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Deposit Refund Systems in Sweden

Case studies for four types of beverage containers

IIIEE Report 2011:05

Naoko Tojo

INTERNATIONAL INSTITUTE FOR INDUSTRIAL ENVIRONMENTAL ECONOMICS AT LUND UNIVERSITY



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The author also wishes to extend her gratitude to the eight interviewees who so generously shared their extensive experiences and expertise in the area.

Lund, December 2011

Naoko Tojo

Abstract

This report contains four case studies of deposit refund systems for beverage containers in Sweden. It provides an in-depth review of the development of Swedish deposit refund system for four types of beverage containers – one-way aluminium cans, one-way PET bottles, refillable glass bottles and refillable PET bottles – since their inauguration, as well as concrete operational mechanism and results of the respective systems.

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1 Introduction

This report contains case studies of deposit refund systems for beverage containers in Sweden. The study is a part of the research project entitled Reframing the Concept of Collection Systems with Economic Incentives – Based on the Review of Deposit-Refund Systems and Point Systems – carried out in collaboration with three organisations in Japan: National Institute for Environmental Studies (NIES), Fukushima University and Community Policy Institute.¹

The objective of the overall research project was to revisit and analyze measures which aim to promote collection of recyclables and waste with the provision of economic incentives. As existing examples of such measures, various aspects of deposit-refund systems and reward points collection systems were examined from both theoretical and practical viewpoints.

The case studies presented in this report sought to contribute to the overall research project by providing an in-depth review of several aspects of Swedish deposit refund system for four types of beverage containers – one-way aluminium cans, one-way PET bottles, refillable glass bottles and refillable PET bottles. These aspects include development of the systems since their inauguration, as well as concrete operational mechanism and results of the respective systems. In-depth interview of 8 people who have been involved in the development and operation of the respective systems (see Appendice), as well as various written materials, constitute the main source of the study.

¹ The final project report is in Japanese and is available at: <http://www.nies.go.jp/kanko/kenkyu/pdf/r-205-2010.pdf> The English summary of the report is available at <http://www.nies.go.jp/kanko/kenkyu/pdf/r-205-2010-e.pdf>.

2 Deposit-refund system for one-way aluminium cans and PET bottles

In this section, the system for the two types of beverage containers – one-way aluminium cans and one-way PET bottles – are described. The system for these two types of containers have been run by the same organisation called Returpack, thus there are many similarities between the two. Under each sub section the description starts with the system for aluminum cans as it was introduced first. The description on the system for PET bottles follows, mainly highlighting additional issues specific to the latter.

2.1 Background for introducing the system

The discussion of introducing a mandatory deposit-refund system started in the late 1970s when one-way beverage packages started to emerge and refillable glass bottles started to decline. There was a very strong movement in the society against one-way bottles by environmental NGOs due to the decline of the refillable system and littering problems. The movement accelerated when PLM, a packaging company, introduced a new manufacturing facility for aluminium cans in Malmö (the third biggest city in Sweden located in southern Sweden). The movement was also supported by the state-owned brewery which had a good distribution and collection network for glass bottles. They were unwilling to lose their market advantage with the introduction of one-way containers.

The mandatory deposit-refund system initially met strong resistance from the industry – can manufacturer, breweries² and retailers. However, continued societal demand, failure to achieve the recycling rate³ indicated by the government (75%) under an intensive volun-

tary collection project,⁴ as well as demonstration projects indicating that the collection would not create perceived hygienic problems such as flies, wasps and odour, gradually convinced the industry that they had no choice but to establish a system. The three parties established a company called Returpack in 1984 (Returpack, n.d.a).

The introduction of one-way containers triggered actions not only in Sweden but also in her neighbouring countries. These countries took different (and more restrictive) measures to address the issue – ban in Denmark and high taxes in Finland and Norway. These approaches would have been difficult to use in Sweden due to the existence of a can manufacturer, its expanded business and employment opportunity.

In the case of PET bottles, the introduction went much more smoothly. The only major issue was the necessity to have refillable system for all the PET bottles introduced in Sweden. However, this was quickly changed and both one-way and refillable systems started to exist (see Section 2.2).

2.2 Legal basis and mandate

The main pieces of legislation related to deposit refund system for aluminium cans and PET bottles are the following (hereafter referred to with the numbers mentioned at the end of each laws):

- Lag (1982:349) om återvinning av dryckerförpackningar av aluminium [Law (1982:349) on the recycling of aluminium packaging for drinks] (SFS 1982:349)
- Lag (1991:336) om vissa dryckesförpackningar [Law (1991:336) on certain packaging for drinks] (SFS 1991:336)

² The term “breweries” in this document includes not only beer breweries but also manufacturers of other beverages, mainly soft drinks.

³ The term “recycling” in this document refers to various form of material recycling, and does not include energy recovery.

⁴ A voluntary collection trial was carried out by PLM and a major Swedish brewery (Pripps) from February to October 1980 in a coastal town of Varberg. During the 8 month, the highest collection rate achieved, even after spreading the achievement from the two collection campaigns that took place in October, was 63% (Backman, 1984).

- Förordningen (1997:185) om producentansvar för förpackningar [Ordinance (1997:185) on producer responsibility for packaging] (SFS 1997:185)
- Förordning om ändring in förordningen (1997:185) om producentansvar för förpackningar [Ordinance on changes in the Ordinance (1997:185) on producer responsibility for packaging] (SFS 2004:558)
- Förordning om retursystem för plastflaskar och metallburkar [Ordinance on return system for plastic bottles and metal cans] (SFS 2005:220)
- Förordning om producentansvar för förpackningar [Ordinance on producer responsibility for packaging] (SFS 2006:1273)

SFS 1982:349, SFS 1991:336 and SFS 2005:220 directly concerns deposit refund systems, while SFS 1997:185, SFS 2004:558 and SFS 2006:1273 set producer responsibility for packaging and define the recycling targets for the two packaging. All the legislation has been revised several times due to the need to adjust to the changes of other legislation, clarification, etc. These revisions are discussed to the extent relevant to the development of deposit refund system.

SFS1982:349 mandated the introduction of a deposit refund system for aluminium cans. Prior to the introduction of the legislation, the government proposed that 100% recycling rate should be achieved. This was met by a strong resistance from the industry. The final mandate was set at the level of 75% recycling rate (Riksdagen 1982).⁵ In the beginning of the 1990s the mandate for recycling rate was raised to 90% (Backman et al. 1988, Riksdagen 1982), and has been held at that level since then (SFS 1997:185, SFS 2004:558; SFS 2006:1273). According to the interviewees who were engaged in the development of the system at that time, the 90% recycling goal is based on the balance of energy consumption

required for the existing refillable system for glass bottles.

When a deposit refund system was introduced for PET bottles under SFS1991:336, the legislator required the industry to introduce a refillable PET bottle system as a condition to introduce PET bottles in the market. (Riksdagen 1982). However, this brought forth a big fight among the breweries of different sizes. The use of refillable bottles require infrastructure for collection and washing. While large manufacturers have such capacities, it is difficult for smaller manufacturers to equip themselves with such facilities. (Riksdagen 1993). In the end, the government accepted that one-way PET bottles can be also introduced, provided that deposit refund system is introduced for them (SFS 1993:418). The 90% refillable/recycling rate has been kept since the beginning (SFS 1997:185, SFS 2004:558; SFS 2006:1273). The level was set at 90% on the ground that the ambition level should be as high as that of the aluminium cans (Riksdagen 1991).

2.3 Scope

Under the current legislation (SFS 2005:220), beverages that are professionally bottled in the following packaging should be part of a deposit-refund system approved by the government:

- Plastic bottles: packaging made primarily of polymer material, and
- Metal cans: packaging made of metal.

The original two laws governing aluminium can and PET bottles respectively had narrower definition – drink packaging made of aluminium (SFS 1982:349), and bottle that are made of polyethylentereftalat (SFS 1991:336). The definition in the new law (SFS2005:220) that replaced the two existing laws have broader definitions in order to keep up with the development of materials used for beverage containers, as discussed further in the subsequent sections.

Among the beverages that are bottled in plastic bottles or metal cans, those which principally contain dairy products, vegetable, fruit or berry juice are exempt. According to an interviewee, it is due to the higher hygiene requirement should those products be included. Inclusion of the packaging of these products would require

⁵ The recycling target at that time was not mandated within the law itself, but is found in the government preparatory work. The initial recycling rate for PET bottles was mandated in the same manner.

that reverse vending machine (RVM) be re-refrigerated, and that workers at the recycling plants have extra breathing equipment to avoid contamination by bacteria.

Deposit refund system for refillable PET bottles is also mandated by law, but is organized separately from that for one-way PET bottles. This will be discussed further in Section 3.

Table 2-1: Annual registered consumption and domestic production of beer, soft drinks, cider and water in Sweden, 2007

Type of beverages	Total registered consumption (in million litre)*	Domestic production (in million litre)**	% of domestic production*
Beer	486	401.1	83%
Soft drinks	733.9	619.6	84%
Cider	20.1***	20.1	100%
Bottled water	283.5	193.4	68%
Total	1523.5	1234.2	81%

* Total registered consumption = registered domestic sales plus imports

** Domestic production = production by member companies of Sveriges Bryggerier

*** As there was no figure for total registered consumption, the figure for domestic production is used.

Source: Sveriges Bryggerier 2009c; Sveriges Bryggerier 2009d; Sveriges Bryggerier 2009e; Sveriges Bryggerier 2009f; Sveriges Bryggerier 2009g; Sveriges Bryggerier 2009h; Sveriges Bryggerier 2009i

Table 2-2: Types of packages used for beverages with alcohol, sweetened soft drinks and water by Swedish breweries, 2007, by volume in percentage

Type of beverages	One –way deposit system organised by Returpack		Refillable deposit system organised by the breweries			Other types of packages*	Total
	Aluminium cans	One-way PET bottles	33cl refillable glass bottles	50 cl refillable glass bottles	1.5 litre refillable PET bottles		
Beverages with alcohol	65.5	0.4	8.5	7.1	0	18.5	100
Sweetened soft drinks	17.5	50.5	8.1	0	9.1	4.8	100
Other soft drinks incl. juice**	0.4	31.3	0	1	0	67.3	100
Bottled water	7.9	60.1	31.4	0	0.1	0.5	100
Total beverages sold in this type of package	30.5	34	11.1	2.4	4	18	100

* Other types of packages include one-way glasses, barrels and tanks, carton boxes and “bag in box”, and packages under private returnable systems run by individual breweries.

** Some of this type of beverages are not part of the deposit refund system since 2005.

Source: Sveriges Bryggerier 2009b

Table 2-1 provides an overview of annual consumption registered in the system (as domestic sales and import figures) and domestic production of beverages covered under the deposit

refund systems in this section as well as Section 3. Further, Table 2-2 indicates the types of packaging materials used for the respective

beverages produced by Swedish breweries in 2007.

2.4 How the system works

The actors involved in the system, material and financial flow of the system is indicated in Figure 2-1. Each element is discussed further in this section.

2.4.1 Actors participating in/ organizing the system

Originally it was the can manufacturer (PLM, which later became Rexam), breweries and retailers together established a company called Returpack (AB Svenska Returpack) to set up the system for the collection and recycling of the aluminum cans. Similarly Returpack-PET (AB Svenska Returpack-PET) was established for PET bottles in 1994 (Returpack, n.d.a). Returpack organizes the overall activities needed for the deposit-refund system for one-way aluminium cans and PET bottles. In addition to Returpack, can/PET bottles manufacturers, breweries and retailers, there exist recyclers/smelters for aluminium and PET, as well

as consumers who buy beverages with cans/bottles and return empty cans/bottles to the stores. Among the retailers, the entities that sell alcohol in Sweden, called Systembolaget, have never been part of the system, despite that they also sell many cans.

Concerning the ownership of Returpack, the initial ownership of the company was 48% PLM, 48% breweries and 4% retailers. However, now the can manufacturer does not own the company anymore. An official explanation for the change is to do with the fact that unlike representatives of breweries and retailers who are industry organisations, the can manufacturer represents a single company. The current ownership is shared among the breweries (50%), the association of large retail chains (25%) and the association of small and individual retailers (25%). The same ownership structure exists for the system for PET bottles (Returpack-PET: AB Svenska Returpack-PET).

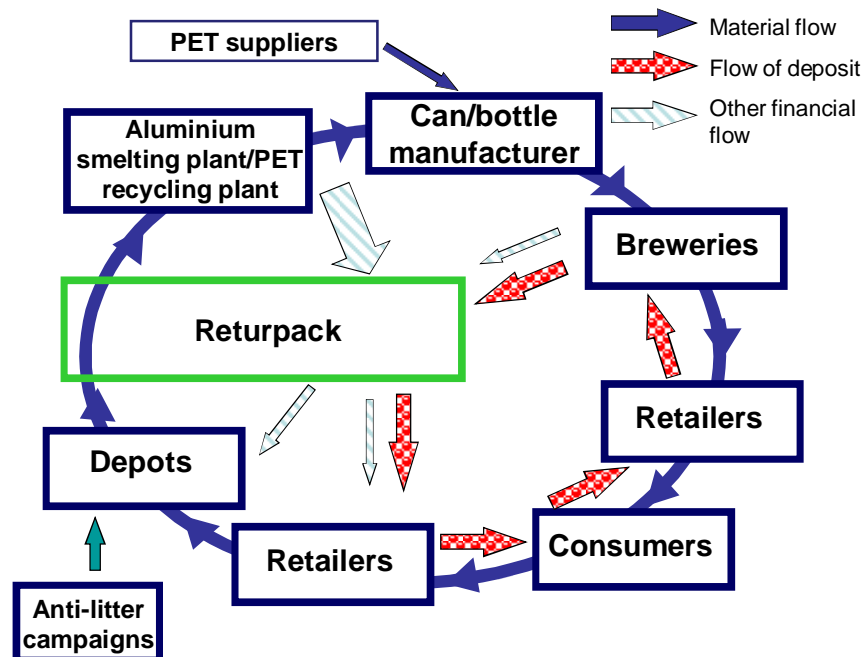


Figure 2-1: Deposit refund system for one-way aluminium cans and PET bottles in Sweden

Source: Lindhqvist (2009) modified by the author

2.4.2 Material flow

The overall system has been gradually optimized over time, especially with the establishment of a facility in Returpack in Norrköping in 2003. In this section the flow of the current operation is first described, followed by the changes over time and prospects for the future.

Aluminium cans

As illustrated in Figure 2-1, in principle materials used for one-way aluminum cans in Sweden have been moving around in a closed system. Manufactured cans are sold to breweries, who fill in beverages and sell them to retailers. Approximately 30% of beer and soft drinks produced by Swedish breweries are sold in aluminium cans today (Sveriges Bryggerier 2009b, see Table 2-2). The total number of cans sold in Sweden today including the import is over 1 billion (Returpack, 2009).

Retailers sell the beverages to consumers, who after drinking the content bring the empty beverages back to the retailers. The empty cans – currently in total of approximately 900 million per year – are brought to depots – intermediate collection facilities where cans collected by retailers are brought together –, which are then gathered at a facility in Returpack and bailed together. The bailed cans are sold to smelters in the UK and France, and are sold back to the can manufacturer as a roll of long sheet of metal.

Among the optimisations that took place over the years include:

- Location of depots and bailing stations: in the past it was principally the breweries who accept the empty cans collected at the retailers and bail them together to be sent to the smelter. Now the depots are mostly located at the whole sellers, with a small number of breweries still functioning as depots. A reason for having depots at the whole seller is the retailer's strategy to reduce the number of people handling goods coming to their warehouses. All the empty cans are then brought to the plant at Returpack for bailing.
- Development of big storage places: in order to further optimize the transportation, Returpack started to develop a middle col-

lection station where a large number of empty cans can be temporary stored. So far they have 4-5, but the plan is to have around 50 in different parts of Sweden.

- Types of containers used at the retailers: they used to use carton boxes which cost 35 SEK (434 JPY)⁶ each and in total of 1.5 million boxes are used a year. Instead they started to introduce plastic boxes, which are much less expensive.

PET bottles

The material flow for PET bottles is more or less the same up until the PET bottles are brought to the plant at Returpack. The only main difference relevant to recycling is that in the case of PET bottles, it is not the ready-to-be filled bottles but the smaller and condensed version of it – called pre-forms – that are brought to the breweries. The breweries then inflate them into the size of normal bottles before filling the bottles.

When the empty PET bottles – in total of approximately 500 million now – are brought to the Returpack plant, the coloured and non-coloured bottles are sorted and bailed. They are then brought to a plant called Cleanaway, located right next to the Returpack plant. At Cleanaway the PET bottles are broken into small flakes and cleaned. The closure of the material loop is not complete due to the fact that PET has much wider usage than the materials used in the aluminium cans. As of today, about 70 % of the PET collected by Returpack is used for the manufacturing of new PET bottles (Returpack, 2009).

In addition to the optimisation measures common to the aluminum cans, the following changes have taken place over time:

- Non-use of “elephant foot”: when the deposit refund system for PET bottles started, Returpack said to the breweries that they cannot use the bottles with so-called elephant foot anymore. That should be changed to so-called five-foot structure to ease the process of recycling.

⁶ With the exchange rate of 1SEK = 12.4 JPY (as of 1 December 2009). The same exchange rate is used for the rest of the sections.

- Use of pre-forms: When PET bottles were introduced to the market, similarly to the aluminium cans the bottles were produced as ready-to-be-filled bottles at the bottle manufacturers and were sent to breweries. However, it was gradually taken over with pre-forms. Pre-forms significantly reduce the space needed to transport bottles from bottle manufacturers to breweries.⁷
- Establishment of recycling plant within Sweden: In order for an economically feasible operation of a PET recycling plant, the volume of PET bottles collected should be at least more than 6-10 thousand tons. For this reason the collected PET bottles were sent to Germany for cleaning and recycling. However, with the increase of PET bottles, it was decided that Cleanaway was built in 2006-7 and now 19 thousand tons of PET bottles are coming back. This greatly saves the cost for transport.⁸
- Sorting of colored and non-colored bottles: when breweries requested the introduction of coloured PET bottles, Returpack did not agree to it due to the need to install expensive sorting machines. In the end, however, it had to agree. At that time the bottles were still collected at the breweries for bailing, thus 10 machines should have been installed.
- Inclusion of non-PET materials: gradually bottle manufacturers started to use materials other than PET as an inner layer. A brewery who started to use the alternative bottles argued that as their products include materials other than PET, they do not need to be part of any return system. This among others led to the change of the legislation (See Section 2.2), and now these bottles are also brought in the system. They are sorted as coloured bottles.

⁷ For example, a fully loaded truck could carry 37 235 1.5 litre PET bottles. The same truck could carry 557 600 bottles in the form of pre-forms (Returpack-PET 1999).

⁸ According to one interviewee, the cost of transport of 1000 tons of PET bottles was 1 million SEK.

2.4.3 Financial flow

Similarly to the material flow, the financial flow of the system has changed over time. As it stands now, it moves as follows (also see Figure 2-1):

1. Domestic breweries as well as the importers of the drinks subject to the legislation must pay 1) the deposit as well as 2) administration fee to Returpack. The size of the deposit is 50 öre (6 JPY) for aluminium cans, 1 SEK (12 JPY) for PET bottles smaller than 1 litre, and 2 SEK (25 JPY) for 1.5 litre and 2 litre PET bottles.
2. The deposit is carried on top of the price of the product until the final consumers buy the product. Consumers will see in the receipt that they paid the deposit. The size of the deposit is also indicated on the cans/bottles.
3. When consumers return an empty can/bottle to the reverse vending machine set up at a shop, they receive a small slip from the machine indicating the amount of refund to be paid back. the shop pays the refund back to the consumer. There is an on-line system that connects the vending machine and Returpack, and the payment made by the shop on behalf of the system is immediately registered. On top of that the retailers get some handling fee (15 öre (2 JPY) per can, 40 öre (5JPY) per PET bottles with 1 SEK (12 JPY) deposit and 50 öre (6 JPY) per PET bottles with 2 SEK (25 JPY) deposit at the moment) as compensation.
4. There is also a small fee paid to the depot stations (50 SEK (620 JPY) per carton box/12 SEK (15 JPY) for plastic bags) paid from Returpack.
5. Returpack receives money when selling aluminum/PET to smelters/recycling plants. The price is negotiated annually based on the quantity as well as the percentage of what is determined in London Metal Exchange (LME).

Costs related to the system (item 1-4 above) is financed by the unpaid deposit, interests arisen from the deposit, administrative fee and the income from selling the materials. Retailers

buy the reverse vending machines that they put in the shop, and it is up to the retailers to decide how to finance the purchase. An inter-

viewee commented that the compensation fee from Returpack would be sufficient to gradually pay off the investment. .

Table 2-3: Indicative price of beer and beverages sold in supermarkets and kiosks in Lund, Sweden (June 2010)

Type of container	Content	Type of Distributor	Price of the content: SEK, JPY in ()	Size of the deposit: SEK, JPY in ()	Total: SEK, JPY in ()
500 ml Al. can	Cider (low alcohol content)	supermarket	5.5 (68)	0.5 (6)	6 (74)
500 ml Al. can	Beer (up to 3.5%)	supermarket	10-12 (124-149)	0.5 (6)	10.5-12.5 (130-155)
350 ml Al. can	Energy drink	supermarket	18.5 (229)	0.5 (6)	19 (235)
350 ml Al. can	Energy drink	Kiosk	29.5 (372)	0.5 (6)	30 (372)
500ml PET	Soft drink	supermarket	11-14 (136-174)	1 (12)	12-15 (148-186)
500ml PET	Soft drink	Kiosk	24 (298)	1 (12)	25 (310)
500ml PET	Water	Kiosk	19 (236)	1 (12)	20 (248)
1.5 l PET	Water	supermarket	10-11 (124-136)	2 (25)	12-13 (149-161)
1.5 l PET	Soft drink	supermarket	18-19 (223-236)	2 (25)	20-21 (248-261)
1.5 l PET	Soft drink	Kiosk	28 (347)	2 (25)	30 (372)

Source: based on a few visit to the local shops in Lund by the author

Table 2-4: Revenue and cost of Returpack system in the late 2000s (in million SEK, JPY in parenthesis)

	Aluminium cans	PET bottles	Total
Revenue			
Deposit	51.6 (639.8)	74.8 (927.5)	126.4 (1567.4)
Administrative fee	0	29.7 (368.3)	29.7 (368.3)
Recycled materials	15.4 (191)	5.5 (68.2)	20.9 (259.2)
Total	67 (830.8)	110 (1364)	177 (2194.8)
Cost			
Refund	39.6 (491)	67.1 (832)	106.7 (1323.1)
Administration	7.3 (90.5)	7.7 (95.5)	15 (186)
Handling compensation	17.1 (212)	33 (409.2)	50.1 (621.2)
Transport	2 (24.8)	2.2 (27.3)	4.2 (52.1)
Total	66 (818.4)	110 (1364)	176 (2182.4)

Source: calculation by the author based on Returpack (n.d.a)

Table 2-3 provides the price of different types of beverages sold in a local supermarket and a kiosk at the train station in Lund as of June 2010. Depending on the content, the type of distributor and the brand, the size of the deposit in comparison to the total amount of money a consumer would pay to purchase the products ranges from 2% to 17%.

Changes that took place over time include the following:

- Initial loan from the government: When the system was set up, 50 million SEK (620 million JPY) was loaned from the government to set up the system. Over the course of 7-8 years it was paid back.

- Entities paying the deposit to Returpack: Until recently, it was the manufacturers and importers of containers and the importers of filled products that paid the deposit to Returpack. However, this was changed and now the entities paying the deposit are breweries.⁹
- Introduction of administrative fee: similarly to other deposit refund systems, the financial resources of the system were unclaimed deposit, interests raised from the deposit and the income from selling the recyclable materials. In order to avoid the ironical situation where the system cannot continue due to the high return rate (thus unclaimed deposit decreases), a small sum of administration fee was added to the deposit paid to Returpack sometime in the beginning of the 1990s. However, perhaps reflecting upon the higher price of metal, administrative fee for aluminium cans were not collected in the late 2000s (see Table 2-4).

Increase of the size of deposit: The size of the deposit for aluminium cans increased over time (from 25 öre (3 JPY) to 50 öre (6 JPY) in 1987) to enhance collection (Backman et al. 1988). The size of the deposit for PET bottles stays at the same level since the system was introduced

Table 2-4 summarises the revenue and the cost of the two Returpack systems. As mentioned, administrative fee has disappeared in the case of the system for the aluminium cans, while it constitutes 27% of the revenue for PET bottles.

2.5 Achievement so far

The achievement of deposit refund systems for aluminium cans and non-refillable PET bottles since the inauguration of the each system is found in Figure 2-2 and Figure 2-3. In addition, Table 2-5 and Table 2-6 indicate the amount of aluminium cans and PET bottles put on the market as well as amount recycled between 1996 and 2008 in absolute terms.

In both cases, the introduction of deposit refund system led to a drastic increase of source separation of these products. In the case of aluminium cans, the raise of the size of the deposit in 1987 clearly induced the increased collection by 10%.

The return rate over the last 15 years for aluminium cans move between 85 and 92%. Concerning the PET bottles, since refillable PET bottles gradually disappeared (See Section 3), some of these refillable PET bottles started to come back as one-way PET bottles. Figure 2-3 and Table 2-6 indicates the contribution of PET bottles coming from refillable system. When excluding the inputs from the refillable system, the return rate of PET cans have stayed somewhat lower compared to that of the aluminium cans and are between 74 and 85%. All in all, it is a good return rate but has not been meeting the legal mandate of 90%.

⁹ Though not certain, most likely it is around the time when the ownership structure changed when this change took place (see Section 2.4.1).

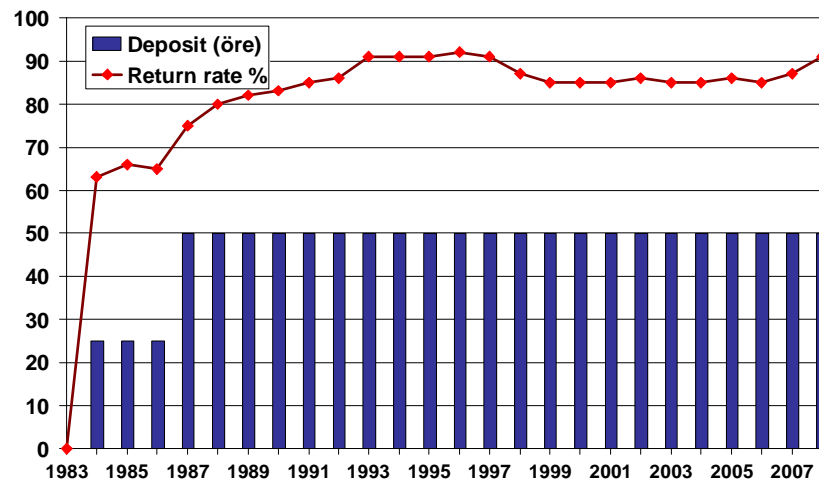


Figure 2-2: Deposit refund system for aluminium cans in Sweden: changes in the return rate and the size of deposit 1983-2008

Source: Lindhqvist (2009), Naturvårdsverket (2008b), Naturvårdsverket (2010)

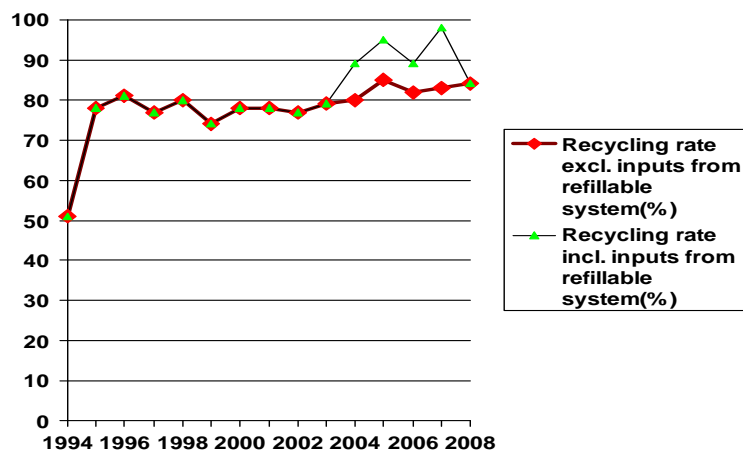


Figure 2-3: Deposit refund system for PET bottles in Sweden: changes in return rate 1994-2008

Source: Lindhqvist (2009), Naturvårdsverket (2006), Naturvårdsverket (2008a), Naturvårdsverket (2008b), Naturvårdsverket (2010)

Table 2-5: Deposit refund system for aluminium cans in Sweden: amount put on the market and material recycling achieved 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003
Put on the market (tonne)	15 244	15 500	14 687	15 486	15 000	15 379	15 641	15 547
Material recycling (tonne)	14 000	14 047	12 745	13 148	12 800	13 044	13 474	13 266
Recycling rate (%)	92	91	87	85	85	85	86	85

	2004	2005	2006	2007	2008
Put on the market (tonne)	15 264	15 163	16 939	17 158	17 169
Material recycling (tonne)	12 906	13 006	14 447	14 904	15 622
Recycling rate (%)	85	86	85	87	91

Source: Naturvårdsverket (2010)

Table 2-6: Deposit refund system for non-refillable PET bottles in Sweden: amount put on the market and material recycling achieved 1996-2008

	1996	1997	1998	1999	2000	2001	2002
Put on the market (tonne)	3 643	5 470	6 101	7 637	8 415	9 475	11 281
Material recycling (tonne)	2 933	4 220	4 886	5 650	6 533	7 373	8 659
From refillable system	-	-	-	-	-	-	-
Material recycling excl. inputs from refillable	3 643	5 470	6 101	7 637	8 415	9 475	11 281
Recycling rate incl. inputs from refillable system(%)	81	77	80	74	78	78	77
Recycling rate excl. inputs from refillable system(%)	81	77	80	74	78	78	77

	2003	2004	2005	2006	2007	2008
Put on the market (tonne)	13 488	14 614	16 703	20 095	21 152	22 893
Material recycling (tonne)	10 652	13 017	15 866	17 826	20 829	19 196
From refillable system	-	1 318	1 597	1 346	3 210	-
Material recycling excl. inputs from refillable	13 488	11 699	14 269	16 480	17 619	19 196
Recycling rate incl. inputs from refillable system(%)	79	89	95	89	98	84
Recycling rate excl. inputs from refillable system(%)	79	80	85	82	83	84

Source: Naturvårdsverket (2002), Naturvårdsverket (2008b), Naturvårdsverket (2010)

2.6 Perception of stakeholders

2.6.1 Success factors

Interviews with the stakeholders involved in the system for a long time indicate that the system has been considered to be quite successful. Factors that have led to the success of the system, as mentioned by the interviewees, can be summarized below.

- Government mandate but not involvement: The fact that the introduction of the deposit refund system was mandated by law and is endorsed by the government is viewed as a crucial success factor. It created a situation where industries are free to sell aluminum cans and PET bottles, so long as they can establish a good return system. It was also stressed, meanwhile, that the government should not be en-

gaged in the management of the system. Under the current system, the government has the role of setting up the basic rules and approving the system in place, while leaving the handling of the system in the hands of industry.

- Consumers' habit of returning drink containers: prior to the introduction of one-way deposit-refund system for aluminium cans, the society had had a return system for glass bottles. An addition of a convenient deposit-refund system was accepted well in society.
- Consumers' convenience: the fact that it is possible for consumers to return empty containers to retailers where they buy things – thus they need to go anyway – makes shops a good candidate as a collection point. Moreover, the fact that any retailers selling cans/PET bottles – not limited to the store he/she bought the product, as was the case in Germany when mandatory deposit-refund system was introduced – enhances the convenience, which is considered instrumental in securing a good return rate.
- Non-profit nature of the system: the importance of keeping the system as a not-for-profit company was stressed by an interviewee. The enhancement of collection should not be used as a profit making opportunity for any entities involved.
- Isolation of the system from the surrounding nations: when the system for aluminium cans started, none of the neighbouring countries had aluminum cans. That helped avoid the abuse of the system during the initial phase. The problem of transboundary movement of non-deposit cans occurred subsequently, but as mentioned the technological development of the RVM fixed it.
- Retailers' preference of having RVM: Despite the fact that retailers did not like the introduction of the deposit refund system due to the hygiene and space reasons, they gradually started to see the benefit of accepting the empty bins. When there are more than one super markets in a shopping mall, super markets do not wish to

have the RVM outside of the store, or if it is outside, closer to their competitors. They fear that consumers tend to go to the shop closer to the RVM.

2.6.2 Future prospect

The interviewees unanimously agreed that deposit refund system, in light of its success so far, will continue to exist in the foreseeable future. They pointed to several issues that have been discussed/may come up in the future, as found below.

- Increase in the size of deposit: the return rate of the containers have not reached 90% as mandated by law. As a remedy the increase of the size of the deposit has been discussed over the last several years. However, it has been opposed by retailers fearing that the raise would lead to the decrease of sales. Unlike EPR programs covering other products such as electrical and electronic equipment and batteries, there is no penalty provision.
- Introduction of multi-layered PET bottles with other materials: as mentioned earlier, some bottle manufacturers already introduced the PET bottles with some internal layers. This development has continued: one of the most promising developments for beer is the PET bottles with glass-skin inside of the PET bottles (Andersson, n.d.). The system for recycling should develop also to incorporate these changes.

3 Deposit-refund system for refillable glass bottles and PET bottles for beer and soft drink

Parallel to the system for one-way aluminium cans and PET bottles, breweries have been organising another deposit-refund system for refillable glass bottles and PET bottles for beer and soft drinks.

3.1 Background for introducing the system

Deposit refund system for the 33 cl refillable glass bottles was introduced long time ago, around 1886-87. At that time, breweries decided to have a uniform system for returnable bottles, instead of establishing their own separate systems. Reasons for the decision include: 1) It would enable the breweries to purchase bottles from bottle manufacturers with better price; and 2) It would be easier for consumers to have one uniform system than having different breweries develop their own systems. A uniform system would allow consumers to bring back empty bottles to whichever retailers they want instead of bringing them back to the retailer from which they purchase the bottles. The exchanges of the bottles could be done among the breweries themselves once the bottles come back to the retailers.

Thus a voluntary deposit refund system for 33 cl bottles has been there for a long time. What is relatively new is the use of plastic crates. Deposit refund system for 50 cl refillable glass bottles came much later. As the Swedish breweries introduced 50 cl only in the late 1990s, it is assumed that the system for 50cl was established after that, more or less copying the one for 33 cl, as it was working very well.

Deposit refund system for 1.5 litre refillable PET bottles came at the same time as the deposit refund system for one-way PET bottles came into place (1994, see Section 2.2).

The market for breweries has been changing dramatically over time. When the system for 33cl refillable glass bottles was introduced, there existed more than one hundred breweries in Sweden, with one-two breweries in each

town. Now there exist only a few big ones, and that is a global phenomena.¹⁰

3.2 Legal basis

As mentioned, the deposit refund system for glass bottles started on a voluntary basis. When the

Ordinance for Producer Responsibility for Packaging (SFS 1997:185) was introduced, the reuse rate of 95% was mandated for refillable glass for beer and soft drinks bottled in Sweden. This target was revised in 2004 when the target for the rest of packaging as also revised. The target since 2004 revision (found in SFS 2004: 558) has been 70% for glass packaging in general – including not only drink bottles but also for food item - , and continued on until now (SFS 2006:1273).

In contrast, introduction of deposit refund system was mandated for PET bottles regardless of whether they are refillable or one-way under SFS 1991:336. The recycling rate mandate has been kept at the level of 90% since the beginning (Prop. 1990/91: 71; SFS 1997:185; SFS 2004:558; SFS 2006:1273).

3.3 Scope

The system organised by breweries include:

- 33 cl and 50 cl glass bottles for beer and soft drinks, and
- 1.5 litre refillable PET bottles for beer and soft drinks.

There used to be a deposit refund system for bottles filled in Sweden for wine and liquor as well, but this system ceased to exist at the end of the 1990s. The main reason for the disappearance of the system was the introduction of different types of bottles in the Swedish market due to the fact that Sweden joined the EU.

¹⁰ In 1890, there were 554 breweries in Sweden which in 2002 is reduced to 18 with the total production being doubled (Sveriges Bryggerier, 2009a).

Before Sweden became a member of the EU, the wine and liquor were imported in barrels and bottled in Sweden. This, together with the fact that it is only Systembolaget, a publicly owned liquor company, that can sell alcohol above 3.6%, enabled the company to sell wine and liquor in standard bottles. After joining the EU, however, due to the rules on free movement of goods within the EU, Sweden could not prohibit foreign wine and liquor manufacturers from selling their products in their own bottles. The system for bottles for wine and liquor was run separately from the refillable system run by the brewery and is not discussed further here. Similarly, Coca Cola had its own system for 2 litre PET bottles but it was not part of the common returnable system, and will not be discussed further here.

3.4 How the system works

3.4.1 Actors articulating in/ organizing the system

There are three separate systems for respective types of the refillables – 33cl glass bottles, 50cl glass bottles and 1.5 litre PET bottles – and three different organisations are managing

them respectively. The reason for having separate companies for the respective types of refillable bottles is that different breweries use different packaging materials.

Sveriges Bryggerier, the industry organisation for breweries, handles these three companies by holding 48-49% of the shares. The remaining share is held by individual breweries.

Individual breweries do not have to become a member of Sveriges Bryggerier to become a part of the refillable system. They can ask the companies managing the bottles and as long as they have economic and physical capacity to be a part of the refillable systems, they can be part of the system. The possibility of the breweries taking part in the refillable systems without becoming a member of the industry association is required by the Competition authority in Sweden.

Figure 3-1 summarizes the material and financial flow within the system as well as the roles of actors in the system. In addition to the breweries, other actors include whole sellers, retailers and consumers.

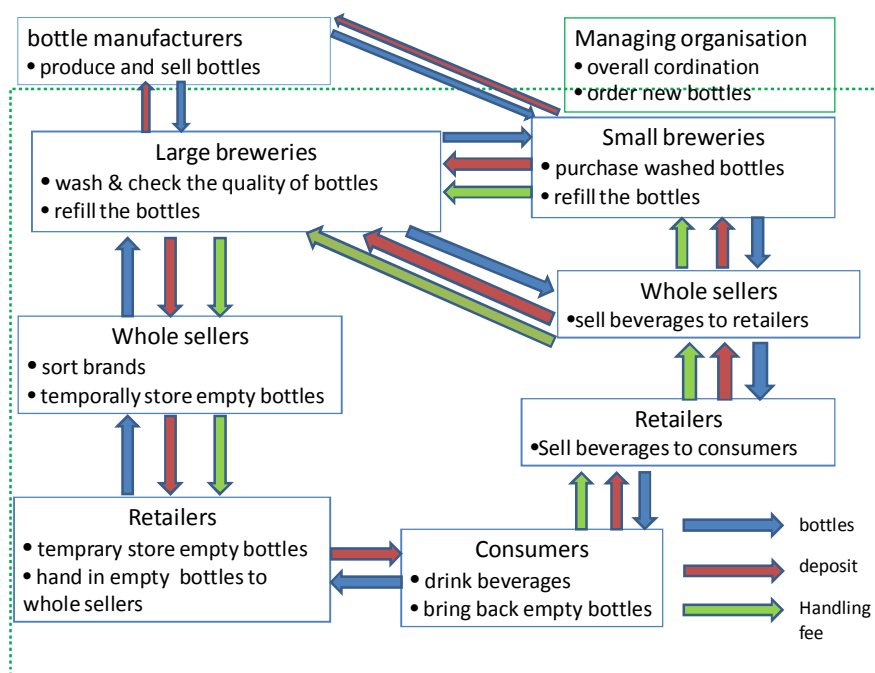


Figure 3-1: Deposit refund system for refillable glass bottles and PET bottles organised by breweries in Sweden

Source: developed by the author based on the interviews

The three different managing organisations handling the respective types of bottles negotiate price of the bottles upon request of its members (i.e. breweries). Meanwhile, it is the individual breweries who purchase the bottles directly from the bottle manufacturers themselves and own the bottles.

The organisations for the respective types of refillable bottles also decide if the system should expand, shrink, close down, etc. When changes are made, the cost incurred is shared among the member breweries in proportion to their market share. This is to avoid the situation in which one or two large companies suddenly decide to leave the system and that the cost from the change falls on the shoulder of remaining smaller companies. In order to run a system without such risks, some safety net needs to exist. In case a brewery decides to leave a system, they have to pay for their share of the past 5 years. The crates and the bottles from the brewery need to be taken out of the system as well.

3.4.2 Material flow

First the breweries fill the bottles with products and sell them to the trade. They are usually delivered to whole sellers. Individual shop owners then order and receive products from the whole sellers. Shop owners sell products to the consumers, and after consuming the content the consumers bring back the empty bottles back to the shops. The shop owners then bring these empty bottles back to the whole sellers, who then bring them back to the breweries for washing and using them again. The large breweries do the washing and smaller breweries purchase washed bottles from them.

3.4.3 Financial flow

Concerning the financial flow, in essence, the deposit and handling fee follows the physical flow of the products. However, when consumers return the bottles, only the deposit will be given back to consumers while the handling fee stays in the hands of retailers who receive the bottles from the consumers.

There have not been major changes in the size of the deposit, as it is too complicated to change it. If you raise a deposit by certain amount and announce it to the newspaper that the change will take place after a certain date, all the consumers would wait for that date to

come to get more pant. However, now it would be possible to distinguish the old bottle and the new bottle by using a bar code, so it would be possible to change it.

The current size of the deposit is found in Table 3-1

Table 3-1: Size of the deposit for refillable bottle systems in Sweden

Item	Size of the deposit (JPY in parenthesis)
33 cl glass bottle	60 öre (7 JPY)
50 cl glass bottle	90 öre (11 JPY)
1.5 litre PET bottle	2 SEK (25 JPY)*
Case for 33 cl glass bottles and 1.5 litre PET bottles	22.40 SEK (278 JPY)
Case for 50 cl glass bottles	28.00 SEK (347 JPY)

* Until the refillable system disappeared, it was 4 SEK (50 JPY) per bottle.

Source: Carlsberg Sverige (n.d.)

3.4.4 Methods for distinction

Bar code has been used for the distinction. For PET bottles RVM was used for collection.

3.5 Achievement so far

Figure 3-2 and Figure 3-3 show the return rate achieved for refillable PET bottles and glass bottles for the period 1999 - 2007 and 1999 - 2004 respectively. The absolute amount put on the market and returned in the two systems are found in Table 3-2 and Table 3-3.

The refillable system for PET bottles gradually declined and was ceased to exist in October 2007.

Due partly to the fact that there is no specific target set for glass bottles anymore (See Section 3.2), no data is available regarding the return rate of glass bottles after 2005. However, a very high return rate (above 98%) in both systems is observed.

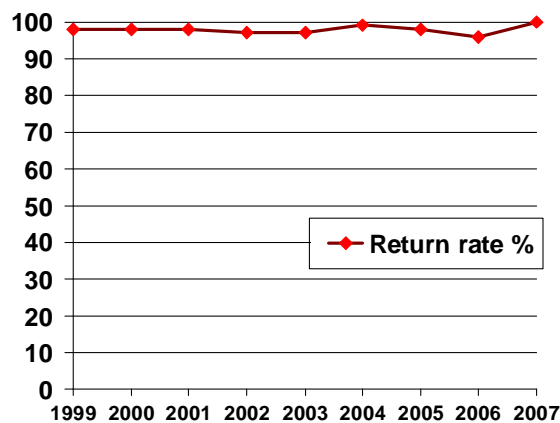


Figure 3-2: Return rate achieved in the deposit refund system for refillable PET bottles in Sweden, 1999-2007

Source: Sverige Bryggerier as cited in Naturvårdsverket (2008b)

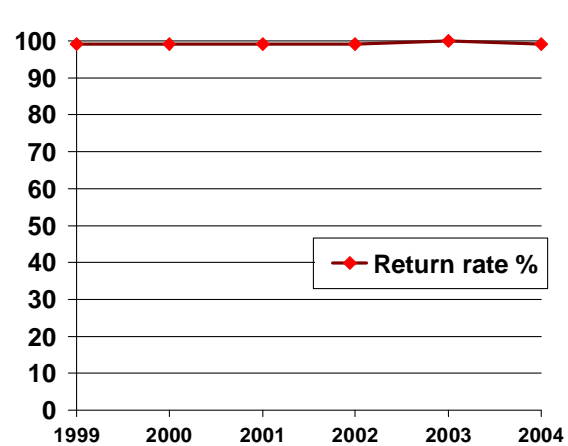


Figure 3-3: Return rate achieved in the deposit refund system for refillable glass bottles in Sweden, 1999-2004

Source: Svenska Bryggareföreningen AB as cited in Naturvårdsverket (2006)

Table 3-2: Deposit refund system for refillable PET bottles in Sweden: amount put on the market and returned bottles 1999-2007

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Put on the market (tonne)	18 551	18 615	18 615	18 653	17 171	13 536	9 867	9 463	5 538
Amount returned (tonne)	18 212	18 187	18 187	18 105	16 731	13 420	9 653	9 083	5 538
Estimated return rate (%)	98	98	98	97	97	99	98	96	100

Source: Sverige Bryggerier as cited in Naturvårdsverket (2008b)

Table 3-3: Deposit refund system for refillable glass bottles in Sweden: amount put on the market and returned bottles 1999-2004

	1999	2000	2001	2002	2003	2004
Put on the market (tonne)	304 832	289 006	282 724	253 078	218 152	189 365
Amount refilled (tonne)	300 569	286 490	279 922	250 151	217 712	188 009
Estimated refilled (%)	99	99	99	99	100	99

Source: Svenska Bryggareföreningen AB as cited in Naturvårdsverket (2006)

3.6 Changes over time and reasons

Overall the refillable system has been gradually reducing its market share. Table 3-4 indicates the changes in the share of refillable bottles

used for products sold from breweries (beer, soft drinks, water) by volume between 2005 and 2007. As a comparison, the figures for one-way bottles are also included.

Table 3-4: Changes of the share of refillable bottles used for beer, soft drinks and water by volume (in percentage), Swedish breweries, 2005-2007

Type of packaging	2005	2006	2007
33 cl Refillable glass bottles	14.9	12.9	11.1
50 cl Refillable glass bottles	2.6	2.6	2.4
1.5 litre refillable PET bottles	12.7	12.3	4.0
One-way PET bottles	21.5	23.2	34.0

Source: Sveriges Bryggerier (2009b)

Due to the changes in the manners the information is collected, data prior to 2005 is not available. However, according to one of the interviewees, the system for 33 cl has been getting smaller and smaller over the years. The decline is mainly due to the increasing market share of one way PET bottles, which is evident from the table. Moreover, with breweries wanting to have their own bottles, there are more one-way bottles.

The closure of the system for the refillable PET bottles took place over the last 4-5 years. First Carlsberg decided to withdraw 4-5 years ago, followed by Spendrups a few years later. Then the remaining brewery, Coca-Cola, decided to close down the system in 2007.

According to the interviewee who has been involved in running the system, the reasons for the closure include the following:

- Unique bottles become more attractive: the increasing fierce competition among the breweries and difficulties of making changes in the standardized bottles. The standardised bottles that allow a common refillable system would not enable them to, for instance, design the shape of their bottles differently from competitors.
- Retailers' preference of one-way PET bottles over refillable bottles: The retailers were not so fond of the refillable system. One-way PET bottles, which can be crushed, are easier for them to handle than collecting the refillables and take them to the whole sellers.

- Emergence of pre-form and cost efficiency: The new technology that enabled the breweries to get the small mould of pre bottles that can be blown up at the manufacturing sites has made the one-way bottle a more attractive solution than refillable solution. In the case of refillables, empty bottles that are bulky and full of air must be carried to the breweries.

However, discussion with another interviewee cast some doubts on the strengths of the latter two points. Indeed they may prefer not to have the large empty bottles in the backside of the RVM, but they are not very heavy, as have been the case with the glass bottles. Capturing them in a large plastic bag or carton box should not be prohibitably difficult for retailers. Regarding the third issue, the review of some older industry documents (e.g. Return-pack-PET 1999) indicates that pre-forms already existed 10 years ago.

Another reason given by other interviewees is the taste that remains in the bottle. Unlike glass bottles, PET bottles tend to take in the taste of beverages with strong. This would make it difficult to refill water in a bottle that used to contain beverage with strong smell. Consumers' use of PET bottles different from its original purpose – for instance, keeping liquid washing detergents – also contributes to this problem. This in turn makes the life of the refillable PET bottles much shorter than what was expected.

However, according to the interviewee who was running the system, the issue of taste remaining in the bottle was also an issue, but not the most crucial one. The bottles were washed and checked with “electronic nose”. Moreover, before manufacturers start to put new products in the bottles, they have to check how the new products might influence the bottle.

All in all, the disappearance of the refillable PET bottles may have something in common with the overall decline of the market for the refillable. Just like the problem when the system started, it is difficult for small breweries to have their own washing systems. The brewery association recommends new comers in the market to go for one-way bottle system due to the difficulties of having their own washing system.

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Appendix: List of interviewees (in the order of the timing of the interviews)

Name	(former) position in relation to this research	Date & Time	Mode & Place
Michael Backman	Senior Research Fellow, IIIIEE (was involved in the initial development of Returpack system)	17 March 2009, 09h30-10h30	In person, IIIIEE
Jörgen Sallenhag	Former CEO of PLM, Former chairperson of the board, Returpack	18 March 2009, 09h00-09h45	In person, IIIIEE
Rolf Andersson,	First CEO of Returpack	20 March 2009, 10h00-12h00	In person, interviewee's residence in Stockholm
Göran Uebel	Former government official in charge when the DR system was introduced	20 March 2009, 12h15-13h00	In person, restaurant in the vicinity of his current office in Stockholm
Dag Lundén	Environmental manager, TeliaSonera AB Broad-band Service	20 March 2009 14h30-15h20,	In person, Telia Sonera office, Stockholm
Hans Funke	Economy chief, Returpack	12 May, 09h45-11h00	In person, Returpack, Norrköping
Peter Matsson	Former president of the board, Sveriges Bryggerier	13 May 2009, 09h00-09h45	Via telephone
Thomas Lindhqvist	Associate Professor, IIIIEE	28 June 2009, 15h00-16h00	In person, IIIIEE

Deposit Refund Systems in Sweden

Case studies for four types of beverage containers

IIIEE Report 2011:05

The National Institute for Environmental Studies (NIES) in Japan and the International Institute for Industrial Environmental Economics at Lund University (IIIEE) has been collaborating on a number of research projects under the overall research collaboration agreement between the two institutions on Product and Waste Oriented Environmental Management and Policy.

The case studies on deposit refund systems in Sweden presented in this report were the results of one of the collaborative research project. It is part of the research project entitled Reframing the Concept of Collection Systems with Economic Incentives – Based on the Review of Deposit-Refund Systems and Point Systems – carried out in collaboration with three organisations in Japan: National Institute for Environmental Studies (NIES), Fukushima University and Community Policy Institute.