% of liter items in South Australia, where deposits have been mandatory since 1977, compared to 14.2% in Western Australia, whose DRS is only set to launch in October 2020.^{xxiii} Further comparative evidence comes from a 2018 study published in Marine Policy by Australia’s national science agency CSIRO, which evaluated the effectiveness of DRSs when it comes to litter reduction on the coasts of two countries, Australia and the U.S. CSIRO concluded that “the proportion of containers found in coastal debris surveys in states with [DRS] was approximately 40% lower than in states without [DRS]. ... These results provide strong evidence that fewer beverage containers end up as mismanaged coastal waste in states that provide a cash refund for returned beverage containers.”^{xxiv}

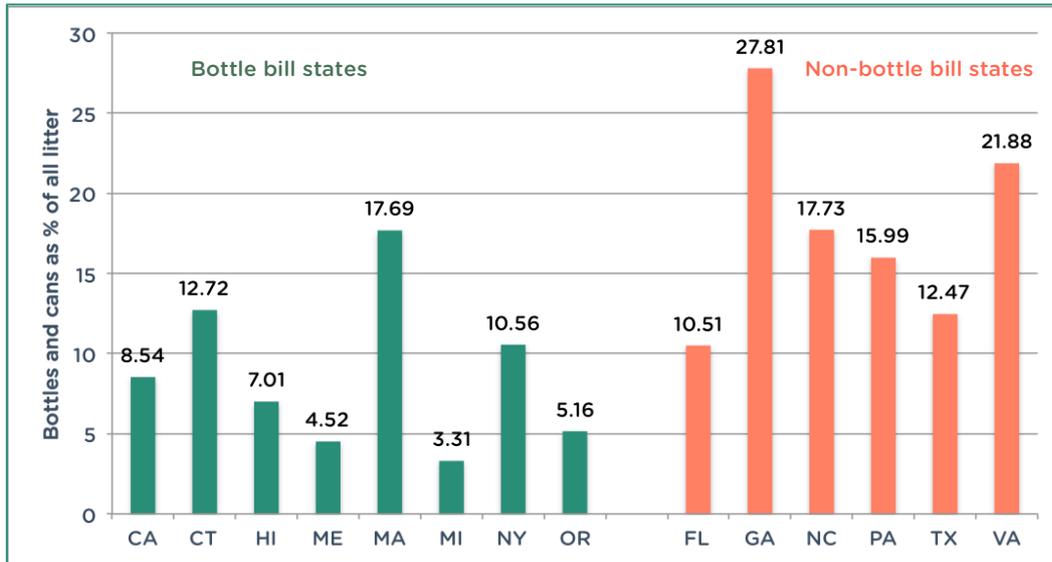
In a more recent study (2020), Keep America Beautiful (KAB) found that on a per capita basis, there was substantially less deposit-material litter in states with bottle bills than in non-bottle bill states (4.1 litter items per capita compared to 8.5 litter items per capita, respectively). See Figure 1. In addition to less deposit-material being littered, the study also found that there was less non-deposit litter per capita in bottle bill states (111.2 littered items per capita) than in non-bottle bill states (157.8 littered items per capita).

Table 1 Aggregate Count of Litter per Capita, Bottle Bill and Non-Bottle Bill^{xxv}

	Bottle Bill	Non-Bottle Bill	Total
Deposit Material Litter Items	365,705,800	2,001,483,400	2,367,189,200
Non-deposit Material Litter Items	9,867,790,500	37,338,065,700	47,205,856,200
Total Litter Items	10,233,496,300	39,339,549,100	49,573,045,400
Population	88,751,439	236,637,918	325,386,357
Deposit Material Litter Items Per Capita	4.1	8.5	7.3
Non-Deposit Material Litter Items Per Capita	111.2	157.8	145.1
Total Litter Items Per Capita	115.3	166.2	152.4

In another study that compared litter data between states with and without bottle bills, Clean Virginia Waterways of Longwood University found that plastic bottles, glass bottles, and aluminum cans are approximately 2.5 times more frequently littered in Virginia (a state without a bottle bill) than in U.S. states with bottle bills (see Figure 2). In Virginia, bottles and cans accounted for nearly 22% of all litter recorded by volunteers in the 2019 International Coastal Cleanup. In contrast, in states with bottle bills, they accounted for 8.69%, on average, of the total debris recorded.^{xxvi}

Figure 2 Bottle Bill States vs. Non-Bottle Bill States: Litter from Bottles and Cans



METHODOLOGICAL ISSUES WITH MEASURING LITTER

When analysing the results of litter studies, it's important to recognise that such studies often use different methodologies to quantify litter, which prevents direct comparisons and harmonisation of data across regions or time-scales. Part of the problem is that there is no standardised system for quantification. In general, there are three ways to think about, and measure, the overall amount of beverage container litter, and the proportion of all litter that is comprised of beverage containers.

Some studies measure beverage container litter by weight, which is relatively easy and provides a quick method for quantifying large numbers of containers that have been collected during a survey. Weight measurements also make it possible to rapidly deal with broken or fragmented material (e.g. glass bottles). Others surveys quantify litter by item count, in which a cigarette butt is equivalent to a discarded plastic bottle, for example. Still, others measure litter by volume. Depending on which one is used, estimates of actual litter quantities can vary substantially. To illustrate, a litter composition study in the Czech Republic concluded that PET bottles accounted for 30% of overall litter by weight, and 37% of litter by volume.^{xxvii}

As noted by the Container Recycling Institute, another issue that must be taken into consideration when comparing the results of litter surveys is that there is no standardised method for determining "deposition rates", or clean-up and counting frequency.^{xxviii} Some surveys might be conducted a year after the last clean-up at a given study site, while others might be conducted just a few days or weeks after. Studies also differ in the types of areas or use patterns they survey. For instance, some litter surveys may be conducted on roadsides while others are carried out in rivers, beaches, or parks. Even within a specific area category, several other factors play a role, such as traffic densities on urban vs. rural roads. The entities that fund the studies can also vary; for example, some studies may be funded by non-profit organisations while others are funded by the beverage industry. Even studies that employ similar methodologies can generate different results (e.g. depending on how and the extent to which small items of litter (size threshold) are counted). Clearly, these methodological variations will impact the results of litter surveys.

Different stakeholders have varying opinions on which of these methodologies are most relevant to the discussion. Most survey protocols recommend one or more of these methods with “item counts” being the predominant approach. Irrespective of current usage, each of these methods has its advantages and pitfalls.

Reloop believes that the “best methodology” depends on the issue we’re attempting to address. For instance, if we are looking at litter in the context of rising waste collection costs, then it is likely that volume is the most relevant measure as beverage containers are generally of large volume relative to their weight, compared to other types of waste. Voluminous waste types cause collection containers to fill up quickly and thus require a higher collection frequency, which increases costs. Volume is also a relevant measure if we are talking about visual amenity. While they may not weigh as much as other types of litter and may not be as common as cigarette butts or chewing gum in terms of count, research by Keep Scotland Beautiful (2007) suggests that people consider large or highly visible items of food and drink packaging to be the most irritating types of litter.^{xxix}

FINAL THOUGHTS

Beyond increasing recycling rates, litter reduction is one of the primary benefits of DRS. No other method of beverage container collection has proven, in and of itself, to be nearly as effective at reducing litter rates. From an industry perspective, DRS not only helps reduce public pressure around the litter problem, but secures larger quantities of clean feedstock to use as recycled content in their new bottles. As governments around the world consider their options to solve the complex challenges of packaging waste over the coming years, DRS should be front and centre.

ENDNOTES

ⁱRobertson, D. "Absolute Rubbish! The Litter Crisis in Europe." Accessed August 5, 2020 from <https://visual.ly/community/Infographics/environment/litter-crisis-europe-infographic>

ⁱⁱHampton VA. "Keep America Beautiful: Litter Research." Accessed August 5, 2020 from <https://hampton.gov/958/Keep-America-Beautiful-Litter-Research>

ⁱⁱⁱNSW Government. December 2019. "NSW Litter Prevention Strategy 2019-2022." Accessed 21 August 2020 from <https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/litter/19p1753-litter-prevention-strategy.pdf?la=en&hash=37A13D05A443F1532AE98E6306E15BC2EF77C64B>

^{iv}Sapere Research Group. August 2017. "Cost-benefit analysis of a Container Deposit Scheme." Report for the Auckland Council. Accessed 21 August 2020 from <http://www.wasteminz.org.nz/wp-content/uploads/2017/12/Container-Deposit-CBA-Report-Final.pdf>

^vNew South Wales Environment Protection Authority (2015) Op cit. p.15, as cited in Sapere Research Group, August 2017, "Cost-benefit analysis of a Container Deposit Scheme." Accessed 21 August 2020 from <http://www.wasteminz.org.nz/wp-content/uploads/2017/12/Container-Deposit-CBA-Report-Final.pdf>

^{vi}Marsden Jacob Associates. April 2018. "Final Report – A Model Framework for a Container Refund Scheme in Tasmania." Report prepared for EPA Tasmania. Accessed 21 August 2020 from <https://dpipwe.tas.gov.au/Documents/Marsden%20Jacob%202018%20CRS%20Model%20Framework.pdf>

^{vii}Jarvie, E. 6 June 2019. "Tasmanian government commits to introducing container refund scheme." The Advocate. Accessed 21 August 2020 from <https://www.theadvocate.com.au/story/6204281/tasmania-to-implement-container-refund-scheme-by-2022/>

^{viii}Container Recycling Institute. Bottle Bill Resource Guide: Litter Studies in Bottle Bill States." Accessed August 5, 2020 from <http://www.bottlebill.org/index.php/benefits-of-bottle-bills/litter-studies-in-bottle-bill-states>

^{ix}Ocean Conservancy International Coastal Cleanup, 2003-2011

^xNSW Government. "Return and Earn: NSW recycling success story." Accessed 20 August 2020 from https://www.exchangeforchange.com.au/_cache_51b2/content/6531970000008035.pdf

^{xi}Exchange for Change. "Return and Earn Annual Statutory Report 2018-2019." Accessed from <https://www.exchangeforchange.com.au/who-we-are/publications-and-reports.html>

^{xii}Exchange for Change. "2018-2019 ACT CDS Annual Statutory Report." Accessed from <https://www.exchangeforchange.com.au/who-we-are/publications-and-reports.html>

^{xiii}Container Exchange (CoEX). "Annual Report 2019-2020." <https://containerexchange.com.au/wp-content/themes/coex160620/annual-report/dist/img/ce-report.pdf>

^{xiv}Boomerang Alliance. February 2013. "Independent Review: The Northern Territory Container Deposit System." Accessed 2 September 2020 from http://www.bottlebill.org/assets/pdfs/campaigns/australia/NT%20CDS%20Report%20Final_180213.pdf

^{xv}ibid.

^{xvi}Balcers, O., Brizga, J., and H. Morra. (2019). "Deposit Return Systems for Beverage Containers in the Baltic States. Riga: Green Liberty. Accessed August 5, 2020 from https://www.researchgate.net/publication/332242306_Deposit_Return_Systems_for_Beverage_Containers_in_the_Baltic_States_Riga_Green_Liberty

^{xvii}Eunomia Research and Consulting. May 2020. "California: Environmental & Social Impacts of a Failing Bottle Bill." Accessed August 5, 2020 from <https://www.eunomia.co.uk/reports-tools/california-bottle-bill/>

^{xviii} Eunomia Research and Consulting. March 2020. “Impacts of Increasing Vermont’s Bottle Bill Scope and Deposit Value.” Accessed August 6, 2020 from <https://www.eunomia.co.uk/reports-tools/impacts-of-increasing-vermonts-bottle-bill-scope-and-deposit-value/>

^{xix} Government of Western Australia, Department of Water and Environmental Regulation. August 2018. “Consultation Regulation Impact Statement: Western Australia Container Deposit Scheme.” Accessed August 5, 2020 from <https://www.wa.gov.au/sites/default/files/2019-12/cris-wa-container-deposit-scheme.pdf>

^{xx} Eunomia Research and Consulting. October 2017. “Impacts of a Deposit Refund System for One-Way Beverage Packaging on Local Authority Waste Services – Final Report.” Accessed August 5, 2020 from <https://www.sas.org.uk/wp-content/uploads/Financial-impacts-of-a-DRS-on-Local-Authority-Waste-Services.pdf>

^{xxi} Marsden Jacob Associates. 16 April 2014. “Final Report: Cost Benefit Study of a Tasmanian Container Deposit System – Final Report.” Accessed 21 August 2020 from https://dipwe.tas.gov.au/Documents/Marsden%20Jacob%202014%20Tasmanian%20CDS%20Cost_Benefit%20Study.pdf

^{xxii} Sapere Research Group. August 2017. “Cost-benefit analysis of a Container Deposit Scheme.” Report for the Auckland Council. Accessed 21 August 2020 from <http://www.wasteminz.org.nz/wp-content/uploads/2017/12/Container-Deposit-CBA-Report-Final.pdf>

^{xxiii} KESAB Environmental Solutions. December 2019. “CDL Containers and Plastic Shopping Bags in the Litter Stream 2018-19.” Accessed August 6, 2020 from https://www.epa.sa.gov.au/files/14628_kesab_cdl_2019.pdf

^{xxiv} Schuyler, Q. et al. (2018). “Economic incentives reduce plastic inputs to the ocean.” *Marine Policy*, 96, 250-255. <https://www.sciencedirect.com/science/article/abs/pii/S0308597X17305377>

^{xxv} Keep America Beautiful. 2021. “2020 National Litter Study – Summary Report: May 2021.” Accessed 14 June 2021 from <https://kab.org/litter-study/>

^{xxvi} Clean Virginia Waterways of Longwood University. 2020. “Report: Littered Bottles and Cans: Higher in Virginia Than in States with Bottle Bills.” https://drive.google.com/file/d/1wyDpBGJcjUj6uOuddgOuzg_OK3w8IRpW/view

^{xxvii} SPF Group. 2007. ANALÝZA VOLNĚ POUŽITÝCH OD PADŮ V ČESKÉ REPUBLICE. Accessed 2 September 2020 from http://data.idnes.cz/soubory/vedatech/95A100219_TAJ_ANALYZAVOLNEPOHOZENYCH.PDF

^{xxviii} Container Recycling Institute. April 2015. “Estimating Beverage Container Litter Quantities and Cleanup Costs in Michigan.” Accessed August 6, 2020 from <http://www.bottlebill.org/assets/pdfs/benefits/MichiganLitterCleanupCosts%20FINAL%20April2015.pdf>

^{xxix} Zero Waste Scotland. “Rapid Evidence Review of Littering Behaviour and Anti-Litter Policies.” Accessed 2 September 2020 from <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>