



Costs and impacts of a deposit on cans and small bottles in the Netherlands

Extended summary



Committed to the Environment

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More information on this study can be obtained from [Geert Bergsma](#)

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CE Delft

Committed to the Environment

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Extended summary

Background

The current Dutch deposit system for beverage packaging covers large PET bottles, small refillable soft-drinks bottles sold by caterers and refillable beer bottles. Other types of packaging are exempt. CE Delft was commissioned by the Ministry of Infrastructure and the Environment to research the costs and (environmental) impacts of introducing a deposit on cans and small plastic bottles, so the results could be used as input for comparing options in the decision-making process.

The results are set out at length in the Dutch-language report “Kosten en effecten van statiegeld op kleine flesjes en blikjes” (131 p.). This extended English summary of the report combines the Dutch-language Summary and Results chapter and lists the organizations and agencies that provided support, in the Advisory Group or otherwise.

Introduction and process

During this extensive study we were supported by numerous stakeholders, to whom we extend our warmest thanks. In particular, we would like to thank:

- Stichting Retourverpakking Nederland (SRN, Dutch Return Packaging Foundation, SRN, administrators of the present deposit system, on which a wealth of data was provided)
- Recycling Network Benelux
- Centraal Bureau Levensmiddelenhandel (CBL, Dutch Supermarkets Association; feedback on supermarket impacts)
- Nederlandse Vereniging van Reinigingsdiensten (NVRD, Royal Dutch Association for Waste Management and Cleaning, plus member organizations; practical data on cleaning processes)
- Nedvang (PET recycling inventory and costs of other systems)
- Returpack, Sweden (practical data on the Swedish situation)
- Dansk Retursystem, Denmark (practical data on the Danish situation)
- Morssinkhof Plastics (data on the recycling process)
- Tomra, Anker Andersen & Lamson Group (manufacturers of reverse vending machines and counting machines).

For their regular input and extensive feedback, we also thank the members of our Advisory Group, listed here in alphabetical order:

- Belangenvereniging tankstations (Beta, Dutch Association of Petrol Stations)
- CBL, Dutch Association of Food Retailers
- Federatie Nederlandse Levensmiddelenindustrie (FNLI, Dutch Federation of Food Producers)
- Federatie Nederlandse Rubber- en Kunststoffindustrie (NRK, Dutch Federation of Rubber and Plastics Industries)
- Kennis Instituut Duurzaam Verpakken (KIDV, Netherlands Institute for Sustainable Packaging)
- Koninklijke Horeca Nederland (KHN, Royal Dutch Association for the Restaurant, Hotel and Catering Industry)
- Natuur & Milieu (Netherlands Society for Nature and Environment)
- Nederland Schoon (‘Keep the Netherlands Tidy’)
- Nederlandse Brouwers (Dutch Brewers Association)
- Nederlandse Vereniging Frisdranken, Waters, Sappen (FWS, Dutch Industry Association for Soft Drinks, Bottled waters and Juices)
- Netherlands Recycling Network
- NVRD, Royal Dutch Association for Waste Management and Cleaning
- Plastic Soup Foundation
- Raad Nederlandse Detailhandel (RND, Dutch Retail Council)



- SRN, Dutch Return Packaging Foundation
- Stichting Kringloop Blik (SKB, Dutch Foundation for Tinplate Recycling)
- Vereniging Nederlandse Gemeenten (VNG, Association of Netherlands Municipalities)
- Jan van der Kolk (chairman).

The contents of this report are the sole responsibility of the researchers at CE Delft.

Central research question

What are the costs and (environmental) impacts of introducing a deposit on cans and small plastic bottles?

Variants

To obtain the broadest possible picture, eight possible variants were examined, reflecting differences in the monetary level of the deposit (10 or 25 eurocents), collection points (supermarkets only, or all relevant sales outlets) and types of packaging materials (plastic bottles and cans only, or also one-way glass). The eight variants, summarized in Table 1, were chosen in consultation with the Advisory Group and cover most of the possibilities. In determining the costs and impacts of a deposit system for cans and small bottles, introduction thereof was taken as an add-on to the current deposit system for large plastic bottles and refillable beer bottles.

Table 1 - Variants of a deposit system for small beverage packaging

	Name	Type of packaging	Return points	Deposit level
1	PB-SUP-10	Cans and small plastic bottles	Supermarkets	10 eurocent
2	PB-SUP-25			25 eurocent
3	PB-AL-10		All sales outlets	10 eurocent
4	PB-AL-25			25 eurocent
5	PBG-SUP-10	Cans, small plastic bottles and one-way glass	Supermarkets	10 eurocent
6	PBG-SUP-25			25 eurocent
7	PBG-AL-10		All sales outlets	10 eurocent
8	PBG-AL-25			25 eurocent

Introduction of a deposit on cans and small bottles would mean an additional 2.7 to 2.9 billion packaging units being covered by a deposit annually: 1.8 billion cans, 900 million small plastic bottles (mostly PET, with a little HDPE/PP) and possibly 200 million one-way glass bottles. At the moment around 1 billion individual packaging units are returned annually to supermarkets to reclaim deposits. This means the number of individual packaging units to be potentially returned will increase by a factor 3.5 if a deposit on cans and small bottles is introduced (assuming 85% of these smaller items are indeed returned). Existing infrastructure for returning deposit packaging will therefore need to be expanded. The resultant costs for supermarkets (mainly for purchase of reverse vending machines (RVMs) and staffing costs) will thus constitute by far the largest cost of system expansion (65-95%).



Results

The costs and impacts of a deposit on cans and small bottles are shown in **Table 2** for each variant. The table reports total net annual cost and cost per bottle or can, cost coverage via unredeemed deposits, cost savings on current systems, and impacts on litter, ocean waste, recycling rates and CO₂ emissions.

Table 2 - Extension of deposit system to include cans and small bottles: synopsis of results

Deposit system	PB-SUP-10 #	PB-SUP-25	PB-AL-10	PB-AL-25	PBG-SUP-10	PBG-SUP-25	PBG-AL-10	PBG-AL-25
Number of cans and bottles sold in the variant, millions	2,700	2,700	2,700	2,700	2,900	2,900	2,900	2,900
Net annual cost of system extension, € mln (incl. revenue from materials) (eurocent per packaging)	10 ~ 68 (0.4~2.5)	14 ~ 79 (0.5~2.9)	13 ~ 80 (0.5~2.9)	15 ~ 87 (0.6~3.2)	21 ~ 88 (0.7~3)	27 ~ 103 (0.9~3.6)	26~ 102 (0.9~3.5)	29 ~ 110 (1~3.8)
Cost coverage via unredeemed deposits, € mln* (eurocent per packaging)	45 ~ 72 (1.7 ~ 2.7)	47~ 113 (1.7 ~ 4.2)	31 ~ 58 (1.1 ~ 2.1)	45 ~ 111 (1.7 ~ 4.1)	48 ~ 77 (1.7 ~ 2.7)	50 ~ 121 (1.7 ~ 4.2)	33 ~ 62 (1.1 ~ 2.1)	48 ~ 119 (1.7 ~ 4.1)
Current collection systems								
Cost savings on current collection systems, € mln (eurocent per packaging)	5.5 (0.20)	6.1 (0.23)	5.8 (0.21)	6.1 (0.23)	7.4 (0.26)	8.0 (0.28)	7.7 (0.27)	8.0 (0.28)
Litter								
Reduction in number of cans and bottles in litter, %	70 to 90% ^							
Reduction in waste plastic in oceans, tonne	Approx. 11~140 tonne (0.5~6 million bottles, 15% of plastic packaging ends up in water)							
Maximum reduction in costs of litter clean-up	Approx. maximum: € 80 mln (up to 3 eurocent per packaging)							
Cost savings on emptying public litter bins, € mln (eurocent per packaging)	€ 3 mln to € 10 mln (0.10 to 0.37 eurocent per packaging)							
Recycling and environment								
Expected Return percentage, %	80	90	85	90	80	90	85	90
Increased materials recycling, ktonne	4.2 alu 6.6 PET	4.8 alu 7.6 PET	4.5 alu 7.2 PET	4.8 alu 7.6 PET	4.2 alu 6.6 PET	4.8 alu 7.6 PET	4.5 alu 7.2 PET	4.8 alu 7.6 PET
Increased recycling relative to Framework Packaging Agreement, %	2.1% alu 1.4% plastic	2.4% alu 1.6% plast.	2.2% alu 1.5% plast.	2.4% alu 1.6% plast.	2.1% alu 1.4% plast.	2.4% alu 1.6% plast.	2.2% alu 1.5% plast.	2.4% alu 1.6% plast.
CO ₂ reduction, ktonne	44	54	49	54	44	54	49	54
Monetized environmental gains in 2030 environmental prices, € mln (eurocent per packaging sold)	3.5 ~ 22 (0.13~0.8)	4 ~ 27 (0.16~1)	4 ~ 25 (0.14~0.9)	4 ~ 27 (0.16~1)	3.5 ~ 22 (0.13~0.8)	4 ~ 27 (0.16~1)	4 ~ 25 (0.14~0.9)	4 ~ 27 (0.16~1)

* No monetary benefits to society. Cost coverage is at the expense of disposable consumer income. Consumers who fail to return packaging lose their deposit.

PB = plastic bottles and cans, SUP = return to supermarkets only, AL = return to all outlets, PBG = plastic bottles, cans and one-way glass, 10/25 = deposit in eurocents.

^ A 25 eurocents deposit will obviously lead to higher reduction percentages than a 10 eurocents deposit, but research on the issue shows that even with a lower deposit level major reductions are achieved.



Uncertainties and ranges

For several key factors we were unable to calculate an exact figure in this study, and instead estimated a range. While every attempt was made to minimize these ranges, there remain uncertainties, such as the number of packaging units that Dutch consumers will return and the number of additional RVMs that supermarkets will install. The ranges reported reflect current understanding as accurately as possible, with the ultimate value lying somewhere between the upper and lower bound.

Costs, material yields and financing of the deposit system

This heading refers to the costs, material yields and financing of introduction of the deposit system for small bottles and cans itself. The largest cost item will be the additional RVMs required in supermarkets. The reference is to net costs: revenue accruing from sales of materials (PET, cans, glass) have been deducted from the costs of system expansion.

The costs are highest in the variant with a 25 eurocent deposit, return to supermarkets and small retail outlets, and inclusion of one-way glass (PBG-AL-25), for the following reasons:

- With a 25 eurocent deposit more packaging is likely to be returned, leading to higher intake and handling costs (RVMs, staffing, transport, etc.), which will not be offset by the extra materials revenue.
- With manual intake, a great many more return points will be added to the system (snack bars, petrol stations, kiosks, etc.). This requires more transport movements to pick up the packaging from retailers, time expenditure for manual intake, and extra space at the outlets concerned.
- One-way glass requires extra investments by supermarkets, being heavier and bulkier in transport and needing separate machine capacity for counting.

The overall cost of system extension falls as the variants differ in the above features. The variant with a 10 eurocent deposit, return solely via supermarkets and exclusively one-way glass is therefore the cheapest, with the other variants lying somewhere between the extremes.

The cost of system extension can be partly financed via unredeemed deposits, i.e. by consumers who pay their deposit on purchase but fail to reclaim it at the supermarket. As the system becomes more successful and more people return their packaging, revenue from unredeemed deposits will decline. The deposit sum will also be of influence. From the perspective of society at large, this revenue cannot be considered as 'benefits', because it is at the expense of disposable consumer income.

Costs of different variants (glass, dairy and juices)

The analysis shows that the systems with unrestricted packaging return are slightly more expensive than those with return at supermarkets only. Additionally, it is above all the systems that include a deposit on one-way glass that are more expensive. If the extra costs for glass are allocated entirely to the limited stream of one-way glass, the cost of system extension is 6.5 to 12 eurocent per one-way glass bottle. The extra cost of introducing a deposit on juice and dairy containers was also calculated, yielding a figure of an additional 0.2 to 0.3 eurocent per packaging unit.



Cost savings on current collection and processing system

Introducing a deposit on cans and small plastic bottles will lead to cost savings relative to the current collection system, as this packaging will then no longer have to be processed along with residual waste or separately collected waste. In the current separate waste collection set-up, material revenues from packaging will also be missed, (though less than in a deposit system, because the materials are less meticulously separated). On balance, the cost savings will be around € 6 to 8 mln per variant (0.2 to 0.3 eurocent per packaging).

Impact on litter

According to KplusV 2015, 50-100 million plastic bottles and 100 to 160 million cans end up as litter each year (2008-2014). Introducing a deposit will reduce these figures substantially, with best available data suggesting a 70-90% reduction. This is the range to emerge from physical counts in the USA in the 70s and 80s, estimates based on a 2001 questionnaire in the Netherlands, and recent analysis of the share of cans in litter in Denmark. The greatest reduction will probably result from the variants with a high deposit sum and including one-way glass. Again, we emphasize we are reporting a *range*, with 70% reduction perhaps just as likely as 90% (when citing this report it is therefore essential to mention the entire range as the potential impact).

The reduction in the number of discarded cans and small bottles will lead to cost savings on litter clean-up. A key consideration here is whether those managing public spaces will maintain the same 'tidiness targets' if the deposit system is extended and consequently scale back their clean-up efforts, or pursue more ambitious targets. As municipal efforts are generally based on assessments of visual tidiness, these will probably decline as the amount of litter falls. On balance, the areas concerned will therefore not get much tidier, with other types of litter making up for the reduction in bottles and cans. However, there will be cost savings in the tens of millions (as a rough estimate, max. € 80 mln per annum, 3 eurocent per packaging unit). If municipalities and others set themselves more ambitious targets, the total amount of litter (cans, bottles and other varieties) will also indeed decline in areas that are cleaned. In places where there is presently no such cleaning the amount will certainly fall, as litter reduction is independent of cleaning efforts there. In addition, there will be savings on the cost of emptying street litter bins, estimated at € 3-10 million.

With cleaning efforts unchanged, extension of the deposit system will reduce the amount of plastic ending up in the world's oceans ('plastic soup'). We estimate this reduction at around 11 to 140 tonnes annually (0.5 to 6 million bottles, 15% of the plastic packaging currently ending up in the oceans).

Recycling and environment

A deposit on cans and small plastic bottles will mean extra recycling of aluminium and PET, to the tune of an estimated 4.2-4.8 kt aluminium and 6.6-7.6 kt PET. This translates in the Netherlands to around 1.5 percentage points extra plastic recycling and around 2.2 percentage points extra metal recycling. This in turn would lead to 44-54 kt lower CO₂ emissions annually, which in terms of 2030 environmental prices is equivalent to 0.13-1 eurocent per packaging unit with a deposit. While recycling percentages for plastic and metal packaging will improve slightly, for one-way glass we anticipate a very limited increase, if at all.



Cost-revenue distribution

Table 3 shows the cost/revenue distribution across the various parties.

Table 3 - Cost/revenue distribution after deposit system extension, based on current distribution key, in € mln
(positive numbers: net cost, negative numbers: net revenue)

	PB-SUP-10	PB-SUP-25	PB-AL-10	PB-AL-25	PBG-SUP-10	PBG-SUP-25	PBG-AL-10	PBG-AL-25
Sales points	70 ~ 27	73 ~ 26	74 ~ 28	72 ~ 24	86 ~ 35	90 ~ 34	90 ~ 35	88 ~ 32
Deposit system administrators	-61 ~ -76	-73 ~ -92	-38 ~ -59	-63 ~ -87	-60 ~ -76	-73 ~ -92	-36 ~ -57	-62 ~ -87
Directly to consumers	58	80	44	78	63	86	48	84
Savings on other systems (incl. Waste Fund)	-6	-6	-6	-6	-7	-8	-8	-8
Municipalities and other agencies	Max. -90	Max. -90	Max. -90	Max. -90	Max. -90	Max. -90	Max. -90	Max. -90
Citizens/neighbourhoods/leisure*	+	+	+	+	+	+	+	+

* A + for "citizens/neighbourhoods/leisure" means a positive impact.

reports the parties to whom the costs and benefits of system extension primarily accrue in the eight variants, distinguishing six groups: sales points; deposit system administrators (including beverage producers); consumers; other systems (including the Waste Fund); municipalities and other agencies; and "citizens/neighbourhoods/leisure". "Sales points" include supermarkets and manual return to other retailers (snack bars, kiosks, etc.).

The costs will be borne mainly by sales points (RVM purchase, staffing, and storage space) and consumers (unredeemed deposits). The system administrators will reap net benefits, as they receive the revenue associated with unredeemed deposits and materials while bearing relatively little of the cost of system extension, part of which is already in place, while there is scope for cost savings through system innovation (compacting machines).

"Municipalities and other agencies", the parties responsible for keeping public spaces tidy, save costs because of the decline in litter and cleaning efforts. Citizens and neighbourhoods benefit from reduced litter and a cleaner local environment, though these benefits were not quantified.

Cost distribution if costs are passed on to consumers

3 shows where the costs are initially borne. In practice, distribution may work out differently, though, depending on what arrangements are negotiated on this point. In a normally functioning market the costs of the deposit system will be passed on to consumers, translating to a higher consumer price (unless retailers accept a lower profit margin).

On the other hand, the cost savings of municipalities and other agencies will ultimately be passed on to citizens/consumers. Reduced litter clean-up costs will translate to lower council taxes, for example. These benefits will probably accrue to a wider group of citizens than the group onto whom the costs of the deposit system are passed, because not all Dutch citizens buy cans and plastic bottles to the same extent.



Scope for further in-depth study

In a short space of time, in this study we have endeavoured to gain maximum insight into the costs, benefits and other impacts of introducing a deposit system for small beverage bottles and cans in the Netherlands. For yet better understanding, though, certain issues are amenable to more in-depth study, including the following:

Measurements on impact of packaging deposits on litter

One issue to emerge in this study are the numerous unknowns concerning the total amount of litter (numbers, volume) and its distribution in the natural environment and particularly the oceans, also as these relate to packaging deposits. This holds specifically for the Netherlands as well as for other European nations. In consultation with those countries a study could be undertaken in the form of 'before and after' measurements following introduction of deposits in one particular country, for example.

Further analysis of precise intervention at supermarkets and other retailers

One key area of uncertainty in estimating the cost of introducing a deposit on cans and small bottles is the number of additional RVMs required. The likely range could be narrowed in a more extensive study in collaboration with the supermarket sector, differentiating by supermarket size and type (discount to service) and intensity of current RVM usage.

Greater precision in litter reduction impact of Danish cans

From the Danish litter measurements and beverage can sales with and without a deposit (major imports from Germany) the probability of the two categories being discarded as litter can be calculated. By collecting more data on this case (e.g. 2017 figures) and with deeper analysis, these data could be estimated more accurately.

Inclusion of results of current studies on at-source and post-consumer plastics separation

On average, deposits mean savings of around 0.2 eurocent per packaging unit thanks to cost savings in the other systems now processing cans and bottles. These are mainly marginal costs associated with at-source and post-consumer plastics separation. Two studies on this issue are already underway as part of the review of the Framework Packaging Agreement. While this is not a major factor in the findings of the present study, this issue could be checked when the results come in.

Better modelling of consumer behaviour

Consumer behaviour could be more accurately modelled. How often will plastic bottles and cans be returned? What percentage of consumers will return small packaging items along with large PET bottles? What percentage will return them to the sales point where they were bought or to similar outlets?

Reviewer's statement

Prof. Carl Koopmans, research director of SEO Economisch Onderzoek, has reviewed the research methodology and results of this study (reported in full in Appendix G of the Dutch-language report). His main conclusion reads as follows: "The study has been carried out in a thorough manner, with a vast amount of information being gathered. This information is presented and discussed in a nuanced fashion. The calculations are extensively supported in a series of appendices." The reviewer agrees with our recommendation that additional study is needed on how extension of the deposit system will affect litter.

