How do effective deposit refund systems work?

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Benefits of introducing deposit refund systems (DRSs)

At a time when littering of our planet, in particular the marine environment, is a growing problem and the amount of non-renewable natural resources is constantly shrinking, deposit refund systems\(^1\) can be an effective tool in partly solving these two problems. Under such systems, consumers buying products pay a small deposit, which is returned to them when they return non-reusable containers to a collection point for recycling.

The experience of countries operating deposit systems confirms that the average collection rate of packaging waste included in the system is very high and amounts to about 90%, and the vast majority of the collected beverage containers is subjected to the process of recycling of high quality secondary raw materials. This is enabled, first of all, by designing the containers in line with the requirements of the deposit system and the recycling technology. Secondly, the high efficiency of the system results from developing the DRS with a view to retaining the highest possible economic value of the materials, while meeting the conditions set out in the applicable regulations.

The basic advantage of the deposit refund system over other collection methods is the high quality and separation of the collected waste. This allows, among others, to use the materials even in food packaging and to maximize the amount of recycled waste. In the case of municipal waste collection systems, a large part of this type of waste ends up in landfills.

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1. In the Scandinavian countries, the term “deposit” (pant) refers to both reusable and non-reusable packaging. The consumer pays a deposit each time he/she purchases a product, and receives it back each time he/she returns the packaging. Due to borrowing from English, the term depozyt is also used in Poland; in the Polish version of this document, the terms kaucja and depozyt are used interchangeably.

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Return rates of beverages containers included in the system

up in an incineration plant\(^2\), and the material obtained from residual waste cannot, according to the law, be used as food grade material.

Currently, around a quarter of the European Union’s population uses a deposit refund system. However, due to the increasing legal requirements concerning packaging waste, a growing number of countries are considering its introduction. Among other things, taking into account the current technology, it seems that the new collection targets set out in the EU Directive on the reduction of the impact of certain plastic products on the environment can be achieved only if a DRS is used. According to this directive, the collection rate of single-use plastic bottles is to reach 77% and 90% respectively by 2025 and 2029. In addition, from 2025, these bottles are to contain 25% recycled material (30% from 2030). Ensuring such a quantity of high quality recycled material requires a deposit refund system, which is clearly suggested in the directive.

Therefore, introduction of a deposit refund system seems inevitable. In such a case, the question needs to be asked how to plan an efficient DRS? It may be helpful to take a look at the oldest and, at the same time, most effective deposit systems in the world – those currently operating in the Scandinavian countries. Their great similarity suggests that these countries may have found a recipe for efficient packaging waste management.

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2. For example, in Belgium, about 1/3 of the sorted PET bottles are incinerated instead of recycled (source: https://recyclingnetwerk.org/2019/10/03/belgiums-recycling-is-overrated/)
Basic flowchart of the deposit refund system operation in the Scandinavian countries (based on the Norwegian, Finnish and Swedish systems)

How do effective deposit refund systems work?
Deposit refund system in Norway

The commercial sector is fully responsible for the operation of the voluntary deposit refund system in Norway, the alternative to which is the environmental tax. The possibility to reduce the amount of the tax as a result of achieving high collection and recycling rates was the incentive to establish the deposit system.

The collection rates achieved are among the highest in the world. In 2019, the system enabled the return of 89.5% of all cans and 89.4% of all bottles placed on the market, i.e. over one billion containers. Additional collection methods included, 98.5% of all cans and 95.7% of all bottles were collected. Such a high collection rate of good quality material already today enables Norwegians to produce PET bottles with 80% recycled content, and the producers participating in the deposit system have the priority right to buy the recycled material.

Implementation of the system: 1999

Packaging for:
- water, carbonated beverages, non-carbonated beverages, fruit and vegetable juices, alcoholic beverages

Deposit amount:
- 2 NOK (0,82 PLN) < 0,5l
- 3 NOK (1,24 PLN) > 0,5l

Collection rate (2019):
- Cans 89,5% (98.5% including other collection methods)
- Bottles 89,4% (95.7% including other collection methods)

Packaging material:
- PET, HDPE, aluminium, steel

Market size (2019):
- 1.3 billion cans and bottles with the population of 5.4 million

Number of collection points per 1000 inhabitants:
- approx. 2.8

Scale of recycling (2019):
- Plastics: 20,219 tons
- Aluminium: 9,025 tons
The deposit refund system is one of three, and until recently four, methods of beverage packaging collection available in Norway:

**Kerbside system**

The regular system enables collection of single-use glass and metal containers. Although producers of canned beer can join this system, the collection rates do not meet their expectations. As a result, they decide to participate in the deposit system.

**„Grønt Punkt Norge”**

If a producer chooses to join this system, the sale of bottles is not subject to the deposit, but the producer has to pay a higher environmental tax than in the case of the DRS. This system reports lower collection rates, and a significant proportion of waste is incinerated.

**Refillable system**

Until 2015, Norway had a system for refillable glass and PET bottles. However, it was shut down due to excessively high costs of operation.

All this means that even though the deposit refund system in Norway is voluntary, almost all products sold in the country bear the deposit mark. This is the most environmentally friendly option and, at the same time, it generates the lowest costs.

Placement of beverages in containers on the market without participating in the system requires payment of high environmental taxes, amounting to, e.g., approximately PLN 1.5 for a plastic bottle and approximately PLN 2.5 for a can. That was the initial incentive for producers and retailers to establish Infinitum – a company involved in the development and operation of the deposit refund system. In the Norwegian DRS, it is the producer who is fully responsible for financing of the system, while the central and local governments do not bear any costs. The income of the deposit system is provided by the administration fee paid by beverage producers or importers depending on the quantity and type of packaging (in the case of such a valuable material as aluminium, it is Infinitum that pays the producers for the containers placed on the market, because Infinitum becomes the owner of the waste).

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The reverse vending machines (RVMs) accept only two types of plastic bottles with approved labels. Standard barcodes that allow the product to be sold outside Norway generate additional costs for the producer or importer, which is intended to cover the increased risk of possible fraud.

Each producer participating in the system is obliged to submit its containers to Infinitum for approval. For example, even the glue used for affixing labels is checked.

Non-transparent PET bottles, the material of which poses problems with reuse, are charged with a higher fee.

The sorted and baled packaging waste is delivered to the recycler, who buys the recovered raw material at a profit for the system operator. Infinitum is a non-profit organisation, but efficiency, including economic efficiency, remains its priority. This is why Infinitum strives to achieve the lowest possible costs. To this end, many ecodesign solutions are used:

The system covers the costs of:

- operation of the collection points;
- logistics and sorting;
- administration and marketing.
The deposit amount in Norway is VAT free and is not included in the product price. Since 2018, depending on the size of the container, the deposit has amounted to NOK 2 (containers of up to 0.5 l) or NOK 3 (containers of over 0.5 l). Previously, for almost twenty years, the deposits were NOK 1 and NOK 2.5 respectively.

All retail outlets selling beverages are obliged to accept containers belonging to the system and pay out the deposit refund. It is also possible for consumers to use the recovered deposit amount to participate in the recycling lottery with high winnings or to support a charity. In addition, imported cans are accepted, but in such a case the deposit is not refunded. Small shops conduct manual collection (about 7% of all collected waste). Large retailers prefer using RVMs, which automates the process, including generation of reports based on barcodes.

The Norwegian deposit refund system is an essential tool to reduce littering of the natural environment with bottles and cans. Currently, only around 1% of them are littered. The quantity and quality of the recovered materials make it possible to satisfy 80% of the market demand for raw materials, while some producers already use containers made of 100% recycled material. These effects have been achieved through appropriate adaptation of the system to the needs of producers and retailers, who are the creators of the system, as well as the needs of consumers, among others by ensuring an adequate number of collection points and a proper deposit level, encouraging the return of packaging.
Deposit refund system in Finland

Each Finn returns to the deposit refund system an average of 342 beverage containers a year. This means nearly two billion containers returned per year. Despite such huge volume of the turnover of waste, the Finnish DRS is able to achieve very high collection rates. At the same time, the system is very flexible – in 2019, the company operating the system, i.e. PALPA (Soumen Palautuspakkaus Oy), employed only 14 people, while most of the operations were outsourced and the company only supervised the following processes:
» collection,
» transport,
» recycling,
» information flow,
» financial flows in the system.

<table>
<thead>
<tr>
<th>Year</th>
<th>Packaging Material</th>
<th>Market Size (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>cans</td>
<td>approx. 1.8 billion cans, glass and plastic bottles with the population of 5.5</td>
</tr>
<tr>
<td>2008</td>
<td>plastic bottles</td>
<td>approx. 1.8 billion cans, glass and plastic bottles with the population of 5.5</td>
</tr>
<tr>
<td>2012</td>
<td>glass</td>
<td>approx. 1.8 billion cans, glass and plastic bottles with the population of 5.5</td>
</tr>
</tbody>
</table>

**Implementation of the system**

<table>
<thead>
<tr>
<th>Year</th>
<th>Packaging for</th>
<th>Deposit amount</th>
<th>Collection rate (2019)</th>
<th>Scale of recycling (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>water, carbonated beverages, non-carbonated beverages, fruit and vegetable juices</td>
<td>€ 0.10 (PLN 0.45) plastic &lt; 0.5l</td>
<td>Cans 95%</td>
<td>Plastics: 13,900 tons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>€ 0.20 (PLN 0.90) plastic &lt; 0.5l, 1l &gt;</td>
<td>PET bottles 90%</td>
<td>Aluminium: 18,400 tons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>€ 0.40 (PLN 1.80) plastic &gt; 1l</td>
<td>Glass bottles 88%</td>
<td>Glass: 54,300 tons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>€ 0.15 (PLN 0.67) metal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The success of the system is primarily a consequence of close cooperation and negotiations between the parties – the beverage industry and the retail sector, in particular during the implementation of the system and its extension to new materials. Such a result has been achieved, among others, by an appropriate ownership structure of the non-profit company operating the system. PALPA is owned 50% by retailers and their associations and 50% by companies operating in the beverage industry. The system is supervised by the Ministry of the Environment, with participation of representatives of the public, which guarantees high public acceptance of the system.

Law-making process in the context of the Finnish deposit refund system

Source: own work based on Ettlinger S. (2016): Deposit Refund System (and Packaging Tax) in Finland
The deposit refund system in Finland, as in the case of Norway, is not obligatory, and participation is incentivised by exemption from high taxes imposed on producers of beverages in single-use packaging, amounting to EUR 0.51 (approx. PLN 2.3) per litre of beverage. This is why the vast majority of producers decide to join the system.

Retailers who sell products in containers covered by the system are obliged to collect such containers. Retailers may choose manual or automatic collection of containers. Having chosen the latter option, which currently accounts for 95% of the total collection, the retailer buys a reverse vending machine, while the system operator specifies the conditions to be met by the RVM. The retailer is remunerated for the service consisting in providing and operating a collection point. In the case of hotels, restaurants, offices, schools, etc., containers are returned and deposits are refunded through beverage suppliers.

Currently, the deposit system for single-use containers covers cans (since 1996), plastic bottles (since 2008) and glass bottles (since 2012). The value of the deposit varies and depends on the type, and in the case of plastic also the capacity, of the container. The deposit level is set high enough to motivate consumers to return their packaging, but low enough not to encourage different types of fraud. It is possible to return glass and metal containers that are not part of the system, but no deposit is refunded for these. Plastic packaging that is not included in the DRS cannot currently be returned to the system.

Consumers know that they can return containers being part of the deposit system on the basis of the deposit symbol, which also specifies the amount of the deposit. Companies participating in the system are required to send an authentic sample of their beverage containers to both PALPA and the RVM suppliers to have the effectiveness of their packaging identification tested. In addition, only those beverage containers that meet the relevant guidelines are approved. In this way, the possibility of collection and recycling of containers is optimised, and the operational costs are minimised.

The collected packaging waste is owned by PALPA, which, having delivered the waste to the recycler, recovers the secondary raw material and then sells it. Other revenues of the company include the following fees paid by entities placing packaged products on the market:

» administration fees (also called recycling fees),
» annual membership fees,
» fees for each product introduced to the system.

Additional revenues of the system are those from unclaimed deposits on containers that have not been returned to the system.

The Finnish deposit refund system confirms that appropriate cooperation of all stakeholders, based primarily on an evolutionary approach to the regulation or modification of the system’s operations, allows for excellent results. Moreover, in this way it is possible to achieve considerable operational flexibility without significant investments, which may be a response to the upcoming technological changes, modifications of consumer behaviours and new legislation at the supranational level.
Deposit refund system in Sweden

Since the mid-1980s, the refund of the deposit on beverage containers has been part of every Swede’s life. The world’s first deposit refund system, initiated in 1984 with the purpose of reuse of aluminium cans, was so successful that ten years later it was extended to include single-use plastic bottles. Today, the brand of the Swedish deposit system – “Pantamera” (recycle more) – is as well recognised by the public as the “Coca-Cola” logo.

Implementation of the system

<table>
<thead>
<tr>
<th>Year</th>
<th>Packaging for</th>
<th>Packaging material</th>
<th>Deposit amount</th>
<th>Market size (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>cans</td>
<td></td>
<td>SEK 1 (PLN 0.43) plastic &lt; 1l, SEK 2 (PLN 0.86) plastic &gt; 1l, SEK 1 (PLN 0.43) metal</td>
<td>approx. 2.5 billion cans and plastic bottles with the population of 10.2 million</td>
</tr>
<tr>
<td>1994</td>
<td>plastic bottles</td>
<td>PET, HDPE, aluminium, steel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Collection rate (2019):

- Cans 85.5%
- PET bottles 84.1%

Number of collection points per 1000 inhabitants:

- approx. 1.6

Scale of recycling (2019):

- Plastic (PET): 23,244 tons
- Aluminium: 19,870 tons
Closing the material flow loop means that beverage producers have access to a reliable source of recycled materials, with limited raw material price fluctuations. In addition, thanks to the public support for the deposit refund system, the participating companies can improve their image among consumers.

The DRS enables packaging producers to make better use of resources; e.g., production of an aluminium can from recycled material requires approximately 95% less energy compared to virgin material.

Retailers experience an inflow of customers who, when returning their beverage containers, decide to shop at the same store.

For Returpack, operating as a non-profit company, the DRS means that any extra money is reinvested to improve the efficiency of the system.

The perception of the DRS is universally positive. When producers of various types of juices were allowed to join the system on a voluntary basis (in 2015 and 2018 respectively), many of them decided to do so. The arguments in favour of the DRS included the possibility to improve the perception of the brand by consumers, as well as to increase production efficiency in the situation of the growing regulatory requirements, also at the supranational level. Producers of water, beer and beverages in cans and plastic bottles were obliged by the regulator to participate in the system at the time when the DRS was introduced.

The Swedish deposit refund system aims to recycle 90% of all cans and PET bottles. This target has not yet been met, but the collection rates are improving from year to year, and 100% of the collected waste is recycled. The slightly lower collection rates than in other Scandinavian countries result primarily from the lack of obligation for retailers selling deposit beverages to participate in the collection system. As a consequence, the number of collection points in relation to the population is smaller than in other Scandinavian countries, which affects the convenience of the packaging return process for consumers. The little lower collection rate also results from transnational flows of goods.

Although under Swedish law retailers are not obliged to accept empty beverage containers, there is a financial incentive to participate in the collection – the handling fee paid by Returpack for each accepted container. As a result, Returpack becomes the owner of the packaging waste. Other costs incurred by the company include the expenses related to the operation of a logistics centre and 24 warehouses, as well as the costs of external logistics services.

Returpack, owned by beverage producers and breweries (50%) and two grocery trade associations (50%), is involved in operating the DRS. It is so effective in this activity that the model of cooperation between the retail sector and beverage producers has been adopted by numerous deposit refund systems worldwide.

Such a solution, in addition to environmental and social benefits, brings real economic profits. For example:
The revenues of Returpack are:

- **Sale of secondary raw materials recovered from waste.**
- **Administration fees and sorting fees charged to producers.**
- **Unclaimed deposits.**
- **Annual membership fee.**

The administration fee in Sweden depends on the capacity of the container and is charged for plastics only, while the sorting fee is charged for coloured PET bottles, bottles made of other plastics and steel cans. Since Returpack is a non-profit company, should any losses occur, the producer administration fees will increase.

The Swedish model has been the prototype of an effective deposit refund system that enables reconciliation of the interests of all stakeholders. In addition, the path it set has made the followers realise that a DRS can be an essential tool in raising environmental awareness of the public. It turns out that, as a result, even those producers who are not obliged to charge a deposit on the packaging of their products, and are not encouraged to do so by tax exemptions, may willingly and to the benefit of their businesses decide to participate in the system.
Conclusions on effective deposit refund systems based on Scandinavian experience

Deposit refund systems in Scandinavia are characterised by highly effective collection, which already today actually ensures fulfilment of the increasing legislative requirements. Recycling concerns practically 100% of the collected packaging waste, and the recycled material obtained has a higher market value compared to other municipal waste collection systems. Additionally, deposit systems raise public awareness in the field of ecology and positively influence consumer choices.

Compliance with the circular economy concept

Ecodesign
Producers in Scandinavia are allowed to market only recyclable packaging that is not harmful to the environment or human health. The mechanism of eco-modulation of administration fees additionally encourages the use of containers that can be recycled into food grade materials.

Maximisation of recycling
Maximisation of recycling by introducing recyclable quality packaging that guarantees high collection rates of pure material streams.

Recycled material content
The recovered material is first made available to the producers who participate in the system, in order for them to manufacture new beverage containers of similar type. This solution enables meeting the regulatory targets regarding the mandatory recycled content in packaging.
User and environmentally friendly collection

Availability of collection points

Obligatory participation of retailers selling deposit products in the collection system maximises the number of collection points and thus enables consumers to return their beverage containers in the same places where they buy the products. Due to the different nature of collection points, both automatic and manual collection is used.

Clear marking

Each container included in the deposit refund system bears the symbol of this system for the purpose of communication with the consumer, and a barcode for the purpose of container clearing in the system and reporting.

Communication with the consumer

One of the activities carried out by the entity managing the DRS is communication regarding the correct use of the system and its benefits. Additional incentives to engage the consumer are also provided, e.g. the possibility for the consumer to donate the recovered deposit amount to charity or use it for participation in lotteries.

Smaller carbon footprint

The introduction of the possibility to return used packaging in the shop means that no additional consumer trips to dedicated collection points are required. Moreover, the return of beverage containers to retail locations, where they are compacted, ensures optimisation of transport. The deposit refund system generates significantly less emissions than kerbside collection of beverage containers.
The introduction of a deposit refund system is part of the implementation of the Extended Producer Responsibility (EPR) scheme for beverage containers. Under the EPR scheme, producers and importers of beverages cover the net costs of the system. In order to prevent cross-subsidisation of one material by another, individual cost centres are created for each material fraction.

**Ambitious targets**

The ambitious collection targets at the level of 90% match the high efficiency of the collection tool, i.e., the deposit refund system. Failure to achieve the target level results in severe financial sanctions. Such a solution motivates the entities responsible for the operation of the system to achieve high collection rates.

**Reporting**

In deposit refund systems, reports concerning the number of beverage containers placed on the market and collected are based on the number of bottles and cans counted on the basis of barcodes. The results of the system are reported to the regulator in a transparent and timely manner. The system operator also publishes reports on its activities.
The deposit should not be subject to Value Added Tax, as it does not generate any additional economic value, while taxation makes financial settlements within the system significantly more difficult.

The deposit should be high enough to make it worthwhile for consumers to return their packaging, but, at the same time, low enough to prevent fraud.

The system is established to fulfil the producer’s obligations to ensure recycling of packaging placed on the market. It is not a profit-making instrument and, therefore, the system operator is not an entity operating for profit. In addition, the amounts of unclaimed deposits are revenues of the system.

The system is centrally managed by a non-profit company established by the food industry and the retail sector, which makes it possible to balance the interests of both parties and maintain cost efficiency.

How do effective deposit refund systems work?
The Institute of Innovation and Responsible Development INNOWO is a non-governmental organisation, THINK to DO TANK established to support the development of innovation and implementation of systemic changes for the purpose of sustainable socio-economic progress. We connect and cooperate with various stakeholder groups such as scientists, government administration, decision makers, businesses and NGO’s in order to initiate joint actions to improve the situation of the society and the condition of the environment. Innowo is the initiator and coordinator of the nationwide Polish Circular Hotspot platform, established to support the transformation of the economy towards circularity.

Deposit refund system in Norway INFINITUM: https://infinitum.no/
Deposit refund system in Sweden RETURPACK: https://pantamera.nu/
Deposit refund system in Finland PALPA: https://www.palpa.fi/
Recycling lottery in Norway: https://pantelotteriet.no/