Reuse and Recycling Systems for Selected Beverage Packaging from a Sustainability Perspective

An analysis of the ecological, economic and social impacts of reuse and recycling systems and approaches to solutions for further development

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Aggregation of Selected, Significant Findings

A General consideration of different systems for collecting and recycling beverage packaging

Refillable beverage packaging

- From an **ecological** viewpoint, refillable beverage containers provide advantages when compared to single-use beverage packaging as long as they are not transported over very long distances and their reuse is ensured.
- Refillable beverage packaging causes significantly less packaging waste than single-use beverage packaging.
- After having been established, reuse systems usually show return rates of almost 100%.
- Usually, there is no littering with refillable bottles due to the financial incentive to return them. A precondition for this – as is the case with deposit systems for single-use beverage packaging – is that consumers have sufficient and easily reachable possibilities to return the packaging.
- From an **economical** viewpoint, the investment expense associated with refillable beverage packaging increases for beverage manufacturers due to the necessary investments in washing facilities, pool bottles and logistics structures. On the other hand, however, through the acquisition of reusable beverage containers (which avoids the need to purchase bottles for each filling), beverage manufacturer can benefit from significant operating cost savings, which more than compensate for the higher investment costs. Beverage manufacturers with regional production and distribution structures, in particular, can take advantage of this savings potential, but it can also be realised by international groups which have a number of regional filling locations.
- Under otherwise similar conditions, reusable beverage systems are usually more cost-intensive for food retailers than non-reusable systems.
- From a **social** aspect, reuse systems have a positive impact on the employment situation as more personnel are required to operate a reuse system than for single-use beverage packaging.
- The reuse deposit system complies fully with extended producer responsibility.

Deposit systems for single-use beverage packaging

- An **ecological** advantage of deposit systems for single-use beverage packaging is the realisation of very high collection rates (proportion of empty packaging returned), which averages more than 80% internationally, and in some countries is even above 95%.
- Single-use beverage packaging that is collected separately within the scope of deposit systems can be more easily recycled due to targeted sorting of packaging waste. Consequently, in deposit systems, recycling rates that essentially correspond to the respective collection rates can be

achieved. This promotes the use of secondary raw materials in the manufacture of new products and so reduces resources consumption.

- A relevant and rising proportion of the collected single-use plastic beverage packaging is fed into bottle-to-bottle recycling (closed loop recycling), which is possible in mixed collection (see green dot system) only under more difficult conditions (the need to sort out residual waste, sorting and separating a large number of different materials as well as getting rid of impurities resulting from other packaging and foodstuff residues).
- Mandatory deposit systems contribute significantly to reducing total littering due to high return rates, in particular when compared to deposit-free beverage packaging.
- From an **economical** viewpoint, it can be determined that systems costs (costs for the central system, logistics, counting centers, reverse vending machines, deposit clearing) are mostly borne by beverage manufacturers or by trade.
- The initial investment costs are relatively high for trade as it must ensure that beverage packaging is returned. In particular, retail, as the place where deposit beverage packaging is collected can, however, balance out the costs over the medium term through a well-organised and well-applied mandatory deposit system.
- Lower initial costs arise for beverage manufacturers as, here, only the labelling has to be adjusted and the packaging used must be registered with the system. Revenue may be generated for beverage manufacturers through e.g. unredeemed deposits.
- As a result of mono-fraction collection, a mandatory deposit system may provide for higher and more stable proceeds as the quality of the collected packaging is superior to that of green dot systems. Under otherwise similar conditions, this then leads to deposit systems being less affected by difficult market conditions.
- From a **social** viewpoint, a need for additional personnel arises, e.g., for manual take-back or the operation of reverse vending machines (e.g., cleaning, maintenance), as well as for transport, counting centers, clearing services and recycling capacities whereby, in comparison to a situation without a deposit system for beverage packaging, additional workplaces can be created.
- In deposit systems for single-use beverage packaging, beverage manufacturers and retailers bear the entire extended producer responsibility.

Curbside collection and recycling systems (green dot systems)

- In relation to beverage packaging, beverage packaging from mixed curbside collection and recycling systems (green dot systems) achieves lower collection and recycling rates than deposit systems. As a rule, beverage packaging in this system is not fed into closed-loop recycling as it is collected together with other types of packaging and packaging materials and so requires increased subsequent sorting and cleaning efforts. Consequently, from an **ecological** viewpoint, overall the reduction potential concerning resources consumption and greenhouse gas emissions is lower than with deposit systems for beverage packaging.
- In green dot systems there is no incentive for consumers to reduce littering. Consumers usually have no direct financial incentive to dispose of packaging in a green dot system. In the event of

consumption outside the household, in particular, there is very little incentive to take empty beverage packaging home or to use a collection bin. It is likely that this packaging will probably be disposed of in a public waste bin or even through littering.

- From an **economic** viewpoint, a green dot system incurs high costs for setting up a curbside return and licencing structure. As these costs relate to the collection and sorting of packaging used in households (and not only to beverage packaging), a direct comparison with the costs for implementing a deposit system is not possible. Maintaining the system involves costs for operating the collection system, for sorting and disposal (e.g. sorting residues, wrong disposal of items and – in the case of poor quality material, for example – recycling of the collected material. In a green dot system also, revenue is mainly generated from the sale of secondary materials. The license fees to be paid by manufacturers are calculated from the costs and revenues (and in Germany, additionally from the profit margin of the dual system operator).
- From a **social** aspect, green dot systems (depending on the system design), also have a positive impact on overall employment due to the increased recycling requirements.
- In shared producer responsibility systems which, in a European comparison are most frequently used, extended product responsibility is implemented with restrictions as beverage manufacturers and retailers need only bear some of the costs, and the municipalities bear financial responsibility through passing on costs to the citizens.
- In the case of full-cost systems (as in Germany, for example), manufacturers assume comprehensive cost responsibility for their products.
- In green dot systems, consumers only have a financial incentive to participate responsibly in the system if residual waste charges are to be paid depending on quantities.

B Detailed assessment of the systems for collecting and recycling beverage containers existing in Germany

- A comprehensive analysis of the **ecological impact indicators** shows the ecological advantages that refillable beverage containers have for Germany when compared to single-use beverage containers.
- Due to the present market development in the mineral water, soft drinks and fruit juice segment, which indicate an increasing tendency towards the use of single-use beverage containers, the stability of reuse systems is at risk in these beverage segments.
- In green dot systems, collection rates (after residues have been extracted) amount to between 43 and 54 % for PET single-use bottles, 53 % for drinks cartons, and 76 to 82 % for single-use glass bottles. The recycling rates (relating to the quantity put into circulation and after residues have been extracted as well as energy recovery) in a green dot system amount to 25 to 31 % for PET single use bottles, 39 % for drinks cartons, and 76 to 82 % for single-use glass bottles.
- The mandatory deposit system shows collection rates of 96 to 99 % and recycling rates of 81 to 98 % (depending on the type of packaging material). These rates are thus significantly higher than is the case with dual systems.

- In an **economic** comparison of German return systems for single-use beverage containers - the mandatory deposit system and the green dot system – it has been determined that it is not possible to make any general statement about which is the more cost-intensive system. While earlier analyses arrived at the finding that the deposit system gives rise to higher costs, current data indicates that, taking costs and revenues into account, developments are tending to favour mandatory deposit systems and that participation in a deposit system can be less costly than participation in a green dot system. If the return and recycling rates of the systems are included in the assessment, a mandatory deposit system can be viewed as being more cost efficient.
- The cost and revenue options in the systems examined depend on a number of influencing factors, in particular the price of secondary materials and the weight of the packaging, but also, for example, on the number of beverage containers in the system.
- The reuse rate and the recycling rate are central success and steering parameters for the German systems for collecting and recycling beverage packaging. In Germany, the mandatory deposit system is proving to be a meaningful measure for supporting the political targets (promotion of ecologically beneficial beverage packaging, high return rates, high recycling rates, less littering), and in practice is thus a meaningful supplement to the green dot system for the beverage packaging segment.
- If the **social impact** on system participants is considered, the additional requirements in German reuse systems for filling, sorting and logistics create additional workplaces, especially where regional beverage manufacturers are concerned. In comparison, single-use filling is more strongly automated. In the event of conversion from reuse filling to single-use filling, it is to be assumed – all else being equal – that workplaces will be lost.

C Recommendations for action re optimising the systems that exist in Germany for collecting and recycling beverage packaging

- Stabilising and increasing the reuse rate in some beverage segments is just as necessary as raising the qualitative and quantitative collection and recycling rates (including the bottle-to-bottle recycling rate) respecting non-deposit single-use beverage containers.
- Provided the following suggested measures are implemented, an immediate stabilisation and medium-term increase in the proportion of ecologically advantageous beverage packaging as well as positive effects on return and recycling rates can be expected:
  - Clear labelling of beverage packaging (deposit amount, single use/reuse)
  - Inclusion of other beverage segments in the deposit obligation
  - Information campaign on ecological properties of types of beverage packaging
  - Incentive levy on economically detrimental types of beverage packaging: To be charged directly by the retailer and shown separately on the sales receipt

D Guideline for political decision-makers concerning the introduction of systems for collecting and recycling beverage packaging

- In countries without - or with very little - recycling infrastructure, return systems for beverage packaging can be a manageable and effective first step towards creating a flow of high quality recyclable fractions.
- In this respect, achieving high return rates (collection rates) and recycling rates as quickly as possible as well as ensuring the high and consistent quality of collected packaging material are important success factors. For single-use beverage containers, this can best be achieved through the introduction of a deposit system.
- European member states that wish to introduce mandatory single-use deposit systems must observe certain requirements in order to ensure that a good compromise is found between environmental targets and the requirements of the domestic market. These requirements apply primarily to the following aspects:
  - Adequate transition periods
  - Fair, open and transparent design of the system
  - Labelling of packaging
  - Clearing system
  - Exemptions for smaller businesses
  - Ensuring the easy import and import of products
- In countries where, to date, no system exists for curbside collection of packaging and/or other recyclable fractions, green dot systems can generate large quantities of packaging (not only beverage containers) that can be fed into the recycling market.
- However, these quantities tend to be more suitable for open loop recycling. In order to aim for high-quality closed loop recycling, the focus should be on higher quality, both with respect to collection (e.g. minimising the quantity of wrong disposal of items, maximising return rates, pre-sorting to the extent possible, a lower amount of impurities, etc.) as well as with respect to recycling (e.g. mandatory minimum recycling rates and minimum quality criteria).
- In many countries, green dot systems (also for taking back and recovering beverage containers) have already been introduced to varying extents. If the recycling rate and, in particular, the bottle-to-bottle recycling rate is to be increased, it is recommended that a deposit system for beverage containers be additionally introduced.
- Mandatory deposit systems and green dot systems for single-use beverage containers are aimed in part at different segments. Green dot systems are primarily targeted at household use. However, a significant proportion of beverage packaging, in particular, is used outside the home. Green dot systems usually cover this packaging only to a limited extent, whereas the deposit system also covers consumption outside the home due to the financial incentive provided. Consequently, the two systems supplement one another and can co-exist very well.

Executive Summary

Around 81 million tons of packaging waste was generated in the European Union (EU) in 2006. About 20% of this packaging waste was beverage packaging.

The amended EU Waste Framework Directive confirms and prescribes the five-tier waste hierarchy for the EU Member States. Pursuant to the directive, waste prevention generally takes priority over waste recycling to the extent that ecological reasons do not speak against prevention.

A Background and Scope of the Study

Life-cycle assessments have previously established themselves as an instrument for assessing products and value-added chains. However, experience has shown that the "traditional" assessment of ecological effects of beverage packaging through life-cycle assessments requires two additional elements:

- On the one hand, the normal calculation of quantified environmental impacts must be supplemented by a transparent analysis and presentation of the general conditions and the respective current or future forecasted market relevance. For example, aspects such as the quality of recycling and closed material loop recycling must be investigated more intensely than previously and included in the assessment of systems.
- On the other hand, exclusive concentration on ecological aspects does not help to achieve the goal as only through a complementary examination of the economic and social impacts of a product or an added-value process can all of the facts relevant to a decision be determined.

For the first time, this study therefore provides a comparative overview of the ecological, economic and social impacts of various collection and recycling schemes for beverage packaging. All stages of added value are considered, from filling to take-back on to re-filling or recovery and disposal. The study is intended to serve interest groups from business, politics and society as a basis for discussion with an extensive look at influencing variables.

A 1 Systems investigated and evaluation model

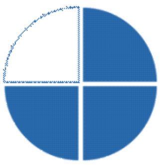
If beverage packaging waste is taken back, reused or recycled in an organized manner, this is predominantly done in three very different systems:

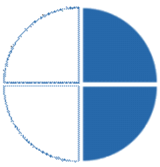
1. Reuse systems, which are aimed at multiple use (reuse) and refilling of the same beverage packaging.
2. Mandatory single-use container deposit systems, in which beverage packaging is used only once and the deposit previously paid by the consumer is refunded upon return at the point of sale ("POS").

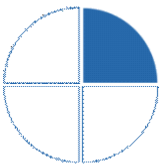
3. In curbside collection systems ("green dot systems"), which are predominantly or partially financed by the bottlers or retailers, beverage packaging is collected together with other packaging at households or is collected via drop-off systems.

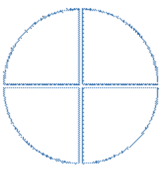
In the first part of the study, these three systems are initially described on the basis of their respective functionalities. Subsequently, the interrelations between the packaging systems and a selection of nine ecological, eight economic, and six social impact categories, such as resource consumption, system costs or littering are analyzed. Finally, performance indicators and results of the respective systems are summarized and assessed. This assessment provides a summarized overview of whether the systems tend to have a positive or negative impact on the respective categories and the respective individual indicators. The assessment uses a five-stage system:

 = System's influence on the indicator is very positive

 = System's influence on the indicator is predominantly positive

 = System's influence on the indicator is slightly positive or negative

 = System's influence on the indicator is predominantly negative

 = System's influence on the indicator is very negative

A 2 Detailed study – Germany

In the second part of the study, the country-specific characteristics of the different systems in Germany are investigated in detail. Germany is suitable for such an investigation because all three of the investigated reuse and recycling systems for beverage packaging are present in Germany at the same time and therefore very good prerequisites for a comparative examination of the systems are in place.

An evaluation is made, based on the findings collected in Germany and on the defined indicators, of the extent to which the respective systems are suitable for meeting the legal or economic objectives in terms of sustainability.

The detailed study of Germany closes with a scenarios analysis and with recommendations for optimizing the design of the beverage packaging collection and recycling systems existing in Germany and for the legal measures necessary for such optimization. The recommendations for action are then compared with the results of the study on the evaluation of the German Packaging Ordinance (*Verpackungsverordnung*) published by the Federal Environment Agency (Umweltbundesamt, "UBA") in 2010.

A 3 Guidelines for implementation of collection and recycling systems for beverage packaging

Based on the developed findings, a generally applicable guideline for political decision-makers for implementing collection and recycling systems for beverage packaging is presented in the third and final section of the study. This guideline describes the potential impact of the systems on specific target dimensions, identifies general conditions for the systems' functionality, and defines critical points for implementing the systems.

B Results of the Model Comparison

B 1 Reuse systems

From an ***ecological*** aspect, reusable beverage containers are superior to single-use containers as long as they are not distributed over very long transport distances. Multiple use (reuse) generally consumes fewer resources and produces fewer environmentally hazardous greenhouse gases than single-use beverage containers, which are filled only once.[1]

Generally, the advantages of reusable beverage containers are predominantly cumulative over the entire life-cycle (i.e., production, filling, transport and disposal). The ecological benefit increases with the utilization of uniform bottle pools and tends to decline with increasing use of individual bottles and boxes by fillers because that makes the return logistics more complex.

[1] For example, according to a UBA life cycle assessment, compared to a PET single-use bottle, one PET reuse - bottle consumes 40% fewer raw materials per 1,000 liters of fill material and emits about 50% less environmentally hazardous greenhouse gases.

Due to the material and hygienic characteristics, reusable glass bottles enable higher circulation rates (up to 50 turnovers) than those of reusable PET bottles. The circulation rate depends on breakage resistance, the stability of the packaging, and on how fast a material wears out. Overall – in particular for stability reasons – reusable beverage containers are heavier than single-use beverage containers.

In established reuse systems the collection rate (proportion returned) is typically close to 100%. The primary reason for the very high collection rate in such systems is the deposit paid, which the consumers get back at the POS upon return of the reusable beverage containers. Upon re-filling, old, worn out bottles or those that no longer meet the specifications are sorted out and sent to recycling separately from other materials. There is practically no littering with reusable bottles.

From an ***economic*** perspective, the use of reusable beverage containers increases capital expenses for beverage producers through the required investments in washing equipment, pool bottles and logistics structures. Regarding operating costs for the filling process, reuse systems are more economical for beverage producers than single-use systems. Although the expense for cleaning is higher, the individual packaging is more expensive due to the higher weight and the transport expense is greater, these added costs are more than compensated for through the lower number of packaging units.

All else being equal, reuse systems usually entail higher costs, in particular, for the retail grocery trade than single-use systems. This is essentially related to higher costs for slightly higher storage capacities and for the take-back and sorting.

Reuse systems do not pay off with very long transport distances. They therefore make only limited sense for major companies with a centralized production structure and internationalized distribution. In contrast, reuse can be a competitive advantage for companies with regional production and distribution structures (also for international groups with several regional filling locations).

With regard to ***social*** parameters, it is clear that reuse systems have a positive impact on employment because more workers are required for operating a reuse system. In addition, the structures of reuse-based markets are normally more strongly characterized by the more job-intensive small and medium-sized companies than the structures of single-use-based markets. [2]

Beverages in reusable beverage containers may have a higher sales price than beverages in single-use beverage containers. However, this is normally due to the fact that beverages sold in reusable beverage containers are positioned in a higher price segment. Beverages that are intended to be differentiated by quality or the brand are only seldom filled in single-use beverage containers.

With reuse systems, the extended producer responsibility is comprehensively implemented: Private business bears all costs, the responsibility for the material and the responsibility for the functioning of the system. The beverage producers and wholesalers have primary responsibility as they have a significant influence on the system's efficiency due to being responsible for the design of the packaging and the logistics chain.

[2] According to a 1998 study by the European Commission, the increased use of reusable beverage containers could create 27,000 new jobs in Germany. Conversely, by substituting single-use beverage containers for reusable beverage containers 53,000 jobs would be lost.

In order to enable consumers to make an active purchasing decision, given parallel mandatory deposit systems and reusable deposit systems, consumers should be able to clearly differentiate between reusable and single-use beverage containers. This can be attained, for example, by clear and consumer-friendly labeling with respect to reuse, by charging a deposit and by the amount of the deposit fee.

Many people see a clean environment as an important element of a high standard of living, as being essential for a social environment with a positive impact, and as beneficial for individual well-being. Reuse makes a positive contribution here because refillable packaging is practically never casually thrown away (littered).

B 2 Mandatory single-use beverage packaging deposit systems

Significantly more resources and energy are used for a single-use beverage container relative to the filling quantity than for a reusable beverage container. Therefore, from an ***ecological*** perspective, single-use beverage containers contribute more to environmental damage and climate change, given medium and short transport distances.

Single-use beverage containers cannot be reused directly as such; they therefore also create more packaging waste than refillable packaging. Due to one-time usage, they have disadvantages when compared to reusable beverage containers respecting summer smog, acidification and eutrophication impact indicators. With regard to greenhouse gas emissions, however, long transport channels can lessen the ecological advantages of reusable beverage containers vis-à-vis single-use beverage containers.

Deposit systems for single-use beverage containers achieve very high collection and recycling rates of sorted packaging materials. This promotes the use of secondary raw materials (recyclates) during the production of new products, which reduces resource consumption. The collection rates (return rates) of beverage packaging in mandatory deposit systems are over 80% on average and, in some countries, significantly higher at more than 95%. The proportion of single-use beverage containers returned depends on the amount of the deposit. For example, countries with high deposit amounts have very high return rates (Germany: 98.5% at €0.25 deposit). In Michigan, the mandatory deposit was doubled to $0.10 (about €0.08), which, at 95%, attained the highest return rate in the US. Legally established exceptions from the mandatory deposit (e.g., for individual beverage segments, packaging materials or package sizes), in addition to a less consumer-friendly design of the return options, can negatively impact return rates because it impairs the comprehensibility and transparency of the system

Mandatory single-use deposit systems favor high-quality and segregated recycling through separated collection. Single-use beverage containers collected separately within the scope of deposit systems are practically completely recycled. Return quantities and recycled quantities are therefore virtually identical. In some countries a relevant and increasing proportion of the returned plastic single-use beverage containers is fed into bottle-to-bottle recycling, which is achievable from mixed collection only under more difficult conditions. In almost all collection systems, glass is collected as a mono-fraction and fed into closed-loop recycling.

Mandatory single-use deposit systems make a considerable contribution to reducing littering. In Germany, for example, prior to the introduction of the mandatory deposit, littering from single-use beverage containers was estimated to be about one-fifth of the total litter volume. The currently reported high proportion of beverage packaging bearing deposits and being returned shows that, with a deposit system, there is practically no longer any littering of single-use beverage containers bearing deposits.

From an ***economic*** perspective, it should be noted that the system costs (e.g., costs for the collection systems, recycling, handling, reverse vending machines, deposit clearing) are borne for the most part by the beverage producers and retailers. A cost analysis carried out by the Swedish deposit system operator Returpack even shows that the revenues in sub-areas, such as aluminum cans, can exceed the costs. However, many stakeholders do not currently provide any official information about the costs and financing sources.

The investment costs upon initial implementation of a deposit system are relatively high for retailers because retailers must ensure that beverage packaging is taken back. However, retailers, in particular, can offset all costs over the medium term through a well-organized and well-structured mandatory deposit system and through material revenues and handling fees, such as in Sweden, for example. Beverage producers incur lower entry costs as they only need to revise the labeling.

For major international companies, the various national requirements concerning deposit systems can give rise to minor additional expense when supplying international markets. This is always the case, in particular, if country-specific bar codes must be printed on the labels, or, in the case of cans, be applied directly on the packaging and if the labeling of the bar codes is subject to certification. It is possible that national system requirements may cause additional costs and thus impede market entry for import companies; however, this is legally permissible. This comprises, in particular, the post-labeling of single-use beverage containers at small and medium-sized international enterprises, for whom label conversion in production is not worthwhile due to small quantities exported to Germany.

The ongoing operating system costs (depending on the materials and amount) can be covered in full or at least in part from unredeemed deposits. With high return rates, however, complete funding from unredeemed deposits is not to be expected. In addition, system revenues from the sale of secondary material (returned packaging materials) are achieved in mandatory deposit systems. These can also be used for funding the system costs. Depending on the structure of the mandatory deposit system, materials revenues go to the retailers, the system operators or governmental offices. By using separated collection, the mandatory deposit system can reckon with higher and more stable revenues because the quality of the collected packaging is higher than with green dot systems. As a consequence, given similar conditions, deposit systems are less affected by difficult market conditions than green dot systems.

From a ***social*** perspective, taking back beverage packaging within the scope of a mandatory deposit system leads to additional personnel being required for manual take-back or for operating reverse vending machines (e.g., cleaning, maintenance), as well as for transportation, counting centers, clearing services and recycling capacities, as a result of which additional jobs can be created when compared to a situation without a deposit system for beverage packaging.

The framework and arrangement of the mandatory deposit system influences the system's cost effectiveness. If the system revenues (from unredeemed deposits, from *handling* fees or through generated materials revenues) for a system participant exceed the costs, prices can be reduced. By contrast, if the costs exceed the system revenues generated for the retailer or beverage producer, it is possible that the costs will be passed on to consumers and thus influence the product price. However, the retailer could also pass on the costs retrogressively in the supply chain to the filler so that the price for consumers is not further influenced. Whether costs and revenues are actually passed on to consumers cannot be determined because corresponding information is not normally published. At global level, an open, verifiable and documented price increase due to mandatory deposit costs is unknown to date.

In deposit systems for single-use beverage containers the beverage producers and retailers bear extended producer responsibility in full.

Consumers are usually informed of the deposit system by means of information campaigns. The design of the practical return options for empty, single-use beverage containers can influence consumer behavior: If return is not possible at all sales locations, there is an increased risk that consumers will not return the empty beverage containers – despite having paid a deposit.

A further positive effect (although not primarily intended) of the deposit system that can sometimes be observed is that people in precarious living situations collect bottles and redeem the deposit in order to earn some additional income. In the USA, in particular, where a mandatory deposit system has been established, this group of people forms a fixed element among all returners.

B 3 Curbside collective collection systems ("green dot systems")

The majority of beverage packaging from mixed curbside collective collection and recovery systems (green dot systems) is not fed into closed-loop recycling because it is collected together with other packaging types and materials. Hence, from an ***ecological*** perspective, the potential for reducing the consumption of resources and greenhouse gas emissions is lower than with deposit systems for beverage containers.

In order to attain maximum conservation of resources in a green dot system, in addition to high collection rates (return rates), precise sorting is required - initially by consumers - and subsequently precise post-sorting at sorting facilities by the waste management companies so that as much well-sorted material (i.e., easily recyclable materials), are sorted out, from which high quality materials can be manufactured. In mixed collection using green dot systems, however, single-use beverage containers are mixed with other packaging or combined with wrong disposed of items. This results in contamination and residues to a greater or lesser extent and has a significantly adverse effect on the quality of recycling.

The quantity and quality of beverage packaging returned in connection with a green dot system depends on whether it is a pick-up or drop-off system, on how attractively the system is structured, and also on the consumers' level of information and motivation. The settlement structure and social structure of households play a decisive role here. Generally, the collection quantity and quality of the packaging materials collected in green dot systems is higher and better in rural areas and in areas with single family homes than in densely populated high-rise areas where collection containers are not (socially) controlled. In those areas, there is sometimes no difference when compared to residual waste containers (wrong disposal of items in both directions: packaging in the residual waste and residual waste in the green dot system).

The collection and recovery rates of green dot systems and deposit systems are very difficult to compare for several reasons:

- Green dot systems take their licensed packaging quantity as a starting point for quantity-related success. However, this is less than the quantity on the market (e.g., due to free riders).
- Green dot systems use the "the quantity fed into recovery" as an additional starting point for quantity-related success. This is regularly determined by weighing the sorting facility's output. However, this quantity contains some non-packaging weight due to residual build ups or weather influences.
- Additional weight is lost during the recycling process itself.

In green dot systems, there is no incentive for consumers to reduce littering.

From an ***economic*** perspective, the distribution of costs between the state and private business differs depending on the financing model of the green dot systems. Beverage producers incur costs primarily through fees for participating in the green dot system. Material with regard to the amount of these costs is whether the system uses a full-cost or partial-cost model. With full-cost models, costs are higher for beverage producers because they must bear the total costs that arise from the system. If a retailer distributes its own brands it is considered to be a beverage producer.

In the partial-cost model (*shared producer responsibility*), beverage producers and the retailers pay fees through their green dot system to the municipal waste disposal authority, but these fees only cover part of the costs incurred due to segregated collection and recovery of the packaging. The regional administrative bodies or municipalities bear the remainder of the costs. In turn, they pass on the costs to the residents of the respective municipalities. It is to be assumed that the residents thus pay a portion of the system costs as an internalized component of the product price when buying a packaged product, and again as a local taxpayer in their respective municipality. The partial-cost model is the model most commonly used.

With green dot systems, statutory recovery rates are the benchmark for the total system costs to be raised from the obligated parties. Materials collected beyond target achievement allow for cost optimized recovery including disposal, where appropriate. The respective system operators can use agreements with disposal contractors on price scales to appropriately control or cap the recovered quantities in their interests.

Revenues for funding the system are generated by the sale of secondary materials that arise from the collected and sorted packaging waste. Because green dot systems incur higher sorting and cleaning expense, the revenue potential is less than in deposit systems for beverage packaging, in particular for PET bottles.

Typical start-up difficulties are normally free riders (non-licensing of packaging requiring licensing) and a high proportion of wrong disposal of items as a result of deficient consumer information, existing habits and control mechanisms that are not yet established or not functioning. Problems can also arise through a lack of initial funding, difficulties in coordinating with municipal disposal contractors, delayed implementation of regional coverage or of functioning logistics and sufficient sorting and recycling capacities. Even after the start-up phase, the system's stability is jeopardized by free riders. Packaging that is not licensed but is disposed of through the green dot system endangers the ability to finance the overall system.

Green dot systems are particularly dependent on the commodities and recycling markets. Beneficiation expenses and the quality of secondary materials must be weighed against each other in order to ensure refinancing. If the prices for primary commodities and high quality secondary raw materials fall, e.g., from mandatory deposit systems, it is possible that green dot system operators would actually have to pay extra to get rid of secondary raw materials of lower quality coming from green dot systems. In Portugal, for example, the green dot system was confronted with funding problems because the recycling of plastic packaging incurred very high costs. In Spain, too, the green dot system in operation there had to sharply increase prices (by 35.8%) because the packaging quantity brought onto the market had declined during the economic and financial crisis and prices on the secondary materials market had fallen. In particular, the prices for licensing beverage bottles saw an increase.

From a ***social*** perspective, a green dot system can have a positive effect on overall employment, depending on the system design. In Germany, for example, the introduction of the green dot system created 17,000 new jobs.

In the shared cost system, which is used most predominantly, extended producer responsibility is not being sufficiently implemented because beverage producers and retailers must only bear some of the costs.

With full cost systems, producers assume extensive cost responsibility for their products. Green dot systems focus more on cost responsibility for the collection, sorting and subsequent recovery of packaging (financial responsibility), and not on the collection and recovery of the packaging per se (direct material responsibility).

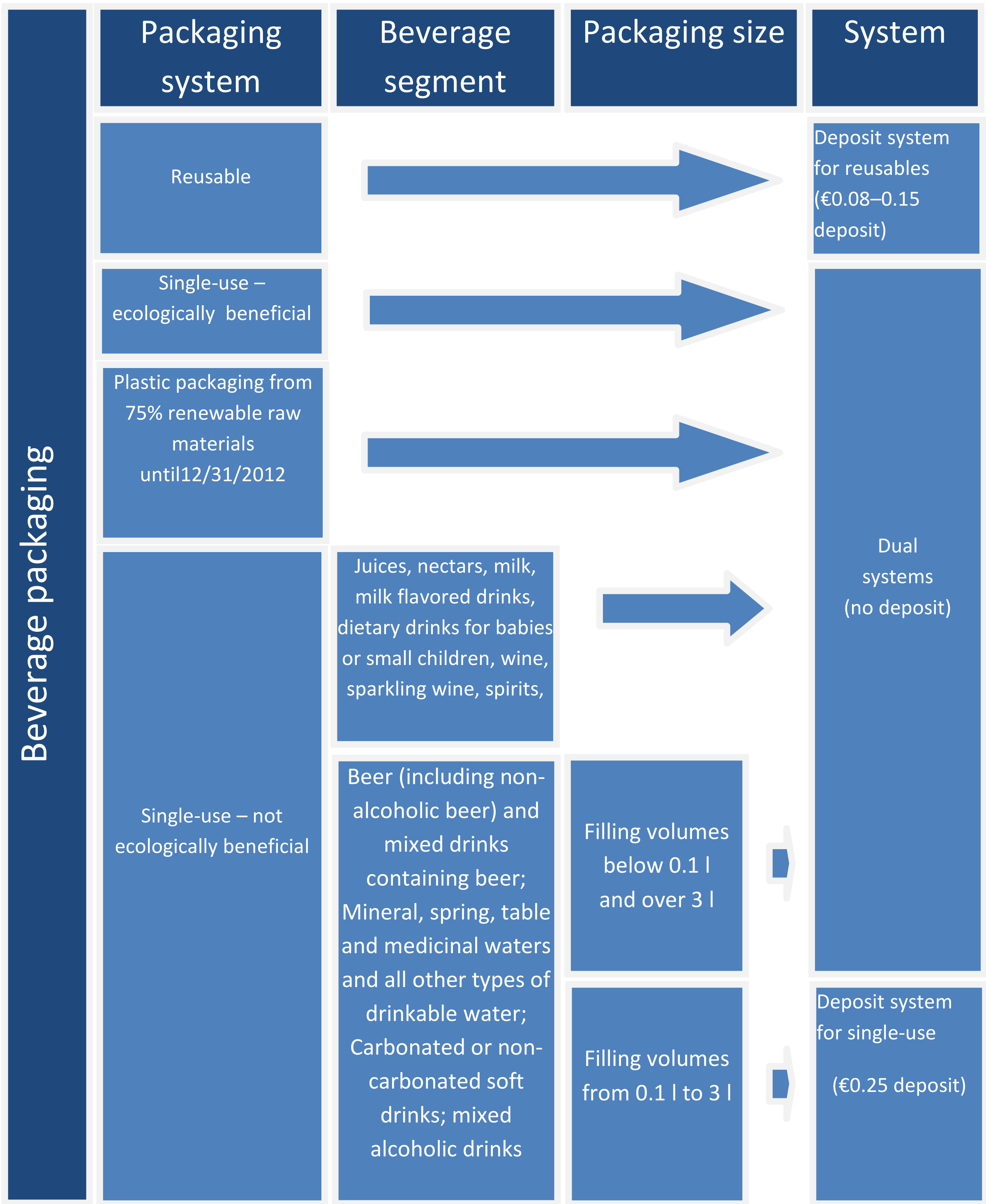
Consumer behavior is also a decisive success factor for green dot systems: The system functions only if consumers responsibly exercise the presorting task in their own households and, in addition, fulfill their drop-off function. The financial incentive for consumers who participate in a green dot system materializes only when the fees for residual waste are paid on the basis of quantity. When consuming away from home, it cannot be assumed that the consumer will predominantly act responsibly and take the empty beverage packaging back home or use a collection container. Rather, the packaging will probably be disposed of via littering or public waste bins.

C Country Section: Germany

C 1 Existing systems in Germany

In Germany, there are reusable packaging and mandatory single-use deposit systems as well as green dot systems (also called a dual system) side-by-side for various kinds of beverage packaging. They are differentiated by type and scope as follows:

Illustration 1: Delineation of the beverage packaging systems



C 2 System comparison based on impact categories

The extensive analysis of **ecological impact indicators** documents the ecological advantages for Germany of reusable beverage containers vis-à-vis single-use beverage containers.

The reuse systems in Germany indicate that high circulation rates are being generated in the various beverage segments, in particular for glass bottles. Analysis of the materials weights indicates that reusable beverage containers have greater environmental impacts in production due to the higher packaging weight than do single-use beverage containers. However, this effect is more than compensated for by the significant reduction in the environmental impact from reuse, which is made possible by the stabilizing higher packaging weight. However, supplementary studies respecting the various distribution distances must still be conducted on this question in order to be able to make conclusive statements.

A systematic analysis of the various collection and recycling schemes for beverage packaging for Germany has shown that, in relation to collection and recycling rates, deposit systems show advantages vis-à-vis the dual systems. Deposit systems show collection rates of 96% to 99% and recycling rates of 81% to 98% (depending on the packaging material). These are therefore significantly higher than with the dual systems. There, the collection rates are between 43% and 54% for PET single-use bottles, 53% for beverage cartons, and 76% to 82% for glass single-use bottles. The recycling rates (in relation to quantity brought onto the market) for PET single-use bottles are 25% to 31%, 39% for beverage cartons, and 76% to 82% for glass single-use bottles. An additional fact is that deposit systems are fundamentally suitable for high-value recycling within closed loops due to the segregated flow of materials (separate collection of glass, metals and plastics at retailers).

Due to the inherent incentive for consumers to return the packaging, deposit systems (for both single-use beverage containers as well as for reusable beverage containers) actually lead to an end of deposit packaging littering and, consequently, also to reducing the total volume of litter.

Structural factors, in particular, influence the **economic impact categories** of beverage packaging systems. As a whole, reuse systems are primarily beneficial for small, regional companies and the specialized beverage trade from a cost and competition perspective. By contrast, larger companies (often with centralized filling) and the retail grocery trade, in particular discounters, appear to benefit more from single-use beverage container systems. The current competitive environment and market developments in Germany show a tendency toward the use of single-use beverage containers. But there are also exceptions here, as the situation in the German beer market shows, where major breweries also use reusable bottles. Current market developments, in particular in the mineral water, soft drinks, and fruit juice market, which are showing an increasing trend toward the use of single-use beverage containers, are seriously jeopardizing the stability of the reuse systems in these beverage segments.

When comparing the German return systems for single-use beverage containers – mandatory deposit systems and dual systems – it has been found that it is not possible to make a general statement about which is the more cost-intensive system. While earlier analyses found that the deposit system causes higher costs than the dual systems, current data indicates that, when considering costs and revenues, developments have favored the mandatory deposit systems, and participation in a deposit system in one scenario can actually be more economical than participating in dual systems. The cost and revenue options depend strongly on the market conditions, in particular on the prices of secondary materials and the weight of the packaging but also, for example, on the number of beverage containers found in the system. Mandatory deposit systems permit separated collection (in particular of PET bottles) compared to dual systems and thus greatly improve the revenue potential. In addition, a mandatory deposit system does not incur costs for sorting and beneficiation after consumers return items at the POS, as a result of which processing costs also decline for the recycling companies. Beverage producers and retail companies can also generate direct revenues from the mandatory deposit system.

For consumers, a broad product range is generally advantageous. The various return systems for beverage packaging impact on product diversity to different degrees. Cost driven bulk filling in single-use beverage containers does not promote the offering of a large, possibly regional variety of products as this would lead to increased set-up times. By contrast, reuse systems, and in part also closed-loop bottles ("Stoffkreislaufflaschen") enable or simplify market entry for smaller and medium-sized, mostly regional beverage producers and, in this respect, have a positive influence on product diversity. On the other hand, single-use beverage containers are more flexible with regard to shape, design and size.

Looking at the **social impact** on system participants, the additional requirements for filling, sorting and logistics in the German reusable packaging system create additional jobs. In comparison, single-use filling is more automated. Converting from multi-use filling (reusables) to single-use filling would eliminate jobs accordingly.

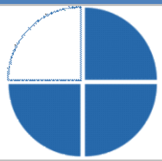
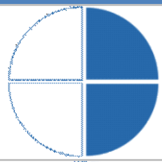
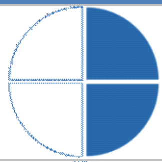
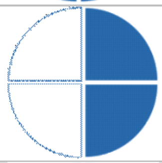
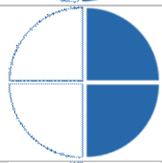
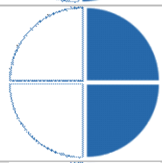
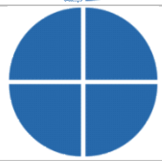
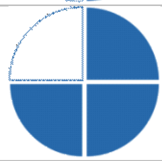
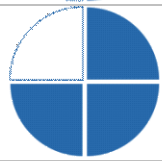
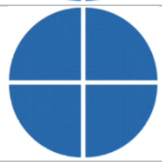
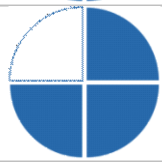
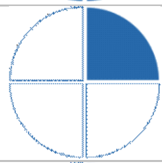
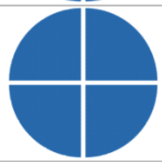
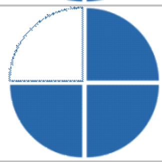
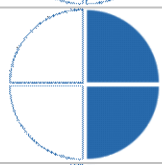
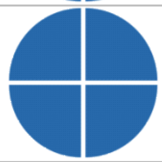
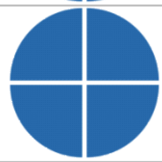
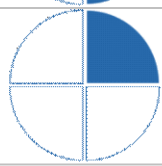
With respect to the system abuse indicator, the reusable packaging system generally shows the lowest susceptibility because the beverage producer has an interest in its bottles being returned and in a logistical system that functions accordingly. In the mandatory single-use deposit system, the introduction of a bar code and the mandatory printing of the Deutsche Pfandsystem GmbH's symbol reduce the options for abuse. In the past, these control mechanisms were circumvented in individual cases, but without this reaching a noteworthy level. Dual systems are the most susceptible to system abuse at various levels such as reporting and settlement by retailers and the industry vis-à-vis the dual systems, system participation and correct sorting by consumers, correct reporting of the licensed quantity by the systems, as well as effective control by governmental bodies. This susceptibility is a result of the large quantities in the materials flow, a large diversity of materials, and the large number of operators, which makes transparency and control more difficult.

The possibilities are limited with regard to the effect of information campaigns on individual behavior. Of general importance in this respect is to simplify and transparently present the ecological effects of beverage packaging collection and recycling systems to consumers. The pertaining legal directives must be designed such that they are understandable, binding, and clear to the stakeholders and comprehensible for consumers. Exceptions from the deposit duty such as for juices, that are difficult for consumers to understand, minimize consumer acceptance.

Table 1: Assessment of the systems existing in Germany for collecting and recycling beverage packaging

	Reuse deposit system	Single-use mandatory deposit system	Dual system
Ecological			
Resource consumption	●	◕	◑
Climate change	●	◕	◕
Other impact categories from life cycle assessments	●	◕	◕
Reuse quota	●	◑	◔
Collection rate	●	●	◑
Recovery rate (recycling + energy recovery)	●	●	◕
Disposal (incineration and land filling)	●	●	◕
Ecological packaging (re-)design	●	◑	◑
Littering	●	●	◔

Economic			
System costs	◕	◑	◑
System revenues (materials revenues and unredeemed deposits from the system)	◕	●	◕
Distribution of the costs between government and private business (positive influence means less costs for the government)	●	●	●
Implications for small, regional beverage producers	●	Single-use beverage containers in general (regardless of the return system): ◔	
Implications for large, international beverage producers	◔	Single-use beverage containers in general (regardless of the return system): ●	
Implications regarding international competition	◑	◑	◕
Start-up difficulties (positive influence means fewer start-up difficulties)	◕	◑	◔
Stability of the system	◕	◕	◔

Social			
Product diversity			
Product price			
Employment			
System abuse			
Extended producer responsibility and consumer behavior			
Littering			

C 3 Summarized assessment of the systems

Under realistic assumptions (above all in terms of distribution distances and circulation rates), reuse systems offer ecological advantages compared to single-use beverage container systems. In particular, in regional – and under certain circumstances in intraregional – markets, they offer small and medium-sized enterprises an opportunity to conduct business cost-efficiently and in an ecologically beneficial manner. In addition, they have a positive impact on social factors such as product diversity and employment and implement the principle of enhanced product responsibility (financial responsibility, material responsibility and responsibility for the functioning of the overall system). For these reasons, promoting efficiently functioning reuse systems is reasonable for an economic system geared towards sustainability.

In contrast to the reuse systems, single-use beverage systems are more flexible and optimized for transport and can therefore adjust more swiftly to changes in the market or consumer habits.[3] In addition, single-use beverage containers facilitate international trade and concentration processes concerning distribution structures. By the same token, they provide large beverage producers and

[3] Single-use beverage containers are, for example, often offered in smaller container sizes than reusable beverage containers (e.g., 6 x 1.5 liter mineral water in shrink wrap, without a beverage crate), which means a convenience benefit for consumers due to the lower weight. However, it must be noted that reuse systems have also already brought about such convenience aspects through the development and marketing of smaller container sizes (e.g., multipacks and smaller, handier beverage crates).

the retail trade with cost-saving potentials in the event of large filling quantities. In order to partially compensate for the ecological disadvantage of single-use beverage containers, it must be ensured, on the one hand, that packaging is collected separately and is subsequently recycled at the highest possible quality. On the other, the ecological impact should be reflected by internalizing the ecological costs in the market.

The reuse rate and the recycling rate are thus core performance and control measures. In Germany, the mandatory single-use deposit system is proving to be a rational measure for supporting the political goals formulated in the Packaging Ordinance (promotion of ecologically advantageous beverage packaging, high return rates, high recycling rates, reduced littering), and hence in practice as a reasonable advancement and alternative to the dual systems for beverage packaging. Considered in absolute terms, the costs of both systems are about equally high, but the approximately 3-times higher recycling rate and better quality of recycling in the mandatory single-use deposit system results in a significantly more effective system when considered relatively.

C 4 Scenarios analysis

Five scenarios with various political instruments and the respective influence on the impact categories, in particular in relation to the reuse rate and recycling rate, were investigated in this study. Recommendations for the further design and optimization of systems for collecting and recycling beverage packaging in Germany were derived from the findings gained from the scenarios analysis (see section C. 4).

C 4.1 "Status quo" scenario – no supplementary activities of any kind

With respect to advancing the goals of stabilizing and increasing the reuse rate and increasing the qualitative and quantitative recovery and recycling rates of single-use beverage containers, the "status quo" scenario is assessed as meeting its goal only to a limited extent. Based on the assumptions made, the following developments are plausible:

Table 2: Impact of the "status quo" scenario on ecological, economic and social impact categories

Ecological impact categories	• It must be expected that the reuse rate will decline further and that stabilization of the reuse rate – except in the beer segment – cannot be achieved. • Collection and recovery rates for beverage packaging remain constant at the current level. • No incentives for innovation are provided with regard to ecological packaging design.
Economic impact categories	• As a result of the long-term decline in the reuse rate, smaller-scale beverage producers who use reusable beverage containers as well as beverage wholesalers and retailers will come under further pressure and successively disappear from the market.

	• Due to the stability of the general conditions, neither costs are incurred nor is potential income generated for further political measures. • A direct influence on the markets for secondary materials is not to be expected.
Social impact categories	• Over the longer term, there may be a decline in the number of small beverage producers on the market and, consequently, a decline in product diversity. • An increase in littering is not to be expected. • A decline in the number of employees directly related to the reusable packaging system is to be expected.

C 4.2 "Publicity campaign" scenario – change consumer behavior

Against the backdrop of the goals formulated in the Packaging Ordinance, publicity campaigns could supplement the existing system. To this end, individual weak points and information deficits must be addressed.

Given appropriate implementation, publicity campaigns can be expected to make a contribution to stabilizing the reuse rate. However, publicity campaigns can only support implementation of the system, but cannot be used as a replacement for rational general conditions. Based on the assumptions made, the following developments are possible:

Table 3: Impact of the "Publicity campaigns" scenario on ecological, economic and social impact categories

Ecological impact categories	• It is to be expected that the reuse rate can be moderately increased through targeted publicity campaigns. For example, by eliminating the existing information deficit regarding "differences between mandatory single-use deposit and reusable deposit systems", consumer preferences can be shifted from deposit single-use beverage containers to reusable beverage containers. • Targeted feedback is expected to improve return behavior concerning non-deposit beverage packaging.
Economic impact categories	• Publicity campaigns entail significant costs. For example, prior to the introduction of the mandatory deposit, the Ministry of Environment (BMU) spent just under € 600,000 for advertisements on information about the introduction of the single-use mandatory deposit system. The dual systems also required significant outlays for publicity work. The responsibilities, and as a component thereof, the issue of cost absorption must be clarified in advance. Initially, the government comes primarily into question as the agent for publicity campaigns. However, beverage

	packaging producers and beverage producers could also participate in financing in connection with extended producer responsibility. • With publicity campaigns, the cost-benefit ratio must be weighed in advance. • Given the generally high environmental awareness, the more expensive path of monetary incentives (for example through vouchers) must normally be assessed as inefficient. Targeted feedback on behavior can attain similar effects.
Social impact categories	• A reduction in littering caused by non-deposit beverage packaging due to publicity campaigns appears possible, but only to a moderate extent due to the general irrationality of the underlying behavior.

C 4.3 "Incentive levy" scenario – introduction of an additional incentive levy

With regard to the desired increase and stabilization of the reuse rate, the introduction of an incentive levy appears to be a very appropriate instrument for reaching the goal. In the "incentive levy" scenario, it is to be expected over the short and medium-term that reusable beverage containers or other types of beverage packaging considered ecologically beneficial will gain major significance and that the current decline here can be permanently averted. Ecologically disadvantageous single-use beverage containers will be pushed back to beverage segments where consumers take price surcharges in their stride.

Table 4: Impact of the "incentive levy" scenario on ecological, economic and social impact categories

Ecological impact categories	• At appropriate levy level, the quota of reusable bottles and ecologically advantageous single-use beverage containers (RBeaSBC quota) can be raised to the desired level of 80%. • Incentives will be created for innovations in the field of ecologically beneficial beverage packaging (in particular reusable beverage containers). • It is to be expected that the waste volume from beverage packaging can be reduced due to indirect effects (in particular, an increase in the proportion of reusable containers). • It is also to be expected that the recovery/recycling rates will increase slightly due to indirect effects (in particular, due to an increase in the proportion of reusable containers).

Economic impact categories	• The incentive levy affects consumers depending on their purchasing behavior. Large sections of the population generally consider a levy-based solution to be reasonable. Supporting information campaigns are a means to promote acceptance. In this respect, the reasonable use of the generated revenues must be clearly communicated. • The new system entails additional administrative costs concerning the required data collection for structuring the levy as well as steering activities governing the control and further development of the levy. To a large extent, these depend on the specific structure and may be reduced, for example, by limiting the levy to ecologically disadvantageous types of beverage packaging, for example. • The amount of the levy must be regularly examined critically and swiftly adjusted if the goals are not being met or in the event of excess steering (possibly even a prohibitive impact). • It is expected that market participants will be influenced to support the producers of ecologically beneficial beverage packaging. Beverage producers, who rely on ecologically disadvantageous beverage packaging, will be urged to take action and change production structures toward ecological benefit. • Over the medium term, market participants are expected to respond to the new general conditions with innovations. Improved offers in the field of ecologically beneficial beverage packaging can shift consumer preferences in this area. The resulting reduction in the volume of ecologically disadvantageous beverage packaging can result in a reduction of the levy revenues initially generated.
Social impact categories	• Supporting smaller beverage producers can bring about a medium and long-term stabilization of or an increase in product diversity. • It is to be expected that beverage packaging littering will decline slightly due to indirect effects (in particular, an increase in the proportion of reusable containers). • An increase in employment in the industries linked with reusable containers is to be assumed. At the same time, a decline in employment in industries directly related to single-use systems must be assumed. Because single-use systems are less labor intensive when compared to reusable container systems, overall positive effects on employment can be assumed.

C 4.4 "License model" scenario – direct steering of beverage quantities

Looking at the theoretically ideal case, the introduction of licenses appears to be an option for increasing and stabilizing the reuse rate. However, experience with existing license systems has shown that practical implementation, and, consequently, attainment of the ecological goals, is associated with considerable difficulties. The expense for controlling and avoiding system abuse, in particular, must be estimated as high. In addition, an arrangement conforming to EU and national law entails further challenges.

With regard to littering, as with the charge-based solutions, indirect positive effects are possible. An increase in the recovery/recycling rates of single-use beverage containers is not to be expected from the basic model; however, a license model that is coupled with recovery and/or recycling rates could theoretically also be promoted.

Given that such a license system could actually be structured in a practical manner despite the aforementioned challenges, it is to be expected that reusable beverage containers and other types of ecologically beneficial types of beverage packaging may significantly gain importance and that the current decline can be permanently corrected. Transition periods must be fixed in such a way that this effect is not impaired. In general, however, the benefit of a license system is restricted in that currently incalculable administrative costs may arise, which reduce the presented theoretical benefits.

Table 5: Impact of the "license system" scenario on ecological, economic and social impact categories

Ecological impact categories	• Theoretically, given an appropriate restriction on the quantity of licenses issued, the quota for reusable and ecologically beneficial beverage packaging could be increased to the desired 80% level. • Theoretically, incentives for innovations in ecologically beneficial packaging could be provided (through potential profits when selling licenses).
Economic impact categories	• Price increases concerning types of beverage packaging that are impacted by license trading may lead to acceptance problems. A supporting information campaign can contribute to promoting acceptance. • Revenues to the government arise only in the case of auctioning licenses. On the other hand, *grandfathering* minimizes the burdens on obligated beverage producers. In the event of an auction, rationally and clearly communicating the use of the generated revenues is very important with regard to acceptance of the method. • To ensure its functioning, the system requires high to very high administrative costs for data collection and consistent enforcement (monitoring and control expense). Compared to the levy system, higher administrative costs are to be expected due to the complexity of the instrument in a license model. It must be noted here that enforcing the

	current Packaging Ordinance is already proving to be difficult. • Influences on the market participants are to be expected over the medium term. Beverage producers filling reusable beverage containers will be supported through the changed general conditions, while beverage producers who use ecologically disadvantageous beverage packaging will come under pressure. • Over the medium term, market participants are expected to respond to the new general conditions with innovations which, in turn, will lead to a decline in the initial license price.
Social impact categories	• Supporting smaller beverage producers over the medium term means that medium term stabilization of product diversity must be presumed. • It cannot be ruled out that the small quantities regulation will create a (difficult to control) grey area of beverage producers who are not required to pay the charge, or that creative efforts will be undertaken to circumvent the rule. This problem exists in the United Kingdom, for example. • It is to be expected that beverage packaging littering will decline slightly due to indirect effects (in particular, due to an increase in the proportion of reusable containers). • A long-term increase in employment in labor intensive industries that fill reusable beverage containers is to be assumed, while a comparatively lower decline in employment in industries primarily in the segment of single-use beverage containers must be assumed.

C 4.5 "Zero option" scenario – abandonment of the single-use mandatory deposit rules

With regard to the goals formulated in the Packaging Ordinance (i.e., prevention of packaging waste and environmental impact incurred through packaging waste, stabilization of the proportion of reusable beverage containers and ecologically beneficial single-use beverage containers as well as promoting quantitative and high-quality recycling), the "zero option" must be assessed as counterproductive.

In the "zero option" scenario, it is to be expected that over the medium to long-term, single-use beverage containers will almost completely replace reusable beverage containers, which would be accompanied by corresponding, increasing negative ecological effects. In addition, overall lower collection and recycling rates as well as deteriorated recycling quality for beverage packaging must be expected. In addition, an impact on both consumer behaviour, in particular national environmental awareness, as well as the employment situation is probable. Based on the assumptions made, the following developments are plausible:

Table 6: Impact of the "zero option" scenario on ecological, economic and social impact categories

Ecological impact categories	• It is to be expected that the reuse rate will drop sharply. • In addition, due to elimination of the deposit as an incentive for returning or collecting single-use beverage containers, the total quantity of single-use beverage containers that are collected separately (collection rate), and which could subsequently be fed into high-quality recycling and closed-loop recycling (recycling rate), would likely decline. • Littering with the - once again - no-deposit beverage packaging would be expected to the same extent as before the introduction of the mandatory deposit on beverage packaging (about 20% of total litter). • PET recyclate from PET single-use beverage containers would no longer be collected separately. A decline in the recovery quality of PET would likely be the result because, in practice, PET from the dual systems capture will not be fed into bottle-to-bottle recycling. • Eliminating the mandatory deposit already implemented may also trigger increased skepticism about the meaningfulness of waste separation, for example, which would negatively impact consumer involvement.
Economic impact categories	• It is to be expected that the market for PET recycling will come under pressure and will lose volume because the number of market participants will also decline as a result of lower collection and recovery rates. • For smaller beverage producers, in particular, market participation could become difficult due to the further shift from reusable to single-use beverage containers. Given extensive expansion of single-use beverage containers across all beverage segments, the survival of smaller-scale beverage producers, who frequently operate in the multi-use business, appears to be at risk.
Social impact categories	• Given a decline in the number of smaller beverage producers participating in the market, a resultant decline in the often regional product diversity is to be presumed. • It is to be expected that beverage packaging littering will again increase massively. • A decline in employment in the industries directly related to the reusable packaging system must be assumed. By contrast, increased employment in the industries directly related to single-use systems is to be expected. However, as reuse filling is more labor intensive, it is expected that overall employment will rather decline.

C 5 Options for optimizing the collection and recycling schemes for beverage packaging (action plan)

Given complete implementation of the measures proposed below, an immediate stabilization and an increase in the reuse rate over the medium term, as well as positive effects on collection and recycling rates are to be expected.

The deficient and insufficiently consistent enforcement of the current Packaging Ordinance is being discussed as a weakness in the ordinance's implementation. When implementing the actions proposed here, setting clear penalties and respective enforcement are important for success. The previously described actions for increasing system transparency as well as for creating a clear classification system and improving data quality can support effective enforcement.

It is reasonable to implement the specified measures successively; this means initially taking steps to simplify the system, create system transparency and to improve the available data. These steps are the necessary basis for successfully introducing an incentive levy. Without introducing an incentive levy and rational use of the revenues generated from this, it currently appears hardly possible that substantial and long-lasting improvements will be attained with respect to the goals formulated in the Packaging Ordinance.

Table 7: Action plan for optimizing the collection and recycling schemes for beverage packaging and for attaining the goals of the Packaging Ordinance

	Benefits	Affected parties/addressees (+) positive effects on (-) negative effects on
Comprehensibility and transparency of the system for consumers		
• Clear labeling of beverage packaging	Improvement in system transparency; increase in the RBeaSBC quota	(+) Consumers (+) RBeaSBC beverage producers (-) Ecol. disadvantageous single-use beverage producers
• Inclusion of additional beverage segments in mandatory deposit system	Improvement in system transparency; increase in RBeaSBC quota; increase in collection and recycling rates	(+) Consumers (+) RBeaSBC beverage producers (+) Recycling centers (-) Beverage producers using single use containers (-) Dual system operators
• Information campaigns on the ecological attributes of types of beverage packaging	Improvement in consumers' level of information; increase in RBeaSBC quota	(+) Consumers
Data material and additional formalization		
• Reporting requirements respecting packaging quantities brought onto the market	Improvement in the level of information of governmental decision-makers & market operators on packaging quantities	(+) Governmental decision-makers (-) Beverage bottlers
• Reassessment of all relevant packaging forms	Improvement in the level of information of governmental decision-makers on the ecological effects from packaging types	(+) Governmental decision-makers (+) Innovative leaders in packaging design
• Supplement ecological measurement parameters by economic and social sustainability parameters	Structured consideration of economic and social implications	(+) Innovation leaders in packaging design
• Standard procedures for reassessment in the event of substantial product improvements	Improvement in the system's adaptability to innovations	(+) Innovative leaders in packaging design
• Accreditation of reuse systems	Requirement for actions to promote reuse systems; control individual containers	(+) Reusable producers using reusable containers upon attaining accreditation
Price signals for consumers		
• incentive levy for ecologically disadvantageous types of beverage packaging; levied directly at the retailer and separate disclosure on the purchase receipt	Amount of ecologically disadvantageous single-use beverage containers can be flexibly controlled via the fee level; generation of funds for actions to promote RBeaSBC	(+) RBeaSBC beverage producers (+) Consumers with appropriate purchasing behavior (-) Retail segments with high proportion of single-use containers (in particular hard discount)
Use of funds from incentive levy		
• Costs of the incentive levy system	Avoidance of costs in excess of the levy	(+) Consumers (+) Beverage bottlers (+) Retailers
• Costs for improving the data basis and additional formalization	Avoidance of costs in excess of the levy	(+) Consumers (+) Beverage bottlers (+) Retailers
• Direct benefit from RBeaSBC	Set a direct incentive for behavior; refund part of the income to	(+) RBeaSBC beverage producers (+/-) Consumers depending on

	Benefits	Affected parties/addressees (+) positive effects on (-) negative effects on
	consumers; increase the RBeaSBC quota	the purchasing behavior
• Promotion of a uniform take back system for reusables	Use of levy revenues to improve available options for action; sorting, networking; increase RBeaSBC quota	(+) RBeaSBC beverage producers (+) Consumers with appropriate purchasing behavior (+) RBeaSBC retailers
• Promotion of independent research and development	Promotion of innovations	(+) Innovative leaders in packaging design (+) Consumers

D Guideline on the implementation of collection and recycling systems for beverage packaging

The guideline on the implementation of collection and recycling systems for beverage packaging provides political decision-makers with assistance in the implementation of systems for taking back and recycling beverage packaging – both during the introduction of new systems as well as for the optimization of existing systems. In addition, the guideline is a decision aid for business enterprises which, as part of their responsibility as producers, aim at designing their products more sustainably.

Under the general conditions examined, the findings of the present study have shown that, in most of the impact categories examined, the deposit systems (both for reusable as well as for single-use beverage containers) show benefits when compared to the green dot systems. Consequently, in the guideline, the focus is on the implementation of deposit systems for reusable as well as for single-use beverage packaging. Since many countries have already implemented green dot systems for packaging waste to various extents, the introduction of a deposit system for single-use beverage containers in addition to an existing green dot system has been taken into account.

From the viewpoint of political decision-makers, a differentiation must be made between a decision-making phase with the steps of goal definition and analysis of the general conditions, and a later implementation phase.

D 1 Decision-making phase: goal definition

In many countries, ecological goals are the primary incentive for introducing systems for collecting and recycling beverage packaging – and usually, additional economic and social goals generally increase acceptance of the measures.

Ecological goals that are frequently aimed for in the introduction of systems for the collection and recycling of beverage packaging are, for example, implementation of the waste hierarchy, increased resources efficiency, reduced greenhouse gas emissions, less littering with beverage packaging, improved collection (higher collection rate) of beverage packaging and improved recycling of packaging waste. Under the general conditions examined, the findings of the study indicate - with respect to practically all ecological indicators - a three-phase effect: generally, reuse packaging best meets ecological goals. Single-use beverage containers bearing a deposit also have a significant positive impact on ecological objectives. From an ecological aspect, the impact of green dot systems is more limited.

Frequently aimed for **economic goals** include, for example, the creation of cost-efficient systems, relieving the financial burden on governmental bodies, minimizing start-up difficulties, and high systems stability. Reducing costs, for example in the form of higher systems revenues, is usually not a primary target in the introduction of systems for the collection and recycling of beverage packaging, but it helps to achieve the defined goals as cost-efficiently as possible. When considering the cost efficiency of a system, the results achieved through the system must be taken into account in addition to the total system costs and revenues. In this respect, mandatory deposit systems and green dot systems in Germany operate at approximately equally high costs, but achieve different results (costs per result unit): Therefore, cost efficiency in a mandatory deposit system is greater than in green dot systems. Reuse systems relieve the financial burden on governmental bodies the most, followed by mandatory deposit systems, followed by full-cost green dot systems. Partial-cost green dot systems are least efficient. Deposit systems have lower start-up difficulties and higher system stability than green dot systems.

Social goals frequently aimed for are, for example, the creation of workplaces, the implementation of extended product responsibility, the avoidance of system misuse, and less littering with beverage packaging. All the systems examined contribute to higher employment, especially reuse systems. In the avoidance of system misuse, the implementation of extended product responsibility and reducing littering, reuse systems contribute most to achieving goals; they are followed by mandatory deposit systems and, in last place, green dot systems.

D 2 Decision-making phase: general conditions

In this study it was not possible to analyze all possible general conditions and combinations of general conditions. Therefore, as an example, the impact of certain general conditions respecting the introduction of a reuse system, which was defined as the goal, was discussed. This procedure can, however, also be applied to mandatory single-use deposit systems and green dot systems.

The general conditions that are necessary for introducing a reuse system were examined, specifically which conditions limit the benefit of reuse systems and which corresponding measures can be taken. In the guideline, a total of four general conditions were examined; transport distances, production and distribution structures, recycling markets and consumer needs.

D 2.1 Transport distances

Average transport distances have an adverse impact on the ecological efficiency of all collection and recycling systems for beverage packaging. Basically, long transport distances cause a higher environmental impact. The transport of reusable beverage containers over long distances usually has a stronger negative effect than is the case with single-use containers. For this reason, if very long transport distances are concerned, the basic ecological and economic benefits of reuse systems shift in the direction of single-use systems.

If most of the (one-way) **transport distances** are **shorter than 300km**, then general conditions are advantageous for reuse systems. In this case, the introduction of new or the strengthening of existing reuse systems for beverage packaging should be promoted if the reuse system is the one preferred in the goal definition.

Nationwide distribution with average (one-way) **transport distances of 300km to 600km** need not necessarily have a limiting effect on the ecological efficiency of reuse systems. In the case of standardized pool bottles, in particular, reuse systems can continue to be operated efficiently from both an ecological and an economic viewpoint.

In the event of market-relevant proportions of single-use beverage packaging, a mandatory deposit system should additionally be introduced in the two afore-described distance scenarios. It will give the purchasers of single-use beverage containers an incentive to return the containers. At the same time, an incentive to buy non-refundable single-use packaging which need not be returned to retailers (which is required for reuse systems) would be avoided.

If mainly (or to a large extent) centralized distribution with average **long transport distances (i.e., more than 600km)** is concerned, deposit systems for single-use beverage containers are probably the system preferred in the goal definition for collecting and recycling beverage packaging.

The mandatory deposit systems should be planned in a transparent and consumer-oriented manner, and should enable comprehensive and uniform implementation of the systems at national level. In the process, adequate transition periods, clear labeling, a clearing system for the administration (paying and redeeming) of deposit amounts, and, if appropriate, exemptions for small enterprises as well as possibilities for smooth importing and exporting of products are to be taken into account.

D 2.2 Production and distribution structures

Local production and distribution structures are positive general conditions for reusable beverage containers. Accordingly, under these general conditions, systems for reusable beverage containers should be introduced and supporting measures aimed at increasing and stabilizing the proportion of reusable beverage containers over the medium to longer term should be taken.

In the event of market-relevant proportions of single-use beverage packaging, a mandatory deposit system should additionally be introduced because increasing the proportion of reusable beverage containers is an on-going process. The introduction of a deposit system for single-use beverage packaging can create a balance in this respect since the fact that single-use beverage containers do not carry a deposit can no longer be used as a sales argument.

In **central production and distribution structures** with a low number of beverage manufacturers and filling locations, the proportion of single-use beverage containers is usually high or very high. In this constellation, a mandatory deposit system is probably the preferred solution. It would enable very high return rates (collection rates), and recycling rates and also a very high proportion of high-quality closed-loop or bottle-to-bottle recycling.

D 2.3 Recycling markets

The existing recycling markets and also the politically targeted expansion of recycling markets in combination with the collection and recycling rates striven for, represent significant general conditions.

In places where no recycling infrastructure exists - or where it exists only to a limited extent - take-back systems for beverage packaging can provide a first, manageable and effective step towards creating high-quality material flows. Important success factors in this respect include achieving higher return rates (collection rates) as quickly as possible as well as ensuring high and stable quality of the collected packaging material. For beverage packaging, this can best be achieved by introducing a deposit system for single-use beverage containers. Accordingly, such a system should be introduced if recycling capacities for closed-loop recycling are to be established. Due to the financial incentive to return packaging, deposit systems for single-use beverage containers are also effective (i.e., generating high return rates) in places where there is an otherwise low awareness of the negative environmental impact of packaging waste.

In countries where, to date, no system exists for the household collection of packaging and/or other waste materials, green dot systems can generate large quantities of packaging (not only beverage packaging) which can serve as input for the recycling market. However, this packaging tends to be suitable for open loop recycling. In order to guarantee high quality recycling, the focus should be on high quality both with regard to collection (e.g., minimizing wrong disposal of items, maximizing return rates, pre-sorting to the maximum extent possible, etc.), as well as recycling (e.g., obligatory minimum recycling rates and minimum quality criteria for recycling).

In **reuse deposit systems** the respective reusable beverage containers are taken back at POS as mono-material fractions (no wrong disposal of items, residues, etc.). In the retail trade, reusable beverage containers are returned to beverage producers presorted (according to form and color) and as a mono-fraction (glass bottles separately and PET bottles separately). Beverage producers usually sort out the bottles which, due to wear and tear, cannot be refilled (ca. 1-4% in Germany). The reusable beverage containers sorted out are mono-material fractions – not only according to the packaging materials glass and PET, but also usually according to color. Accordingly, they undergo high-grade recycling (closed loop). The lack of a (or very little) recycling structure has no direct, negative impact on reuse systems as the focus is on reuse, and there are only minor reject volumes.

In **deposit systems for single-use beverage containers**, the respective packaging is taken back as mono-fractions at POS - as in the case of reuse systems (no wrong disposal of items, no residues etc.). In the event of automated return (in reverse vending machines), the beverage packaging taken back is mainly compacted on site and sorted according to the respective material fraction (PET clear, PET colored, glass and metal). In the event of manual take-back, the respective single-use beverage containers (e.g. PET non-returnable bottles, aluminum drinks containers, beverage tins and non-returnable glass bottles) are initially collected together without being compacted and are only sorted within the scope of automatic subsequent sorting according to the respective material fractions (PET clear, PET colored, glass, aluminum, tin). Both in the automated and manual take-back of single-use beverage packaging bearing a deposit, mono-fraction materials are generated which are then fed entirely into a respective high-quality recycling system.

The quality of packaging materials collected in **green dot systems** is usually worse than in deposit systems mainly as a result of wrong disposal of items (e.g. foodstuff waste, paint residues, etc.) and residues. In green dot systems, single-use beverage containers can be collected either in curbside collection systems (pick-up of packaging material directly at households) or in bring systems (consumers take separately collected packaging to containers specially set up for this purpose or to recycling yards). In curbside collection systems, especially, various types of beverage packaging (e.g. drinks cartons, PET bottles and drinks tins) are often collected together and, additionally, also collected in a mixed collection with light packaging made of other plastics, metal, or other composite material. This packaging must then be subsequently sorted and this, with an increasing degree of impurity, requires more effort and cannot be completely realized (due to incorrect sorting and sorting residues, among other things).

D 2.4 Consumer needs

Under certain circumstances, consumers may judge the handling of single-use beverage containers to be easier than the handling of reusable beverage containers. This subjectively felt convenience advantage for products in single-use beverage containers compared to reusable beverage containers can partially, but not completely, be compensated for through a mandatory deposit system. In addition, other measures such as taking external costs into account in price fixing and the promotion of innovations in reuse systems are possible. Furthermore, greater value should be placed on innovative transport comfort and the easy return of reusable beverage containers.

D 3 Excursus: compatibility with EU law

In the European Union, the introduction of measures of environmental policy must take into account the regulations in the EU Treaty governing the free movement of goods and competition. In the Commission's Communication 2009/C 107/01 on the issue of beverage packaging, deposit systems and the free movement of goods, the European Commission provides the European member states with a current overview of the principles of EU law, and the law derived from same.

In practice, this means that member states may introduce mandatory deposit systems if a member state considers this to be necessary for environmental reasons.

European member states that wish to introduce a mandatory single-use deposit and return system must, however, observe certain requirements in order to ensure that a good compromise between environmental protection goals and the requirements of the internal market is found. These requirements mainly apply to the following aspects:

- Adequate transition periods
- The system concept must be fair, open and transparent

- Labeling
- Clearing system
- Exemptions for small enterprises
- Possibilities concerning the smooth import and export of products

D 4 Excursus: co-existence of mandatory deposit system and green dot system

To a varying extent, many countries have already implemented green dot systems for taking back and recycling beverage packaging. Experience has shown that many of these systems – relative to the amount of beverage packaging put onto the market – achieve neither particularly high proportions of returned empty packaging (collection rates) nor very high recycling rates, or high quality concerning the packaging materials collected. Therefore, with a view to improving the recycling of packaging in both qualitative and quantitative terms, some countries are considering also introducing deposit systems for single-use beverage packaging in addition to the existing green dot systems.

By some, the opinion has been communicated that the simultaneous operation of green dot systems and deposit systems is not expedient for meeting the ecological goals beverage packaging aims for, or that it is even harmful to the operation of green dot systems. The latter is based on the view that green dot systems can no longer be operated economically due to the withdrawal of beverage packaging which, as secondary material, is economically attractive, and that this may lead to an increase in the fees for the packaging remaining in the green dot systems or even in the breakdown of these systems.

Practical experience gained with parallel systems does not confirm these fears, however. A deposit system for single-use beverage packaging was introduced in Germany in 2003, for example, which is run parallel to the green dot system that has existed since 1991. It should be noted in this context that the German green dot system continues to exist in its original density of the collection structure eight years after introduction of the deposit system, although competition has intensified significantly in this segment as a result of the admission of further providers. Also, it should be noted that the license fees for packaging in the green dot system are currently significantly below those charged before the deposit system was introduced. The reduction in license fees is probably mainly due to the intense competition. However, a significant decline would not have been possible if costs had increased substantially. Accordingly, the German situation does not indicate that the introduction of a mandatory deposit system for beverage packaging has a direct negative impact on the general operation of green dot systems.

In principle, it can be noted that deposits systems and green dot systems for single-use beverage packaging are aimed at different segments. Green dot systems are primarily aimed at use in households. However, a significant amount of beverage packaging, in particular, is consumed away from home. A green dot system does not give consumers any financial incentive to collect this material separately. In a green dot system, when consumption takes place away from home, it can be assumed that beverage packaging will be almost entirely disposed of with mixed waste (e.g. from waste bins or from the municipal collection of litter) and is then mainly disposed of in waste incineration plants or landfills. In deposit systems, there is a financial incentive for consumers not to dispose of beverage packaging consumed away from home in waste bins or simply throw it away as litter but rather to keep it until they next visit a retailer and then return it there. Accordingly, a mandatory single-use deposit system is aimed much more clearly at the consumption of drinks away from home. Consequently, with a mandatory deposit system, beverage packaging that would never be collected in a green dot system is collected.

As a result, the proportion of empty packaging returned (collection rates) in deposit systems for single-use beverage containers is usually significantly higher than in green dot systems. In Germany, for example, 98.5% of the PET bottles bearing a deposit are collected in the deposit system and recycled, while only 25-31% of the PET bottles which do not bear a deposit are collected and subsequently recycled in the German green dot system. Accordingly, in the green dot system, the majority of the PET bottles that do not bear a deposit are not collected and recycled. This means that, to a large extent here, too, the mandatory deposit system is aimed at beverage packaging that is not collected and recycled within the scope of the green dot system.

With green dot systems and deposit systems there is relatively little overlapping relative to the collected beverage packaging: They are mainly aimed at different packaging and can therefore co-exist satisfactorily.

D 5 Implementation phase

Goal achievement is to be reviewed at regular intervals; action should be taken following the interim results. In the implementation of systems aimed at taking back and recycling beverage packaging, it is likely that - upon initial introduction – certain adaptation requirements occur, especially during initial implementation and in case of the lack of historical data.

D 5.1 Plan

The implementation of all systems aimed at taking back and recycling beverage packaging requires the development of a reliable, easily comprehensible legal basis. Greater acceptance of political measures can be achieved through the active involvement of stakeholders. Table 8 provides an overview of some important aspects which should be taken into account when structuring the legal fundamentals.

Table 8. Aspects to be taken into account in the development of legal fundamentals

Reuse system	Mandatory single-use deposit system	Green dot system
• Definition of the legal framework • Determination of target parameters • Involvement of operators (stakeholders)	• Definition of the legal framework • Determination of target parameters • Involvement of operators (stakeholders)	• Definition of the legal framework • Specification of target parameters (e.g., minimum collection rates, recycling rates, density of collection

Reuse system	Mandatory single-use deposit system	Green dot system
• Designation of persons responsible for the system and definition of responsibilities • Development of accompanying information campaigns • Clear role determination for all system participants • Consumer-friendly system design • Development of supporting accompanying promotion measures as required	• Planning the clearing process and designation of those responsible for the system • Development of supporting information campaigns • Clear definition of roles for all system participants and implementation taking the principle of extended product responsibility , costs and material (Recycling quality) into account • Consumer-friendly system design • Development of regulations governing system transparency (distribution of revenues, amount of packaging brought onto the market) • (In the EU:) Development of a structure without inadmissibly limiting the free movement of goods (see section D.3).	points) • Differentiated target parameters (standard use of net recycling rates, clear differentiation of recycling options, quality criteria for the various recycling options) • Involvement of operators (stakeholders) • Development of supporting information campaigns • Clear definition of roles for system participants • Implementation of the principle of extended product responsibility (full cost model) in the form of cost responsibility and materials responsibility (recycling quality) • Consumer-friendly system design

D 5.2 Do

The consumer, as the “supplier” of empty beverage packaging, plays a central role in all systems aimed at taking back and recycling beverage containers. The systems must therefore be designed in a consumer-friendly manner in order to achieve high return rates (collection rates). Moreover, the system design must enable practical handling by the system operators, must be transparent, and should permit continuous control by the law enforcement agencies. Table 9 provides an overview of selected aspects that should be taken into account on the do-phase.

Table 9. Aspects to be taken into account in the do-phase

Reuse system	Mandatory single-use deposit system	Green dot system
• Easy accreditation of reuse systems in order to ensure	• Provision of adequate and convenient possibilities to	• Provision of adequate and convenient

Reuse system	Mandatory single-use deposit system	Green dot system
minimum quality standards • Development of more consumer-friendly and optimized beverage packaging • Provision of sufficient and easy return options for the consumers • Clear labeling of reuse beverage packaging in order to increase transparency for the consumers	return packaging to consumers • Clear identification of single-use beverage containers bearing a deposit • Ensuring the possibility for importers and minimum quantity importers to participate without setting up trade barriers • Establishing a reliable clearing system which is not susceptible to fraud	possibilities to return packaging to consumers • Implementation of a comprehensive control system • Ensure high-quality recycling • Ensure the necessary purity of the collected materials

D 5.3 Check

The legal regulations and the degree of implementation of the systems for taking back and recycling beverage packaging must be checked and examined regularly with regard to the goals to be achieved. These controls should be carried out on the basis of previously determined control indicators.

Furthermore, undesirable developments and indications of misuse must be analyzed. When solution approaches are being developed, both the system operators concerned as well as environmental- and consumer protection associations (NGOs) should be involved in order to comply with the aim of transparency.

D 5.4 Act

If goals are not achieved, the legal regulations should be supplemented on the basis of knowledge gained during the check phase, and/or additional steering mechanisms should be implemented. In Table 10, some examples regarding adaptations and measures in deposit systems are listed that, depending on which goal has not been achieved, may come into question.

Table 10: Examples of required system adaptations in the act-phase

Adaptation / measure	Goal
Altering or putting labeling into precise terms	• Increase transparency for consumers • Simplified return in retail trade • Reducing the susceptibility to fraud through the introduction of further security labeling (e.g. by means of security color)
Clearly defined requirements concerning possibilities to return packaging (e. g., definition of a	• Concentration and improvement of possibilities for consumers to return packaging • Increased proportion of return rates (collection rates)

Adaptation / measure	Goal
minimum number or exact description of return possibilities)	
Extension of the scope of the system (e.g., for individual types of packaging and beverage segments)	• Increase the entire volume of collected beverage packaging • Adaptation to market developments
Adaptation or differentiation of the amount of the deposit	• In principle, increasing the amount of the deposit leads to higher return rates (collection rates) • Differentiated deposit amounts for various types of packaging (according to the environmental impact) can have a steering effect towards more ecologically beneficial beverage packaging
Introduction of additional financial steering instruments, e.g., taxes or levies on ecologically disadvantageous beverage packaging	• Increase in the proportion of ecologically beneficial beverage packaging • Promotion of ecologically beneficial beverage packaging material

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Abbreviations Table

Alct.	Allocation
BCME	Beverage Can Makers Europe
BMELV	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz / Federal Ministry of Food, Agriculture and Consumer Protection
BMU	Bundesministerium für Umwelt, Naturschutz und Reak-torsicherheit / Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BUWAL	für Umwelt, Wald und Landschaft (Schweiz) Department of the Environment, Forestry and Agriculture (Switzer-land)
BWST	Beverage wholesale trade
CO_2	Carbon dioxide
CRI	Container Recycling Institute
CSD	Carbonated Soft Drink
CVUA	Chemisches und Veterinäruntersuchungsamt, Stuttgart
DIN	Deutsches Institut für Normung /German Institute for Standardisation
DKK	Danish krone
DPG	Deutsche Pfandsystem GmbH
DSD	Duales System Deutschland GmbH
DUH	Deutsche Umwelthilfe
EAN	European Article Number
EEB	European Environmental Bureau
EU	European Union
EU ETS	European Trading System for Greenhouse Gas Emissions
FKN	Fachverband Kartonverpackungen für flüssige Nah-rungsmittel e. V.
FRT	Food retail trade
FTE	Full-Time Equivalents
FillV.	Filling volume
GDB	Genossenschaft Deutscher Brunnen
GRRN	Grassroots Recycling Network
GVM	Gesellschaft für Verpackungsmarktforschung mbH
HDPE	High-density polyethylene
IFEU	Institut für Entsorgung und Umwelttechnik gGmbH
IK	Industrievereinigung Kunststoffverpackungen e. V.
JNSD-Segment	Juices, nectars and still drinks segment); segment desig-nation in the data survey of the Canadean market re-search institute
km	Kilometre
LC	large companies
LDPE	Low-density polyethylene
LOHAS	Lifestyle of health and sustainability
LWP	Light weight packaging

MövE	Mehrweggetränkeverpackungen und ökologisch vorteil-hafte Einweggetränkeverpackungen / Refillable beverage packaging and ecologically advantageous one-way pack-aging
OECD	Organisation for Economic Co-operation and Develop-ment
OSD	Other soft drinks; segment designation in the data survey of the Canadean market research institute
PET	Polyethylenterephthalate (plastics)
PO_4	Phosphate
POS	Point of Sale
PP	Polypropylene
PRN	Packaging Waste Recovery Notes
RU	Reuse
RWTÜV	Rheinisch-Westfälischer Technischer Überwachungsver-ein e. V.
SIM	Stiftung Initiative Mehrweg
SME	Small-and medium sized enterprises
SO_2	Sulphur dioxide
OW	One-way
tkm	Tonnes kilometres
UBA	Umweltbundesamt / Federal Environment Agency
VerpackV	Verpackungsverordnung / Packaging Ordinance

Glossary

Clearing (of deposits)	Process that governs the deposit settlement between beverage producers and retailers. Clearing is necessary when deposit beverage containers are not returned to the shop where they were purchased.
Closed-loop-recycling/bottle-to-bottle-recycling	Recycling procedure where pieces of old glass or recyclates (in the event of PET) are used for the production of new bottles in a closed cycle.
Crate-based deposit one-way PET bottles	One-way beverage containers made of PET that are marketed in reusable crates. After being returned by consumers, empty PET one-way bottles are transported back to the beverage producers and are compacted there in order to be subsequently consigned to recycling as mono-fraction material.
Crate system	Denotes the sale and delivery of one-way and refillable bottles in beverage crates
Downcycling, aspect of open-loop-recycling	Downcycling describes the processing of packaging material for use in other, usually lower-quality products (e.g. recycling plastic bottles to manufacture roofing canvas or textiles).
Green Dot system (dual systems in Germany)	A disposal system for used sales packaging, independent of public disposal
Energy recovery	Through energy recovery, fossil fuels such as coal or oil are replaced with waste. The main purpose is not to dispose of waste but to generate energy. Clean air requirements must also be observed. [4]
Grandfathering	Cost-free allocation of emission rights
Handling	Handling in this context describes all operational processes arising within the scope of filling, transport and distribution of beverage packaging.
Hard discounter	Supermarkets characterised by a very low price level and a strongly limited range of fast-selling products. The focus is on own brands.
Individual bottle	Beverage bottle individually designed by a beverage producer (cf. standard bottle)
Island solution (for the return of deposit beverage containers)	Return systems for deposit one-way bottles where retailers prescribe that only one-way beverage containers sold in their shop can be returned to their shops. This results in a so-called island solution that exists in parallel to other existing deposit return systems. This involves additional efforts for consumers as the containers must be returned to different retail stores.

[4] Bayerisches Landesamt für Umwelt website, *Energetische Verwertung*.

Life-cycle assessment	Denotes a systematic analysis of the environmental impact of products during the entire life cycle. Materials- and energy flows of products are recorded to the extent possible from the usage phase through to disposal of the product, including the associated downstream- and upstream processes (e.g. production of raw materials and supplies) and are measured by means of defined impact categories.
Littering	Waste that is carelessly thrown away and left in public areas, in particular on streets, in squares and in parks
Open-loop-recycling	Processing of packaging material for use in other products (e.g. recycling beverage cans for other metal applications)
Pool system (refillable)	In a pool system, beverage producers share standard packaging so that, after use and return by the consumer, a refillable bottle (for example) that has been put into circulation by a beverage producer, can be refilled by any other beverage producer participating in the system.
Primary material	Substances required for the production of a beverage containers that do not arise from the recycling process and, consequently, do not qualify as secondary materials
Recyclate	Generic term for secondary material resulting from the recycling process concerning plastics that can be used to manufacture products.
Recycling	Recovery of materials and return of the processed (recycled) material into the production cycle.
Regranulate	A grainy raw material obtained from the recycling process; used, for example, for the production of PET bottles[5]
Secondary material / secondary raw material	Secondary materials are materials that are obtained from the recycling of waste and which serve as the basic material for new products.
Soft discounter	Compared to hard discounters, soft discounters' range of goods is more extensive by 2,000 to 2,500 articles, and they are sometimes supplemented by bakers and butchers. They focus on brand articles.
Standard bottles (refillable system)	Refillable bottles that are jointly used within a pool system by many beverage producers in Germany (e.g. standard 0.5 litre so-called NRW beer bottle)
Tray	Tray describes packaging that is usually made of corrugated cardboard and in which individual beverage containers are marketed. For example, beverage cans are frequently sold in trays.
Unredeemed deposits	Income from deposit beverage packaging that is not returned

[5] Hellerich et al., 2004, p.51

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A Introduction

“Waste accounts for 3 % of all greenhouse gas emissions worldwide.”

60 % of the savings potential concerning greenhouse gas emissions due to waste can be realised by recycling.

McKinsey, 2009, S. 111

About 81 million tonnes of packaging waste were generated in the European Union (EU) in 2006.

Ecologic and IEEP, 2009, p. 40 (Report for the European Commission)

Beverage packaging accounts for about 20 % of all packaging waste in the EU.[6]

European Commission, 2006, p. 8

Waste is a by-product of our society that has negative impacts on the environment. The figures quoted above point to the potential environmental damage that results from waste. Packaging is responsible for a large proportion of the entire waste volume generated in households (ca. 38 %[7]), which, in turn, consists to a significant extent of beverage containers.

Both natural and non-renewable resources are consumed within the life-cycle of a beverage container, and emissions are generated through the production, transport, and possible reuse, recovery and disposal of packaging waste. Protecting resources and minimising the ecological impact arising from production and consumption as well as from the disposal of products are therefore important components of an active approach towards sustainability.

Worldwide, there are great differences in the way packaging is reused, recycled or disposed of: In Europe, the landfill of packaging waste is declining, not least due to statutory requirements, whereas landfill continues to be practised to a great extent in other regions. Under ecological and also under economic aspects, the landfill of packaging waste is not a desirable option. Packaging not only uses a lot of space in landfills, the landfill of non-processed waste also causes harmful emissions and is therefore tolerated only for a transitional period in the EU. The biological degradability process of most packaging is very slow. Moreover, the manufacture of packaging requires the use of natural, non-renewable primary raw materials which are destroyed irretrievably in the event of landfill or

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[6] Calculation on the basis of waste volume, 2002.
[7] Calculation based on the following sources: Ecologic und IEEP, 2009, p.40 (81 million tonnes of packaging waste); Eurostat website, *Abfallaufkommen von Haushalten [sic!] bei Jahr und Abfallkategorie (*ca. 215 million tonnes of waste volume).

incineration. This, in turn, necessitates the renewed consumption of primary raw materials. The high quantity of packaging consumed contributes to the intensive utilisation of natural resources. Reuse (refilling) and recycling are means to minimise this resources consumption considerably and, in so doing, reduce the ecological impacts of packaging.

When considering the system as a whole, reuse (refilling) and recycling also have advantages from an economic aspect. The reuse (refilling) or recycling of materials (from which packaging is made) leads to a decline in production costs (due to lower resources consumption) and lower costs for eliminating environmental damage. At present, these aspects are not fully reflected in price calculations, however. This is due, on the one hand, to the long-term effects of environmental impacts and the pertaining costs. On the other hand, the reason here is also to be found in external factors that result in imperfect markets or market failures. Externalities such as clean air are public assets. They have no direct owner and are therefore not taken into account in price calculations. Over the long term, a rise in resources consumption is expected to result in a shortage of public assets and this may lead to costs for the national economy.

Historically, refillable beverage containers were used in the beverage packaging segment since mugs, and later on glass bottles, were too expensive to be disposed of after one-time use. Currently, this cost factor appears to be less relevant for market operators as is indicated by the rising proportion of one-way beverage containers. In addition, today, forms of beverage packaging play a greater role than they once did in the decision-making of some market operators in the supply chain. Nowadays, many market operators deliberately decide in favour of or against certain forms of beverage packaging.

In order to counteract rising resources consumption and growing waste quantities through packaging, statutory provisions aimed at promoting closed substance cycle management of packaging and packaging waste were and are issued not only in Germany. For the purposes of this study, closed substance cycle management relates to both the recycling of bottles and the recycling of packaging material.[8] In Germany, for example, beverage packaging collection and recycling systems for one-way beverage containers were prescribed, which put beverage producers and retailers/wholesalers under an obligation to apply closed substance cycle management with respect to packaging material. As far as refilling of bottles (closed loop use of bottles) is concerned, only target requirements have been legally prescribed in most cases to date as the distribution and return systems are already organised on a voluntary basis by the stakeholders involved.

A 1 Targets

The present study aims to provide an overview of the ecological, economic and social impacts of various beverage packaging collection and recycling systems - from filling through to take-back and refilling or recycling and disposal, respectively. The study is intended to provide stakeholders from the business community, politics and society with a basis for discussion with a comprehensive view of influencing factors.

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[8] The two types of closed substance cycles differ in qualitative terms. When related to bottles, the bottles are refilled (reused); when related to packaging material, the packaging material is consigned to recycling. Closed substance cycle management regarding bottles is to be found in the refillable system. The aspect of closed substance cycle management of packaging material, i.e., ensuring refilling (reuse) over the longer-term or repeated high-quality recycling is a particular focus of this study.

This approach results in the following procedures:

- Description of existing beverage packaging collection and recycling systems and the respective effects in selected impact categories
- Analysis of the interrelations between packaging systems and a selection of ecological, economic and social impact categories
- Establishing scenarios for a qualitative survey of various design and regulation options for beverage packaging collection and recycling systems and the respective impacts, using Germany as an example
- Developing recommendations for action aimed at optimising beverage packaging collection and recycling systems, including the respective legal fundamentals in Germany
- Developing general, cross-national recommendations for action aimed at optimising beverage packaging collection and recycling systems within the scope of a general implementation guideline

A 2 Relevant facts

A 2.1 One-way and refillable beverage packaging

Refillable beverage containers are used numerous times for the same purpose (filling of beverages) without undergoing any changes. They require respective logistics in order to again provide the beverage producer with bottles and crates for cleaning and refilling. Refillable bottles are generally made of glass or polyethylene terephthalate (PET).

One-way beverage containers, by contrast, are used by the producer only once for the filling of beverages and, after one-time use, are recycled, used for energy recovery or are disposed of. In order to increase the recycling rate of one-way beverage containers, either curbside collection systems for packaging (Green Dot systems) or deposit systems are generally implemented with respect to one-way beverage containers.

A 2.2 Packaging systems

In the present study, the term "packaging system” relates to the life-cycle of packaging from production of the packaging (made of raw materials or secondary materials), through to disposal or recovery. The system limits basically comply with those of the relevant life-cycle assessments, in particular the life-cycle assessments of the Federal Environment Agency [Umweltbundesamt (UBA)] [9]. This study assesses beverage packaging made of metal, glass, plastics or beverage carton. The scope of the survey is limited to the beverage segments: water, beer, juice, carbonated and non-carbonated non-alcoholic refreshments. Only the packaging itself is a subject of the study and not the product or its possible interaction with the respective packaging.[10] Milk is not assessed in this study as statutory regulations governing packaging systems frequently exclude milk, and also because it is difficult to

[9] In particular, the life-cycle assessments "*Ökobilanz für Getränkeverpackungen II – Hauptteil*“ from 2000 (Prognos et al., 2000) and "*Ökobilanz für Getränkeverpackungen II/Phase 2*“ from 2002 (Prognos et al., 2002).
[10] There are indications that the product quality of the respective beverage containers is impacted, but no reliable and valid data are available as yet. This aspect should be subjected to further analysis in subsequent studies.

make a clear distinction between milk as a beverage and milk as foodstuff. For the purpose of this study milk is regarded as a foodstuff and not primarily as a beverage.

A 2.3 Disposal options (recovery and disposal)

The term recovery includes both recycling and energy recovery. To the extent that the text below refers only to materials recycling, the term recycling is used in order to differentiate more clearly between energy and materials recycling With respect to recycling, a distinction is made between closed-loop recycling (or bottle-to-bottle recycling for beverage bottles) and open-loop recycling (or downcycling if clearly low-value products are produced from the recycled material), in order to emphasise the aspect of recycling quality from a sustainability viewpoint in the assessment. Open-loop recycling describes the processing of packaging material for use in other products (e.g., recycling of plastic bottles for the production of roofing canvas or textiles). Closed-loop recycling or bottle-to-bottle recycling, by contrast, relates to the processing of packaging in a manner that enables the remanufacture of similar packaging (e.g., glass containers serve to again produce glass containers). In such a case, the material requires a high level of closed substance cycle capacity (see Section A 2.4), meaning that the quality does not - or only to a minor extent -deteriorate due to repeated recycling (this applies to glass and metals). This is the only means to manufacture products which are of a sustained, homogeneous quality.

The term disposal always refers to the final disposal of packaging so that the material (in this case: beverage packaging) can no longer be utilised. Generally, the means of disposal include landfill or incineration in waste incineration plants.

A 2.4 Closed substance cycle capacity

In addition to the already described possibility of using materials as recycled secondary material for the manufacture of new products, the closed substance cycle capacity also relates to the possibility to refillable beverage packaging. A distinction must be made between these two aspects in qualitative terms, however. The refilling of beverage packaging represents a completely closed cycle. The recycling of packaging material consigns the secondary material to a repeated production process. In process terms, here, too, a closed cycle is concerned. However, these recycled materials can also be used for another product which, possibly, can no longer be recycled.

The closed substance cycle capacity requires material that virtually displays the same properties over several phases of use. Recycling capacity relative to closed substance cycle management means that materials can be recycled with very low or even no loss of material or quality. The more frequently a material can be recycled, the less material needs to be disposed of and the fewer primary raw materials are required. Materials that lose quality during the recycling process due to fibres or molecular chains becoming shorter or due to impurities - and which can thus be recycled only a few times before they are consigned to energy recovery or disposal - have a lower closed substance cycle capacity.

A 2.5 The "polluter pays principle" and extended product responsibility

In order to prevent market failure due to external factors, several laws were adopted, in particular with respect to environmental law. According to these laws, market prices should reflect the public environmental assets and thus permit optimised pricing. The basic principles of these laws include, among other things, the polluter pays principle and the principle of extended producer responsibility.

The polluter pays principle requires that those who cause or have the potential to cause environmental pollution must pay the cost of remedying the resulting damage or avoiding the occurrence of damage.[11] This requirement also relates to waste, which is always potentially harmful to the environment. In accordance with this principle, producers, in this case beverage producers, must bear the costs of the environmental damage caused by the respective packaging or the costs required to avoid the environmental damage, respectively. This also includes, for example, the cost required for reducing the waste volume[12], for refilling or for the recovery of packaging.

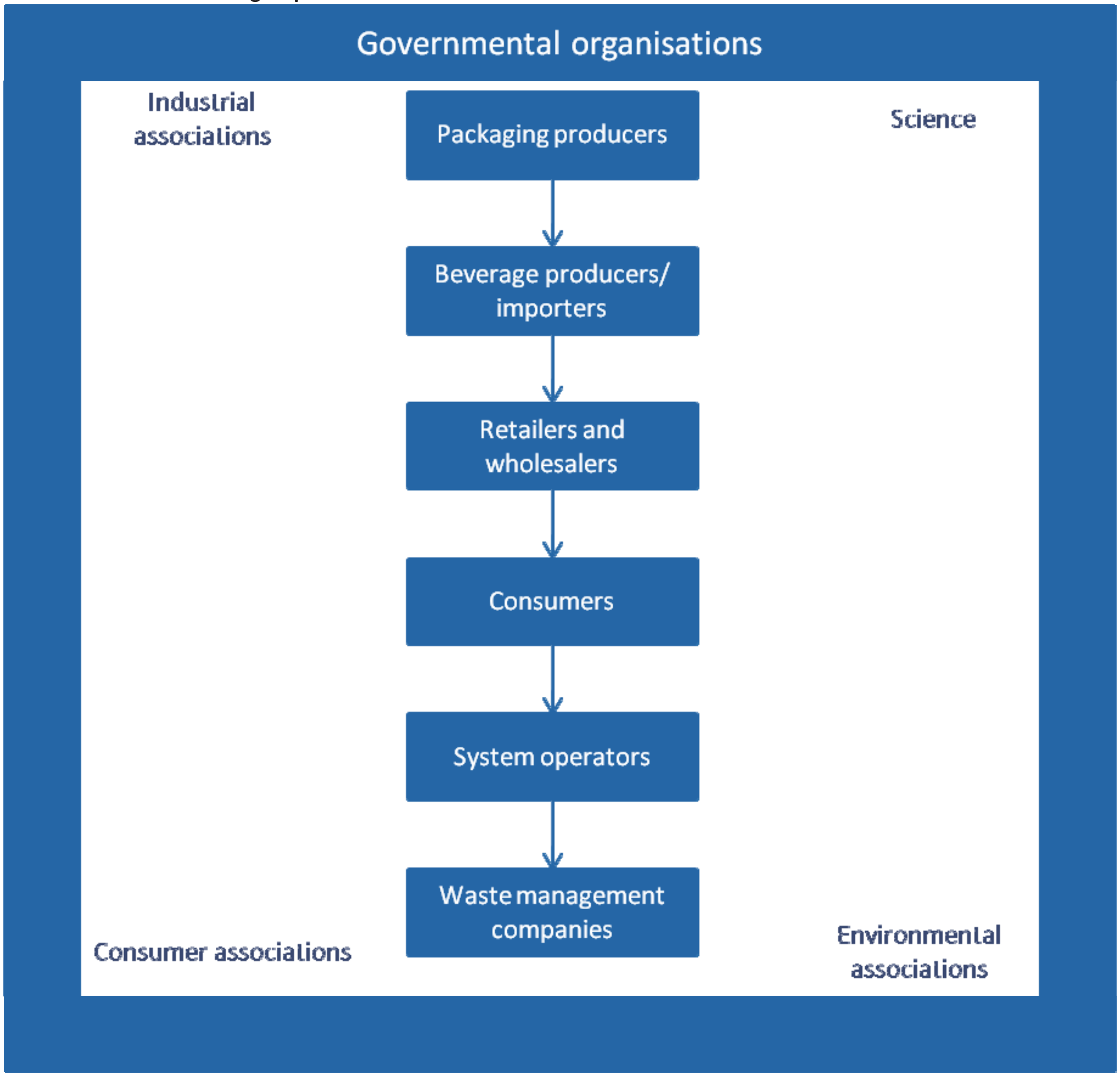
The Organisation for Economic Co-operation and Development (OECD) defines extended product responsibility as an approach where manufacturers' product responsibility extends beyond a products' life-cycle, i.e., it includes product recovery or disposal. Political measures aimed at extended product responsibility are effective in two ways: Firstly, the scope of the system for which producers bear responsibility is extended to include disposal or recovery. Consequently, producers, and not the general public or public authorities, respectively, are responsible for the financial costs of their activities. Secondly, they should create incentives for product manufacturers in order to encourage them to increase the eco-efficiency of their products.[13] If producers are not responsible for the take-back or recovery of packaging (primarily of one-way beverage containers) there is not enough incentive for them to reduce the packaging volume and foster the reuse (refilling) or recovery through ecologic packaging design.[14] In this respect it should be noted that the motivation for producers increases if redesign provides them with a direct benefit. The principle of extended product responsibility is not limited to financial responsibility, however; rather, it includes general responsibility for the material used. A system where, for example, a beverage producer is directly responsible for closed substance cycle management is to be preferred from this viewpoint.

A 2.6 Stakeholder groups

Within the scope of the preliminary survey and literature research, stakeholder groups that participate in one-way and refillable systems for beverage packaging (cf.Illustration 1) were identified. The system participants are split into direct participants (flow chart) and indirect participants (corners of the inner square

[11] Cf. Bell, S. and McGillivray, D., 2006, p. 266.
[12] For example, through investments in further developed processes, research and development expenditure or expenditure for the new development of refillable product packaging.
[13] Cf. OECD website, Extended Producer Responsibility.
[14] Cf. OECD, 2006, p. 4.

Illustration 1: Stakeholder groups



The roles and responsibilities of direct system participants are analysed within the scope of this study. Moreover, the role of the government is analysed more closely in each case as legislation has a major influence on the design of the systems. All other indirect stakeholder groups are analysed in more detail only to the extent that they exert a significant influence on the system.

An assessment of packaging systems principally requires that a distinction be made between packaging producers and beverage producers. Packaging producers manufacture packaging from the respective raw materials and beverage producers fill their products into the packaging. When a beverage is imported and the beverage producer's firm is located abroad, the regulations governing extended producer responsibility also apply to the importer.[15] The term ‘beverage producer’ therefore also includes importers. The group of waste management companies encompasses all system operators who participate in the process of waste disposal. i.e., recycling companies, recovery firms, other disposal companies, waste logistics companies (including municipal disposal firms), etc.

This results in the following main stakeholder groups:

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[15] Cf. OECD, 2006, p. 4.

- Packaging producers
- Beverage producers (manufacturers)
- Wholesale and retail trade
- Consumers
- System operators of beverage packaging take-back systems
- Waste management companies
- Governmental organisations

A 2.7 Legal background

The precaution and prevention principle is another important approach of environmental legislation. Many factors that are potentially harmful to the environment or the ecological impacts of these factors, which may involve long-term negative effects on society, are qualitatively known but it has not yet been possible to describe them in a scientific and comprehensive manner or provide clear proof of their existence. To the extent possible, the precaution and prevention principle therefore already applies before potential damage has occurred, i.e., the damage that will probably occur is to be avoided through these precaution measures. A significant reason for observing the precaution principle is that, once it has been proven without doubt, it is frequently too late to avert damage or it can only be averted through very high efforts.

Laws governing the prevention, recovery and disposal of packaging waste are based on the above-mentioned polluter pays principle and the principle of extended product responsibility, which puts the responsibility of product manufacturers into more precise terms. Generally, the laws require producers (in this case beverage producers) to take back packaging and to recover a certain portion of this packaging. This requirement leads to the implementation of the polluter pays principle through establishing Green Dot systems or the introduction of mandatory deposit systems for one-way beverage packaging by product manufacturers. Legislation in a growing number of states explicitly prescribes a mandatory deposit system for beverage packaging.

With the Packaging Ordinance, the EU sets the general framework for waste legislation in Germany. In accordance with the amending ordinance from the year 2008 (Ordinance 2008/98/EG of the European Parliament and the Council of 19 November 2008 concerning waste[16]) Article 4 defined the following priorities in the waste hierarchy:

1. Prevention
2. Preparation for reuse
3. Recycling
4. Other recovery, i.e. energetic recovery
5. Disposal

This sequence of priorities is binding for all EU member states, i.e., the prevention of waste is to be given priority over all other options in the organisation of waste management systems. The disposal of waste is deemed a last option. Any exemptions to this rule require substantiation. The German implementation is the Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal of 27 September 2004 [Kreislaufwirtschafts- und Abfallgesetz (Kreislaufwirtschafts- und Abfallgesetz vom 27. September 1994 (BGBl. I, S. 2705)], as last

[16] Cf. Ordinance 94/62/EG.

amended through Article 3 of the law dated 11 August 2009 (BGBl. I, S. 2723) amended, Krw-/AbfG). The Act for Promoting Closed Substance Cycle and Waste Management and Ensuring Environmentally Compatible Waste Disposal was in the process of being reworked at the time this study was prepared. The law, and also the first version of the Packaging Ordinance in the year 1991 (see below), already defined a waste hierarchy before corresponding EU legislation existed. While the amended Waste Framework Directive introduced a five-stage waste hierarchy and thus differentiated between recycling and energy recovery in a more realistic approach, the current Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal so far defines only three stages (prevention, recovery and disposal).

In Europe, Ordinance 94/62/EG governing packaging and packaging waste was issued by the European Parliament and the Council in 1994 (hereinafter: EU Packaging Ordinance), and was amended as Ordinance 2004/12/EG of 11 February 2004. The Ordinance specifies Europe-wide recovery and recycling rates and implements the principle of extended product responsibility.

An ordinance governing the prevention of packaging waste was adopted in Germany as early as in 1991, which served as a role model for the ordinance at EU level. The ordinance was amended in 1998 and defined as the Ordinance for the Prevention and Recovery of Packaging Waste of 21 August 1998 (BGBl. I, p. 2379), which was most recently amended through Articles 1 and 2 of the Ordinance of 2 April 2008 (BGBl. I, p. 531) (hereinafter Packaging Ordinance): The latter implemented EU requirements. The currently valid Packaging Ordinance includes the following regulations on waste management:

- A target rate of 80 % for refillable beverage containers and ecologically advantageous one-way packaging (MövE)[17]
- Since the originally defined refillable target rate (72 %[18]) was not achieved, introduction of a mandatory deposit on one-way beverage containers (with the exception of defined, ecologically advantageous one-way beverage containers)[19]
- The duty of producers to take back all deposit-free packaging and to participate in a Green Dot system[20] with respect to sales packaging that is generated as packaging waste in households (including the ecologically advantageous one-way beverage containers)[21]

Discussions on the effectiveness of provisions stipulated in the Packaging Ordinance and the assessment of the ecological advantages or disadvantages of certain types of beverage containers have accompanied the history of the ordinance since it came into existence. While it was possible to attain recovery and recycling rates, the MövE ratio was repeatedly not achieved. In accordance with the legal obligation arising from the Packaging Ordinance, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety [Bundesministerium für Umwelt, Naturschutz und Reaktorsi-

[17] Cf. Packaging Ordinance, § 1(2).
[18] Cf. BMU, April 2009, p. 10
[19] Cf. Packaging Ordinance, § 9.
[20] In this study, "Green Dot system" is subsequently used as a collective term for all "mainly curbside collection and recovery systems", with the exception of Section C, which deals with the specific situation prevailing in Germany where the term "dual system" is easier to comprehend. This serves to simplify the use of terms. It must, of course, be noted in this context that this term describes an organisation concept and does not imply actual use of the brand "the Green Dot". There are similar systems in the USA, e.g., curbside collection systems such as the "Blue Box“ system in Ontario, California (R3, 2009, Section 8).
[21] Cf. Packaging Ordinance, Articles 6 and 7.

cherheit (BMU)] is required to carry out a review of the effects of the regulations governing the mandatory deposit on one-way beverage containers on waste management by 1 January 2010 at the latest.[22] A publication of this survey was not yet available at the time the present study was completed (June 2012).

A 3 Procedures and methods

This study is primarily based on secondary research, i.e., on the evaluation of existing authoritative literature. The following sources were used, in particular:

- Life-cycle assessments
- Socio-economic analyses of beverage container collection and recycling systems
- Theoretical guidelines governing the economic, ecological and social assessment of beverage container collection and recycling systems
- Evaluations of legal standards and regulations
- Studies on beverage packaging collection and recycling systems
- Market analyses
- Expert opinions on the implementation of political instruments
- Statistics
- Information material provided by stakeholders

Evaluating the sources within the scope of this study also included an assessment of the transparency and conclusiveness of data in order to present the study as objectively as possible on the basis of comparable results. In actual terms, this means that if, for example, the results of two life-cycle assessments were compared, the respective framework conditions including possibly differing assumptions were taken into account. In addition, experts were interviewed and discussions were held with the stakeholders with a view to validating the work results.

The scope of examination and the structure of the study were developed using literature research. In doing so, significant impact categories that are suitable for assessing the results of beverage packaging collection and recycling systems under economic, ecological and social aspects, in particular, were identified. To the extent possible, indicators that enable quantification were specified for these impact categories. If no data or no plausible data were available for individual impact categories, approximate data were used, including a reference to possible underlying limitations. If this was not possible, calculations or assumptions were made. If this, too, was not possible, the indicator was described qualitatively.

In order to permit a more detailed analysis of the economic impacts beyond the information that is publicly available, we carried out supplementary questionnaire-based telephone interviews with industry representatives. Within the scope of these expert interviews, beverage producers from the juices and mineral water beverage segments as well as beverage wholesale trade representatives were interviewed with regard to their assessment of the economic implications of various packaging systems. Moreover, individual representatives from the disposal sector were asked about the cost of beverage systems. The information gained supplements the outcome of the evaluation of secondary literature and is disclosed as the findings of the interviews.

[22] Cf. Packaging Ordinance, Article 1(2).

A 3.1 Ecological impact categories

The ecological impact categories initially include the usual criteria from life-cycle assessments. In this respect, the way individual beverage containers and, if in place, collection and recycling systems are evaluated in life-cycle assessments. The following categories, including the respective indicators, were selected:

Table 1: Ecological impact categories, Section 1

Impact category	Indicator
Resources consumption	1. Oil consumption in litres per 1,000 litres filling volume
Climate change	2. Greenhouse gas emissions in tonnes CO_2 equivalents per 1,000 litre filling volume
Other impact categories from life-cycle assessments	3. Summer smog in kilogram ethane per 1,000 litre beverage liquid 4. Acidification in kilogram SO_2 per 100 litres filling volume 5. Eutrophication in kilogram PO_4 per 100 litre filling volume

In addition, influencing factors were denoted as indicators of the ecological benefit of beverage packaging collection and recycling systems. The influential factors are intended to facilitate the assessment of measures aimed at reducing the ecological impact of beverage packaging by promoting recycling, for example.

Table 2: Ecological impact categories, Section 2

Impact category	Indicator
Refillable rate The refillable rate denotes the proportion of all beverages in a beverage segment or in a country that is filled into refillable beverage containers. Refillable beverage containers have high circulation rates and regional distribution patterns and consequently are ecologically advantageous. A high refillable rate therefore usually points to an ecologically advantageous system.	6. Percental proportion of refillable beverage packaging in the total amount of beverage packaging in circulation in all beverage segments per country under review
Circulation rate The circulation rate describes the number of times refillable beverage packaging is refilled and impacts on the respective ecological benefit - the higher the circulation rate the more advantageous	7. Average circulation rate of refillable beverage packaging
Return rate The return rate describes the percental proportion of returned containers in all packaging put into circulation within a deposit system. In curbside collection systems (e.g. Green Dot system) it indicates the proportion of collected packaging in the total amount of packaging put into circulation. Higher return rates potentially enable higher recovery rates, which has a positive effect on the ecological impact of systems.	8. Percental proportion of returned/collected beverage containers in all beverage packaging put into circulation

Table 3: Ecological impact categories, Section 3

Impact category	Indicator
Recovery rates – Recycling – Energy recovery High recovery rates generally reduce the ecological impacts of beverage packaging. In accordance with the waste hierarchy, recycling is preferable to energy recovery.	9. Percental proportion of energy recovery in the total amount of beverage packaging consigned to recovery as well as beverage containers put into circulation 10. Percental proportion of recycling in the total amount of beverage packaging subject to recovery and also beverage packaging in circulation 11. Percental proportion of closed-loop recycling in the total amount of beverage packaging subject to recycling 12. Percental proportion of open-loop recycling in the total amount of beverage packaging subject to recycling
Disposal rate (landfill and waste incineration) Landfill and waste incineration generally lead to considerably more negative ecological impacts when compared to reuse or recycling.	13. Percental proportion of beverage packaging that is dumped or burned in waste incineration plants in the total amount of packaging put into circulation
Ecological packaging (re)design Ecological packaging (re)design is aimed at reducing the packaging volume (e.g., through weight reduction), at reducing resources consumption (e.g., through increased use of secondary material) or at designing packaging in such a way that it is easy to recycle. A bottle design that enables refilling and high circulation rates may also be regarded as eco-design.	14. Secondary materials use ratio 15. Average packaging weight (per 1,000 litres filing volume) of the various forms of packaging during the past three years
Littering Littering describes environmental pollution as a result of waste disposal in areas not intended for this purpose and not protected accordingly. In addition to materials diffusion into the environment, this packaging may also harm fauna.	16. Proportion of beverage packaging in the total littering volume (measured in terms of the number of littering incidences per item)

A 3.2 Economic impact categories

Initially, relevant cost and revenue categories were selected with respect to the economic impact categories, i.e., an assessment was made as to which costs arise from participation in the system for the individual stakeholders, in particular beverage producers and retailers, and the revenues that can be generated. The costs are split into investment costs and operational costs. Revenues can usually be generated through the sale of secondary material and, with respect to deposit systems, through unredeemed deposits (deposit beverage packaging that is not returned). With a view to the objectives of environmental policy in terms of sustained packaging management, the distribution of revenues is another significant criterion. Not only the cost volume in absolute terms but the amount of the costs relative to the targets achieved is of significance for cost estimation.

Table 4: Economic impact categories, Section 1

Impact category	Indicator
System costs Cost of participating in the system. The cost assessment is influenced by the system's effects on those impact categories that have a direct effect on target dimensions such as the recycling rate.	17. Beverage producers' investment costs 18. Costs incurred by beverage producers for the purchase of beverage packaging 19. Handling costs incurred by beverage producers 20. Handling costs incurred by wholesale/retail trade 21. System-based fees and levies to be paid by beverage producers 22. System-based fees and levies to be paid by trade 23. Costs incurred by governmental bodies
System revenues Revenues that can be generated through participation in the system.	24. Market volume for secondary material. Split up according to type of material in tonnes 25. Market prices for 1,000 tonnes of secondary material split up according to type of material 26. Expense compensation 27. Revenue from unredeemed deposits
Distribution of costs and proceeds among system participants and other stakeholders In accordance with the polluter pays principle or extended product responsibility, respectively, the cost of responsible resources management (i.e. closed substance cycle management through reuse (refilling) and recycling) are borne by system participants and not by governmental authorities.	28. Distribution of costs and revenues among the private economy (in particular retail/wholesale trade and beverage producers) and public authorities

In addition, impact categories were identified that describe the effects of beverage packaging collection and recycling systems on the market situation and market dynamics. This assessment mainly includes qualitative information as categories such as the competitive environment or the impacts on small and medium sized companies are very difficult to measure.

The selection of indicators was aimed at complying with various requirements such as making a statement on systems stability, for example.

Table 5: Economic impact categories, Section 2

Impact category	Indicator
Impacts on regional, national and international economies The introduction of beverage packaging collection and recycling systems alters the market and leads to restructuring, e.g., through the creation of new markets. Respective interventions aimed at promoting certain markets or products may be a component of political objectives.	29. Qualitative description
Impacts on small and medium sized enterprises (SMEs) and large corporations (LCs) The respective system design may offer both advantages and disadvantages for SMEs and LCs. As SMEs and LCs differ with respect to production and distribution processes, in particular, the impact of a system on an SME may differ from that on an LC.	30. Proportion of SMEs per beverage segment 31. Qualitative description
Impacts on the competitive situation Beverage packaging collection and recycling systems may change the competitive situation, in particular when they are based on statutory requirements. Likewise, additional administrative requirements may simplify or complicate market access for individual operators. Targeted measures can promote competition by supporting product diversity, for example (see below).	32. Qualitative description
The above-stated impact categories interact with each other. To the extent possible, this complex interaction was taken into account in the assessment.	

Table 6: Economic impact categories, Section 3

Impact category	Indicator
Start-up problems Beverage packaging collection and recycling systems generally do not function smoothly right from the start. These (temporary) start-up problems may impair the acceptance and benefit of the system. Some difficulties can be eliminated through minor adjustment of system requirements. Others are immanent to the system and are therefore difficult to remove.	33. Qualitative description of system-based start-up problems
System stability The stability of a system may be jeopardized through various factors. It is important, for example, that regulations be adhered to by as many stakeholders as possible and, in the optimum case that compliance is ensured on a full-coverage basis. This also includes the clarity and enforceability of the regulations. The extent to which a system is suitable for attaining the targets set is also influenced by aspects such as high recycling potential and the generation of revenues through the sale of secondary material. Over the longer term, dependence on primary raw materials may lead to instability.	34. Price relationship between primary raw materials and secondary raw materials respecting PET 35. Qualitative description (e.g. implementation practice)

A 3.3 Social impact categories

The social impact categories comprise the individual influence on consumers and the aspects that are relevant to society as a whole. With respect to the individual effects, the demands or requirements of consumers are to be observed (product diversity and convenience). In social terms or in economic terms, respectively, the employment aspect is of importance. The social impact indicators also include the extent to which responsibility is transferred to system participants within the scope of the system.

Table 7: Social impact categories, Section 1

Impact category	Indicator
Product diversity and convenience Product variety is generally important for consumers, whereby the product itself (i.e. the beverage), is more important than the packaging design. The packaging design, on the other hand, impacts on convenience, that is the practicability of handling for the consumer, which frequently has an effect on consumer behaviour. Generally, the quantitative data on product diversity in this impact category are supplemented by qualitative data on consumer convenience, where these could be determined.	36. Number of beverage producers per million inhabitants 37. Qualitative description of product diversity, including packaging diversity
Product price When beverage packaging collection and recycling systems cause additional costs or savings possibilities and additional income, this may impact on the product price.	38. Qualitative description if applicable, the price of five selected beverage brands per beverage segment and type of packaging
Employment Beverage packaging collection and recycling systems also impact on the labour market through the creation or loss of workplaces.	39. Number of employees required for system operations per 1,000 litres of produced beverage liquid
System misuse System misuse undermines the targets of beverage packaging collection and recycling systems and thus generally also implementation of the polluter pays principle and the principle of extended product responsibility	40. Number of violations of the law 41. Rate of wrongly returned or incorrectly disposed of items

Table 8: Social impact categories, Section 2

Impact category	Indicator
Extended product responsibility and consumer behaviour Implementation of the principle of extended product responsibility and a positive influence on consumer behaviour are significant factors for the implementation of sustainable packaging collection and recycling systems.	42. Waste volume in kilogram per 1,000 litre filling volume 43. Expenses for campaigns for consumer information purposes
Littering Littering has ecological impacts and also influences the quality of the environment as a social, natural and recreational area	44. Qualitative description of the educational effects relative to littering behaviour

A 3.4 Assessment scheme

Based on the data evaluated according to these impact categories, the systems are assessed using the defined indicators. This concluding assessment is intended to provide a summary overview of whether the systems tend to have a positive or a negative effect on the respective impact categories. The assessment uses a five-stage system:

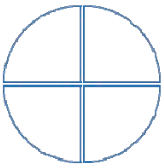
Illustration 2: Assessment scheme

 = System's influence on the indicator is very positive

 = System's influence on the indicator is predominantly positive

 = System's influence on the indicator is slightly positive or negative

 = System's influence on the indicator is predominantly negative

 = System's influence on the indicator is very negative

A 3.5 Supplementary Remarks

If reliable details about indicators could not be provided due to the insufficient data situation, these were initially estimated on the basis of other available data. All assumptions concerning these assessments are presented. To the extent that it was not possible to make any assessment, the indicator was described using qualitative information. If the selected indicators were not sufficient for assessing an impact category, the findings are supplemented with qualitative information. The model descriptions in Section B initially provide an abstract definition of the effects on the impact categories without quantifying the individual indicators at this point. An actual discussion of the situation in Germany can be found in Section C.

Literature research indicated that, in many cases, the available findings of the survey are not comparable in their entirety and scope. The quality of the survey procedure, the parameters included and, in particular, the assessment and analyses of the findings were marked by significant differences. It was not possible to identify a primary source that provided a holistic overview of all significant parameters. As a rule, ecological and, in some cases, economic factors are considered, whereas social factors are examined only in rare cases. Also, the parameters are generally weighted only to a limited extent or not very transparently. We were also unable to detect any transnational uniform systematics when examining the international primary sources.

Every study and, perforce, also all of the sources used here are based on surveys with previously made assumptions. The great variety of these general settings or underlying assumptions, respectively, leads to corresponding differences as regards the results. We anticipated this variance in assumptions for the purpose of our study and included it in the further course of our work. We recommend the system participants to draw upon further empirical surveys with a broader-based research structure that provide a sufficiently reliable and scientifically sound basis for all related issues.

A 4 Structure of the Study

The present study is divided into four main sections.

Section B presents typical beverage packaging collection and recycling system models. Specifically, we present the model of a mandatory deposit system for refillable beverage containers, the model of a mandatory deposit system for one-way beverage containers, and the model of a collective collection and recovery system for mainly curbside waste. In some cases, the individual circumstances are illustrated using examples from the country surveys.

The situation in Germany is described in detail in Section C. The specific German situation regarding roles, responsibilities and processes as well as steering and financing mechanisms are presented. Moreover, the ecological, economic and social impact categories of the systems implemented in Germany are presented in detail. In addition, we assessed the extent to which the respective system designs are suitable for achieving legal or national economic targets in terms of sustainability on the basis of the information gained and the defined indicators. Section C 3 contains a scenario analysis, and Section C 4 concludes with action options aimed at optimising the system design and the legal measures required to this end.

Section C 5 provides a comparison of the findings of this study with the findings of the bifa institute study commissioned by UBA: *Bewertung der Verpackungsverordnung: Evaluierung der Pfandpflicht* [Assessment of the (German) Packaging Ordinance: Evaluation of the Mandatory Deposit] (hereinafter, UBA study)[23].

To conclude, Section D contains a general guideline for the implementation of beverage packaging collection and recycling systems on the basis of our findings, which presents the impact potential of the systems on specific target parameters, framework conditions for the functionality of the systems and critical issues concerning implementation of the systems.

[23] Cf. bifa, 2010.

B Description of the Models

B 1 Deposit systems for refillable beverage packaging

The following model-type description of refillable systems is mainly based on experience gained with the refillable system in Germany. At some points, information about the refillable systems in Ontario, Canada, and in the Scandinavian countries was included.

B 1.1 Targets and scope

In contrast to deposit systems for refillable beverage packaging, which are generally legally prescribed, a deposit is charged for refillable beverage containers due to a voluntary initiative of the industry since beverage producers that use refillable beverage packaging can thus ensure that consumers return their containers for refilling.[24]

The first refillable systems developed as from about 1870. At that time, the various beverage producers mainly put individual bottles onto the market. However, as these were too valuable to be disposed of as waste, the bottles of competitors were also used for refilling. The first standard pool bottle for beer originated due to increasing market integration in the sixties of the twentieth century.[25]

In order to support the refillable systems, governmental authorities can determine fixed target quotas for the proportion of beverages that must be filled into refillable beverage containers as well as further measures to promote reuse. This, however, is not the rule; instead, it is the case where distinctive refillable structures that have grown over decades exist. Only in Denmark are the operators of refillable systems legally obliged to set up a return system for refillable beverage packaging and to achieve a return rate of 98%.[26] The aims of deposit systems for refillable beverage packaging originate from beverage producers‘ motivation to ensure that bottles are returned so that they can be refilled again, which has a positive impact both ecologically and in economic terms. The amount of the deposit, which is determined voluntarily - and which can differ from case to case - by the respective filling industry therefore represents manufacturers’ economic interest in getting back their bottles.

Refillable beverage containers are mainly made of glass or plastic. In a comparison of the various beverage segments, beer is most frequently sold in refillable beverage containers, followed by min-

[24] Cf. Institute for Local Self-Reliance, 2002, p. 2.
[25] Cf. DUH, o. J., pp. 1–4.
[26] Cf. Vogel, G., 2009, p. 56.

eral water and non-alcoholic soft drinks.[27] In most countries, refillable beverage containers are sold in bottle crates, which can also be reused.

Refillable systems are frequently organised as pool systems[28] with standard packaging, and this applies to both bottles (primary packaging) as well as to beverage crates (transport packaging). Standard packaging simplifies the organisation of a comprehensive refillable system as this packaging (excluding labels) can be used by every manufacturer; however, at the same time, the design of the label makes the individual beverage manufacturer or the brand recognisable.[29] In the course of technical development and the growing variety of forms of one-way container models, a trend towards individualisation of the bottle design has also developed. This leads to increased requirements being placed on the system organisation (e.g. sorting the returned refillable bottles or additional technology for bottle recognition at bottling plants).[30]

[27] Cf. GVM, 2009 b, p. 11; *Anteil an allen Verpackungsarten (Mehrweg und Einweg)*; the exact figures are documented under the findings of the program (Section 3.2.2); ECOLAS, N. V. and PIRA, 2005, p. 211; based on a survey of an INCPEN member company (The Industry Council for Packaging and the Environment).
[28] In a Pool system, beverage manufacturers share standard packaging so that a refillable bottle, for example, that was put into circulation by a beverage manufacturer can be refilled by any other of the participating beverage manufacturers after it has been used by a consumer.
[29] Cf. ECOLAS, N. V. and PIRA, 2005, p. 212 and 213; R3, 2009, Section 7–9; Institute for Local Self-Reliance, 2002, p. 2; Resch, J., 2009 a, p. 23 et seqq.
[30] Cf. CIS, 2009, p. 23 et seqq.

B 1.2 Roles, responsibilities and processes

Table 9: Roles, responsibilities and processes in the deposit system for refillable beverage containers; here: Packaging and beverage manufacturers

Packaging manufacturers	• The production processes for one-way and refillable beverage containers made of glass and plastic are basically identical.[31] Due to the multiple use of refillable container models, they are subject to high stability requirements; they are therefore usually more stable (e.g. due to thicker bottle glass) than one-way beverage container models. When packaging is being developed, packaging manufacturers must meet the requirements of the Food Law, of consumers (advertising effect and user friendliness) and logistics as well as of retailers (break resistance and handling in storage and in shops). • When refillable beverage containers are being developed, it is necessary to pay attention to the fact that they can be safely and easily cleaned and frequently refilled as simply as possible without them becoming unhygienic and/or unsightly. In addition, beverage manufacturers must observe logistic and ecological requirements. • The innovation cycles for refillable beverage containers are long in comparison to those of one-way beverage containers as the entire pool must be changed in each case.[32]
Beverage manufacturers	• Used refillable beverage containers must first be unpacked and washed at the beverage manufacturer's bottling plant. After cleaning, the containers are re-filled, labelled and prepared for transport.[33] Other types of bottles, i.e. bottles which, due to form, size or colour are not filled by the respective manufacturers but which are among the delivered empties, must be sorted out. Usually, manufacturers swap other types of bottles directly or over internet platforms. • Manufactures must establish appropriate cleaning plants, and possibly sorting or bottle recognition facilities for handling refillable beverage containers (e.g. unpacking the containers), and bottling plants for refillable containers. In order to ensure continuous refilling, a manufacturer must also obtain and store a safety stock of refillable beverage containers.[34]

[31] Cf. Institute for Local Self-Reliance, 2002, p. 11.
[32] Cf. ECOLAS, N. V. and PIRA, 2005, p. 214.
[33] Cf. Institute for Local Self-Reliance, 2002, p. 10; Prognos et al., 2000, p. 66.
[34] Cf. ECOLAS, N. V. and PIRA, 2005, p. 223 f.; Institute for Local Self-Reliance, 2002, p. 10 f.; GUA and IFIP, 2000, p. 95 f.

Table 10: Roles, responsibilities and processes concerning refillable beverage containers; here: wholesale, retail and consumers

Wholesale and retail	• With regard to distribution from the beverage manufacturer to retailers, wholesalers are usually important as a coordinating intermediate stage. They pick up the filled refillable beverage containers from the beverage manufacturers and store them at central locations so that they can be distributed from there to retailers. Conversely, wholesalers organise the collection of empty refillable beverage containers from the retailers as well as the sorting and return of containers to beverage manufacturers. Wholesalers pay the corresponding deposit for the quantities collected to the beverage manufacturers and receive this back from the beverage manufacturers when empty refillable beverage containers are delivered back to them. Wholesalers invoice the beverage manufacturers for outstanding deposits. The same principle is applied when filled and empty refillable beverage packaging is exchanged among wholesalers and retailers. • Retailers acquire beverages in refillable beverage containers from wholesalers or from bottling plants themselves. When a beverage is sold in a refillable beverage container, the retailer charges the consumer a deposit and refunds it again when the consumer returns the empty container. At the retailers, returning the deposit or taking back empty containers is done either manually or by means of an automat.[35] • Wholesalers and retailers must make the required storage capacities and resources for taking back and sorting empty refillable beverage containers available. Sorting and taking back containers requires space and also personnel efforts. The latter can be reduced through acquiring reverse vending machines.[36]
Consumers	• Consumers pay a deposit when purchasing beverages in refillable beverage packaging; they receive this deposit back when they bring back the empty refillable beverage packaging. Empty refillable beverage containers can usually be returned to any retailer that also markets this packaging (in the event of pool bottles, regardless of the manufacturer and/or the product brand).[37]

[35] Cf. Institute for Local Self-Reliance, p. 3 and p. 10.
[36] Cf. ECOLAS, N. V. and PIRA, 2005, p. 223 f.; Institute for Local Self-Reliance, 2002, p. 10 f.; GUA and IFIP, 2000, p. 95 f.
[37] Cf. BMU, April 2009, p. 7 f.

Table 11: Roles, responsibilities and processes in deposit systems for refillable beverage packaging; here: system operators, waste management companies, public authorities

System operators	• As refillable structures have usually grown over longer periods and are not legally regulated, the role of the system operator is generally not clearly specified; instead, it is defined as required by the system participants. Tasks may be the publication of data and information, taking on clearing and administrative activities as well as making refillable bottles available.
Waste management companies	• When refillable beverage containers can no longer used because they have been damaged or look unsightly, for example, they are recycled by waste management companies via the beverage manufacturer or beverage wholesalers. The beverage manufacturer, the wholesaler or the retailer sorts out the beverage packaging, and the recovery firm (e.g. responsible for the recovery of glass, plastics) consigns it to recycling. If consumers do not return refillable beverage containers in exchange for a deposit refund, the items are usually disposed of through waste collection or residual waste. Here, too, waste management companies take on the job of picking up the collection containers.
Public authorities	• Government can promote the use of refillable beverage packaging through appropriate legislation and political instruments.[38] A further task is the determination of refillable rates, return rates, etc.. These data are success indicators for the refillable systems. Consequently, it is in the interest of those participating in the system that these data are recorded by independent parties.[39]

[38] The political instruments for promoting reuse are referred to under Financing and Steering the system.
[39] Cf. ECOLAS, N. V. and PIRA, 2005, p. 222.

B 1.3 Financing and steering

Due to the grown and non-regulated structures that have arisen, no sources describing the financing mechanism have been found to date. Presumably, unredeemed deposits contribute very little to financing the system, which depends on high return rates to enable maximum reuse (refilling) of the refillable beverage containers. Money from deposits can, theoretically, only be distributed via central clearing locations as is usual with regard to mandatory deposit systems (cf. Section B 2.2). Direct clearing among the stakeholders is the general practice.

As explained in the paragraphs above, refillable systems are general initiated by the private sector and are subsequently steered by those participating in the system.

However, the government can implement framework conditions that promote refillable systems. The following political instruments aimed at the promotion of refillable systems have been implemented in some regions, or their implementation is being discussed: [40]

- Mandatory deposit on one-way beverage containers
- Incentive levies on one-way beverage containers
- Target ratios for refillable beverage packaging
- Incentive levies on one-way beverage containers depending on refillable rate (bonus-/malus system)[41]
- Subsidising refillable beverage containers
- Duty to offer refillable packaging to be observed by wholesalers and retailers
- Trading with certificates and limited licenses for one-way beverage packaging or minimum rates respecting refillable beverage packaging
- Consumer-oriented information campaigns
- Clearly identifiable labelling of one-way and refillable beverage packaging
- Negative labelling of ecologically disadvantageous one-way beverage containers
- Optimisation/simplification/extension of mandatory deposits to include further beverage segments and/or packaging sizes
- General take-back duty for all one-way and refillable beverage containers

In addition, there is the possibility of direct promotions, e.g., by subsidising refillable systems or also the possibility of indirect promotions which more strongly burden one-way systems due to the introduction of a mandatory deposit, for example.[42]

[40] Cf. ECOLAS, N. V. and PIRA, 2005, p. 227 ff.; Pladerer, C., 2009; Vogel, G. 2009, p. 19 f., p. 33, p. 60 f.
[41] Cf. Austrian Ecology Institute and Institute for Technology and Sustainable Product Management of the Economic University, Vienna, 2009, p. 198 f.
[42] Cf, ECOLAS, N. V. and PIRA, 2005, p. 214 f.

B 1.4 Success factors and results

Table 12: Success factors and results in the deposit system for one-way beverage packaging; here: resources consumption and climate change

Ecological	
Resources consumption and climate change	• Refillable beverage containers are refilled repeatedly before they are taken out of the refillable system and are subsequently recycled. In this manner, refillable bottles made of glass can be refilled over fifty times (see circulation rates). In general, multiple reuse (refilling) reduces resources consumption and produces less environmentally harmful greenhouse gas when compared to the manufacture of one-way containers which can be filled only once. A life-cycle assessment carried out by the IFEU-Institut für die Genossenschaft Deutscher Brunnen eG (GDB), which assesses the environmental impact of packaging systems over their entire life-cycle arrives at the following conclusion: compared to a PET one-way bottle, a PET refillable bottle requires ca. 40% less raw material and emits ca. 50 % less environmentally harmful greenhouse gas (per 1,000 litre product).[43] • Due to a comparatively higher weight when transported and larger volumes upon return transport (empty refillable beverage containers cannot be compacted), refillable beverage containers tend to consume more resources and emit more greenhouse gas per tkm when compared to one-way beverage packaging. • The advantages of refillable beverage packaging generally prevail when the total life-cycle is assessed (i.e. manufacture, filling, transport and disposal).[44] • An increasing proportion of individual bottles make logistics processes more difficult which, among other things, may impact adversely on user friendliness and on ecological effects.[45]

[43] Cf. IFEU, 2008, p. 62.
[44] Cf. IFEU, 2008, p. 103 and p. 104.
[45] Cf. ECOLAS, N. V. and PIRA, 2005, pp. 214–215.

Table 13: Success factors and results in the deposit system for refillable beverage packaging; here: other impact categories of life-cycle assessments, refillable rate and circulation rate

Other impact categories of life-cycle assessments	• Refillable beverage packaging has advantages over one-way packaging with respect to the acidification and summer smog impact categories. The UBA life-cycle assessments from 2000 indicate similar values in the summer smog and acidification categories with respect to beverage cartons.[46] • Refillable beverage packaging has advantages over one-way packaging in the category of eutrophication.[47] • A further aspect, which is frequently not taken into account in life-cycle assessments, is the interaction between the packaging and the product. There is still a need for research with respect to beverage cartons and PET bottles (see also p. 88).
Refillable rate	• Due to the complex interactions and market conditions in the various countries and concerning individual beverage segments, the refillable rate may differ strongly in the individual case. Generally, a high refillable rate is attained only when pool systems are introduced on a full-coverage basis. In addition, the refillable rate is also strongly impacted by the extent to which beverage producers as well as wholesalers and retailers see strategic advantages in the use of refillable beverage packaging compared to one-way packaging.
Circulation rates	• Circulation rates denote the number of times refillable beverage containers are reused. Circulation rates impact directly on both the economic and ecological efficiency of refillable systems: the higher the circulation rate, the lower the environmental impact. Due to their respective material and hygienic properties, the circulation rates of glass bottles are higher when compared to those of PET bottles. The circulation rate depends on breakage resistance, the stability of packaging and on how fast a material wears out. Overall, refillable beverage packaging is heavier than one-way packaging for stability reasons, in particular.

[46] Cf. Prognos et al., 2000, p. 186.
[47] Cf. IKP, 2003, p. 56; in Germany, carton packaging is deemed the ecologically advantageous form of packaging although its impacts are quite significant in the eutrophication category. This assessment relates to a carton packaging generation that differs from the cartons on the market today, however. A complete, new assessment is not in place.

Table 14: Success factors and results in the deposit system for refillable beverage packaging; here; return rate, recovery rate and disposal

Return rate	• High return rates are generally attained in deposit systems. There are indications that the predominant sale of refillable beverage containers in beverage crates within the scope of refillable systems even contributes to an increase in the return rate. In Germany, for example, a return rate of 99 % is achieved for refillable bottles in the mineral water segment, and a rate of 98% in the beer segment in Ontario.[48] • In the event of lower return rates, higher deposits may cause an increase in the return rates. A consumer-friendly design of return options may also impact positively on the return rate.
Recovery rate (recycling + energy recovery)	• In practice, all refillable beverage containers that are returned (see return rate) and which, after having been refilled numerous times can no longer be used, are recycled.[49] This is due to the fact that the material at the beverage producer and in retail is usually mono-fraction material and can therefore be recycled very well. Materials losses in refillable systems therefore relate only to breakage and/or incorrect disposal by consumers. • Packaging material in a refillable system that is not returned to beverage producers is either consigned to a separate collection of recyclable fractions (e.g., old glass collection), or is disposed of as residual waste. • Due to the high recycling rate regarding packaging material from a refillable system, the proportion of energy recovery is generally very low.
Disposal	• Due to the high return rate respecting refillable beverage packaging, a very low disposal rate can be assumed.

[48] Cf. IFEU, 2008, p. 26; R3, 2009, Section 7-8.
[49] Cf. IFEU, 2008, p. 27.

Table 15: Success factors and results in the deposit system for refillable beverage packaging; here: ecological packaging (re)design and littering

Ecological packaging (re)design	• As refillable beverage packaging is designed for refilling, it must be in keeping with the concept of ecological packaging design. However, the overall logistics system is oriented more strongly to the life-cycle than to the packaging alone. Moreover, as the system operators are responsible for all system costs, the efficient consumption of resources and optimised logistics (as well as increased circulation rates) provide a direct incentive.
Littering	• In a refillable system, the fact that a deposit is charged is responsible for high collection ratios. Consequently, refillable systems contribute significantly to reducing littering in the respective segment as a deposit is effective motivation to return the bottles. Even if refillable beverage containers are left in a public area, the deposit incentive generally causes somebody to collect the packaging and redeem it at the retailer.

Table 16: Success factors and results in the deposit system for refillable beverage packaging; here: system costs

Economic	
System costs	• The investment expense incurred by producers and retailers for refillable beverage systems increases through the necessity to invest in refillable packaging washing facilities, pool bottles and logistics structures.[50] • The current operating costs of refillable systems are generally more advantageous than one-way systems for beverage producers with respect to filling. While cleaning expenses are higher, the individual packaging is more costly and transportation is more expensive, these additional costs are more than compensated for through the lower packaging piece numbers.[51] • In some countries, there are companies which meanwhile specialise in the efficient design of refillable systems logistics in order to make optimum use of efficiency potential. [52] • Under otherwise similar conditions, refillable systems are generally more expensive than one-way systems, in particular for food retailers.[53] This is mainly associated with higher costs for slightly increased storage capacities[54] as well as for take-back and sorting. These higher costs, in turn, are directly connected with the respective design of the refillable system.[55] A refillable system does not necessarily mean additional costs for beverage wholesalers that are primarily oriented towards the handling of refillable beverage packaging.[56]

[50] According to a study by the British Soft Drinks Association, the investment requirement for establishing a refillable system for the British soft drinks industry would come to between € 6 to 10 billion. This result of the study cannot be regarded as being of general validity, however, as it depends on many factors such as consumer behavior and infrastructure (cf. ECOLAS, N. V. and PIRA, 2005, p. 223 f.).

[51] Cf. Institute for Local Self-Reliance, 2002, p. 11 and p. 12.; IML, o. J.; Interview with industry experts

[52] Cf. Österreichisches Ökologie-Institut und Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität, Vienna, 2009, p. 230

[53] Institute for Local Self-Reliance, 2002, p. 12.

[54] The demand for storage capacities is higher for refillable beverage containers than for one-way containers as the latter are compacted on site after having been returned.

[55] While the EHI assumes additional costs of € 0.0321 per refillable bottle, a survey carried out by the Fraunhofer-Institut IML, established that, under certain conditions, refillable systems may even cause lower costs for wholesalers and retailers than one-way systems (see Section C 2.2).

[56] Interview with industry experts.

Table 17: Success factors and results in the deposit system for refillable beverage packaging; here: system revenues, distribution of costs between government and the private sector, implications for local, national and international economic regions and implications for SMEs and LCs

System revenues	• Direct revenues from unredeemed deposits and the sale of secondary materials are relatively low due to high return rates and the comparably small quantities of materials arising from repeated reuse. • The refillable beverage containers sorted out are generally of mono-fraction material and are therefore suitable for attaining high revenues. • Moreover, refillable systems offer savings potential with regard to disposal costs as they reduce the waste volume.
Distribution of costs between government and private sector	• The private sector finances the system completely (except for the survey and documentation of refillable rates, if respective data are legally required. Costs incurred to this end can be borne by the government).
Implications for local, national and international economic regions	• In addition to the environmental impacts, a refillable system also involves costs in the event of larger transport distances. Cross-regional transport over long distances or international trade (with the possible exception of trade in border regions) can become difficult for refillable systems.[57] This is due to the logistics requirements of refillable systems and the necessary coordination regarding forms of packaging (i.e., standard packaging). As a general rule, enterprises that are engaged in the filling of refillable beverage containers operate on a largely local/regional basis. • Refillable systems generally function most effectively when standard bottles are used. The use of uniform standard bottles is difficult to realise on an international scale, however.
Implications for small- and medium sized enterprises (SMEs) and large corporations (LCs)	• In the event of transportation distances that are limited to a given region - as is the case with many reuse-oriented beverage producers - it is easier to realise cost savings by operating refillable systems. Refillable systems therefore tend to be more advantageous for SMEs than for LCs. Nevertheless, there are some large corporations among reuse-oriented beverage producers in Germany, for example, that operate successfully on a cross-regional scale. However, refillable systems mean higher costs for large corporations, in particular for those that mainly operate cross-regionally over long distances and/or internationally, due to the necessary return logistics when individual bottles are used. Central production (a production centre for international distribution) in particular, is not suitable here.[58] However, refillable systems can still be attractive for LCs with several production centres. Coca-Cola Germany, for example, fills more than 70% of its products into refillable bottles[59]

[57] Cf. ECOLAS, N. V. and PIRA, 2005, p. 214 and p. 215.
[58] Cf. ECOLAS, N. V. and PIRA, 2005, p. 214 and p. 215.
[59] Cf. Coca-Cola GmbH website, *Mehrfachnutzung der Flaschen, Verpackungen, Nachhaltigkeitsbericht 2009*.

Table 18: Success factors and results in the deposit system for refillable beverage packaging; here: implications for international competition

Implications for international competition	• Refillable systems are not profitable if long transport distances are involved. Consequently, for LCs with centralised production structures and internationalised distribution they are actually available only to a limited extent. With regard to the respective national competition, this may be a disadvantage for LCs. • By contrast, refillable systems may promote competition among companies with regional production and distribution structures (also with respect to international groups). • Operating a refillable system does not per se represent a competition barrier - in particular since refillable systems are usually voluntarily organised by the system participants themselves. • However, the prohibition of one-way systems and the regulation governing the exclusive use of refillable systems are regarded as being anti-competitive. [60]

[60] Cf. EGH, C-463/01 and C.309-02.

Table 19: Success factors and results in the deposit system for refillable beverage packaging; here: start-up problems

Start-up problems	• Start-up problems may be incurred when a refillable system is introduced – assuming that this takes place in the form of converting a one-way system with or without a deposit to a refillable system with a deposit. • An increased provision of information is required if consumers have no experience with beverage packaging refillable systems and/or deposit systems. Firstly, it must be ensured that the system is understood. Consumers must be informed that the deposit paid when purchasing a product in a refillable bottle is refunded when the bottle is returned, and that the price for the product in refillable bottles is not actually higher when compared to a one-way product. Consumers must also be informed about the need to return bottles and that the bottles should not be disposed of together with residual waste or within the scope of old glass collection. Secondly, there may be concerns about the reuse (refilling) of bottles in some countries. In such cases, in order to promote the acceptance of refillable systems it is essential to stress that refillable bottles do not give rise to any hygienic concerns or concerns respecting food law (e.g., due to effective cleaning of the bottles, clinical filling conditions), and that traces of use on the bottles do not impair the product quality. This, of course, must actually be ensured.[61] • Take-back logistics (incl. sorting) are essential but are also complex with regard to refillable bottles; this may require additional co-ordination among the system participants for a transitional period until the system has got underway in practice. • In order to attain high acceptance of a refillable system, a broad-based and user-friendly network of return options should be made available from the outset. Failing to do so may lead to temporary bottlenecks, especially in the process of introducing individual refillable systems or refillable beverage containers. • The transition to refillable beverage packaging means additional investments in washing facilities, bottle labelling etc., for beverage producers that had so far filled their products only into one-way containers.

[61] Interview with industry experts.

Table 20: Success factors and results in the deposit system for refillable beverage packaging; here: stability of the system, product diversity and product price

Stability of the system	• The reuse of the refillable bottles and the mono fraction recycling of sorted, refillable beverage containers that can be used for manufacturing new packaging, particularly when it is made of glass, reduces a country's dependence on raw materials and/or secondary materials. • The more cost efficient central production and distribution are, as is the case with some international suppliers, the less attractive is it for producers to participate in refillable systems.[62]
Social	
Product diversity	• The use of standard bottles reduces the costs incurred by beverage producers and facilitates market access for SMEs. Refillable systems can therefore contribute to an increase in product and brand variety. • Refillable systems are generally efficient when standard bottles are used, in particular. At the same time, the diversity of packaging forms is reduced due to the use of standard bottles that are used jointly by various beverage producers and differ only with respect to labelling. In addition to the use of standard bottles, a refillable system also provides the possibility to put individually developed packaging forms (individual bottles) onto the market through repeated use of the refillable bottles. This usually means an increase in system costs for beverage producers, however, due to increased sorting expenses.
Product price	• The sales price for beverages in refillable beverage containers may by higher than for beverages in one-way containers. However, this is usually due to the fact that the product, i.e., the beverage which is sold in a refillable beverage container, is positioned in a higher price segment. Beverages which are to be distinguished from other beverages in terms of quality or brand seldom tend to be filled into one-way beverage containers. In effect, beverages in refillable beverage containers may be more expensive than beverages in one-way containers. In practice, however, possible differences in the product price are not, or are only to a minor extent, due to the use of refillable packaging.

[62] Cf. ECOLAS, N. V. and PIRA, 2005, p. 214 and p. 215; Vogel, G., 2009, p. 61.

Table 21: Success factors and results in the deposit system for refillable beverage packaging; here: employment and misuse

Employment	• Refillable systems impact positively on the employment situation as more labour is required for operating a refillable system. In addition, the structures of reuse-oriented markets are usually more strongly dominated by SMEs than are one-way oriented markets, which secure employment in the SME segment.[63] According to a study performed for the European Commission in 1998, the increased use of refillable beverage packaging can create 27,000 new jobs in Germany. By contrast, the substitution of refillable beverage packaging by one-way packaging would mean the loss of 53,000 jobs.[64]
System misuse	• Participation in refillable systems is generally voluntary and therefore provides only little incentive for misuse with respect to beverage producers and wholesales/retailers. This is also confirmed by the high return rates of ca. 99 %.

[63] Interview with industry experts.
[64] Cf. Golding, A., 1998, p. 72.

Table 22: Success factors and results in the deposit system for refillable beverage packaging; here: product responsibility and consumer behaviour

Product responsibility and consumer behaviour	• Extended product responsibility is realised to the full extent in refillable systems: The private sector bears all costs, is responsible for the material applied and for the functioning of the system. Beverage manufacturers and wholesale trade play a central role in this as they exert a significant influence on the system's efficiency through the packaging design and logistics chain.
	• In order to enable consumers to take an active purchase decision, they should be able to differentiate clearly between refillable and one-way packaging if parallel one-way and refillable deposit systems are in place. This can be attained, for example, through clear and consumer-friendly labelling.
	• Furthermore, refillable beverage containers for which a deposit must be paid should be clearly marked as such to avoid their being mistakenly disposed of as residual waste or via old glass collection.
	• The return option must likewise be aligned to consumer needs. The denser the take-back network and the more attractive the return options for empty packaging, the higher are the return rates and the consumer acceptance that can be achieved.
	• The success of refillable systems may be impaired by the following trends, among other things:
	  ○ Increased import of beverages
	  ○ Focus on the variety of packaging forms and frequently varying preferences respecting packaging design
	  ○ Consumers' convenience requirements (deliberate purchase of non-deposit beverage containers to avoid return)
	• The following trends, inter alia, promote refillable systems:
	  ○ Giving preference to regional products
	  ○ Optimum system orientation between wholesale/retail trade and industry
	  ○ Crate-based sales of beverages
	  ○ High environmental awareness on the part of consumers "LOHAS" culture[65]

[65] Abbreviation for Lifestyle of Health and Sustainability, i.e., for those consumers whose lifestyle is oriented towards health and sustainability.

Table 23: Success factors and results in the deposit system for refillable beverage packaging; here: littering

Littering	• A deposit creates a high willingness on the part of consumers not to dispose of their refillable beverage containers in household waste or in public areas. • Refillable systems may have an educational effect if consumers are aware that the purchase of refillable packaging contributes actively to practised closed substance cycle waste management, to the protection of resources and to climate protection. Whether or not this effect also extends to environmental behaviour in other areas cannot be conclusively answered.

B 1.5 Preliminary assessment

● = System’s influence on the indicator is very positive

◕ = System’s influence on the indicator is predominantly positive

◑ = System’s influence on the indicator is slightly positive or negative

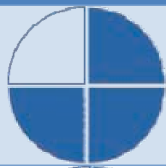
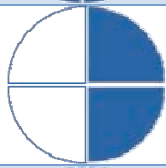
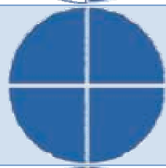
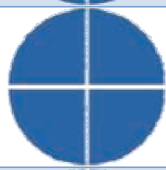
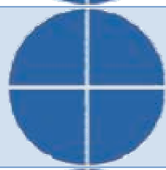
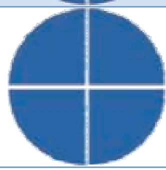
◔ = System’s influence on the indicator is predominantly negative

○ = System’s influence on the indicator is very negative

Table 24: Preliminary assessment of the deposit system for refillable beverage packaging

Ecological (positive impact means efficient reduction of environmental damage relative to the targets that were defined for the system)	
Resources consumption and climate change	●
Other impact categories of life-cycle assessments	●
Refillable rate	●
Return rate	●

Recovery rate (recycling + energy recovery)	●
Disposal (reduction of the volume to be disposed of)	●
Ecological packaging (re)design	●
Littering	●
Economic (the cost efficiency of the system is assessed here, i.e., the fact that the system incurs costs is not only negative)	
System costs	◕
System revenues	◕
Distribution of costs between government and the private sector (a positive impact means lower costs for the government)	●
Implications for small, regional beverage manufac-turers	●
Implications for large, international beverage manu-facturers	◔
Implications for international competition	◑
Start-up difficulties (positive influence means less start-up difficulties)	◑

Stability of the system	
Social	
Product diversity	
Product price	
Employment	
System misuse	
Extended producer responsibility and consumer behaviour	
Littering	

B 2 Deposit systems for one-way beverage containers

The model-type presentation of a one-way deposit system is based on publications respecting deposit systems in Scandinavia, in selected American east coast states, in Germany and in California.

B 2.1 Targets and scope

Deposit systems for one-way beverage containers usually result from legal regulations. Such regulations are aimed alternatively or cumulatively at a number of targets:

- Increasing the recycling rates of one-way beverage packaging
- Qualitative increase in the recycling processes relating to bottle-to-bottle applications
- Reducing the volume of littering by giving consumers an economic incentive to return packaging appropriately[66]
- Depending on the design of the mandatory deposit on one-way beverage packaging, a stabilisation and increase in refillable rates[67]

The laws governing the types of containers and beverages that are included in a deposit system for one-way beverage packaging differ greatly from country to country. Usually, a deposit is charged on one-way beverage containers made of plastic, glass and/or metal. However, in most countries, a deposit is charged depending on the beverage segment and not on the packaging material.

The amount of the deposit varies in the different countries and to some extent within a country, depending on the packaging material, the package size or beverage segment. In the countries considered here, it ranges from € 0.03 to € 0.25.[68]

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[66] Cf. Dansk-Retursystem website, Danish deposit and return system; Petcore-Website, National Legislation; Packaging Ordinance § 1 (1)–(3); Roland Berger, 2007, p. 4; CIWMB website, History of California Solid Waste Law, 1985–1989.
[67] Cf. Packaging Ordinance § 1 (1)–(3).
[68] Cf. Dansk-Retursystem website, Areas covered; Packaging Ordinance § 9 (2); R3, 2009, § 4–4; California Resources Agency, 2009, p. 8; MassDEP website, Guide for Consumers to the Bottle Bill.

B 2.2 Roles, responsibilities and processes

Table 25: Roles, responsibilities and processes in the deposit system for one-way beverage packaging; here: packaging, beverage manufacturers and wholesale/retail trade

Packaging manufacturers	• Packaging manufacturers usually are not required to meet legally prescribed obligations. However, in some countries (e.g. Germany), the labelling must indicate that a security deposit is charged.[69] • When packaging is being developed, packing manufacturers must fulfill the requirements of food law, the customers (advertising effect and user-friendliness) and logistics as well as those of retailers (break resistance and handling in storage and in shops).
Beverage manufacturers	• The duties of beverage manufacturers usually encompass participation in a deposit system, charging a deposit, refunding deposits to a central systems operator (public sector or private sector) or to retail, the labelling of deposit one-way beverage containers, registering the packaging and, where required, paying an additional fee to the system operator or to a public authority.[70] In almost all countries that have a deposit system, using a national, modified EAN bar code is mandatory in order to participate in the deposit system.
Wholesale and retail	• Both wholesalers and retailers are generally under a legal obligation to participate in a deposit system for one-way beverage containers if they sell beverage packaging to which the legal obligation applies. • If beverage manufacturers sell their products through wholesalers and not directly to retailers, wholesalers must pay the deposit to the beverage manufacturer upon purchase of the beverages. When the beverages are passed on to a retailer, the wholesaler, in turn, claims the deposit from the retailer.[71] • When beverages are sold in one-way containers, the retailer must charge consumers a deposit and then reimburse the amount when empty beverage containers are taken back.

[69] Cf. DPG website, *Hersteller von Etiketten und DPG Verpackungen*.
[70] Cf. DPG website, *Getränkehersteller und Importeure, Aufgaben und Pflichten*; EUROPEN, 2008 a, p. 6; Massachusetts General Laws, Chapter 94, Section 323.
[71] Cf. Packaging Order 9 (1); DPG website, *Händler und andere Letztvertreiber*

Table 26: Roles, responsibilities and processes in the deposit system for one-way beverage packaging; here: wholesalers, retailers and consumers

Wholesale and retail	• Retailers take back deposit beverage containers and pay out the deposit in exchange. Containers can be returned either manually or automatically by means of reverse vending machines. For purposes of coordinating and financing the clearing process within the system, the return of the beverage containers must be documented (e.g. counted and reported to a system operator) before the returned packaging material is sold. In the process, the beverage packaging taken back must be invalidated (e.g. through shredding or compacting), so that it cannot be returned another time in exchange for a deposit payout. Retailers can either assume these tasks themselves (e.g. by using reverse vending machines), or they can pass on the returned and accepted beverage packaging to counting centres, waste disposal companies or logistic providers that take over these tasks.[72] • The acceptance and sorting of packaging requires efforts in terms of both space and personnel. The latter can be reduced by acquiring reverse vending machines.[73] • The party to which returned one-way beverage containers or the packaging materials are to be passed on depends significantly on whether or not the retailer is the owner of the packaging material taken back. In existing one-way deposit systems, this is regulated in different ways. If retailers are the owners of the returned packaging materials, they sell the materials on their own account to the waste disposal industry. If system operators are the owners of the packaging materials taken back, they organise their collection at the retailers and sell the materials on their own account (see also p. 63, central deposit clearing). • In some deposit systems for one-way beverage containers, the retailer receives a handling fee from the system operator for each deposit one-way beverage container taken back.
Consumers	• Consumers pay a deposit to the retailer for each deposit one-way beverage container purchased: The deposit is refunded when they return the empty one-way beverage container to the retailer.[74]

[72] Cf. DPG website, *Händler und andere Letztvertreiber, Aufgaben und Pflichten*; Dansk-Retursystem website, Registration and collection.
[73] Cf. ECOLAS, N. V. and PIRA, 2005, p. 223 f.; Institute for Local Self-Reliance, 2002, p. 10 f.; GUA and IFIP, 2000, p. 95 f.
[74] Cf. R3, 2009, Section 10 - 6.

Table 27: Roles, responsibilities and processes in the deposit system for one-way beverage packaging; here: system operators, waste disposal companies and public authorities

System operators	• As a rule, system operators form the organisational and contractual framework for deposit clearing. They are responsible for managing and operating the deposit system.[75] • Deposit clearing is necessary because, in comparison to refillable systems, the packaging and deposit cycles in one-way systems differ. The design of roles concerning deposit clearing is described in detail below.
Waste management companies	• Depending on the system design, wholesalers or retailers usually pass on empty, one-way beverage containers after take-back to the respective assigned counting centres, logistics providers or waste management companies, unless the system operators collect the beverage containers and sell the material to waste management companies. • Waste management companies are then under a legal obligation to consign the one-way beverage containers to recycling or to energy recovery.[76] In Germany, recycling is prescribed as the preferred recovery method, for example. However, the law does not differentiate between closed-loop recycling and open-loop recycling.[77]
Public authorities	• In some countries public authorities control the system operators with respect to compliance with prescribed framework conditions, such as administration and the orderly collection of fees. In part, public authorities are also responsible for the administration of financial resources and promote the demand for secondary materials.[78] • In other countries, public authorities only perform the required surveys regarding the recovery, recycling and, where appropriate, refillable rates, and make this available to the public (e.g. in Germany).[79]

Deposit clearing is a central process with regard to deposit systems for one-way beverage containers. Generally, central deposit clearing centres and public authorities are the main stakeholders in deposit clearing. Their respective activities are not aimed at income but at serving public interests. Table 28 & Table 29 provide examples of three frequently used deposit clearing process.

[75] Cf. DPG website, *Aufgaben der DPG*; Dansk-Retursystem website, Danish deposit and return system.
[76] Cf. R3, 2009, Section 10–7; Nurminen, P., 2008, p. 25.
[77] Cf. Packaging Ordinance, § 9 (1).
[78] Cf. R3, 2009, Section 4 - 16; CRI website, Litter taxes and deposit laws: A comparison.
[79] Cf. Packaging Ordinance § 1 (2).

Table 28: Process descriptions of the reference systems for deposit clearing - Part 1

Central deposit clearing (the deposit clearing centre administers the deposits)	• When beverages are delivered, wholesalers and retailers pay the deposit amount to the beverage manufacturers. The beverage manufacturers remit the collected deposit amounts to the central clearing centre. The retailer, in turn, charges consumers a deposit and refunds the deposit upon return of one-way beverage containers. • Returned one-way beverage containers are taken back by retailers either automatically and are registered, counted, compacted and invalidated while still in the reverse vending machine, or, after manual acceptance, they are delivered to counting centres where the one-way beverage containers are registered, counted, and sorted if necessary. • The deposit clearing centre pays back the deposit amount to retail on the basis of the electronically reported quantity of returned empties. The clearing centre retains and administers unredeemed deposits.[80]
Deposit clearing is done decentrally through external service providers (the industry administers the deposits)	• Beverage manufacturers collect the deposit from retailers and administer the deposits. Retailers, in turn, request the deposit from consumers and refund it when one-way beverage containers are returned. • Various service providers commissioned by retailers and beverage manufacturers support the retailers and beverage manufacturers in deposit clearing. For this purpose, electronic data records of the counting centres and from reverse vending machines are forwarded to them. • Based on the deposit invoicing, beverage manufacturers pay retailers the outstanding deposits. Usually, the beverage manufacturers or retailers receive unredeemed deposits if they own the brand.[81] • The fact that beverage manufacturers or the industry keep unredeemed deposits is criticised to some extent since they profit economically when consumers throw away deposit one-way containers as waste at the cost of the general public.[82] On the other hand, unredeemed deposits can then also be used by those involved to finance the system.

[80] Cf. Dansk-Retursystem website, Danish deposit and return system; Grytli, J., 2002, p. 8.
[81] Cf. DPG website, *Abwicklung des Pfandausgleichs*.
[82] "Third, producers should not be permitted to keep unclaimed deposits. Producers should bear the social costs of disposal for products that end up as trash. But as disposal fees will not reflect all of this cost, producers require a further disincentive—which they will not generally have unless they lose the deposit when recyclable items are disposed of as trash." (Calcott, P., Walls, M., 2005, p. 301).

Table 29: Process descriptions of the reference systems for deposit clearing - Part 2

Public authorities are system operators (public authorities administer deposits)	• Beverage manufacturers must pay all deposits collected directly to public authorities (or to a government fund). In turn, retailers request the deposit from consumers. • Returning one-way beverage containers in exchange for a deposit refund takes place either at the retailers or at approved recycling acceptance points. • Public authorities reimburse retailers or these service providers with the deposit amount. • The responsible public authority retains and administers unredeemed deposits.[83]

As a rule, central deposit clearing centres assume the steering and administration of the system.[84]

B 2.3 Financing and steering

In accordance with the polluter pays principle,[85] beverage manufacturers as well as retailers and wholesalers contribute, in particular, to financing the mandatory deposit system for one-way containers. These systems can be financed mainly through unredeemed bottles and the sale of secondary materials.[86] The respective legal regulations generally specify to whom the revenue from a mandatory deposit system for one-way containers accrues.[87] In the absence of regulations regarding system revenues, they may be made freely available to the system stakeholders.

As explained in Table 28 and Table 29, either industry or a central system operator (government or private economy) is responsible for the administration of unredeemed deposits. In some systems, unredeemed deposits are tied to a specified purpose, for example, extending the deposit system or launching information campaigns for the users of a mandatory deposit system for one-way containers. Moreover, ecological and social projects can also be supported via unredeemed deposits, as is the case in Denmark.

Due to the value of aluminium packaging material, no further registration fees other than a deposit must be charged by the manufacturers of aluminium beverage cans within the scope of optimised one-way deposit systems (e.g. Sweden). The one-way deposit system for this type of packaging finances itself through unredeemed deposits and revenues from material. In some countries, beverage

[83] Cf. California Department of Conservation, 2007, p. 1; CRI website, Litter taxes and deposit laws: A comparison.
[84] Cf. DPG website, Die DPG in Berlin; Dansk-Retursystem website, Danish deposit and return system.
[85] Polluter pays principle: Those responsible for environmental pollution must pay for cleaning and prevention. (Cf.Bell, S. and McGillivray, D., 2006, p. 265 and p. 266).
[86] Cf. CRI website, Litter taxes and deposit laws: A comparison; CRI website, The New York Deposit Law; Deutscher Bundestag, 2007, p. 4; R3, 2009, Section 10 - 4.
[87] Cf. California Department of Conservation, 2007, p. 1; CRI website, Litter taxes and deposit laws: A comparison; Dansk-Retursystem website, Deposits and fees; Deutscher Bundestag, 2007, p. 4.

manufacturers pay additional registration, packaging and logistics fees to the system operators for steel beverage cans, plastic bottles and glass bottles (e.g., Norway).[88]

In addition to the general mandatory deposit on one-way beverage containers, the following political instruments have already been implemented or are being discussed in some countries:[89]

- State provisions governing the regulations on revenue distribution
- Optimisation/simplification/extension of the deposit and return obligation to include further one-way beverage packaging (e.g. through cancellation of exemption provisions concerning the mandatory deposit)
- Introduction of minimum recycling rates or minimum return ratios
- Special taxation on one-way beverage containers, depending on the recycling rate
- Information campaigns for consumers respecting the ecological impacts of one-way beverage containers and correct handling of the deposit system

B 2.4 Success factors and results

Table 30: Success factors and results in the deposit system for one-way beverage packaging; here: resources consumption and climate change

Ecological	
Resources consumption and climate change	• A one-way beverage container is used only once before being disposed of as packaging waste. Relative to the product quantity, significantly more resources and energy are used for one-way beverage containers than for refillable beverage containers. One-way beverage containers therefore contribute more to environmental damage and climate change if medium and short transport distances are concerned. • One-way beverage containers cannot be directly reused as such and therefore cause more packaging waste than refillable beverage containers.[90] • With respect to greenhouse gas emissions, long transport distances may counterbalance the ecological advantages of refillable beverage containers when compared to one-way beverage containers. • Deposits systems for one-way beverage containers lead to high collection and recycling rates of mono-fraction packaging material and this promotes the use of recyclates in the production of new products which, in turn, reduces resources consumption.[91]

[88] Cf. Vogel, G. 2009, p. 22.
[89] Cf. Grytli, J., 2002, p. 8; EEA, 2005; Packaging Ordinance § 1 (1)–(3); Roland Berger, 2007, p. 4; Massachusetts-Sierra Club website, Update the Bottle Bill; Dansk-Retursystem website, Danish deposit and return system.
[90] Cf. IFEU, 2008, p. 104 ff.; Prognos et al., 2002, p. 220.
[91] Cf. Prognos et al., 2002, p. 94.

Table 31: Success factors and results in the deposit system for one-way beverage packaging; here: other impact categories of life-cycle assessments, refillable rate and return rate

Other impact categories of life-cycle assessments	• Due to one-time use, when compared to refillable packaging, one-way packaging has ecological disadvantages with respect to the impact categories: summer smog, acidification and eutrophication.[92] • A further aspect that is frequently not considered in life-cycle assessments is the interaction between packaging and the product. There is still a need for research with respect to beverage cartons and PET bottles (see also p. 87).
Refillable rate	• Depending on the design, a mandatory deposit on one-way packaging can also serve as an instrument for stabilising and, to the extent possible, increasing refillable rates since, due to the deposit, one-way beverage containers are equal to refillable beverage containers with respect to the efforts involved for consumers (who must return the beverage containers if they want their deposit back).
Return rate	• Beverage packaging return rates are generally very high in mandatory one-way deposit systems. Impacted by the deposit amount, they average more than 80 %, and in some countries even 95 %. • The return rate of one-way beverage containers depends on the amount of the deposit. The return rates in countries with high deposit amounts are very high (Germany: 98.5 %, deposit € 0.25 [93]). In Michigan, the mandatory one-way deposit was doubled to the amount of USD 0.10 (ca. € 0.08). As a result, the highest return rate (95 %) could be achieved in the USA.[94] • Legally prescribed exceptions concerning the mandatory deposit (e.g., for specific beverage segments, packaging material or packaging sizes) as well as a form of return options that has little appeal to consumers, may have a negative impact on return rates as they impair the comprehensibility and transparency of the system.[95] • Ultimately, the clarity and comprehensibility of legal regulations as well as clear packaging labelling influence the return rates.

[92] Cf. Prognos et al., 2000, p. 278 ff.
[93] Cf. DPG, in: Deutsches Dialog Institut, 2010, p. 12.
[94] Cf. CRI, 18.12.2003, p. 2.
[95] Cf. ECOLAS, N. V. and PIRA, 2005, p. 214 f.; Pladerer, C., 2009, p. 36 ff.; Vogel, G., 2009, p. 19 f., p. 33, p. 60 f.

Table 32: Success factors and results in the deposit system for one-way beverage packaging; here: recovery rate, disposal, ecological packaging (re)design and littering

Recovery rates (recycling + energy recovery)	• In a deposit system for one-way beverage containers, mono-fraction collection and increased return rates contribute to raising the recovery and recycling rates. [96] • Mandatory one-way deposit systems promote high-quality, mono-fraction recycling. In some countries, a relevant and increasing proportion of the one-way (plastic) beverage containers that are disposed of are consigned to bottle-to-bottle recycling, which is hardly possible from mixed collection. In almost all collection systems, glass is collected as a mono-fraction and consigned to closed-loop recycling. • In countries where there is either an inadequate infrastructure or no infrastructure at all for the recovery of one-way beverage containers taken back, the collected materials are usually exported.
Disposal	• The higher the return rate and the more mono-fraction the collected material is, (e.g. also plastics sorted according to colour), the greater the proportion of packaging materials that goes into recycling and the smaller the proportion that is being disposed of. Separately collected one-way beverage containers collected within the scope of deposit systems are generally entirely consigned to recovery.
Ecological packaging (re)design	• In principle, the increased efforts required for operating a mandatory one-way deposit system (in comparison to a situation without a deposit system for one-way beverage containers) may create incentives for packaging innovations. However, it has not been determined so far that there is a direct causal connection between ecological packaging innovations (e.g. weight reduction) and the introduction of a deposit system.
Littering	• Mandatory one-way deposit systems contribute significantly to reducing littering of deposit one-way beverage containers.[97] • In Germany, before the mandatory deposit was introduced, littering of one-way beverage containers was estimated to amount to one fifth of all litter. The currently reported high return rates of deposit beverage containers indicates that, in a deposit system, littering of deposit one-way beverage containers practically no longer occurs.[98]

[96] Cf. CRI, Beverage Container Legislation in Sweden; R3, 2009, Section 10 - 7 ff.; California Department of Conservation, 09.09.2009; CRI website, Litter taxes and deposit laws: a comparison.
[97] Cf. CRI website, Litter studies in seven Bottle Bill states.
[98] Cf. Witzenhausen-Institut, 2001, p. 6; Resch, J., 2009 a, pp. 48–49.

Table 33: Success factors and results in deposit systems for one-way beverage containers; here, system costs

Economic	
System costs	• System costs (e.g. costs for the collection system, recycling, handling, reverse vending machines, deposit clearing) are largely borne by beverage manufacturers and retailers.[99] A cost analysis carried out by the Swedish system operator Returpak shows that revenues slightly exceed costs.[100] However, many stakeholders presently do not make any official information regarding costs and financing sources available.[101] • The initial cost burden for retailers in a one-way deposit system is relatively high as retailers must ensure that beverage packaging is taken back. However, retail in particular can compensate for all costs over the medium term through a well-organised and well implemented one-way deposit system, through materials revenue and via handling fees such as those applied in Sweden.[102] Costs are lower for beverage manufacturers since here, only the labelling has to be adjusted.

[99] Cf. CRI website, Litter taxes and deposit laws: a comparison; CRI website, The New York Deposit Law; Deutscher Bundestag, 2007, p. 4; R3, 2009, Section 10 - 4.
[100] Cf. Vogel, G., 2009, p. 16.
[101] Cf. R3, 2009, Section 10 - 4.
[102] Cf. Vogel, G, 2009, p. 16.

Table 34: Success factors and results in deposit systems for one-way beverage packaging; here, system revenues and distribution of costs between public authorities and the private sector

System revenues	• If the use or allocation of unredeemed deposits is legally regulated, these amounts then accrue to the authorities themselves or to the bodies designated by them.[103] If no legal regulations exist, trade or the beverage manufacturers decide independently on the use of unredeemed deposits.[104] • Unredeemed deposits can cover system costs completely or at least in part (depending on the amount). In the event of high return rates, this refinancing effect due to unredeemed deposits is not to be expected. If system participants (trade and/or beverage manufacturers) receive earnings from unredeemed deposits, there is generally no public information available regarding the extent to which system participants re-invest these earnings in the one-way deposit system. • Moreover, in one-way deposit systems other system revenues are earned through the sale of secondary materials (returned packaging material taken back): These can be used to refinance the system costs. Depending on the design of the one-way deposit system, materials revenue accrues to retailers, the system operators, or to authorities. Since, for example, PET bottles must no longer be separated from other packaging and cleaned, as is the case with PET bottles from a Green Dot system, it is to be assumed that PET bottles from one-way deposit systems will achieve higher prices. As PET bottles from a one-way deposit system usually achieve appropriate revenues on the secondary materials market, it is to be assumed that they will be consigned to recycling and not to energy recovery.[105]
Distribution of costs between the public sector and the private sector	• The industry, i.e. beverage manufacturers and retail, usually bear the system costs. In some cases, when authorities are responsible for steering and controlling the system, the authorities demand fees from beverage manufacturers and retail in order to cover these costs.

[103] Cf. California Department of Conservation, 2007, p. 1; CRI website, Litter taxes and deposit laws: a comparison; Dansk-Retursystem website, Deposits and fees.
[104] Cf. Deutscher Bundestag, 2007, p. 4.
[105] Interview with industry experts.

Table 35: Success factors and results in deposit systems for one-way beverage containers; here: implications for regional, national and international economic zones and implications for SMEs and LCs

Implications for regional, national and international economic zones	• Very good recovery and usage markets exist for high quality, separately collected and sorted material fractions, such as those resulting out of a one-way deposit system. It can be assumed that these markets will be further strengthened by a deposit system. • An international comparison shows a differentiated picture for the glass fraction: in the eleven US federal states that have a mandatory one-way deposit system, the glass industry receives sufficient secondary material for use in new products almost exclusively from deposit glass collections. In Germany, by contrast, an extensive, dense network of old glass collection points already existed before the mandatory deposit was introduced. It can be determined here that the use of one-way glass as a packaging material has been strongly retrograde in recent years. • When a deposit system is being designed, attention should be paid to the fair distribution of costs and revenues among the system participants so that competitive distortions or one-sided financial burdens are prevented.
Implications for small and medium sized companies (SMCs) and for large companies (LCs)	• Due to the respective national specific requirements for deposit systems, the additional expense incurred by an international LC when supplying international markets may be lower if country-specific bar codes must be printed directly onto labels or, in the case of cans, directly onto the containers, and the bar code labelling is subject to certification. Stabilisation or an increase in the refillable rate as a result of the introduction of a mandatory deposit system for one-way beverage containers may impact positively on SMCs (see also explanations concerning refillable systems).

Table 36: Success factors and results in deposit systems for one-way beverage systems; here: implications for regional, national and international economic zones, and implications for SMCs and LCs

Implications for international competition	• It is possible that national system requirements cause additional costs and so make market entry for importers more difficult. This relates, in particular, to the subsequent labelling of one-way beverage containers at international SMCs where converting the labelling in production is not worthwhile due to the low quantity exported to Germany.[106] • In regions close to borders, difficulties may arise from cross-border trade. In principle, bilateral agreements may help to compensate for competitive distortions.
Start-up difficulties	• When systems start there may be temporary delays - for example as a result of shorter implementation periods, a lack of controls or due to structural problems associated with the implementation of statutory requirements - in the introduction of a comprehensive one-way deposit system. This applies, in particular, to correct labelling and to providing consumers with return options. Start-up difficulties may also occur in the clearing procedure as the necessary infrastructure with the pertaining (IT) systems must first be established, and coordination requirements among those involved in clearing may be higher during the start-up phase.[107] • The extent of the start-up difficulties depends on consistency and clarity in the implementation of regulations as well as on acceptance of the regulations by stakeholders from trade and the industry. • Consumers' need for information, which has already been explained in the description of refillable deposit systems (see p. 51), also applies accordingly to deposit systems for one-way beverage packaging in order to ensure that the system functions and that it is accepted by consumers.

[106] Cf. Roland Berger, 2007, p. 41.
[107] Cf. DPG, 2008, p. 61.

Table 37: Success factors and results in deposit systems for one-way beverage packaging; here: stability of the system and product diversity

Stability of the system	• The stability of the system can be endangered mainly by free riders (importing small quantities without reporting them to the import authorities and subsequent domestic sale without a deposit), due to inconsequent implementation or inadequate enforcement and also due to a return infrastructure and labelling that is not consumer-friendly. • Due to mono-fraction collection, a one-way deposit system is likely to achieve higher and more stable revenues as the quality of the collected packaging is higher than is the case with Green Dot systems. Given similar conditions, this leads to deposit systems being less affected by difficult market conditions than Green Dot systems.
Social	
Product diversity	• The market situation in some countries indicates that a market which is supplied entirely with one-way beverage packaging shows lower product or manufacturer diversity. In the USA, beer is mainly sold in one-way beverage containers and is distributed by only three brewery groups. By contrast, the refillable rate in Germany is 86 %[108] in the beer segment and there are more than 1,300 breweries.[109] • One-way beverage packaging tends to be used by large companies, while smaller companies are more likely to use refillable beverage containers for filling. The existence of numerous small manufacturers can give rise to higher product diversity that is not promoted by one-way beverage containers. • Relative to the diversity of packaging forms, the advantage of one-way beverage containers is that they can be adapted more swiftly.

[108] Cf. GVM, 2009 b, p. 11.
[109] Cf. Deutscher Brauer-Bund, 2009, p. 3; Institute for Local Self-Reliance, 2002, p. 1; Resch, J., 2009 a, p. 29.

Table 38: Success factors and results in deposit systems for one-way beverage packaging; here, product price, employment and system misuse

Product price	• The framework conditions and the design of a one-way deposit system impact on the cost efficiency of the system. If system revenues (from unredeemed deposits or materials revenue earned) exceed the costs for system participants, they can reduce prices. If, by contrast, costs exceed the system revenues earned by retail or beverage manufacturers, the costs may possibly be passed on to consumers and so impact the product price. Costs can also be passed on retrogressively in the supply chain so that the price for consumers is not further affected. It is not possible to determine whether costs and revenues are actually passed on to consumers as corresponding information is usually not published. To date, an open, comprehensible and documented price increase due to cost burdens associated with a mandatory one-way deposit is not known.
Employment	• In a one-way deposit system, the take-back of beverage containers leads to additional personnel being required for taking back empties or for operating reverse vending machines (e.g. cleaning, maintenance) as well as for transport, counting centres, clearing services and recycling capacities. As a consequence, additional workplaces can be created, compared to a situation where there is no deposit system for beverage packaging.
System misuse	• System misuse or violations of the system involve, for example, failure to charge a deposit, missing, incorrect or inadequate labelling of one-way beverage containers, refusing to participate in the system and refusing to pay the prescribed fees to the system operator or to governmental authorities or agencies designated by the authorities. In some cases, all of these listed violations have occurred. However, as far as is known, these were always individual cases that did not lead to the existence of the deposit system being endangered. • In almost all countries, monetary fines have proven effective for preventing and penalising system misuse and violations.[110]

[110] Cf. BMU, April 2009, p. 6; Packaging Ordinance § 15.

Table 39: Success factors and results in deposit systems for one-way beverage packaging; here: extended product responsibility and consumer behaviour and littering

Extended product responsibility and consumer behaviour	• In deposit systems for one-way beverage containers, beverage manufacturers and retailers bear the entire extended product responsibility. In principle, beverage manufacturers should already minimise the negative impacts of one-way beverage containers on the environment during the product development stage.[111] In the waste hierarchy, the prevention of waste is given highest priority. According to the European five-stage Waste Framework Directive, recycling is to be given preference over energy recovery. While a deposit system for one-way beverage containers contributes significantly to high-grade recycling of beverage packaging (instead of being used for energy recovery or disposed of), this does not provide stakeholders with a direct incentive to avoid waste. • Consumers are generally informed about the deposit system via information campaigns. • The design of the practical return options for empty, one-way beverage containers can influence consumer behaviour: If it is not possible to return empties at all POS, there is an increased risk that consumers will not return the empty beverage containers – despite having paid a deposit. • Another positive (although not primarily intended) effect of a deposit system that has sometimes been observed is that socially deprived persons collect and return deposit bottles in order to earn some income. In US states with a mandatory deposit system, in particular, people from this group form a significant element of all those who return packaging.[112]
Littering	• A deposit increases consumers' willingness to return used one-way beverage containers and not to dispose of them in household waste or in public areas. If deposit beverage containers are nevertheless disposed of in public areas, the deposit causes other people to collect the containers and hand them in.

[111] Cf. CIWMB website, About ERP; KrW-/AbfG, § 22.
[112] Interview with industry experts.

B 2.5 Preliminary Assessment

 = System's influence on the indicator is very positive

 = System's influence on the indicator is predominantly positive

 = System's influence on the indicator is slightly positive or negative

 = System's influence on the indicator is mainly negative

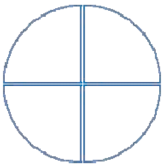
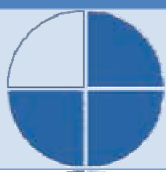
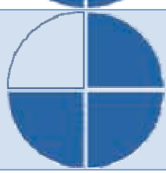
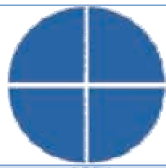
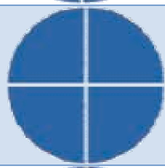
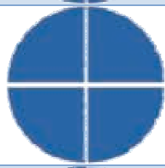
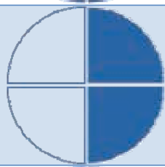
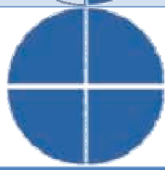
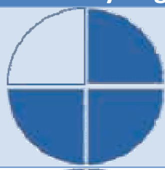
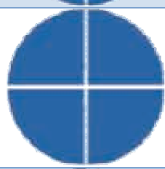
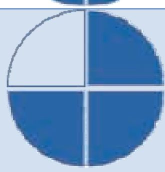
 = System's influence on the indicator is very negative

Table 40: Preliminary assessment of the deposit system for one-way beverage packaging

Ecological (a positive influence means efficient reduction of environmental pollution in relation to the goals defined for the system)	
Resources consumption and climate change	
Other impact categories of life-cycle assessments	
Refillable rate	

Return rate	
Recovery rate (recycling + energy recovery)	
Disposal (reducing the volume to be disposed of)	
Ecological packaging (re)design	
Littering	
Economic (here, cost efficiency is evaluated i.e. also in respect of the degree of target achievement, i.e., the costs incurred by the system are not only negative)	
System costs	
System revenues	
Distribution of costs between government and the public and the private sector (positive influence means lower costs for the government)	
Implications for small, regional beverage manufacturers (compared to refillable beverage containers)	One-way beverage containers in general (regardless of the collection system): 
Implications for large, international beverage manufacturers (compared to refillable beverage containers)	One-way beverage containers in general (regardless of the collection system):

	◕
Implications for international competition	◑
Start-up difficulties (positive influence means less start-up difficulties)	◑
Stability of the system	◕
Social	
Product diversity	◑
Product price	◑
Employment	◕
System misuse	◑
Extended producer responsibility and consumer behaviour	●
Littering	●

B 3 Mainly curbside collection- and recovery systems

B 3.1 Targets and scope

The legal framework for the collection or recovery of packaging is provided by the EU Packaging Ordinance according. The Ordinance aims to "...harmonise national measures in order to prevent or reduce the impact of packaging and packaging waste on the environment and to ensure the functioning of the Internal Market"[113]. In detail, the absolute waste volume in the EU member states is to be reduced, the reuse (refilling) of packaging is to be promoted, recycling and recovery rates are to be increased, and the disposal rate is to be reduced.[114]

In addition to the general goals of the EU Packaging Ordinance, Section 6 of the Ordinance defines specific quantitative targets that are summarised in Table 41. The ordinance specifies two objectives. The first targets (columns 2 and 3) had to be met by the member states by 2001. Other, more differentiated and overall higher targets (columns 4 and 5) had to be attained by the end of 2008.[115] The targets apply to the total volume of national packaging. Specifically, in accordance with Section 3 of the Ordinance, they encompass not only the curbside collection of waste but all sales packaging, secondary packaging and transport packaging[116].

Table 41: Recycling and recovery targets of the EU Packaging Ordinance; source: EEA, 2005, p. 10

Material	Recycling target 2001 as a %	Total recovery target 2001 as a %	Recycling target 2008 as a %	Total recovery target 2008 as a %
Glass	15	-	60	-
Paper/carton	15	-	60	-
Metals	15	-	50	-
Plastics	15	-	22.5	-
Wood	15	-	15	-
Total	**25–45**	**50 to max. 65**	**55–80**	**min. 60**

These targets generally apply to all member states. There are some exceptions in individual cases, however (e.g., for Ireland), and extended time-limits for the new member states.[117] The requirements of the EU Packaging Ordinance have been implemented in national law in all member states. However, the individual states have the possibility to exceed the targets specified in the Ordinance. Austria, for example, requested that the recovery ratios specified by the EU for 2008 already be met in the year 2007.[118]

The ordinance relates to packaging as a whole and is not directed towards beverage packaging alone. The member states themselves determine how the reuse, recycling and recovery goals defined in the

[113] EU website, packaging and packaging waste
[114] Cf. ibid
[115] Cf. 94/62/EG, Art. 6.
[116] Cf. 94/62/EG, Art. 3; The EU requirements are also implemented in German law. The described dual systems, however, are responsible only for sales packaging and secondary packaging. Commercial waste in quantities similar to curbside collection volumes can also be recovered via the dual systems but the manufacturer is not obliged to consign the recovery waste to these systems.
[117] Cf. EEA, 2005, p. 10 and p. 11.
[118] Cf. EUROPEN, 2008 b, p. 2 and p. 3.

ordinance are to be achieved and how the respective systems are to be organised. This means that, in order to support target achievement, the member states can issue not only ambitious recovery rates but also special regulations for certain types of packaging such as a mandatory deposit on beverage packaging or quotas for ecologically advantageous packaging such as refillable systems.[119]

Collection systems where consumers separate and collect household waste are one way to recover beverage containers. The collection system operator picks up the packaging directly at the households (pick-up system) or at near-by collection containers (bring system) and then consigns the packaging to recycling or energy recovery.[120] In Europe, in particular, such systems were introduced in many countries as a response to the European Packaging Ordinance[121].

Germany was the first country in Europe to introduce such a collection system involving the principle of producer responsibility. Duales System Deutschland GmbH (DSD) was responsible for the organisation of the collection system and used the “Green Dot” as the system identification mark. Meanwhile, the Green Dot is an established synonym for curbside collection and recovery systems. The German model became the orientation model for many other EU member states and also for the EU Packaging Ordinance.[122]

Significant issues in this type of system vary greatly among the various EU member states, for example in the number of Green Dot organisations, the intensity of competition among Green Dot system operators and the responsibilities of those participating in the various systems. [123]

Within the scope of implementing such systems, the organisation of recovery differs greatly in the individual member states and ranges from a central organisation where all (beverage) manufacturers and distributors are required to register and pay contributions (e.g., Italy), through to an open system with intense competition where every company can act as a recovery organisation if it fulfils defined criteria (e.g., Great Britain).

Another significant difference relates to the implementation of producer responsibility or the financing requirements to be met by producers, respectively. In Germany and Austria, producers are responsible for the entire system costs (full cost model - extended producer responsibility), whereas in other countries they are responsible for only some of the costs, and the public sector is responsible for the remaining portion (partial cost model - shared producer responsibility).[124] How the target quotas are met is also of importance. Some countries such as Great Britain and Austria, for example, meet EU targets largely through the collection and recovery of transport packaging and secondary packaging that arise at production plants or at retailers' sites. This is a means to avoid or limit the more cost-intensive collection of curbside waste, which is more difficult to recycle as the targeted sorting of packaging waste is not ensured. [125] In other countries such as Germany, the EU quotas are also generated through curbside collection.

[119] Cf. EGH, C-463/01 and C.309/02.
[120] Cf. EEA, 2005, p. 65 f.
[121] Cf. Ordinance 94/62/EG.
[122] Cf. Perchards, 2005, p. 167.
[123] Cf. Perchards, 2005, p. 179; EEA, 2005, p. 66.
[124] Cf. Perchards, 2005, S. p.79; EEA, 2005, p. 66.
[125] Cf. EEA, 2005, p. 66.

Generally, only one-way beverage containers are collected within the framework of Green Dot systems. The present study deals exclusively with beverage packaging and pertaining secondary packaging that typically occur in households. Transport packaging and secondary packaging that occur at packaging and beverage producers are therefore not taken into account.

B 3.2 Roles, responsibilities and processes

The following table summarises the fields of responsibility of the stakeholder groups:

Table 42: Roles and responsibilities of stakeholders in Green Dot systems; here: packaging manufacturers

Packaging manufacturers	• The legal regulations governing packaging waste and the pertaining responsibilities usually concern beverage manufacturers. i.e., the users of beverage packaging.[126] Consequently, the packaging manufacturer has no legally prescribed duties. One exception is Great Britain, where packaging manufacturers are obliged to bear 9 % of the recovery responsibility.[127] • Packaging manufacturers are obliged to develop packaging in accordance with the requirements of food law, the customers (advertising effect and user-friendliness) and logistics as well as those of trade (breakage resistance and handling in storage and shops).

[126] Cf. Perchards, 2005, p. 169.
[127] Cf. Perchards, 2005, p. 183; RIGK, 2006, p. 2.

Table 43: Roles and responsibilities of stakeholders in Green Dot systems; here: beverage manufacturers and wholesalers/retailers

Beverage manufacturers	• Basically, the roles and responsibilities of beverage manufacturers, brand owners and importers concerning one-way beverage packaging comply with those of the Green Dot system in Germany (see Section C 1.4). According to the legal regulation, either the importer or the beverage manufacturer is largely responsible for registering with a recovery organisation and paying the respective fees concerning packaging waste that occurs in private households. • In practice, brand owners that may assume various roles in the supply chain are usually responsible for registration, the payment of fees and for reporting. It is assumed that, on the basis of civil law regulations, brand owners can pass on fees and costs within the supply chain. (This passing on of costs and fees is not legally prescribed, however.)[128] One exception is Great Britain, where the fees are defined and spread over the supply chain on a prorated basis and all those participating in the supply chain are responsible for reporting.[129]
Wholesalers and retailers	• When a wholesaler or retailer is also the brand owner, the responsibilities are the same as those borne by beverage manufacturers, brand owners and importers.[130] • In some countries, wholesalers and retailers are obliged to take back packaging from the consumer and pass it on to the manufacturer[131] or they may voluntarily decide to take back packaging.

[128] Cf. Perchards, 2005, p. 168 and p. 169.
[129] Cf. ibid.
[130] Cf. Perchards, 2005, p. 182.
[131] Cf. OECD, 2001, p. 57.

Table 44: Roles and responsibilities of stakeholders in Green Dot systems; here: consumers

Consumers	• If a system for the separate collection of packaging from private households exists, consumers are informed accordingly and are asked to act in compliance with the system requirements, i.e., to separate packaging as instructed. • Packaging is collected via a pick up and/or a bring system. A bring system always means additional efforts for consumers. Within the scope of Green Dot systems, both pick-up and bring systems as well as material-based combinations are possible. • In Germany, for example, (and with significant regional differences) the yellow bag or yellow bin are common pick-up systems for sales packaging made of plastic, metal or composite material, whereas glass, and in some cases also paper, are largely collected in a bring system.[132] In some regions all the various packaging materials are collected via a bring system at a waste collection centre. The situation is similar in some member states such as Great Britain, where mainly bring systems are used for household packaging.[133]

[132] Cf. Kern, M. und Siepenkothen, H.-J., 2005, p. 560 f.
[133] Cf. Kummer, B., 28.03.2007.

Table 45: Roles and responsibilities of stakeholders in Green Dot systems; here: system operators

System operators	• System operators are either Green Dot organisations or waste management organisations (recyclers, collection firms, recovery firms) that have concluded contracts with brand owners.[134] These contracts include the obligation to meet the take-back and recovery duty of the brand owner in exchange for payment. Throughout Europe, the umbrella organisation, PRO EUROPE, is responsible for promoting the cooperation among Green Dot systems.[135] • Some member states decided against permitting competition among the system operators and approved only one national Green Dot organisation.[136] Austria, Finland and Ireland are examples of this.[137] • In other countries such as Great Britain and Germany, competition among recycling and recovery organisations is subject to targeted promotion. There are indications, however, that these measures make the systems more complex and reduce transparency.[138] In these cases it is more difficult for public authorities and the executing authorities to assess the effectiveness of the system, i.e., the contribution to achieving targets regarding national implementation of the EU Packaging Ordinance and the quality of collection and the collected recycling materials.

[134] Cf. ecologic and IEEP, 2009, p. 19.
[135] Cf. DSD-GmbH website, PRO EUROPE.
[136] Cf. Perchards, 2005, p. 206.
[137] Cf. ibid.
[138] Cf. EEA, 2005, p. 66 f.

Table 46: Roles and responsibilities of stakeholders in Green Dot systems; here: waste management companies, public authorities and regional and local authorities/ public disposal agencies

Waste management companies	• Waste management organisations can cooperate with system operators or they themselves function as system operators and compete with other providers. The roles and responsibilities depend on how the respective local authorities implement the EU Packaging Directive into national law.[139] • Collected one-way beverage packaging is to be recycled by a waste management company if this is technically feasible and economically reasonable. If this is not so or if the legally prescribed materials quotas are met, the packaging may be consigned to energy recovery. Presumably, this depends on the profitability of recycling: If profit can be generated with recycling it is probable that more materials will be recycled than the legally defined quotas. When formulating recycling quotas, no differentiation has yet been made between closed-loop recycling (e.g., the manufacture of new bottles from glass or PET bottles) and open-loop recycling (e.g. synthetic fibres for textile production are made of PET bottles, or corrugated cardboard is made from beverage cartons).
Government authorities	• Government is responsible for implementing the EU Packaging Ordinance into national law and must ensure that implementation leads to observance of the EU Ordinance. Government is also responsible for ensuring compliance with national provisions and the resulting responsibilities for brand owners. An international comparison indicates that there are significant differences in the way these legal provisions are being implemented and controlled.[140]
Regional and local authorities / public disposal agencies	• In the shared producer responsibility scheme, (see p. 79) public disposal agencies continue to be responsible for collecting packaging. Via Green Dot systems, they receive contributions from beverage producers for the costs incurred through separate collection. This allowance does not cover all costs, however, and public disposal agencies must therefore also bear some of the costs.[141]

[139] Cf. Perchards, 2005, p. 177 f.
[140] Cf. Perchards, 2005, p. 175 f.
[141] Cf. Perchards, 2005, p. 179.

B 3.3 Financing and steering

A significant differentiation factor among the various Green Dot systems is whether beverage manufacturers are fully responsible for financing the system or whether they contribute only partially to financing (see p. 79).[142]

In addition to the legal provision governing partial or full cost financing, the following factors impact on the amount of the fees: [143]

- Structural and market differences such as population density and the price structure of waste collection companies
- Extent of recycling and recovery targets and definition of specific goals for packaging materials and types
- Structure of the collection system (pick-up systems are generally more costly than bring systems)
- The system's area of responsibility (collection of waste from private households is more costly than the collection of commercial waste)
- Exemption provisions for individual types of packaging
- Monopoly position of a Green Dot system or competition among several Green Dot systems
- Quality of collected and separated materials and the pertaining respective revenue situation on the secondary raw materials market

The amount of the fee to be paid depends on the individual packaging volume of a brand owner. Some of the items mentioned (e.g. regulations regarding competition, exemption regulations) may be used by government authorities to steer the system or to increase the effectiveness of the systems with respect to collection and recovery rates, for example.

[142] Cf. EEA, 2005, p. 71.
[143] Cf. Perchards, 2005, p. 179 and 180.

B 3.4 Success factors and results

Table 47: Success factors and results in Green Dot systems; here: resources consumption and climate change

Ecological	
Resources consumption and climate change	• The introduction of a Green Dot system leads to savings in resources consumption and in greenhouse gas emissions when compared to the disposal of beverage packaging via household waste (which is generally disposed of in landfills and/or through incineration) due to increased recycling and recovery rates, which usually more than compensate for the emissions caused by additional logistics efforts. • Beverage packaging from mixed curbside Green Dot systems is generally not consigned to closed-loop recycling as it is collected together with other types of packaging. Consequently, the reduction potential respecting resources consumption and greenhouse gas emissions is likely to be lower than in the case of deposit systems for beverage packaging. • In order to achieve maximum protection of resources in a Green Dot system, the material must be carefully sorted, initially by consumers and subsequently through precise post-sorting by waste management companies at sorting plants. This is an essential factor for ensuring mono fraction, i.e. material that can be recycled well is sorted out, which enables manufacture of the highest possible quality material. • Generally, beverage cartons are disposed of via Green Dot systems. In the resources consumption and greenhouse gas emission categories, this type of packaging is deemed more advantageous than other one-way packaging such as PET bottles. According to German surveys, for example, beverage cartons are considered to be equivalent when compared to refillable beverage containers in these categories. In order to achieve this result, a high recycling rate must be attained for beverage cartons. The recycling rate is also dependent on the paper portion as generally only this portion is recycled.

Table 48: Success factors and results in Green Dot systems; here: other impact categories of life-cycle assessments, refillable rate and return rate

Other impact categories of life-cycle assessments	• With respect to the impact categories: summer smog, acidification and eutrophication, the disadvantages of non-deposit one-way beverage containers are similar to those of one-way beverage containers that carry a deposit.[144] The impacts of beverage carton packaging in the eutrophication category are higher than those of PET and glass one-way containers (see above). • A further aspect, which is frequently not taken into account in life-cycle assessments, is the interaction between packaging and the product. There is still a need for research concerning beverage cartons and PET bottles. A research project on the possible effects of printer's colours on product and health, e.g. concerning beverage cartons, has currently been commissioned by the German Federal Minister of Food, Agriculture and Consumer Protection.
Refillable rate	• It cannot be assumed that Green Dot systems have a positive effect on the refillable rate. In fact, as they make it relatively easy to dispose of one-way beverage containers, they may even contribute to reducing the refillable rate.
Return rate (in the Green Dot system: collection rate)	• The return quantities depend on whether a pick-up or a drop-off system is concerned, on how attractively the system is designed, and also on consumers' information status and motivation. In this respect, the general settlement structure and the individual social structure of households play an important role. The quantities collected and the quality of packaging material collected in a Green Dot system are generally higher or better in rural areas and in regions with predominantly single-family homes than in densely populated high-rise areas where the collection containers are not controlled socially. In the latter case, sometimes the difference from residual garbage cannot be determined (i.e. incorrectly disposed of waste in both directions: packaging in residual waste and residual waste in the Green Dot system).[145] • Generally, pick-up systems attain higher return quantities than bring systems.[146] However, the quality of the collected packaging is generally higher in bring systems (less incorrectly disposed of waste). • If the labelling and definition of packaging is not transparent or if the collection system is inadequate (e.g. insufficient return options, collection is too infrequent, impractical, unhygienic and unsafe collection containers) an increase in the number of Green Dot containers incorrectly disposed of in other waste is to be expected.

[144] Cf. Prognos et al., 2000, p. 278 ff.
[145] Cf. Witzenhausen-Institut, 2001, p. 11.
[146] Cf. Kern, M. and Siepenkothen, H.-J., 2005, p. 563.

Table 49: Success factors and results in Green Dot systems; here: recovery rate

Recovery rate (recycling + energy recovery)	• The collected one-way beverage containers are to be recovered in keeping with the waste hierarchy if this is technically feasible and economically acceptable. A differentiation is made between recycling and energy recovery. The EU Packaging Ordinance defines quotas for both recycling and energy recovery. Exemption or transitional regulations were defined for some member states, in particular for the new EU member states, with respect to legally defined quotas. • Legislation does not make a distinction between closed-loop recycling (e.g. where new bottles are made from glass or PET bottles) and open-loop recycling (e.g. where plastic fibres for textile production are made from PET bottles, or corrugated cardboard from beverage cartons). • Plastics from Green Dot collections are recycled as well as consigned to energy recovery. As already described, the recycling quota regarding beverage cartons depends on the paper portion as generally only the paper and not the plastics or aluminium portions are recycled (the latter are largely consigned to energy recovery). • While some of the beverage cartons collected in Green Dot systems are recycled, there are indications that, when the material streams are assessed separately, the officially reported quantities of recycled beverage cartons lag behind both the actual and the legally prescribed quotas. Generally it is to be assumed that only the paper portion is recycled. Perusal of authoritative literature indicates that most of the plastics portion is subject to energy recovery but that some of it is also disposed of in landfills.[147]

[147] Interview with industry experts

Table 50: Success factors and results in Green Dot systems; here: recovery rate and disposal

Recovery rate (recycling + energy recovery) (continued)	• The collection and recovery quotas of Green Dot systems and deposit systems are very difficult to compare for various reasons:[148]
	  ○ Green Dot systems take the volume of packaging that they licensed as the starting point for their success in terms of quantity. This licensed packaging quantity, however, is lower than the quantity on the market (for example, due to free riders).
	  ○ The "quantity consigned to recovery" is a further starting point for the quantity-based success of Green Dot systems. It is determined by weighing the output of the sorting plant. The determined quantity contains significant proportions of weight unrelated to packaging as a result of residues or weather influences.
	  ○ Further weight losses occur during the recycling process.
	• The quality of the recovery form may differ strongly depending on the design and framework conditions of the system. Some influencing factors are, for example, incentive systems such as quality bonuses concerning glass collection, a lack of quality standards for individual fractions and, at the same time, intensive competition, the attractiveness of the collection system, the sorting depth as well as surplus capacities or capacity shortages concerning waste incineration plants.
	• Generally, the materials used indicate that separately collected one-way containers can always be recycled. In mixed LWP collection on the basis of Green Dot systems, one-way beverage containers are mixed with other packaging or incorrectly disposed of items, however, and this leads to a more or less high level of impurities and residues, which impairs the quality of recycling.

Disposal	• One-way beverage containers that are incorrectly disposed of in residual waste or which cannot be reused due to impurities are disposed of together with residual waste. Depending on the structure of the waste treatment plants, in most countries this means the incineration of waste in waste incineration plants. In some countries, waste is disposed of in landfills. One-way beverage containers from littering are disposed of through public waste disposal.

[148] Interview with industry experts

Table 51: Success factors and results in Green Dot systems; here: ecological packaging (re)design, littering and system costs

Ecological packaging (re)design	• Due to beverage manufacturers having to share the recovery costs of one-way beverage containers they, together with packaging manufacturers, have a more or less strong incentive to reduce the weight of individual containers. It does not, however, provide an incentive for a mono fraction packaging design that is suitable for recovery.
Littering	• There is no incentive for consumers to reduce littering.
economic	
System costs	• Costs for beverage manufacturers arise primarily through fees for participating in a Green Dot system. A significant point in this respect is whether a full cost or a partial cost model is concerned. Full cost models mean higher costs for beverage manufacturers as they must bear the total costs arising from the system. • The efforts associated with the accountability requirements and the pertaining data survey may be quite high when these requirements are consistently met. Companies must account for the packaging volumes that they put into circulation and also for respective recovery in keeping with the law (e.g. in Germany, a completeness statement). Depending on the definition of the legal regulations, according to civil law this accounting is to be submitted to the recovery organisation (in which case the requirements and, consequently, the costs are generally lower), or to the legislator or a place designated by the government. • Initially, curbside collection does not give rise to costs for retailers. If, however, retailers manufacture their own brands or are obliged to make take-back options available in shops, respective costs will be incurred. For retailers, the cost burden in a Green Dot system is usually lower than in a deposit system. • At present, it has not yet been possible to clearly compare the costs of Green Dot System for manufacturers with the costs of deposit systems. In Green Dot systems, statutory recovery targets are the benchmark; anything above the quotas can be recovered at the optimum price or can be disposed of where appropriate.

Table 52: Success factors and results in Green Dot systems; here: system revenues, distribution between the government and private economy, implications for regional, national and international economic zones, and implications for SMEs and LCs.

System revenues	• Revenues for financing the system arise through the sale of secondary materials which originate from the collected and sorted packaging waste. • As sorting and cleaning efforts are higher in Green Dot systems, revenue potential - in particular with respect to PET bottles - is assumed to be lower than in deposit systems for beverage packaging.[149]
Distribution of costs between government and the private sector	• The distribution of costs between the government and the private economy differs depending on the respective financing model. • In the full-cost model, beverage manufacturers bear the costs and in certain circumstances they are also partially borne by trade. • In the partial cost model, beverage manufacturers and trade make payments through their Green Dot system to municipal waste disposal organisations, which, however, only cover the portion of the costs that arise due to separate collection and recovery of the packaging. The rest of the costs are borne by local authorities/municipalities. The partial cost model is the most frequently used model.
Implications for regional, national and international economic zones	• In countries where, to date, the market for secondary materials is not very well developed, new markets and, consequently, new jobs can be created through a Green Dot system if prices on the global markets are not more attractive. • Further explanations concerning the stability of these markets can be found under the aspect: “Stability of the system”.
Implications for small and medium sized companies (SMEs) and also for large companies (LCs)	• In theory, the regulations concerning Green Dot systems affect SMCs and LCs to an equal extent as all companies pay the same fees. • Administrative requirements affect SMCs more strongly since they often do not have adequate, high-quality information recording systems for establishing quantity flows about packaging.[150]

[149] Interview with industry experts.
[150] Cf. Perchards, 2005, p.185.

Table 53: Success factors and results in Green Dot systems; here: implications for international competition, start-up difficulties and the stability of the system

Implications for international competition	• The obligation to participate in a Green Dot system and the varying reporting and accountability duties in different countries may make market entry difficult for importers, but they do not always impede it.
Start-up difficulties	• Typical start-up difficulties are, as a rule, free riders (non-licensing of packaging subject to a licensing duty), a high proportion of incorrectly disposed of items due to deficient consumer information, existing habits and control mechanisms that are not yet established or which do not function. • In addition, problems arise due to deficient initial financing, difficulties in the coordination with communal disposal organisations, sluggish implementation of the coverage of relevant areas or the structure of functioning logistics and adequate sorting and recycling capacities.
Stability of the system	• On the one hand, the stability of a system is endangered by free riders. Packaging that is not licensed but which is disposed of by means of a Green Dot system endangers the ability to finance the entire system. • On the other hand, Green Dot systems depend on the raw materials and recycling markets. Beneficiation efforts and the quality of secondary materials must be weighed against each other in order to secure refinancing. If the prices for high-quality raw materials (from one-way deposit systems, for example) and primary raw materials should fall, additional payments may have to be made for the sale of low-quality secondary raw materials from Green Dot systems. For example, In Portugal the Green Dot system was faced with financing problems as the recycling of plastic packaging caused very high costs.[151] In Spain, too, the Green Dot system operating there had to strongly increase prices (by 35.8 %), as the amount of packaging material put into circulation within the scope of the economic and financial crisis had dropped and prices on the secondary materials market had fallen. In particular, the prices for licensing beverage bottles were increased.[152]

[151] Cf. European Environment and Packaging Law, 25.09.2009, p. 4.
[152] Cf. European Environment and Packaging Law, 09.12.2009, p. 6 and p. 7.

Table 54: Success factors and results in Green Dot systems; here: product diversity, product price, employment and system misuse, extended product responsibility, consumer behaviour and littering

Social	
Product diversity	• The fact that beverage packaging can be disposed of via a Green Dot system does not contribute positively to product diversity, but basically, it does not limit it.
Product price	• A Green Dot system can impact on the product price if the resulting costs are refinanced by manufacturers and trade through a higher product price. However, costs can also be offset within the supply chain.
Employment	• Depending on the system design, a Green Dot system can have a positive impact on overall employment. In Germany, for example, 17,000 new workplaces were created due to the introduction of the Green Dot system.[153]
System misuse	• System misuse occurs due to the non-licensing of packaging that is subject to a license but which is nevertheless disposed of by consumers through the Green Dot system. • Items that are incorrectly disposed of by consumers due to careless sorting can also be regarded as system misuse.
Extended product responsibility and consumer behaviour	• In a partial costs system, extended product responsibility is implemented only to an inadequate extent as beverage manufacturers and trade must only bear some of the costs. • In full cost systems, manufacturers assume comprehensive cost responsibility for their products. However, usually no specifications are issued about the quality of recycling and reuse (refilling) is not promoted. • Consumer behaviour is a decisive success factor for Green Dot systems also: The system only functions when consumers responsibly carry out the pre-sorting task in their own households and also perform the bring function. Consumers only have a financial incentive to participate in a Green Dot system if household waste charges are to be paid depending on the quantity. When products are consumed away from home, the question is whether consumers will act responsibly and take the empty beverage containers back home with them or if they will throw them into a collection bin, dispose of them by littering, or put them into a public waste bin.
Littering	• It is possible that the aspect of littering is mentioned within the scope of public relations work by Green Dot systems. Whether PR measures actually have an effect in practice is doubtful given the littering practice.

[153] Cf. ECOLAS, N. V. and PIRA, 2005, p. 189.

B 3.5 Preliminary assessment

 = System's influence on the indicator is very positive

 = System's influence on the indicator is mainly positive

 = System's influence on the indicator is slightly positive or negative

 = System's influence on the indicator is mainly negative

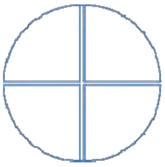
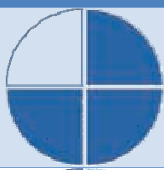
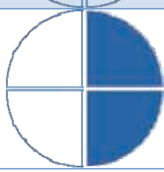
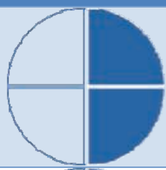
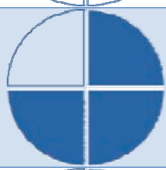
 = System's influence on the indicator is very negative

Table 55: Preliminary assessment of Green Dot systems

Ecological (a positive influence means an efficient reduction in environmental pollution in relation to the targets defined for the system)	
Resources consumption and climate change	
Other impact categories of life-cycle assessments	
Refillable rate	
Return rate	

Recovery rate (recycling + energy recovery)	
Disposal (reduction of the volume to be disposed of)	
Ecological packaging (re)design	
Littering	
Economic (the cost effectiveness of the system is assessed here, i.e., costs caused by the system are not only negative	
System costs	
System revenues	
Distribution of costs between the government and the private economy (positive influence means lower costs for the government)	
Implications for small, regional beverage manufac-turers (compared to refillable beverage packaging)	One-way beverage containers in general (regardless of the collection system): 
Implications for large, international beverage manu-facturers (compared to refillable beverage contain-ers)	One-way beverage containers in general (regardless of the collection system): 

Implications for international competition	
Start-up difficulties (positive influence means less start-up difficulties)	
Stability of the system	
Social	
Product diversity	
Product price	
Employment	
System misuse	
Extended producer responsibility and consumer behaviour	
Littering	

C The Situation in Germany

C 1 Description of the systems used in Germany

There are three parallel systems for the collection and recovery of beverage containers in Germany. In addition to the voluntary deposit system for refillable beverage containers, there is a mandatory deposit system for specified one-way beverage containers and separate, mandatory curbside collection of one-way beverage containers that are not subject to a mandatory deposit - so-called dual systems (the first Green Dot system worldwide).

The characteristics of the three systems are analysed in the following sections. Initially, the legal fundamentals and objectives of the systems are presented. This is followed by a description of the scope and delimitations and of the function and processes of the systems. In addition, the characteristic aspects of the systems - such as stakeholders, roles and responsibilities, the implementation of product responsibility, financing mechanisms, as well as system control and system steering - are discussed in detail.

C 1.1 Legal fundamentals and objectives

C 1.1.1 The deposit system for refillable beverage containers

The use of refillable beverage containers has a long tradition in Germany. To a large extent, a number of beverage producers use a common refillable bottle system with standard bottles but some beverage producers also use individual refillable bottles (see p. 39).

It is in the interest of beverage producers who use refillable bottles to have the refillable bottles returned, as only then can the bottles be refilled. In order to achieve a high return rate, beverage producers voluntarily charge a deposit on refillable bottles. In this way, beverage producers who sell beverages in refillable containers ensure that their beverage packaging is returned by consumers and that it can be refilled.[154]

The introduction of deposit systems for refillable bottles in Germany is based on voluntary initiatives of the industry. Consequently, there is no legal basis for the deposit system respecting refillable beverage containers. Nevertheless, the Packaging Ordinance defines a goal for the stabilisation and promotion of ecologically beneficial beverage packaging, such as refillable beverage containers. Under Section 1 (2), the Packaging Ordinance stipulates that the proportion of beverages filled into refillable beverage containers and into ecologically beneficial one-way beverage containers (MövE) should reach at least 80 %[155].

C 1.1.2 The deposit system for one-way beverage containers

Since 1 January 2003, a number of one-way beverage containers have been subject to a mandatory deposit, which is governed by Section 9 of the Packaging Ordinance.

[154] Cf. Institute for Local Self-Reliance, 2002, p. 2.
[155] Before the introduction of this quota for MövE in 2005, the Packaging Ordinance stipulated a target quota of 72% (cf. BMU, April 2009, p. 10) for refillable beverage containers only.

The mandatory deposit system was introduced as a consequence of repeated underachievement of the predefined refillable rate of 72% (which, today, is replaced by the MövE quota of 80%, see above), as legally stipulated in the Packaging Ordinance. The goals to be achieved through the introduction of a mandatory deposit system can be summarised as follows:

1. Promotion of refillable beverage packaging and ecologically beneficial beverage packaging [156]
2. Promotion of the recycling of packaging waste through increased return rates and the targeted sorting and collection of one-way beverage containers [157]
3. Reduction of littering caused by beverage packaging waste [158]

C 1.1.3 The dual systems

The Packaging Ordinance also serves as the legal basis for the dual systems. Section 6 of the Packaging Ordinance governs the duty of manufacturers and distributors to ensure the comprehensive return of sales packaging that originates from private consumer use.

Initially, the Packaging Ordinance and the introduction of the dual systems were aimed at instigating a turnaround relating to the reduction of packaging waste volumes and at a rejection of the throw-away society. The fundamental approach of the regulation was the "Polluter Pays Principle", which was implemented in the form of extended product responsibility for the manufacturers[159] and distributors [160] of products. Starting from 1991, the industry was thus required to take back packaging after it had been used and to finance or cooperate in its disposal, which hitherto had been the responsibility of public waste disposal firms. This measure was aimed at providing an incentive to reduce waste.[161] The former monopoly of Duales System Deutschland GmbH (DSD) was discontinued in 1998 for reasons of competition law. Since then, several dual systems compete in the market for the disposal of packaging originating from private end-consumer use.

The guiding principle of the Packaging Ordinance stipulates that packaging waste shall be avoided as far as possible. Where this is not possible, the reuse (refilling) and recycling of packaging shall take priority over energy recovery and disposal.[162] The Packaging Ordinance specifies requirements for the recovery of packaging - including beverage containers - collected within the scope of dual systems in the form of minimum recycling rates for glass (75%), tinplate (70%), aluminium (60%), paper, cardboard and cartons (70%), and composite packaging such as beverage cartons (60%). [163]

[156] Cf. BMU, April 2009, p. 10.
[157] Cf. bifa, 2010, p. 43.
[158] Cf. Deutscher Bundestag, 2008, p. 3 and p. 4.
[159] "A manufacturer within the meaning of this Ordinance is any party that manufactures packaging, packaging materials or products from which packaging is directly manufactured, and any party that imports packaging into the territorial scope of this Ordinance." (Packaging Ordinance, § 3 (8)).
[160] "A distributor within the meaning of this Ordinance is any party that puts into circulation packaging, packaging materials or products from which packaging can be directly manufactured, or goods in packaging, at whatever level of trade. A distributor within the meaning of this Ordnance also includes the mail-order trade (Packaging Ordinance, § 3 (9)).
[161] Cf. BMU website, Packaging Ordinance.
[162] Cf. ibid.
[163] Cf. Packaging Ordinance, Annex I, No. 1 (2).

C 1.2 Scope and delimitations

C 1.2.1 The deposit system for refillable beverage packaging

As already explained, deposit systems for refillable bottles were set up as a result of voluntary initiatives of beverage producers. Consequently, the legislator did not enact regulations concerning deposit systems for refillable bottles (such as respecting the size of packaging, the amount of the deposit, type of material, beverage segment). Nevertheless, due to the long-standing tradition and development of refillable systems, uniform regulations and handling procedures have become established in many cases.

Refillable bottles made of glass and PET are used in Germany. Depending on the beverage segment, standard filling volumes have become the norm:

- Beer: usually 0.33 litre or 0.5 litre
- Mineral waters and carbonated soft drinks: usually 0.2 litre (restaurant packaging), 0.5 litre, 0.7 litre, 0.75 litre, and 1.0 litre
- Beverages containing fruit juice: usually 0.2 litre (restaurant packaging), 0.5 litre, 0.7 litre, and 1.0 litre.

Likewise, deposit rates usual in the market have meanwhile gained acceptance: : € 0.08 for beer bottles with crown corks, € 0.15 for beer bottles with swing-top caps, and € 0.15 for refillable bottles for mineral water, soft drinks and fruit juices.

C 1.2.2 The deposit system for one-way beverage packaging

The mandatory deposit on one-way beverage packaging relates to beverage containers with a filling volume of 0.1 to 3 litres in the following beverage segments:[164]

- Beer (including alcohol-free beer) and mixed beverages containing beer
- Mineral waters, spring waters, table waters and remedial waters as well as all other types of potable water
- Carbonated and non-carbonated soft drinks (specifically lemonades, including cola drinks, fizzy drinks and ice tea)
- Mixed beverages containing alcohol

Beverage segments that are exempt from a mandatory deposit include juices, nectars, milk, mixed beverages containing milk (with a milk content of at least 50%), dietetic beverages for babies and small children as well as wine, sparkling wine and spirits.[165]

A mandatory deposit for one-way beverage containers applies irrespective of the packaging material (e.g. metal, plastic, glass). Exceptions only apply with respect to one-way beverage packaging that is specifically classified as "ecologically beneficial beverage packaging" under Section 1 (3) No. 4 of the Packaging Ordinance. Currently, this relates to beverage cartons, beverage packaging in the form of polyethylene bags and foil stand-up bags. One-way plastic beverage containers made to at least 75%

[164] Cf. Packaging Ordinance, § 9 (1) and (2).
[165] Cf. Packaging Ordinance § 9 (2).

from renewable raw materials are exempt from a mandatory deposit until 31 December 2012. Until then, those containers must be included in a dual system.[166]

Pursuant to the Packaging Ordinance, a deposit of at least € 0.25 (including VAT) applies equally to all one-way beverage containers that are subject to a mandatory deposit, irrespective of filling size, type of material and beverage segment.[167]

C 1.2.3 Dual systems

Dual systems encompass all packaging materials that originate from private end-customer use, regardless of whether beverage containers or any other packaging is concerned (exception: one-way beverage containers bearing a deposit and refillable packaging [168], see above). Beverage packaging only represents a subset in the dual systems.

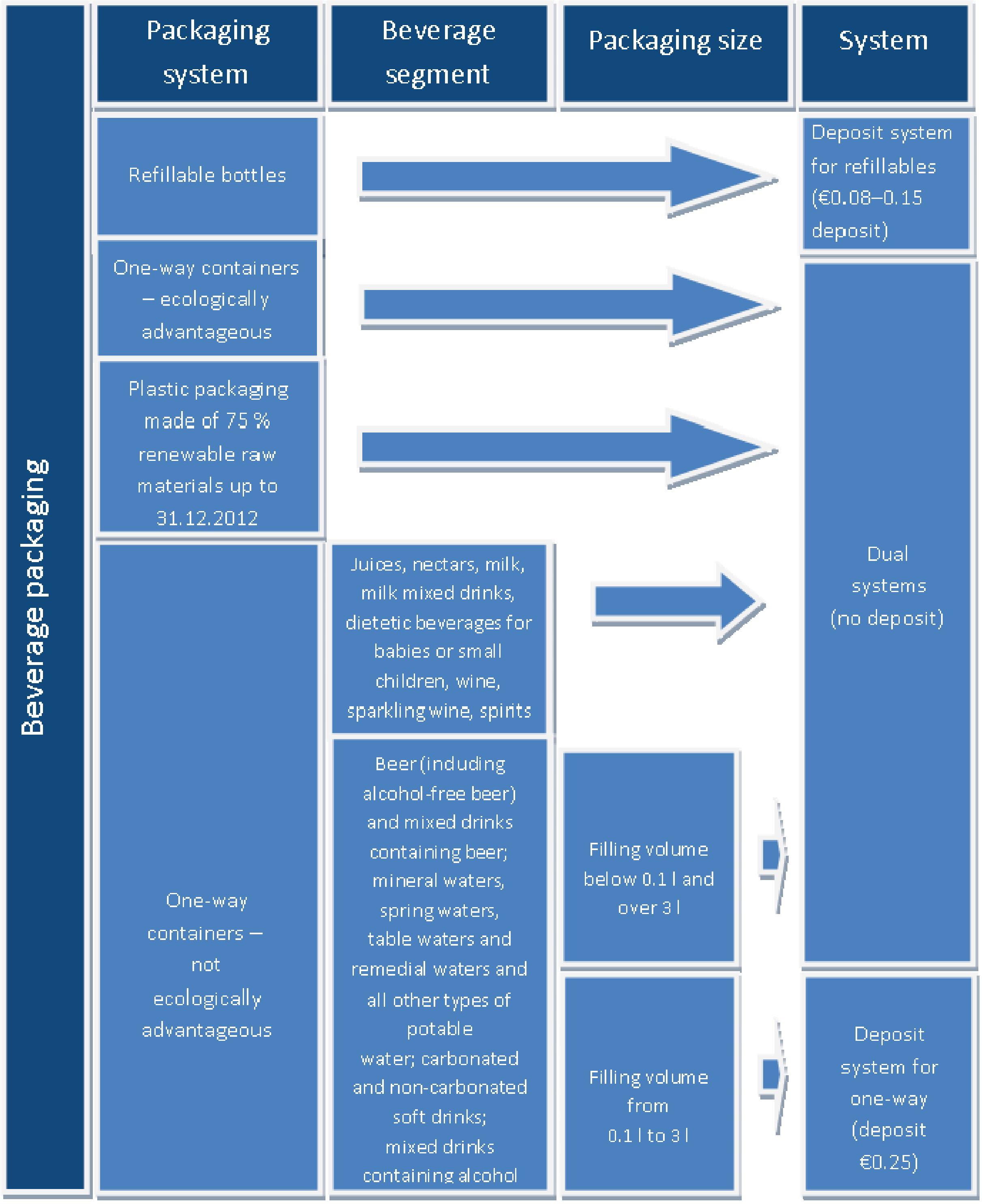
All one-way beverage containers that are not subject to a mandatory deposit and which originate as packaging waste at private end-consumers must participate in a dual system and must be collected and recovered through separate curbside collection. This also applies with respect to ecologically beneficial one-way beverage containers.[169] This obligation does not provide for any exceptions respecting the filling volume, type of material or beverage segment.

[166] Cf. Packaging Ordinance, § 16 (2), sent. 3
[167] Cf. Packaging Ordinance, § 9 (1).
[168] Cf. Packaging Ordinance, § 6 (9) and (10).
[169] Cf. Packaging Ordinance, § 6.

C 1.2.4 Summary of the scope and delimitations of all systems

The following chart provides a summary of the beverage packaging systems in Germany and the respective delimitations concerning the beverage segments included in this study.

Illustration 3: Delimitation of beverage packaging systems



C 1.3 Function and processes

The respective processes of the deposit system for refillable containers, the deposit system for one-way containers and the dual systems are described in the following sections. To conclude, the systems' significant interfaces and differences will be analysed.

C 1.3.1 The deposit system for refillable beverage containers

The deposit system for refillable beverage containers is characterised by the fact that packaging is consigned to a closed cycle due to its reuse. Corresponding logistics, which enable the return of empty beverage containers to the beverage producers, must be in place for realising this cycle.

In Germany, most refillable bottles are used jointly by a number of beverage producers (pool bottles, uniform or standard bottles). In a pool system, beverage producers share specific standard beverage packaging. For example, a refillable bottle put onto the market by a given beverage producer may be refilled by any other participating beverage producer after the bottle has been used and returned by the consumer. The utilised standard packaging comprises glass and plastic bottles as well as beverage crates made of plastic. This facilitates the organisation of a comprehensive refillable system since standard packaging can be used by any beverage producer and only the labels must be designed individually.[170] One reason for the introduction of pool containers by beverage producers was to optimise logistics. Since the beverage producers' pool containers are only distinguished by the labelling, which is replaced in the refill process, empty pool bottles can be reused by the next beverage producer.[171] The return logistics process can thus be structured more efficiently. The first standard bottle for mineral water was introduced by the cooperative association, Genossenschaft Deutscher Brunnen eG (GDB), in 1969. In addition to the original 0.7 litre GDB refillable glass bottle, further GDB standard bottles made from glass or PET have meanwhile been introduced.[172] The standard glass bottle of the Association of the German Fruit Juice Industry [Verband der deutschen Fruchtsaft-Industrie e. V., VdF] has existed since 1972. There are several standard glass bottles for beer on the market (e.g. with respect to 0.5 litre bottles: NRW bottle, the longneck bottle, euro bottle, and the Steinie bottle; with respect to 0.33 litre bottles: the longneck bottle, Vichy bottle and the Steinie bottle). There are also refillable bottles that are used by only one beverage producer (individual bottles). There has been a trend towards individual bottles in the beer beverage segment in recent years, which has been pursued by some major breweries, in particular. [173] Currently, this trend is diminishing.[174] Due to the sorting and exchange of bottles, these products require additional coordination of the refillable systems in the beverage retail and wholesale trade.

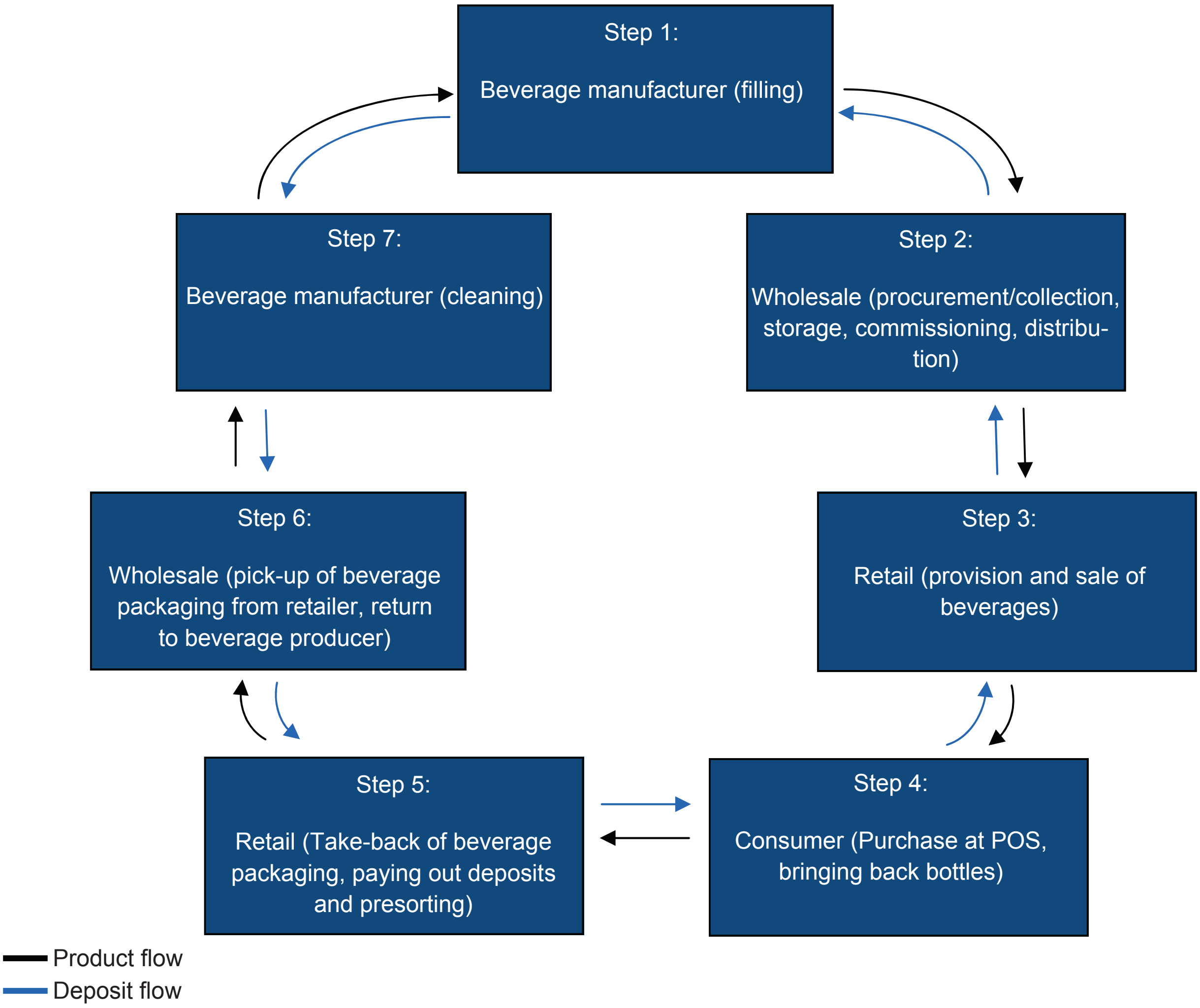
In Germany, refillable beverage containers are sold individually and in various beverage crates and multipacks, whereby the majority of the refillable beverage containers are sold in beverage crates.[175] The use of beverage crates facilitates logistics (including return logistics for empty beverage packaging) for beverage producers and distribution partners. Plastic beverage crates are reused repeatedly – just as are refillable bottles - and are subject to a deposit of € 1.50, in addition to the deposit on the

[170] Cf. ECOLAS, N. V. and PIRA, 2005, p. 212 and p. 213; R3, 2009, Section 7-9; Institute for Local Self-Reliance, 2002, p. 2; Resch, J., 2009 a, p. 23 et seqq.
[171] Major, nationwide brands participating in a refillable system are taken back at almost all shops and stores. Allegedly, there are some shops and stores that refuse to accept brands that they do not carry.
[172] Cf. GDB website, "*Vom Tonkrug zum Mehrweg mit System*"; GDB website, "*Flasche und Co*."
[173] Cf. CIS, 2009, p. 23 et seqq.; Löwer, C., 21 September 2009.
[174] Interview with industry experts.
[175] According to an estimate of industry experts for beer and water, ca. 85 to 90%.

bottles. The usual beverage crate sizes are the 6-pack (e.g. 6 x 1 litres) for juices, the 12-pack (e.g. 12 x 0.7 litre) for water and soft drinks, and the 20-pack or 24-pack (e.g. 20 x 0.5 litre) for beer. The use of multipacks (e.g. 6-packs) for beer and soft drinks also permits the sale of refillable bottles in smaller units. Multipacks for 0.33 and 0.5 litre fillings usually come in the following sizes: 6-pack, 4-pack, 8-pack and 10-pack.

The following chart illustrates the process of the German deposit system for refillable bottles:

Illustration 4: The refillable cycle, derived from the website of "Arbeitskreis-Mehrweg" (Refillable system Working Group), System



The refillable system consists of the following process steps (see Illustration 4): [176]

Step 1 **Filling performed by beverage producer**
Refillable beverage containers are filled by the beverage producer and are usually prepared for transport in refillable beverage crates and also in smaller packaged units (multipacks).

Step 2 **Procurement/pick-up, storage, commissioning and sale through beverage wholesaler**
Wholesalers are usually the intermediate stage in the distribution from the beverage producer to the retailer. Wholesalers are responsible for the procurement/pick-up, storage, commissioning and the sale of beverages in refillable beverage containers before the beverages are made available to the consumers by retailers. The beverage wholesaler therefore assumes an important role in the deposit system for refillable bottles in Germany. When picking up the beverage containers, the beverage wholesaler pays a deposit on the beverage containers to the beverage producer.

Step 3 **Provision and sale of beverages by retailers**
Retailers usually obtain beverages in refillable beverage containers from beverage wholesalers. Upon receipt of the beverages, the retailer pays a deposit to the wholesaler. When selling a beverage in a refillable beverage container, the retailer charges the consumer a deposit. In some cases, retailers procure beverages in refillable beverage containers directly from the beverage producer. In such cases, the retailer pays the deposit directly to the beverage producer.

Step 4 **Purchase of beverages from retailers and return of empty bottles by the consumer**
The consumer usually purchases beverages in refillable beverage containers from a retailer. When purchasing the bottle, the consumer pays a deposit to the retailer. The retailer repays the deposit to the consumer when the latter returns the empty refillable beverage containers. Usually, the consumer can return the bottles - especially standard bottles (see p. 102 for further details) to any retailer that sells beverages in refillable beverage containers.

Step 5 **Return of empty beverage containers to retailers**
The retailer refunds the deposit when the consumer returns empty, refillable beverage packaging. The taking back of bottles and the refund of the deposit may be performed manually or by means of reverse vending machines. The retailer pre-sorts the bottles according to bottle type (e.g. standard bottles/carts, individual bottles/carts) and thus prepares them for collection by the beverage wholesaler.

Step 6 **Return of empty beverage packaging to beverage producers by beverage wholesalers**
The wholesaler picks up the pre-sorted, empty refillable beverage containers and refunds the corresponding deposit to the retailer. Thereafter, the wholesaler organises the further sorting and transport back to the respective beverage producers.

Step 7 **Cleaning of refillable beverage containers by the beverage producer**
The beverage producer receives the empty refillable beverage containers back from the wholesaler and refunds the corresponding deposit to the latter. Subsequently, the containers are unpacked and washed by the beverage producer. Specialised washing facilities ensure that all impurities (e.g. residual contents, dirt, labels) are removed. This

[176] Cf. Prognos et al., 2000, p. 66; Institute for Local Self-Reliance, 2002, p. 3 and p. 10; ECOLAS, N. V. and PIRA, 2005, p. 222; Arbeitskreis-Mehrweg website, system.

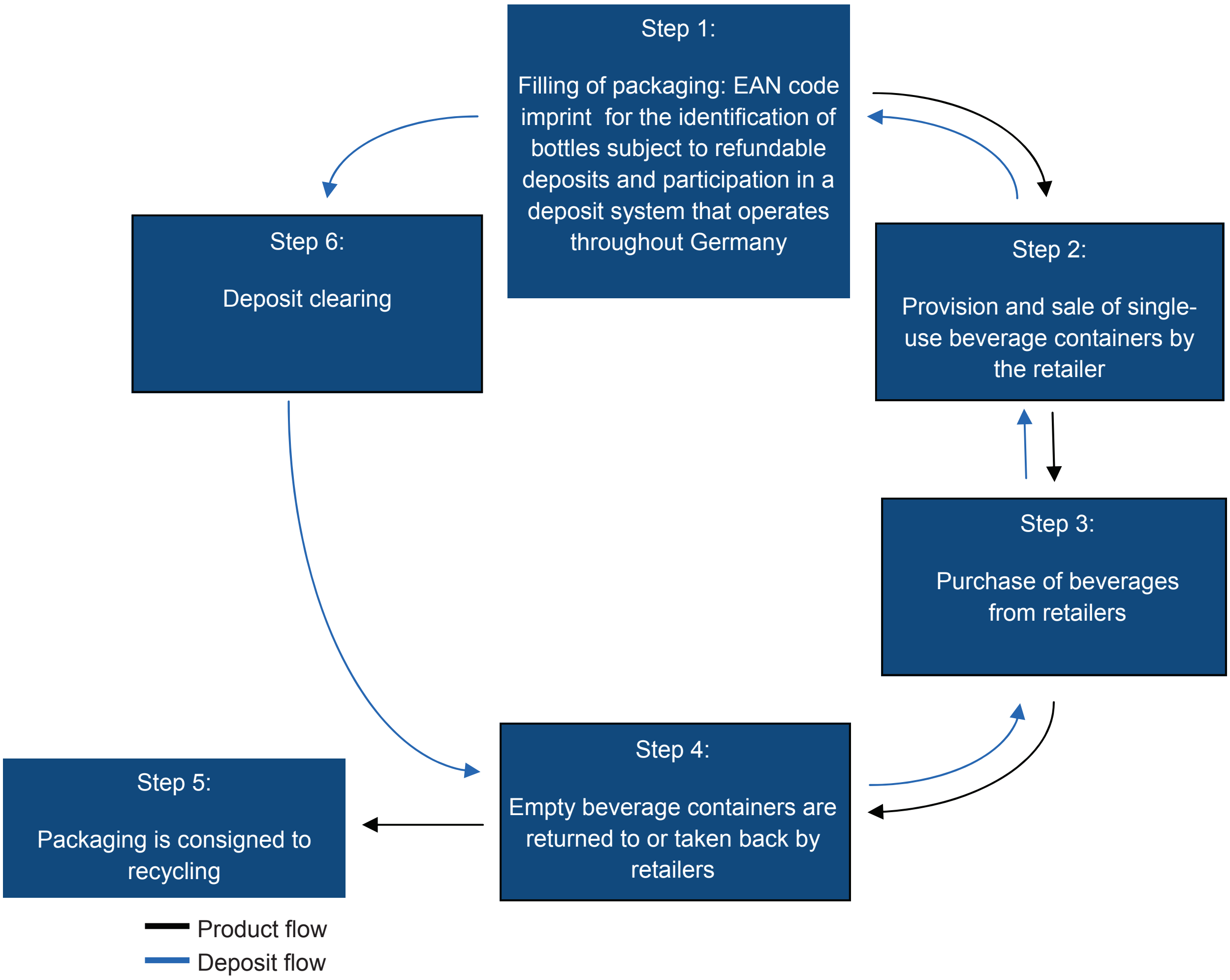
process is easier for glass bottles than for plastic bottles, since higher washing temperatures may be used for glass bottles.

C 1.3.2 The deposit system for one-way beverage containers

One-way beverage containers are only used once and are then disposed of. In contrast to the refillable system, there is no closed cycle management of beverage packaging (closed cycle management of bottles). However, an option to recycle one-way beverage containers (closed cycle management of packaging materials) after use exists. In order to make this possible, consumers must consign beverage containers to the recyclers. Due to the deposit charged on one-way beverage containers, these beverage containers can be consigned to recyclers bundled and as mono-material.

The following illustration shows how the German mandatory one-way deposit system process functions:

Illustration 5: How the deposit system works; Source: based on AGVU, 2007, p. 8



Step 1 **Filling of packaging: EAN code imprint for the identification of bottles subject to refundable deposits and participation in a deposit system that operates throughout Germany**

Beverage producers that put into circulation one-way beverage containers subject to a mandatory deposit are obliged to participate in a deposit system that operates throughout Germany (participation obligation).[177] In Germany, there is only one deposit system operating in this way for one-way beverage containers, namely that of the Deutsche Pfandsystem GmbH (DPG). With due consideration of the legal specifications, DPG furnishes the standardised framework for the take-back and deposit clearing of one-way beverage containers which are subject to a mandatory deposit. This includes the operation of a master database for deposit clearing and the assignment of a label for one-way beverage containers that are subject to a mandatory deposit (the DPG label).

According to the Packaging Ordinance, beverage producers are obliged to label their one-way beverage containers as being subject to a mandatory deposit before putting them on the market. Such labelling must be clearly legible and applied to a readily visible area of the packaging (labelling obligation).[178] For participation in the DPG deposit system, beverage producers must accordingly ensure that the DPG label is applied legibly to all one-way beverage containers together with an EAN number and a corresponding bar code. Beverage producers and importers of smaller quantities may subsequently label the packaging with a separate sticker.[179] In practice, the label is usually applied by label producers (e.g. PET) or packaging producers (e.g. cans).[180] The function of producer may also relate to retailers in the event of them selling own brands.

Step 2 **Provision and sale of one-way beverage containers by retailers**

According to the Packaging Ordinance, distributors (including manufacturers) putting one-way beverage containers that are subject to a mandatory deposit into circulation are obliged to charge consumers a deposit (obligation to charge deposits).[181] To a large extent, retailers purchase products in one-way beverage containers directly from beverage producers and only rarely from beverage wholesalers.[182] Since the mandatory deposit on one-way beverage containers must be charged at any distribution level[183], the retail trader pays a deposit of € 0.25 to the beverage producer for every filled one-way beverage container upon receipt. Subsequently, when a beverage is sold in a one-way beverage container that is subject to a mandatory deposit, the retailer charges the consumer a deposit.

[177] Cf. Packaging Ordinance, § 9 (1), sent. 4.
[178] Cf. ibid.
[179] Cf. DSD GmbH website, *Das DPG-Pfandsystem*.
[180] Cf. Roland Berger, 2007, p. 39.
[181] Cf. Cf. Packaging Ordinance, § 9 (1), sent. 3.
[182] Interview with industry experts.
[183] Cf. Packaging Ordinance, § 1 (1), sent. 3.

Step 3 **Purchase of beverages from retailers**

The consumer usually purchases beverages in one-way beverage containers that are subject to a mandatory deposit from a retailer. Consumers pay a deposit of € 0.25 per beverage container to retailers when purchasing products in deposit one-way beverage containers.

Step 4 **Empty beverage packaging that is returned to and taken back by retailers**

When taking back beverage packaging, the mandatory deposit on one-way beverage containers must be refunded at any distribution level (obligation to refund deposit).[184] Accordingly, when consumers return empty, one-way beverage containers, they receive the deposit back from the retailer. In this context, retail traders selling one-way beverage containers that are subject to a mandatory deposit are only required to take back deposit beverage packaging of the same material (glass, plastic and/or metal)[185]. If, for example, a retail trader only sells PET bottles, he is obliged to take back all one-way PET bottles that are subject to a mandatory deposit. However, the retailer is not required to take back beverage cans and one-way bottles made of glass.[186]

Empty packaging can be taken back by retailers either manually or automatically.

- Automated take-back:
  When taking back deposit one-way beverage containers by means of a reverse vending machine, an electronic raw data record [187] is created for each beverage container. At the same, the packaging is destroyed in order to make repeated return impossible. Deposit invoicing is subsequently based on the electronic raw data record.
- Manual take-back:
  When retail traders take back one-way beverage containers manually, the electronic identification, invalidation and clearing process is performed at counting centres.[188] The data is compared to the information entered in the DPG master database, which can be accessed by any certified service provider. By means of the EAN Code recorded in the master data base, the electronic raw data records can be allocated to the responsible beverage producers. Thereafter, the deposit invoice and receivables report are generated and sent to the beverage producers and the service providers (that might have been commissioned by the beverage producer). The manufacturer receives an invoice for the deposit amount and the electronic raw data records for the returned packaging, which serve as documentary vouchers.[189]

[184] Cf. Packaging Ordinance, § 9 (1), sent. 3.
[185] Cf. Packaging Ordinance, § 9 (1), sent. 5-7.
[186] Cf. BMU, 26 January 2009; DPG website, *Gesetzliche Anforderungen an die Rücknahme pfandpflichtiger Einweggetränkeverpackungen*.
[187] An electronic raw data record is a data record that is created automatically and which contains information on the beverage producer, packaging material, beverage type, and beverage size, among other things.
[188] Cf. R3, 2009, Section 10 – 4.
[189] Cf. DPG website, *Abwicklung des Pfandausgleichs*.

Step 5 **Consignment of packaging to recovery**

Frequently, the packaging that was taken back is returned (through intra-company logistics) from the branch to the central warehouses, where the packaging is picked up by external logistics providers. The beverage containers may also be picked up by external logistics providers directly at the branch. The packaging material taken back is either sent to the counting centres by logistics providers from where it is then consigned to recycling or - if the packaging material had already been invalidated automatically at the branch - it is directly delivered to a recovery firm, which then recycles the material. No legal specifications are in place with respect to the type of recycling, such as closed-loop recycling. The Packaging Ordinance only stipulates that one-way beverage containers subject to a mandatory deposit "shall be primarily consigned to recycling". The proceeds from the sale of beverage packaging as secondary material go to the owner of the packaging material that was taken back, which is usually the German retailer. The retailer sells the material to a recovery firm. In many cases, the logistics and clearing company commissioned by the retailer is at the same time also a recovery firm, as a result of which the proceeds from the sale of packaging material are offset against the transport and clearing services.

Step 6 **Deposit clearing**

Since one-way beverage containers that are subject to a mandatory deposit do not have to be returned to the retail store at which they had been purchased, and in order to enable deposit offsetting between beverage producers and retail traders, deposit clearing is necessary.

The following steps roughly illustrate the clearing process for one-way bottles in Germany:[190]

1. When selling a beverage, the beverage producer receives a deposit from the retail trader
2. When reselling the product, the retail trader charges a deposit to the consumer
3. The retail trader refunds the deposit to the consumer upon take-back of the one-way beverage container
4. The retail trader claims the deposit from the beverage producer or the service provider commissioned
5. The beverage producer or service provider settles the deposit claim

Beverage producers are only obliged to refund the deposit (via specialised service providers commissioned to that end) to retail traders in the event that the following prerequisites have been met: the beverage packaging had been returned by the consumer, the take-back of beverage packaging was registered as a result of the scanned-in bar code and recognition of the DPG deposit label, the packaging was invalidated in line with certification requirements and a corresponding raw data record was generated in accordance with DPG specifications and evidence had been presented to the beverage producer to that effect. Until then, the deposits are at their disposal.[191] The retail traders retain the deposits in the event that they hold the brand rights to the beverage, which si-

[190] Cf. Roland Berger, 2007, p. 29.
[191] Cf. Deutscher Bundestag, 2007, p. 4.

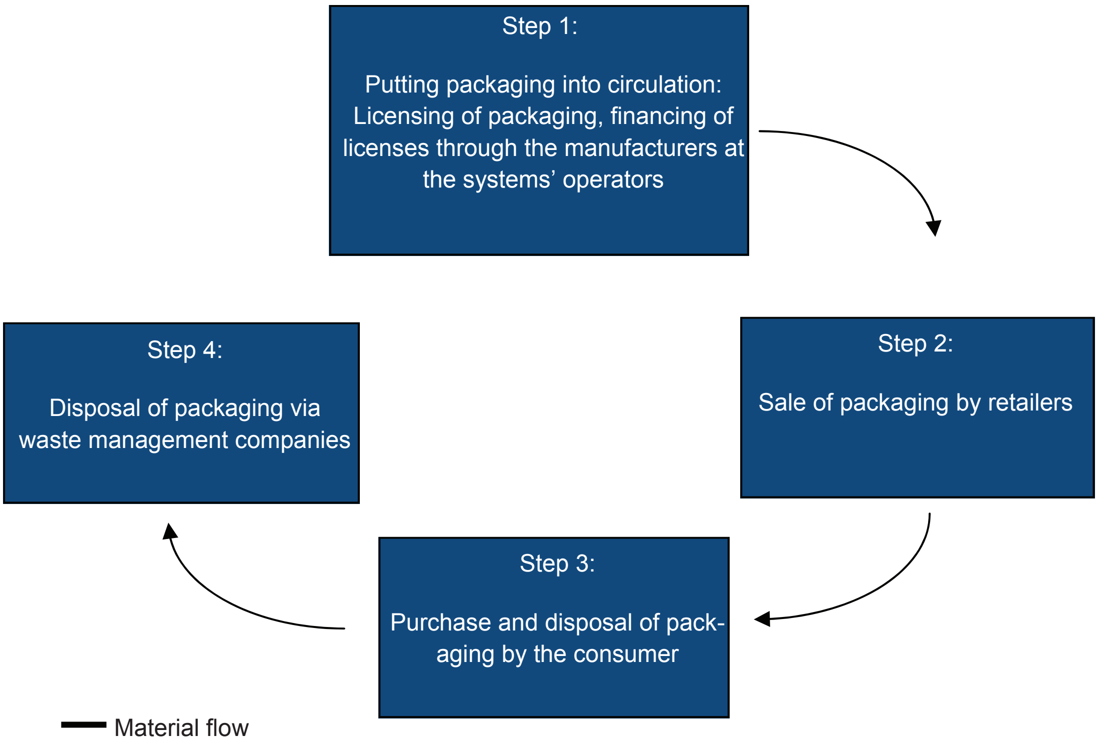
multaneously classifies them as beverage producers. Consumer protection in the event of a beverage producer's insolvency has not yet been clarified.[192]

C 1.3.3 The dual systems

With respect to beverage packaging, the dual systems only collect and recycle one-way beverage containers that are not subject to a mandatory deposit.[193] In Germany both pick-up and drop-off systems exist for the collection of packaging (materials collection) through dual systems. The pick-up system with the yellow bag or the yellow waste bin is the most widely used system for packaging made of plastic and metal and for composite packaging (including beverage cartons). The proportion of drop-off systems for such packaging is below 10% in all federal states, except Bavaria.[194] By contrast, glass is collected throughout Germany via drop-off systems (usually sorted according to colour) in containers that are available nationwide and at recycling yards, with the exception of a few districts in Berlin where glass is also collected via curbside collection (pick-up system). The respective municipality and the dual system commissioned decide jointly on the type of collection system to be implemented.[195]

The following illustration portrays the process of dual systems in Germany.

Illustration 6: DSD material flows; source: based on AGVU, 2007, p. 8



[192] Interview with industry experts.
[193] Cf. Packaging Ordinance, § 6 (9) and (10).
[194] Cf. Kern, M. and Siepenkothen, H.-J., 2005, p. 562.
[195] Cf. DSD GmbH website, *Fragen zur DSD GmbH*.

Step 1 **Putting packaging into circulation: Licensing of packaging**

Beverage producers (including retailers in the event that they put own brands into circulation) must participate in a dual system with respect to one-way beverage containers that are not subject to a mandatory deposit and which are sold to private end-customers. This participation enables beverage producers to meet their obligation to take back returned sales packaging pursuant to Section 6 (1) of the Packaging Ordinance. The beverage producer and the dual system conclude an agreement under civil law for the inclusion of packaging in a dual system. This agreement defines the license fees per weight and type of material (e.g. glass, PET, composite packaging, aluminium, and tin), among other things. Beverage producers are then obligated to pay license fees in accordance with the beverage containers which they put into circulation.

Step 2 **Sale of packaging by retailers**

When beverage containers are passed on from a beverage producer to a retailer, it is not necessary to observe special requirements since no deposit is charged.

Step 3 **Purchase and disposal of packaging by the consumer**

The consumer purchases beverages from a retailer in beverage containers that are not subject to a mandatory deposit. No deposits are charged. After consuming the beverages, the consumer should dispose of the beverage packaging via collection bins provided for that purpose (see p. 109: Explanations concerning pick-up and drop-off systems).

Step 4 **Disposal of packaging via waste management companies**

Dual systems and the waste management companies commissioned by dual systems pick up packaging waste from the respective sources where waste occurs and sort the packaging at a sorting facility. In accordance with their respective market share, the sorted fractions are delivered to the recovery firms by the dual systems and are consigned to recycling or to energy recovery. In this context, the recycling and recovery rates stipulated by the Packaging Ordinance must be complied with.

C 1.4 Stakeholders, roles and responsibilities

Table 56 compares the roles and responsibilities of the stakeholders in the various systems. Due to the detailed and specific presentation for Germany, this section considers more stakeholders than in Section B.

Table 56: Stakeholders, roles and responsibilities within German beverage packaging return and recycling systems

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
Packaging manu-facturers	Manufacturers of refillable beverage containers have no direct obligations pursuant to the Packaging Ordinance.	Section 9 of the Packaging Ordinance concerning the one-way deposit system does not define obligations for packaging producers. With respect to the practical implication of a mandatory deposit, packaging producers are required to participate in the DPG system and must obtain corresponding certification for such participation in order to be eligible to use the required colours for the manufacture of packaging and labels.[196]	Packaging producers have no specific obligations pursuant to Section 6 of the Packaging Ordinance.
Beverage producers	Beverage producers have no obligations arising from the Packaging Ordinance. They do, however, have an interest in receiving the refillable beverage containers back from the consumers after use in order to refill them again. When participating in a coordinated refillable pool system, corresponding pool agreements must be complied with in order to use the system (e.g. GDB, VdF).	The manufacturers and importers of beverages in one-way beverage containers need to clarify whether their respective products are subject to a mandatory deposit pursuant to the applicable Packaging Ordinance. If this is the case, beverage producers must meet the following obligations:[197] • Labelling obligation: Distributors (including beverage producers and importers) must label deposit one-way beverage containers as being subject to a mandatory deposit before putting them on the market. Such labelling must be clearly legible and applied to a readily visible area of the packaging. • Obligation to charge deposits: Beverage producers are	Provided that beverages are not filled into refillable beverage containers or in one-way beverage containers that are subject to a mandatory deposit, beverage producers (or importers) must comply with the following obligations:[198] • Licensing of packaging put into circulation through one or several providers of dual systems; this ensures that packaging is taken back on a comprehensive scale • Submission of a declaration of compliance [199] to the locally responsible Chamber of Commerce and Industry (IHK), which confirms the

[196] Cf. DPG website, *Hersteller von Etiketten und DPG Verpackungen*.
[197] Cf. DPG website, *Getränkehersteller und Importeure, Aufgaben und Pflichten*.
[198] Cf. ibid.; ARGE website, *Verpflichteter*.
[199] "By 1 May each year, all actors putting sales packaging pursuant to section 6 into circulation shall be obligated to submit a declaration of compliance, audited by an accountant, tax consultant, registered auditor or independent expert pursuant to No. 2 subsection (4) of Annex I for all sales packaging they have filled with products and put into circulation for the first time in the previous calendar year, and to deposit it in accordance with subsection (5)." (Packaging Ordinance § 10 (1)).

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
		obliged to charge buyers a deposit of at least € 0.25 including VAT per beverage container. This deposit must be charged by any further distributor at any distribution level until the product has been placed with the end-consumer. • Obligation to participate in a deposit system: Distributors (including beverage producers and importers) are required to participate in a deposit system that operates throughout Germany and which allows its participants to settle deposit refund claims among each other. • Obligation to refund deposit: Distributors (involving all distribution levels, which includes beverage producers) are required to refund the deposit when taking back packaging.	complete licensing of all packaging put into circulation • Mass flow verification and compliance with legally required recovery rates by the commissioned providers of dual systems
Wholesale and retail trade[200] (distributors)	Duties of retailers within the scope of agreements under civil law concerning system participants:[201] • Charging deposit amount • Take-back of beverage packaging • Refunding the deposit to consumers A retail trader is not obliged to accept refillable beverage containers. However, according to the industry experts interviewed, retail traders in the specialised beverage trade usually also accept (on a voluntary basis) refillable beverage con-	Wholesalers and retailers must comply with the following obligations: [203] • Charging a deposit • Take-back of beverage packaging • Refunding the deposit to consumers • Take-back of transport packaging • Financing and organisation of return logistics and recovery According to the Packaging Ordinance, wholesalers and retailers are required to take back all empty, deposit one-way beverage containers of the same material which they (subject to a mandatory deposit) also carry in their product line. Stores with a sales	Wholesalers and retailers must comply with the following obligations: • If they sell own brands, they have the same duties as beverage producers (licensing of packaging) • Providing take-back possibilities for secondary packaging at sales locations.[204]

[200] Wholesalers act as distributors in Germany. Wholesalers are responsible for picking up the filled beverage containers from beverage producers and for storing them at central locations so that they can be distributed to retailers. Conversely, wholesalers organise the collection of empty beverage containers from retailers and the return of beverage containers to beverage manufacturers.
[201] With respect refillable beverage containers, the obligation to charge a deposit and take back packaging is only based on civil law.

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
	tainers that they did not sell themselves.[202] Wholesalers are usually responsible for organising the logistics (incl. sorting) of the refillable system. According to the industry experts interviewed, retailers in the specialised beverage trade largely take back packaging manually (without using a reverse vending machine), while showing a tendency towards automation. In contrast, the take-back of containers in the food retail trade is mainly automated.	area of less than 200 square meters may limit their taking back of one-way beverage containers to brands that they carry in their product line. According to the industry experts interviewed, retailers in the specialised beverage trade mainly take back containers manually (without using a reverse vending machine). By contrast, take-back in the food retail trade is mainly automated.	
Consumers	The consumers pay the deposit to the retailer. After returning the beverage packaging, the consumer receives the deposit back from the retailer where he purchased the beverage or from another retailer. Empty one-way beverage containers can usually be returned to any retailer that sells such beverage containers.[205]	Consumers pay the deposit to a retailer. After returning the beverage containers, consumers receive the deposit back from the retailer where they purchased the beverages or from another retailer. Empty, one-way beverage containers can generally be returned to any retailer that sells deposit beverage packaging of the same material.	Consumers are requested to dispose of non-deposit one-way beverage containers via curbside collection, i.e. via glass containers or in yellow bags and waste bins.
System operators	In Germany, refillable systems are coordinated by the respective industries themselves. As a result, the systems for the various beverage seg-	The DPG provides the organisational framework for the take-back of containers and for deposit clearing. The tasks include: • The operation of a master database [206] for deposit clear-	The dual systems are responsible for the establishment and operation of comprehensive curbside collection, sorting and subsequent recovery of bever-

[203] Cf. Packaging Ordinance § 9 (1).
[204] Cf. Packaging Ordinance § 4.
[202] Interview with industry experts; retailers that do not carry refillable bottles usually are not willing to accept them. In all, the readiness to take back refillable bottles that are not included in the product line of a retail branch depends on the goodwill of the respective retail branch. With respect to automated take-back, a reverse vending machine only takes back bottles that have been programmed into the machine. Manual take-back of bottles that have not been programmed into the machine again depends on the goodwill of the retailer.
[205] Cf. BMU, April 2009, p. 9.
[206] Manufacturers and distributors participating in the system are included in the master database with a view to deposit clearing. DPG's deposit clearing is based on electronic raw data records that were generated in DPG reverse vending machines located at the stores of retailers and elsewhere. By means of the master database,

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
	ments are organised in different ways. For example, the bottle pool for mineral waters and non-alcoholic soft drinks is coordinated by GDB, whereas the bottle pool for fruit juice-containing beverages is coordinated by VdF. Tasks include the provision of refillable beverage containers, maintenance and modernisation of the bottle pool as well as public relations activities. In the beer segment, every brewery procures refillable bottles according to its needs.	ing and management of the DPG labelling • Administration of the set of agreements • IT interface management • Certification management • Marketing and public relations activities for the system [207]	age containers.[208] Its tasks also include the marketing of collected packaging on the secondary materials market.
Waste management companies	Refillable beverage containers that cannot be reused are handed over to the commissioned waste management companies and are recycled.[209]	Logistics providers and waste management companies pick up the packaging from stores. Thereafter, the beverage containers are to be counted - if necessary - and, in all cases, to be recycled by recovery firms.[210]	Presently, the dual systems invite tenders for the collection, sorting and recovery of packaging on a nationwide scale. In accordance with their respective market share, the various providers of dual systems gain access to material from sorting facilities in order to consign this material to recovery as prescribed.[211]
Public authorities	Political measures of the German federal government encompass:[212] • Determination of target quotas for refillable beverage containers • The introduction of a mandatory deposit on one-way beverage containers in order to	Enforcing compliance with the regulations concerning the obligation to charge deposits pursuant to Section 9 of the Packaging Ordinance and control of the recovery rates are the responsibility of the federal states (Bundesländer).[213]	The federal states (Bundesländer) are responsible for enforcing the corresponding regulations stipulated in the Packaging Ordinance. Dual systems require a license for nationwide operations. The annual mass flow verifications of recovery and recycling rates of dual systems and individual beverage

the deposit amounts to be refunded are allocated to the respective manufacturers (cf. DPG website, *Automatenhersteller*).
[207] Cf. DPG website, *Aufgaben der DPG*.
[208] Cf. DSD GmbH website, *Porträt*.
[209] Cf. IFEU, 2008, p. 27 et seq.
[210] Cf. R3, 2009, Section 10 - 7.
[211] Cf. DSD GmbH website, *Entsorger sammeln und sortieren Wertstoffe mit dem Grünen Punkt*.
[212] Cf. Packaging Ordinance, § 1 (1) and (2).
[213] Cf. BMU website, Packaging Ordinance.

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
	protect refillable systems • Survey and documentation of refillable rates		producers (declarations of compliance) must be verified by the federal states. The government also collects data on packaging volumes and packaging recovery.
Clearing service providers	There are no official clearing authorities for refillable systems. Presumably, the deposit cash flows are offset directly among business partners without involving further intermediaries. In the meantime, however, the Federal Association of German Beverage Wholesalers, Incorporated Association [*Bundesverband des Deutschen Getränkefachgroßhandels e.V.]* has convinced the German competition authority [*Bundeskartellamt*] that – with regard to the GDB pool for standard bottles – the GDB should be responsible for clearing if the flows of full and empty bottles should diverge. This happens when end-consumers increasingly purchase beverages on special offer and subsequently return the empty bottles when paying their weekly visits to the specialist beverages store.[214]	Service providers for deposit invoicing make their technical expertise as well as their soft- and hardware-related capacities available in order that the data volumes may be recorded and processed accordingly. As a consequence, beverage producers (deposit account administrator) and retail traders (refund claimant) have the possibility to commission clearing service providers.[215] The clearing service providers do not concern themselves with the physical packaging and its recovery.	Owing to competition prevailing among dual systems, it was necessary to establish a coordinating authority. Accordingly, the 5th amendment to the Packaging Ordinance provided for the establishment of such an authority. In 2007, several dual systems founded the "Gemeinsame Stelle dualer Systeme Deutschlands GmbH“.[216] The tasks of this authority include, inter alia, integration of the tasks of the clearing authorities that.[217]

[214] [214] Interview with industry experts.
[215] Cf. DPG website, *Dienstleister für die Pfandabrechnung*.
[216] Cf. Packaging Ordinance, § 6 (7).
[217] Cf. DSD GmbH website, *Duale Systeme gründen Gemeinsame Stelle*.

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
Manufacturers of reverse vending machines	Refillable beverage containers are taken back manually and by means of reverse vending machines. Both reverse vending machines solely for refillable beverage containers and reverse vending machines for refillable as well as one-way beverage containers are being used. Refillable bottles can also be sorted in reverse vending machines according to size and other criteria.	Deposit one-way beverage containers are taken back manually and by means of reverse vending machines. Manufacturers of reverse vending machines must acknowledge the DPG licensing agreement, which mainly provides for the certification of reverse vending machines and their entry in the DPG database by the parties that take back packaging (usually wholesalers/retailers).[218] In detail, this gives results in the following obligations:[219] • Every manufacturer of reverse vending machines has to have its machine types certified by the DPG [220] • Wholesalers/retailers taking back packaging report every reverse vending machine to the DPG. • The reverse vending machine needs to regularly load the latest universe barcode (regular download of information taken from the DPG database) • The reverse vending machine must generate data records on the packaging taken back by the machine (€ 0.25/beverage container) in the prescribed manner • The clearing service provider must be able to retrieve these data records from the reverse vending machines in the prescribed, encrypted manner. The reverse vending machines must be recertified at regular intervals.	

[218] Cf. DPG website, *Automatenhersteller*.
[219] Interview with industry experts.
[220] Certification takes into account the following aspects, among other things: IT security, fraud prevention, correctness of deposit charged to consumer, prescribed compacting, ensuring that it is not possible to intervene manually between the identification process and compacting.

	Refillable deposit systems	Mandatory one-way deposit systems	Dual systems
Counting centre operators	-	Retail traders that take back beverage containers manually pass them on to counting centres in order for them to be properly checked, sorted, and to have the deposit amount invalidated by means of industrial reverse vending machines. Counting centre operators are also required to accept the DPG agreement and obtain official certification for the respective locations.[221]	

C 1.5 Financing mechanisms

C 1.5.1 The deposit system for refillable beverage containers

Cost factors for beverage producers participating in a refillable deposit system mainly relate to the procurement of refillable bottles and crates and to suitable sorting, cleaning and bottling plants as well as operating costs for ensuring return logistics and the sorting and cleaning of beverage containers. Revenues are generated only from the sale of refillable beverage containers that cannot be used again. Such containers are sold as secondary material for recovery purposes.

The substantial financing requirements, the bearers of the costs incurred and possible revenues are presented below. Since refillable systems are organised by the private economy and are not subject to legal provisions, there is only little public information available in this context. The cost and financing structures presented below are derived from interviews that we conducted as part of our survey of experts. In practice, deviations from this basic model cannot be ruled out. Investment costs in bottling plants were not taken into account since only the additional investments relating to participation in a system are analysed.

[221] Cf. DPG website, *Zählzentrumbetreiber*.

Table 57: Financing model of the deposit system for refillable beverage containers

Cost type/revenue type	Costs subject/revenues	Cost bearer/recipient of revenues
Investment costs	Plants for sorting, cleaning and filling refillable beverage containers	Beverage producers
Operational costs	Take-back and sorting	Beverage producers as well as wholesalers and retailers. It is possible that beverage producers make compensation payments to wholesalers and retailers for offsetting the additional costs incurred for taking back and sorting refillable beverage containers.
Operational costs	Cleaning	Beverage producers
Operational costs	Membership fees for pool systems, if applicable	Beverage producers
Operational costs	Coordination and organisation of a refillable standard bottles pool	System operators, financed through membership fees, according to information received
Revenues	Sale of refillable beverage containers that cannot be used again (rejects). These containers are sold as secondary material	Beverage producer, wholesaler or retailer, depending on where rejects occur

C 1.5.2 The deposit system for one-way beverage containers

System participants mainly incur costs attributable to the deposit system for one-way beverage containers as a result of imprinting the EAN Code, the establishment of return logistics and deposit clearing. System-related revenues are generated from unredeemed deposits and from the sale of collected, one-way beverage containers as secondary material.

The substantial financing requirements, revenues, cost bearers and recipients of the revenues are presented below. The Packaging Ordinance does not govern the distribution of costs and revenues. In practice, deviations from the information presented below may occur. The financing mechanism is mainly based on a publication by Roland Berger[222] and on interviews with industry experts.

Table 58: Financing model of the deposit system for one-way beverage containers

Cost type/revenue type	Cost subject/revenues	Cost bearer/recipient of revenues
Investment costs	Ensuring compliance with DPG requirements respecting the labelling obligation	Packaging manufacturers/label manufacturers
Acquisition costs	Reverse vending machines (in the event of automated take-back)	Retailers
Operating costs	Take-back and sorting (manually or automated)	Retailers
Operating costs	Clearing (including DPG membership fees)	Retailers and beverage producers
Revenues	Unredeemed deposits	Beverage producers (retailers if they should sell own brands and are thus beverage producers)
Revenues	Sale of collected, one-way beverage containers as secondary material	Retailers (usually, however, offset against the logistics and clearing services rendered by service providers that pick up the packaging at the retailers' branches and central storage facilities; very rarely do beverage producers participate in the revenues)[223]

[222] Cf. Roland Berger, 2007, pp. 39-47.
[223] Interview with industry experts.

C 1.5.3 The dual systems

Collection, sorting and the recovery of one-way beverage containers that are not subject to a mandatory deposit are financed through license fees paid by beverage producers and retailers (if they carry own brands) for participation in a dual system.[224] The (weight-based) license fees always relate to material fractions (e.g. paper, cardboard, carton, glass, plastic, composites, aluminium, tin) and not to how the packaging is used (e.g. beverage packaging).

D The license fee per tonne of packaging material is determined by the following factors:[225]

- Costs arising from the curbside collection of packaging
- Costs incurred for sorting the collected material fractions
- Recovery costs and revenues

License fees are not determined by a central unit/authority, but rather individually among the dual systems and beverage producers.

C 1.6 System control and system steering

C 1.6.1 The deposit system for refillable beverage containers

As already explained, refillable systems in Germany are implemented by the private economy. As a consequence, refillable system are managed by the system participants that utilise refillable beverage containers.

The German federal government supports the refillable system in that it established the following framework conditions, which have been in place since 1991: [226]

- Regular survey and documentation of refillable rates
- In the event of the refillable rate dropping below 72%, a mandatory deposit is introduced on (certain) one-way beverage containers
- Introduction of target quotas for MövE packaging

C 1.6.2 The deposit system for one-way beverage containers

As already mentioned, DPG manages the one-way deposit system, which has been implemented uniformly throughout Germany. In contrast to the Scandinavian one-way deposit systems, this does not, however, include deposit flow clearing. Deposit flow clearing in Germany is assumed bilaterally by trade and industry - usually on both sides - while involving service providers. DPG determines the framework conditions for all participants in the deposit system, certifies all system participants, monitors compliance with the standards it stipulated and provides for an EAN Code database, which forms the basis for all transactions involving take-back and deposit reimbursement procedures among trade and industry.[227]

The federal states (Bundesländer) are responsible for controlling compliance with the provisions of Section 9 of the Packaging Ordinance.

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[224] Cf. DSD GmbH website, *Fragen zur DSD GmbH*; Timmermeister, M., 1998, p. 36 et seq.
[225] Interview with industry experts.
[226] Cf. ECOLAS, N. V. and PIRA, 2005, p. 228; Institute for Local Self-Reliance, 2002, p. 2; Vogel, G., 2009, p. 21 et seqq.
[227] Interview with industry experts.

Under waste management objectives, the Packaging Ordinance stipulates that the German federal government is responsible for carrying out the required surveys regarding the reuse, recovery and recycling rates. The results are published in the Federal Official Gazette (Bundesanzeiger) on an annual basis.[228] This is to provide transparency as to whether the defined objectives of the Packaging Ordinance have been met. Accordingly, the market research company, Gesellschaft für Verpackungsmarktforschung mbH (GVM), has been conducting surveys on consumption rates for one-way and refillable beverage containers since 1978, as commissioned by the Federal Environment Agency (UBA). Since the objectives respecting the proportion of beverages that are filled into refillable beverage containers had not been meet, the mandatory deposit on one-way beverage containers was introduced with a view to promoting refillable beverage containers and ecologically beneficial packaging. The Packaging Ordinance also defines the framework conditions respecting the return system for one-way beverage containers.

C 1.6.3 The dual systems

As commissioned by manufacturers, the dual systems must ensure that packaging is collected and recovered pursuant to the Packaging Ordinance. The dual systems calculate the license fees on the basis of the volumes reported by the parties subject to a licensing obligation. Additional collection, sorting and recovery costs are incurred due to unlicensed packaging that consumers nevertheless dispose of via materials collection through the dual systems. These additional costs are not covered by license fees. The dual systems generally have their own interest in the proper licensing of beverage packaging since the license fees are used for financing the take-back, sorting, and consignment of packaging to recovery. Unlicensed packaging that is consigned to the dual systems via curbside collection creates additional costs that are not included in the license fee calculation. For this reason, the dual systems also have their own interest in the control of proper licensing. However, the implementation of effective control mechanisms presents a great challenge and had not been sufficiently implemented in the past (see also p. 289).

The federal states are responsible for the admission of dual systems and for controlling compliance with the provisions of Section 6 of the Packaging Ordinance.[229] The mass flow verifications of the dual systems and the declarations of compliance provided by manufacturers that put filled packaging into circulation serve as control tools.

[228] Cf. Packaging Ordinance § 1 (2).
[229] Cf. R3, 2009, Section 9 - 10, BMU website, *Verpackungsverordnung*.

C 2 Analysis of impact categories

In the model descriptions from Section B, the effects of model-type systems on the selected ecological, social and economic impact categories are analysed hypothetically. While it was only possible to make general statements with respect to the model descriptions, the influence of the three systems existing in Germany are analysed in detail in the following. The analysis is performed on the basis of published data and also contains a detailed analysis of quantitative and qualitative information.

In the following, the impacts are analysed according to system, whenever possible. In doing so, the following structure was selected:

Refillables	Statements concerning an impact indicator that apply to the deposit system for refillable beverage containers
One-way deposit	Statements concerning an impact indicator that apply to the deposit system for one-way beverage containers
One-way dual sys-tems	Statements concerning an impact category that apply to dual systems
All sys-tems	Statements concerning an impact indicator that applies to all systems

At some points, individual topics are gone into in more detail within the scope of excursuses. These are each marked as "excursus".

C 2.1 Ecological impact categories

In the following Section, the results of the systems on ecological impact categories are examined. In the process, the diverse procedures for defining the ecological impacts are also considered. Consequently, the basic remarks on the challenges involved in defining the ecological impact are followed by an analysis of the different life-cycle assessments before the individual impact categories are examined in detail.

C 2.1.1 Selected challenges respecting the assessment of ecological impacts

The most common instrument for assessing the environmental impacts of various products and services – among them beverage containers – is a life-cycle assessment. In life-cycle assessments, quantitative data on material flows and energy flows are collected in a life-cycle inventory analysis for the system to be examined and the effects are evaluated on the basis of the impact categories defined in Regulations 5 to 10. In this respect, the usual categories are: resources consumption, climate change, summer smog and acidification; in some cases, indicators regarding human toxicity and/or other selected parameters are also examined. DIN-EN-ISO norms (14040[230] and 14044[231]) regulate the practical compilation of life-cycle assessments. When the procured findings are being evaluated and interpreted, however, it is necessary to keep in mind that life-cycle assessments are subject to restrictions and therefore do not provide a complete basis for political decision-making. Some of the restrictions regarding life-cycle assessments are outlined in the following.

Assumptions and framework conditions contribute decisively to the findings of life-cycle assessments

The definition of system limits and the choice of products or services examined significantly influence the findings of life cycle assessments. Individual assumptions about the systems examined also have a decisive effect on the result. When life cycle assessments are prepared for various packaging systems, this applies - inter alia - to the assumed transport distances, the number of times refillable beverage containers are circulated, the weight of the packaging, the return and recycling rates, the use of secondary materials in manufacture, and the allocation model applied in the issuance of credits. The Institut für Energie- und Umweltforschung Heidelberg GmbH (IFEU Institute) states: "A product is only clearly defined by life-cycle-related system parameters, such as distribution distance or recycling rates.”[232] This means that, when assumptions are made which have little to do with reality, life-cycle assessments carried out in keeping with DIN-EN-ISO can lead to results that do not reflect reality.

In order to illustrate the above described influencing factors on the results yielded by life cycle assessments of various packaging systems, detailed comments on two life cycle assessments performed by the IFEU Institute are presented in Sections C 2.1.2 and C 2.1.2.2.

Mainly static consideration instead of focus on dynamics and developments

The life cycle assessments under consideration often focus on a market average. In many cases, the market average - in particular with respect to refillable systems that have been established for many

[230] Cf. DIN, DIN EN ISO 14040.
[231] Cf. DIN, DIN EN ISO 14044.
[232] IFEU, 2010 b, p. 12.

years now – does not reflect the state-of-the-art technology found in modern refillable systems. Consideration of the market average thus only has limited suitability with regard to defining trend-setting developments or for working towards them.

As a general rule, sensitivity analyses can be used for examining variables (e.g. different transport distances, circulation rates, the proportions of recycled materials, etc.) that provide clues about system interrelations and developments to be aimed for. Sensitivity analyses thus offer the possibility to consider market dynamics and future developments. However, it is necessary to take into account that sensitivity analyses should consider all systems in a balanced manner. This means that if, for example, the potential for optimisation is to be analysed for a given system, the optimisation potential of the other analysed systems should also be examined.

Incongruence between theory and practice

As already explained, the compilation of a life cycle assessment requires certain assumptions. These assumptions may deviate from actual market practice or may only apply to a certain portion of the market. Owing to structural developments, parameters such as recycling rates, transport distances and circulation rates may also change. The results thus only apply under the indicated framework conditions and are not to be regarded as being of general validity.

Selective communication of results concerning life cycle assessments

The latest life cycle assessments performed by governmental authorities on beverage packaging in Germany were published by the Federal Environment Agency (UBA) in 2000 and 2002 (UBA II Main Section and UBA II Phase 2)[233]. Since then, life cycle assessments have been mainly conducted by industry representatives. The subsequent assessment and presentation of various study results by the respective parties commissioning such studies may also lead to a selective presentation of results.

Going beyond life cycle assessments

Life cycle assessments analyse energy and materials consumption as well as selected and standardised environmental impacts. Owing to the numerous studies and sensitivity analyses conducted, comprehensive information for the derivation of dynamics and interactions is already available. It would appear to make sense to replace the quest for “ecologically advantageous packaging” with a quest for a "sustainable system" and a "sustainable structure". Correspondingly, examinations of systems and system dynamics should be performed with a focus on answering how desirable developments can be promoted.

The fundamental approach of a life cycle assessment is solely on examining ecological impacts, which makes it a helpful tool for assessing the impacts of certain beverage packaging systems. However, the statements made above show that life cycle assessments always have to be interpreted by taking their underlying assumptions into account and that they do not suffice for a holistic consideration of market dynamics and for determining sustainability aspects. Consequently, life-cycle assessments must be supplemented by further analyses.

[233] Cf. Prognos et al., 2000 and Prognos, IFEU and UBA., 2002.

The presented aspects are illustrated in the following by means of the life-cycle assessments published by Beverage Can Makers Europe (BCME) and by IK Industrievereinigung Kunststoffverpackungen e. V. (IK) on various packaging systems in the first half of 2010.

C 2.1.2 Excursus: An examination of assumptions underlying a current life-cycle assessment, based on examples

C 2.1.2.1 Remarks on the study *Ökobilanzielle Untersuchung verschiedener Verpackungssysteme für Bier* (Life Cycle Assessment of Various Packaging Systems for Beer) conducted by the IFEU Institute as commissioned by Beverage Can Makers Europe (BCME)

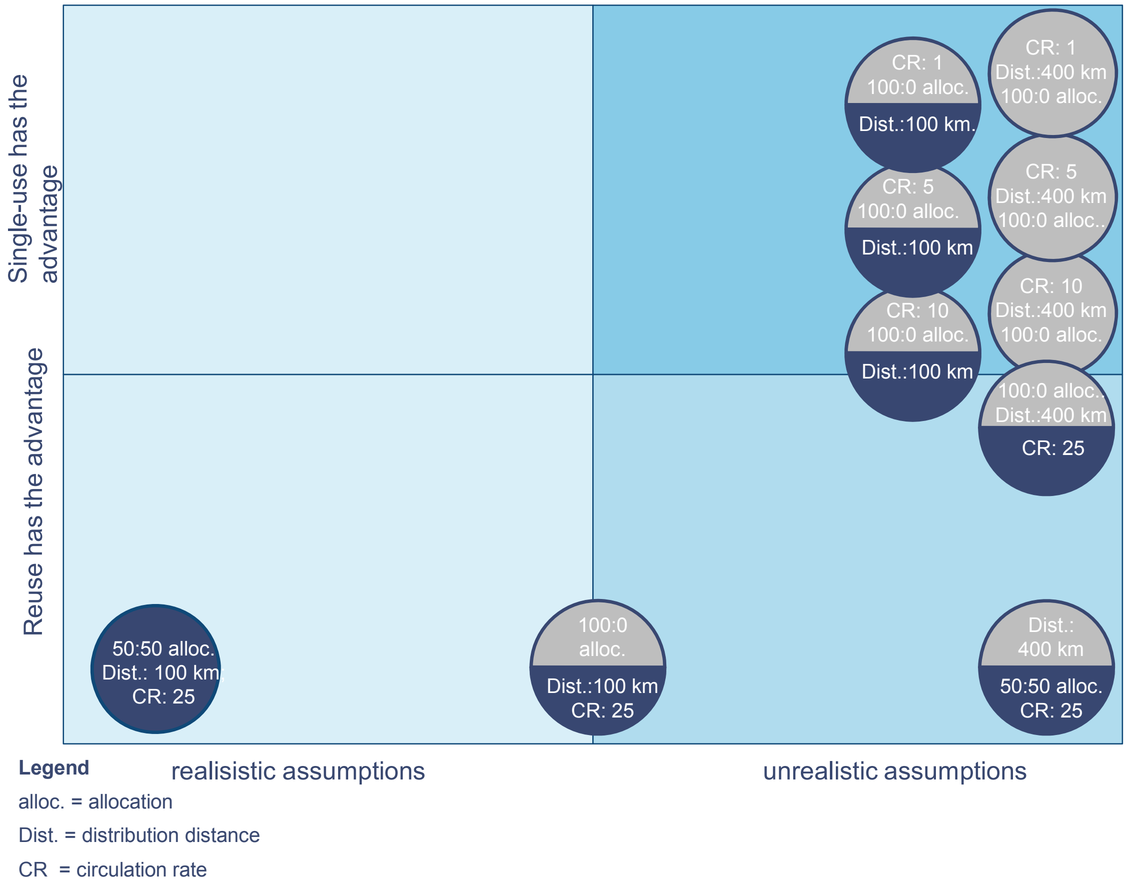
In a life cycle assessment of various packaging systems for beer (hereinafter: IFEU Life Cycle Assessment Beer 2010), the IFEU Institute examined the environmental impact of one-way and refillable beverage containers for beer in 2010. The study was commissioned by BCME and examined refillable glass bottles, one-way glass bottles, PET one-way bottles (with and without multilayers), as well as beverage cans made of aluminium and steel.

The IFEU Institute comments on the results of the study as follows: "Based on the UBA studies conducted in 2000 and 2002, the Federal Environment Agency (UBA) reached the conclusion that refillable glass bottles clearly offer environmental advantages over cans and PET one-way bottles. The current life cycle assessments confirm that this still applies to many consumption situations. In all, however, a differentiation of this statement has become necessary."[234]

Illustration 7 provides an overview of the assumptions made in the IFEU Life Cycle Assessment Beer 2010 and the results obtained therefrom.

[234] IFEU, 13.07.2010 , p. 3.

Illustration 7: Schematic overview of the findings provided by various scenarios applied within the scope of the study *IFEU Life Cycle Assessment for Beer 2010*, which was commissioned by BCME and carried out by IFEU, derived from IFEU, 2010 c. The classification of the reality level and the entire graphic presentation is derived from an own assessment of the study.



The illustration shows that the study analysed significantly more scenarios with theoretic and unrealistic assumptions (with correspondingly lower market relevance) than with realistic assumptions. In this context, the assumptions made lead to more positive results for beverage cans when compared to refillable bottles than would have been the case if realistic assumptions had been applied.

Among other parameters, the basic scenarios assume transport distances of 100 and 400km: with respect to refillable glass bottles, the basic scenario assumes 25 refills and the sensitivity analyses, 1, 5 and 10 refills.

The IFEU Life Cycle Assessment Beer 2010 concluded that, given a "medium situation" (here defined by distribution distance of 100 km and 25 refills), refillable beverage packaging is ecologically advantageous compared to other types of packaging, even in the event that the 100:0 credit allocation model (allocation[235], cf. Section C 2.1.2.1.4) - which is the industry's preferred allocation model - is

[235] With regard to life cycle assessments, the allocation approach takes effects beyond the system limits under consideration into account. When a product or materials of the product examined leave the analysed system and are available as secondary raw materials, additional credits are generated. Material flows leaving the system are by nature lower with regard to refillable bottles than for beverage cans, which is attributable to refilling (reuse). Consequently, credit allocation models are more prone to impact on the life cycle assessment results of one-way beverage containers.

applied.[236] When applying the 50:50 method used by UBA for credit allocation, the refillable glass bottle offers, on balance, an ecological advantage with respect to regional as well cross-regional distribution, given the above assumptions.[237]

Moreover, the authors of the IFEU Life Cycle Assessment Beer 2010 determine that "[…] general statements in favour of refillable systems […] based on the present findings may only be derived reliably for regional distribution and under the condition that refillable pool systems (with corresponding circulation rates of at least 25 refills) have been established".[238]

In the following, the largely unrealistic assumptions relating to distribution distances, circulation rates and selection of the allocation method are considered in more detail. In this context, the focus is on refillable glass bottles and on beverage cans. PET and one-way glass bottles are not discussed in more detail.

C 2.1.2.1.1 Assumed transport distance for refillable bottles

The IFEU Life Cycle Assessment Beer 2010 assumes (without further derivation details) transport distances of 400km for cross-regional distribution and 100km for regional distribution, respectively. In this context, equal distances are calculated for one-way and refillable beverage containers.[239] The assumptions applied seem to be only partly representative and tend to imply advantages for beverage cans in the calculations.

The IFEU Institute comments as follows in the IFEU Life Cycle Assessment Beer 2010: "Owing to a lack of data, the quality of the data on beverage distribution in the present study is limited."[240] The calculations are performed on the basis of distribution distances of 100km and 400km as "requested by the client".[241] It must also be noted that "the findings only apply to the assumed distribution model and cannot be unreservedly applied in general."[242] For example, small- and medium-sized breweries carry out their regional direct selling of beer in refillable bottles [243], which is neither mentioned nor taken into account in the study.

A current study of the Verband Private Brauereien Deutschland e. V. (see also circulation rates on p. 148) concluded that 89 % of the 147 breweries [244] surveyed sell their beer within a radius of 50km. This finding shows that the regional distribution distances of small and medium-sized companies are even lower than assumed in the IFEU Life Cycle Assessment Beer 2010.

The IFEU Life Cycle Assessment Beer 2010 confirms that breweries operating cross-regionally and which fill their beer into refillable beverage containers mainly serve a regional market and that the proportion of cross-regional sales is usually lower. The example of the Veltins brewery, which operates on a cross-regional scale, is mentioned in the IFEU Life Cycle Assessment Beer 2010. This brewery sells 70 % of its output within a radius of 100km, and only the remaining 30% is transported to

[236] Cf. IFEU, 2010 a, p. 149.
[237] Cf. IFEU, 2010 a, pp. 156 and 160
[238] IFEU, 2010 a, p. 163.
[239] Cf. IFEU, 2010 a, p. 136.
[240] Cf. IFEU, 2010 a, p. 136.
[241] Cf. IFEU, 2010 a, p. 54.
[242] IFEU, 2010 a, p. 144.
[243] Interview with industry experts.
[244] Cf. Verband Private Brauereien Deutschland e.V., 2009, average output of the 147 breweries: 17,000 hl per annum.

more distant regions. According to information provided by industry representatives, of this 30%, approximately 70% (i.e. 21% of total production), remains within a radius of 100 to 200km, and the remaining proportion of 9 % diminishes further with increasing distance. Large breweries operating on a cross-regional scale also state an average distance of 240km. [245] This indicates that the transport distance of 400km only applies to a minor market share and does not reflect the average distribution distance of refillable beer bottles made of glass.

According to industry experts, beer filled into beverage cans is usually transported over greater distances than beer filled into refillable bottles. The assumption that these beverage containers have the same transport distances - which tends to be advantageous for beverage cans - does not appear realistic.

C 2.1.2.1.2 Assumed circulation rates for refillable beverage containers

In addition to the basic scenario of 25 refills, the IFEU Life Cycle Assessment Beer 2010 also examines scenarios with 1, 5 and 10 refills. These scenarios are based on the assumption that the number of times refillable bottles are refilled drops sharply in the case of cross-regional distribution, in particular. Furthermore, individual beverage containers and "flopped trend beers“[246] are believed to lead to a reduction in circulations rates.[247] The circulation rate of <5, which was assumed in the calculation without sufficient evidence, would lead to a reversal in the findings in favour of the beverage can according to the IFEU Life Cycle Assessment Beer 2010. However, industry participants state that individual bottles also have circulation rates greater than 30.[248] Breweries that operate on a broad cross-regional scale also confirm circulation rates ranging from 20 to 30.[249] In proportion to the market share, the market failure of a trend beer (flopped trend beer) is to be considered as marginal and it does not seem appropriate to use such an eventuality as a basis for an ecological assessment of refillable systems.

With respect to the calculations of low circulation rates, the IFEU declares very transparently in its IFEU Life Cycle Assessment Beer 2010: “In accordance with the client's request, the calculations were performed by using the circulation rates 10, 5 and 1. However, there is no information available on the market relevance of those figures. In particular the circulation rate of 1 should, if at all, be of epistemological significance”.[250]

25 refills are assumed to be the most favourable scenario for the refillable system. While GVM assumes an average circulation rate of 19.2, the IFEU Life Cycle Assessment Beer 2010 also notes that there is an increasing exchange of bottles even with respect to individual bottles, and that the circulation rates appear to be lower than they actually are due to the purchase of bottles when renewing bottle pools. Accordingly, IFEU considers the figures provided by GVM to be too low.[251] This is also

[245] Interview with industry experts.
[246] "Flopped trend beers" means new or flavour-added beer-containing beverages that were not accepted on the market.
[247] Cf. IFEU, 2010 a, pp. 28 and 29.
[248] Interview with industry experts.
[249] Interview with industry experts.
[250] IFEU 2010 a, p. 40.
[251] Cf. IFEU, 2010 a, pp. 26 and 27.

confirmed by statements made by industry experts, who also mentioned that the trend towards individual bottles has meanwhile been diminishing.[252]

According to the above-mentioned survey conducted by the Verband Private Brauerein Deutschland e.V., the average circulation rate respecting breweries that operate mainly on a regional scale stands at approx. 50 (which is twice as high as assumed in the IFEU Life Cycle Assessment Beer 2010).[253] It has already been mentioned in the introduction that refillable beer bottles made of glass are ecologically more beneficial than beverage cans given a scenario with 25 refills and a distribution distance of 100 or 400km, when applying the UBA method respecting the allocation of credits. This advantage increases accordingly when there are about 50 refills. In this context, however, it must be assumed that the ecological benefit does not increase on a straight-line basis, but rather to a disproportionately low extent.

C 2.1.2.1.3 Return rates

The IFEU Life Cycle Assessment Beer 2010 assumes the following return rates for the various packaging systems [254]:

- Refillable glass bottles: 87.9 %
- Beverage cans (one-way): 96 %

Feve 2009, the Association of European Glass Manufacturers, is mentioned as the source for the return rates of refillable glass bottles. It is therefore assumed that the figures relate to the European market's average and not to Germany. With respect to refillable glass bottles, breweries operating regionally as well as those operating cross-regionally indicate return rates ranging from 98.5 % to 99 %.[255] If the higher return rates for refillable glass bottles were taken into account in the life cycle assessment, this would tend to imply a reduced environmental impact of refillable bottles.

The life cycle assessment results concerning aluminium as well as steel beverage cans depend strongly on the recycling rate. High return rates are a prerequisite for high recycling rates. In Germany, high return rates have only been achieved since the introduction of a deposit on one-way beverage containers.

C 2.1.2.1.4 Allocation model and assessment of recycling

Depending on the model, credit notes and debit notes, which due to the reuse of materials stemming from a system (e.g. glass, aluminium, PET and steel from beverage containers), are allocated to the delivering or receiving system to varying extents. The IFEU Institute explains very transparently that, in general, allocation procedures are not solely based on scientific facts, but rather on conventions, which "also embrace value systems“.[256] Specific explanations are provided on the calculation performed: "In keeping with the client's request, all basic scenarios are stated using the 100 per cent allocation (100:0 allocation) method". This means that aluminium and steel beverage cans are fully credited (100 % allocation) and that the material can be reused for another application after its use. The type of reuse - with due consideration for the quality of the products manufactured from secon-

[252] Interview with industry experts.
[253] Cf. Verband Private Brauereien Deutschland e.V., 2009.
[254] Cf. IFEU, 2010 a, p 34.
[255] Interview with industry experts.
[256] IFEU, 2010 a, p. 14.

dary material - and the closed substance cycle potential (see Section A 2.4) are usually not taken into account.[257] From the viewpoint of the IFEU Institute, there is no material-specific limitation respecting aluminium. Consequently, strict closed cycle management is not considered necessary. The important issue is to use as much secondary aluminium as possible.

However, with respect to the production of aluminium cans, the IFEU Life Cycle Assessment Beer 2010 does not assume the use of scrap material from used beverage cans for the manufacture of new beverage cans. Scrap material from cans collected by retailers and wholesalers or the end-consumer are mainly used in the manufacture of other products, such as aluminium casting parts. Accordingly, this does not concern a closed material cycle of beverage cans (i.e. a beverage can is used to produce a new one), but rather open-loop recycling. Nevertheless, the provision of the entire aluminium scrap material is allocated to the beverage can as a credit[258], just as in the case of recycling in a closed cycle. A recycling rate of 96 % is assumed for steel cans.[259] However, this assumption is higher than the scrap material portion actually used in the manufacture of cans. The aluminium recovered from steel cans (9 % of the weight, see Illustration 18) is consigned to energy recovery. [260] Nevertheless, credits are granted for the entire material (96 %) discharged from the system.

The net result of the ecological assessment for aluminium and steel cans depends strongly on the credit allocation model applied.[261] If the actual proportion of recycling material used in a can is high, the results approach the 100:0 allocation. However, no data is available on the real input of recyclates.[262] A schematic comparison of various methods for credit allocation is provided in the following Table.

[257] Cf. IFEU, 2010 a, p. 145.
[258] Cf. IFEU, 2010 a, p. 48.
[259] Cf. IFEU, 2010 a, p. 50.
[260] Cf. IFEU, 2010 a, p. 48
[261] Cf. IFEU, 2010 a, pp. 83 and 88.
[262] Cf. IFEU, 2010 a, p. 153.

Table 59: Presentation of various allocation possibilities (allocation of credit notes)

Allocation model	Comments
50:50 allocation "UBA method" (IFEU Institute term)	The use of aluminium, steel, PET or glass that leave the analysed system is allocated to the delivering system (here: beverage can or bottle) at 50 %, while the other half is allocated to the receiving system as a credit note. In this way, both the provision and use of recycled material are rewarded equally.
100:0 allocation "Industry method" (IFEU Institute term)	The use of aluminium, steel, PET or glass that leave the analysed system is fully allocated to the discharging system (here: beverage can or bottle) in the form of a credit note. Under this approach, credits are allocated to the manufacturer for providing one-way beverage containers for open-loop recycling.
0:100 allocation "Closed-loop promotion approach"	The use of aluminium, tin, PET or glass that leave the analysed system is fully allocated to the receiving system (only in the case of closed substance cycle management does this relate to beverage cans or bottles) in the form of a credit note. In abstract terms, this approach can be considered to be the consistent implementation of producer responsibility for the producer's material: Accordingly, the producers/manufacturers are generally responsible for processing their packaging with a view to its reuse. A credit note is only granted for material that is actually used again in the manufacture of beverage packaging, i.e. for closed substance cycle management. With respect to open-loop recycling, only the system that makes use of the material would receive a credit note.

UBA's life cycle assessments used the 50:50 allocation approach. This means that credits were equally allocated to the delivering and to the receiving system (which uses the material), each being allocated a proportion of 50 %. Since then, the 50:50 allocation approach has mainly been used as the standard method in Germany and is a means to prevent one-sided preference for either the delivering or the receiving system. In contrast, a 100:0 allocation was selected in the IFEU Life Cycle Assessment Beer 2010, which translates into better results for the beverage can. Conversely, the UBA method was applied in the sensitivity analysis, which, for example, indicates a doubling of greenhouse gas emissions with respect to aluminium cans (in the climate change impact category) compared to the basic scenario with a 50:50 allocation. With respect to beverage cans made of steel, greenhouse gas emission increase by approximately 25 %.[263]

[263] Cf. IFEU, 2010 a, pp. 149 and 155.

As presented in Table 59, a 0:100 allocation would reflect the strict implementation of producer responsibility based on the underlying assumption that the producer/manufacturer is responsible for processing the used material in order to further utilise the same material cycle, if possible. Consequently, the use of recycling would only be rewarded due to the actual use of the material used: With respect to the delivering system, this would only be the case if the recycled material were used in a closed cycle. Such an assessment approach is aimed at promoting the creation of closed cycles wherever possible. In contrast, a 100:0 allocation rewards the provision of material, even if - in the extreme case - the material is not used at all, or is used for other purposes.

In addition to the aspects considered above, the recovery quality, options, and limitations of closed substance cycle management and the transparency of a system must be increasingly taken into account. The former models for credit allocation do not take recovery quality into account.

C 2.1.2.1.5 Parameters to be considered in addition to the life cycle assessment

The parameter concerning human toxicity mentioned in the IFEU Life Cycle Assessment Beer 2010 has rarely been considered to date. The results for this impact category show clear advantages for beverage packaging made of glass (refillable and one-way bottles) compared to beverage cans and PET bottles. However, the data is assessed as being unreliable and is therefore is not taken into account in the final assessment. With a view to a holistic assessment, a precise analysis of this issue should be performed.

In addition to the greenhouse effect, acidification and eutrophication, which are the established impact categories examined in Europe, current studies conducted in the United States of America increasingly examine the impact on human health and include aspects such as human toxicity, the impact on respiratory tracts, cancer risk, and ecotoxicity in their assessments of various product and recycling systems.[264] The aspect of interaction between packaging and contents was not primarily considered within the scope of this study: However, its relevance became clear from the analysis of secondary materials and also from interviews with industry experts.

[264] Cf. Morawski C., 2010, p. 4.

C 2.1.2.2 Remarks on the PET Life Cycle Assessment 2010 conducted by the IFEU Institute as commissioned by IK Industrievereinigung Kunststoffverpackungen e. V. (IK)

In the second study, which is analysed in detail below, the IFEU Institute compared the environmental impact of one-way and refillable beverage containers for carbonated mineral waters and soft drinks as well as non-carbonated mineral waters in the study "PET Life Cycle Assessment 2010: Life Cycle Assessment of Various Packaging Systems for Carbonated Mineral Waters and Soft Drinks as well as Non-Carbonated Mineral Waters" (hereinafter: IFEU PET Life Cycle Assessment 2010). The study was commissioned by IK and examined beverages for storage (≥ 0.7 litre) and for immediate consumption (≤ 0.5 litre).

In all cases analysed, PET refillable bottles are assessed as being significantly more advantageous than the respective comparable PET one-way bottles, although PET one-way bottles have 50 % more filling volume in two of the cases examined. In three out of four comparisons, the examined refillable system for glass proved to be more advantageous than PET one-way bottles. Only with respect to mineral waters containing CO_2 do PET one-way bottles achieve a similar result as refillable glass bottles in the IFEU PET Life Cycle Assessment 2010, based on the assumptions made. However, the examined 0.7 litre refillable bottles have less than half the filling volume of the examined 1.5 litre one-way bottles for stock-up purchases. When it comes to a general comparison of one-way and refillable systems with respect to the ecological impact, a comparison with the market-leading PET refillable packaging of GDB as the basic reference system would appear to be more appropriate. A schematic presentation of the results is provided in the following table:

Table 60: Schematic overview of the findings of the IFEU PET Life Cycle Assessment 2010, *Ökobilanzieller Vergleich von Mineralwasser und CO_2-haltigen Erfrischungsgetränken in Mehrweg- und Einweggebinden* (Life-Cycle Assessment-based Comparison of Mineral Water and Soft Drinks Containing CO_2 in Refillable and One-way Packaging), performed by the IFEU Institute as commissioned by IK; source: IFEU, 2010 b

	Refillable bottles		One-way bottles
Material	PET	Glass	PET
Still mineral waters - immediate consumption	+ 0.5 litre (GDB)	+ 0.5 litre (GDB)	- 0.5 litre
Mineral waters containing CO_2 and non-alcoholic soft drinks - immediate consumption	+ 0.5 litre (GDB)	+ 0.5 litre (GDB)	- 0.5 litre
Still mineral waters – for storage	+ 1.0 litre (GDB)	+ 0.75 litre (GDB)	- 1.5 litre
Mineral waters containing CO_2 and soft drinks - For storage	+ 1.0 litre (GDB)	+/- 0.7 litre (GDB)	+/- 1.5 litre

\+ = overall analysis indicates ecological advantages
\- = overall analysis indicates ecological disadvantages
+/- = overall analysis indicates neither ecological advantages nor ecological disadvantages

An analysis of the assumptions used in the IFEU PET Life Cycle Assessment 2010 revealed that the following additional aspects must be taken into account in the assessment of the findings.

C 2.1.2.2.1 Systematics

Comparison of varying filling volumes:
A comparison of the 1.5 litre PET one-way bottle with the 0.75 litre refillable glass bottle (instead of comparing it with the 0.7 litre refillable glass bottle) already indicates advantages for the refillable glass bottle in some categories. In this context, the packaging forms most commonly used in the market are compared, which differ greatly as regards filling volume, however. A larger filling volume usually means higher ecological efficiency. Consequently, the advantages of refillable glass bottles increase when compared to PET one-way bottles with lower filling volumes or to refillable glass bottles with the same filling volumes. In the IFEU PET Life Cycle Assessment 2010, these comparisons were only made with regard to the immediate consumption segment, but not for the storage segment.

Selection of reference system:
The IFEU PET Life Cycle Assessment 2010 compared modern, one-way systems (modern bottling plants and bottles) with the 41-year-old refillable system of GDB as a reference system. Optimisation potential concerning glass refillable systems was presented in the study, but not taken into account in the basic scenario calculations.

Assumptions concerning circulation rates:
40 refills were assumed for refillable glass bottles designated for the stock-up sale of beverages containing CO_2. The calculations of the Fraunhofer-Institute for Material Flow and Logistics (Fraunhofer IML) indicate 59 refills.[265] Taking the higher circulation rate (current status) into account would lead to improved results for refillable glass bottles in comparison to PET one-way bottles. In all, the apparently below-average assumption respecting the circulation rate led to a worse result for the 0.7 litre refillable glass bottle.

C 2.1.2.2.2 Current state of technology in refillable systems

As part of the IFEU PET Life Cycle Assessment 2010, the sensitivity analysis examines potential regarding the optimisation of bottling plants in general. Various statements have been made respecting the implementation status of these optimisation measures. If the optimisation measures had already been taken into account in the basic scenario, this would result in an advantage for the refillable system when comparing a 0.7 litre refillable glass bottle with a 1.5 litre PET one-way bottle.

Various aspects of optimisation potential are presented in the following:

Filling:
Modern fillings plants for refillable packaging require less water and energy for process steam production than was assumed in the basic scenario of the IFEU PET Life Cycle Assessment 2010. According to the calculations of the study's sensitivity analysis, about 10 % less CO_2 equivalents are generated during the filling process at efficient plants.[266]

Crate optimised for transport:
GDB has developed a crate for the 0.7 litre refillable glass bottle that is optimised for transport. In

[265] Cf. IML, 2010; according to the IFEU Institute, these data were yet been available at the time the study was prepared.
[266] Cf. IFEU, 2010 b, p. 129.

the future, this crate is to be used increasingly. Rheinfels-Quellen already uses a crate with similar dimensions. Owing to optimised logistics, use of the new crate leads to a reduction in CO_2 equivalents.

An example of optimised bottles and an optimised crate system:
The individual bottle of Hornberger Lebensquell GmbH, which has been on the market for many years, has a filling volume of one litre and weighs 625 grams (also suitable for mineral waters containing CO_2), making it 26 % (per filling volume) lighter than GDB's 0.7 litre refillable glass bottle. Similar weight reductions can also be assumed for modern 0.75 litre bottles.

The presentation in Table 61 indicates that, according to information provided by the beverage producer, a truck with lower load can transport about 23 % more water (per truck) and a maximum loaded truck 54 % more water when compared to the calculations provided in the IFEU PET Life Cycle Assessment 2010.[267] This would correspondingly reduce the ecological impact implied per litre of liquid filled into refillable bottles compared to the results shown in the IFEU PET Life Cycle Assessment 2010.

Table 61: Optimised truck utilisation through the crate system of Hornberger Lebensquell GmbH compared to the brown GDB crate for the pearl glass bottle; source: interview with industry experts

	GDB crate (brown) (12 x 0.7 litre crate without a central carry handle on Euro pallet)	**Hornberger Lebensquell crate** (6 x 1 litre crate with a central carry handle on Euro pallet) lower load	**Hornberger Lebensquell crate** (6 x 1 litre crate with a central carry handle on Euro pallet) maximum load
Load per pallet	432 x 0.7 l = 302 l	4 layers 384 x 1 l	5 layers 480 x 1 l
Load per truck	14,688 x 0.7 l = 10,282 l	12,672 x 1 l	15,840 x 1 l
Difference (in percentage terms) compared to the DGB crate (brown)		**+ 23 %**	**+ 54 %**

[267] Interview with industry experts; when shipping to various trading companies, the truck load is partly packed in four layers and partly in five layers per pallet.

C 2.1.2.2.3 Utilised average weights of PET one-way bottles

Deutsche Umwelthilfe e. V. (DUH) measured the weight of various PET one-way bottles that are currently sold by retailers. According to these measurements, the bottle weight of brand products is higher by up to 33 % than assumed in the IFEU PET Life Cycle Assessment 2010.[268]

As a result of the bottles selected, the IFEU PET Life Cycle Assessment 2010 covers 59 % of all one-way fillings for mineral waters and soft drinks in the segments examined. The segments mainly concern beverage producers for discounters, and thus own brands.[269] According to information provided, brand-name beverages in PET one-way bottles have a market share of approximately 10 to 15 %.[270] The weight measurements performed by DUH indicate that higher weights must be assumed for brand-name beverages with respect to PET one-way bottles. The assumption of higher average rates should presumably result in a negative impact on the ecological assessment since the manufacture of PET bottles has a significant influence on the life cycle assessment of one-way bottles.

In its analysis of PET one-way bottles, the IFEU PET Life Cycle Assessment 2010 did not take into account beverage container sizes of 1.25 litres and 1.0 litre. According to the DUH analysis, the weights of those beverage containers for soft drinks containing CO_2 are higher than the bottle weights assumed in the IFEU PET Life Cycle Assessment 2010 for 1.5 litre PET one-way bottles. For example, according to those weight measurements, the 1.25 litre PET one-way bottles are - on average - about 11 % heavier than the average weights assumed in the IFEU PET Life Cycle Assessment 2010 for 1.5 litre PET one-way bottles, even though their filling volume is 17 % lower.[271] It is recommended that bottle weights be determined on the basis of statistically relevant values in order to obtain assurance respecting this factor.

C 2.1.2.2.4 Distribution distances

The PET one-way bottling plants analysed in the IFEU PET Life Cycle Assessment 2010 usually serve to manufacture a few uniform store brands that are sold under the same brand name throughout Germany. In contrast, mineral waters in refillable bottles are mainly distributed regionally. The IFEU PET Life Cycle Assessment 2010 assumes average distribution distances of 260km (there and back) for refillable bottles made of glass and PET.[272] A transport distance of only 212km was assumed for the PETCYCLE system (crate-based PET one-way system). This is 19 % shorter than the distance indicated for refillable systems, even though the study claims that the distribution channels for the PETCYCLE system are the same as those for refillable systems.[273]

The study does not take into account imports of beverages in one-way bottles, even though the three French brands: Brunnen Volvic, Vittel and Evian, jointly have a market share of 90% in the beverage segment "still mineral waters".[274] A significantly higher distribution distance must be assumed

[268] Cf. DUH and SIM, 23.06.2010.
[269] Cf. IFEU, 2010 b, p. 4.
[270] Interview with industry experts.
[271] DUH, weight measurements of various beverage containers, 2010. Those measurements indicate that the average weight of 1.25 litre PET one-way bottles is 36.5 grams. This weight was placed in relation to the weight indicated for 1.5 litre PET one-way bottles in the IFEU PET Life Cycle Assessment 2010, which is 33.0 grams.
[272] Cf. IFEU, 2010 b, p. 62, analogous to IFEU, 2008.
[273] Cf. IFEU, 2010 b, p. 49.
[274] Interview with industry experts.

for those products when compared to the products of local beverage producers, which were already taken into account in the study.

C 2.1.2.2.5 Proportion of recyclates in PET one-way bottles

The IFEU PET Life Cycle Assessment assumes the proportion of recyclates to amount to 25 % in the manufacture of 1.5 litre PET one-way bottles for beverages containing CO_2, without providing the source for this estimate. Complex processing and the use of food grade recyclates[275] are determined by supply and demand, which, due to fluctuating raw material prices, is difficult to define as an absolute parameter. Depending on the respective recyclate's price compared to the primary material and the demand for PET bottles, the recylate is used for bottle-to-bottle recycling or for the manufacture of other products.[276] It would make sense and be helpful if transparent documentation - encompassing the various manufacturers - on the bottle-to-bottle secondary material input rates for PET bottles were provided.

C 2.1.2.2.6 Assumptions concerning refillable individual bottles

The IFEU PET Life Cycle Assessment 2010 examines refillable individual bottles made of PET, but does not analyse refillable individual bottles made of glass. Such an analysis would also be beneficial, since, in the meantime, there are individual beverage containers made of glass on the market that have been optimised with respect to weight and logistics (see also. p. 280). This positive potential for optimisation of the refillable systems for glass has not been taken into account in the study's calculations and results.

[275] Recyclate, which is suitable for use as packaging in the foodstuff segment.
[276] Interview with industry experts.

C 2.1.3 Detailed analysis of ecological impact categories based on specified impact indicators

Presently, there are no current life cycle assessments available that were performed by a governmental authority and which extensively compare various types of packaging or the packaging and return systems of various beverage segments. The most recent analyses available concern the life cycle assessments published by the Federal Environment Agency (UBA II, in two parts). These life cycle assessments were already prepared in 2000 and 2002 and thus relate to even older data. Subsequently, various stakeholders prepared their own studies, which partly make reference to the UBA studies, but deviate with respect to the scope of the study, the data used and also the time when such data were collected. A direct comparison of the various results would therefore not be of informative value.

C 2.1.3.1 Climate change

With a view to providing a transparent presentation of different life cycle assessments of beverage packaging in various beverage segments, the results (examples) for the indicator "climate change" are compared with each other in the following. Please see Sections C 2.1.2 and C 2.1.2.2 for a more detailed explanation of the assumptions underlying the various life cycle assessments.

With respect to the structure, it was originally planned to analyse the ecological impact indicators; resource consumption, summer smog, acidification and eutrophication in addition to the parameter, climate change. However, since the results of various life cycle assessments are not comparable due to different objectives and assumptions and a comparative presentation of the quantitative results would thus not lead to the desired objective, only one indicator was used as an example in the comparison. In this context, the beverage containers examined within the scope of several life cycle assessments were taken into account wherever possible. Due to the great number of available life cycle assessments, it was more in line with the desired objective - against the backdrop of this study's integrative objective - to analyse the assumptions of the various life cycle assessments in detail in order to emphasise the reasons for the partly different results. This was done in the previous sections: C 2.1.1 to C 2.1.2.2.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

Refillables

Water and soft drinks beverage segment (with and without CO_2):

Comparison of results of various life cycle assessments for mineral water and soft drinks containing CO_2 (in kg CO_2/1,000 litre product)				
	UBA II 2000/ 2002[277]	IFEU PETCORE 2004[278]	IFEU GDB 2008[279]	IFEU PET Life Cycle Assessment 2010 (basic scenario)[280]
Refillable glass bottle 0.7 l GDB (pearl bottle)	ca. 83	ca. 162	84	ca. 81
Refillable glass bottle 0.75 l GDB (little CO_2 and still)	ca. 78	-	-	ca. 73
PET refillable bottle 1.0 l GDB	-	-	69	ca. 64
PET refillable bottle 1.0 l (lemonade)	ca. 46	-	-	-
Refillable glass bottle 0.5 l	ca. 100	-		ca. 100
PET refillable bottle 0.5 l	ca. 105	-	-	ca. 90
supplementary for still mineral waters				
PET refillable bottle 1.5 l	-	-	-	ca. 47.5

The following were not taken into account:

- Optimisation scenarios included in the IFEU PET Life Cycle Assessment 2010 for the various types of packaging
- 1.0 litre refillable glass bottles
- Light glass bottles that were examined in UBA II/Phase 2, since they proved not to be marketable

Juices beverage segment:

Result for juices (in kg CO_2/1,000 litre product)	UBA II[281]
Refillable glass bottle 0.7 l (VdF, clear)	ca. 90
Refillable glass bottle 1.0 l (VdF, clear)	ca. 90
One-way glass bottle 1.0 l (brown)	ca. 355

The latest life cycle assessment of the Fachverband Kartonverpackungen für flüssige Nahrungsmittel e. V. (FKN) conducted in 2006 did not analyse refillable bottles.

[277] Cf. Prognos et al., 2000, pp. 174 and 192; Prognos, IFEU & UBA, 2002, pp. 109 and 114.
[278] Cf. IFEU, 2004, p. XII.
[279] Cf. IFEU, 2008, p. 62.
[280] Cf. IFEU, 2010 b, pp. 91 and 98.
[281] Cf. Prognos et al., 2000, p. 186.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

Refillables

Beer beverage segment:

The beer beverage segment was analysed by government authorities in the UBA I Life Cycle Assessment. The data originate from 1995.[282] The data are compared to the results provided in the IFEU Life Cycle Assessment Beer 2010. As a result of the different framework conditions, however, the data can only be compared to a very limited extent. A number of scenarios were calculated for beer (see also Section C 2.1.2). Of these scenarios, two were selected as examples for demonstrating the differences, given varying framework conditions, based on the following assumptions:

Comparisons of results of various life cycle assessments for beer (in kg CO_2/1,000 litre product)

	UBA I[283]	IFEU Life Cycle Assessment Beer 2010 Scenario I "UBA regional"[284]	IFEU Life Cycle Assessment Beer 2010 Scenario II "UBA cross-regional"[285]	IFEU Life Cycle Assessment Beer 2010 Scenario III "Industry cross-regional"[286]
Refillable glass bottle 0.5 l	ca. 59	ca. 100*	ca. 159**	ca. 160***

* The scenario I, "UBA regional", describes the results when assuming a transport distance of 100km (which is a rather high assumption for the regional sale of beer in refillable bottles), 25 refills and application of the 50:50 UBA credit allocation model.

** Scenario II, "UBA cross-regional", describes the results when assuming a transport distance of 400km (which is a rather high assumption for the sale of beer in refillable bottles), 25 refills and application of the 50:50 UBA credit allocation model.

*** Scenario III, "Industry cross-regional", describes the results when assuming a transport distance of 400km (which is a rather high assumption for the sale of beer in refillable bottles), 25 refills and application of the 100:0 industry credit allocation model.

Owing to this theoretical assumption, scenarios with circulation rates below 25 were not listed in this context.

[282] Cf. Schmitz, S. et al., 1995.
[283] Cf. Schmitz, S. et al., 1995, p. B 13.
[284] Cf. IFEU, 2010 a, p. 83.
[285] Cf. IFEU, 2010 a, p. 89.
[286] Cf. IFEU, 2010 a, p. 89.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

One-way deposit

Beverage segments "mineral water" and "soft drinks containing CO_2":

Comparison of results of various life cycle assessment for mineral water and soft drinks containing CO_2 (in kg CO_2/1,000 litre product)				
	UBA II 2002[287]	PETCORE 2004[288]	GDB 2008[289]	PET Life Cycle Assessment 2010 (basic scenario)[290]
PET one-way bottle 1.5 l	ca. 88	ca. 193	118	ca. 83
PETCYCLE one-way bottle 1.0 l	ca. 113	-	118	ca. 88
PETCYCLE one-way bottle 1.5 l	ca. 82	-		ca. 71
PET one-way bottle 0.5 l	-	-	-	ca. 136
supplementary for still mineral waters[291]				
PET one-way bottle 1.5 l	-	-	-	ca. 83

287 Cf. Prognos, IFEU & UBA, 2002, p. 104.
288 Cf. IFEU, 2004, p. XII.
289 Cf. IFEU, 2008, p. 52.
290 Cf. IFEU 2010 b, p. 91.
291 Cf. IFEU 2010 b, p. 98.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

One-way deposit

Beer beverage segment:

Comparisons of results of various life cycle assessments for beer (in kg CO_2/1,000 litre product)			
	IFEU Life Cycle Assessment Beer 2010 Scenario I "UBA re-gional"[292]	IFEU Life Cycle Assessment Beer 2010 Scenario II "UBA cross-regional"[293]	IFEU Life Cycle Assessment Beer 2010 Scenario III "Industry cross-regional"[294]
Aluminium beverage can 0.5 l	ca. 280	ca. 295	ca. 150
Steel beverage can 0.5 l	ca. 290	ca. 300	ca. 240
PET one-way bottle, multi-layer 0.5 l	ca. 220	ca. 240	ca. 230
PET one-way bottle (single layer) 0.5 l	ca. 175	ca. 195	ca. 190
One-way glass bottle 0.5 l	ca. 335	ca. 360	ca. 335

The data on beverage cans appearing in the UBA Life Cycle Assessment I (with data from 1995) were not taken into account in this context since beverage cans were still being disposed of through the dual system at that time.

With respect to the selection and description of scenarios I to III of the IFEU Life Cycle Assessment Beer 2010, please see p. 140. Since this assumption is viewed as lacking proper market coverage, scenarios with circulation rates below 25 were not listed in this context.

292 IFEU, 2010 a, p. 83.
293 IFEU, 2010 a, p. 89.
294 IFEU, 2010 a, p. 89.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

One-way dual systems

Beverage segments: "mineral water" and "soft drinks containing CO_2":

Comparison of results of various life cycle assessments for mineral water and soft drinks containing CO_2 before introduction of a mandatory deposit (in kg CO_2/1,000 litre product)

	UBA II 2000/2002[295]	IFEU PETCORE 2004[296]
PET one-way bottle 1.5 l	ca. 105	ca. 188
PET one-way bottle 0.5 l	ca. 198	-
One-way glass bottle 1.0 l	ca. 275	-
Aluminium beverage can 0.5 l	ca. 207	
Aluminium beverage can 0.33 l	ca. 335	
Steel beverage can 0.5 l	ca. 364	
Steel beverage can 0.33 l	ca. 510	

The studies quoted for refillable and one-way deposit systems – i.e. IFEU PET Life Cycle Assessment 2010 and IFEU GDB 2008 - did not examine beverage packaging that is disposed of through the dual systems.

Beer beverage segment:

Results of life cycle assessment for beer before introduction of a mandatory deposit (in kg CO_2/1,000 litre product)

	UBA I[297]
Aluminium beverage can 0.5 l	ca. 289/433[298]
Aluminium beverage can 0.33 l	-
Steel beverage can 0.5 l	ca. 300/360[299]
Steel beverage can 0.33 l	-
One-way glass bottle	ca. 302

[295] Cf. Prognos et al., 2000, p.198; Prognos, IFEU & UBA, 2002, pp. 104, 109, 117 and 120.
[296] Cf. IFEU, 2004, p. XII.
[297] Cf. Schmitz, S. et al., 1995, p. B 13.
[298] The source, Schmitz, S. et al., 1995, p. B 13 noted that life cycle inventories were not available for all emissions. Consequently, estimates were made that resulted in values that were 50 % higher for aluminium cans.
[299] The source, Schmitz, S. et al., 1995, p. B 13 noted that life cycle inventories were not available for all emissions. Consequently, estimates were made that resulted values hat were 20 % higher for tinplate cans.

Indicators 1 to 5 – some examples for analysis of the indicator "climate change" (in kg CO_2 per 1,000 litre product)

One-way dual systems

Juices beverage segment:

Comparisons of results of various life cycle assessments for juices (in kg CO_2/1,000 litre product)		
	UBA II[300]	IFEU FKN 2006[301]
Beverage carton 1.0 l	ca. 83	ca. 57
Beverage carton 1.0 l with spout	-	ca. 68
Beverage carton 1.5 l with spout	-	ca. 59
Beverage carton 0.5 l with spout	-	ca. 107
Beverage carton 0.2 l with straw	-	ca. 107
PET one-way bottle 1.0 l	-	ca. 178
PET one-way bottle 0.5 l	-	ca. 277
PET one-way bottle 0.33 l	-	ca. 272

The presentation of the "climate change" indicator clearly demonstrates that the results provided by the different life cycle assessments for the individual packaging systems vary substantially. This great variation in results is attributable to differences in the objectives, the scope of the respective analysis, the years selected as a basis for the data used, framework conditions, and other factors. Almost no analyses were performed which yielded values that can actually be compared.

[300] Cf. Prognos et al. 2000, p. 186.
[301] Cf. IFEU, 2006, pp. 54 and 59.

C 2.1.3.2 Refillable rates

Indicator 6 – Refillable rate

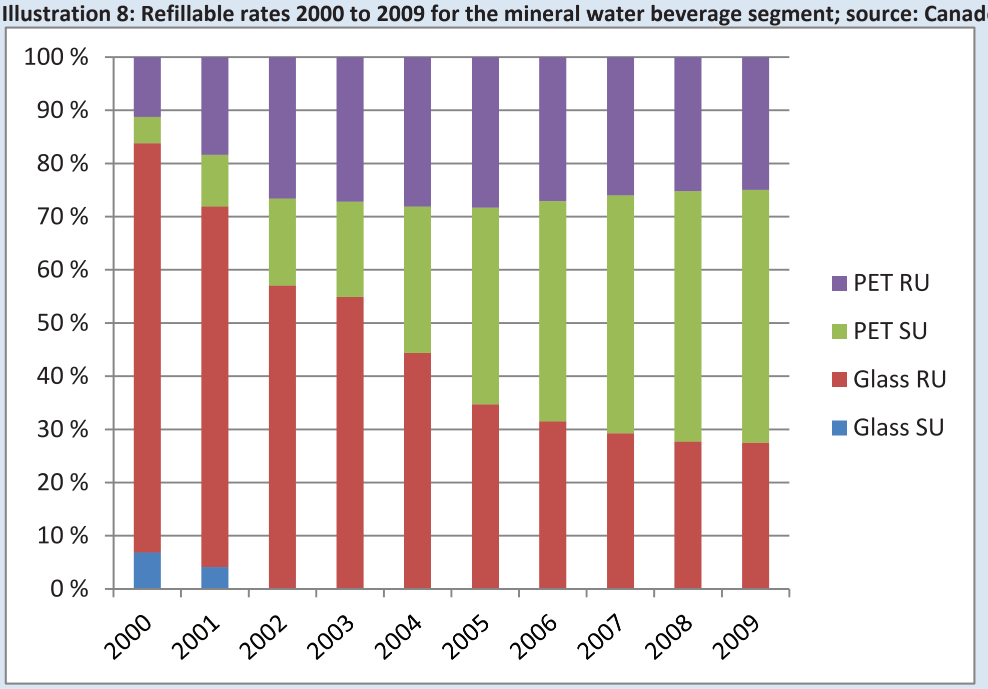
Refillables

	GVM 2007 (% of beverages filled into refillable beverage containers in total beverage consumption in l) [302]	**Canadean 2009 (% of beverages filled into refillable beverage containers in total beverage consumption in l)** [303]
Mineral water	46.9 %	52.3 %
Soft drinks	33.6 %	38.1 %
Beer	86.0 %	84.8 %
Mixed beverages containing alcohol	23.1 %	N/A
Juices	N/A	8.1 %
Refillable rate, total (weighted according to filling quantity)	**51.3 %**	**50.3 %**

The development of refillable rates for the period from 2000 to 2009 is presented by segment in the following. The data were provided by the market research institute Canadean (proportion of beverages filled into refillable beverage containers in total beverage consumption, expressed in percentage terms):

Mineral water beverage segment:

Illustration 8: Refillable rates 2000 to 2009 for the mineral water beverage segment; source: Canadean, 2010



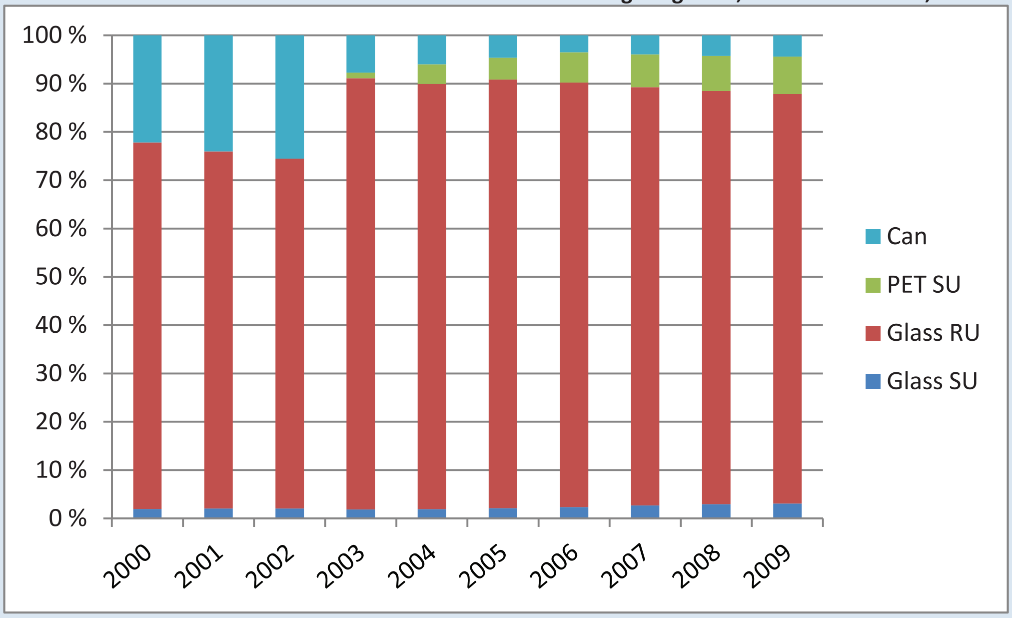
[302] Cf. GVM, 2009 b, p. 11.
[303] Canadean, 2010 (PwC analysis of Canadean data).

Indicator 6 – Refillable rate

Refillables

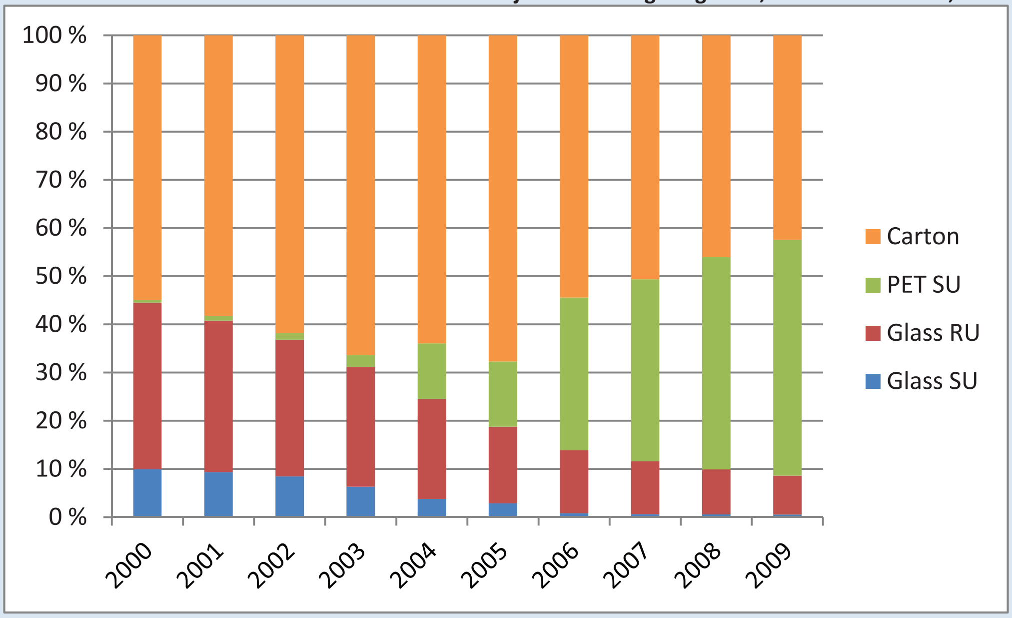
Beer beverage segment:

Illustration 9: Refillable rates 2000 to 2009 for the beer beverage segment; source: Canadean, 2010



Juices beverages segment (*juice and non-carbonated soft drinks*):

Illustration 10: Refillable rates 2000 to 2009 for the juices beverage segment; source: Canadean, 2010

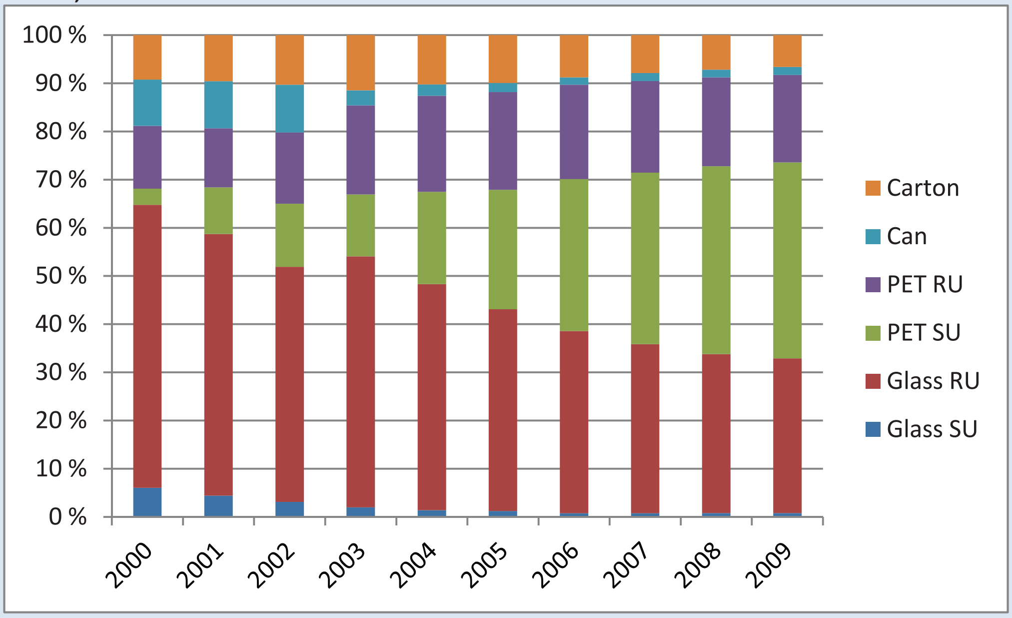


Indicator 6 Refillable rate

Refillables

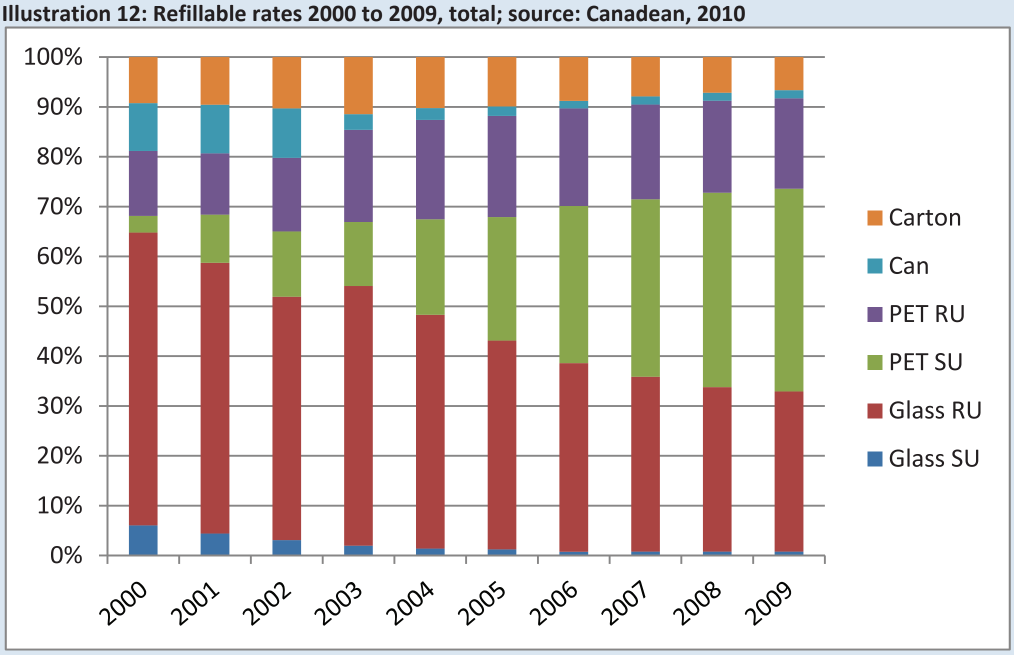
Non-alcoholic soft drinks beverage segment (*other soft drinks*):

Illustration 11: Refillable rates 2000 to 2009 for the non-alcoholic soft drinks beverage segment; source: Canadean, 2010.



Total (all beverage segments):

Illustration 12: Refillable rates 2000 to 2009, total; source: Canadean, 2010



C 2.1.3.3 Circulation rates respecting refillable systems

Indicator 7 – Circulation rate

Refillables

Circulation rates for refillable glass bottles:

Source	Water	Beer	Soft drinks	Juices	Juice-containing beverages	Iced tea
GVM[304]	53	19	31	28	46	24
IFEU PET Life Cycle Assessment 2010[305]	40	-	-	-	-	-
IFEU-GDB 2008[306]	40	-	-	-	-	-
IML 2010[307]	59	-	-	-	-	-
UBA II[308]	40–50	-		17–37	17–37	-
Small and medium-sized private breweries[309]	-	33–63* Ø ca. 50*	-	-	-	-
Cross-regional breweries[310]	-	25–30	-	-	-	-
Industry survey[311]	35-40					
IFEU Life Cycle Assessment Beer 2010[312]	-	reg.: 25 cross-reg: 10; 5; 1**	-	-	-	-

* The data are based on a survey conducted by the Verband Private Brauereien Deutschland e.V. among 147 member companies. Circulation rates 33 to 63 describe the averages achieved for various bottle types (e.g. Euro, Longneck, NRW). The total average for all refillable bottles utilised stands at about 50.

** Various scenarios were calculated in the IFEU Life Cycle Assessment Beer 2010. 25 refills were assumed for regional sales. The refill rates one, five and ten were additionally assumed for cross-regional sales. Based on other results, it is assumed that a circulation rate of 25 applies - on average - with respect to cross-regional sales while higher circulation rates are achieved for regional sales. According to the study, there is no information on the market relevance of circulation rates one, five and ten, given cross-regional distribution (see Section C 2.1.2.1.2).

[304] Cf. GVM, 2009 a, p. 34.
[305] Cf. IFEU, 2010 b, p. 39.
[306] Cf. IFEU, 2008, p. 24.
[307] Cf. IML, 2010, p. 2.
[308] Cf. Prognos et al., 2000, p. 100.
[309] Verband Private Brauereien Deutschland e.V., 2009.
[310] Interview with industry experts.
[311] Interview with industry experts (the figure is based on individual estimates derived from historical data and is not necessarily representative).
[312] Cf. IFEU, 2010 a, p. 3.

Indicator 7 Circulation rate

Refillables

Circulation rates for refillable PET bottles:

Source	Water	Soft drinks	Juices	Iced tea
GVM[313]	11	13	13	14
IFEU PET Life Cycle Assessment 2010[314]	15 12*	-	-	-
IFEU-GDB 2008[315]	15	-	-	-
UBA II[316]	16	16–21	-	-
Industry survey[317]	10-15 6-8*			

* Circulation rate for the individual refillable PET bottle

The environmental impact of refillable beverage containers depends strongly on the respective circulation rates and transport distances: the higher the circulation rate and the shorter the transport distance, the lower the environmental impact. The circulation rates for refillable beverage containers in Germany are high: for refillable glass bottles, the circulation rate is between 25 and 59 refills, depending on the beverage segment; for refillable PET bottles it stands at 15 refills in the mineral water segment, and 13 refills in the carbonated soft drinks beverage segment. The 16 to 21 refills stated in UBA II[318] for refillable PET bottles are not confirmed by current data.

The statements concerning the differences in circulations rates for standard and individual bottles diverge. With respect to the water beverage segment, for example, lower circulation rates are indicated for PET individual bottles than for pool bottles. As regards the regional sale of beer in refillable glass bottles, the circulation rates are usually also high for individual bottles (33 to 50).[319]

The proportion of cross-regional sales is usually lower than the proportion of regional sales with respect to beverages in refillable bottles (see Section C 2.1.2.1.1). Breweries that sell their beverages on a cross-regional scale indicate circulation rates ranging from 20 to 30.[320] GVM assumes a general market average rate of 19 for beer sold regionally and cross-regionally in refillable glass bottles. The industry survey indicates that, from a differentiated angle, higher circulation rates are to be presumed with regard to regional as well as cross-regional sales.

313 Cf. GVM, 2009 a, p. 34.
314 Cf. IFEU, 2010 b, p. 39.
315 Cf. IFEU, 2008, p. 24.
316 Cf. Prognos et al., 2000, p. 100.
317 Interview with industry experts (the figures are based on individual estimates derived from historical data and are not necessarily representative).
318 Cf. Prognos et al., 2000, p. 100.
319 Interview with industry experts; Verband Private Brauereien Deutschland e.V., 2009.
320 Interview with industry experts.

C 2.1.3.4 Return rates

Assumptions and explanation of terms concerning indicator 8 – return rate/collection rate

All systems

Data material:
The data used in the following are mainly based on surveys conducted by GVM, publicly available life cycle assessments and interviews with industry experts. The surveys conducted by GVM as commissioned by UBA provide the most comprehensive data that are publicly available on packaging volumes, recovery and recycling. In its publications, GVM points out that a lot of the data are based on estimates, and it is acknowledged that there is great uncertainty regarding the recovery of refillable beverage containers, in particular.

With a view to closing data gaps and in order to present a differentiated picture in the analysis of material flows, the GVM surveys were supplemented by additional information, i.e. quantitative data, if available, otherwise qualitative information. It is recommended that further analyses be performed with a view to continuing the above-mentioned approach and to obtaining generally valid and statistically relevant data.

Differences in documentation and calculation of collection rates:
As a general rule, a distinction must be made between the collection and documenting in deposit systems and in dual systems.

With respect to refillable and one-way deposit systems, returned bottles are recorded one by one and can thus be directly placed in proportion (in percentage terms) to the number of bottles brought into circulation. Consequently, the net collection volume equals the gross collection volume.[321]

In contrast, collection and recovery volumes in the dual system are documented according to weight and not one by one. Since the calculation of collection and recovery volumes takes place according to weight upon receipt at the recovery plant, beverage packaging in the dual systems includes residues and residual build-ups (gross collection volume) in the measurement of collection and recovery rates. This approach is in line with the provisions of the German Packaging Ordinance. In an ecological comparison of refillable and one-way deposit systems with dual systems, the net collection and recycling volumes should be taken into account for comparability purposes.

With regard to PET bottles, residues amount to about 9 to 14 % of the bottle weight.[322] With respect to beverage cartons, residues and build-ups are assumed to make up 20 % of the weight in the case of juice-containing beverages.[323] The net collection volumes are correspondingly lower. It must be noted, however, that residual build-ups are not determined comprehensively.

[321] Interview with industry experts.
[322] Cf. Bosewitz, S., 2007, p. 24.
[323] Cf. Bosewitz, S., 2007, p. 20.

Assumptions and explanation of terms concerning indicator 8 – return rate/collection rate

All systems

The GVM data do not contain any specific collection rates for PET bottles that were collected through the dual systems. Collection rates were only available with respect to the licensed volume. Within the scope of this study, the proportion of unlicensed packaging that is generally indicated for plastics (i.e. 25 %) was deducted in this case[324]. In this context it must be again noted that the data material is insufficient, since no differentiated rates for PET bottles are available with respect to unlicensed packaging.

Summary of the fundamentals for the calculation of collection and recycling rates:
The following differentiation proves to be expedient in the analysis of data on collected, recovered and recycled beverage packaging volumes:

- **Quantity put into circulation:**
  The reference values for the total collection, recovery and recycling rates are the quantities of beverage containers put into circulation within the scope of the systems analysed.

- **Gross volume of collected packaging (dual systems):**
  The documented gross volume of beverage packaging in dual systems includes residues and build-ups.

- **Collected packaging (total) (dual systems: gross volume collected, less residual build-ups and residues):**
  With regard to deposit systems, the quantity (total) collected one by one equals the gross collected quantity since no deductions need be made for residuals.
  As to dual systems, the collected quantity (total) relates to the gross collected quantity, less a general deduction for residues, incorrect sorting and build-ups.

The data as well as the recovery rates are presented graphically on pp. 164 to 182.

[324] Cf. GVM, 2009 c, p. 10.

Indicator 8 – Return rate/collection rate

Refillables

Return rates for refillable bottles made of glass and PET:

Return rates	UBA II[325]	GDB[326]	IFEU PET Life Cycle Assessment 2010[327]	BWST[328]	Industry Communication[329]	IFEU Life Cycle Assessment Beer 2010[330]
Water, soft drinks	97.2–99.5 %	99 %	99 %	98–99 %	-	-
Beer	-	-	-	95 %	98.5–99 %	88 %

In the remarks on the IFEU Life Cycle Assessment Beer 2010 (see Section C 2.1.2.1.3) it was already explained that the return rate of 88 % indicated in the study for refillable glass bottles for beer cannot be ascertained plausibly. Most sources state a return rate ranging from 98 to 99.5 %; the lowest value indicated by experts within the scope of interviews was 95 %.

Consumer behaviour determines whether high return rates can be achieved. A high density of collection points has a positive influence on the return rate. If - taking individual bottles as an example - only few sales points offer the possibility to return packaging, this could negatively impact on consumers' readiness to return packaging.

325 Cf. Prognos, IFEU & UBA, 2002, p. 41.
326 Cf. IFEU, 2008, p. 25; According to GVM it is not possible to determine the entire amount of refillable beverage containers available in the market (Cf. GVM, 2009 a, p. 353).
327 Cf. IFEU, 2010 b; p. 55.
328 Interview with industry experts.
329 Interview with industry experts.
330 Cf. IFEU, 2010 a, p. 34.

Indicator 8 – Return rate/collection rate

Refillables

Reject rate for refillable bottles made of glass and PET:

Not only the return rate - i.e. the proportion of packaging returned by consumers - is important with regard to refillable beverage containers but also the reject rate, which relates to packaging sorted out by retail traders or beverage producers with a view to ensuring the quality of the bottles in the bottle pool.

Based on experience, UBA II arrives at the following assumptions concerning the reject rate and the return rate: [331]

- "Beverage producers eliminate broken bottles and bottles that have been sorted out due to aesthetics-related quality criteria – or for other reasons - from the cycle. More PET bottles are sorted out than glass bottles.
- Experience has shown that losses incurred by wholesalers and retailers are very low.

With respect to consumers, high return rates are usually achieved if bottles are mainly sold in crates and high deposit amounts are charged. Losses are incurred due to breakage or other disposal."

According to GVM, the following quantities of refillable beverage containers occurred as packaging waste in 2007:[332]

- Refillable glass bottles: 368,580t
- Refillable PET bottles: 58,563t
- Beverage crates: 71,785t
- PETCYCLE crates: 5,477t

The target reject rate for refillable glass bottles in the GDB bottle pool, for example, stands at ca. 2.25 % and has been increased in recent years due to the declining input volumes.[333] At 3.5 %, the target reject rate in the juices beverage segment is also very high, which is attributable to a strong decline in refillable glass bottles.[334] The reject rate for refillable PET bottles in the GDB bottle pool ranges between 1.5 to 4.0 %.

[331] Cf. Prognos, IFEU & UBA., 2002, p. 41.
[332] Cf. GVM, 2009 a, p. 34.
[333] Interview with industry experts; Cf. IFEU, 13.07.2010, p. 20.
[334] Cf. Beverage industry, 2010, p. 25.

Indicator 8 – Return rate/collection rate

One-way deposit

Return rates for PET one-way bottles:

Return rates	GDB 2008[335]	IFEU PET Life Cycle Assess-ment 2010[336]	DPG[337]	IFEU Life Cycle Assessment Beer 2010[338]
Water, carbonated soft drinks				
PET one-way bottle	90(–95) %	94 %	98.5 %	-
Crate-based one-way PET bottles (PETCYCLE bottles)	97 %	99 %	-	-
Beer				
PET one-way bottle	-	-	-	94 %

The current IFEU PET Life Cycle Assessment 2010 and IFEU Life Cycle Assessment Beer 2010 assume a return rate of 94 % for PET bottles. In the spring of 2010, DPG indicated a return rate of 98.5 % for deposit one-way beverage containers made of PET. Since DPG can directly determine the return rates on the basis of its own system (while other studies are based on published figures and estimates), it must be assumed that the figure provided by DPG is valid.

According to the IFEU Institute, the return rate for crate-based deposit one-way PET bottles stands at 99 %
(97 % is collected through the PETCYCLE crate system and 2 % through the DPG deposit system).[339]

[335] Cf. Cf. IFEU, 2008, pp. 25 and 32.
[336] Cf. IFEU, 2010 b, pp. 48 and 53.
[337] Cf. Deutsches Dialoginstitut, 2010, p. 12.
[338] Cf. IFEU, 2010 a, p. 34.
[339] Cf. IFEU, 2010 b, pp. 53 and 54.

Indicator 8 – Return rate/collection rate

One-way deposit

Return rates of beverage cans made of aluminium or tin:

Cans only account for approximately 5 % of the quantity of deposit beverage packaging.[340]

According to the IFEU Life Cycle Assessment Beer 2010, the return rates for aluminium and steel cans amounts to 96 %.[341] At present, there are no direct figures available from DPG concerning beverage cans.

According to market research and press reports of Deutsche Umwelthilfe e.V. (DUH), deposit one-way beverage containers are sometimes sold at small sales locations, such as kiosks, without a deposit being charged.[342] When analysing various distribution channels for beverages, the market research institute, Canadean, also examined the “other on-premise” distribution channel (kiosks, cinemas, street vendors, sales within the scope of leisure activities). Canadean concluded that 4 % of all beverages (sold in one-way or refillable beverage containers) are put into circulation via the "other on-premise" distribution channel.[343] Since only a limited proportion of those beverage containers is sold illegally (as no deposit is charged) at such sales locations, the influence on the total return rate can be assessed as low.

Studies, such as the one conducted by BIO Intelligence Services, assumed that one-way deposit systems in combination with dual systems would lead to a decrease in the return rate.[344] This cannot be confirmed on the basis of the information available. The return rates were relatively low in Germany only when the one-way deposit system first got started due to the island solutions (see also p. 269). However, the presented high return rates are being continuously achieved since the abolishment of island solutions.

Return rates for deposit one-way glass bottles:

No separate return rates are reported for deposit one-way glass bottles. Presumably, the return quantities are similarly high as for PET bottles and beverage cans due to the high deposit amount. Accordingly, the return rate is assumed to range between 96 and 98.5 %.

340 Canadean, 2010 (PwC analysis of Canadean data).
341 Cf. IFEU, 2010 a, p. 34.
342 Cf. DUH, 04.08.2009.
343 Canadean, 2010 (PwC analysis of Canadean data).
344 Cf. BIO Intelligence Services, 2005, p. 3.

Indicator 8 – Return rate/collection rate

One-way dual systems

Since the introduction of a mandatory deposit on one-way beverage containers which are not ecologically advantageous, the beverage segments analysed in this study only collect (within the scope of the dual systems) beverage cartons for juices and mineral waters as well as all other non-deposit one-way beverage containers for the juices and fruit drinks segment. In addition to beverage cartons, PET one-way bottles, in particular, are used as beverage packaging for juices and fruit drinks.

Collection rates are determined in the dual systems with regard to the specific materials and not with respect to individual products or product segments. For this reason, there are no valid surveys concerning the precise quantities of the analysed beverage containers, which are collected through the dual systems. The GVM data listed below are thus subject to uncertainty. Consequently, further sources of information (e.g. surveys of experts) were used in the analyses to the extent possible.

Collection rate for beverage cartons:

	GVM collection rate 2007	IFEU FKN 2006
Gross volume of collected beverage cartons (incl. residues and build-ups)	67 %[345]	65 %[346]
Total volume of collected beverage cartons (less 20 % residues and build-ups)[347]	53 %	52 %

The official presentation of the collection rates for beverage cartons by GVM and packaging producers relates to the gross quantity of collected beverage cartons (see also Section C 2.1.3.6).

According to GVM, the gross quantity of collected beverage cartons (incl. residues and build-ups) amounted to 67 % in 2007.[348]

[345] GVM, 2009 a, p. 87.
[346] IFEU, 2006, p. 27.
[347] Cf. Bosewitz, S., 2007, p. 20; Resch, J., 2009 b, pp. 22 and 23. The DUH measurements indicate residues of more than 20 % for juices and fruit drinks. In this context, the calculation assumed residues and build-ups of 20 %.
[348] GVM, 2009 a, p. 87.

Indicator 8 – Return rate/collection rate

One-way dual systems

Collection rates for PET one-way bottles:

	Collection rate after introduction of a mandatory deposit[349]
Gross volume of collected PET one-way bottles for juices	64 % for 0.33 litre bottles 80 % for 1 to 1.5 litre bottles
Total volume of collected PET one-way bottles for juices (less deduction for average amount of residues and sub-licensing, see text)	43 % for 0.33 litre bottles 54 % for 1 to 1.5 litre bottles

With respect to juices, DSD indicated collection rates of 64 % (0.33 litre bottles) and 80 % (1 to 1.5 litre bottles) for 2005. However, these data are not confirmed by surveys and are viewed as being unrealistic by industry experts, who assume that the data refer to the licensed volume of bottles and not the volume put into circulation.[350] In 2009, 25 % of plastic packaging was not licensed.[351] Taking those assumptions into account as well residues of ca. 10.5 %[352] for PET one-way bottles, we arrive at a total collected quantity of 43 % for 0.33 litre bottles, and 54 % for ≥ 1 litre bottles.

349 Cf. IFEU, 2006, p. 33.
350 Interview with industry experts.
351 GVM, 2009 c, p. 10
352 see p. 155, residues between 9 and 14 %

Indicator 8 – Return rate/collection rate

One-way dual systems	
	A study conducted by the Witzenhausen Institute in 2001, i.e. before the mandatory deposit was introduced, concluded that between 14 % and 51 % (depending on the respective extrapolation) of one-way beverage containers brought into circulation are disposed of as residual waste. In this context, the proportion of one-way beverage containers disposed of as household waste is estimated to be lower for rural regions. This is due, on the one hand, to different consumer behaviour of the population and, on the other hand, to the fact that the separate collection of waste and recyclable materials is easier in rural areas due to the greater space available and for other reasons.[353] Comparable current surveys are not available. **Return rates for one-way glass bottles:** GVM data refer solely to recovery rates and not to collection rates. However, it must generally be assumed that the collected glass is also recycled due to its positive characteristics in the melting process of new glass.[354] Accordingly, no great differences between and recovery and collection rates are to be expected with regard to one-way glass bottles.

[353] Cf. Witzenhausen-Institut, 2001, p. 44 et seqq.
[354] Cf. IFEU, 2008, p. 27; interview with industry experts.

C 2.1.3.5 Recovery and disposal rates as well as secondary materials input ratio

General comments regarding indicators 9 to 12 - Closed-loop recycling, bottle-to-bottle recycling, open-loop recycling/downcycling

All systems

While the distinction between energy recovery and the recycling of packaging waste is relatively clear and established, a distinction in qualitative terms is usually not made between different recycling schemes, even though different recycling procedures can contribute to a reduction in the environmental impact of packaging materials to varying degrees. We therefore not only consider recycling rates in this context, but also closed-loop and bottle-to-bottle recycling rates as well as open-loop and downcycling recycling rates (for definitions, please see Section A 2.3).

Since the closed substance cycle capacity is also of relevance (for a definition, see Section A 2.4), some aspects concerning the recycling of different materials are described in brief below.

Glass from refillable and one-way bottles:

With respect to the packaging material glass, the closed-loop recycling and bottle-to-bottle recycling procedures have been very well established for many years. In this context, the input ratios of broken glass (cullet) are very high, in particular in the manufacture of green and brown glass. This is also reflected in a high secondary materials input ratio (see 164 to 182). Owing to its material properties, glass can be recycled indefinitely in a closed cycle (old packaging is processed into new packaging) without losing quality.

Glass is generally not subject to any limitations in the recycling process and can be recycled without loss of mass or quality. However, there is a practice-related limitation respecting colouration. Clear glass cannot be manufactured from coloured glass. Consequently, sorting accuracy must be ensured.

General comments regarding indicators Nos. 9 to 12 - Closed-loop recycling, bottle-to-bottle recycling, open-loop recycling/downcycling

All systems

PET from refillable and one-way bottles:

PET recylate from collected refillable PET bottles and deposit one-way PET bottles is used to manufacture new PET bottles. However, no official ratios are determined with respect to the secondary materials input ratio. The average secondary materials input ratio is thus not transparently known. The technical processing of PET secondary material into new PET bottles requires high quality and purity respecting the secondary material. Among the systems analysed, this high quality and purity is usually only ensured within the refillable system and the one-way deposit system. Furthermore, the maximum input ratio of secondary materials used in new PET bottles is limited for technical reasons. Generally, in percentage terms, more primary material than secondary material is therefore used at present in one-way PET bottles. Different publications provide varying indications regarding the maximum utilisation rate. However, since the introduction of a mandatory deposit on one-way beverage containers in 2003, bottle-to-bottle recycling has increased greatly in Germany, which is attributable to the fact that mono-fraction PET material flows have been available since then.[355] It must also be assumed that the input ratio of secondary materials used in non-refillable PET bottles depends on price fluctuations in the secondary materials market, depending on the development of the respective price ratio of secondary material to primary material (for further explanations, see p. 271).

According to information received, no secondary materials are used in refillable bottles.

Aluminium and steel from beverage cans:

The way packaging materials are reused in the manufacture of beverage cans (aluminium or steel) had hitherto not been taking into account in the assessment of recycling. The IFEU Life Cycle Assessment Beer 2010 assumes that no scrap material from beverage cans is used in the manufacture of aluminium cans.[356] Scrap material stemming from the collection of beverage cans by retailers and wholesalers or by end-consumer is mainly used in the manufacture of other products, such as aluminium casting parts. Thus, recycling from beverage cans made of aluminium is not closed-loop recycling, but rather open-loop recycling. This is not to be considered as downcycling, since aluminium can be recycled at high quality.

A low portion of scrap material from beverage cans is used in the manufacture of beverage cans made of steel (closed-loop recycling). However, the major portion of steel from beverage cans is used for open-loop recycling (see Section C 2.1.2.1.4 and pp. 164 to 182). The aluminium - which is used for lids of steel beverage cans - is consigned to energy recovery.[357]

[355] Interview with industry experts.
[356] Cf. IFEU, 2010 a, p. 18; 37–38.
[357] Cf. IFEU, 2010 a, p. 48

General comments regarding indicators Nos. 9 to 12 - Closed-loop recycling, bottle-to-bottle recycling, open-loop recycling/downcycling

All systems	Analysis of the recovery quality of metals is complex since aluminium and steel are used - cast or rolled - in the most varied products, and different types of scrap material of varying quality are used in the production process. To date, the differences in quality have only been reflected in different prices. Whether and to what extent such price differences or other quality criteria might provide clues respecting varying technical suitability criteria must be analysed. **Pulp (paper/carton), aluminium and plastics from beverage cartons:** The reuse of pulp (paper portion) derived from used beverage cartons in the manufacture of new beverage cartons (closed-loop recycling) is not possible. Instead, pulp stemming from beverage cartons that are collected and recovered in Germany is usually used for the internal or unseen layers of secondary packaging (downcycling). Every recycling step leads to a further shortening of the paper fibres, which limits the material's reuse. Paper fibres from recycled paper can be recycled up to seven times.[358] A similar picture is assumed with respect to the proportion of carton in beverage cartons. As yet, there is no information available on an existing assessment model based on this quality limitation. Although aluminium from beverage cartons can generally be recycled (open-loop recycling), beverage cartons collected in Germany are solely consigned to energy or raw materials recovery, according to information provided by the IFEU Institute. The rejects from the recovery of beverage cartons (plastic and aluminium fractions) are incinerated along with other materials in the cement industry.[359]

[358] Cf. Bohny Papier AG website, *Informationen betreffend Recyclingpapier.*
[359] Interview with industry experts.

Indicators Nos. 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

With a view to improving the clarity of the presentation and to provide greater readability, the rates for the following ecological impact indicators are presented jointly in the graphs shown below:

- Energy recovery (indicator 9)
- Recycling (indicator 10)
- Closed-loop recycling (indicator 11)
- Downcycling (indicator 12)
- Disposal (indicator 13)
- Secondary materials input ratio (indicator 14)

In this context, the secondary materials input ratio represents the indicator for ecological packaging (re)design (see also Section A 3.2). Indicator 15 (packaging weight) regarding the category "Ecological packaging (re)design" is presented separately from the above in Section C 2.1.3.7 followed by a qualitative description of the materials composition.

The presentation is based on the following structure:

Assumptions and definition of terms concerning indicators 9 to 14: Return, recovery and disposal rates as well as secondary materials input ratio

All systems

With respect to the data material, assumptions and definition of terms concerning return and collection rates, please see also p. 150.

Differences in documentation and calculation of recycling rates:
GVM assumes that a major proportion of one-way and refillable beverage containers made of PET are consigned to energy recovery (see also detailed analyses on p. 164 and p. 182), but nevertheless reports that recycling represents the most important recovery method for such material flows.[360] The surveyed industry experts stated that it is not to be assumed that such a substantial proportion is consigned to energy recovery. This is due to the fact that the energy recovery of PET as a high-quality material is not worthwhile when compared to recycling.[361] Moreover, energy recovery of PET is associated with difficulties due to the possible release of hazardous substances.[362] The study thus assumes that all PET bottles collected separately through deposit systems are fully (100 %) consigned to recycling. The total recycling rate corresponds to the collected volume (total). Despite this assumption, it is possible that low losses, which cannot be quantified, might be incurred in the recycling process. The textual description also includes the GVM ratios.

With respect to the recycling rates for beverage packaging collected through dual systems, GVM reports that the actual volume recycled in dual systems is usually lower than the net collection volumes (which is due to residues on packaging, post-sorting, mass losses in the processing of packaging material, and the like). For example, the actual volume recycled in dual systems is about 25 % lower than the net collection volume in the case of beverage cartons, and 15 to 30 % lower with regard to plastic packaging.[363]

The GVM data use adjustment rates for glass in the calculation of recycling rates[364]. In this context, the weights of lids and labels are deducted on the basis of a general deduction rate in accordance with their proportional share. The GVM data do not provide for such adjustment rates with respect to light packaging such as plastic bottles and beverage cartons.[365]

[360] Cf. GVM, 2009 a, pp. 56 and 61.
[361] Interview with industry experts.
[362] Cf. Schu, R. et al., 2009, pp. 7-10.
[363] Cf. GVM, 2009 a, p. 40.
[364] There are also adjustment rates for paper, which, however, are not relevant to beverage packaging.
[365] Cf. GVM, 2009 a, pp. 37–41.

Assumptions and definition of terms concerning indicators 9 to 14: Return, recovery and disposal rates as well as secondary materials input ratio

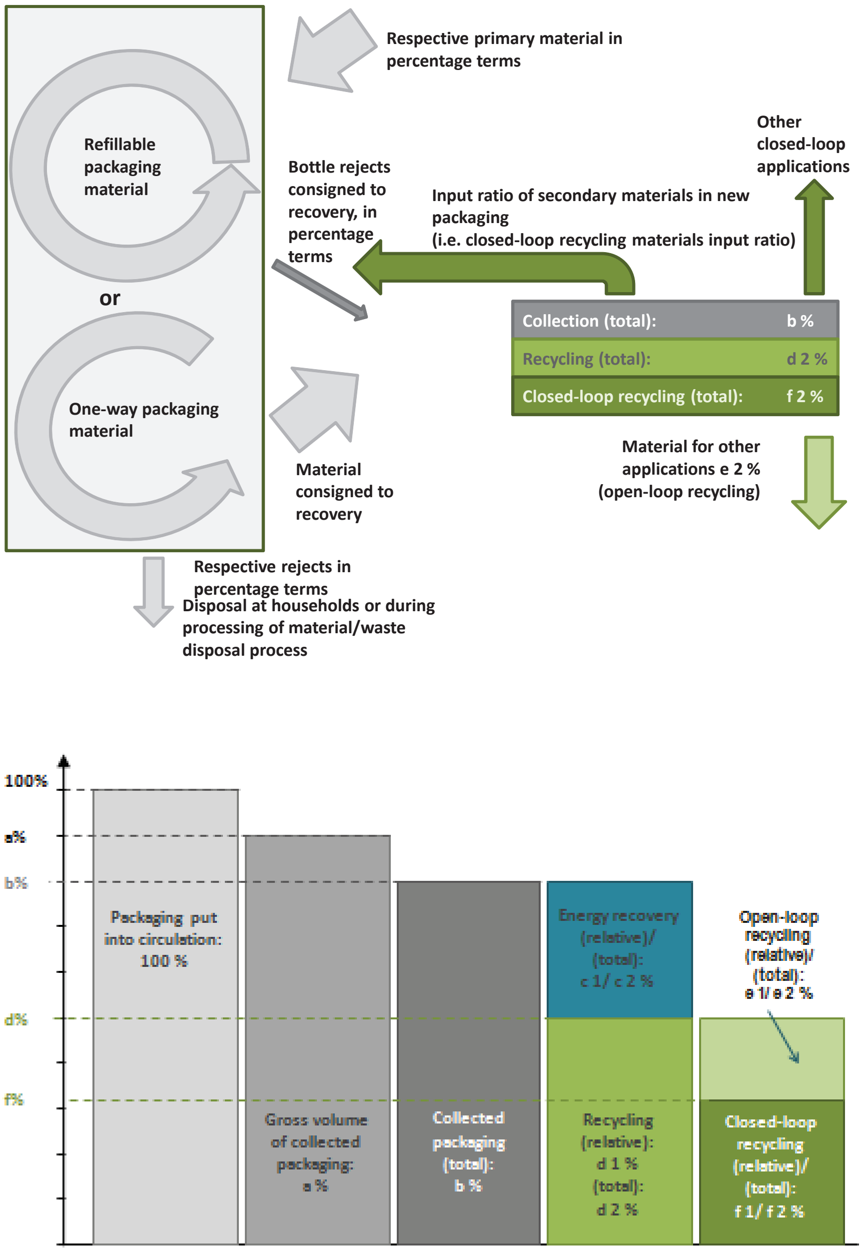
All systems

Definition of terms regarding the calculation of collection and recycling rates:
The following differentiation proves to be expedient in the analysis of data on collected, recovered and recycled beverage packaging volumes:

- **Quantity put into circulation:**
  The reference values for the total collection, recovery and recycling rates are - within the scope of the systems analysed - the respective quantities of beverage containers put into circulation.
- **Gross quantity of collected packaging (dual systems):**
  The documented gross volume of beverage packaging in dual systems includes residues in and on beverage packaging.
- **Collected packaging (total) (dual systems: gross quantity collected, less residues in and on packaging):**
  With regard to deposit systems, the quantity (total) collected equals the gross collected volume, since bottles are documented one by one and no deductions need thus to be made for residues.
  With regard to dual systems, the collected quantity (total) relates to the gross collected volume, less a general deduction for residues in and on packaging and for incorrect sorting.
- **Recycling (relative):**
  The recycling rate (relative) relates to the proportion of recycled beverage packaging in the quantity collected (total).
- **Recycling (total):**
  The recycling rate (relative) relates to the proportion of recycled beverage packaging in the quantity collected (total).
- **Closed-loop recycling (relative) and open-loop recycling (relative):**
  The closed-loop recycling rate (relative) and the open-loop recycling rate (relative) describe the respective proportion in the quantity collected (total).
- **Closed-loop recycling (total) and open-loop recycling (total):**
  The closed-loop recycling rate (total) and the open-loop recycling rate (total) describe the respective proportions in the quantity put into circulation.
- **Energy recovery (relative):**
  The energy recovery rate (relative) describes the proportion in the quantity collected (total).

The respective rates for all analysed beverage packaging types are presented in the illustration below, using the following structure:

Illustration 13: Schematic presentation of material flows of the packaging and recycling systems analysed, including collection/return rates, recycling rates, disposal rates as well as secondary materials input ratios



In the illustration, the mass percentage portions of packaging are presented in relation to the respective system (reuse, one-way deposit and dual systems) and with respect to their share in the total quantity of beverage packaging. Only mass percentage indications have been provided in this context. With regard to the materials volume, light packaging (in particular PET material) would have a much higher share in the volume compared to glass.

The material flows of the packaging and recycling systems analysed are outlined in the upper section of the illustration:

- Use of primary materials and recycled materials
- Rejects for disposal
- Collected packaging (total) – depicted as "b“ in the illustration
- Recycled packaging (total) – depicted as "d2“ in the illustration
- Closed-loop recycling (total) – depicted as "f2“ in the illustration
- Open-loop recycling (total) differentiated – depicted as "e2“ in the illustration
- Refillable systems: number of bottle refills)

The recovery methods are symbolised by arrows.

The lower part of the illustration shows the respective proportions of beverage packaging containers that are collected and recycled in the examined packaging and recycling systems (for a definition of terms, see p. 164). The letters used serve as placeholders for the amounts in order to provide greater comprehensibility.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

Refillables

Primary material 16–37 %

Other glass packaging

Secondary material/cullet used in new packaging
63 % clear
84 % green
84 % brown

Refillable glass bottle
ca. 25–60 refills

Collection (total): 99 %
Recycling (total): 99 %
Closed-loop recycling (total): 98 %

ca. 2 % of bottles consigned to recovery as rejects

Metal products < 1 % (open-loop recycling)

Broken glass (cullet) from households for disposal + labels that fell off during the refilling process

ca. 1 % rejects

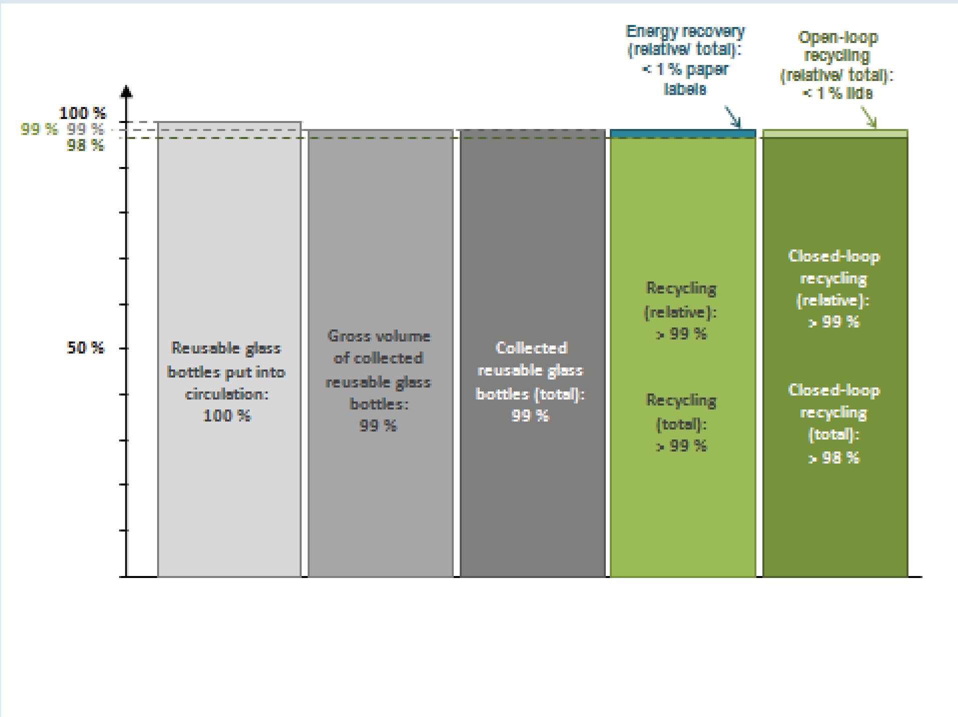


Illustration 14: Material flows for refillable glass bottles with information on circulation rates, reject and recycling rates as well as the use of broken glass fractions; sources: IFEU, 2010 b, pages 39 and 58; IFEU, 13.07.2010, page 20; IML, 2010; IÖW and Öko-Institut, 2009, page 47; Verband Private Brauereien e.V. 2009; interviews with industry experts; Canadean, 2010.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

Refillables

As regards refillable glass bottles, the containers are only consigned to recycling after having been refilled between 25 to approximately 60 times (see p. 148) depending on the respective circulation rate. Before each re-filling, the bottles are inspected with respect to aesthetics and safety-related aspects, and defective bottles are sorted out; this concerns about 2 % of the bottles, depending on the respective bottle pool. The quantity of material to be recycled is correspondingly low.

Consumers return 99 % of refillable glass bottles to the beverage producers via retailers and wholesalers. The remaining quantity of 1 % is (possibly broken glass bottles) either disposed of as residual waste or is collected and recycled through the curbside collection of glass containers. For simplification purposes, the calculations assume that all refillable glass bottles which are not returned to beverage producers are disposed of.

In the manufacture of new glass containers, no distinction is made between glass from refillable bottles and glass from one-way beverage containers with respect to the recycling material (cullet) used. All collected waste glass pieces - from sorted out refillable glass bottles and also from one-way glass beverage containers collected separately - are fully recycled (100 %) and are solely used in the production of glass containers (i.e. bottle-to-bottle recycling).[366]

Paper labels and lids for refillable glass bottles account for ca. 0.8 % of the total bottle weight and must be re-applied after each re-filling. Old labels and seals are disposed of. They are removed before or during the process of cleaning refillable bottles. In this context, paper labels (0.2 %, indicated as < 1 % in the illustration) are usually consigned to energy recovery and the lids (0.6 %, indicated as < 1 % in the illustration) are recycled (see also Section C 2.1.3.7).

At a range of 63 to 84 %, the use of recycling material (cullet) in the manufacture of refillable bottles and one-way glass beverage containers is very high compared to the share of recyclates in other packaging materials.[367] Since refillable and one-way bottles are manufactured at the same glass factories, the input ratios of cullet indicated in the system description of one-way deposit systems and of dual systems are the same as for refillable systems for glass.

[366] Cf. IFEU 2010 b, p. 58; IFEU 2008, p. 27; interview with industry experts.
[367] Cf. IÖW and Öko-Institut, 2009, p. 47.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

Refillables

Primary material 100 %

Secondary material PET regranulate for bottles production N/A

Refillable PET bottle
ca. 15 refills

Collection (total): 99 %

Recycling (total): 99 %

Closed-loop recycling (total): N/A

ca. 2–4 % of bottles consigned to recovery as rejects

Secondary material for other applications N/A (open-loop recycling)

Disposal as residual waste + labels that had fallen off in the refilling process

ca. 1 % rejects

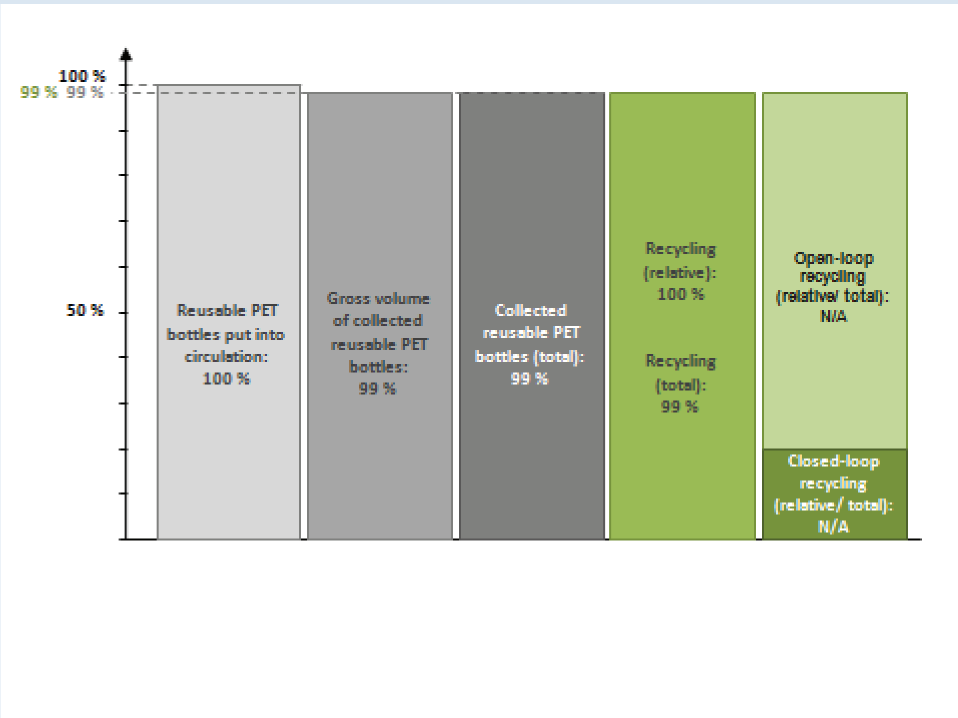


Illustration 15: Material flows for refillable bottles made of PET with information on circulation rates as well as reject and recycling rates; sources: IFEU, 2008, pages 24 and 28; IFEU, 2010 b, page 42; interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

Refillables

Consumers return 99 % of refillable PET bottles to the beverage producers via retailers and wholesalers. The remaining volume (1%) is either disposed of as residual waste or is collected and recycled as curbside waste through the dual systems. For simplification purposes, the calculations assume that all refillable PET bottles which are not returned to beverage producers are disposed of.

Refillable PET bottles are refilled 15 times on average before leaving the bottle cycle. This means that refillable PET bottles need only be disposed of and re-manufactured after they had been refilled 15 times on average. The quantity of packaging waste from refillable PET bottles is correspondingly low compared to the volume of packaging waste arising from one-way beverage containers. Of the refillable PET bottles that are returned to beverage producers, 2 to 4 % are sorted out by beverage producers during every bottle rotation cycle for quality and safety-related reasons or due to wear and tear.

Sorted out refillable PET bottles are usually fully consigned (100 %) to recycling.[368] In contrast, GVM data indicate that 92 % of refillable PET beverage containers are consigned to recovery, of which 61 % are recycled and the remainder is consigned to energy recovery.[369] However, it does not appear to be plausible that high-grade mono-material flows are consigned to energy recovery. GVM reveals that the data on refillable beverage packaging is subject to great uncertainties and that all refillable material flows are consigned to high-grade recovery. According to the GVM data, even 85 to 95 % of the lids of refillable beverage packaging are returned and consigned to high-grade recovery.[370] For this reason, the recovery and recycling rates indicated in the illustration reflect the information provided by industry experts and not the figures furnished by GVM. A secondary materials input ratio of 0 % is stated for the manufacture of 1.0 litre refillable PET bottles of GDB.[371] Industry experts also confirmed that, usually, no recyclates are used in the manufacture of new, refillable bottles.[372]

[368] Interview with industry experts.
[369] Cf. GVM, 2009 a, p. 61.
[370] Interview with industry experts; Cf. GVM, 2009 a, p. 61 et seq.
[371] Cf. Ifeu 2008, p. 28.
[372] Interview with industry experts.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

Refillables	Information on bottle-to-bottle and closed-loop recycling respecting PET bottles usually does not distinguish between one-way and refillable beverage containers. Consequently, the same rates as for one-way PET bottles are assumed regarding the secondary material recovered from disposed-of refillable PET bottles. The input of recyclates and regranulates is presented in the illustrations on one-way PET beverage containers made from secondary material. Lids and labels account for about 5 to 6 %.[373] Plastic materials are usually separated during the recovery process and consigned to recycling; paper labels are largely consigned to energy recovery.[374]

[373] Cf. IFEU, 2010 b, p. 42.
[374] Cf. GVM, 2009 a, p. 40; interview with industry experts.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

Primary material 74–85 %

Secondary material/
PET granulate 15–26 % in
new packaging

One-way
deposit
PET bottle

Collection (total): 99 %

Recycling (total): 99 %

Closed-loop recycling (total): N/A

Secondary material for
other applications
N/A
(open-loop recycling)

Disposal as
residual waste

ca. 1 % rejects

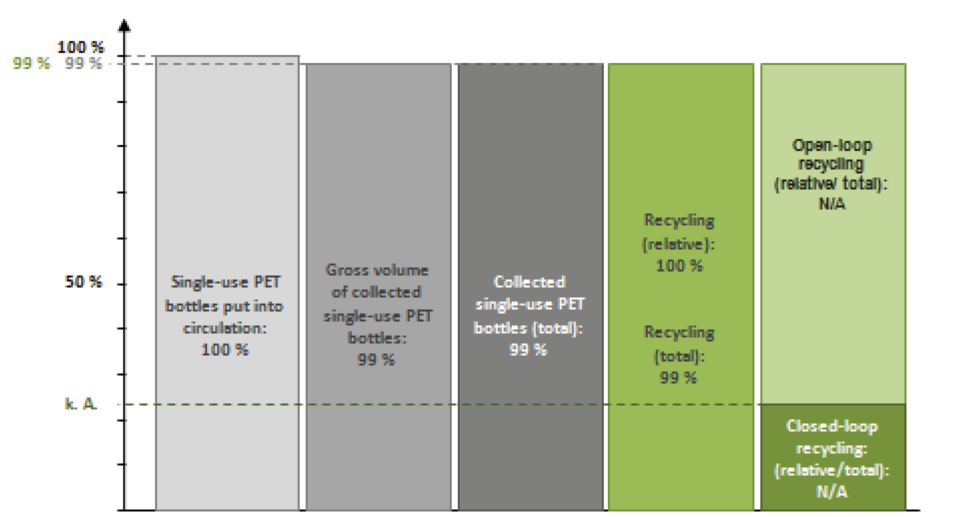


Illustration 16: Material flows concerning deposit one-way PET bottles with information on return and recycling rates as well as the proportion of recyclates in newly manufactured one-way PET bottles; sources: IFEU 2010b, pages 47 and 62; Deutsches Dialoginstitut 2010 page 12; Schu R. et al., 2009, page 10; interviews with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

On average, 98.5 % (rounded to 99 % in the illustration) of one-way PET bottles in the one-way deposit system are returned by consumers to retailers and wholesalers and are collected separately.[375] The remaining volume (1.5 %) is either disposed of as residual waste or is collected and recycled as curbside waste through dual systems. For simplification purposes, the calculations assume that all one-way PET bottles which are not returned to retailers and wholesalers are disposed of.

GVM assumes that ca. 13 % of all collected, deposit one-way PET beverage containers are consigned to energy recovery.[376] As already described on page 163, this analysis assumes - based on statements made by experts - that all returned and deposit one-way PET beverage containers are consigned to recycling as mono-fraction material flows.[377] With respect to one-way PET bottles, lids and labels are also separated in the recovery process. With very few exceptions, they are all made of plastic and are also recycled.

The bottles are either used to produce new bottles (closed-loop recycling) or in the manufacture of other products (open-loop recycling). Since the introduction of a mandatory deposit on one-way packaging, bottle-to-bottle recycling has increasingly been carried out in Germany.[378] The IFEU PET Life Cycle Assessment 2010 indicates that the proportion of secondary material in new, one-way PET bottles stands at 15 to 26 %.[379] Some industry experts also estimate this share to be 25 %. Other sources assume that the maximum proportion of secondary material in PET bottles is 15 % throughout Europe.[380] For this reason, the secondary materials input ratio indicated in the illustration ranges between 15 to 26 %.[381]

[375] Cf. Deutsches Dialoginstitut, 2010, p. 12.
[376] Cf. GVM, 2009 a, p. 61.
[377] Interview with industry experts.
[378] Cf. IFEU, 2010 b, p. 47.
[379] Cf. IFEU, 2010 b, p. 47.
[380] Cf. Schu, R. et al., 2009, p. 10.
[381] The fact that there are also some manufacturers that use 100 % primary material cannot be ruled out.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

The PETCYCLE system

The PETCYCLE system constitutes a special case of deposit one-way PET bottles. This is not specifically shown in the above illustration since it makes no general distinction between the one-way PET bottles. However, one-way bottles in the PETCYCLE system are mainly sold in refillable crates. The collected crate-based deposit one-way PET bottles are fully (100 %) consigned to recycling, just as are other deposit one-way bottles.[382] Due to the crate logistics, the sales logistics process in the PETCYCLE system pursues a similar pattern as for refillable systems; i.e. beverage producers sell crate-based deposit one-way PET bottles (PETCYCLE bottles) to consumers via retailers and wholesalers. The consumers return the bottles to retailers and wholesalers, which return them to the beverage producers. However, the crate-based deposit one-way PET bottles (PETCYCLE bottles) are not refilled, but instead are compressed into bales and passed on to recycling companies. Lids and labels are also separated and recycled in this context.

According to information provided by the surveyed industry experts, the participants in the PETCYCLE system presently commit themselves to using at least a 50 % proportion of regrind in the manufacture of new crate-based deposit one-way PET bottles (PETCYCLE bottles) and to have this verified by a certified public accountant. Industry experts state that the entire material flow is verified and controlled within the scope of this examination.

All beverage producers and most packaging producers, recycling companies, machine manufacturers, and system identification manufacturers that participate in the PETCYCLE system are registered by the system coordinator PETCYCLE as shareholders. According to industry experts, the crate-based deposit one-way PET bottles and reuse crates utilised in the PETCYCLE system as well as the recyclates and regrind of the crate-based deposit one-way PET bottles (PETCYCLE bottles) may only be used and processed by those shareholders and by recyclers and preform manufacturers certified by PETCYCLE.

The use of recyclates and regrind from foreign systems in the manufacture of crate-based deposit one-way PET bottles (PETCYCLE bottles) is theoretically possible, provided that the material meets the stipulated quality requirements. So far, such "foreign material" is not being used, according to industry experts.[383]

[382] Cf. IFEU, 2010 b, p.60; IFEU 2008, p. 26 et seq.; interview with industry experts.
[383] Interview with industry experts.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit	However, the DUH questions whether a secondary materials input ratio of 50 % is achieved in practice. According to the DUH, it has not been comprehensibly demonstrated to the public that the crate-based deposit one-way PET bottles (PETCYCLE bottles) include at least 50 % PET recyclates in practice. DUH also criticises that the closed materials cycle is not attained. In this context, DUH makes reference to written statements provided by PETCYCLE-certified recycling companies, which ascertain that there is no separate processing of PETCYLE secondary material and other PET secondary material.[384] The proportion of crate-based deposit one-way PET bottles (PETCYCLE bottles) that is collected through the DPG deposit system and not in crates is recovered in the same manner as regular one-way PET bottles.

[384] Cf. DUH, 25.11.2010.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

Primary material and other scrap materials N/A

Secondary material/aluminium scrap Their use in new cans can be assumed. However, there has been no data provided

One-way deposit aluminium can

Collection (total): 96 %

Recycling (total): 94 %

Closed-loop recycling (total): N/A

Secondary material for other applications N/A (open-loop recycling)

Disposal as residual waste

4 % rejects

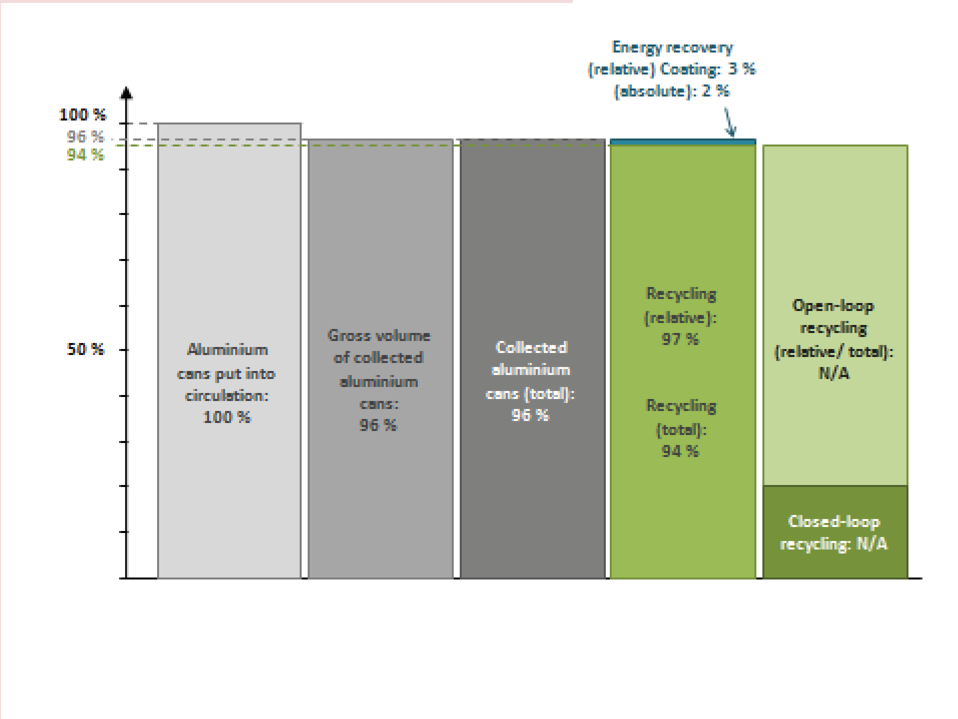


Illustration 17: Material flows for deposit beverage cans made of aluminium with information on return and recycling rates; source: IFEU, 2010 a, pages 31, 34 to 35 and 48; interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

Consumers return 96 % of all aluminium beverage cans put into circulation to retailers and wholesalers.[385] The remaining volume (4 %) is either disposed of as residual waste or is collected and recycled as curbside waste through dual systems. For simplification purposes, the calculations assume that all aluminium beverage cans that are not returned to retailers and wholesalers are disposed of. Aluminium beverage cans collected through the one-way deposit system are fully (100 %) consigned to recycling.[386] With a return rate of 96 %, the recycling rate for aluminium is 96 % in relation to the quantity put into circulation.[387]

In addition to used beverage cans, which end-consumers return to retailers and wholesalers, about 20 % of aluminium scrap is already generated during the production process. While aluminium scrap arising in the production process is directly used in the manufacture of new beverage cans, there is no data available on the specific input rates of old beverage cans in the production of new beverage cans.[388] According to the material flow depicted in the IFEU Life Cycle Assessment Beer 2010, no aluminium scrap from beverage cans is used in the production of new beverage cans[389]. The Swiss-based IGSU (Interest Group for a Clean Environment) states that aluminium scrap materials from beverage cans could theoretically be used in the production of new beverage cans any number of times. The impurities from inks and coatings could be removed during the production process in separate plants or within the scope of the remelting process.[390]
The proportion of inks and coatings in the total weight of an aluminium beverage can stands at about 2.5 % of the weight (rounded to 3 % in the illustration).[391] The calculations assume that inks and coatings are consigned to energy recovery.

[385] Cf. IFEU, 2010 a, p. 34.
[386] Interview with industry experts 2010.
[387] Cf. IFEU, 2010 a, pp. 34 and 50. A recycling rate of 95 % is indicated for aluminium and for tinplate on page 34, while a recycling rate of 96 % is stated for tinplate on page 50. For simplification purposes, the collection rates of 96 % indicated for both metals were also used as recycling rates in the illustration.
[388] Cf. IFEU, 2010 a, p. 153.
[389] Cf. IFEU, 2010 a, p. 35.
[390] Cf. IGSU website, FAQs.
[391] Cf. IFEU, 2010 a, p. 31.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

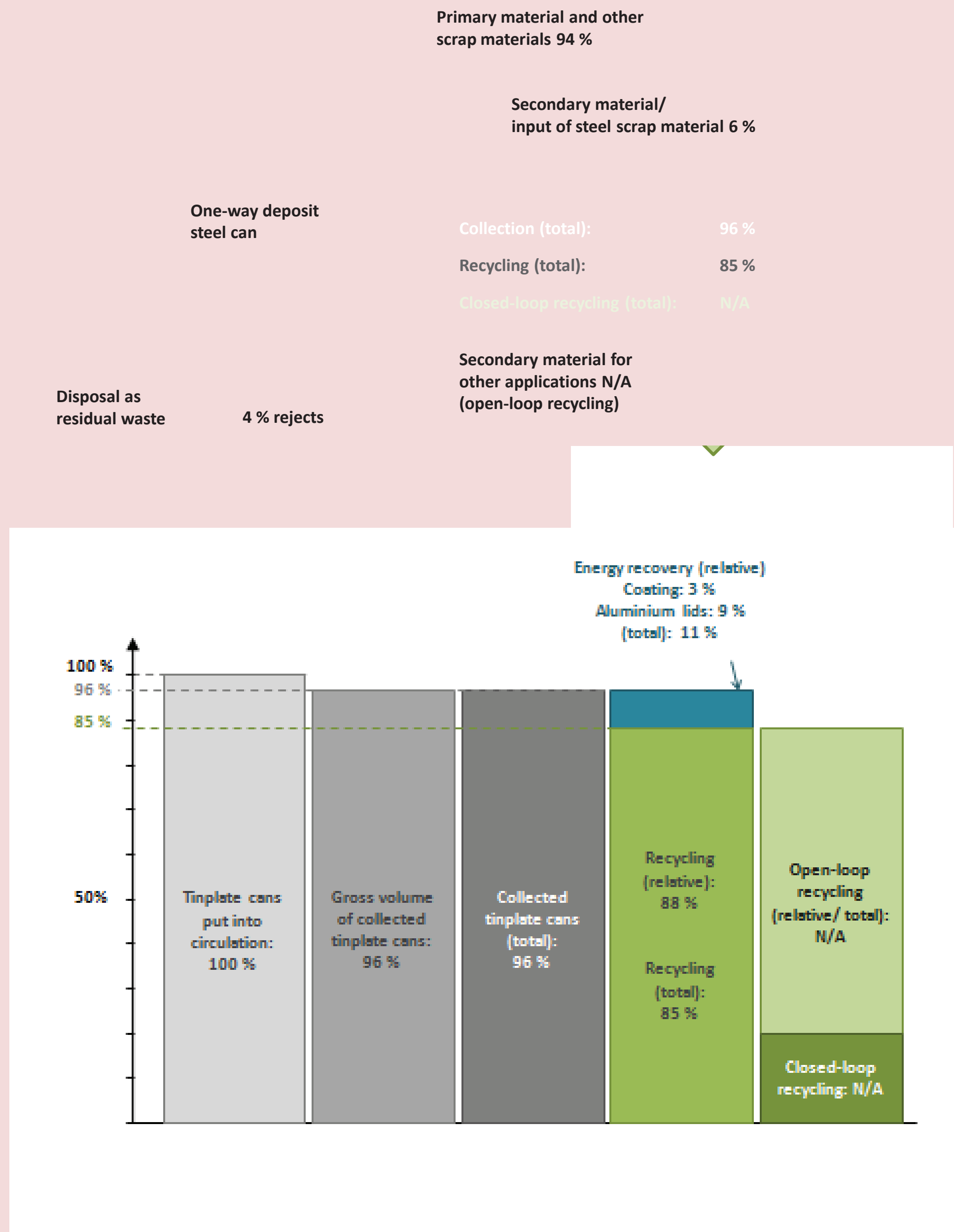


Illustration 18: Material flows of deposit beverage cans made of steel with information on return and recycling rates; source: IFEU, 2010 b, pages 31, 35 and 48 to 50: interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit	
	Consumers return 96 % of the steel beverage cans put into circulation to retailers and wholesalers[392]. The remaining volume (4 %) is either disposed of as residual waste or is collected and recycled as curbside waste through dual systems. For simplification purposes, the calculations assume that all steel beverage cans which are not returned to retailers and wholesalers are disposed of. Steel beverage cans collected through the one-way deposit system are fully (100 %) consigned to recovery.[393] The lids of beverage cans are made of aluminium and account for 9 % of a steel beverage can's total weight; inks and coatings account for a further 2.5 % (rounded to 3 % in the illustration) of the total weight, which is the same as for aluminium beverage cans.[394] Aluminium lids are consigned to energy recovery and are not recycled separately.[395] During the recycling process of steel, impurities from inks and coatings are removed in separate plants or within the scope of the remelting process.[396] The calculations assume that inks and coatings are consigned to energy recovery. Based on the IFEU Life Cycle Assessment Beer 2010, the input ratio of steel scrap from beverage cans in the manufacture of beverage cans was calculated to be ca. 6 %.[397]

[392] Cf. IFEU, 2010 a, p. 34.
[393] Interview with industry experts 2010.
[394] Cf. IFEU, 2010 a, p. 31.
[395] Cf. IFEU, 2010 a, p. 48.
[396] Cf. IGSU website, FAQs.
[397] Cf. IFEU, 2010 a, p. 35.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

Secondary material/ cullet used in new packaging

63 % clear
84 % green
84 % brown

Primary material
16–37 %

Other glass packaging

One-way deposit glass bottle

Collection (total): 96–99 %
Recycling (total): 96–98 %
Closed-loop recycling (total): 95–98 %

Disposal as residual waste

1–4 % rejects

Metal lids
Secondary material for other applications < 1 %
(Open-loop recycling)

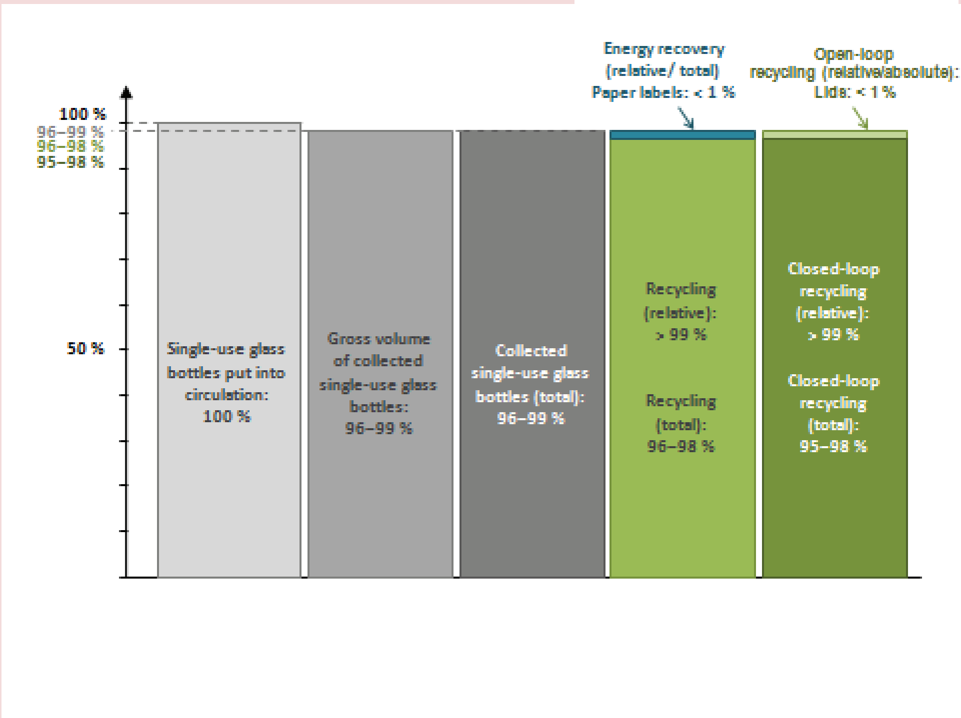


Illustration 19: Material flows of deposit one-way glass bottles with information on return and recycling rates as well as the proportion of cullet in manufacturing; source: GVM, 2009 a, page 47; IÖW, Oeko-Institut, 2009, p. 47; interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way deposit

No specific return rates are available for deposit one-way glass bottles. Analogous to one-way PET bottles and beverage cans, return rates ranging from 94 % (beverage cans) to 98.5 % (one-way PET bottles, rounded to 99 % in the illustration) are assumed. The remaining volume of 1 to 4 % is (possibly broken glass bottles) either disposed of as residual waste or is collected and recycled through the curbside collection of glass containers. For simplification purposes, the calculations assume that all one-way glass bottles which are not returned to retailers and wholesalers are disposed of.

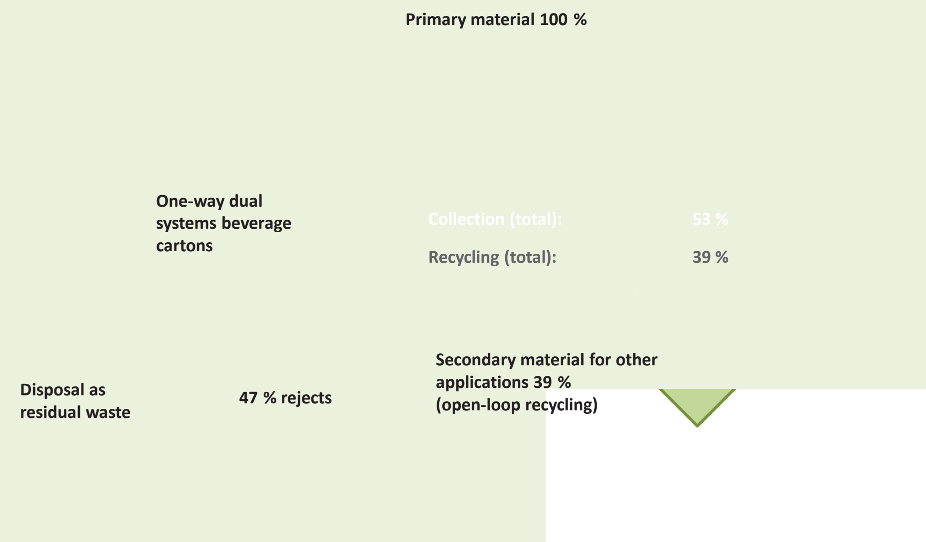
One-way glass bottles that are collected through the deposit system are fully (100 %) consigned to recovery. Glass stemming from collected one-way bottles is fully (100 %) recycled and solely used in the manufacture of glass containers (i.e. bottle-to-bottle recycling).[398] Since the manufacture of refillable and one-way glass bottles and other glass containers is carried out at the same glass factories, it is not possible to make a distinction regarding the extent to which waste glass in used in one-way glass bottles, refillable glass bottles and other glass containers. Paper labels account for 0.2 % (indicated as < 1 % in the illustration) and lids for 0.6 % (also indicated as < 1 % in the illustration) of the total weight of one-way glass bottles. Paper is usually consigned to energy recovery and lids are recycled (see also Section C 2.1.3.7).

At a range of 63 to 84 %[399], the use of recycling material (cullet) in the manufacture of both refillable bottles and one-way glass beverage containers is very high compared to the share of recyclates in other packaging materials.

[398] Cf. IFEU 2010 b, p. 58; IFEU 2008, p. 27; interview with industry experts.
[399] Cf. IÖW and Öko-Institut, 2009, p. 47.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way dual systems



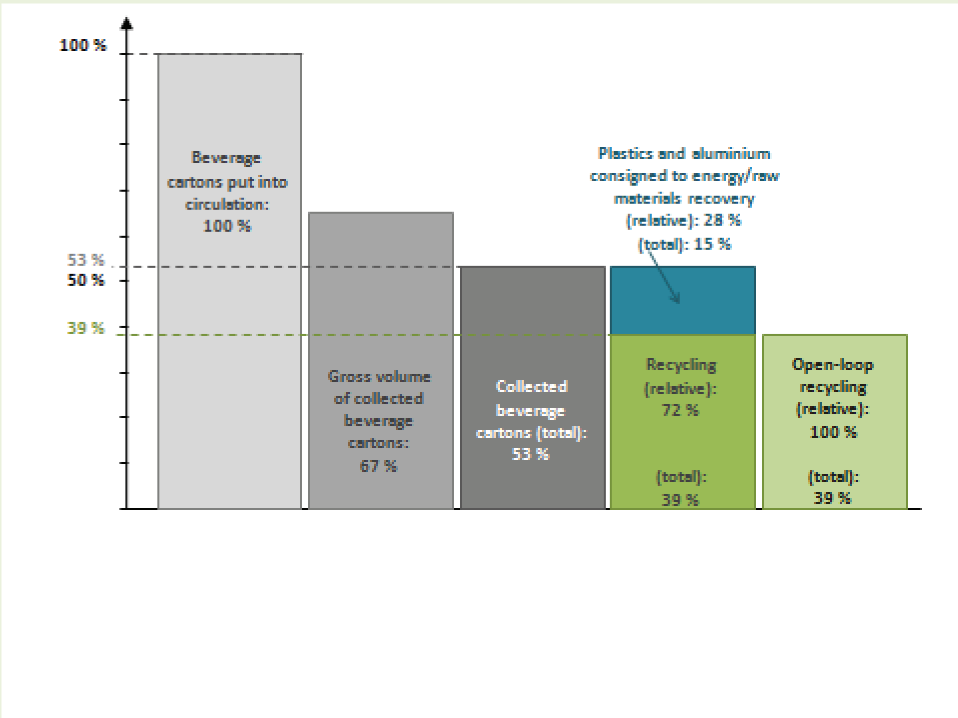


Illustration 20: Material flows of beverage cartons in the juices segment, which are disposed of through the dual systems, with information on collection and recovery rates; sources: GVM, 2009 a, pages 39 and 87; IFEU, 2006, page 27; Resch, J., 2009 b, pages 11, 22 and 24; interview with industry experts

The recovery of beverage cartons is described in detail in the following Section C 2.1.3.5 in the excursus on the recovery of beverage cartons.

C 2.1.3.6 Excursus: Recovery of beverage cartons

GVM shows that beverage cartons which are collected through dual systems (66.7 %) are fully consigned to recovery.[400] This rate already takes into account the fact that about 10 % of the beverage cartons collected through dual systems are not sorted out at the sorting facilities, but are consigned to energy recovery as sorting residues.[401]

The recovery rate published by the GVM does not take into account deductions concerning residues, humidity and incorrectly disposed of waste nor does it take into account that only the carton portion of the packaging is recycled, while the plastic and aluminium portions are consigned to energy recovery.

The DUH has published a new calculation of the recycling rate for beverage cartons, which accounts for residues and energy recovery. The calculation is structured as follows:[402]

The volume put into circulation serves as the starting value, from which are deducted:

- Material sorted out at sorting facilities
- Residues
- Energy recovery of the plastics portion

[400] Cf. GVM, 2009 a, p. 87.
[401] Cf. IFEU, 2006, p. 27.
[402] Cf. Resch, J., 2009 b, pp. 22, 24 and 25.

Table 62: Presentation of the recycling rate achieved for beverage cartons in practice, based on DUH's calculation methodology; source: Resch, J., 2009 b

Beverage cartons	Volume in tonnes	Percentage share (in relation to the quantity put into circulation)
Quantity of beverage cartons put into circulation (2007)[403]	219,500	100 %
Quantity of collected beverage cartons made available to recovery[404]	146,500	67 %
Quantity of collected beverage cartons (total) (receipt at the recovery plant takes into account a deduction totalling 20 % concerning residues in and on packaging, humidity and incorrect sorting)[405]	117,200	53 %
Quantity of collected beverage cartons (total), less deduction of plastics portion, which is consigned to energy recovery: 22 % to 34 %[406], conservative calculation basis for the average of 25 %[407]		
a) Carton quantity calculation, given a plastics proportion of 22 %	91,416	42 %
b) Carton quantity calculation, given a plastics proportion of 34 %	77,352	35 %
c) Carton quantity calculation, given an average plastics proportion of 25 %	87,900	40 %
Quantity of collected beverage cartons (total), including deduction of the aluminium proportion, which is usually incinerated along with other materials at cement plants: 0 to 6.2 %[408], assumed average: 3.1 %		
Quantity of collected beverage cartons (total), including deduction of an aluminium proportion of 6.2 %	a) 85,748 b) 72,556 c) 82,450	39 % 33 % 38 %
Quantity of collected beverage cartons (total), including deduction of an average aluminium proportion of 3.1 %	a) 88,582 b) 74,957 c) 85,175	40 % 34 % 39 %
Open-loop recycling rate (total) of beverage cartons, less deduction of plastic and aluminium proportions	**72,556 to 91,416 average: 85,175**	**33 to 42 % average: 39 %**

With respect to beverage cartons that are collected through dual systems and which are sorted at sorting facilities, it is assumed that residues in and on packaging, humidity and incorrect sorting account for about 20 %.[409] After deducting these factors, the total collected quantity of beverage car-

[403] Cf. GVM, 2009 a, p. 87.
[404] Cf. GVM, 2009 a, p. 87.
[405] Cf. Resch, J., 2009 b, pp. 21 to 22; Bosewitz, S., 2007, p. 20.
[406] Resch, J., 2009 b, p. 24; IFEU, 2006, p. 21.
[407] Resch, J., 2009 b, pp. 11 to 12.
[408] Resch, J., 2009 b, p. 24; IFEU, 2006, p. 21.
[409] Cf. Resch, J., 2009 b, pp. 21 to 22; Bosewitz, S., 2007, p. 20.

tons (in relation of the quantity of beverage cartons put into circulation) is ca. 53 %, as derived from Table 62. In addition, beverage cartons are already used for energy recovery as sorting residues at the sorting facilities (i.e. before the gross collected quantity of beverage cartons is made available for recovery at recycling plants for beverage cartons), after deductions of residues in and on packaging and other factors, that account for about 8 % of the volume of beverage cartons put into circulation.[410] The calculation assumes that the rest of the beverage cartons are disposed of (eliminated) as residual waste.

With regard to calculation of the actual recycling proportion, GVM states that the proportion of recycled carton respecting beverage cartons is about 25 % lower than the volume indicated.[411] Presumably, the deduction made by GVM corresponds to the assumed proportions of beverages cartons that do not contain cellulose. According to the calculation methodology applied in the Table, only 33 to 42 % (average of 39 %) of beverage cartons are recycled after deductions for the proportions of plastics and aluminium in the beverage cartons.

The proportion of paper in beverage cartons is entirely (100%) manufactured from fresh fibres. Closed-loop recycling of the proportion of cellulose-containing carton in beverage cartons is not possible. The plastics and aluminium proportions of beverage cartons (average of 25 % for plastics and about 3.1 % for aluminium according to conservative estimates) are usually incinerated at cement plants (consigned to energy or raw materials recovery). Correspondingly, the illustration on material flows regarding beverage cartons includes both proportions collectively (28.1 %) as the proportion consigned to energy and raw materials recovery. However, since the plastics and aluminium proportions are received together with the carton portion of the beverage packaging at recovery plants, they are included in the recycling rate through the regular calculation of ratios even though the materials are sorted out in the recycling process.[412]

In its calculations concerning the recovery of beverage cartons in 2009, DUH deducts another 10 % for the incineration of "beverage cartons with overly long storage periods". According to research conducted by DUH, this is attributable to the fact that beverage packaging collected in Germany in 2009 was temporarily only recovered at a single recovery plant, which led to capacity shortages and, due to above-average storage periods, partly to the inferior quality of the collected and sorted beverage cartons.[413]

The collection and recycling rates presented play an important role in the ecological assessment of beverage cartons. With respect to the ecological assessment of beverage cartons, the partially growing plastics proportion in beverage cartons along with increasing packaging weights have repeatedly been a subject of discussion in recent years. Due to the renewable raw material wood (cellulose), carton is assessed more favourably than plastic (fossil raw material) and aluminium in ecological comparisons. In the most recent life cycle assessment of 2006, which was commissioned by FKN, beverage cartons were assessed as ecologically beneficial even when they had plastic spouts.

[410] Cf. IFEU, 2006, p. 27 (10 % of sorted out beverage cartons, less 20% residues on packaging equals 8 %)
[411] Cf. GVM, 2009 a, p. 40.
[412] Cf. GVM, 2009 a, pp. 37–41.
[413] Cf. Resch, J., 2009 b, p. 26.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way dual systems

Primary material 100 %

One-way dual system
PET bottle (juice)

Collection (total): 43–54 %

Recycling (total): 25–31 %

Disposal as
residual waste

46–57 % rejects

Secondary material for other
applications 25–31 %
(open-loop recycling)

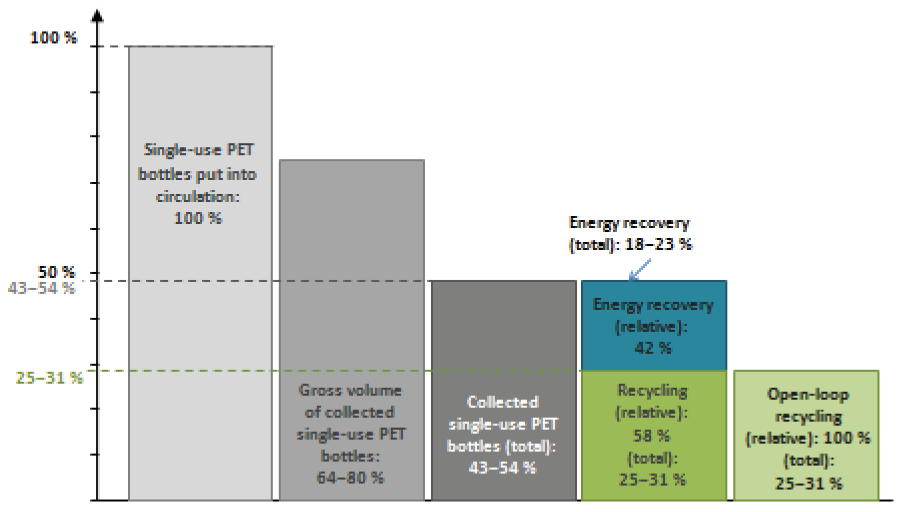


Illustration 63: Material flows for one-way PET bottles (concerning the juices segment) that are disposed of through the dual system, with information on collection and recovery rates; source: IFEU, 2006, page 33; GVM, 2009 2009 c, page 10; Bosewitz, 2007, page 24; interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way dual systems

No data that is separate from the entire PET material flow are collected with respect to one-way beverage containers made of PET and which are not subject to a mandatory deposit. In all, the PET packaging quantities collected through dual systems are significantly lower than the volumes returned through the deposit system. The average collection rate for all the plastic packaging in the dual system was 62 % (less deductions for residues in and on packaging), in 2007.[414] The Duales System Deutschland GmbH showed collection rates of 64 % (0.33 litre) and 80 % (1 to 1.5 litres) for one-way PET bottles for juices in 2005.[415] As described in the remarks on Section C 2.1.3.4, the collection rate would decrease to 43 % - 54% of the volume put into circulation if residues and unlicensed packaging were taken into account.

As regards one-way PET bottles for juices, which are not disposed of through dual systems, it must be assumed that they remain as residual waste and are disposed of accordingly.

According to industry experts, PET stemming from collection through dual systems is usually used for other applications (open-loop recycling or downcycling) and not used for bottle-to-bottle recycling. This is attributable to the higher level of impurities and greater product diversity (e.g. detergent bottles) in mixed curbside collection and to the colour of juice bottles.[416] About 58 % of the PET juice bottles collected through dual systems in 2005 were consigned to recycling, while the remaining volume was consigned to energy or raw materials recovery.[417]

The caps and labels of recycled PET juice bottles are usually removed since they are made out of other plastic materials. They are, however, also recycled. This material flow was not presented separately in the illustration.

In relation to the volume of one-way PET bottles for juices put into circulation, the graphic presentation shows a total recycling rate of 25 to 31 %, while taking all deductions into account.

[414] Cf. GVM, 2009 a, p. 64.
[415] Cf. IFEU, 2006, p. 33.
[416] Interview with industry experts.
[417] Cf. IFEU, 2006, p. 33.

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way dual systems

The following data relate to collection rates for glass packaging overall since specific rates were not available for beverage packaging:

Primary material
16–37 %

Secondary material/
cullet used in new
packaging

63 % clear
84 % green
84 % brown

Other glass
packaging

One-way dual system
glass bottle (juice)

Collection (total): 76–82 %

Recycling (total): 76–82 %

18–26 % rejects

Disposal as residual waste or
material sorted out during glass
processing

Metal lids
Secondary material for other
applications < 1 %
(open-loop recycling)

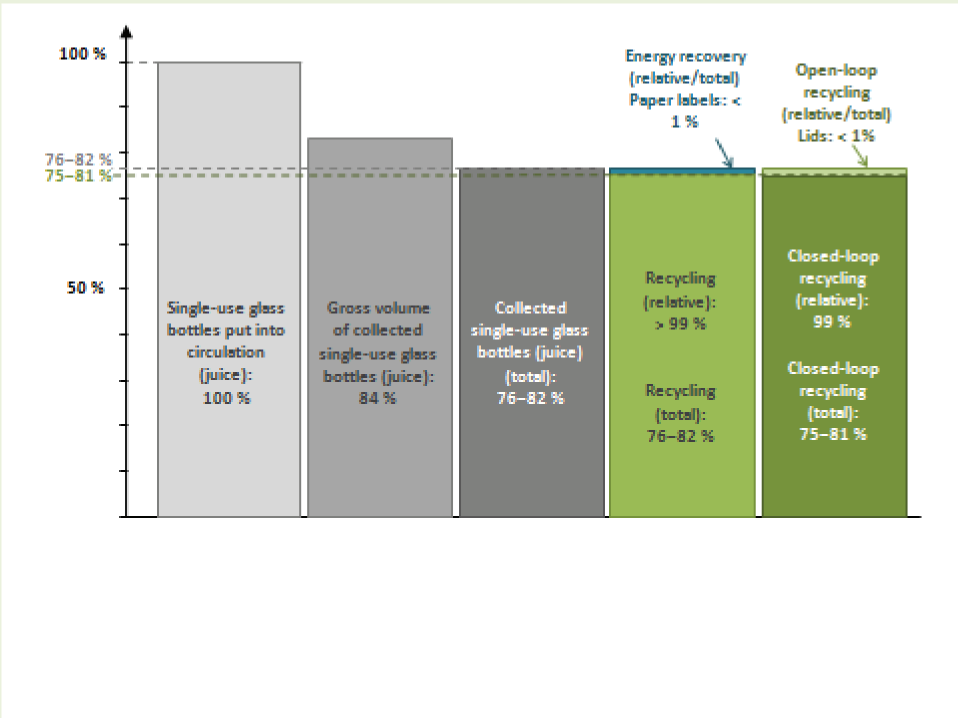


Illustration 22: Material flows for one-way glass bottles (concerning the juices segment) that are disposed of through the dual system, with information on collection and recovery rates as well as the proportion of cullet in manufacturing; source: GVM 2009 a, pages 40 and 54; ; IÖW, Öko-Institut, 2009, page 47; interview with industry experts

Indicators 9 to 14 - Return, recovery and disposal rates as well as secondary materials input ratio

One-way dual systems

84 % of all glass containers are collected within the scope of dual systems (incl. residues, incorrect disposal of waste, etc.); specific data concerning beverage bottles are not available.[418] Owing to container collection, the degree of impurities is higher when compared to deposit systems: Various sources indicate that the impurity rate stands at 2.5 to 10 %.[419] After foreign materials and impurities have been extracted at glass processing plants, the quantity of one-way glass bottles collected through dual systems (in relation to the volume put into circulation) is 76 to 82 %. In the calculations it is assumed that the remaining volume of 18 to 24 % is disposed of as residual waste (possibly as broken glass bottles).

The glass portion of all one-way glass bottles collected through dual systems is fully (100 %) consigned to closed-loop (bottle-to-bottle) recycling. Analogous to deposit glass bottles, the input ratio for cullet is not determined specifically, but only as a general ratio for glass manufacturing. The input ratios of cullet for the manufacture of new glass containers before and after introduction of a mandatory deposit are compared in the following:

	UBA II/1[420]	IÖW and Öko-Institut[421]
Clear glass	59 %	62.5 %
Green glass	80 %	84.4 %
Brown glass	65 %	84.4 %

Paper labels from one-way glass bottles for juices are consigned to energy recovery, while the lids are recycled in accordance with the open-loop approach.

[418] Cf. GVM, 2009 a, p. 54.
[419] Cf. GVM, 2009 a, p. 40; interview with industry experts.
[420] Cf. Prognos et al. 2000, p. 110.
[421] Cf. IÖW, Öko-Institut, 2009, p. 47.

C 2.1.3.7 Ecological packaging (re)design

Indicator 15 – Average packaging weight

Refillables

Refillable bottles made of glass and PET: Refillable bottles made of glass or PET are usually heavier than corresponding one-way bottles. How-ever, due to the reuse (refill) of refillable bottles, the weight in relation to the beverage volume (here: 1,000 litres) filled into the bottles is significantly lower. The examples below provide a summary of weights per refillable bottle and of the weight of the refillable bottles required for a filling volume of 1,000 litres. In the calculation of the weight in relation to the volume filled into the bottles, the bottle weights in absolute terms (with labels and caps) as well as the circulation rates of the respective bottles are significant (see Section C 2.1.3.3 Circulation rates respecting refillable systems).

	Weight, g/bottle	Weight, g/lid	Label weight, g/bottle	Weight, g/crate	Circulation rates for bottles	Circulation rates for crates	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Crate weight kg/1,000 l filling vol.	**Total weight of all materials**
Water, non-alcoholic soft drinks [422]											
0.5 l refillable glass bottle	360.0 g	1.5 g aluminium (60 %) 3.2 g HDPE (40 %)	1.1 g paper	1,350 g HDPE	21	50	34.3 kg glass	average 4.4 kg (aluminium/HDPE)	2.2 kg paper	2.7 kg	**43.6 kg**
0.7 l refillable glass bottle	590.0 g	1.5 g aluminium (60 %) 3.2 g HDPE (40 %)	1.0 g paper	1,400 g HDPE	40/59	120 150[423]	14.3/21.2 kg Glass	average 3.1 kg (aluminium/HDPE)	1.4 kg paper	1.3 kg 1.1 kg	**19.9–27 kg**
0.75 l refillable glass bottle	540.0 g	1.5 g aluminium (60 %) 3.2 g HDPE (40 %)	1.0 g paper	1,400 g HDPE	40/59	120 150[424]	12.2/18.0 kg glass	average 2.9 kg (aluminium/HDPE)	1.3 kg paper	1.3 kg 1.1 kg	**17.5-23.5 kg**

[422] Bottle and lid weights for glass: IFEU, 2010 b, p. 39; for PET: ebd., p. 42; circulation rate: ebd., p. 39.
[423] IFEU, 2008, p. 24.
[424] IFEU, 2008, p. 24.

Indicator 15 – Average packaging weight

Refillables

	Weight, g/bottle	Weight, g/lid	Label weight g/bottle	Weight, g/crate	Circulation rates for bottles	Circulation rates for crates	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Crate weight kg/1,000 l filling vol.	**Total weight of all materi-als**
0.5 l refillable PET bottle (GDB)	51.5 g	2.7 g HDPE	0.4 g PP	1,100 g HDPE	15	120	6.9 kg PET	5.4 kg HDPE	0.8 kg PP	1.5 kg	**14.6 kg**
0.75 l refillable PET bottle (GDB)	62.0 g	3.2 g HDPE	0.6 g PP	1,600 g HDPE	15	120 100[425]	5.5 kg PET	4.2 kg HDPE	0.8 kg PP	1.5 kg 1.8 kg	**12.0–12.3 kg**
1 l refillable PET bottle (GDB)	62.0 g	3.2 g HDPE	0.6 g PP	1,850 g HDPE	15	120 100[426]	4.1 kg PET	3.2 kg HDPE	0.6 kg PP	1.3 kg 1.5 kg	**9.2- 9.5 kg**
1.5 l refillable PET bottle (GDB)	69.8 g	3.2 g HDPE	0.9 g PP	1,320 g HDPE	15	120	3.1 kg PET	2.1 kg HDPE	0.6 kg PP	1.2 kg	**7.0 kg**

When reference is made to a filling volume of 1,000 litres, it becomes clear that refillable PET bottles involve hardly more material than the lids and labels which are only used once.

Life cycle assessments for refillable glass and PET bottles provide varying figures respecting refillable crates. In the IFEU PET Life Cycle Assessment 2010, the calculations for all beverage crates are based on the same circulation rate, namely 120. The GDB Life Cycle Assessment 2008 indicates circulation rates of 150 concerning crates for refillable glass bottles and 100 respecting crates for refillable PET bottles and PETCYCLE crates.[427] According to the GDB, circulation rates of 120 are realistic.[428] In all, the quantity of materials required is comparatively low due to the high circulation rates.

425 IFEU, 2008, p. 24.
426 IFEU, 2008, p. 24.
427 IFEU, 2008, p. 24.
428 Interview with industry experts.

Indicator 15 – Average packaging weight

Refillables

	Weight, g/bottle	Weight, g/lid	Label weight g/bottle	Weight, g/crate	Circulation rates for bottles	Circulation rates for crates	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Crate weight kg/1,000 l filling vol.	**Total weight of all materi-als**
Beer[429]											
NRW glass bottle 0.5 l	380 g	2.2 g steel	1.2 g paper	1,850 g HDPE	44/25	120/40	17.3/30.4 kg glass	4.4 kg steel	2.4 kg paper	1.5/4.6 kg HDPE	**25.6-41.8 kg**
Longneck glass bottle 0.33 l	310 g	2.2 g steel	1.2 g paper	2,200 g HDPE	42/25	120/40 or six-pack	22.4/37.7 kg glass	6.7 kg steel	3.6 kg paper	2.3/6.9 kg HDPE or 22.1 kg carton	**35.0-53.9 kg with crate, 54.8–70.1 kg with carton**
Longneck glass bottle 0.5 l	385 g	2.2 g steel	1.2 g paper	2,300 g HDPE	42/25	120/40	18.3/30.8 kg glass	4.4 kg steel	2.4 kg paper	1.9/5.8 kg HDPE or 25.2 kg carton	**27.0–43.4 kg with crate, 50.3–62.8 kg with carton**
Euro glass bottle 0.5 l	385 g	2.2 g steel	1.2 g paper	2,300 g HDPE	63/25	120/40	12.2/30.8 kg glass	4.4 kg steel	2.4 kg paper	1.9/5.8 kg HDPE	**20.9-43.4 kg**

[429] Bottle weights: Hartmut-Bauer website, *Leere Bierflaschen kaufen*; lid weights: IFEU, 2010 a, p. 31; NRW bottle: analogous assumption for longneck and euro bottle; Circulation rates of bottles: IFEU, 2010 a, p. 42; Verband Private Brauereien Deutschland e.V. 2009; secondary packaging: IFEU, 2010 a, p.31; DUH, weight measurements of various beverage containers, 2010; circulation rates of crates: interview with industry experts.

Indicator 15 – Average packaging weight

Refillables

	Weight, g/bottle	Weight, g/lid	Label weight g/bottle	Weight, g/crate	Circulation rates of bottles	Circulation rats of crates	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Crate weight kg/1,000 l filling vol.	**Total weight of all materi-als**
Juices[430]											
VDF glass bottle 0.7 l	450 g	1.4 g aluminium	1.2 g paper	1,110 g HDPE	45.8/ 25.5	120	14.0/23.4 kg glass	2.0 kg aluminium	1.7 kg paper	2.2 kg HDPE	**19.9-29.4 kg**
VDF glass bottle 1.0 l	600 g	1.4 g alu-minium	1.2 g paper	1,040 g HDPE	45.8/ 25.5	120	26.2/43.6 kg glass	1.6 kg aluminium	1.2 kg paper	1.4 kg HDPE	**30.4-47.8 kg**
Glass bottle design 1.0 l (MW innova-tion award)	540 g	1.4 g	1.2 g paper	1,040 g HDPE	45.8/ 25.5	120	23.6/39.3 kg glass	1.6 kg aluminium	1.2 kg paper	1.4 kg HDPE	**27.8-43.5 kg**

[430] Cf. Hartmut-Bauer website, *Leere Saftflaschen günstig kaufen bei Bauer*; DUH and SIM, 25.3.2010; lid weight: assessment based on measurements of other lid weights.

Indicator 15 – Average packaging weight

Refillables	While - with respect to the mineral water, non-alcoholic soft drinks and beer beverage segments - refillable glass and PET bottles with higher volumes in relation to a 1,000 litre filling volume require less material than smaller container sizes, the use of 1 litre glass juice bottles leads to an increase in materials consumption when compared to light-weight 0.7 litre glass juice bottles. However, high filling volumes generally offer advantages with regard to transport capacity utilisation. When comparing refillable glass bottles from the various segments with the differing circulation rates, it becomes evident that circulation rates generally have a stronger impact on materials consumption than do weights. This means that higher weights - if they should increase bottle stability and thus enable the repeated usage of bottles - contribute more effectively to lower resources consumption than the separately assessed reduction of bottle weights. However, this does not account for the impact on transport. It would seem to be expedient to analyse this aspect more exhaustively than has been possible within the scope of this study. The circulation rates of refillable crates and the corresponding resources consumption differ in the various beverage segments. While standard crates that achieve high circulation rates are mainly used in the mineral water and juices segments, the beer segment largely utilises individual crates. Crates are exchanged more frequently in this segment due to marketing-related aspects.[431] The calculations show that the use of six-packs instead of crates leads to increased materials consumption respecting carton packaging when compared to refillable HDPE plastic crates.

[431] interview with industry experts.

Indicator 15 – Average packaging weight

One-way deposit

	Weight, g/bottle total	Weight, g/lid	Weight, g/label	Weight per bottle, net	Weight, shrink wrap/crate	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Weight, wrap/crate kg/1,000 l filling vol.	**Total weight of all mate-rials**
Water, non-alcoholic soft drinks[432]										
0.5 l one-way PET bottle CO_2	19.7/20.0 g	2.3 g HDPE	0.4 g PP	17.0/17.3 g	8.0 g LDPE (6 bottles)	34.0 kg/34.6 kg	4.6 kg	0.8 kg	2.7 kg	**42.1-42.7 kg**
0.5 l one-way - PET bottle brand-name product CO_2	-/26.6 g	2.3 g HDPE	0.4 g PP	23.9 g	8.0 g LDPE (6 bottles)	47.8 kg	4.6 kg	0.8 kg	2.7 kg	**55.9 kg**
0.5 l one-way PET bottle still mineral water	18.7/20.8 g	2.5 g HDPE	0.5 g PP	15.7 g/17.8 g	7.2 g LDPE (6 bottles)	31.4 kg/35.6 kg	5.0 kg	1.0 kg	2.4 kg	**39.8-44 kg**
1.0 l one-way PET bottle CO_2	-/32.9 g	2.3 g HDPE	0.8 g PP	29.8 g	11.3 g LDPE (6 bottles)	29.8 kg	2.3 kg	0.8 kg	1.9 kg	**34.8 kg**
1.0 l crate-based one-way PET bottle (PETCYCLE bottle)	32.4 g/-	2.3 g HDPE	1.4 g 83 % Paper, rest PP	28.7 g	1,850 g (12-pack crate circulation rates 120 and 100[433])	28.7 kg	2.3 kg	0.8 kg	1.3 kg (crate) 1.5 kg (crate)	**33.1-33.3 kg**

[432] The first values in this column respectively: IFEU, 2010 b, p. 48; the second values in the column: DUH, weight measurements of various beverage containers, 2010.
[433] IFEU, 2008, p. 24.

Indicator 15 – Average packaging weight

One-way deposit		Weight, g/bottle total.[434]	Weight, g/lid	Weight, g/label	Weight per bottle, net	Weight, shrink wrap/crate	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Weight, wrap/crate kg/1,000 l filling vol.	**Total weight of all materi-als**
	1.25 l one-way PET bottle brand-name product CO_2	-/36.5 g	2.3 g HDPE	0.8 g PP	32.8 g	n/a	26.2 kg	1.8 kg	1.1 kg	n/a, as-sumption: average between 1.0 and 1.5 l bottle: 1.8 kg	**30.9 kg**
	1.5 l one-way PET bottle CO_2	33.0/34.0 g	2.3 g HDPE	0.9 g PP	29.8/30.8 g	16.0 g LDPE	19.9 kg/20.5 kg	1.5 kg	0.6 kg	1.7 kg	**23.7-24.3 kg**
	1.5 l one-way PET bottle brand-name product CO_2	-/42.9 g	2.3 g HDPE	0.9 g PP	39.7 g	16.0 g LDPE	26.5 kg	1.5 kg	0.6 kg	1.7 kg	**30.3 kg**
	1.5 l crate-based one-way PET bottle (PETCYCLE bottle)	37.6 g	2.3 g	1.6 g 81 % pa-per	33.7 g	1,370 g (6-pack crate) Circulation rate 120	22.5 kg	1.5 kg	1.1 kg	1.3 kg	**26.4 kg**
	1.5 l one-way PET bottle still	31.9/33.4 g	2.3 g	0.9 g	28.7/30.2 g	16.0 g	19.1/20.1 kg	1.5 kg	1.1 kg	1.3 kg	**23.0-24.0 kg**
	1.5 l one-way PET bottle brand-name product still	-/37.4 g	2.3 g	0.9 g	34.2 g	16.0 g	22.8 kg	1.5 kg	1.1 kg	1.3 kg	**26.7 kg**

[434] The first values in this column respectively: IFEU, 2010 b, pp. 48 and 53; the second values in the column: DUH, weight measurements of various beverage containers, 2010.

Indicator 15 – Average packaging weight

One-way deposit	In all, the weights of one-way PET bottles have decreased in recent years. Presumably, bottle weight reduction is possible only up to a certain limit in order to ensure bottle stability. The IFEU PET Life Cycle Assessment 2010 mainly analysed bottle weights (incl. caps and labels) of beverage packaging with respect to sale through discounters.[435] According to DUH measurements, the average weights of one-way PET bottles relating to four large discounter chains are higher than the values assumed in the IFEU PET Life Cycle Assessment 2010. The DUH measurements also indicate that the bottle weights of brand-name products are significantly higher than those of store brands. For example, it was found that the bottle weights of one-way PET bottles for brand-name beverages (e.g. in the case of still mineral waters) filled into 1.5 litre bottles was about 17 % higher than the bottle weights of store brands, while the weights of 1.5 litre and 0.5 litre bottles were respectively about 30 % and 35 % heavier for mineral waters containing CO_2. The weight differences ascertained must be taken into account in an analysis of the total weight. Accordingly, the weights of various bottle types are presented in the above Table. Weight measurements from both the IFEU Institute and DUH are not available for all bottle types examined. As a result, there is only one value indicated for some bottles while two values are provided for others. The first value reflects the IFEU Institute indications and the second value the DUH measurements. As demonstrated for reusable crates, different sources indicate circulation rates of 100 and 120 for PETCYCLE crates. Consequently, the value indicated for materials consumption in the different sources differs by about 20 %. In all, however, this difference is comparatively low. In the weight comparison made in this context, refillable glass bottles require - depending on the respective circulation rate - a similar amount of materials as do one-way PET bottles with respect to a filling volume of 1,000 litres. In addition to mass volumes, the factors recycling and product quality must also be taken into account (see Section C 2.1.3.5).

[435] Cf. IFEU, 2010 b, p. 45.

Indicator 15 – Average packaging weight

One-way deposit

Beer									
	Weight, g/bottle[436]	Weight, g/lid	Weight, g/label	Weight, tray or shrink wrap/6-pack	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Label weight kg/1,000 l filling vol.	Tray weight kg/1,000 l filling vol.	**Total weight of all materi-als**
0.5 l one-way beer bottle	260 g	2.2 g steel	0.6 g paper	302.7 g	520.0 kg	4.4 kg	1.2 kg	25.2 kg	**550.8 kg**
0.33 l one-way beer bottle	125 g[437]	2.2 g Steel	0.6 g	302.7 g	250.0 kg	4.4 kg	1.2 kg	25.2 kg	**320.4 kg**
0.5 l one-way PET beer bottle, monolayer	24.1 g	2.9 g HDPE	0.8 g paper	106 g 9 g	48.2 kg	5.8 kg	1.6 kg	8.3 kg carton 3.0 kg wrap	**63.9 kg** **58.6 kg**
0.5 l one-way PET beer bottle, multi-layer	27.9 g	2.9 g HDPE	0.8 g paper	106 g 9 g	55.8 kg	5.8 kg	1.6 kg	8.3 kg carton 3.0 kg wrap	**71.5 kg** **66.2 kg**

As shown in Section C 2.1.3.5, the use of non-refillable glass bottles in the beverage segments that are required to charge deposits dropped sharply. Data on weight measurements are only available for one-way beer bottles. Materials consumption regarding glass and carton for use as transport packaging is highest with respect to one-way glass bottles.

[436] Cf. IFEU, 2010 a, p. 31; weights of trays: DUH, weight measurements of various beverage containers, 2010.
[437] Bundesverband-Glasindustrie-e. V. website, *Gewichtsreduzierung*.

Indicator 15 – Average packaging weight

One-way deposit

Water, non-alcoholic soft drinks	Weight, g/can	Body weight, g/can	Weight, g/lid	Tray weight	Weight, coating/can	Total weight, cans kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Coating weight kg/1,000 l filling vol.	Tray weight kg/1,000 l filling vol.	**Total weight of all materi-als**
0.33 l steel can non-alcoholic soft drinks[438]	24.6 g	21.6 g	2.2 g alu-minium	77.6 g (24 cans)	ca. 0.6 g	67.0 kg	6.6 kg	0.9 kg	9.8 kg	**83.3 kg**
0.25 l steel can non-alcoholic soft drinks[439]	24.6 g	21.9 g	2.3 g alu-minium	66.82 g (24 cans)	ca. 0.4 g	87.6 kg	9.2 kg	1.6 kg	11.1 kg	**109.5 kg**
0.25 l aluminium can non-alcoholic soft drinks[440]	11 g	8.5 g	2.3 g	66.82 g (24 cans)	ca. 0.2 g	34.0 kg	9.2 kg	0.8 kg	11.1 kg	**55.1 kg**

[438] DUH, weight measurements of various beverage containers, 2010; calculation of lid weight analogous to IFEU figures for tinplate beer cans (9.7 %), estimate of coating proportion based on data presented in IFEU, 2010 a, p. 31 for 0.5 l cans.
[439] DUH, weight measurements of various beverage containers, 2010; calculation of lid weight analogous to IFEU figures for tinplate beer cans (9.7 %), estimate of coating proportion based on data presented in IFEU, 2010 a, p. 31 for 0.5 l cans; use of tray weight for 0.25 l Red Bull aluminium cans, since no specific values were available regarding the tray weight for 0.25 l tinplate cans.
[440] DUH, weight measurements of various beverage containers, 2010; calculation of lid weight analogous to IFEU figures for aluminium beer cans (16.7 %), estimate of coating proportion based on data presented in IFEU, 2010 a, p. 31 for 0.5 l cans.

Indicator 15 – Average packaging weight

One-way deposit

Beer										
	Weight, g/can	Body weight g/can	Weight, g/lid	Tray weight	Weight, coating/can	Total weight, cans kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Coating weight kg/1,000 l filling vol.	Tray weight kg/1,000 l filling vol.	**Total weight of all materi-als**
0.5 l steel beer can[441]	31.3 g	27.8 g	2.7 g aluminium	162 g (24 cans)	0.8 g	55.6 kg	5.4 kg	1.6 kg	13.5 kg	**76.1 kg**
0.33 l aluminium beer can [442]	13 g	10.5 g	2.2 g	77.6 g (24 cans)	ca. 0.3 g	31.8 kg	6.6 kg	1.8 kg	9.8 kg	**50.0 kg**
0.5 l aluminium beer can[443]	16.1 g	12.9 g	2.7 g	162 g (24 cans)	0.4 g	25.8 kg	5.4 kg	0.8 kg	13.5 kg	**45.5 kg**

In all, the weights of beverage cans have also decreased in recent years. The DUH measurements show that the weights of 0.33 litre steel cans for non-alcoholic beverages decreased from 24.9 to 24.6 g (a little more than 1 %) in the period from 2006 to 2010. The weight reduction possibilities are also limited with respect to beverage cans since stability must be ensured.

Presently, 0.25 litre cans that weigh just as much as 0.33 litre cans have been launched on the market, which translates into increased materials consumption of 33 % in relation to the same filling volume.

Compared to the can weights presented, beverage can manufacturers indicate weights of 27.6 g for 0.5 litre steel cans and 13.3 g[444] for aluminium cans. The IFEU measurements for steel cans are thus about 12 % higher than the values provided by the manufacturers, while the measurements for aluminium cans are ca. 17 % higher.

[441] Cf. IFEU, 2010 a, p. 31
[442] DUH, weight measurements of various beverage containers, 2010; calculation of lid weight analogous to IFEU figures for aluminium beer cans (16.7 %), estimate of coat-ing proportion based on data presented in IFEU, 2010 a, p. 31 for 0.5 l cans.
[443] Cf. IFEU, 2010 a, p. 31.
[444] Ball-Packaging-Europe website, *Gewichtsreduktion*.

Indicator 15 – Average packaging weight

One-way dual systems

Beverage cartons:

Beverage cartons[445]	Weight, g/beverage carton	Weight, g/plastic lid	Weight, g/aluminium share	Weight, g/carton share	Weight, g/carton or tray	Weight, carton kg/1,000 l filling vol.	Weight, plastic kg/1,000 l filling vol.	Weight, aluminium kg/1,000 l filling vol.	Tray weight kg/1,000 l filling vol.	**Total weight of all materi-als**
0.5 l with cap	21.8 g	7.7 g	1.0 g	13.2 g	105 g	26.4 kg	15.4 kg	2.0 kg	17.5 kg	**61.3 kg**
0.2 l with straw	8.6 g	2.3 g	0.5 g	5.7 g	100 g/3.8 g wrap	28.5 kg	11.5 kg	2.5 kg	8.3 kg 1.9 kg wrap	**52.7 kg**
1 l without cap	26.7 g	5.7 g	1.4 g	19.5 g	128 g	19.5 kg	5.7 kg	1.4 kg	10.7 kg	**37.3 kg**
1 l with cap	31.5 g	8.6 g 27.1 %	1.5 g 4.6 %	21.4 g 68.3 %	128 g	21.4 kg	8.6 kg	1.5 kg	10.7 kg	**42.2**
1 l with cap, brand-name product	39 g[446]	10.5 g[447]	1.8 g	26.6 g	128 g	26.6 kg	10.5 g	1.8 kg	10.7 kg	**49.6 kg**
1.5 l with cap	43.9 g	11.1 g	1.7 g	30.9 g	134 g	20.6 kg	7.3 kg	1.1 kg	11.2 kg	**40.2 kg**

445 Cf. IFEU, 2006, p. 21.
446 Resch, J., 2009 b, p. 23; average packaging of brand-name fillers (here: "Lindavia“ and "Becker’s Bester“, the other containers measured concern store brands).
447 Calculation of the weight proportions of various materials analogous to the percentage share of the individual weights indicated by IFEU (see the column above)

Indicator 15 – Average packaging weight

One-way dual systems

There are various types of beverage cartons with varying weights. While almost only beverage cartons without spouts were in use at the time when UBA II was conducted - which also formed the basis for assessing the ecological benefit - 90 % of the 1 litre and 1.5 litre beverage cartons were already equipped with spouts in 2006[448]. For this reason the values indicated in the 2006 IFEU study commissioned by the Fachverband Kartonverpackungen are used in this context. The carton proportions of the packaging analysed in this study deviate very little from the values provided in UBA II.

The presentation indicates that beverage cartons with spouts are heavier and that their plastics proportion is significantly higher.[449] DUH measurements reveal that beverage cartons can be up to 24 % heavier than assumed in this context.

One-way juice bottles[450]

	Weight, g/bottle	Weight, g/lid	Weight, g/label	Bottle weight, net	Weight g/ per sheet of shrink wrap	Bottle weight kg/1,000 l filling vol.	Lid weight kg/1,000 l filling vol.	Lable weight kg/1,000 l filling vol.	Wrap weight kg/1,000 l filling vol.	**Total weight of all materials**
0.33 l one-way PET bottle	21.7 g	3.3 g	0.4 g PP	18.0 g	4.3 g	54.5 kg	10.0 kg	1.2 kg	2.2 kg	**67.9 kg**
0.5 l one-way PET bottle	32.4 g	3.3 g	1.4 g paper	28.0 g	4.8 g	56.0 kg	6.6 kg	2.8 kg	1.6 kg	**67.0 kg**
1 l one-way PET bottle	43.1 g	3.3 g	1.8 g	38.0 g	10.0 g	38.0 kg	3.3 kg	1.8 kg	1.7 kg	**44.0 kg**

Due to their very low market share (see Illustration 10), a detailed analysis of one-way glass bottles for juices is not performed in this context.

[448] Cf. IFEU, 2006, p. 26
[449] Cf. IFEU, 2006, p. 21.
[450] Cf. IFEU, 2006, p. 31.

C 2.1.3.8 Excursus: Qualitative description of materials composition of packaging

Beverage packaging with several combined packaging materials

In general, it is easier to recycle packaging made of individual materials (mono-materials) than to recycle so-called composite packaging, i.e. packaging consisting of two or more layers of material that are connected with each other. With respect to composite packaging, the individual materials must first be separated from each other, which results in an additional step in the recycling process. Furthermore, in some cases the individual material layers are only available in very low quantities and combined with other layers, which makes high-quality recovery more difficult or even impossible. In the beverage packaging segment this concerns, for example, beverage cartons (a composite made of carton, aluminium and plastic) and PET bottles with barrier layers (multilayer bottles).

Interaction between beverage packaging and product

Another aspect that should be taken into account in the assessment of beverage packaging is the interaction between beverage containers and the product (i.e. the beverage). On the one hand, this can impair the quality of the product (e.g. no taste neutrality) due to insufficient barrier properties (permeability) of the beverage container and, on the other hand, this can even pose health hazards due to the discharge of pollutants (e.g. use of printing agents in beverage cartons and hormone-active substances in the case of PET bottles). Whether certain beverage containers really pose health hazards - and under what circumstances - (in relation to the respective beverage packaging design) is presently being discussed and has not yet been fully clarified. [451] There is thus still a need for research in this respect.

Packaging made of bioplastics

The use of so-called bioplastics - i.e. plastics that are fully or partly manufactured from renewable raw materials and which possibly are biodegradable - is presently being tested with respect to protective foil and shrink wrap.[452] The first bottles made of biodegradable plastics have already come onto the market.[453] However, the available volumes of packaging materials made of bioplastics are still very low. Furthermore, the ecological impact of bioplastics depends on the source materials and their cultivation.[454]

One-way beverage cups made of PET, polystyrene, carton and polylactid acid (PLA) were compared with reusable cups made of polypropylene in a life cycle assessment pursuant to DIN EN ISO 14040 and 14044.[455] Overall, the reusable cups system was superior to all one-way solutions - including biodegradable PLA cups - from an environmental perspective. The environmental pollution caused by PLA cups is comparable to the environmental pollution from PET cups, which is thus significantly higher than the environmental impact from one-way carton cups. Based on the life cycle assessments available up to now, the UBA[456] concludes that biodegradable plastic’s ecological advantage over conventional plastics is to be expected primarily underthe following conditions:

[451] Cf. FAZnet, 13.03.2009; BfR, 25.03.2009; CEFIC et al., 2010; DUH, 7 September 2010.
[452] Cf. ECOLAS, N.V. and PIRA, 2005, p. 214.
[453] Cf. Pankratius, M., 19.05.2010; euwid, 04.08.2009.
[454] Cf. *die umweltberatung*, 2010, p. 1.
[455] Cf. UBA, 2008.
[456] Cf. UBA, 2008.

- The raw materials stem from sustainable agricultural production that is based on ecological criteria.
- Residual materials from agricultural production and food production are increasingly being used.
- The product design enables repeated utilisation (refillable beverage containers).
- High quality recycling or energy recovery takes place at the end of the product life cycle.[457]

[457] Cf. UBA, 2008.

C 2.1.3.9 Littering

Indicator 16 – Littering

Re-filla-	There is an economic incentive to return refillable beverage containers due the deposit charged on them. The achieved return rate of ca. 99 % of the packagingcontributes very strongly to reducing the volume of littering.
One-way deposit	According to a study conducted by Rheinisch-Westfälischer Technischer Überwachungsverein e. V. (RWTÜV) in 1998, i.e. significantly before introduction of the mandatory deposit, beverage packaging only accounted for 6 % of the "visible surface" of the littering volume. The definition of "visible surface" as a parameter is not very comprehensible.[458] For example, the study does not take waste dropped on the entries and exits to highways into account, where – as is shown by experience - beverage containers make up a significant portion of littering. Furthermore, plastic bottles were not defined as beverage packaging in the study.[459] In a statement made by the Witzenhausen Institute on the RWTÜV study, the proportion of beverage packaging in littering was not calculated on the basis of the "visible surface", but rather based on the total number of littering incidents. In its statement, the Wizenhausen Institute comes to the conclusion (based on data taken from the RWTÜV study) that, out of a total of 456,000 counted littering incidences, 95,000 were attributable to beverage containers (two thirds of the beverage packaging concerned beverage cans). This means that the proportion of beverage packaging in relation to the total number of littering incidences was about 21 %.[460] The methods and results of two surveys conducted independently in Basel and Vienna are compared in a study[461] commissioned by the Swiss Federal Office for the Environment, Forests and Landscape (BUWAL) in 2005. Even though the parameters applied in the studies are not completely identical, the findings of the studies largely concur. On average, 50 % of the littering volume concerns "fast food", i.e. packaging of take-away products and beverage containers, whereby the majority of the littering volume is attributable to take-away products. Another Austrian study[462] compared the littering volumes (measured in terms of the number of packaging units) in five big cities (Frankfurt, Brussels, Vienna, Prague, and Barcelona) in 2003. The study revealed that - as an average for all cities - 6 % of all littering items concerned beverage containers. In contrast, the Basel study is based on littering volumes determined for Basel, Bern, Zurich, Lausanne, and Illnau-Effretikon. On average, 16.9 % of the littering volume indicated in this calculation is attributable to beverage containers.

[458] Cf. Witzenhausen-Institut, 2001, p. 3.
[459] Cf. RWTÜV in Witzenhausen-Institut, 2001, pp. 3 and 5.
[460]Cf. Witzenhausen-Institut, 2001, p. 6.
[461] Cf. Heeb J. et al., 2005, pp. 32 and 35.
[462] Cf. Heeb J. et al., 2005, pp. 32 and 35.

Indicator 16 – Littering

One-way deposit	The assessment bases used in the different studies are not directly comparable. It can nevertheless be observed - in view of the presently very high return rates of 98.5 % in Germany - that the deposit charged on one-way beverage containers inevitably leads to a sharp reduction of littering in this segment. These results are also confirmed by other foreign studies and analyses. A study was conducted in the United States between 1990 and 1999, which encompassed the Federal states of New York, Oregon, Vermont, Maine, Michigan, Iowa, and Massachusetts. The study concluded that the proportion of beverage packaging in the total littering volume (with respect to all littering incidences, not only beverage containers) ranges between 36 % and 69 % in Federal states without a deposit regulation. As a result of the introduction of a mandatory deposit, the entire littering volume was reduced by 30 % to 47 %. Littering caused by beverage containers decreased by up to 84 % due to the mandatory deposit.[463] A British study conducted in 2008 also concludes that the introduction of a one-way deposit system can have positive effects on littering. In this context, the study makes reference to what was experienced in New York City as a result of the introduction of a deposit system.[464] Under a campaign conducted by the Ocean Conservatory, 883,737 plastic beverage containers, which had been dropped into the oceans as waste, were found worldwide on one day in 2009. Beverage containers made of all types of materials accounted for 17 % of the total volume of waste collected, thus representing the second-largest fraction.[465] In all, these data show that beverage packaging accounts for a significant proportion of the littering volume where there are no deposit systems in place, and that this proportion can be considerably reduced by implementing deposit systems.
One-way dual systems	It can be assumed that the proportion of beverage packaging in littering in Germany mainly concerns one-way beverage containers that are not subject to a mandatory deposit and which should theoretically be disposed of through the dual system. Owing to the lack of economic incentive, dual systems have no direct influence on the arising littering volume.

[463] Cf. CRI, o. J., p. 1.
[464] Cf. Eunomia Research & Consulting, 2010, p. 40.
[465] Cf. ICC, 2010, p. 11.

C 2.1.4 Interim conclusion concerning ecological impact categories

As explained in Section A 2.7 on "Legal background", a five-stage waste hierarchy was defined for the European member states on the basis of the amended EU Waste Framework Directive. Pursuant to the Directive, waste prevention (e.g. through reuse) generally takes priority over waste recycling to the extent that ecological reasons do not speak against prevention. A comprehensive analysis of the ecological impact indicators shows the ecological advantages of refillable beverage containers. It was demonstrated in detail that life cycle assessments have become established tools for performing ecological analyses of products and systems, but that they do not suffice as the only instrument for conducting an ecological assessment - and that they are even less suitable for making a sustainability assessment - of various types of beverage packaging. The results provided by life cycle assessments must always be considered in relation to the assumptions made and the prevailing framework conditions. An up to date and, as far as possible, complete analysis of different packaging systems for various beverage segments that is performed by a neutral institution would thus be considered helpful.

The examination of refillable systems indicates that high circulation rates are being generated in the various beverage segments, in particular for glass bottles. With respect to refillable beverage containers, analysis of the materials' weights indicates that maintaining the stability of refillable bottles, which enables high circulation rates, is more essential than reducing the weight of refillable bottles, which could probably lead to lower circulation rates. In this context, however, supplementary studies respecting the impact in the event of various distribution distances must also be conducted in order to permit comprehensive statements to be made.

A systematic analysis of the various types of packaging and return systems has shown that, in relation to return and recycling rates, deposit systems have advantages over dual systems. Deposit systems show collection rates of 96 % to 99 % and recycling rates of 81 % to 98 % (depending on the packaging material). These rates are significantly higher than the corresponding figures for dual systems. The collection rates for dual systems are between 43 % and 54 % for PET one-way bottles and beverage cartons, and 75 % to 81 % for one-way glass bottles. The recycling rates (in relation to the quantity brought onto the market) for PET one-way bottles and beverage cartons range between 25 % to 39 %, and between 75 % to 81 % for one-way glass bottles. An additional fact is that deposit systems are generally suitable for high quality recycling within the scope of closed cycle management due to the segregated flow of materials (separate collection of glass, metals and plastics by the trade sector). Such high quality recycling is mainly recommended for materials that - as pure material flows - enable a high recycling quality for high-quality products or for which a significant improvement in the ecological result is to be expected due to an increase in return rates.

In addition, deposit systems (for one-way and refillable beverage containers) reduce littering due to consumers having an increased incentive to return the packaging.

When evaluating the ecological impact of beverage packaging by means of life cycle assessments, it is essential that the quantified environmental impact (e.g. the emission of hazardous gases) be calculated and that the framework conditions - provided they have a significant impact on the ecological result - together with the respective current and future projected market relevance be analysed and presented transparently. When assessing beverage packaging to provide a basis for decision-making processes, the economic and social impact should always be analysed in addition to the ecological impact in accordance with a holistic approach. The economic and social impact is analysed in the following sections.

C 2.2 Economic impact categories

C 2.2.1 Selected challenges in connection with economic impact categories

When assessing the economic impact categories, some specific market characteristics become apparent. Before conducting a detailed assessment, we present below the most significant of these characteristics.

Concentration and asymmetries

The market structures of beverage vendors and beverage producers are characterised by oligopoly-like concentrations in some stakeholder segments. The concentration in the food retail trade is a generally known development. In recent years, similar development has also been observed in the juices segment, for example. Meanwhile, ten companies account for more than 80 % of the sales generated in Germany in this segment. A similar picture is presented with respect to beverage packaging producers. Furthermore, only a few suppliers are represented in the market for some packaging materials.

Market concentrations are not necessarily disadvantageous. However, market concentrations generally enable those suppliers to manifest their power to a greater extent than in less concentrated markets. Within the scope of our analyses we found indications that these power asymmetries are utilised in some stakeholder segments that focus on one-way systems for asserting stakeholders' interests respecting upstream and downstream supply chain levels. When taking these interrelations into account in the examination of beverage packaging and beverage packaging systems, it seems likely that the current trend towards one-way systems in the areas of beverage packaging and beverage packaging systems is decisively influenced by a few stakeholders. Several of the surveyed stakeholders confirmed this situation within the scope of our primary research.

Intransparency

Great efforts are involved in order to obtain reliable and verifiable data on beverage packaging, return systems and the respective effects, costs and revenues, beverage output and market operators, while such data cannot be obtained at all for a few segments. This makes fact-based and targeted examination and decision-making difficult for the legislator, and it is also more difficult for stakeholders to hold unbiased discussions.

Micro-economic analysis and nature of the discussions

When system participants perform cost-benefit analyses to decide in favour or against certain packaging materials or return systems, the focus is on the stakeholders' opportunities and risks. The economic impact is mainly taken into account as a side issue. This is an insufficient examination, in particular with respect to sustainability aspects.

The effects of various systems on impact categories relating to sustainability and which are of economic relevance differ significantly in some cases. For example, refillable systems tend to have a positive impact on smaller beverage producers, while one-way systems do not. Market trends that give preference to systems in one or other direction thus have a medium- to long-term effect on the industry sectors concerned.

When two stakeholders cooperate, conflict situations arise, in particular if one of the beverage packaging systems entails a particularly high benefit for one system participant while, for the other, it translates into additional costs. In keeping with market logic, the stakeholder with greater assertiveness will prevail and the other stakeholder will either adapt or will not be able to continue the business relationship. Interrelations such as those mentioned in the above example are not sufficiently analysed at present nor are they sufficiently taken into account in the discussions.

C 2.2.2 Detailed assessment of impact categories

C 2.2.2.1 System costs for beverage packaging systems

An analysis of the system costs and revenues differentiates between the specific costs of beverage packaging systems, such as the expenses incurred for the filling, handling and transport of refillable bottles, and the return system costs, which are costs associated with participation in a deposit system for one-way beverage containers and in dual systems. Only the costs relating to the beverage packaging system are examined with respect to the deposit system for refillable beverage containers, since, in this context, the filling and sales processes as well as the return and reuse (refill) processes are identical owing to the closed cycle. A comparison of the participation costs for the deposit system for one-way beverage containers and the dual systems is provided in Section C 2.2.2.6.

Indicator 17 – Investment costs for beverage producers

Refillables	According to the surveyed industry experts, the costs for bottling plants are influenced by various factors. For example, bottling plants with high bottling speeds are more expensive than bottling plants with lower bottling speeds. Depending on the respective features, the plants can generate varying investment costs. The industry experts surveyed state that - given an output capacity of ca. 15,000 one-litre bottles per hours - the price of a bottling plant for refillable PET bottles in the mineral water market comes to ca. € 8.0 to € 10.0 million.[466] According to industry experts, the costs for acquiring bottling plants for refillable glass bottles are presumably lower than the costs for bottling plants for refillable PET bottles.
One-way deposit	According to the industry experts surveyed in the mineral water segment, the price of a bottling plant for crate-based one-way PET bottles (one-way PET bottles in the PETCYCLE system) with an average output capacity of 15,000 one-litre bottles per hour ranges between ca. € 5.0 to € 8.0 million. The costs of other bottling plants for one-way PET bottles are comparable. High operational performances of up to 40,000 one-litre bottles per hour can only be achieved with bottling plants for one-way PET bottles. Their price comes to ca. € 12.0 million[467] concerning machines for cold aseptic filling[468] (e.g. for fruit juice mixed with carbonated water or flavoured water; see also the following page).

[466] Interview with industry experts.
[467] Interview with industry experts.
[468] Process relating to the chemical sterilisation of beverage containers without heating.

Indicator 17 – Investment costs for beverage producers

One-way dual systems	
	Juices are not subject to a mandatory deposit in Germany. Compared to the filling of mineral water into bottles, the filling of juice into PET bottles creates additional requirements regarding the manufacturing process. The infrastructure for filling beverages into refillable glass bottles can also be used for the hot-filling of juices into PET bottles. However, additional investments amounting to ca. € 1 to € 2 million are required for upgrading the plants. Investments of € 6 to € 7 million are required [469] for acquiring new plants for cold aseptic-based filling[470] of juices into PET bottles. According to the industry experts surveyed, plants for filling beverages into beverage cartons are either leased or purchased, depending on the respective supplier. We were told that the leasing fees amount to € 10,000 to € 12,000 per month, while the acquisition costs of the plants range between € 1 to € 2 million, plus packaging material and repair costs.[471] While juice manufacturers can usually fill beverages into refillable glass packaging[472], only about 5 to 7 % of the beverage producers are able to fill beverages into beverage cartons. The surveyed industry representatives assume that only 2.5 % of beverage producers are able to employ the cold aseptic filling process for filling beverages into one-way PET beverage containers.

[469] Interview with industry experts.
[470] Cold aseptic filling is thus more suitable for PET bottles, especially if high filling volumes are to be achieved. Costs can thus also be saved respecting operations.
[471] Interview with industry experts.
[472] This is also attributable to the fact that juices were traditionally filled into glass containers and that all juice producers thus had a filling plant for refillable glass containers.

Indicator 18 – Operational costs for beverage producers (total beverage packaging costs)[473]

Refillables

The acquisition costs of various types of beverage packaging are presented in the following tables, sorted according to beverage segment and source. With a view to enabling a comparison of refillable beverage containers with one-way beverage containers to be made, the costs per filling were calculated. In this way, the reuse of refillable beverage containers is taken into account.

Mineral water segment:

Industry survey[474]

As a first step, the minimum circulation rates indicated by the industry experts were used in the table presented below. This results in the maximum total costs for the acquisition of beverage packaging.

	Costs per bottle (€)	Refills min.	Costs per filling (€)	Costs compared to one-way PET beverage containers 1.0 l, see p. 215)	Costs compared to a beverage carton 1.0 l (max., see p. 216)
Refillable glass beverage container 0.7 l GDB	0.2	35	0.006	- 87 %	- 95%
Refillable PET beverage container 1.0 l	0.22	6475	0.037	- 19 %	- 68%

[473] The evaluations of various sources concerning the costs of various types of packaging are presented under the impact categories regarding the operational costs (pp. 217–268, Nos. 19–21). In this context, the packaging types are allocated to the refillable system, one-way deposit system and dual systems, as applicable. Wherever possible, the cost differences between refillable and one-way beverage containers are presented in percentage terms. The percentage figures are always to be found in the refillable systems field with a reference to the page on which the examined packaging is presented for comparison purposes. Usually, only the costs indicated by one source were compared. For example, the cost information stemming from the industry survey is only compared to other cost figures obtained from the survey. Consequently, only types of beverage packaging are compared about which information is available from the respective source or respecting which the surveyed experts provided information. For example, not all sources provided information on one-way PET bottles and/or crate-based one-way PET bottles. A detailed analysis of cost comparisons can be found on p. 268. The presentation is broken down by segment in order to account for structural differences.
[474] Interview with industry experts.
[475] Individual bottles.

Indicator 18 – Operational costs for beverage producers (total beverage packaging costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

The maximum circulation rates stated by the industry experts were used subsequently in the table presented below. This results in the lower total costs for the acquisition of beverage packaging.

	Costs per bottle (€)	Refills, max.	Costs per filling (€)	Costs compared to one-way PET beverage containers 1.0 l, see p. 215	Costs compared to beverage carton 1.0 l (min., see p. 216)
Refillable glass container 0.7 l GDB	0.2	592	0.003	- 90 %	- 96 %
Refillable glass container 0.7 l GDB	0.2	40	0.005	- 89 %	- 95 %
Refillable PET beverage container 1.0 l	0.22	15	0.015	- 67 %	- 85 %

The evaluation shows that cost savings can already be achieved with lower circulation rates. It also becomes apparent that the maximum savings decrease with increasing circulation rates (see comparative cost accounting for refillable glass containers with 35, 40 and 59 refills on this page and on the previous page).

Indicator 18 – Operational costs for beverage producers (total beverage packaging costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

Beer segment

EHI Retail Institute[476]

The EHI Retail Institute conducted a process costs comparison of the total costs of refillable glass bottles and beverage cans to the overall process, ranging from the acquisition of beverage containers through to filling and handling in the trade sector and to return of the containers for reuse (refilling) or recovery purposes. The cost analysis, broken down by the various impact indicators (costs relating to the acquisition of packaging, operational costs incurred by beverage producers and operational costs incurred by the trade sector), is presented in the following. Initially, the acquisition costs for beverage containers are presented.

It must be taken into account that the analysis assumes that the beverages are offered as a six-pack sales unit. With respect to refillable beverage containers in six-packs, beverage crates are only taken into account with respect to commissioning. The six-pack on the shelf is generally assumed to be the distribution unit. The EHI presentation does not analyse in detail to what extent sale in beverage crates compared to sale in trays affects costs. However, according to the industry experts surveyed, the individual, unit-based filling of beverages into six-packs is more costly than the filling of beverage containers sold in crates.[477]

	Costs per bottle (€)	Refills	Costs per filling (€)	+ Tray, six-pack carrier, see p 215	Costs compared to 0.33 l can, see p. 215
Refillable bottle 0.33 l	0.112	20	0.005	0.0346	- 68 %

[476] Cf. EHI Retail Institute, 2009, p. 6: In its calculations, the EHI Retail Institute also uses a scenario with five refills. Both the DVM data (19.2) and the evaluations of a survey conducted by the Verband mittelständischer Privatbrauereien e.V. (52) assume higher circulation rates. The surveyed breweries report an average filling volume of 17,700 hectolitres. Breweries with a total annual output of up to 10,000 hl account for 74 % of the market share. When considering the survey conducted by the Verband mittelständischer Privatbrauereien as representative for companies of that size, a circulation rate of ca. 50 would thus cover a higher market share. Five refills are only to be assumed with regard to individual cases for individual beverage containers that are transported over very great distances and for which return transport would therefore no longer be worthwhile from either an economical or an ecological perspective.

[477] Interview with industry experts.

Indicator 18 – Operational costs for beverage producers (total beverage packaging costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

Own calculation based on cost assumptions of the EHI Retail Institute concerning the beer market, assuming a circulation rate of 50 (based on a survey of the Verband Private Brauereien Deutschland e.V., see Section C 2.1.3.3)

	Costs per bottle (€)	Refills	Costs per filling (€)	+ Tray, six-pack carrier, see p. 215	Costs compared to 0.33 l can, see p. 215
Refillable bottle 0.33 l (own calculation)	0.112	50	0.0022	0.0312	- 72 %

One-way deposit

Mineral water segment

Industry survey[478]

	Costs per bottle (€)	Refills	Costs per filling (€)
Crate-based one-way PET bottle 0.5 l	0.35	1	0.035
Crate-based one-way PET bottle 1.0 l	0.045	1	0.045

For a cost comparison with

Beer segment

EHI Retail Institute[479]

	Costs per can[480] (€)	Refills	Costs per filling (€)	+ Tray, six-pack crrier
Can 0.33 l	0.0800	1	0.0800	0.1097
Can 0.5 l	01005	1	0.1005	0.1302

[478] Interview with industry experts.
[479] Cf. EHI Retail Institute, 2009, p. 6.
[480] The source does not indicate whether aluminium or tinplate cans are being analysed in this context

Indicator 18 – Operational costs for beverage producers (total costs for packaging)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

One-way dual systems

Juice segment

Industry survey[481]

	Costs per beverage carton (€)	Refills	Costs per filling (€)	+ Lid (€ 0.015) and shipping carton (€ 0.025)
Beverage carton 1.0 l (min.)	0.095	1	0.095	0.135
Beverage carton 1.0 l (max.)	0.115	1	0.115	0.155

Indicator 19 – Operational costs for beverage producers (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

As regards the bottling in refillable bottles, beverage producers incur additional handling costs due to the return logistics, cleaning and sorting of empty refillable bottles. The operating costs of the various types of beverage packaging are presented in the following tables, sorted according to beverage segment and source.

Mineral water segment

	Costs per litre of filled beverage (€;ca.	Cost comparison to one-way PET beverage containers (crate-based one-way PET bottle 1.0 l: ca.), see p. 217	Cost comparison to one-way PET containers 1.0 l (ca.), see p. 217
RefillablePET bottle 0.5 l	0.14	+ 13 %	- 21 %
Refillable PET bottle 1.0 l	0.09	- 25 %	- 47 %
Refillable PET bottle 1.5 l	0.09	- 29 %	- 50 %

Industry survey[482]

	Costs per litre of filled beverage (€; ca.)	Cost comparison to one-way PET container (crate-based one-way PET bottle 1.0 l), see p. 217
Refillable PET packaging 1.0 l	0.07	+ 17 %

481 Interview with industry experts.
482 Interview with industry experts.

Indicator 19 – Operational costs for beverage producers (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

Beer segment

EHI Retail Institute[483]

	Operating costs[484] per bottle (€)	Operating costs compared to 0.33 l can, see p. 217	+ Acquisition costs	Costs per litre	Total costs compared to 0.33 l can, see p. 217
Refillable glass bottle 0.33 l	0.042	+ 70 %	0.0766	0.2321	- 43 %
Refillable glass bottle 0.33 l (own calculation)	0.042	+ 70 %	0.0732	0.2219	- 46 %

One-way deposit

Mineral water segment

	Costs per litre of filled beverage (€; ca.)
Crate-based one-way PET bottle 1.0 l	0.12
One-way PET bottle 1.0 l	0.17

Industry survey[485]

	Costs per litre of filled beverage (€; ca.)
Crate-based one-way PET bottle 1.0 l	0.06
Crate-based one-way PET bottle 0.5 l	0.05

Beer market

EHI Retail Institute[486]

	Costs per can[487] (€)	+ Acquisition costs	Cost per litre
Can 0.33 l	0.024	0.1344	0.4073
Can 0.5 l	0.032	0.1629	0.3258

[483] Cf. EHI Retail Institute, 2009, p. 6.
[484] The EHI includes the following activities in this respect: unloading and sorting of empty packaging, filling process, incl. packing and stretching, interim storage, loading of trucks, expenses for storage premises (full and empty packaging), investment costs relating to industrial trucks).
[485] Interview with industry experts.
[486] Cf. EHI Retail Institute, 2009, p. 6.
[487] The source does not indicate whether aluminium or tinplate cans are being analysed in this context

Indicator 19 – Operational costs for beverage producers (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

One-way dual systems

Juices segment

We were not able to obtain information on operational costs incurred by beverage producers respecting the filling of beverages into beverage cartons. The following costs were indicated for licensing the beverage cartons under the dual systems and for shipment of the beverage cartons:[488]

License fee per beverage carton: ca. € 0.02

Handling costs per beverage carton: ca. € 0.05–0.055

Indicator 20 – Operational costs for the trade sector (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

The trade sector incurs costs due to the sorting, storage and logistics of beverage packaging. The operating costs relating to the various types of beverage packaging are presented in the following tables, sorted according to beverage segment and source.

Beer and mineral water segment:

Fraunhofer Institute[489]

The Fraunhofer Institute conducted a process costs analysis of one-way and refillable beverage packaging systems for the trade sector. In this context, the processes relating to the receipt, sale, return and shipping of empty beverage containers were taken into account.

	Costs per container (€; ca.)	Costs compared to one-way individual bottle, see p. 222	Costs compared to one-way six-pack, see p. 222
Refillable individual bottle	0.055	+ 2 %	-
Refillable 1.0 l containers in 12-pack crate	0.018	-	- 33 %
Refillable 0.5 l containers in 20-pack crate	0.011	-	- 59 %

Sale in beverage crates compared to sale in individual bottles can reduce costs since the expenses per bottle decrease when the bottles can be processed in greater sales units. About 85 to 90 % of all refillable beverage containers put into circulation are sold in beverage crates.[490]

[488] Interview with industry experts.
[489] Cf. IML, 2005, p. 8; no detailed information is provided on the analysed packaging sizes and materials.
[490] Interview with industry experts.

Indicator 20 – Operational costs for the trade sector (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

No beverage segment allocation:

EHI Retail Institute[491]

The EHI Retail Institute compared the costs of refillable packaging systems (not clear whether glass or PET), PET one-way packaging systems and beverage carton packaging systems for the retail trade. In this context, the results are compared with the results obtained from the analysis performed by the Fraunhofer Institute (see above).

	Costs per container (€; ca.)	Costs compared to Fraunhofer (see above) individual bottl	Costs compared to Fraunhofer (see above) 12-pack crate	Costs compared to Fraunhofer (see above) 20-pack crate	Costs compared to PET one-way container according to EHI	Costs compared to beverage carton according to EHI
Refillable beverage container 1.0 l	0.0782	+ 42 %	+ 334 %	+ 611 %	+ 70 %	+ 133 %

In view of the differences in the results of the two studies, a comparison of the underlying assumptions would be interesting and could contribute to identification of the cost drivers as well as the positive and negative framework conditions for the various types of beverage packaging. Since the assumptions underlying the analysis conducted by the EHI Retail Institute have not been published, such a comparison is not possible. Within the scope of this study, it is thus also not possible to perform a plausibility check on the results provided by the EHI Retail Institute. When comparing the assumptions, however, it can be assumed that the crate logistics would lead to greater efficiency with respect to refillable beverage containers.

[491] Cf. EHI website, *Getränkeverpackung als Gewinntreiber.*

Indicator 20 – Operational costs for the trade sector (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

Beer segment:

EHI Retail Institute: trade sector only[492]

	Process costs BWST[493] (€) per container	Process costs retail trade (€) per container	Total	Costs (trade) compared to 0.33 l can (€), see p. 222
Refillable glass bottle 0.33 l	0.0117	0.0303	0.042	+ 39 %
Refillable glass bottle 0.33 l (owncalculation)	0.011	0.0303	0.042	+ 39 %

It should be noted that the EHI Retail Institute assumes a transport distance of 350km from the beverage producer to the beverage wholesaler. Neither in the perusal of secondary material nor during our industry survey could it be ascertained that, on a market average, beer which is filled into refillable bottles is transported over such long distances. As explained on p. 127, it should instead be assumed that this concerns individual cases and that beer is usually transported over shorter distances. Consequently, the costs incurred by beverage wholesalers, given shorter transport distances, should be lower than assumed by the EHI Retail Institute. The impact of these cost savings could not be quantified precisely.

EHI Retail Institute: Manufacturer + trade sector
(The process costs stated in the cost analysis performed by the EHI Retail Institute were listed separately in the previous cost presentations in accordance with the indicators defined in this context. The following table summarises the results of the entire cost analysis conducted by the EHI Retail Institute.)

	Total costs trade sector + producer (€), see p. 217	Total costs compared to 0.33 l can (€), see p. 222
Refillable glass bottle 0.3 l	0.1186	- 28 %
Rusable glass bottle 0.33 l (own calculation)	0.1152	- 30 %

[492] Cf. EHI Retail Institute, 2009, p. 7 and p. 9.
[493] The EHI includes the following activities in this respect: Transport, storage, commissioning, return of empty packaging, pick-up of empty packaging.

Indicator 20 – Operational costs for the trade sector (handling)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

Refillables

No beverage segment allocation:

Hüsch & Partner (process costs comparison BWST)[494]

Hüsch & Partner compared the costs regarding the handling of refillable 0.5 l PET beverage containers and one-way 0.5 l PET beverage containers for the beverage wholesale trade (BWST). In doing so, all processes ranging from the acquisition of full containers (filled beverage containers) to the disposal of packaging were taken into account. Various scenarios were used with respect to the return and disposal of one-way beverage containers.

Figures indicated in €	Refillable PET packaging 0.5 l return logistics and disposal via central warehouse of BWST (€)
Acquisition of full containers from industry to BWST	0.0080
Central warehouse BWST storage and commissioning	0.0050
Central warehouse BWST to point of sale (POS)	0.0040
Take-back through bag logistics at POS	0.0357
Bag logistics to central warehouse BWST	0.0040
Empty packaging at central warehouse BWST	0.0064
One-way system counting center at central warehouse BWST	-
POS to counting center clearing	-
Disposal	0.0008
Total	**0.0639**
Deviation from one-way system logistics - Disposal via central warehouse of BWST, see p. 223	**- 4 %**
Deviation from one-way system logistics - Disposal via outlet/POS (manually), see p. 223	**- 28 %**
Deviation from one-way system logistics - Disposal via outlet/POS (automated), see p. 223	**+ 8 %**

[494] Cf. Ramthun, R., 2006, pp. 1–12 (the total deviates from the amount (€ 0.0604) indicated in the source). In this context, the individual cost-relevant steps that have been indicated in the source are presented as a total. The reason for the deviation was not evident).

Indicator 20 – Operational costs for the trade sector (handling costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

One-way deposit

Beer and mineral water segment:

Fraunhofer Institute (comparison of handling costs) [495]

	Costs per container (€; ca.)
One-way individual bottle	0.054
One-way six-pack	0.027

No beverage segment allocation:

EHI Retail Institute[496]

	Costs per container (€; ca.)
One-way PET container 1.0 l	0.0461

Beer market:

EHI Retail Institute[497]

	Process costs BWST (€) per container[498]	Process costs retail trade (€) per container	Total	Total costs trade sector + producer (€), see p. 217
Can 0.33 l	0.0049	0.0253	0.0302	0.1646
Can 0.5 l	0.0059	00254	0.0313	0.1942

[495] Cf. IML, 2005, p. 8; no detailed information has been provided on the analysed packaging sizes and materials.
[496] Cf. EHI website, *Getränkeverpackung als Gewinntreiber.*
[497] Cf. EHI Retail Institute, 2009, p. 7 and p. 9.
[498] The source does not indicate whether aluminium or tinplate cans are being analysed in this context

Indicator 20 – Operational costs for the trade sector (handling costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

One-way deposit

No beverage segment allocation:

Hüsch & Partner (process costs comparison BWST) [499]

Figures indicated in €	One-way PET container 0.5 l - disposal via central ware-house of BWST (€)	One-way PET container 0.5 l - disposal via outlet/POS (manually; €)	One-way PET container 0.5 l - disposal via outlet/POS (automated; €)
Acquisition of full ontainers from industry to BWST	0.0033	0.0033	0.0033
Central warehouse BWST storage + commissoning	0.0069	0.0069	0.0069
Central warehouse BWST to point of sale (POS)	0.0038	0.0059	0.0059
Take-back through bag logistics at POS	0.0280	0.0280	0.0420
Bag logistics to central ware-house BWST	0.0022	-	-
Empty containers at central warehouse BWST	0.0015	-	-
One-way system counting center at central warehouse BWST	0.0200	-	-
POS to counting center clearing	-	0.0250	-
Disposal	0.0008	0.0200	0.0008
Total	**0.0665**	**0.0891**	**0.0589**

[499] Cf. Ramthun, R.; 2006, pp. 1–12.

Indicator 20 – Operational costs for the trade sector (handling costs)

Please see footnote 473 for an explanation regarding the procedure for cost analysis.

One-way deposit

According to this analysis, the handling of refillable beverage containers is more cost-efficient for the beverage wholesale trade than the handling of one-way beverage containers, unless the one-way beverage containers are taken back via reverse vending machines at the point of sale. However, the investment and maintenance costs for the retail trade must also be taken into account in this scenario. According to the surveyed industry experts, the proportion of one-way beverage containers in the beverage wholesale sector amounts to 2 % only. Beverages filled into one-way beverage containers are usually shipped directly via the central warehouses of food retail trade companies to the retailers' branches. [500]

Indicator 20 – Operational costs for the trade sector (handling costs)

One-way dual sys-

EHI Retail Institute (assumptions have not been published) [501]

	Costs per ontainer (€; ca.)
Beverage carton[502]	0.0336

C 2.2.2.2 Excursus: Logistics of the systems in the trade sector

Some important aspects concerning the impact of refillable and one-way beverage packaging systems on the trade sector were highlighted in the course of the industry survey. A general differentiation is to be made in the study between the specialised beverage trade and the food retail trade (FRT) and discounters. While the specialised beverage trade mainly sells products in refillable packaging and aligned its business processes to the handling of refillable beverage containers, the FRT and discounters tend to prefer one-way beverage containers with a view to keeping their logistics, sorting and storage costs low and in order to achieve low prices for the beverages filled in one-way beverage containers. (High costs can be reduced by decreasing the weights of one-way beverage containers, in particular.) It was explained that the transport distances for one-way beverage containers are longer than for refillable beverage containers (one-way), since the one-way beverage containers are usually sent to central warehouses by a few large beverage producers, from where they are then shipped to the retail stores. Beverage producers that use refillable beverage containers have greater regional presence, which results in shorter transport distances. However, the one-way beverage containers weigh less and require less space. Additionally, one-way beverage containers are not transported

[500] Interview with industry experts.
[501] Cf. EHI website, *Getränkeverpackung als Gewinntreiber.*
[502] No information on packaging size was provided in the source

back to beverage producers. However, the transport of the containers to the sorting and recovery sites must also be taken into account.[503]

With respect to the handling of refillable beverage containers by the specialised beverage trade, the following aspects become evident:

- Difference in the handling of standard bottles and individual bottles:
  GDB bottles (nationwide standard bottles for mineral water) are refilled between about six to eight times each year. Individual bottles (e.g. in the beer beverage segment) attain to lower circulation rates and are refilled ca. 4 to 6 times per year. Consequently, a larger pool of empty packaging is required for individual bottles so as to also have sufficient bottles and crates available when the demand is great. The life-cycle of a refillable bottle does not depend on years, but rather on the circulation rate achieved. Correspondingly, less refills during the year does usually not mean that the refillable bottles are sorted out faster (before the planned circulation rate has been reached), but rather that they circulate for a longer period of time before they are sorted out.
- With respect to the return of individual bottles to the respective breweries, which fill their beverages into these bottles, there exist the following options: Beverage wholesalers pre-sort the bottles and deliver the sorted (mono-fraction) empty bottles in crates to the breweries, or, alternatively, breweries swap other types of bottles[504] among themselves (an Internet portal has in the meantime been set up for swapping empty refillable bottles). With regard to beer bottles, the sorting-out of other types of bottles (especially individual bottles) by beverage wholesalers results in sorting costs of € 0.15 to € 0.20 per crate. According to the surveyed industry experts, no major problems are presently experienced with respect to the swapping of bottles.
- Refillable beverage containers, including standard bottles, are usually returned to the beverage producers that had filled them.

[503] Interview with industry experts.
[504] Bottles that are not included in the product line of a beverage producers, but which are nevertheless found among the empty bottles taken back by them due to the partly mixed return of bottles through consumers.

Indicator 21 – Fees and levies concerning beverage producers and which are not recognised as operational costs

All systems	None, since no additional levies, such as packaging taxes, are charged in Germany. License fees are treated as operating costs in this context (see above)

Indicator 22 – Fees and concerning traders and which are not recognised as operational costs

All systems	None, since no additional levies, such as packaging taxes, are charged in Germany. License fees are treated as operating costs in this context (see above)

Indicator 23 – Expenses of the government for maintaining and/or monitoring the system

Refillables	The government does not participate in the system.
One-way deposit	As a general rule, the federal states (Bundesländer) are responsible for controlling and enforcing the regulations stipulated in the Packaging Ordinance. There are not detailed data available on the amount of the expenses incurred for enforcing the regulations through the one-way deposit system.
One-way dual systems	As a general rule, the federal states (Bundesländer) are responsible for controlling and enforcing the regulations stipulated in the Packaging Ordinance. There are no detailed data available on the amount of the expenses incurred for enforcing the regulations through the dual systems. The 5th amendment to the Packaging Ordinance aimed to achieve greater self-monitoring in the industry in order to contain the free rider problem (see p. 289). Consequently, the parties required to obtain licensing (beverage producers) are now required to have the reported quantities audited by an accountant, tax consultant, registered auditor or independent expert, and to submit an audited declaration of compliance to the regional Chambers of Commerce and Industry.

C 2.2.2.3 Summary of the analysis of the impact category: System costs of beverage packaging systems

According to the surveyed industry experts, the investments in bottling plants for refillable PET containers usually exceed investments in bottling plants for one-way PET containers. This is due to additional investments in the cleaning plant. The so-called cold aseptic bottling plants (one-way filling) with an output capacity of 40,000 one-litre bottles per hour are more cost-efficient when the increased performance capacity is taken into account. According to industry experts, bottling plants for refillable glass containers are more economical than PET bottling plants. Beverage carton filling plants are also cheaper than PET bottling plants. The ratio of carton to glass bottling plants could not be determined. Owing to the decreasing market share of refillable glass beverage bottles, it can be assumed that investments in bottling plants for refillable glass containers were very rare in recent years. However, the high costs of bottling plants for one-way and refillable PET containers exercise a restraining influence on investments, since the change-over to a different filling system is economically not feasible or only with great difficulty, especially with respect to smaller companies, which, for example, might only have a bottling plant for refillable glass containers.

According to the surveyed industry experts, by using refillable beverage containers (instead of one-way beverage containers) in the mineral water segment, companies can save up to 50 % (owing to the high PET circulation rates) in acquisition costs for beverage packaging (operational costs) compared to one-way PET bottles (here: crate-based one-way PET bottle). In case refillable glass containers are used, the savings in acquisition costs rise up to 90 %. The EHI Retail Institute states that the use of refillable bottles in the beer segment can lead to acquisition cost savings of about 70 % compared to the use of cans. The use of refillable bottles instead of beverage cartons can also greatly reduce acquisition costs for beverage packaging.

Industry experts state that the other operational costs (filling, handling, etc.) are about 17 % higher for refillable beverage containers in the mineral water segment. This is attributable to the additional cleaning process, as in the case with the investment costs. Furthermore, filling machines with higher performance - which translates into lower filling time per beverage container - can be used for one-way beverage containers. This reduces operating costs correspondingly. With respect to the beer segment, the EHI Retail Institute states that the operational costs (handling, etc.) for glass bottles are 70 % higher than for cans. When examining the total costs for the beverage producer, i.e. acquisition costs and handling, the costs for refillable beverage containers are about 43 % to 46 % lower according to this analysis. No comparable data could be collected on beverage cartons.

With respect to the costs that wholesalers and retailers incur through the various beverage packaging types, the diverse studies and analyses provide quite different results. One-way beverage containers have low weights (per beverage container) and are optimised for transport and thus enable the trade sector to save costs with regard to transport, storage and in relation to the sales area. Deposit one-way beverage containers are usually compacted (except for the major portion of returned crate-based one-way PET bottles and one-way beverage containers that were taken back manually) for the return transport, which also translates into cost savings in this context. However, due to their sale in beverage crates, refillable beverage containers offer advantages over the sale in individual bottles and also compared to one-way beverage containers sold in six-packs. All cost analyses presented in this context indicate that refillable beverage containers which are sold as individual bottles generate more costs compared to one-way beverage containers, although the extent to which the costs differ varies strongly from survey to survey. It can be assumed that the major difference depends on whether the respective trading companies concern the food retail trade or the specialised beverage trade. The cost analysis conducted by Hüsch & Partner shows that the take-back and sorting of one-way beverage containers is more costly for the specialised beverage trade than the take-back of refillable beverage containers. In contrast, the take-back of one-way beverage containers seems to be more cost-efficient for the food retail trade. This comparison shows the relevance of structural differences to such cost analyses and that general statements cannot be made with respect to the trade sector.

Even though it was demonstrated in this context that certain system participants can achieve cost savings by selecting the refillable system over the one-way deposit system, the use of one-way beverage containers is increasing strongly, while the use of refillable beverage containers is shrinking. As already mentioned, structural aspects seem to be just as important with regard to the selection of beverage packaging as are mere cost considerations. Some reasons for the increasing consumption of one-way beverage containers are listed in the following: [505]

[505] Partially derived from: ECOLAS, N. V. and PIRA, 2005, pp. 214 and 215.

- higher level of automation for one-way beverage containers
- trend towards centralisation and internationalisation, for which one-way beverage containers are more suitable
- lower savings potential owing to the sale of beverage containers in crates and promotion of smaller packaging sizes due to the tendency towards the immediate or on-the-go consumption of beverages in individual bottles
- trade sector prefers one-way beverage containers due to the reduced handling expenses and due to revenues generated from the deposit system for one-way beverage containers, which are attributable to unredeemed deposits (own brands) and materials revenues
- consumer convenience is experienced as a result of - in some cases - lower packaging weights (e.g., one-way PET bottles weigh less than refillable glass bottles) and when refillable beverage containers are sold in larger packaging sizes (e.g. in 20-pack beverage crates), as well as prevention of return of packaging when beverages are bought in beverage packaging that is not subject to a mandatory deposit
- tendency towards mass production and cost minimisation (long plant operating times, low re-equipping times, lightweight packaging)
- increased flexibility of packaging types (compared to pool bottles, in particular)
- one-way beverage packaging might be mistaken for ecologically beneficial refillable beverage containers due to lack of labelling
- avoiding of production processes (cleaning); hygiene-related aspects also present a great challenge in the cleaning process, in particular with respect to the filling of flavoured beverages or juice in refillable PET beverage containers
- avoiding take-back of packaging by traders (for segments not subject to mandatory deposit on one-way beverage containers)

In all, the analysis of the system costs (without accounting for system revenues) shows that general statements cannot be made. However, certain structural findings can be derived from the results. For example, the refillable system seems to be more beneficial for smaller beverage producers and for the specialised beverage trade, but it can entail additional costs for the food retail trade when compared to the use of non-refillable beverage containers. It must be noted that the decision for or against a particular beverage packaging type is always also influenced by strategic deliberations and structural framework conditions. A comparison of the one-way deposit system to dual systems that takes system revenues into account is presented in Section C 2.2.2.6.

The surveyed industry experts did not so much identify the acquisition or operating costs as being crucial in deciding for or against a particular type of packaging. It is rather demand-related factors, such as the preferences of consumers and of trading companies that play the key role. Only the bottling of beverages into refillable glass bottles or into refillable PET bottles or into crate-based one-way PET bottles is suitable for brand-name products of high quality and niche products, since, in addition to the higher quality, they provide greater product protection functionalities than the thin-walled one-way PET bottles. Thin-walled and weight-reduced one-way PET beverage bottles are largely used for the marketing of inexpensive mass products, since the focus is on price minimisation in this context. Long plant operating lives and minimal reequipping times are also prerequisites for low prices in this segment. Consequently, this type of filling process is less suitable for beverage producers with larger product ranges. Large product ranges require more frequent modifications.

C 2.2.2.4 System revenues for beverage packaging systems

Indicator 24 – Total volume of the market for secondary materials (in tonnes)[506]

In order to approximately determine the revenues from the sale of secondary materials relating to beverage packaging, the total volume of the market for secondary materials from beverage packaging was calculated by multiplying the volume put into circulation with the estimated weights of the individual packaging containers. In this context, it must be taken into account that these calculations represent an approximation to the actual volume on the basis of average values. With respect to the sensitivity analysis, some calculations were performed on the basis of deviating weights (different scenarios).

All systems

Beverage packaging types taken into account in the determination of the market volume for secondary materials:

	0.2 l	0.25 l	0.33 l	0.5 l	0.7 l	0.75 l	1.0 l	1.25 l	1.5 l	2.0 l
PET one-way				X		X	X	X	X	X
Glass one-way				X						
Can		X	X	X						
Beverage carton	X					X	X		X	X
Glass refillable			X	X	X	X	X			
PET refillable				X			X		X	

[506] The total volume of the market for secondary materials was determined on the basis of the consumption figures provided by the market research institute Canadean. In its market classification, Canadean distinguishes between beer-containing beverages, water beverages, OSD (other soft drinks) and JNSD (juice, nectars, still drinks). In a first step, the market shares of the individual beverage packaging types are calculated. Only packaging for beer, water and OSD is used as deposit-bearing beverage packaging in the study. Even though deposit-bearing beverages (still, non-alcoholic soft drinks) are also found in the JNSD category, the impact of their market share on the overall analysis is insignificant. Subsequently, a realistic weight was allocated to all significant packaging types (market share > 1 %), which permitted the determination of a total weight on the basis of the consumption figures. Insignificant packaging shares (market share < 1 %) were not taken into account in the extrapolation.

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

Refillables

Refillable glass bottles:

Beverage type	Packaging volume in litres	Units (million)[507]	Assumed weight in g	Source	Result in 1,000 t
Beer	0.33	3,345.7	310.0	Information provided by trader (longneck beer bottle)[508]	1,037.2
	0.5	9,716.0	383.4	IFEU[509]	3,725.1
Water	0.7	3,642.8	593.2	IFEU[510]	2,160.9
	0.75	1,150.2	543.2	IFEU[511]	624.8
Juice	0.7	59.3	440.0	Information provided by trader[512]	26.1
	1.0	223.4	600.0	Information provided by trader[513]	134.0
Total number or weight of filled packaging containers		18,655.4			8,015.4
Total volume of packaging waste (only rejects)[514]					**249.4**

[507] Canadean, 2010 (PwC analysis of Canadean data).
[508] Cf. Hartmut-Bauer website, *Longneck Bierflasche 0,33 l CC braun.*
[509] Cf. IFEU, 2010 a, p. 31.
[510] Cf. IFEU, 2010 b, p. 39.
[511] Cf. IFEU, 2010 b, p. 39.
[512] Cf. Hartmut-Bauer website, *VdF Flasche 0,7 l weiß 28 MCA.*
[513] Cf. Hartmut-Bauer website, *VdF Flasche 1,0 l weiß 28 MCA.*
[514] Assumption: Reject rate for water, JNSD and OSD: 2 %; for beer: 4 %.

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

Refillables

Refillable PET bottles:

Beverage type	Packaging volume in litres	Units (million)[515]	Estimated weight in g	Source[516]	Result in 1,000 t
Soft drinks	0.5	658.3	54.6	IFEU	35.9
	1.0	1,612.7	65.8	IFEU	106.1
	1.5	490.6	73.9	IFEU	36.3
Water	1.0	2,694.5	65.8	IFEU	177.3
	1.5	394.8	73.9	IFEU	29.2
Total number or weight of filled packaging containers		5,850.9			384.8
Total volume of packaging waste[517] (only rejects)					**7.7**

[515] Canadean, 2010 (PwC analysis of Canadean data).
[516] IFEU, 2010 b, p. 42.
[517] Assumption: Reject rate for water and OSD: 2 %.

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

One-way deposit

Deposit one-way PET bottles:

Basic scenario:

Beverage type	Packaging volume in litres	Units (million)[518]	Estimated weight in g	Source	Result in 1,000 t
Beer	0.5	1,093.5	(multilayer) 31.3	IFEU[519]	34.2
Soft drinks	0.5	2,763.9	19.7	IFEU[520]	54.4
	1.0	317.9	(crate-based one-way PET bottle) 32.4	IFEU[521]	10.3
	1.25	387.9	36.5	DUH[522]	14.2
	1.5	1,329.9	33.0	IFEU[523]	43.9
	2.0	236.7	44.00	Extrapolation based on 1.5 l	10.4
Water	0.5	1,162.7	19.7	IFEU[524]	22.9
	1.0	179.5	(crate-based one-way PET bottle) 32.4	IFEU[525]	5.8
	1.5	3,672.7	33.0	IFEU[526]	121.2
Total		**11,144.70**			**317.3**

[518] Canadean, 2010 (PwC analysis of Canadean data).
[519] Cf. IFEU, 2010 a, p. 31.
[520] Cf. IFEU, 2010 b, p. 48.
[521] Cf. IFEU, 2010 b, p. 53.
[522] DUH, weight measurements of various beverage containers, 2010.
[523] Cf. IFEU, 2010 b, p. 48.
[524] Cf. IFEU, 2010 b, p. 48.
[525] Cf. IFEU, 2010 b, p. 53.
[526] Cf. IFEU, 2010 b, p. 48.

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

One-way deposit

Sensitivity scenario (deposit one-way PET bottles):

DUH measured deviating weights for one-way PET bottles in the soft drinks (OSD products) and water beverage segments. Bottles are usually heavier for brand-name products, in particular.

Beverage type	Packaging volume in litres	Units (million)[527]	Estimated weight in g	Source	Result in 1,000 t
Soft drinks	0.5	2,763.9	27.9	DUH[528]	77.1
	1.5	1,329.9	42.9	DUH[529]	57.1
	2.0	236.7	57.2	Extrapolation based on 1.5 l	13.5

Taking the weights of the sensitivity scenario into account, the output volume would increase by ca. 39,000 t (12 %) to ca. 356,300 t.

[527] Canadean, 2010 (PwC analysis of Canadean data).
[528] DUH, weight measurements of various beverage containers, 2010.
[529] DUH, weight measurements of various beverage containers, 2010.

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

One-way deposit

Deposit beverage cans (one-way): [530]

Beverage type	Packaging volume in litres	Units (million)[531]	Estimated weight in g	Source	Result in 1,000 t
Beer	0.5	529.9	Aluminium 15.8	DUH[532]	4.2
	0.5		Steel 31.3	IFEU[533]	8.3
Soft drinks	0.25	343.6	Aluminium 10.9	DUH[534]	1.9
	0.25		Steel 24.6	DUH[535]	4.2
	0.33	434.9	Aluminium 13.3	DUH[536]	2.9
	0.33		Steel 24.6	DUH[537]	5.3
Total		**1,308.4**			**26.8**

Deposit one-way glass bottles:

Beverage type	Packaging volume in litres	Units (million)[538]	Estimated weight in g	Source	Result in 1,000 t
Beer	0.5	344.5	262.8	IFEU[539]	90.5
Total		**344.5**			**90.5**

[530] Equal market shares are assumed for aluminium and tinplate cans. This is an estimate, since precise market data were not available to us.
[531] Canadean, 2010 (PwC analysis of Canadean data).
[532] DUH, weight measurements of various beverage containers, 2010.
[533] Cf. IFEU, 2010 a, p. 31
[534] DUH, weight measurements of various beverage containers, 2010.
[535] DUH, weight measurements of various beverage containers, 2010.
[536] DUH, weight measurements of various beverage containers, 2010.
[537] DUH, weight measurements of various beverage containers, 2010.
[538] Canadean, 2010 (PwC analysis of Canadean data).
[539] Cf. IFEU, 2010 a, p. 31

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

One-way dual systems

Beverage cartons (one-way)

Basic scenario:

Beverage type	Packaging volume in litres	Units (million)[540]	Estimated weight in g	Source	Result in 1,000 t
Juice	0.2	294.1	8.6	IFEU[541]	2.5
	0.75	103.8	32.8	IFEU[542], Extrapolation based on 0.5 l 21.83 g)	3.4
	1.0	906.6	31.5	IFEU[543]	28.6
	1.5	218.0	43.9	IFEU[544]	9.6
	2.0	124.2	58.5	Extrapolation based on 1.5 l	7.3
Soft drinks	1.5	235.2	43.5	IFEU[545]	10.2
	2.0	84.4	58.0	Extrapolation based on 1.5 l	4.9
Total		**1,966.3**			**66.5**[546]

Sensitivity scenario:

When taking the weight of 39 g per 1-litre beverage carton[547] as measured by DUH in 2010 into account, the result for juice products would increase by 6,800 t (10.0 %) to 73,300 t.

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540 Canadean, 2010 (PwC analysis of Canadean data).
541 Cf. IFEU, 2006, p. 22.
542 Cf. IFEU, 2006, p. 22.
543 Cf. IFEU, 2006, p. 21.
544 Cf. IFEU, 2006, p. 21.
545 Cf. IFEU, 2006, p. 21.
546 It is not fitting to compare this data with the data published by GVM (GVM, 2009 a, p. 87), since the underlying data basis is different (Canadean data) and since the GVM data also include carton packaging for milk beverages and the year selected as a basis for the GVM data is different. The collection and recycling rates must accordingly be calculated for the respective parent population of packaging put into circulation.
547 Cf. Resch, J., 2009 b, p. 23 (average of the here weighted 1-litre cartons for juice and brand-name beverages).

Indicator 24 – Total volume of the market for secondary materials (in tonnes)

One-way dual systems

One-way PET bottles:

Beverage type	Packaging volume in litres	Units (million)[548]	Estimated weight in g	Source	Result in 1,000 t
Juice	0.5	381.4	32.4	IFEU[549]	12.4
	0.75	52.8	37.8	Extrapolation based on 0.5 l	2.0
	1.0	957.5	43.1	IFEU[550]	41.2
	1.5	424.9	46.5	IFEU[551]	19.8
Total		**1,816.6**			**75.4**

[548] Canadean, 2010 (PwC analysis of Canadean data).
[549] Cf. IFEU, 2006, p. 31.
[550] Cf. IFEU, 2006, p. 31.
[551] Cf. IFEU, 2006, p. 31.

Indicator 25 – Market prices per tonne of secondary material[552]

Refillables

Beverage packaging/ secondary material	Reference year	Price (€/t)	Remarks
Refillable PET packaging, pure	01/2011	460-530[553]	Prices for sorted out refillable PET beverage containers are not published anymore. Therefore, the prices for deposit one-way PET bottles were used in this context.
Refillable PET packging, light blue	01/2011	280-340[554]	
Green glass	2010	50[555]	
Brown glass	2010	50[556]	
Clear glass	2010	50[557]	

[552] The data featured in this section were exclusively generated from publicly available information; the availability, level of detail and currentness of the available information vary in accordance with the type of material; consequently, the data presented in this context reflect different reference years and diverge with respect to depth of detail.
[553] Cf. euwid, 01.02.2011.
[554] Cf. euwid, 01.02.2011.
[555] Cf. Friedl, C., 2010, p.30.
[556] Cf. Friedl, C., 2010, p.30.
[557] Cf. Friedl, C., 2010, p.30.

Indicator 25 – Market prices per tonne of secondary material

One-way deposit

Beverage packaging/ secondary material	Reference year and month	Price (€/t)	Remarks
Deposit one-way PET bottles, clear[558]	08/2009	190-225	Owing to the economic and financial crisis, the prices for secondary materials decreased in 2009. In 2010, prices started to increase again. The revenues generated from secondary materials in early January 2011 were used for further calculations, since it is assumed that these values have been adjusted for the effects of the economic crisis. Experts expect that revenues will continue to increase in the future.[559]
Deposit one-way PET bottles, clear[560]	01/2011	460-530	
Deposit one-way PET bottles, coloured[561]	08/2009	90-120	
Deposit one-way PET bottles, coloured[562]	01/2011	280-340	
Deposit one-way PET bottles in bales (20 % coloured, 80 % clear)[563]	08/2010	400	
Aluminium scrap (independent of origin) [564]	11/2009	500-1,200	
Aluminium cans[565]	09/2010	950	
Steel cans[566]	09/2010	100	

With respect to the deposit one-way PET bottles, the market price exceeded the expectations before the introduction of the mandatory deposit. The price of € 45 per tonne was assumed in the calculation of the economical impact of the one-way deposit system.[567]

[558] Cf. euwid, 01.09.2009.
[559] Cf. euwid, 01.02.2011.
[560] Cf. euwid, 01.02.2011.
[561] Cf. euwid, 01.09.2009.
[562] Cf. euwid, 01.02.2011.
[563] Interview with industry experts.
[564] Cf. euwid, 01.12.2009.
[565] Interview with industry experts
[566] Interview with industry experts
[567] Cf. Peters, M. and Czymmek, F., 2002, p. 63.

Indicator 25 – Market prices per tonne of secondary material[568]

One-way dual systems	**PET from dual systems:** There are no publicly available price lists for one-way PET bottles from the collection of dual systems. A direct comparison with deposit one-way PET bottles can thus not be made. On the previous page it was already mentioned that the price for one-way PET bottles increased since the introduction of the mandatory deposit. The one-way PET bottles from the DSD collection are a mix of juice bottles of different colours that partly consist of barrier layers. The mix also contains cosmetics and similar bottles. Furthermore, the mixed collection leads to greater impurities. The interviews that we conducted with experts reveal that usually only the one-way PET bottles stemming from the deposit system are suitable for bottle-to-bottle recycling. If the bottles are used for other products for which the purity of the collected materials is less important, than the collection system is also less crucial. With respect to the recovery of PET, industry experts expressed the opinion that the mono-fraction PET products from the deposit system are clearly preferred over mixed collection, since the quality of the material is significantly better.[569] According to industry experts, the prices paid for PET products from the dual systems are about 40 % lower than the prices paid for PET bottles stemming from the collection of materials under the one-way deposit system.[570]

[568] The data featured in this section were generated from publicly available information and from primary research; the availability, level of detail and currentness of the available information vary in accordance with the type of material; consequently, the data presented in this context reflect different reference years and diverge with respect to depth of detail.
[569] Interview with industry experts.
[570] Interview with industry experts.

Indicator 25 – Market prices per tonne of secondary material[571]

One-way dual systems

Compared to the prices achievable from deposit one-way PET bottles (see p.239), this would result in the following prices:

Beverage packaging/ secondary material[572]	Reference year and month	Price (€/t)
One-way PET bottles, clear[573]	08/2009	114-135
One-way PET bottles, clear[574]	01/2011	276-318
One-way PET bottles, coloured[575]	08/2009	54-72
One-way PET bottles, coloured[576]	01/2011	168-204
Deposit one-way PET bottles in bales (20 % coloured, 80 % clear)[577]	08/2010	240

A study conducted by the Container Recycling Institute in the USA also confirms that mono-fraction material increases the recovery quality and decreases the recovery process costs.[578] (see also page 244)

[571] The data featured in this section were generated from publicly available information and from primary research; the availability, level of detail and currentness of the available information vary in accordance with the type of material; consequently, the data presented in this context reflect different reference years and diverge with respect to depth of detail.
[572] Determined on the basis of the data taken from euwid and the information provided by industry experts on the price difference between PET products from the deposit system and from the dual systems.
[573] Cf. euwid, 01.09.2009.
[574] Cf. euwid, 01.02.2011.
[575] Cf. euwid, 01.09.2009.
[576] Cf. euwid, 01.02.2011.
[577] Interview with industry experts.
[578] Cf. CRI, 2009, p. 27.

Indicator 25 – Market prices per tonne of secondary material[579]

One-way dual systems

Glass:

See statements under refillable system

Paper:

Beverage cartons are consigned to paper and carton recovery. From there, aluminium and plastic portions are sorted out and are usually consigned to energy or raw materials recovery. Since the largest materials portion that is consigned to recycling concerns waste paper (which is of a lower quality compared to paper from primary materials), the current market prices for waste paper (paper/cardboard residual materials) are indicated in this context. Waste paper from secondary material is allocated to grades. Beverage cartons are allocated to special grades. No prices were available for those special grades. Since this does not concern pure, high-quality paper, the inferior grades are listed in this context.

Beverage packaging/ secondary material	Reference year	Price (€/t)	Remarks
Waste paper (inferior grades) [580]	2007	65-110	The financial market and economic crisis impacted particularly hard on the waste paper market.[581]
Waste paper (inferior grades) [582]	2008	0-70	

[579] The data featured in this section were exclusively generated from publicly available information; the availability, level of detail and currentness of the available information vary in accordance with the type of material; consequently, the data presented in this context reflect different reference years and diverge with respect to depth of detail.
[580] Cf. GIB and ARGUS, 2009, p. 140.
[581] Cf. GIB and ARGUS, 2009, p. 140; bvse, 2009, p. 7.
[582] Cf. GIB and ARGUS, 2009, p. 140.

Indicator 26 – Compensation payments/expense reimbursements (primarily payable to public authorities)[583]

Refillables	Since the refillable system is based on a voluntary initiative of the industry, no expense reimbursement payments need to be made to public authorities. Under the refillable system, however, manufacturers usually make compensation payments to the trade sector in order to compensate them for possible additional costs.
One-way deposit	No expense reimbursement payments need to be made to public authorities under the German system.
One-way dual systems	No expense reimbursement payments need to be made to public authorities under the German system.

[583] In some countries, system participants must make expense compensations to public authorities for the collection of data on recycling rates and for other administrative tasks performed by the public authorities. This impact category comprises such expense reimbursements.

Indicator 27 – Annual revenues from unredeemed deposits

Refillables

Unredeemed deposits given a return rate of 99 %:

Deposit charged	Number of packaging containers (million)[584]	Assumed return rate (see p. 150)	Unredeemed deposits (€)
€ 0.08 (beer)	13,061.8	95 %	52 mn
€ 0.15 (juice, mineral water, non-alcoholic soft drinks)	11,444.7	99 %	17 mn

One-way deposit

Unredeemed deposits concerning deposit one-way beverage containers

	Source	Assumed percentage of non-returned one-way beverage containers, see p. 150	Assumed volume of deposit one-way beverage containers	Unredeemed deposits (€)
Scenario 1	Roland Berger[585]	5 %	14 bn	175 mn
Scenario 2	IFEU	6 %[586] for PET bottles and glass bottles[587] 4 %[588] for cans	11.36 bn PET 0.51 bn glass 1.38 bn cans[589]	192 mn
Scenario 3	IK (DPG)/ IFEU	1.5 %[590] for PET bottles (DPG) and glass bottles[591] 4 %[592] for cans (IFEU)	11.36 bn PET 0.51 bn glass 1.38 bn cans[593]	58 mn

In the further calculation, we use the DPG data for PET bottles and the IFEU data for cans (Scenario 3), since they are the most recent data available, which assume unredeemed deposits of € 58 million.

One-way dual systems

Unredeemed deposits are not applicable with respect to dual systems.

[584] Canadean, 2010 (PwC analysis of Canadean data).
[585] Cf. Roland Berger, 2007, p. 44; In this context, the costs cannot be reduced through revenues, since the dual systems retain the revenues. The revenues are accounted for in the calculation of the fees for packaging producers.
[586] Cf. IFEU, 2010 b, p. 48.
[587] Equal return rates are assumed for glass bottles and for PET bottles.
[588] Cf. IFEU, 2010 a, p. 34.
[589] Canadean, 2010 (PwC analysis of Canadean data).
[590] Cf. Deutsches Dialog Institut, 2020, p. 1.
[591] Equal return rates are assumed for glass bottles and for PET bottles.
[592] Cf. IFEU, 2010 a, p. 34.
[593] Canadean, 2010 (PwC analysis of Canadean data).

C 2.2.2.5 Excursus: Revenues in the deposit systems for refillable and one-way beverage containers

Owing to the high refillable rate and the thus low volume of packaging waste, revenues are less relevant with respect to the refillable system. However, revenues may be generated through the sale of refillable bottles as secondary material (rejects).

Refillable beverage containers:

Table 64: Annual total revenues from the sale of secondary material attributable to refillable beverage containers in Germany

	Volume of rejects, refillable bottles in t[594]	Revenues (€)
Glass (50[595] €/t)	249,400	249,400 * 50 = **12.5 mn**
PET (280 €/t)[596] → Minimum revenues	7,700	7,700 * 280 = **2.2 mn**
PET (530 €/t) → Maximum revenues	7,700	7,700 * 530 = **4.1 mn**

One-way beverage containers (PET):

Table 65: Annual total revenues from the sale of one-way beverage containers (PET) in Germany

			Revenues from the sale of one-way PET beverage containers that were returned by consumers (€)	
		Volume in tonnes for returned PET bottles	assuming € 280 per tonne for coloured and € 460 per tonne for clear PET bottles[597]	assuming € 340 per tonne for coloured and € 530 per tonne for clear PET bottles[598]
PET bottles (one-way)	Own calculation based on a return rate of 94 %, Canadean (see page 233)	317,300 * 0.94 = 298,262	**126 mn**	**147 mn**
	Own calculation based on a return rate of 98,5 %, Canadean (see page 233)	317,300 * 0.985 = 312,541	**133 mn**	**154 mn**
	Own calculation using data on volumes taken from GVM	353,300[599]	**150 mn**	**174 mn**

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[594] Cf. pp. 237 and 238
[595] Cf. page 244
[596] The prices for deposit-bearing non-refillable PET bottles were used since this data is of more current nature; in this context, one scenario was calculated on the basis of the lowest price, while the highest price was used in another scenario.
[597] Cf. page 246, minimal revenues based on euwid data from 2011; according to industry experts, the market for deposit one-way PET bottles is distributed as follows: clear bottles: 80 %; coloured bottles: 20%.
[598] Cf. page 246, maximum revenues based on euwid data from 2011; according to industry experts, the market for deposit one-way PET bottles is distributed as follows: clear bottles: 80 %; coloured bottles: 20%.
[599] GVM, 2009 a, p.61

One-way beverage containers (aluminium and steel cans):

Assuming average revenues of € 950 per tonne of aluminium and € 100 per tonne of steel[600] attributable to cans collected through the deposit system, and assuming a market distribution of 50 % for aluminium and 50 % for steel cans, results in revenues of ca. € 14 million, given the volume of 26,800 tonnes (see page 235) put into circulation and based on a return rate of 96 %.

In a study, Roland Berger estimates revenues from the sale of secondary material to stand at € 82 million.[601]

The revenues from the sale of secondary material calculated on the basis of the current Canadean and GVM data (PET and aluminium) and of the current rates for unredeemed deposits are thus higher than the revenues assumed by Roland Berger (71 % to 129 %). It must be noted that the analysis focused on the current market situation. Depending on the number of beverage containers, return rates and the market prices for secondary material, total revenues may vary.

[600] Interview with industry experts.
[601] Cf. Roland Berger, 2007, p. 44.

C 2.2.2.6 Excursus: Analysis of costs and revenues concerning deposit systems for one-way beverage containers and for dual systems

Investment costs for producers and trade

The highest capital expenses incurred by the retail trade when implementing a one-way deposit system concern the acquisition of reverse vending machines. In Germany, deposit one-way beverage containers do not have to be taken back in an automated fashion. Distributors of one-way beverage containers may also take them back manually, which is usually associated with higher personnel expenses.

In a study on the costs of the deposit system for system participants, Roland Berger assumed in 2007 that a total of 20,960 reverse vending machines were installed by the trade sector. The study assumed acquisition costs of € 30,000 per machine. When adding € 3,500 in infrastructure costs incurred by the trade sector per machine, the trade sector invested € 702 million in the implementation of the one-way deposit system, according to Roland Berger. The study also assumes that 25 % of the retailers are equipped with reverse vending machines.[602]

A comparison of the costs assumed by Roland Berger with the findings of the current industry survey as part of this study yielded the following results:[603]

Table 66: Assumptions on total investment costs for the trade sector (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts

	Roland Berger	Industry survey	Unit	Deviation between industry survey and Roland Berger
Acquisition costs for reverse vending machines	30,000	20,000	€/machine	- 33.33 %
Structural expenses	3,500	2,000	€/machine	- 42.86 %
Number of reverse vending machines	20,960	29,000	No.	38.36 %
Total costs	**702**	**638**	**€ million**	**- 9.14 %**

The analysis shows that - according to the current findings of the industry survey - the capital expenses for reverse vending machines is lower than assumed by Roland Berger in 2007, even though the number of reverse vending machines increased by 38%.

Significantly less investment expenses are incurred by beverage, packaging and label manufacturers for the change-over to the one-way deposit system. In this context, the cost factors mainly concern the adaptation of the labelling machines for printing the deposit labels and codes on the stickers and cans.

[602] Cf. Roland Berger, 2007, p. 40.
[603] With respect to the comparison of the Roland Berger data to the data obtained from the current industry survey, it must be noted that the differences in the data do not provide any indications regarding the quality of the data. Both surveys make reference to statements provided by experts. Consequently, the data must be viewed as being on par in terms of quality. It is quite possible that different companies might incur different costs with respect to a certain category, which may be a reason (among others) for varying cost assumptions. However, the analysed period differs. It seems plausible that costs decreased over time.

In 2007, Roland Berger calculated the following costs respecting the one-way deposit system:[604]

- necessary colour adjustments for printing presses: € 14 million
- safety checks: € 3 million
- compliance with certification standards: € 2.5 million
- quality assurance: € 1.5 million
- infrastructural measures for safeguarding the labels concerning beverage producers: € 2.8 million

This results in a total cost of € 23.8 million for all manufacturers (beverages, labels, packaging) on which the one-way deposit system has an influence. Our industry survey indicated that these costs are presently lower given the new assumptions. This is reflected in the following Table:

Table 67: Assumptions on total investment costs for beverage, label and packaging producers (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts

	Roland Berger	Industry survey		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
New printing presses for can manufacturers	700,000	500,000	800,000	€/printing press/line	- 28.57 %	+ 14.29 %
Number of printing presses	20	14	14	No.	- 30.00 %	- 30.00 %
Total costs for printing presses	**14**	**7**	**11**	**€ million**	**- 50.00 %**	**- 20.00 %**
Other costs (no new data collection)	9.8	9.8	9.8	€ million	0.00 %	0.00 %
Total costs	**23.8**	**16.8**	**21.0**	**€ million**	**- 29.41 %**	**- 11.76 %**

For traders and manufacturers collectively, this comparison leads to the following results respecting the investment costs associated with the one-way deposit system:

Table 68: Assumptions on **total investment costs for the trade sector and for beverage, label and packaging producers (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts**

	Roland Berger (based on 20,960 reverse vending machines)	Industry survey (based on 29,000 reverse vending machines)		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
Total costs	**726.0**	**654.8**	**659.0**	**€ million**	**- 9.80 %**	**- 9.22 %**

Since the comprehensive collection of packaging through the dual systems (in the beginning based on a monopoly position of Duales System Deutschland GmbH (DSD) as a non-profit organisation) had already been established more than 15 years ago, it was not possible to determine in detail the capi-

[604] Cf. Roland Berger, 2007, p. 41 and Appendix, p. 26.

tal expenditures in the infrastructure that were required at that time. In the beginning, the DSD generated costs of about € 2 billion per annum.[605] This amount is not limited to the collection of beverage packaging and does not only include investment costs, but also operational costs. However, it can be ascertained that the implementation of the dual systems was also accompanied by high investment costs. Those investment costs - on a prorated basis for beverage packaging - may have been similarly high as the investment costs incurred for the implementation of the deposit system.

Operational costs for beverage producers

Costs attributable to the deposit system for one-way beverage containers and which concern manufacturers:

In 2007, the Roland Berger study estimated the annual costs for beverage, packaging and label manufacturers to come to € 93.7 million.[606]

The following cost categories had been accounted for in the study:[607]

- clearing: € 70.3 million
- additional costs for labels: € 14 million
- amortisation/depreciation: € 2.7 million
- certifications and inspection costs: € 2.1 million
- administrative costs: € 1.7 million
- DPG participation: € 1.5 million
- interest: € 1.4 million

Data on the expenses attributable to the two categories associated with the highest costs, i.e. clearing and labels, were again collected within the scope of the industry survey.

Table 69: Assumptions on operational direct costs for beverage, label and packaging producers (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts

	Roland Berger[608]	Industry survey		Unit	Deviation between industry survey and Roland Berger	
Operational costs						
		min.	max.		min.	max.
Clearing[609]	0.5	0.04	0.2	Cent per packaging	- 92.00 %	- 60.00 %
Additional costs for labels	0.1	0.1	0.1	Cent per packaging	0.00 %	0.00 %

605 Cf. Perchards, 2005, p. 41.
606 Cf. Roland Berger, 2007, p. 43.
607 Cf. Roland Berger, 2007, p. 43 and Appendix, p. 28.
608 Cf. Roland Berger, 2007, Appendix p. 28.
609 The following factors impact on clearing costs: higher costs are generated when different service providers are used for the clearing process and the receivables management, and when receivables are taken over by the clearing service provider in its own name (in this case, the default risk must be insured against). The costs also depend on the volume of data records. Cost reductions can be achieved when a large number of data records are involved.

This results in the following total costs:

Table 70: Assumptions on total operational costs for beverage, label and packaging producers (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts

	Roland Berger	Industry survey		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
Total costs for clearing and logistics	67	5	26	€ million	- 92.17 %	- 60.87 %
Total additional costs for labels	13	13	13	€ million	0.00 %	0.00 %
Other costs (no new data collection)	9.4	9.4	9.4	€ million	0.00 %	0.00 %
Total costs for manufacturers	**89**	**28**	**49**	**€ million**	**- 68.76 %**	**- 45.41 %**

This analysis shows that the results of the industry survey indicate 45 to 70 % lower operational costs for beverage producers than assumed in the Roland Berger study.

Costs of the dual systems:

Presently, the total costs for the collection of all packaging materials generated by the dual systems are estimated to range between approx. € 900 million to € 1,000 million per annum.[610] Since 1998, when costs stood at € 2,063 million, the costs have been decreased by ca. 50 %.[611]

Total costs comprise collection (ca. 50 %), sorting (ca. 34 % to 40%) and recovery costs (ca. 10 % to 15 %).[612]

As already mentioned, these costs (which are influenced by revenue from the sale of materials and other factors) are financed through licensing fees. According to industry experts, the following licensing fees apply at present:[613]

- beverage cartons: € 0.66/kilogram
- PET bottles (as plastic fraction): € 0.74/kilogram
- aluminium cans (as aluminium fraction): € 0.55/kilogram
- steel cans (as steel fraction): € 0.40/kilogram

The licensing fees have decreased since the discontinuation of the DSD monopoly. Even though this development coincides with the introduction of the one-way deposit system, the price decrease is rather attributable to competition than to the introduction of the deposit system. The dreaded negative impact on the collection infrastructure and on licensing fees - as anticipated before the introduction of the mandatory deposit - did not set in. On the contrary, it has been possible to continue the collection infrastructure - which was mainly managed and organised centrally by DSD - since the in-

[610] Interview with industry experts.
[611] Cf. Perchards, 2005, p. 41.
[612] Interview with industry experts.
[613] Interview with industry experts.

troduction of the one-way deposit in 2003, even though price competition among the dual systems commenced almost at the same time.

Operational cost for the trade sector

The operational costs incurred by the trade sector respecting one-way deposit systems for beverage packaging amounted to € 699 million in 2006, according to an estimate provided in the Roland Berger study.[614] The cost categories featured in the Roland Berger calculations include: clearing and logistics, cost of personnel required for the take-back of packaging, amortisation and depreciation, maintenance of reverse vending machines, area/space costs, interest, DPG participation.

The costs for manual clearing are attributable to the following: pick-up of empty beverage packaging in bags at the sales locations, transport to counting centres, counting of containers, clearing services provided to the industry, deposit reimbursements to the accounts of business customers and invalidation of packaging. With regards to logistics, it is of crucial importance whether the beverage packaging is picked up at central warehouses or at the individual retail branches. The density of retail branches in the market is also crucial. The more centralised the pick-up logistics can be structured, the lower the costs.[615]

Some selected assumptions made in the Roland Berger study were queried in order to compare the data assumed by Roland Berger to current data. This led to the following results:

[614] Cf. Roland Berger, 2007, p. 42.

[615] Interview with industry experts: The costs for picking up empty packaging depend on whether the packaging is picked up at a central warehouse or at a point of sale. Pick-up at the central warehouse is more cost-efficient. Consequently, costs can be kept down to about € 0.02 per container. When empty packaging is picked up at the point of sale, the costs range between € 0.03 and € 0.04 per container, depending on the density of the retail branches and the volume picked up. The greater the density of retail branches in the market and the higher the packaging volume picked up, the lower the costs.

Table 71: Assumptions on operational direct costs for the trade sector (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pages 26 to 29; interview with industry experts

	Roland Berger[616]	Industry survey		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
Clearing and logistics in case of automated take-back	1.2	0.98	0.98	Cent per container	-	- 18.33 %
Clearing and counting in case of manual take-back	2.5	1.64	2.7	Cent per container	- 34.40 %	8.00 %
Logistics costs in case of manual take-back	3	2	4	Cent per container	- 33.33 %	33.33 %
Maintenance of reverse vending machines	3,000	2,000	2,000	€ annually per machine	- 33.33 %	- 33.33 %
Area/space requirement in case of automated take-back	6	6	6	m² per machine	0.00 %	0.00 %
Area/space requirement in case of manual take-back	4	2	2	m² for storage	- 50.00 %	- 50.00 %
Area/space costs[617]	11	-	-	€ per m²	-	-
Time required for manual take-back	1	1	1	Minutes per take-back of six containers	0.00 %	0.00 %
Manual return transactions respecting six containers	446	223	223	Return transactions concerning six containers, in million	- 50.00 %	- 50.00 %
Time required for automated take-back	30	30	30	Minutes, daily	0.00 %	0.00 %
Personnel costs	15	15	15	€ per hour	0.00 %	0.00 %
Working days per year	N/A	300	300	Days per year	-	-
Share of automated return transactions	80	90	90	%	+ 12.50 %	+ 12.50 %
Return rate	95-97	96-98.5	96-98.5	%	-	-
Amortisation/depreciation period	7	7	7	Years	0.00 %	0.00 %

[616] Cf. Roland Berger, 2007, Appendix p. 27.
[617] An average price per m² could not be determined within the scope of the industry survey. According to industry experts, the costs vary extremely. Consequently, an average price cannot be estimated with a sufficient degree of reliability.

The results taken from Table 71 translate into the following total costs:

Table 72: Assumptions on total operational costs for the trade sector (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pp. 26 to 29; interview with industry experts

	Roland Berger	Industry survey		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
Total costs for clearing and logistics, automated	-	115	115	€ million		
Total costs for clearing and logistics, manual	-	47	87	€ million		
Total costs for clearing and logistics	268	163	202	€ million	- 39.45 %	- 24.57 %
Depreciation of reverse vending machines	100	91	91	€ million		- 8.86 %
Maintenance of reverse vending machines	63	58	58	€ million		- 7.94 %
Interest for investments	42	38	38	€ million		- 8.86 %
Personnel costs, take-back	159	121	121	€ million		- 23.90 %
Area/space costs[618]	51	46	46	€ million		- 9.80 %
DPG participation (no new data collection)	1	1	1	€ million		
Total costs for trade sector	**684**[619]	**517**	**557**	**€ million**	**- 24.32 %**	**- 18.48 %**

According to the results of the current industry survey, the cost factors examined in this context are between 18 to 24 % lower than in the Roland Berger study.

This comparison shows that the costs derived from the current results of the industry survey are lower than estimated by Roland Berger in 2007. The calculation emphasises the sensitivity and range of some cost factors, in particular. These ranges should be accounted for in cost calculations.

[618] Roland Berger's calculation of total costs concerning area/space could not be comprehensibly derived from the individual assumptions. Consequently, the total amount determined by Roland Berger was split into the categories manual take-back (20 %) and automated take-back (80 %) for calculation purposes. The thus calculated costs for the manual take-back were halved in order to reflect the industry experts' assumption that the area/space requirements presently stand at 2 m² , and no longer at 4 m².

[619] The more current Canadean data were used with respect to the total number of one-way beverage containers put into circulation (13,246 billion containers, Canadean, 2010, PwC analysis of Canadean data). Consequently, the total result of the Roland Berger scenario is lower than the figure indicated in the original study.

Adding the operational costs for manufacturers and traders results in the following total costs comparison:

Table 73: Assumptions on total operational costs for the trade sector and for beverage, label and packaging producers (a comparison), derived from: Roland Berger, 2007, pp. 39 to 43 and Appendix pp. 26 to 29; interview with industry experts

	Roland Berger	Industry survey		Unit	Deviation between industry survey and Roland Berger	
		min.	max.		min.	max.
Total costs for trade sector and manufacturers	**773**	**545**	**606**	**€ million**	**- 29.45 %**	**- 21.59 %**

Only one system participant is required to bear the licensing costs in the dual systems. This is usually the manufacturer, but it could also be the retailer if he should be the brand owner of the packaged product. In this case the licensing costs must be assumed to be the same as those for manufacturers.

Analysis of total costs and revenues for the one-way deposit system and the dual systems

The total revenues generated through the deposit one-way beverage containers were already calculated on p. 245.

In the following model, the costs of the one-way deposit system are broken down to one beverage container to enable a comparison to the licensing costs in the dual system. In this context, the costs are examined for both the beverage producers and the trade sector. This concerns a theoretical model comparison, since the financing structures in the deposit system for one-way beverage containers and in the dual systems differ. A notional participation fee for the deposit system is calculated per kilogram of PET bottles, which does not exist in practice. It must also be taken into account that the calculation reflects assumptions, which are often based on statements made by industry experts. In this way, a realistic approximation can be presented. However, individual deviations might occur in practice (the licensing costs, for example, vary depending on the dual system and individual agreements concluded between manufacturers and the system).

In one instance, the cost comparison takes into account the cost estimates provided by Roland Berger (Roland Berger scenario) in 2007, while in the other it accounts for the costs (industry survey scenario) determined from the data collected under the current industry survey (see page 254).

As regards manual clearing, the industry survey provided cost ranges for the clearing, counting and logistics costs respecting the manual take-back of packaging. The following calculation relating to the results of the industry survey assumes a mean of 5.17 euro cents per beverage container for the trade sector. An average value of 0.1 euro cents per beverage container is assumed for the manufacturers' clearing costs. According to the results of the industry survey, this leads to total costs of € 537 million for the trade sector and € 36 million for beverage producers, i.e. a total of € 573 million for the one-way deposit system.

Solely deposit PET bottles are analysed in the following calculation, since, in relation to the filling volume, they account for 94 % of the total market for PET bottles.[620] On the basis of the estimated weights indicated on p. 233 and the market shares of the various packaging sizes[621], average weights were calculated for the entire PET bottle market, a lower average weight in accordance with the basic scenario on p. 233 (market prices per tonne of secondary material) and an average price based on the sensitivity scenario on p. 234. By taking those weights into account, it was possible to determine the (notional) average costs of the (notional) participation of one kilogram of PET bottles in the deposit system and set them into relation to the licensing costs for the dual systems. This leads to the following result (see Table 74 and Table 75 on the following page):

[620] Canadean, 2010, (PwC analysis of Canadean data; segments: CSD; water; OSD; market share greater than 1 %).
[621] Canadean, 2010, (PwC analysis of Canadean data; market shares based on the number of containers put into circulation).

Table 74: Theoretical comparison of costs for system participants concerning the participation of various packaging types in the dual systems and the one-way deposit system, Roland Berger scenario

	Bottles per kg	Costs for trade sector and manufacturers per beverage container in the deposit system (Roland Berger; €)	Costs less unredeemed deposits (€/kg) in the deposit system	Costs less revenues from the sale of secondary material (€ /kg, an average revenue of € 485/t is assumed)[622]	License costs in dual systems (costs less revenues from sale of secondary material) (€/kg)	Costs of deposit system compared to dual systems
Total costs		772,918,271				
Unredeemed deposits		58,312,525				
Number of beverage containers		13,246,037,119				
PET market: Scenario average weight 28.46 g	35	0.0539	1.90	1.44	0.74	+ 94 %
PET market: Scenario average weight 35.4 g	28	0.0539	1.52	1.07	0.74	+ 44 %

Table 75: Theoretical comparison of costs for system participants concerning the participation of various packaging types in the dual systems and the one-way deposit system, industry survey scenario

	Bottles per kg	Costs for trade sector and manufacturers per beverage container in the deposit system (industry survey; €)	Costs less unredeemed deposits (€/kg) in the deposit system	Costs less revenues from the sale of secondary material (€ /kg, an average revenue of € 485/t is assumed)	License costs in dual systems (costs less revenues from sale of secondary material) (€/kg)	Costs of deposit system compared to dual systems
Total costs		573,030,535				
Unredeemed deposits		58,312,525				
Number of beverage containers		13,246,037,119				
PET market: Scenario average weight 28.46 g	35	0.0389	1.37	0.91	0.74	+ 23 %
PET market: Scenario average weight 35.4 g	28	0.0389	1.10	0.64	0.74	- 14 %

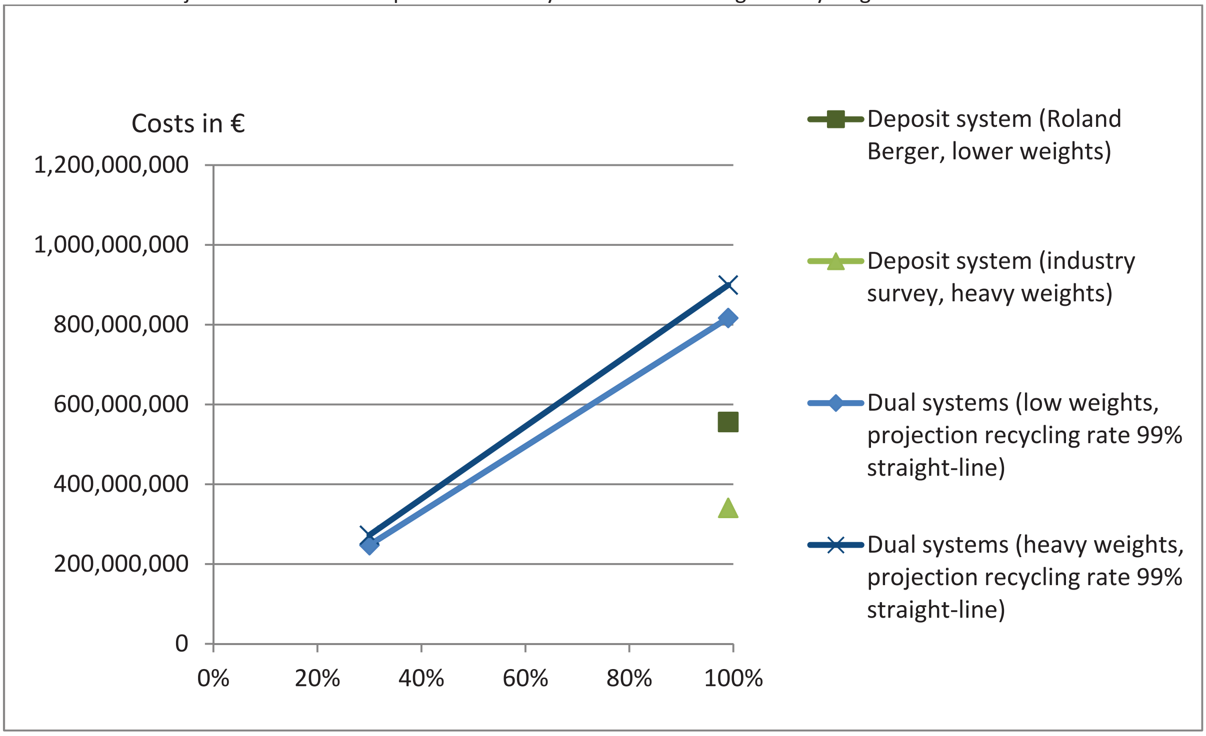
[622] Average value based on current market values (see p. 245) under the assumption that 80 % of the deposit-bearing PET bottles are clear and 20 % are coloured. (Interview with industry experts).

While the costs of the deposit system exceeds the costs of the dual systems by 44 to 94 % based on the Roland Berger data, the costs difference decreases when the assumptions of the current industry survey are used, resulting in that the costs of the deposit system exceed those of the dual systems by 23 % when assuming lower weights, while the costs of the deposit system are 14 % lower than those of the dual systems when assuming higher actually existing weights. It is evident that the results are influenced by the assumed weight, the estimated costs and also by the number of deposit beverage containers put into circulation. The higher the volume of beverage packaging collected through the deposit system, the more favourable the cost analysis for the deposit system.

It must be noted, however, that the comparison presented in Table 74 and Table 75 compares two systems that differ greatly as to their function and operation and which yield different results with respect to the return rate and recycling rate. The dual systems ensure the comprehensive curbside collection of a large number of packaging containers, of which beverage packaging only makes up a portion. The licensing costs are always also due to the system in its entirety and are not only attributable to the costs for the collection of beverage packaging. It must be noted that dual systems achieve lower collection and recycling rates with respect to beverage packaging. While the return and recycling rates for PET bottles in the deposit system stand at ca. 98.5 %, the collection rate for PET bottles in the dual systems is estimated to range between 43 % to 54 %, and the recycling rate between 25 % to 31 %.[623] If those rates should be significantly increased in the dual systems - e.g. through a separate collection of PET bottles -, it can be assumed that the corresponding costs in the dual systems will also rise. Illustration 21 represents a theoretical straight-line extrapolation of costs arising from dual systems for achieving higher recycling rates. To this end, the above presented direct costs for both systems were extrapolated to reflect the total costs for the participation of all beverage containers (here also including beverage cans and deposit one-way glass bottles). It must also be kept in mind that this concerns a theoretical calculation. The actual cost development is not known. The presentation is simply to facilitate the inclusion of the systems' results in the cost analysis.

[623] Cf. pp. 167–184.

Illustration 21: Projection of cost development of dual systems in case of higher recycling rates[624]



In this theoretical extrapolation of costs, the dual systems would generate more costs if similar collection and recycling rates as for the one-way deposit system were achieved. Practically, it is doubtful that dual systems can achieve a recycling rate of 98.5 %, since the deposit system achieves this rate through the financial incentive. It thus seems quite possible that the costs for achieving very high recycling rates in the dual systems increase to an above-proportionate extent and not on a straight-line basis.

The following comparison of the expenses and revenues from the one-way deposit system for the Rewe Group demonstrates that individual retail companies can generate revenue surpluses through the deposit system.

Table 76: Rewe Group's expenses and revenues in 2009 from the one-way deposit system, source: Schlautmann, C., 26.07.2010, *Millionengewinne durch Einwegpfand* (generating profits in the millions from the one-way deposit system)

	Recognised expenses from the one-way deposit system	Recognised revenues from the one-way deposit system	Surplus
Example; the Rewe Group	€ 486 million	€ 498 million	2.5 %

In addition, the one-way deposit system provides for mono-fraction material flows and has a positive influence on bottle-to-bottle recycling (see Illustration 16 – Impact category: Secondary materials input ratio). Another aspect concerns the cost savings for the recycling market, which is not taken into account in many cost analyses. The mono-fraction collection of one-way beverage containers in a deposit system saves costs for recyclers with regard to the sorting and recycling of the collected

624 Only the cost development of the dual systems is projected in this context. The ratio between costs and recycling rates serves as the reference value.

packaging. The recycling quality is also enhanced.[625] However, given the currently available data, these cost savings cannot be quantified in absolute terms.

C 2.2.2.7 Summary of the impact category: System revenues from beverage packaging systems

System revenues are particularly relevant to the one-way deposit system and dual systems, since here the costs can be refinanced through the return and recovery systems. Cost savings are achieved in the deposit system for refillable bottles as a result of the reduced acquisition costs, and the savings can be used for financing the return logistics. Sorting fees for wholesalers respecting the handling of refillable bottles are presently being discussed, but are not yet common on a comprehensive basis.[626]

The one-way deposit system has the advantage that the revenues are directly received by the traders and manufacturers, which also incur the highest costs for the implementation of the one-way deposit system. Furthermore, the revenues are generated from a high-quality material flow, which - in particular with respect to PET bottles - recovery firms prefer over PET bottles from the collections of dual systems, according to industry experts. This is in particular the case if the PET bottles are to be consigned to bottle-to-bottle recycling. In the dual systems, revenues are offset against expenses, which can result in a reduction of licensing fees.

In the model-based offsetting of revenues with the costs of the systems on the basis of the Roland Berger survey, the participation in the deposit system is more beneficial for manufacturers and traders (when taking the data from the industry survey on PET bottles into account) than the participation in the dual systems, according to one of the two scenarios. The results may not be considered as absolute in nature. The analysis shows, however, that neither of the two systems can be generally viewed as more expensive or more cost-efficient. The cost and revenue options depend strongly on the market conditions, in particular on the prices of secondary materials and the weight of the packaging, but also, for example, on the number of beverage containers found in the system. It seems that individual retailers are presently able to generate profits from the deposit system, as the example of the Rewe Group indicates.

Taking into the account the results that the systems achieve with respect to collection, return and recycling rates, the straight-line extrapolation of total costs for the participation of beverage packaging in dual systems shows that the deposit system is more cost-efficient than the dual systems.

In this study, the subjects "costs" and "revenues" were for the first time accounted for to such an extent. The results presented in this analysis indicate that many aspects relating to framework conditions must be taken into account, such as return and circulation rates, level of automation when taking back deposit packaging, and structural differences in the sales structure. Only when such aspects are taken into account, can informative and differentiated statements be made for assessing the impact of collection and recycling schemes. We thus recommend that future studies also give special attention to these subjects and their further scientific in-depth research.

[625] Cf. CRI, 2009, p. 21 and p. 25.
[626] Interview with industry experts.

C 2.2.2.8 Allocation of costs and revenues to stakeholder groups

Indicator 28 – Allocation of costs and revenues to the private sector and state authorities in percentage terms

Refillables	The costs are fully (100 %) borne by the beverage producers and the trade sector. Accordingly, the trade sector and the beverage producers keep the revenues from the system. Costs for public authorities arise only from the collection of data on refillable rates. Presumably, those costs are very low compared to systems in which the government has to bear the enforcement costs.
One-way deposit	The costs are fully (100 %) borne by the beverage producers and the trade sector. Accordingly, the trade sector and the beverage producers keep the revenues from the system. According to surveys conducted among experts, the distribution is often made in favour of the trade sector. In addition to the costs incurred for the collection of data on recovery and recycling rates as well as data on packaging waste volumes, public authorities incur enforcement costs, which are assumed to be very low, however.
One-way dual systems	The costs for the separate collection, sorting, processing and marketing of the one-way beverage containers not subject to a mandatory deposit are fully (100 %) borne by the beverage producers (or by the trade sector in case of own brands). The revenues are managed by the dual system operators. In the event that high revenues are generated, the system costs can be reduced for all system participants. Public authorities incur enforcement costs - in addition to costs arising from the collection of data on recovery and recycling rates and on the packaging waste volume. Compared to a one-way deposit system, ensuring compliance with the legal requirements is more complex. On the one hand, more material flows - of which some are mixed - are covered. On the other hand, the process for deposit containers across several distribution levels - from the sorting of the packaging to the distribution to different dual systems through to the various processing and recovery firms - is more transparent than in the mixed curbside collection.

In all, the industry itself is responsible for assuming the costs for operating the systems, which applies to all systems. Accordingly, the industry receives the system revenues. The government only incurs costs for the collection of data on reuse, recycling and recovery rates as well as on the packaging waste volume. However, one difference is that no expenses are incurred in the refillable system for controlling the systems. The government incurs additional monitoring costs (there is particularly a need for control in the dual systems due to the free riders problem, see p. 289) arising from the one-way deposit systems and dual systems, which are legally regulated systems. This implies that the refillable system calls for greater responsibility on the part of manufacturers right from the start (see further explanations on p. 291).

C 2.2.2.9 Implications for regional, national and international economic regions

Indicator 29 – Creation of new markets; Implications concerning competition among the companies (qualitative description)

Refillables	
	One fact that speaks in favour of an intensification of competition among fillers through refillable systems is the lower process costs compared to one-way systems. Savings can be achieved through the existing pool logistics (see also Section C 2.2.2.1). According to an analysis conducted by Stenum and Hauer, refillable beverage containers can increase customer loyalty and regional fillers are given preference owing to logistics-related reasons (long transport distances are not practical). According to this analysis, refillable beverage containers thus contribute to a more neutral competitive environment.[627] Furthermore, the traditional specialised beverage trade can benefit from close cooperation with beverage producers - which largely operate regionally - as a result of the large product range. The cost effects are less evident in the food retail trade. The decreasing refillable rates indicate that the one-way solutions are preferred by many market operators. The following development provides an indication regarding the increasing market concentration: While the consumption of mineral water from discounters accounted for 21 % of the market volume in 2003, this share increased to 52 % by 2008. According to GDB, only five suppliers of discounters cover this market share. During the same period the number of GDB's “Mineralbrunnenbetriebe” (mineral water fountain operations) decreased from 226 to 208 and share the remaining market (i.e. 48 %).[628] Hard discounters largely use non-refillable PET beverage containers. Analogous to the mineral water segment, more than 60 % of juice beverages are meanwhile sold via discounters.[629]

[627] Cf. Stenum and Hauer, 2000, p. 4.
[628] Cf. Wolff, M., 2009, p. 17 and p. 18.
[629] Cf. Leonhardt, E., 2010, p. 20.

Indicator 29 – Creation of new markets; Implications concerning competition among the companies (qualitative description)

One-way deposit

The market for PET recyclates is strengthened through the one-way deposit system. The monofraction-materials collection prevents impurities and the intrusion of foreign material, thus facilitating high-quality recycling (bottle-to-bottle recycling). The monofraction-materials collection also saves costs with respect to sorting and cleaning (such costs arise in the dual systems). Furthermore, higher prices are realised for the recyclates from the one-way deposit system (see also p. 238). In the first year after the introduction of the mandatory deposit on one-way beverage containers - i.e. from January 2003 to early 2004 - the price for recyclates from one-way PET packaging increased from ca. € 60 per tonne to slightly below € 200 per tonne.[630]

The development of strong markets for secondary raw materials is important to the national economy, since it partly means independence from markets for primary raw materials and more economical sourcing. For example, expensive primary raw materials can be directly substituted and also the input of other primary raw materials - mainly energy - can be reduced.[631] Many cost analyses do not take these benefits for the national economy into account (see p. 210 to 244, indicators Nos. 18 to 27).

The quality of the secondary raw materials is nevertheless relevant, since they have to substitute the primary raw materials while offering the same quality. The mono-fraction materials collection of beverage packaging through deposit systems ensures a higher quality.[632]

The introduction of a one-way deposit system offsets competitive disadvantages for suppliers in the refillable system. Firstly, the introduction of a one-way deposit system ingrains the principle of extended product responsibility more profoundly in the minds of producers of beverages filled in one-way beverage containers. Secondly, the requirement to return refillable beverage packaging - which consumers perceive as a disadvantage of the refillable system - is offset by the introduction of a one-way deposit system which also requires the return of packaging.

[630] Cf. GIB and ARGUS, 2009, p. 155.
[631] Cf. Bardt, H., 2006, p. 12 f.
[632] Cf. CRI, 2009, p. 21 and p. 25.

Indicator 29 – Creation of new markets; Implications concerning competition among the companies (qualitative description)

One-way dual systems	New markets for recyclates are created as a result of the dual systems. However, additional costs arise in particular from the technically complex targeted (mono-fraction) sorting and the preparation of packaging waste for recycling, especially with respect to plastics and composite packaging (e.g. beverage cartons, see also p. 238). Owing to these additional costs, it is more difficult to generate marketable plastic recyclates from the collection of the dual systems.[633] For consumers it is generally more convenient to return packaging through curbside collection (such as through the dual systems) than to return the packaging at the stores (point of sale). If a one-way deposit system and dual systems existed in parallel for a given beverage segment, this could lead to competitive advantages in that beverage segment for beverage producers that fill their beverages in one-way beverage containers which are not subject to a mandatory deposit. Such competitive advantages have a negative impact on the environment in the sense that the return rates and recycling quality of dual systems are usually lower compared to deposit systems. Moreover, the principle of extended product responsibility is thus impaired. In Germany, some beverage segments (e.g. water and beer) are subject to a mandatory deposit, while the packaging of other beverage segments (e.g. juice and milk) is collected through the dual systems. There are no parallel systems within the beverage segments (concerning the filling volumes 0.1 to 3.0 litres that are subject to the mandatory one-way deposit).

[633] Cf. Nakajima, N. and Vanderburg, W. H., 2006, p. 515.

C 2.2.2.10 Impact on small and medium-sized enterprises and large companies

Indicator 30 and 31 – Impacts on SMEs (qualitative description)

All systems

Number of beverage producers in various beverage segments:

Mineral water 2008: 211 Producers of soft drinks and mineral water[634]
Fruit juices 2008: 410 Fruit juice producers[635]
Beer 2008: 1,319 Breweries[636]

Product group	Number of producers 2008	Filling volume in m. l 2008	Producer per 1 m. people	Average output volume in m. l	RU rate as a %
Water and soft drinks	211	22,870.4	0.26	108.4	45.8
Fruit juices	410	4,096,5	0.5	10.0	8.0
Beer	1,319	8,986,0	1.6	6.8	87.8

Reillables

Beverage wholesalers and beverage retailers are mostly small- and medium-scale enterprises. The current consumer trend towards water and other non-alcoholic soft drinks in one-way beverage containers that are offered at low prices by discounters leads to a decline in the number of beverage wholesalers that sell beverages mainly in refillable beverage containers. [637]

One-way deposit

As shown under Section C 2.2.2.1 and C 2.2.2.4, one-way beverage containers are more cost efficient for large companies with international distribution structures and centralised production as it enables them to achieve economies of scale.

The consumption of water in one-way containers is increasing in the mineral water market, in particular, as it is offered costs-efficiently by discounters. This leads to concentration effects on the market and ousts medium-scale companies from the market. [638]

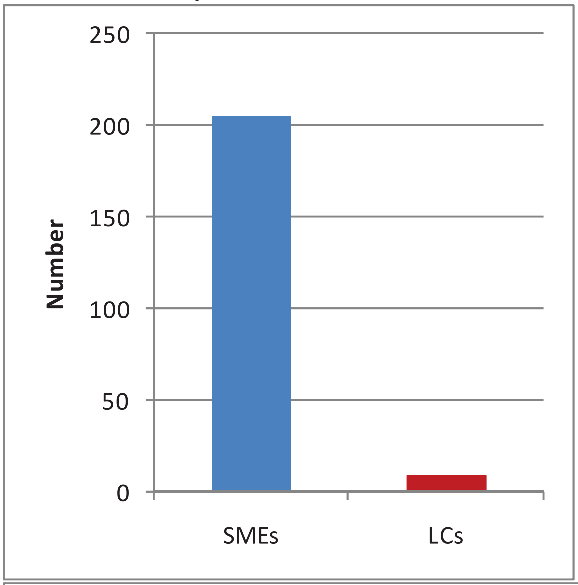
One-way dual systems

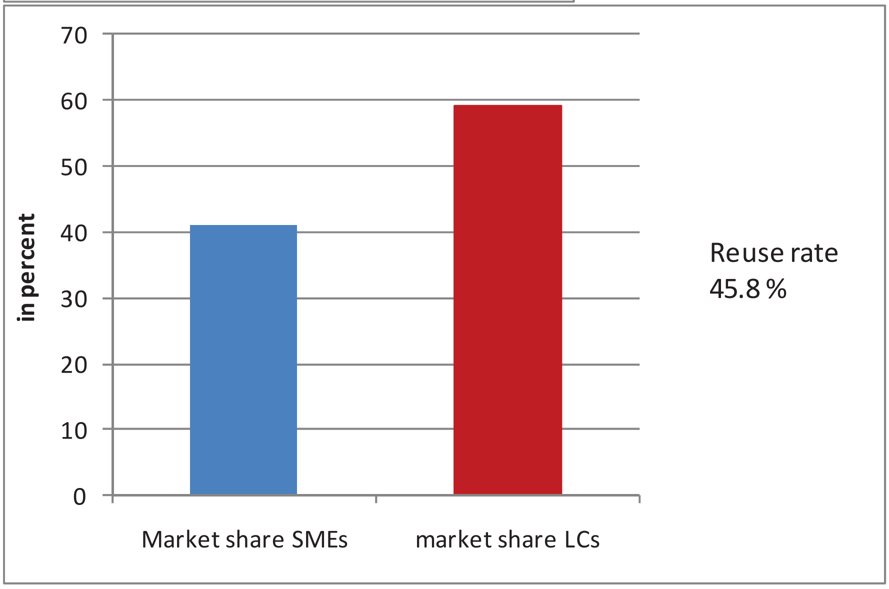
The findings concerning the one-way deposit system also relate to the dual systems. The dual systems also provide simplified preconditions for international sale as only participation fees must be paid. The administrative expense was reduced as applying the Green Dot logo is no longer obligatory.

[634] Cf. NGG, 2010, p. 4.
[635] Cf. VdF wwbsite, *Deutsche Fruchtsaft-Industrie in Zahlen*.
[636] Cf. Deutscher Brauer-Bund, 2009, p. 3.
[637] Cf. Ossendorf, P., 9 June 2009.
[638] Cf. ibid

In the mineral water and soft drinks market, six beverage producers are responsible for 59 % of the filling volume. All of these beverage producers use only one-way beverage containers.[639]

Illustration 22: Comparison of market shares of LCs and SMEs in the mineral water and non-alcoholic soft drinks segment



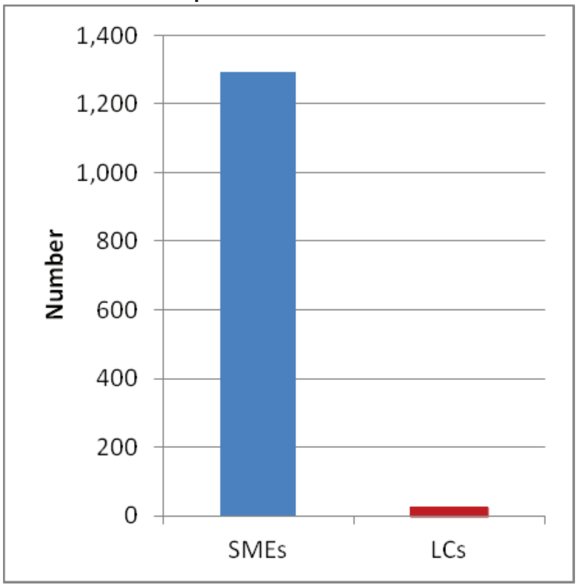


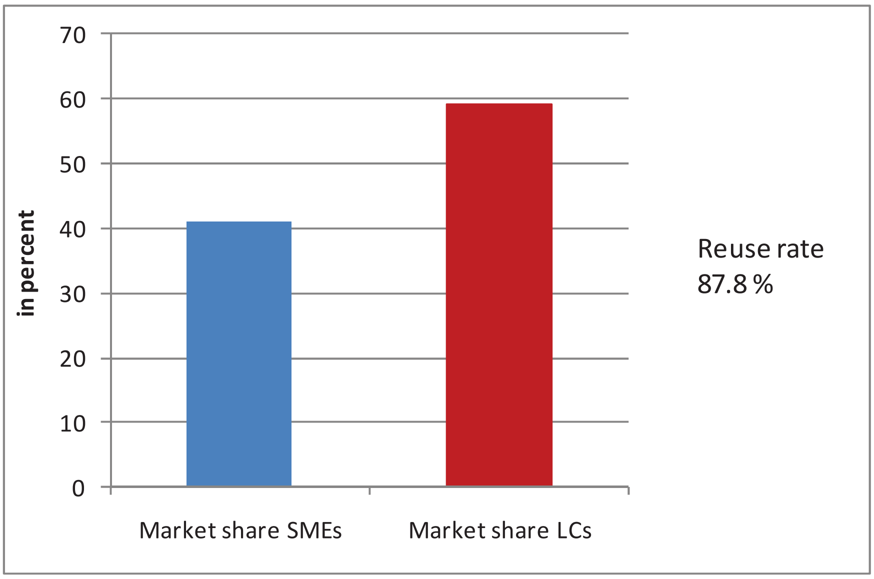
Two thirds (66.6 %) of beer breweries in Germany had an annual output of only up to 5,000 hl beer in 2008 whereas only 2 % of the breweries have an annual output of more than 1 million hl[640] and thus cover ca. 59 % of the total market.[641]

It should be mentioned here that many large companies use glass as a packaging form due to consumer preferences. For the most part, refillable bottles are selected.

[639] Cf. IFEU, 2010 b, p. 3 and 4.
[640] Cf. Deutscher Brauer-Bund, 2009, p. 4.
[641] Cf. Kelch, K., Dr., March 2010; Canadean, 2010 (PwC analysis of Canadean data). According to Dr. Kelch's statement in *Lebensmittel Zeitung*, the beer output of breweries with an output volume of more than 1 million hl annually amounts to 53,385 million hl per year. Pursuant to the Canadean data, the market share of breweries with an annual output of more than 1 million hl is 59 %.

Illustration 23: Comparison of LC and SME market shares in the beer segment



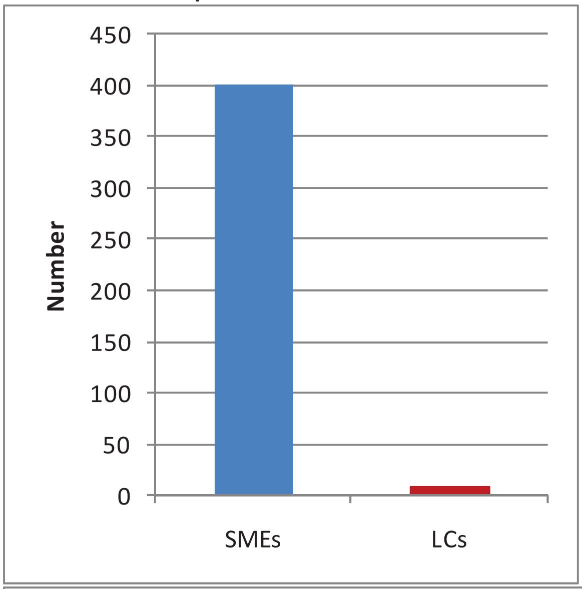


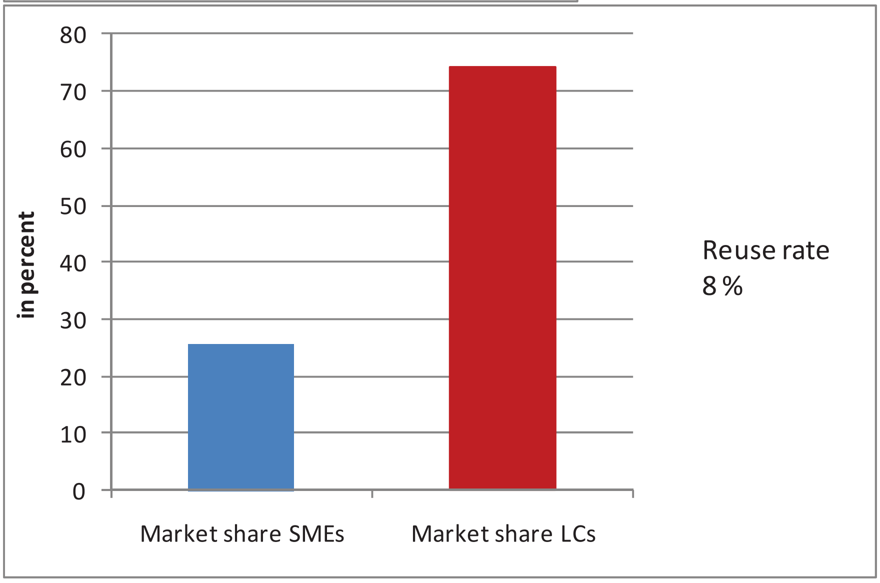
In the fruit juice industry, 92.7 % of producers generated sales revenue of less than € 50 million and are thus defined as SMEs (small- and medium-sized companies). 68.9 % of the companies generate sales revenue of less than € 2.56 million.

74.2 % of total sales in the fruit juice industry in 2008 were generated by only nine producers (4.7 %).[642]

[642] Cf. VdF website, *Branchenstruktur der deutschen Fruchtsaft-Industrie*.

Illustration 24: Comparison of LC and SME market shares in the fruit juice segment





Analysis of the industry survey indicates a connection between the size of the market operator and the preferred beverage packaging, including the pertaining return system. One-way beverage containers are attractive for large companies, in particular. Refillable beverage containers, by contrast, are preferred by small- and medium-sized companies as the associated cost advantages enable these companies to participate in the market. One-way bottling plants for PET are economically worthwhile only if certain preconditions are met. The investment in cold aseptic plants is expedient for fruit juice producers only if larger sales volumes are achieved. Small companies frequently do not generate these sales volumes.

Market operators that offer mainly (or only) refillable beverage containers will face sales problems if retailers increasingly demand beverages in one-way beverage containers or if consumers tend to purchase beverages in one-way beverage containers. Stabilisation or an increase in the currently declining refillable rate would therefore create positive framework conditions for SMEs in the beverage industry.

C 2.2.2.11 Implications for international competition

Indicator 32 – Implications for international competition (qualitative description)

Refillables	Participation in a refillable system is more difficult for foreign companies that also fill beverage containers abroad due to the required return logistics (apart from regional, cross-border trade such as Belgian beer in the German Rhineland). The reason for this is the long distribution distances rather than crossing borders. If transport routes are long, the refillable beverage packaging loses its ecological and economic advantages (see also Section B 1). Since distribution in refillable beverage packaging is not obligatory, the refillable system does not impair competition, however. This is confirmed by court decisions.[643]
One-way deposit	National system requirements may possibly cause higher costs with respect to one-way deposit systems and, consequently, make market access more difficult for importers. These costs include, in particular, the subsequent labelling of one-way beverage containers.[644] One-way deposit systems in general and the mandatory deposit system for one-way beverage containers in Germany, in particular, are compatible with European competition law according to relevant court decisions.[645] The European Commission published a guideline in 2009 which specifies the "*do's and don'ts*" connected with the introduction of a mandatory deposit. The Commission also explained that the member states are responsible for legal implementation and that the EU only reviews the respective draft bill with regard to legal conformity.[646]
One-way dual systems	As with the one-way deposit system, national regulations governing the return of non-deposit bearing beverage containers may make market entry more difficult. In Germany, for example, the duty to prepare a letter of completeness is a national feature. Dual systems or similar regulations have been implemented in many EU member states so that importers who import to Germany are not faced with entry barriers that impair competition.

National regulations governing both refillable beverage packaging as well as one-way beverage containers with and without a deposit generally involve a certain additional expense for importers. Consequently, imports from other countries always mean a certain expense for the importer. The EU aims at keeping this expense as low as possible with a view to promoting intra-Community trade. It was confirmed at European level, however, that ecologically motivated measures such as deposit systems or the specification of target ratios for refillable beverage packaging (if other forms of packaging are not generally forbidden) either do not violate competition law from the outset or present a justified intervention at least for ecological reasons. None of the systems examined within the course of this study result in unlawful competitive barriers.

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[643] Cf. EuCJ, C-463/01 and C.309-02 (see model description).
[644] Cf. Roland Berger, 2007, p. 41.
[645] Cf. Administratice Court Baden-Wuerttemberg, 21 August 2008.
[646] Cf. European Bodies and Institutions & European Commission, 2009, 2009/C 107/01.

C 2.2.2.12 Start-up difficulties

Indicator 33 – System-related start-up difficulties (qualitative description)

Refillables	Refillable systems in Germany have a long tradition. Today, start-up difficulties relating to modernisation of and adjustment to current developments are therefore of particular relevance. The focus here is on both the optimisation of processes and the introduction of new forms of bottles or crates for which the existing logistics need to be adapted and for which high circulation rates must be ensured. As already described under Section C 2.1.3.3, several individual bottles that reach high circulation rates were successfully introduced. Some of the standard refillable beverage containers made of glass such as the GDB-glass bottles or the VdF juice bottle have not been changed for 41 or 38 years. This fact confirms that a joint pool of many beverage producers (here 180 or over 400, respectively) makes decisions on system innovations difficult and this usually extends the innovation interval. Investment costs in such standard bottle pools are high and must be borne by all those involved. Cost savings make themselves felt only over a longer period of time as circulation rates increase (respecting the innovative capability of the refillable pool see page 284).
One-way deposit	The major start-up difficulties for the German one-way deposit system resulted from the initially introduced island solutions. The island solutions were a transitional solution that permitted distributors to limit the take-back of one-way beverage containers which they sold. The island solutions were necessary, inter alia, since large sections of trade and industry had not made sufficient preparations by the time the mandatory deposit entered into force on 1 January 2003. As a consequence, no comprehensive clearing system existed as at 1 January 2003. [647] The fact that consumers could not return deposit one-way beverage containers everywhere tied them more strongly to the individual retailer and also led to lower return rates.[648] The relatively low return rates at the beginning temporarily impaired the ecological targets of the Packaging Ordinance since, in the first years of the one-way deposit system, lower amounts of material were consigned to mono-fraction recycling. This problem was solved when the island solutions were discontinued and a nation-wide return and clearing system was established within the framework of the third amendment to the Packaging Ordinance. Return rates increased and presently stand at 94 % to 98.5 %.

[647] Interview with industry experts
[648] Interview with industry experts

Indicator 33 – System-related start-up difficulties (qualitative description)

One-way dual systems	The most significant start-up problem encountered by the dual system solution was (in addition to the initially not fully available sorting and processing techniques and secondary raw materials markets) the free riders. As the problem of free riders still affects the stability of the system and has not yet been appropriately solved, it is referred to in more detail on page 277. When collection through the DSD started, establishing an infrastructure from collation logistics through to the sorting facility and the recovery firm was problematic. Significant investments had to be made to this end in order to create the recovery capacities required for the collected packaging waste.

Refillable deposit systems require efficient return logistics. If a refillable system for beverage containers is newly introduced, this will be one of the central challenges to be coped with.

The facts presented here indicate that one-way deposit systems may encounter start-up difficulties which possibly prevent the achievement of high return rates due to a lack of comprehensible and consumer-oriented return options.

Establishing a collection, sorting and recovery infrastructure is a challenge for systems aimed at the return and disposal of non-deposit one-way beverage containers. An assessment of the dual systems shows that the start-up difficulties here are primarily associated with checking that manufacturers comply with licensing duties.

C 2.2.2.13 System stability

Indicator 34 – Raw materials price ratio: Primary raw materials relative to secondary materials, using PET as an example

Cross-system	
	Used PET single-useone-way deposit bottles (colour: clear) generated material revenues of € 190-225 per tonne (see page 238) in August 2009. At the same time, the price for one tonne of PET primary raw material was € 1,050 to € 1,200 per tonne.[649] In January 2011, used PET one-way deposit bottles (colour: clear) generated revenue of € 460-530 per tonne (see page 238). At the same time, the price for one tonne of PET primary raw material was € 1,500 to € 1,600 per tonne.[650] In this comparison it should be noted that used PET one-way beverage containers still need to be processed before they can be re-utilised as recyclate in bottles production. Due to the high amount of these processing costs, the total costs for used PET one-way deposit bottles are about as high as the price for PET primary raw materials. The price for one tonne of regrind including processing costs may amount to ca. € 1,200 according to information provided by the industry experts interviewed (depending on acquisition costs for used PET one-way deposit bottles).[651] High prices for PET new material may lead to bottle-to-bottle recycling of PET being more worthwhile. If prices are low, by contrast, it can be assumed that the processing of PET bottles to regrind may be less worthwhile for the manufacture of new PET bottles as new material can be acquired at comparable prices. In such a case, the PET secondary material will possibly rather tend to be used for open-loop recycling (usually downcycling), in particular in the textile industry.

[649] Cf. bvse, September 2009.
[650] Cf. bvse, February 2011.
[651] Interview with industry experts.

Indicator 35 – Qualitative description of other influencing factors regarding the stability of the system (e.g. depending on raw materials prices)

Refillables

The stability of the refillable system is currently impaired by the rising demand for one-way beverage containers (primarily made of PET) on the part of trade, in particular discounters, and also on part of the consumers (not least due to favourable product offers).

In addition to cost considerations, other factors also play a role in the increasing demand for one-way beverage containers:[652]

- Centralisation of trade (see p. 264 and p. 268)
- Trend towards individualised packaging and a high level of variation regarding beverage packaging sizes and forms (makes logistics more difficult and leads to slower innovation cycles respecting refillable packaging)

Declining refillable rates (see Section C 2.1.3.2) indicate that the stability of the German refillable systems concerning non-alcoholic beverages is at risk due to the factors mentioned above.

Stability is to be viewed from a system-internal and a system-external perspective. A refillable system with an efficient and established logistics structure such as that in Germany provides participants with a stable framework. The external influences on the system described above, in particular market developments with a tendency towards one-way beverage packaging, may jeopardise the system.

Internal stability can be ensured through cost-efficient system operation. Companies must buy bottles, but the pool logistics make cost-intensive inventory keeping unnecessary. The remaining system costs are borne by all those participating in the system. Well-balanced and systematic pool coordination is an urgent requirement, however, if all participants are to profit equally in the system and if the pool is to be kept in a good condition. As already described, refillable beverage packaging is attractive for smaller and regional producers, in particular. Conversion to one-way beverage filling, by contrast, may make market participation more difficult or even prevent it for small- and medium-sized companies due to the necessary high investment costs. (see also p. 261). [653]

[652] Partially derived from: ECOLAS, N. V. and PIRA, 2005, p. 214 and 215.
[653] Cf. Sundermann, D., 20.10.2009.

Indicator 35 – Qualitative description of other influencing factors regarding the stability of the system (e.g. depending on raw materials prices)

One-way deposit	A one-way deposit system is efficient only when high return rates can be achieved. As described on p. 269, inadequate return rates were achieved before the island solutions were discontinued (whereby the one-way deposit system then also generated clearly higher return rates than before in the dual system). Due to abolition of the island solutions, return rates attained a stable and high level (94 % to 98.5 %). Overall, the one-way deposit system in Germany is to be regarded as stable. Factors that nevertheless may impair stability relate to applying a deposit inconsistently to only some segments and fluctuating prices for secondary raw materials (see p. 238). The generally higher revenues from the sale of secondary material due to higher marketability of the recyclate - compared to recyclate from the dual systems - may impact positively on the stability of the system.

Indicator 35 – Qualitative description of other influencing factors regarding the stability of the system (e.g. depending on raw materials prices)

One-way dual systems	The dual systems are financed on the basis of participation fees and revenues from secondary raw materials. The fees are calculated from the cost for collection, sorting, processing and marketing materials fractions. These license fees are based on the assumed quantity to be put into circulation (to be collected) that is stated by the respective producer upon licensing. If manufacturers that are obliged to obtain a license do not do so (or not to the full extent), this leads to a financing gap as non-licensed packaging is collected anyway and this causes costs that cannot be calculated. In 2009, the quantity of non-licensed packaging (free riders) was high enough to put the financing of the dual system organisations and, consequently, the stability of the total system at risk (ca. 25 %, see Section C 2.3.2.5). The problem was to be eliminated by the duty to issue a letter of completeness and discontinuation of the island solutions through the 5th amendment to the Packaging Ordinance. The free rider problem is dealt with further on p. 291. The marketability of secondary raw materials from collections of the dual systems can be impaired as a result of impurities in mixed collection. (see p. 238). Whether or not this is the case depends on the intended use of the secondary raw material and the associated required quality (e.g. pure material flows are necessary for bottle-to-bottle recycling). Strongly fluctuating secondary raw material prices may lead to temporary storage of material that can no longer be marketed and, in this context, even to an emergency regarding disposal.[654]

The stability of the refillable system is currently impaired by external market factors, mainly by increased demand on the part of retailers (with the exception of beverage retailers) for one-way beverage packaging. The one-way deposit system is currently stable and used, PET one-way beverage containers from the one-way deposit system generate high revenues on the secondary materials market. While there are some reports about illegal non-deposit bearing beverage containers, the respective quantities are negligible, however.

In comparison, the dual systems are endangered through free riders, in particular. This problem impacts the stability of the entire system. The issue of free riders is dealt with in more detail under the impact category, System Misuse (see p. 289).

The profitability of the collection and recovery of certain material flows is subject to strong fluctuations, in particular respecting individual or mixed fractions from plastics (and PET bottles of low quality). Depending on the revenues from the sale of secondary material, license fees in the dual systems must be adapted, i.e. they may have to be increased if only low revenues are generated from the sale of secondary material in order to ensure that the system can be financed.

[654] Cf. European Environment and Packaging Law, 25.09.2009, p. 4; European Environment and Packaging Law, 09.12.2009, p. 6 f.

C 2.2.2.14 Interim conclusion concerning economic impact categories

The analysis indicates that structural factors, in particular, affect the economic factors of beverage packaging systems. In all, from a cost and competition view, a refillable deposit system appears to be advantageous for small, regional enterprises and beverage retailers. On the other hand, larger (centralised) companies and food retailers, in particular discounters, seem to profit more from one-way beverage packaging systems. The current competitive situation and market developments indicate a tendency towards the use of one-way beverage packaging.

A comparison of return systems for one-way beverage containers - single- use deposit systems and dual systems - indicates that no generalised statements regarding which is the more cost-intensive system can be made. While earlier analyses arrived at the conclusion that the deposit system causes higher costs when compared to the dual systems, current data show that, taking costs and revenues into account, there is a tendency towards cost neutrality or even profit potential respecting one-way deposit systems. Overall, the one-way deposit system enables more targeted sorting and collection of packaging waste (in particular of PET bottles) when compared to the dual systems, and that this leads to an increase in revenue potential. In addition, a one-way deposit system does not incur costs for sorting and processing the beverage containers after being returned by the consumers, and process costs for the recycling companies will probably decline due to mono-fraction collection. Moreover, beverage producers and retailers can generate revenues directly from the one-way deposit system.

The analysis of market factors showed that refillable systems tend to be beneficial for small and regional beverage producers or beverage retailers, in particular. The refillable system impacts positively on these companies' competitiveness, whereas one-way beverage packaging tends to be used by large companies, in particular (frequently with centralised bottling plants). Here, too, there are exceptions however, as is indicated by the situation on the beer market where large breweries also use refillable bottles. The stability of the refillable systems is jeopardised due to current market developments, in particular, in the mineral water, soft drinks and fruit juice market, where an increasing tendency towards one-way beverage containers is observed.

C 2.3 Social impact categories

C 2.3.1 Selected challenges in connection with social impact categories

When assessing the social impact categories, some specific characteristics become apparent. The most significant of these features are dealt with below prior to conducting a detailed assessment.

Complexity of interdependencies

The influence of beverage packaging return systems and beverage packaging on the population and society arises from a complex mix of interdependencies. For this reason, social impacts are difficult to determine and they also cannot always be delimitated and clearly allocated to the assessed correlation.

The definition of indicators in order to describe positive or negative social influences likewise involves difficulties. In the ecological assessment through life-cycle assessments, defined and roughly quantifiable negative effects on the environment that are caused by the systems reviewed are compared. The social factors, by contrast, generally concern multi-variants and, frequently, qualitative data. Therefore, the assessment and measurement of social impacts on the basis of individual indicators is always prone to uncertainties.

Intransparency

Reference to the complexity of impact correlations is frequently given as a reason for justifying that an assessment of social impacts is negligible. Consequently, as in the economic impact categories, such effects are seldom addressed in public discussions or they are referred to as a side issue.

In addition, there is a lack of data and reliable surveys on impact correlations. Acquisition of the few reliable and sound data requires great efforts and this makes fact-based, targeted examination and decision-making difficult for the legislator; it also makes objective discussion among stakeholders difficult.

However, not taking social impacts into consideration leads to an incomplete, overall assessment. We found, for example, that the various beverage packaging return systems differ in their impact on employment. Market trends that give preference to systems in one or the other direction have a respective medium- to long-term effect on the regional employment situation affected by them.

Sustainability targets relative to the behaviour of society and the individual

Within the scope of the assessment, it is important to pay attention to the difference between declared disposition and the actual behaviour of individuals and groups. For instance, an appropriately informed group of persons considers behaviour that is advantageous in terms of sustainability aspects to be expedient. The actual behaviour of the individual, for example when making a purchase decision, may deviate in practice from the willingness declared, however.

Also, disposition in favour of or against certain behaviour is subject to trends and fashions. If, for example, a certain behaviour pattern aimed at sustainability is widely accepted in society, groups of individuals tend to behave accordingly.

A reliable survey of social interdependencies must therefore examine not only attitudes and the information provided but also the gap between the stated and actual behaviour. Dissolution of the current intransparency is a significant prerequisite to this end.

C 2.3.2 Detailed assessment of impact categories

C 2.3.2.1 Product diversity

Indicator 36 – Number of beverage producers per one million inhabitants

All systems	
	Inhabitants in Germany 2008: ca. 82 million[655] Mineral water 2008: • Number of soft drinks and mineral water producers: 211[656] • Number of producers per million residents: 2.6 • Average output quantity: 108.4 million litres • Refillable rate: 45.8 % Fruit juices 2008: • Number of fruit juice producers: 410[657] • Number of fruit juice producers per million inhabitants: 5 • Average output quantity: 10.0 million litres • Refillable rate: 8.0 % Beer 2008: • Number of breweries: 1,319[658] • Number of beer producers per million inhabitants: 16 • Average output quantity: 6.8 million litres • Refillable rate: 87.8 %

Product diversity is determined by the number of available product selection options. Prerequisite is a large number of different beverage producers. While large companies are also able to maintain

[655] Cf. Destatis website, *Bevölkerungsstand*.
[656] Cf. VDM website, indicators.
[657] Cf. VdF website, German fruit juice industry in figures.
[658] Cf. Deutscher Brauer-Bund, 2009, p. 3.

several brands and sub-brands on the basis of one structure, their number is limited by economic considerations. Many individual beverage producers generally lead to greater product diversity.

This is very apparent in the beer segment in Germany, which is characterised by extraordinary broad product diversity provided by many medium-sized beverage producers.

It can therefore be assumed that a declining number of beverage producers also leads to lower product diversity and, vice versa. Favourable framework conditions that permit market access for small and medium-sized beverage producers, such as promoting and supporting refillable packaging, therefore have a positive impact on product diversity.

Even if the data do not indicate any clear correlations, some interrelations are interesting such as the average output quantity relative to the refillable rate. In the beer market, the average quantity produced per year is relatively low at 6.8 million litres, and the RU rate is high at 87.8 %. The situation is quite different in the water and soft drink beverage market where the average production quantity is high at 108.4 million litres, whereas the refillable rate has been falling for years. This confirms a tendency towards one-way bottling and mass production, which may lead to a decline in product variety over the medium to long term.

Indicator 37 – Qualitative description of product diversity

Refillables	Due to their specific structure (lower filling volume, limited possibilities to invest in large, one-way bottling plants, etc.), smaller beverage producers usually have to depend on participating in (available) refillable systems (see also Section C 2.2.2.10). SMEs are mainly regionally oriented. Supporting SMEs through the promotion of refillable systems would also increase product diversity.[659] Within the scope of the industry survey[660] it was additionally stressed that, at present, beverages in refillable beverage containers are mainly positioned in the quality or premium segment, at least as far as the mineral water and non-alcoholic soft drinks segments are concerned. The quality and premium products offered increase product diversity. PET refillable bottles are suitable for juices only to a limited extent due to their comparably poor barrier properties (e.g. taking on the taste of the beverage), and therefore tend to be used in the mineral water market. The cleaning of PET refillable bottles is more expensive than that of glass bottles.
One-way deposit	One-way beverage packaging is generally more advantageous for LCs due to the larger filling volumes. On the other hand, supply diversity is not directly promoted as there are generally fewer LCs. Even if LCs produce more brands it cannot be expected that they will achieve the brand variety that is given by a large number of small- and medium-sized producers. Here, this refers to mass filling into PET one-way bottles that is mainly aimed at price minimisation. Compared to refillable systems, one-way beverage containers are more flexible with respect to form, design and size. As a result, containers can be more easily adapted to changing consumer requirements respecting packaging.
One-way dual systems	See one-way deposit system

Product diversity means that a differentiated selection of various beverage brands and sorts is available to the consumer. Two aspects play a role here: The variety of beverages produced and the variety of used beverage containers.

A broad range of products provides consumers with increased possibilities respecting beverage purchases, and this is generally assessed as very positive by consumers. Price-determined and frequently centralised mass filling into one-way beverage containers is not suitable for a broad range of products as alternating between filling processes among the various types of beverages at the large bot-

[659] Cf. Stenum and Hauer, 2000, p. 4.
[660] Interview with industry experts.

tling plants necessary would require excessively high changeover times. In addition, many brand beverage producers and niche companies prefer refillable beverage containers made of glass due to the higher quality of this packaging. Based on these considerations, refillable systems impact positively on product diversity. The distribution channels for crate-based deposit one-way PET bottles (with a specific take-back and material recycling system) are similar to those for refillable systems. The mainly regional orientation of these markets requires higher product diversity.

With respect to packaging design and the individual weight of packaging, one-way beverage containers can be individualised and adjusted to consumer needs more quickly than refillable bottles as they need not be integrated into a pool system. The individualisation of refillable beverage containers contributes to compensating for their disadvantage in this respect. It must be ensured in this context, however, that high circulation rates are realised and that sorting and transport can be efficiently organised. In practice, there are some examples of successfully implemented refillable systems with individual bottles.

C 2.3.2.2 Excursus: Innovations concerning refillable systems

Refillable systems face the challenge of realising expedient innovation cycles. On the one hand, changing market conditions (e.g. changed requirements of trade), (environmental-) technological developments and consumers' convenience requirements (e.g. easy-to-carry crates, ability to reseal containers) must be accounted for. On the other hand, renewing a pool involves high ecological and economic efforts. The following innovations have already been implemented with respect to:

- Packaging material (e.g. through introduction of the PET refillable bottle of GDB)
- Container size (e.g. introduction of a 1.0 litre glass refillable bottle by Gerolsteiner Brunnen GmbH und Co. KG and Hornberger Lebensquell GmbH as well as plans developed by GDB to launch a new weight and logistics optimised 0.75 litre refillable glass bottle instead of the 0.7 litre bottle)
- Beverage crates (e.g. the launching of weight- and logistics-optimised beverage crates by RheinfelsQuellen H. Hövelmann GmbH und Co. KG and GDB as well as introduction of new, smaller crates or new crate forms with a carrying handle for 6 , 9, 11 or 12 bottles in various beverage segments)
- Consumer requirements (e.g. introduction of the Logipack system with logistically optimised possibilities to offer refillable bottles in six-packs, which are increasingly being demanded by consumers (6 x 0.33 litres or 6 x 0.5 litres))
- Bottle weight (e.g. introduction of a weight- and logistics-optimised 0.2 litre refillable glass bottle for fruit juices in the restaurant and catering segment by Schlör Bodensee Fruchtsaft AG or the already cited draft bottle of GDB)

These forms of packaging could achieve even higher ecological and, possibly, also economic advantages and even better comply with consumers' convenience requirements through innovative renewal of the bottle pool for refillable glass containers. However, a high circulation rate must be ensured as this is a significant criterion respecting ecological advantageousness and it also increases economic efficiency.

C 2.3.2.3 Product price

Indicator 38 – Medium beverage price

Refillables	A cost analysis of refillable systems indicated that using refillable beverage containers may reduce total costs. This may also lead to lower product prices. As already repeatedly mentioned, brand and premium beverages in refillable beverage containers are currently frequently offered. In these cases, higher prices that are associated with the product and not with packaging, however, are to be expected for beverages in refillable beverage containers. For this reason, the difference in the price of beverages in refillable beverage containers and beverages in one-way beverage containers is probably more strongly influenced by factors other than the price of the container.
One-way deposit	Here, analogous to the comments on refillable beverage packaging, the product price is influenced by a variety of factors. According to information provided by some industry experts, trading companies that are strongly price-oriented, in particular discounters that usually sell beverages in one-way beverage containers, are making efforts to reduce the cost of beverages. These beverages in one-way beverage containers are therefore offered at very low prices. One of the industry experts stated that the profit margins from filling are usually low for beverage producers that sell beverages in one-way beverage containers to discounters. As described under Sections C 2.2.2.1 and C 2.2.2.4, the information provided respecting the costs of introducing a mandatory deposit vary strongly. If system revenues cover the costs, no additional costs that would be passed on to consumers are incurred.

Indicator 38 –Average beverage price

One-way dual systems	It is assumed that the license fees to be paid by beverage producers to the dual systems (for collection, sorting and recovery of their beverage packaging) are included in the price either fully or in part and are set off in the supply chain. The structural differences between refillable and one-way filling have already been described. A comparison between beverage packaging with and without a deposit is not possible as the beverages filled into the containers originate from different segments. Likewise, it is not possible to compare the situation prior to introduction of the mandatory deposit (including the respective structural framework conditions) with the current competitive environment.

The product price is mainly determined by the market strategies of individual market operators and is only indirectly associated with the beverage packaging used. If the strategy is oriented towards high sales volumes, economies of scale can generally be achieved and the beverages can be offered at lower prices. It should be noted that this strategy is frequently selected by market operators that offer their products in one-way beverage containers. Higher product prices are frequently a consequence of strategies focused on the sale of brand and premium products. Refillable beverage containers are frequently used in the context of this strategic orientation. Refillable beverage containers are also used by small- and medium-sized regional beverage producers that offer products in both the upper price range and also in the medium to lower price range.

C 2.3.2.4 Employment

Indicator 39 – Number of employees working in the packaging return system per 1,000,000 litres of beverage

All systems

Beverage type	**Filling volume 2000[661] in m. l**	**Employees[662] 2000**	**Employee per 1 m. l beverage 2000**
Water and soft drinks	17,261.3	25.103[663]	1.45
Fruit juices	4,141.8	7.066[664]	1.71
Beer	10,184.3	37.818[665]	3.71

Beverage type	**Filling volume 2000[666] in m. l**	**Employees 2008 (beer 2007)[667]**	**Employee per 1 m. l beverage 2008**
Water and soft drinks	22,870.4	23,232[668]	1.02
Fruit juices	4,096.5	7,500[669]	1.83
Beer	9,082.0	30,953[670]	3.41

Analysis, see p. 287

[661] Canadean, 2010 (PwC analysis of Canadean data).
[662] Data refers to employees at beverage producers.
[663] NGG, 2009, p. 3.
[664] PwC, Internal market report based, inter alia, on data of the German Statistical Office.
[665] Deutscher Brauer-Bund, 2009, p. 20.
[666] Canadean, 2010 (PwC analysis of Canadean data).
[667] Data refers to employees at beverage producers.
[668] NGG, 2009, p. 3.
[669] VdF website, *Deutsche Fruchtsaft-Industrie in Zahlen*.
[670] Deutscher Brauer-Bund, 2009, p. 20.

Indicator 39 – Number of employees working in the packaging return system per 1,000,000 litres of beverage

Refillables

According to a presentation by Bundesverband des Deutschen Getränkefachgroßhandels e. V., bottling plants for refillable bottles require 1.47 employees (in FTE = full time equivalents) per 1,000,000 litres of mineral water sold.[671]

Based on the weighting of the findings from industry interviews, the perusal of business reports and studies on the issue of beverage packaging, beverage production needed an estimated average of 1.25 employees per 1 million litre filling volume. This value reflects an indicative general average. Administrative staff is included in some cases; production processes may vary, irrespective of the beverage packaging. The data are not sufficient to achieve representative statistical coverage, however.

For further analysis of the data, see p. 287.

As the beverage wholesale trade and beverage take-away markets are closely connected with beverages sold in refillable containers, more than 3,000 beverage wholesalers with more than 54,000 employees in Germany are to be included in the assessment of the effects of refillable systems on employment.[672]

According to a study carried out for the EU Commission in 1998, 27,000 new jobs can be created in Germany through the increased use of refillable beverage packaging, and, on the other hand, 53,000 jobs would be lost if one-way beverage containers were to be used instead of refillable beverage containers.[673] This analysis is possibly out of date. Overall, it is also recommended in this context that a new, comprehensive and objective study on employment effects is to be carried out.

[671] Cf. Guder, G., 2009, p. 5.
[672] Interview with industry experts.
[673] Cf. Golding, A. 1998, p. 72.

Indicator 39 – Number of employees working in the packaging return system per 1,000,000 litres of beverage

One-way deposit

According to a survey carried out by the Bundesverband des Deutschen Getränkefach-großhandels e. V., one-way bottling plants require 0.27 employees (in FTE = full time equivalents) per 1,000,000 litres of mineral water sold.[674]

If estimated equivalent to the refillable bottling plants, the estimated indicative average value for bottling in one-way beverage containers results in 0.7 employees per one million litres of filling volume.

For further data analysis, see p. 287.

This data applies to PET or glass one-way bottling plants. Differentiated data on the filling of beverage cans is not available.

An analysis performed by Prognos indicated the following effects on employment as a result of the introduction of the one-way deposit in Germany:[675]

- Beverage producers (beer): - 600 (drop in demand[676])
- Beverage can industry: - 2,100
- Beverage container made of glass: - 800
- Plastic beverage container: + 2,000
- Beverage cartons: + 500
- Wholesale/retail: + 10,500
- Finance sector: + 300
- Mechanical engineering: + 2,300
- Waste industry: + 400

This resulted in a net increase of 12,500 jobs due to the introduction of a deposit system for one-way beverage packaging. The largest additional personnel requirement was due to the return obligation respecting deposit one-way beverage containers in the wholesale/retail trade. Containers can be returned either automatically or manually. The higher the proportion of automatic return, the lower the additional personnel requirement.

[674] Cf. Guder, G., 2009, p. 5.
[675] Cf. Prognos, 2007, p. 12 and p. 13.
[676] It is doubtful whether the drop in demand in the beer market has a causal connection with the depoit system. According to GVM, the decline is compensted for by an increased demand for non-alcoholic soft drinks (Cf. GVM, 2009 b, p. 23). It is unclear whether this growth was taken into account in the Prognos study.

Indicator 39 – Number of employees working in the packaging return system per 1,000,000 litres of beverage

One-way dual systems	With respect to PET filling, see our comments on the deposit system for one-way beverage containers. No analysable data was available regarding the filling of beverage cartons. Current data concerning effects on employment is not available. Estimates from the period when the DSD was established cannot be directly allocated to beverage packaging. In addition, many processes, in particular sorting processes which were initially carried out manually are now automated.[677] At that time, the DSD published the figure of ca. 17,000 newly created jobs. This figure is probably significantly lower today due to automation, and only a minor proportion of it is attributable to beverage packaging.

The following developments can be derived from the calculations on p. 284:

Mineral water/soft drinks market:

- Increasing filling volume from 2000 to 2008 and shrinking number of employees accompanied by declining refillable rates.
- Fewer employees per filling volume compared to the beer market with a lower refillable rate than in the beer market.

Fruit juices:

- Declining filling volume from 2000 to 2008 and increasing number of employees accompanied by a decline in the refillable rate;
- Fewer employees per filling volume compared to the beer market with a lower refillable rate than in the beer market

Beer market:

- Declining filling volume from 2000 to 2008 and shrinking number of employees with an overall increase in the refillable rate during this period
- In a segment comparison, highest employee /filling volume rate and, at the same time, the highest refillable rate.

An evaluation of this data should take into account that no statistically valid causal connection can be presented. With respect to the mineral water market, the data confirm the tendency of the estimated relationship of filling volume and employees for bottling in refillable bottles (more jobs) and bottling in one-way PET beverage containers (fewer jobs).

[677] Interview with industry experts.

Taking all studies and the findings of industry interviews into account, it can be concluded that refillable systems create additional jobs due to the additional requirements placed on sorting and logistics, whereas one-way filling is more strongly automated in comparison. Conversion from reuse filling to one-way filling leads to a corresponding reduction in workplaces.

Based on a system comparison it is to be assumed that all systems create jobs, but to varying extents. The evaluation of data and studies indicates that the effect on employment is strongest in refillable systems, in particular when taking into account the integration of the beverage wholesale trade.

C 2.3.2.5 System misuse

Indicator 40 – Number of violations

Refillables	No violations of regulations governing the refillable pools became known in the course of the study.
One-way deposit	At present there is no reliable information on the number of violations of the deposit obligation. A random sample carried out by Deutsche Umwelthilfe at kiosks and snack bars and at wholesalers indicated that some deposit beverage cans were sold without a deposit.[678] The absolute number and proportion of deposit beverage packaging brought into circulation is not known.
One-way dual systems	In 2009, ca. 26 % of all packaging (not only beverage containers) subject to licensing was not licensed.[679] Further differentiated data was not available. It is assumed that such illegal non-licensing practice also occurs in the beverage packaging segment.

Current data that clearly relates to beverage packaging regarding violations of the systems under review could not be determined. Violations become apparent due to the control structure of the system environment. A more in-depth assessment of the control and enforcement structures was not a subject of this study. However, a violation rate of 26 % in the dual systems indicates that the control and enforcement structures in this area should be further improved in order to counteract the problem of free riders.

This free rider problem is caused, among other things, by the large number of material flows collected by the dual systems. Generally, the collection of many material flows is an advantage of the dual systems but both the efficiency and control of such a complex system are very challenging.

[678] Cf. Der Spiegel, 4 August 2009.
[679] Cf. Vielhaber, J., 2009, p. 4.

Indicator 41 – Ratio of incorrectly disposed of items

Refillables	No reliable, quantitative data is known; see also the comments on one-way systems.
One-way deposit	No reliable, quantitative data available. In some very isolated cases, manipulation and deception due to copies of deposit bar codes or payment of the refillable deposit for one-way containers occurred.[680] These incidences are negligible, however given the total amount of deposit one-way beverage containers (see p. 155).
One-way dual systems	The ratio of incorrectly disposed of non-packaging items in the collection containers of dual systems or of packaging in the waste containers of the municipal waste disposal may amount to up to 50 %, in particular in big cities. In rural regions, too, large proportions of waste material are found in the grey residual waste bin (the yellow bin is for sales packaging made of metal, synthetics and composites).[681] According to BMU, the average proportion of recyclable packaging in residual waste is between 15 to 50 %.[682] Packaging that is incorrectly disposed of in residual waste leads to low collection rates within the scope of the dual systems. The incorrect disposal of residual waste in recyclable collection (yellow bin or yellow bag) leads to lower quality when the collected packaging is recycled. Here, too, no specific statements can be made concerning the beverage packaging segment.

In the system misuse category, the refillable system is generally the least susceptible as beverage producers are interested in having their bottles returned and therefore usually have an appropriately functioning logistics system.

In the one-way deposit system, introduction of the bar code and the obligatory printing of the DPG symbol reduce the possibilities for misuse. These control mechanisms were circumvented in some cases in the past.

Dual systems are most susceptible to system misuse as the high quantity and diversity of material flows, the large number of stakeholders and also the slight possibilities to exert control lead to a lower level of transparency. While a reverse vending machine usually only accepts registered packag-

680 Cf. Dierig, C., 24.08.2008; Focus online, 30 October 2006.
681 Cf. Keßler, H., Dipl.-Ing. (FH) et al., 2006, p. 6.
682 Cf. Rummler, T., Dr., 2009, p. 4.

ing, it is almost impossible to exert similar control over dual systems. In practice, consumers cannot clearly differentiate between unlawful, unlicensed packaging and licensed packaging. Correspondingly, the total quantity of material sorted by the consumer, including incorrectly disposed of items, is collected by the operators of dual systems.

C 2.3.2.6 Extended producer responsibility and consumer behaviour

Indicator 42 – Quantity of packaging waste in tonnes per 1,000,000 litres of beverage

Refillables

When assessing the volume of packaging waste from refillable beverage packaging, not only the respective packaging weight but also the reject rate is relevant as the individual containers are used several times. Only these rejects are actual waste.

	Filling volume in m. l[683]	Weight filling volume in t.[684]	Waste volume in t. per 1 m. l filling volume
Glass	10,002	249,400	24.9
PET	5,964	7,700	1.3

Analysis, see following page.

One-way deposit

	Filling volume in m. l[685]	Weight filling volume in t.	Waste volume in t. per 1 m. l filling volume
PET (deposit bearing) – Basic scenario[686]	11,483	317,300	27.6
PET (deposit bearing) – sensitivity scenario[687]	11,483	356,300	31.0
Cans (steel and aluminium)[688]	494	26,800	54.25
Glass (deposit bearing)[689]	172	90,500	526.2

Analysis, see following page.

683 Canadean, 2010 (PwC analysis of Canadean data).
684 See p. 241 and 242.
685 Canadean, 2010 (PwC analysis of Canadean data).
686 See p. 243, Basic scenario: lower packaging weight for 0.5 l, 1.0 l and 1.5 l, used in IFEU studies.
687 See p. 244, Sensitivity scenario: higher packaging weight for 0.5 l, 1.0 l and 1.5 l, weighted by DUH.
688 See p. 245.
689 See p. 245.

Indicator 42 – Material packaging volume in tonnes per 1,000,000 litres of beverage

One-way dual systems

	Filling volume in m. l[690]	Weight waste volume in t.	Waste volume in t. per 1 m. l filling volume
PET (no deposit)[691]	1,825	75,400	41.3
Beverage carton – scenario 1[692]	2,140	66,500	31.1
Beverage carton – scenario 2[693]	2,140	73,300	34.3

Analysis, see below.

The data shown above indicate that the beverage packaging waste volume in refillable systems is reduced both with respect to the one-way deposit system and the dual systems. This applies to both the assessment of individual packaging material and the comparison of various packaging materials.

The waste volume arising from refillable glass bottles per million litre filling volume is lower than the waste volume arising from one-way glass bottles per one million litres of filling volume. This corresponds to the relation of PET refillable bottles to PET one-way bottles.

It is interesting that, compared to glass and PET refillable bottles, the significantly lighter cans produce a significantly higher filling volume (almost twice as much as glass refillables and thirty times that of PET refillables) per million litres of filled beverage volume. Likewise, a comparison of the packaging waste volume of PET one-way beverage containers that is disposed of via dual systems with the waste volume arising from refillable beverage containers results in a higher waste volume from PET one-way beverage containers relative to the filling volume. In a comparison of bevarage cartons with glass-refillable beverage containers, less waste volume per one million litre of filling volume is produced by glass-refillable beverage containers. In comparison with PET refillable bottles, the weight of beverage cartons is 15 to 18 times higher per one million litres of filling volume.

[690] Canadean, 2010 (PwC analysis of Canadean data).
[691] See p. 243.
[692] See p. 242, Basic scenario.
[693] See p 242, Sensitivity scenario.

Indicator 43 – Expense for information campaigns

Refillables	The total expense for all information campaigns is not known. Campaigns and PR work for refillable systems carried out in Germany between 2007 and 2010: • "Refillables are Climate Protection" ["Mehrweg ist Klimaschutz“] of the Mehrweg Allianz (2007 to 2010) • Preparation of information material for wholesale and retail by Arbeitskreis Mehrweg (2007–2010)[694] • "First Choice, Regional" [“1. Wahl regional” – annual campaign of beverage wholesalers (BWST) • "Juice Loves Glass" ["Saft liebt Glas“] of the Verband der Baden-Württembergischen Fruchtsaft-Industrie e. V. (Start 2009)[695] • Refilables Innovation Award of the DUH/Stiftung Initiative Mehrweg (SIM) (2007 to 2010) • Refillables Movie Award of DUH/SIM (2007 to 2010) • Publication of good examples of refillable packaging by DUH (2008 to 2009)
One-way deposit	The total expense for all information campaigns is not known. In the years 2001 to 2003, prior to introduction of the deposit system, the BMU spent € 570,346 on ads that provided information on the introduction of the mandatory deposit system for one-way beverage packaging.[696] To date, no nation-wide consumer information campaign has been carried out following introduction of the one-way deposit, and the DPG or its shareholders have also not started such a campaign. This may be one of the reasons why consumers are frequently unaware of the significance of the DPG logo on one-way deposit containers.[697]

[694] Cf. Arbeitskreis-Mehrweg-Webseite, *Mehrweg – Ein Zeichen setzen für die Umwelt*.
[695] Cf. Verband-der-Baden-Württembergischen-Fruchtsaft-Industrie-e. V. website, *Saft liebt Glas*.
[696] Cf. BMU, 2005, p. 2.
[697] Interview with industry experts.

Indicator 43 – Expense for information campaigns

One-way dual systems	
	The current total expense for information campaigns is not known. In 1999, the DSD spent about € 42 million on "other costs" which include R&D and communication costs.[698] Clear allocation of these costs was not possible. Industry experts informed us that the budget planned for communication costs prior to discontinuation of the DSD monopoly was ca. € 25 million per year.

The current total expenses spent on information campaigns are not clearly determinable for all systems reviewed. According to information and research, however, a decline in information campaign expenses is assumed in the field of dual systems, in particular.

In the field of dual systems, respective budgets have been prepared. The operators of dual systems are obliged to pay auxiliary fees (an average of € 1.57 per resident[699], which would result in ca. € 130 million Germany-wide) to the municipalities, which is then used to the benefit of consumer information. The extent to which these funds are actually spent on information campaigns other than, for example, the production and distribution of waste calendars, cannot be clearly estimated.

Frequently, aspects of extended product responsibility are discussed only with respect to financing. Both the one-way deposit system and the dual systems were established in order to comply with the extended producer responsibility concept. Due to taking on the responsibility for systems financing and attaining higher recycling and recovery rates, compared to a situation where no return system is in place, this principle is complied with. In comparison to refillable systems, however, refillable beverage containers are a more consistent approach towards the principle of extended product responsibility as both materials responsibility and financial responsibility are included. Due to the refilling of refillable bottles, producers ensure the longest possible use of the bottles and, in so doing, contribute to waste prevention, the highest level in the waste hierarchy. The system contributes to transparency due to the closed substance cycle, and the producers are directly responsible for the entire life cycle. The responsibility of producers within the scope of the one-way deposit system and the dual systems is reflected in participation in the system and payment of the respective contributions. Responsibility for the disposal of packaging is assumed by other stakeholders.

[698] Cf. ARGUS, 2001, Annex I, Germany, p. 13.
[699] Interview with industry experts.

C 2.3.2.7 Littering

Indicator 44 – Littering

All systems	The various systems for filling and returning beverage containers impact on the quantitative littering volume to varying degrees (for detailed comments, see Section C 2.1.3.9). Consumers' littering behaviour is significantly affected by the deposit incentive provided by a system, but not by this alone. Personal ecological attitudes and values and a willingness to act in compliance with these also affect the quantity of beverage packaging thrown away carelessly. Other aspects that lead to a reduction in the littering volume include value-oriented education, the personal environment and the role model provided by other persons. It was not possible to determine current data on the specific littering volume of beverage containers within the scope of this study.

Collection- and recycling systems for beverage containers are suitable only to a limited extent for motivating consumers to behave in an environmentally-friendly manner. The system providing financial impetus to return packaging (through a deposit) also leads to reducing littering even if no general environmental awareness is created, however.

Deposit systems are aimed at motivating consumers to avoid littering through providing a financial incentive. At present, consumers return 96-99% of correctly sorted deposit beverage containers to retailers. Deposit systems (for reuse- and one-way beverage packaging) contribute to freeing the environment of waste, which increases the quality of life. Dual systems do not have similar positive effects in this respect. Deposit systems for beverage packaging can only reduce the littering of beverage containers but cannot exert an influence on littering involving other packaging. Voluntary environmentally-friendly behaviour is rather determined by other influencing factors, in particular those from the personal environment.

The possibilities to communicate the complex information about the impact of their own actions to consumers are limited. It is therefore essential to show consumers the ecological effects of beverage packaging collection and recycling systems in a transparent manner that is easy to understand. Likewise, the legal requirements must also be designed in an understandable, binding and clear manner for stakeholders and in a comprehensible fashion for consumers.

C 2.3.3 Interim conclusion – social impact categories

Consumers generally benefit from a broad product range. The various beverage packaging return systems impact on product diversity to varying degrees. Price-determined mass filling into one-way beverage containers does not appear suitable for offering a great variety of products as this would require excessively high changeover time. Brand suppliers and niche companies fill their products into refillable beverage containers due to the higher quality of the packaging. Moreover, refillable systems (and, in part, crate-based PET deposit one-way bottles with a specific take-back and material recycling system) simplify or facilitate market entry for small- and medium-sized regionally operating beverage producers and, consequently, impact positively on product diversity. One-way beverage containers, by contrast, are more flexible in terms of form, design and size.

When assessing the social impacts on system participants, the additional requirements for filling, sorting and logistics within the scope of a refillable system create additional jobs, whereas the filling in one-way containers is largely automated. Correspondingly, the conversion of filling in reuse-bottles to filling in one-way containers would lead to a reduction in jobs.

In the category, system misuse, the refillable system is generally the least susceptible to misuse as beverage producers are interested in having their bottles returned and therefore ensure that functioning logistic are in place. In the deposit one-way system, the introduction of bar codes and the obligatory DPG logo reduce the possibilities for misuse. In isolated cases, control mechanisms have been circumvented in the past. The dual systems are the most susceptible to misuse as the quantity and diversity of the large materials flow and the large number of stakeholders make transparency and control difficult.

With respect to the impact of information campaigns on individual behavioural patterns, the possibilities are limited. It is important to demonstrate the ecological impacts of beverage packaging collection and recycling to consumers in a transparent and understandable manner. Likewise, the legal requirements should be designed in an understandable, binding and clear manner for the stakeholders and should be comprehensible for the consumers (exceptions from the deposit duty reduce comprehensibility, for example.)

C 2.4 Overall conclusion

Analysis has shown that beverage packaging systems are subject to a variety of factors that interact in a complex manner and which have an influence on the respective impacts. The evaluation indicates that, in the evaluation of life cycle assessment, the underlying assumptions must also be taken into account and analysed in order to arrive at realistic findings concerning the ecological advantages of packaging. It also became apparent that aspects such as recycling quality and closed material recycling must be examined in more detail and must be included in the assessment of systems if a sustainable assessment is to be reached. Given realistic assumptions (in particular concerning distribution distances and circulation rates), refillable systems are more ecologically advantageous than one-way beverage containers. Refillable systems can present efficient solutions for beverage producers and beverage retailers.

Refillable systems enable SMEs to operate in a cost-efficient and ecologically advantageous manner, particularly in regional and, under certain conditions also in cross-regional markets. Moreover, they impact positively on social factors such as product diversity and employment, and they realise the principle of extended product responsibility (financial responsibility, material responsibility and responsibility for a functioning overall system). For these reasons, the promotion of efficiently functioning refillable systems is a worthwile approach for a sustainable economy.

One-way beverage packaging systems are more flexible and transport-optimised than refillable systems, and can therefore faster be adapted to market changes or changes in consumer habits. Compared to refillable beverage containers, one-way beverage containers are frequently offered in smaller packaging entities (e.g. 6 x 1.5 litres of mineral water in shrink wrap) without a beverage crate which, due to the lower weight, means a convenience advantage for consumers. It should be noted here, however, that refillable systems have in part already also been optimised to include such convenience aspects by developing and marketing smaller packaging entities (e.g. multi-packs and smaller beverage crates that are easier to carry). Generally, PET containers have a weight advantage when compared to glass containers. In addition, one-way beverage containers facilitate international trade or concentration processes relating to distribution structures, respectively. For large-scale beverage producers as well as for retailers, they offer cost savings potentials in respect to large filling volumes. If the ecological disadvantage of one-way beverage packaging is to be partially compensated for, it must be ensured that the containers are collected separately and are subsequently consigned to high-quality recycling. In addition, the ecological impacts should be reflected by internalising the ecological costs in the market.

The refillable rate and the recycling rate are thus central success and steering parameters. In the analysis, the one-way deposit system proves to be an expedient measure for supporting the objectives of the Packaging Ordinance (namely the (partial) strengthening of the refillable rate, high return rates, high recycling rates, reduced littering) and thus, in practice, is an appropriate alternative to the dual systems in the beverage packaging segment. Below, scenarios with various political instruments and the respective influence on impact categories, in particular relative to the refillable rate and the recycling rate, are discussed. Recommendations concerning the further design of beverage packaging collection and recycling systems in Germany can be derived from the information thus acquired.

C 2.5 Concluding assessment of the systems

● = System's influence on the indicator is very positive

◕ = System's influence on the indicator is predominantly positive

◑ = System's influence on the indicator is slightly positive or negative

◔ = System's influence on the indicator is predominantly negative

○ = System's influence on the indicator is very negative

Table 77: Assessment of German beverage collection and recycling systems

	Refillable deposit system	One-way deposit system	Dual system
Ecological			
Resources consumption	●	◕	◑
Climate change	●	◕	◕
Other impact categories of life-cycle assessments	●	◕	◕

Refillable rate	●	◑	◔
Return rate	●	●	◑
Recovery rate (recycling + energy recovery)	●	●	◕
Disposal (reduction of the volume to be disposed of in terms of incineration and landfill)	●	●	◕
Ecological packaging (re)design	●	◑	◑
Littering	●	●	◔
Economic			
System costs	◕	◑	◑
System revenues (material revenues and revenues from unre-deemed deposits in the system)	◕	●	◕
Distribution of costs be-tween government and the private sector (positive impact means lower costs for the government)	●	●	●
Implications for small, regional beverage manu-facturers	●	One-way beverage packaging in general (irrespective of the collection system): ◔	

Implications for large, international beverage producers	◔	One-way beverage packaging in general (irrespective of the collection system): ●	
Implications for international competition	◑	◑	◕
Start-up difficulties (positive influence means less start-up difficulties)	◕	◑	◔
Stability of the system	◕	◕	◔
Social			
Product diversity	◕	◑	◑
Product price	◑	◑	◑
Employment	●	◕	◕
System misuse	●	◕	◔
Extended producer responsibility and consumer behaviour	●	◕	◑
Littering	●	●	◔

C 3 Development scenarios concerning various measures in the field of beverage packaging

Based on a detailed analysis of the German beverage packaging collection and recycling systems, the following sections describe various future scenarios, assuming various measures:

- Retaining the regulations governing the mandatory deposit on one-way beverage containers ("status quo" scenario)
- Change in consumer behaviour ("public relations campaigns" scenario)
- Introduction of levy systems ("levy system" scenario)
- Introduction of license models ("license model" scenario)
- Abolishment of the regulations governing the one-way deposit ("zero option" scenario)

The scenario analysis is aimed at creating a basis for assessment of the above-mentioned measures (scenarios) and the respective ecological, economic and social evaluations. Subsequently, recommendations regarding possible measures are derived on the basis of the outcome of these scenario analyses in order to achieve positive ecological, economic and social impacts.

C 3.1 Maintaining the regulations governing the mandatory deposit on one-way beverage containers ("status quo" scenario)

C 3.1.1 The "status quo" scenario

The "status quo" scenario assumes that the systems that have been established in parallel in Germany regarding beverage packaging and the return of beverage packaging continue to exist in unchanged form.

As a consequence, the current developments are directly continued in the "status quo" scenario, assuming that currently observed trends such as a continuously high refillable rate for beer and the continued decline in the refillable rate for non-alcoholic beverages will continue to prevail.

C 3.1.2 The system resulting from the "status quo" scenario

Continuation of the status quo means immediate continuation of the current system in Germany, which is described in detail in Sections C 1 and C 2. Consequently, the objectives of the Packaging Ordinance, i.e. to stabilise and increase the refillable rate as well as to increase the recovery/recycling rates of one-way containers would continue to apply. Moreover, the socially accepted target of reducing littering continues to be pursued.

In the following we examine whether or not these targets can be achieved over the long-term, assuming that the status quo continues to exist unchanged.

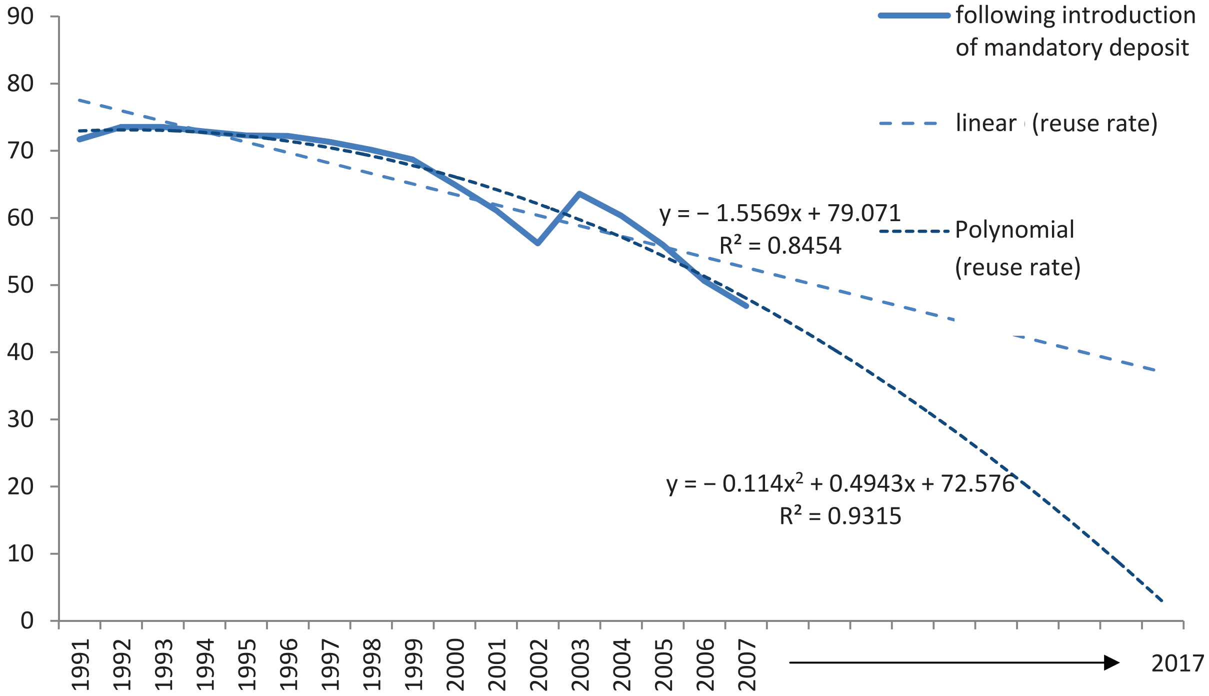
C 3.1.3 Assessment of possible impacts of the "status quo" scenario

C 3.1.3.1 Development of the refillable rate in the "status quo" scenario

In order to assess the objective of attaining the refillable rate or the legally required target rate of 80 %, respectively, for ecologically advantageous packaging while maintaining the existing one-way deposit system and without any additional measures being taken, the development during recent years is extrapolated using the data available for the period from 1991 to 2007 as a basis. Illustration 25 shows that, in this case, a further decline in the refillable rate is to be assumed:

- In an optimistic first case, the average annual decline in the refillable rate of just under 1.6 % is further extrapolated straight-line despite the currently accelerating decrease. On this basis, a decline in the refillable rate to below 40 % is expected by 2017. The actual values for the years 2005, 2006 and 2007 are already significantly below the linear extrapolation value. This indicates that this model is not suitable for describing further developments. However, the legally defined target rate of 80 % for ecologically advantageous beverage containers is clearly not met under these overly optimistic assumptions.
- If, by contrast, the currently accelerating decline (polynomial extrapolation of the development from 1991 to 2002) is taken into account, refillable beverage containers are expected to almost disappear from the market by 2017, if no additional measures are taken and assuming the theoretical extrapolation. This means that the goal of stabilising the refillable rate would be missed completely. The market development in Germany with a widely constant situation up to the mid-1990s and an increasingly accelerated decline from the end of the 90s onwards suggests that, based on these assumptions, the actual development is to be reflected much more realistically than in the linear trend line. As shown below on the basis of the development of individual types of beverages, this development applies, in particular, to the non-alcoholic beverage segment. Polynomial extrapolation respecting the beer segment indicates clearly more positive development of the refillable rate, which may drop, however, as a result of the current increase in beer being offered in beverage cans.

Illustration 25: Development of the refillable rate 1991 to 2007 with trend lines up to 2017; source: own presentation on the basis of GVM data, adjusted values for 2006

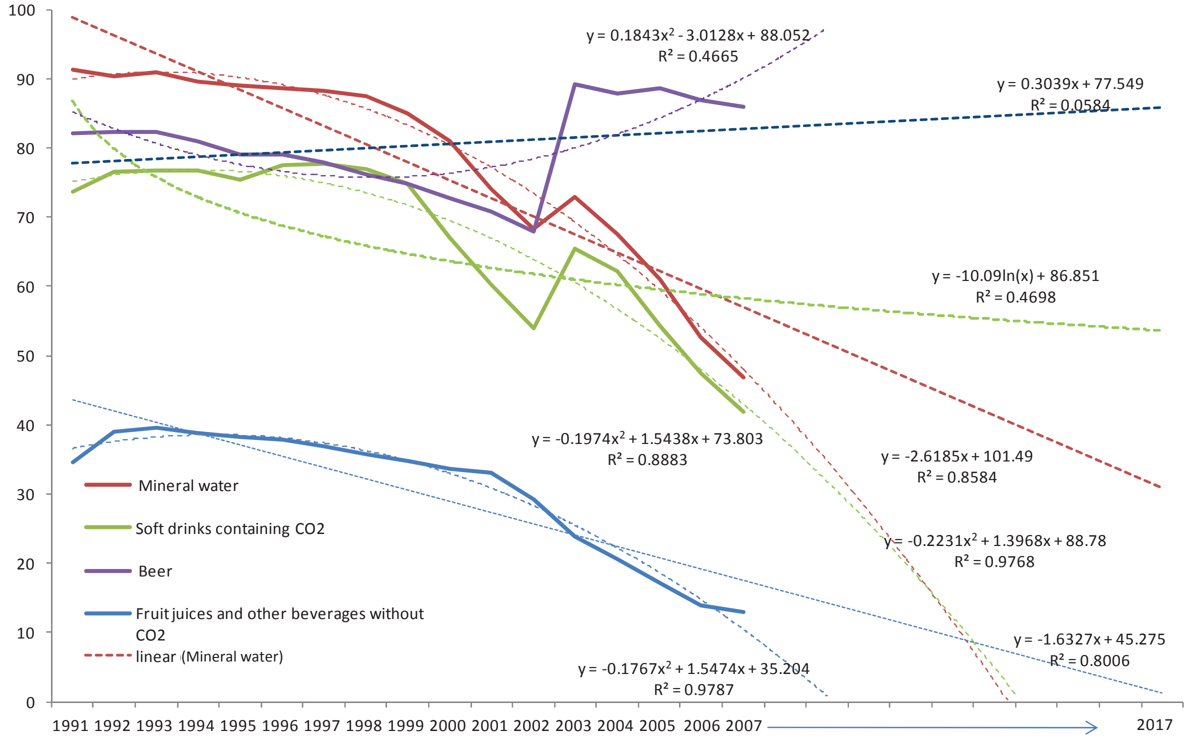


This trend projection makes it clear that the one-way deposit system alone, while contributing to stabilisation of the refillable rate as stated in the "zero option" scenario, will not be able to keep the refillable rate at the level striven for over the longer term. When extrapolating the status quo, a further massive reduction in the refillable rate in favour of one-way beverage packaging must be assumed. The latter would continue to be disposed of and recovered through one-way deposit and dual systems.

As shown in Illustration 26, for the beverage types selected as examples, namely mineral water and CO_2 containing non-alcoholic soft drinks, even under the extremely optimistic assumption of linear extrapolation there is a decline in the refillable rate to a good 30 % by 2017. This decline is even more pronounced than that described for the average of beverage types. The refillable rate respecting fruit juices and other beverages without CO_2 was already just under the marginal area of 13 % in 2007, which is particularly due to the fact that fruit juices are generally not subject to a mandatory deposit. By contrast, given linear extrapolation for the beer segment, a continued high refillable rate of more than 85 % can be assumed for this type of beverage so that it can be assumed that meeting the goal of stabilising and increasing the refillable rates would appear to be quite realistic. Currently, beverage cans are again increasingly being listed in the retail trade, According to Canadean, their total market share is 1.95 % for the year 2009[700]. It is currently not expected, however, that refillable bottles in the beer segment will be replaced with beverage cans to any major extent. When assessing the polynomial development, given similar development, beverages from the segments: juices, mineral water and non-alcoholic soft drinks would no longer be filled into refillable beverage containers as early as in 2013.

[700] Canadean, 2010 (PwC analysis of Canadean data).

Illustration 26: Development of the refillable rate 1991 to 2007 with trend lines up to 2017 for selected beverage types: source: own presentation on the basis of GVM data, adjusted values for 2006



Taking segment-specific differences into account it is apparent that, without any further measures being taken, the aspired refillable objective can only be met over the medium and long term for the beer segment. However, in the beer segment also, retrograde trends have been determined in recent years, which have been taken into account only to a lesser extent in the long-term linear and polynomial extrapolation based on an average value. It therefore seems inevitable that further measures should be taken for all types of beverages.

When considering the trend extrapolations, it should be noted that, taking current trends into account, these are mathematical and theoretical in nature. It is quite possible that, in reality, downward trends do not continue permanently but that a minimum threshold is achieved at a certain point. This means that the total disappearance of the packaging forms concerned is not necessarily to be expected.

C 3.1.3.2 Development of littering in the "status quo" scenario

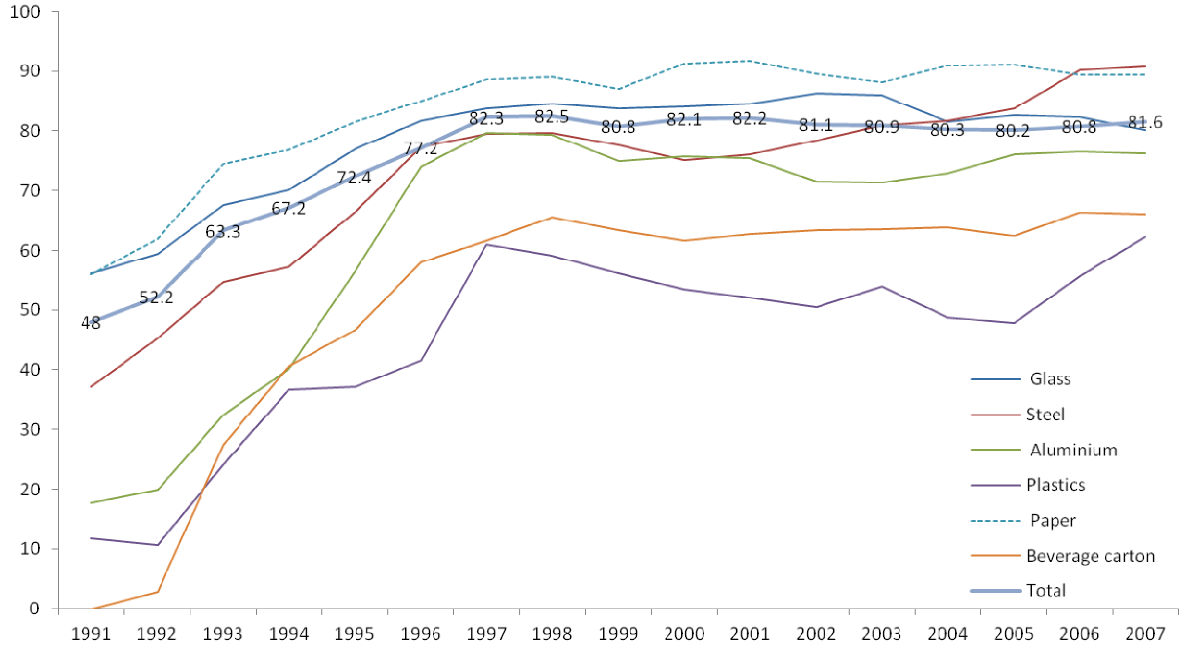
With respect to littering, introduction of the one-way deposit led to a perceptible improvement (see "zero option" scenario). If the status quo is retained, no changes are to be expected so that the goal of reducing littering, which is of relevance to society, can be regarded as being met.

C 3.1.3.3 Development of recovery/recycling rates of one-way beverage containers in the "status quo" scenario

In order to calculate developments respecting the recovery and recycling rates of one-way beverage containers within the scope of the "status quo" scenario, we initially present the long-term trends regarding packaging recovery rates in general, followed by a discussion of the recovery of one-way beverage containers using the example of PET bottles and the respective recovery rates.

The introduction of the Packaging Ordinance in 1991 clearly resulted in an increase in the recovery rates for packaging, whereby beverage packaging is included only as a sub-segment. The increase is primarily due to introduction of the dual system. As shown in Illustration 27, the recovery rate jumped from 48 % to 82.3 % between 1991 and 1997, and remained almost constant in the following years. A slight increase was most recently observed for 2006 and 2007, which concerned the plastics segment, in particular (cf. Illustration 27).

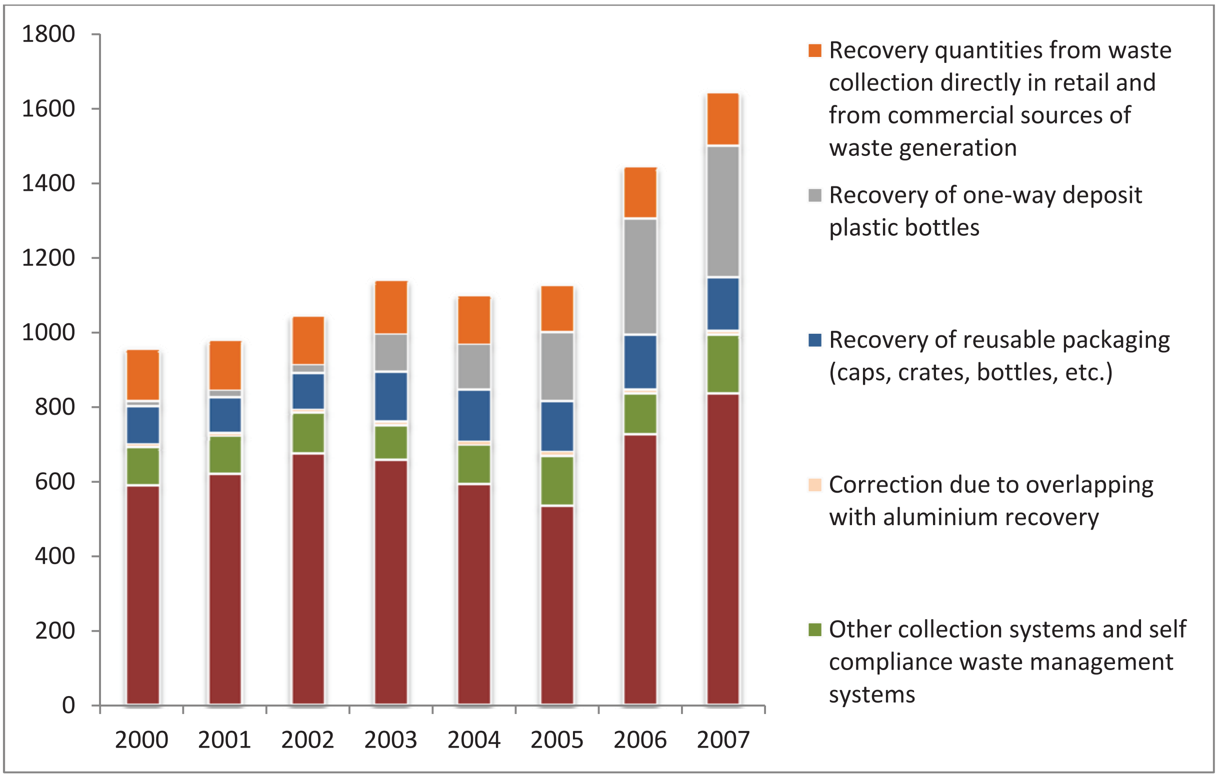
Illustration 27: Development of recovery rates for packaging as a whole and for individual materials (as a percentage); source: own presentation on the basis of GVM data preliminary values for 2007



The development of the general recovery rate of packaging material suggests that the general recovery rate for packaging remains stable at the current level in the status quo scenario. Beverage containers collected within the scope of deposit systems are collected to a very large extent (current return rate: 96-98.5%). All beverage containers collected separately within the scope of deposit systems are consigned to recycling. It is to be assumed that the return and recovery rates will also not undergo any change in the status quo scenario respecting deposit beverage containers.

As shown in Illustration 28, the increase in the recovery rate of plastics is largely due to increasing volumes in the dual systems (whereby beverage containers account only for a partial quantity of plastic packaging in the dual systems) and to the recovery of deposit plastic one-way bottles:

Illustration 28: Recovery quantities of plastic packaging (in kilo-tonnes)[701]; source: own presentation on the basis of GVM data



The increase in the recovered amounts of plastic one-way bottles from 2006 onwards is due to the abolishment of island solutions respecting take-back[702] in addition to the effects of the general growth in the quantities brought into circulation. Consequently, this measure is considered to be successful with a view to the objective of increasing recovery and recycling rates, and makes it clear that targeted amendments to the Packaging Ordinance can impact positively on the results achieved.

As regards the objective of increasing recovery and recycling rates, we conclude that, overall, no major changes in the collection and recovery rates attained through the dual systems and the deposit systems for beverage packaging are to be expected if the status quo is continued. Further improvements in recovery and recycling rates appear to be possible through targeted amendments, however. This approach is therefore preferable to just maintaining the status quo respecting this target.

[701]Prior to 2003, deposit one-way plastic bottles were exclusively crate-based deposit one-way PET bottles (with a specific take-back and material recycling system); since 2003 this category has also included bottles collected through the mandatory deposit system.

[702] Cf.. GVM, 2009 a, p. 57.

C 3.1.4 Assessment of the "status quo" scenario

With respect to the objective of stabilising and raising the refillable rate and increasing the qualitative and quantitative recovery and recycling rates of one-way beverage containers, the "status quo" scenario meets its purpose only to a limited extent. On the basis of the assumptions made, we consider the following developments to be possible:

Table 78: Effects of the "Status quo" scenario on impact categories

Ecological impact categories	• It is expected that the refillable rate will decline further and that the rate cannot be stabilised - except for the beer segment. • The return and recovery rates for beverage packaging remain constant at the present level. • Innovation incentives respecting ecological packaging redesign are not provided.
Economic impact categories	• As a result of the long-term decline in the refillable rate, smaller beverage producers that use refillable beverage containers as well as the beverage wholesale and retail trade will come under pressure and will successively disappear from the market. • Due to the stability of the framework conditions, neither costs nor potential income regarding further political measures will be generated. • A direct influence on the markets for secondary materials is not to be expected.
Social impact categories	• As the refillable rate declines, the number of smaller beverage producers may also drop over the longer term and this would result in a decline in product diversity. • An increase in littering is not to be expected. • A decline in the number of employees whose jobs are directly associated with the refillable system is likely.

In all, it is apparent that the "status quo" scenario has advantages when compared to the "zero option" (see Section C 3.5). In particular, deterioration (and also improvements) seems unlikely with respect to the return and recycling rates as well as in relation to the littering phenomena.

With respect to the refillable rate, when compared to the "zero option" the decline is slower, but it generally continues. Over the longer term it is therefore probable that one-way beverage containers will oust refillable beverage containers from the market - with the exception of the beer segment. Ecological disadvantages of one-way beverage packaging versus refillable beverage packaging would therefore also play a role in the "status quo" option. Likewise, within this scenario, there is increased pressure on small beverage producers, including pertaining consequences regarding product diversity and employment.

C 3.2 Change in consumer behaviour ("Public relations campaigns" scenario)

C 3.2.1 The "Public relations campaigns" scenario

The starting point for the "Public relations campaigns" scenario is the ascertainment that consumers exert a significant influence on the success of beverage packaging disposal or recovery systems: They can (starting with the product range offered by trade) deliberately opt for refillable beverage containers or for one-way beverage containers, they contribute to the purity of sorted packaging waste and the successful collection of containers by returning deposit beverage containers, they contribute to the success of dual systems due to curb-side collection, and they make a decisive contribution when it comes to littering. In order to effect a positive change in consumers' behaviour in terms of the Packaging Ordinance objectives, this scenario deals with the use of public relations campaigns as a central instrument.

This scenario is based on the central assumption that public relations campaigns can influence consumer behaviour successfully and over the longer term. In this scenario it is also assumed that the legal framework conditions remain constant analogous to the "status quo" scenario, i.e. unchanged framework conditions are assumed and communication measures are directly geared to the individual.

The key problem in public relations campaigns is the discrepancy between values and attitudes or environmental awareness and actual environmental behaviour. A generally positive attitude towards waste prevention and forms of reuse, for instance, are not directly linked to actual behaviour and may actually be accompanied by the consumption of beverages in one-way beverage containers. In addition, it is necessary to take into account that knowledge impacts on environmentally-friendly behaviour only if it is supported by respective attitudes and values. Empirically, a high level of knowledge and information alone without a change in attitudes and behaviour has no impact on behaviour.[703]

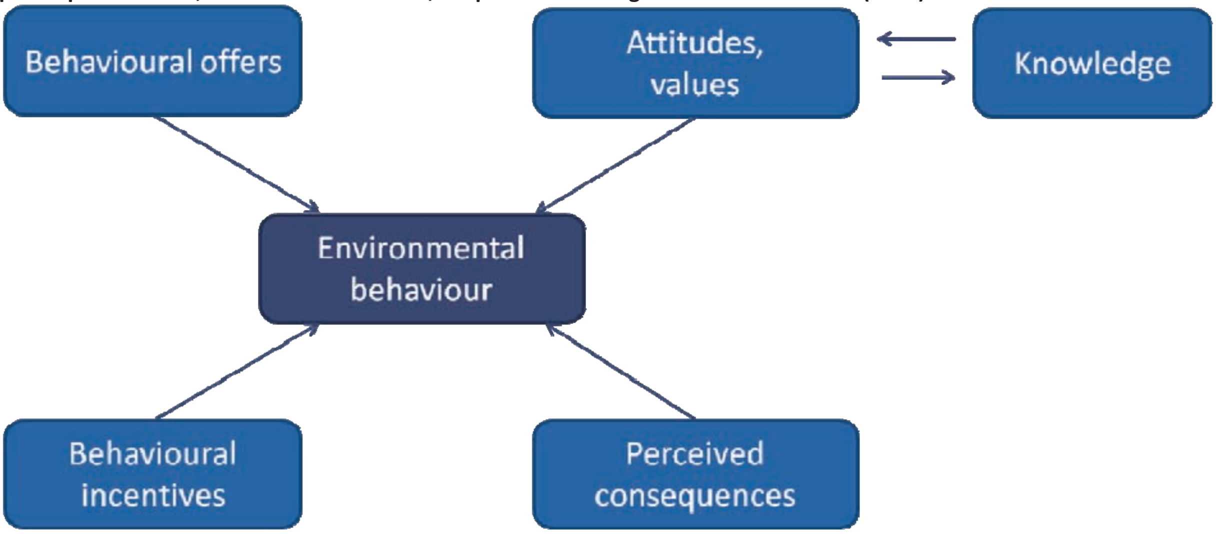
Apart from the impact chain: knowledge, attitudes and behaviour, there are other factors that influence environmental behaviour, in particular those mentioned below:[704]

- The behavioural offers in place (if, for example, a discount supermarket does not offer refillable beverage containers, this option is per se ruled out for the customers of this discounter)
- Individual behavioural incentives (e.g. amount of the deposit, administrative fines)
- Individually perceived consequences of one's own behaviour (e.g. the popular myth that separated waste is again mixed up by the disposal firm and that individual efforts to separate waste are therefore useless)

[703] Cf. Fietkau, H.-J. and Kessel, H., 1981; Diekmann, A. and Preisendörfer, P., 1992.
[704] Cf. Fietkau, H.-J. and Kessel, H., 1981.

The interrelation of these factors can be shown in a framework model on which the following discussion of possible public relations campaigns is based:

Illustration 29: Framework model regarding environmental behavioural pattern pursuant to Fietkau und Kessel in a simplified presentation; source: Rambow 1998, simplified according to Fietkau and Kessel (1981)



Starting with the general framework model, two important environmental behaviour determinants are taken into consideration:

- The lesser the individual effort (e.g. costs, time spent, other efforts) the stronger the impact of environmental attitudes on behaviour. In practice, this so-called low cost hypothesis[705] means that public relations campaigns, which aim at changing attitude, are the most effective where changes in environmental behaviour cause only little additional effort for the individual (e.g. separating waste can be interpreted as a low cost measure, whereas a principal change in eating or purchasing habits such as not buying ecologically disadvantageous beverage containers would rather qualify as a high cost measure).
- At the micro-level of the individual consumer, lasting attitudes and values are based on general lifestyles such as those described in the Sinus-milieus (e.g. consumption materialists, post-materialists).[706]
  The messages of public relations campaigns are perceived differently, depending on individual lifestyles, and their impacts also vary. Moreover, in addition to the micro-level, influential factors at the meso level of groups and organisations as well as at the macro level (e.g. underlying political conditions) must be observed.[707] With respect to the influential factors described in the framework model on the environmental behaviour pattern, behavioural incentives and offers are mainly attributable to the societal macro level and are therefore mentioned below only as restrictive framework conditions.

Generally, it can be established that the environmental awareness of consumers in Germany is relatively high although their willingness to accept cutbacks in their living standards is limited. The Environmental Awareness Study 2008, for example, determined on the basis of a representative population survey, that 84 % of Germans are convinced that environmentally aware purchasing patterns

705 Cf. Diekmann, A. und Preisendörfer, P., 1992.
706 Cf. Sinus Sociovision, 2009.
707 Cf. Baker, 2003, p. 702.

contribute significantly to environmental protection. At the same time, 61 % of the German population links its willingness to act in compliance with environmental protection goals to the condition that this should not impair their living standard. Here too, it became apparent that many of those questioned tend to estimate their consumer habits as being more environmentally-friendly than they actually are.[708]

C 3.2.2 The system resulting from the "Public relations campaigns" scenario

The objectives of the Packaging Ordinance (minimising the volume of packaging waste, reducing the environmental impact of packaging waste, stabilising and raising the refillable rate, reduced littering, increasing the recovery/recycling rates of one-way beverage packaging) continue to apply. With respect to the legal framework conditions, the status quo is continued. Targeted public relation campaigns are carried out in order to achieve the objectives defined in the Packaging Ordinance.

Against the background of the framework model described above (see Illustration 29), possible options regarding public relations campaigns are discussed below. It is not possible, however, to assess the impact of individual campaigns due to the great impact of the individual design on the success of the campaigns. Therefore, in the following, promising approaches for campaigns based on individual targets of the Packaging Ordinance are identified.

C 3.2.3 Assessment of possible impacts of the "Public relations campaigns" scenario

C 3.2.3.1 Development of the refillable rate in the "Public relations campaigns" scenario

Current market research arrives at the following findings concerning consumer attitudes regarding one-way and refillable beverage containers:

1. According to a current survey, 59 % of the purchasers of beverages in one-way beverage containers that are sold in beverage crates state that they consider it important that their beverage containers are refilled (whereas 76 % of the purchasers of refillable beverage containers consider refilling to be important).[709] This indicates that a large number of consumers believe that deposit one-way containers are actually refillable containers.
2. Innofact establishes the following in a current survey on consumer behaviour in the mineral water segment:
    - Some 70 % of the respondents state that the current deposit regulation makes it more difficult for them to distinguish ecologically advantageous from ecologically disadvantageous beverage containers.
    - Some 70 % of the respondents consider the current regulation to be misleading and confusing.
    - About one third of the respondents wrongly believe that deposits are to be paid only for refillable containers.

[708] Cf. SINUS-Institut, ECOLOG-Institut, Marplan, 2008, p. 11
[709] Cf. The Nielsen Company and Bormann und Gordon website (graph via link), *Getränke in Einwegflaschen weiter auf dem Vormarsch* (N = 1.554).

- Some 40 % of the respondents believe that the deposit is an indication of environmental friendliness.[710]

This indicates a substantial information deficit with respect to deposit one-way beverage containers. Quite a lot of the purchasers of deposit one-way beverage containers (in particular beverage containers bought in beverage crates) buy these because of a misunderstanding that these containers are particularly environmentally-friendly, i.e. they mistake the containers for refillable beverage containers.

As already established, the level of environmental awareness is high, at least in the self-assessment of the consumers. Consequently, public relations campaigns aimed at promoting the refillable rate should probably focus on clarifying consumers' difficulties in understanding the one-way deposit system. With respect to the frame model on environmental action described above, (see Illustration 29), the central approach in this case would be an educational and information campaign on the basis of facts. Provided that corresponding product offers of retailers are in place, implementation means a realistic "low cost" situation for consumers, which should lead to an actual change in environmental behaviour rather than only impacting on environmental attitudes.

As concluded in Illustration 30 the fact must also be taken into account that various framework conditions have a significant effect on environmental behaviour and that these condition cannot be fundamentally changed through a public relations campaign. For example, it has been established that retail discounters largely offer one-way beverage containers and that this limits the behavioural offer for discounter consumers. The amount of the deposit obviously fails to provide sufficient behavioural incentives to use refillable beverage containers. This is also due, among other things, to the fact that differences in the deposit amount are no longer a decisive criterion with regard to the total price, as is shown in the following example:

- The deposit on 6 x 1.5 litres of mineral water (in total, 9 litres) in one-way deposit bottles (in six-packs with shrink wrap as are frequently offered by discounters) amounts to € 6 x 0.25 = € 1.50

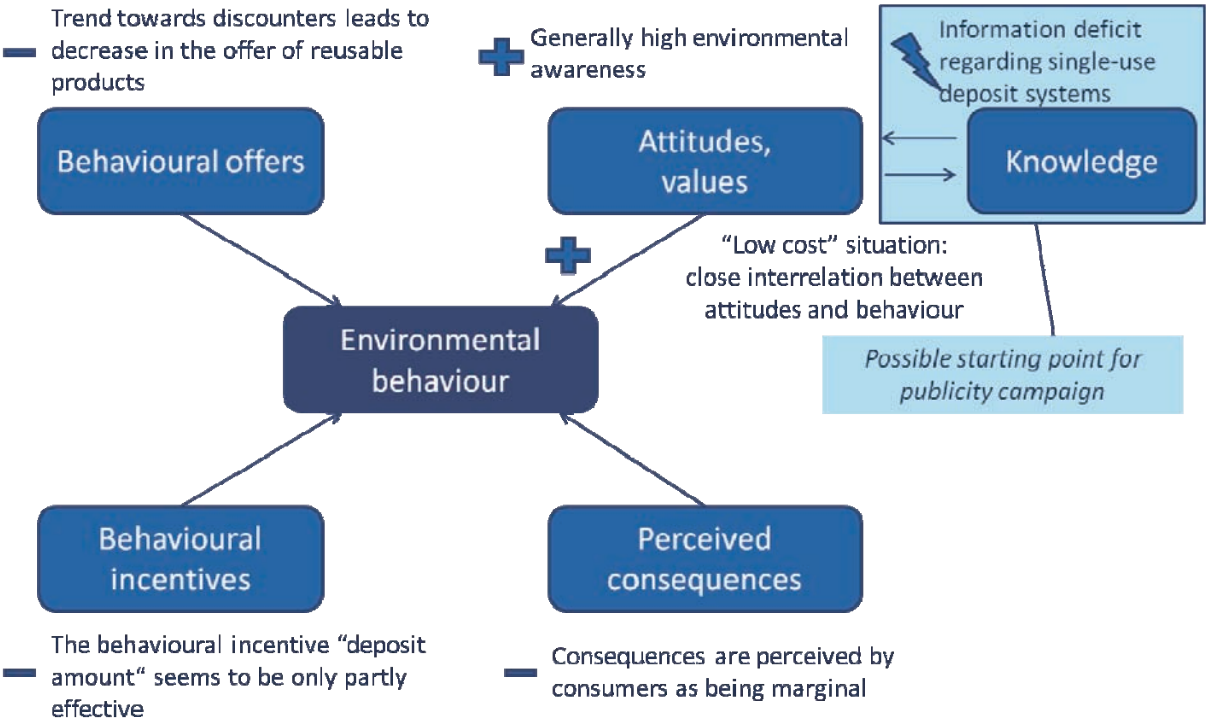
- The deposit on 12 x 0.75 litres of mineral water (in total, 8.4 litres) in refillable bottles in beverage crates amounts to € 12 x 0.15 (bottles) + € 1.50 (crate) = € 3.30

In effect, there is no economic incentive to buy refillable beverage containers.

Rather, according to the survey mentioned above, many consumers believe that the deposit generally signals ecological benefits. Consequently, it can be assumed that the consumers of deposit one-way beverage containers cannot estimate the ecological impact of their purchasing behaviour in this respect.

[710] Cf. Lebensmittel Zeitung, 21 August 2009 (N = 3.297).

Illustration 30: Factors influencing consumer decisions resp. reuse/one-way and starting points for public relations campaigns; source: own presentation



Examples of campaigns that start with this fact are the current action "*Mehrweg ist Klimaschutz*" [Refillables are climate protection] initiated by Allianz Mehrweg as well as the introduction of a label to mark refillable bottles by Arbeitskreis Mehrweg.[711]

C 3.2.3.2 Development of littering in the "Public relations campaigns" scenario

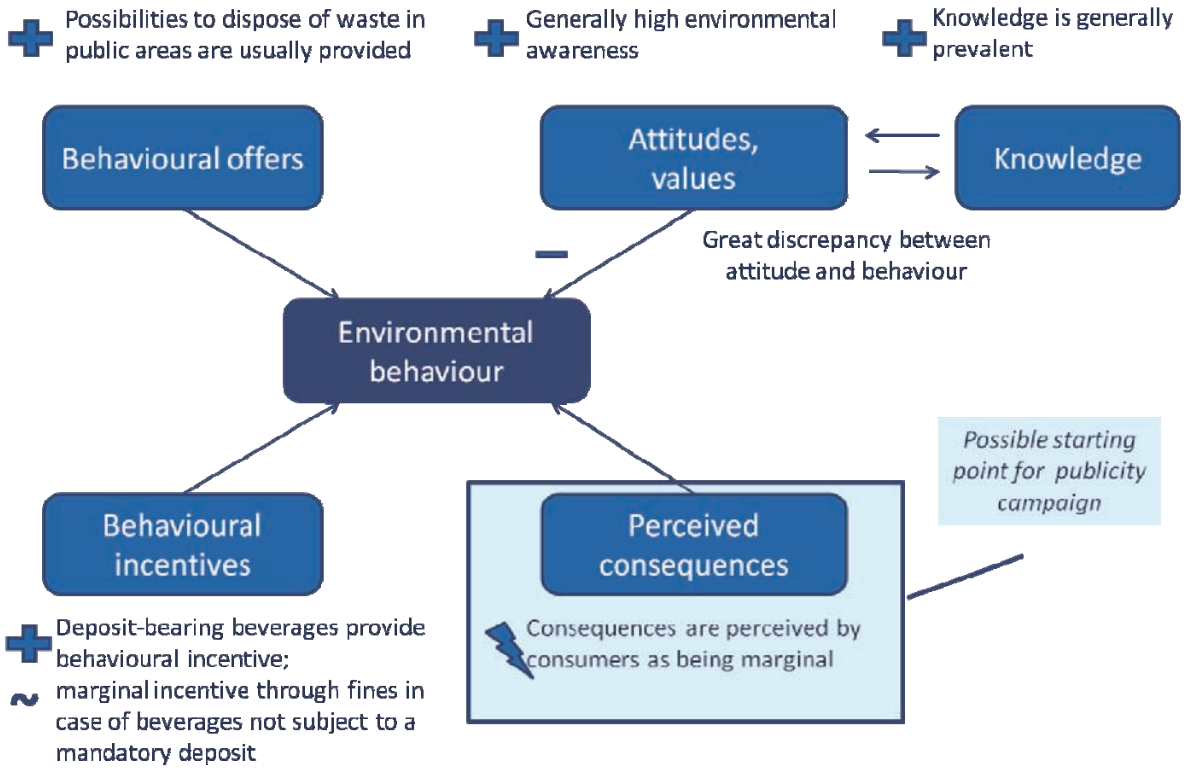
With regard to the issue of littering, there is a clear consensus in society that carelessly throwing-away items is not tolerated. Comprehensive behavioural offers are in place, including possibilities to dispose of waste in public areas. In addition, one-way and refillable deposit systems provide strong behavioural incentives to return deposit beverage containers – hence, for these there is no need for public relations campaigns.

With respect to non-deposit bearing one-way beverage containers, further incentives aimed at appropriate disposal may also arise from the fact that littering is regarded as an infringement of regulations, which involves payment of a respective administrative fine. Only a minor effect is to be expected to result, however, as the administrative fines are low and the individually perceived probability of having to pay for a respective violation is also considered to be low.

Consequently, the only - and the central - starting point for public relations campaigns must be the consequences of own behaviour that causes littering. Frequently, those who cause littering are aware of the negative consequences of their "littering behaviour" only in the form of immediate aesthetic impairment: they are not aware that their actions may have other consequences. Illustration 31 once again summarises the influencing actors described here:

[711] Cf. Verband-pro-Mehrweg website, start of the campaign: *Mehrweg ist Klimaschutz*: 2009.

Illustration 31: Factors influencing the littering phenomenon and starting points for public relations campaigns



The campaign "Saubere Landschaft" (Clean Landscape), which is supported by industry, is an example of a campaign that is aimed at raising the awareness of young people and children, in particular, about the littering problem. The focus of this campaign is not on the provision of theoretical information but rather on enabling the addressees to gain practical experience. For example, the young people are instructed (in cooperation with their schools) to collect thoughtlessly thrown away waste on their way to school; this gives them the possibility to assess the consequences of littering first hand.

Generally, public relations campaigns can approach the littering phenomenon only to a very limited extent since, as stated above, the actual behaviour of individuals is frequently contradictory to their own environmental attitudes and must therefore be considered as irrational.

C 3.2.3.3 Development of recovery/recycling rates for one-way packaging in the "Public relations campaigns" scenario

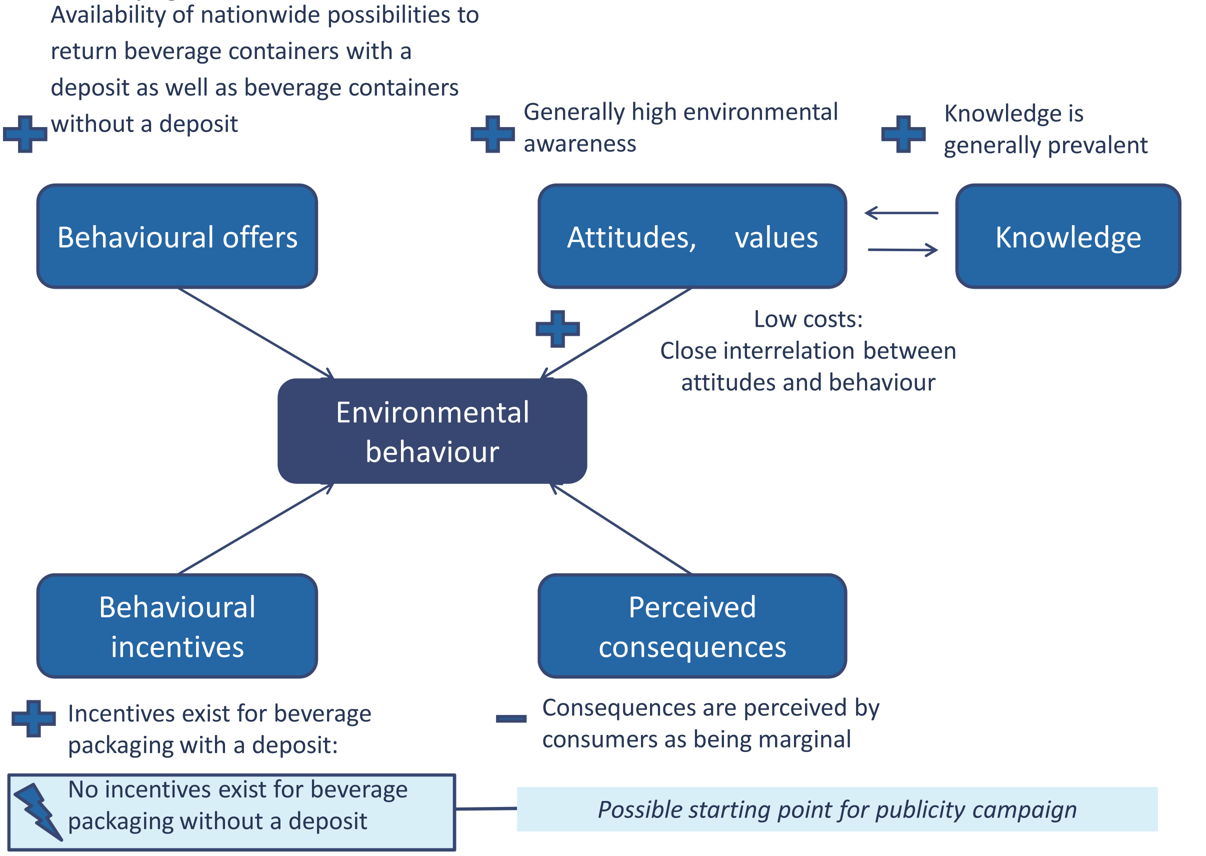
With respect to the recycling or return behaviour of users of one-way beverage containers, it can initially be established that, due to the abolition of island solutions, important behavioural offers were created for deposit one-way beverage containers, and that, consequently, it was possible to increase the refillable rate substantially. The deposit on one-way beverage containers (analogous to refillable beverage containers) provides a high incentive for appropriate return and significantly reduces the probability of littering. Public relations campaigns aimed at increasing the recovery rates for one-way beverage containers must therefore start with the non-deposit bearing, one-way beverage containers, in particular. While the dual systems provide comprehensive behavioural offers, they do not give rise to any explicit behavioural incentives. The consequences of one's own behaviour are also perceived as being rather marginal although - in contrast to confusing refillable beverage containers with one-way beverage containers - people are basically aware of the correct method of disposal.

It would therefore be expedient if a public relations campaign aimed at increasing the return rates and thus the recovery rates of (non-deposit bearing) one-way beverage containers were to make use of feedback mechanisms regarding waste separation and, as required, use communicative measures to draw attention to the (ecological) consequences of incorrectly sorted waste - as already stated in the section on littering.

Another option could include the voluntary introduction of a monetary incentive by retailers, such as the return system that already exists in retail trade, for example by handing out coupons to consumers or through offers regarding the collection of "recycling points" when non-deposit bearing one-way beverage containers are returned (e.g. PET bottles for juice, beverage carton packaging).

Illustration 32 summarises once again the influencing factors described above:

Illustration 32: Influencing factors regarding recovery rates of one-way beverage containers and starting points for public relations campaigns



A current survey of recycling behaviour in households in Great Britain examined three possible measures for individual feedback that could be used in the context of public relations campaigns:[712]

- Door stepping:
  Observation of the recycling behaviour of households and targeted confrontation in the event of incorrect recycling

[712] Cf. Timlett, R. E. and Williams, I. D., 2008, p. 626.

- Feedback (only):
  Observation of the recycling behaviour of households, indicating incorrect sorting behaviourthrough feedback cards
- Incentives:
  Observation of the recycling behaviour connected with a credit note or monetary compensation in the event of exemplary recycling behaviour

On the basis of examination of these alternatives it became apparent that all of these three approaches led to a clear improvement in recycling behaviour. Basic differences were observed, however, with regard to costs: Doorstepping proved to be the most expensive alternative at 47 pounds sterling per household. The incentive systems also caused high costs at about 29 pounds sterling per household. The individual feedback approach was the most cost-efficient at about 3 pounds sterling per household. This measure should therefore be considered as an instrument for improving recycling behaviour, possibly supplementary to general information campaigns.

C 3.2.4 Assessment of the "Public relations campaigns" scenario

Against the background of the objectives of the Packaging Ordinance, public relations campaigns can supplement the existing system. As shown in the examples of individual targets, individual weaknesses and information deficits would have to be dealt with as a first step. The information gap regarding the differentiation between refillable and one-way deposit systems would have to be closed, those who potentially cause littering would have to be made aware of the consequences of their behaviour, and targeted feedback should be given respecting the way in which one-way beverage containers are to be returned.

On the basis of the assumptions made, the following developments are possible, in our opinion:

Table 79: Effects of the “Public relations campaigns“ scenario on impact categories

Ecological impact categories	• It is expected that the refillable rate can be increased moderately through targeted public relations campaigns, e.g. by reducing the existing information deficit respecting differences between one-way and refillable deposit systems and, as a consequence, shifting consumers' preference from one-way deposit to refillable deposit systems. • Improved return behaviour through targeted feedback is to be expected with respect to non-deposit bearing beverage containers.

Economic impact categories	• Public relation campaigns involve considerable costs. Prior to introduction of the mandatory deposit, the BMU, for example, spent just under € 600,000 on ads with information about the introduction of the one-way deposit system.[713] The dual systems, too, require substantial expenses for information work. In general, the responsibilities and, in this context, the question of who bears the costs, must be clarified beforehand. Initially, the public sector is primarily responsible as the organizer of public relations campaigns. Within the scope of extended producer responsibility, beverage packaging producers and beverage producers could also be involved in financing, however. • If public relations campaigns are to be initiated, a cost-benefit analysis should be carried out in advance. • Against the background of generally high environmental awareness, the expensive approach of monetary incentives is generally assessed as not being efficient. Similar effects may be achieved through targeted feedback.
Social impact categories	• As a result of public relations campaigns, a reduction in littering involving non-deposit bearing beverage containers may be possible, but given generally irrational underlying behaviour, only to a moderate extent.

If implemented appropriately, public relations campaigns are expected to contribute to stabilising the refillable rate. However, public relations campaigns can only support the implementation of the system and cannot replace expedient framework conditions. Littering involving non-deposit beverage containers can be avoided by these measures only to a limited extent. Targeted feedback to individual households may lead to an improvement in the return pattern.

Generally, it can be established that consumer behaviour is not influenced by consumers‘values and attitudes alone, but that it is the result of the interplay of general framework conditions (in particular behavioural offers; incentive structures) and subjective factors. This is evidenced, for example, by the success of the cessation of island solutions in the one-way deposit system which obviously was a significant barrier in consumers' return practice.

[713] Cf. BMU, 2005, p. 2.

C 3.3 Introduction of levy systems ("levy system" scenario)

C 3.3.1 The "levy system" scenario

Despite the introduction of a mandatory deposit on one-way beverage containers in 2003, it was not possible to reverse the trend towards ecologically disadvantageous, one-way packaging, with the exception of the beer segment. The proportion of ecologically advantageous beverage containers continues to decline in the non-alcoholic beverages segment. Against this background, alternative or supplementary steering instruments are increasingly becoming the focus of discussions, in particular in relation to incentive levies described in this scenario and the license models described in Section C 3.4. The incentive levy is aimed at contributing to changing consumer behaviour by making ecologically disadvantageous beverage containers more expensive. Put into concrete terms, this means that the inventive levy promotes ecologically advantageous beverage containers such as refillable containers.

The "Levy systems" scenario is based on the central assumption that a levy on one-way beverage containers will be introduced in Germany in addition to the current one-way deposit system and not as a substitute for this system. This assumption is explained by the fact that a levy generally does not have a direct incentive effect with regard to littering and the recovery/recycling rates for one-way beverage packaging.

Table 80 provides an overview of levy models already existing for beverage packaging in various countries. Some countries have introduced a special tax in place of a levy. These taxes are listed below for purposes of an overview and to facilitate comparison. They range from a general tax on packaging through to a specific beverage packaging tax, and a limited levy exclusively on non-deposit bearing one-way beverage packaging. In practice, the models differ to the extent that some of them relate to the environmental impacts of the packaging material concerned (in the Netherlands, further limited to the aspect of CO_2 emission in the life-cycle) while others introduce flat rates. Moreover, various incentive systems are combined in some countries in order to ensure high return rates for one-way beverage containers (e.g., tax exemption in Finland or a variable additional contribution in Norway).

Table 80: Comparison of packaging taxes and levies of selected European countries; sources: Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien (2009); Prognos (2009)

	Denmark	Finland	Netherlands	Norway
Design of the levy or tax	• **Inclusion of all beverage packaging in the general packaging tax** • Tax arises in addition to fees for one-way or refillable deposits • Amount depends on packaging material and volume on the basis of life-cycle analyses	• **Beverage packaging tax on beverage packaging** at fixed tax rates, depending on the material used • Tax exemption for one-way beverage packaging in the event of participation in a deposit system	• **Comprehensive general packaging tax on all packaging materials** • Tax duty if more than 15 tonnes of packaging material per year are put into circulation • Amount depends on packaging material based on the CO_2 emissions during the life-cycle • Reduced tax rate when secondary raw materials are used	• **Environmental levy on one-way beverage containers** • Amount of the levy is derived from a basic amount and a variable additional levy, depending on the achieved return rate • Tax exemption when participating in a **refillable deposit system**
Treatment: one-way deposit	• Mandatory one-way deposit of DKK 1.00–3.00, depending on container volume • Reduced packaging tax rate for beverages in deposit one-way beverage containers	• Voluntary participation in a one-way deposit system • Deposit one-way beverage containers are exempted from the beverage packaging tax on one-way beverage containers if a minimum return rate is ensured	• Mandatory one-way deposit system (Productschap Dranken) for PET one-way bottles with a filling volume of more than 0.5 l	• Fixed basic amount for one-way beverage containers • Incentive to ensure a return rate through variable additional levy; as a result, reduced levies if participating in a one-way deposit system

	Denmark	Finland	Netherlands	Norway
Treatment respecting reuse	• Reduced packaging tax rate for refillable containers • Tax is paid only once; cost advantages depend on circulation frequency	• General exemption from the beverage packaging tax on refillable beverage containers with an officially acknowledged return system	• Tax is paid only once; cost advantages depend on the circulation rate	• General levy exemption

Due to the heterogeneity of the systems described in Table 80 and the interaction (interdependency) of the framework conditions with the existing systems for one-way and refillable deposits, experience gained from a European comparison can be transferred to Germany only to a limited extent. Rather, they make the variety of possibilities to structure a levy or tax system all the more clear.

Both a levy solution and a tax solution are in conformity with EU law.[714] Both structures have the same direct steering effect. The basic difference is in how the money collected is used. While the money received within the scope of a levy system is purpose-bound, earnings received within the scope of a tax structure are included in general tax revenue.[715] A levy solution therefore enables the purpose-bound use of money received, e.g. for strengthening ecologically advantageous beverage packaging.

In legal terms, both the introduction of a tax and the introduction of an incentive levy are possible, given an appropriate structure. Some participants maintain that the introduction of a tax requires less effort and is less complex.[716] The purpose-bound solution, which is linked to the promotion of ecologically advantageous packaging, is assessed as beneficial with regard to an incentive levy being accepted by the general public, however.[717]

The following deals exclusively with the aspect of the incentive effect on ecologically advantageous beverage packaging such as refillable beverage containers, assuming that an incentive levy is generally fixed at an amount that does not appear to be prohibitive, i.e., is not similar to a de facto prohibition of a packaging type (which would involve problems from a legal view point) but that is sufficiently high to be effective.

An incentive levy can generally be charged at packaging producers, beverage producers, or directly at the retailer. Ultimately, the consumers decide the achieved effect from the incentive levy by changing their purchasing behaviour (pattern), in order to achieve the desired effect. The following therefore assumes that a levy is charged in the retail trade. If the levy were to be charged at an earlier stage in the distribution process, this could result in cross-financing and -shifting of the additional cost burden and would thus reduce the actual desired effect of the incentive levy. [718]

Basically, a levy could be charged on all types of beverage packaging, i.e. for both ecologically advantageous and for ecologically disadvantageous types. In such a case, actual implementation would, for example, have to be based on independent life-cycle assessments and supplementary considerations in terms of sustainable packaging systems for individual packaging types in order to account for the individually varying effects. Refillable beverage packaging would be taxed only once and thus (depending on the circulation rate achieved) be given preference over one-way packaging. Such a system also means an additional cost burden for ecologically advantageous beverage packaging. Alter-

[714] Cf. Organe und Einrichtungen der Europäischen Kommission & Europäische Kommission, 2009, p. 12 f.
[715] Cf. IÖW and Öko-Institut, 2009, p. 14 ff.
[716] Cf. IÖW und Öko-Institut, 2009, p. 14–29.
[717] Cf. IÖW und Öko-Institut, 2009 sowie Österreichisches Ökologie-Institut und Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 172.
[718] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 174 ff.; IÖW and Öko-Institut, 2009, p. 17, arrive at the deviating recommendation to charge a levy from the beverage producers. In principle, this possibility may be considered but it dilutes the incentive effect through larger distances to the consumer.

natively, a levy could be charged only on ecologically disadvantageous beverage containers.[719] Given the objectives of the Packaging Ordinance, namely to promote ecologically advantageous types of packaging, this approach seems reasonable. It avoids additional burdens for consumers. Therefore, in the following it is assumed that a levy is charged only for ecologically disadvantageous types of packaging. The definition "ecologically advantageous beverage packaging" should be determined by an independent assessment, for example by the UBA, within the scope of a transparent procedure which includes all relevant stakeholders.

C 3.3.2 The system resulting from the "levy systems" scenario

The "levy systems" scenario assumes the introduction of an incentive levy on ecologically disadvantageous beverage packing in addition to the existing one-way deposit system. The incentive levy is charged directly at the retailer in order to achieve the greatest possible effect by making the product more extensive for the consumer. In particular, the incentive levy is aimed at generally increasing the proportion of ecologically advantageous types of beverage packaging and at stabilising it at a high level.

The direct effect of this instrument, in particular on the refillable rate, and the indirect effect concerning the aspects of littering and recovery/recycling are assessed below.

C 3.3.3 Assessment of possible effects of the "Levy systems" scenario

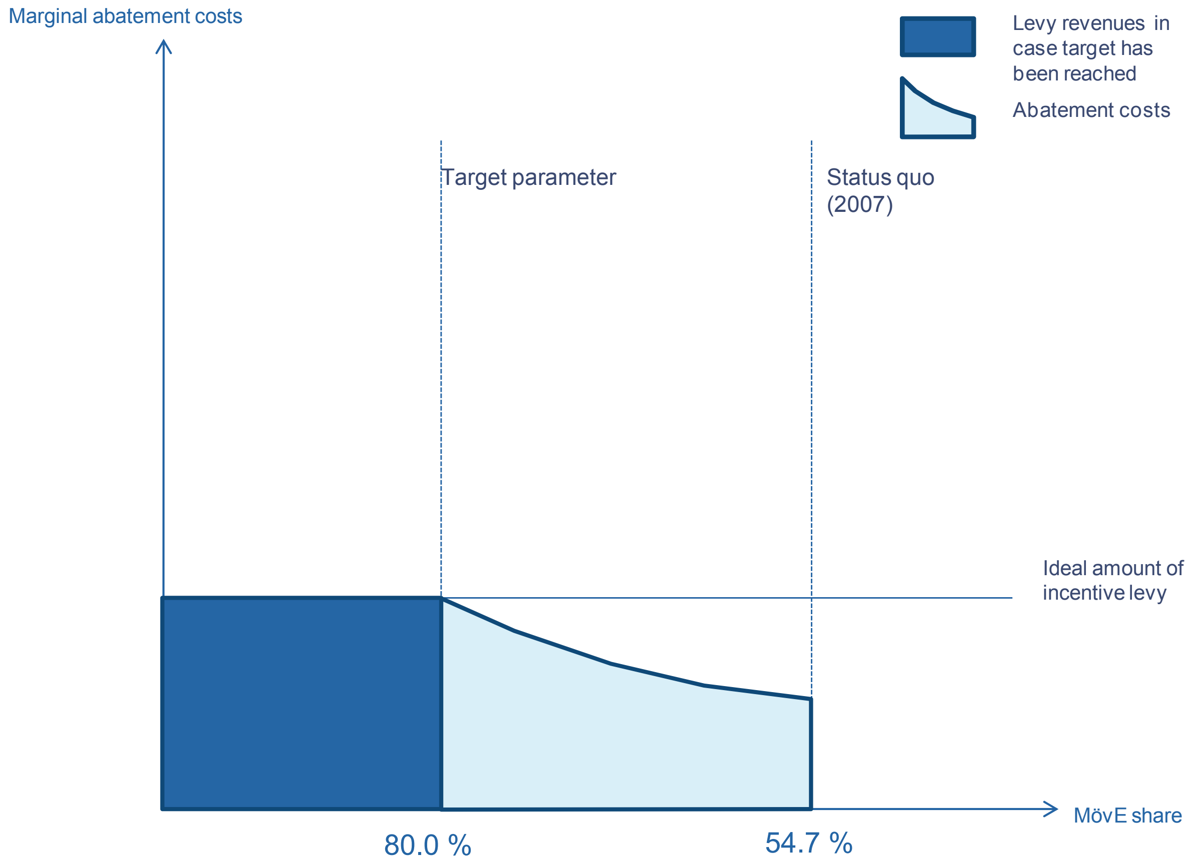
C 3.3.3.1 Development of the refillable rate in the "Levy systems" scenario

It appears reasonable to charge a levy on ecologically disadvantageous beverage packaging both in the non-deposit systems and in the deposit segments and thus to make them more expensive. Achieving revenue is not the primary goal. Instead, the effect of the levy is to increase the use of ecologically advantageous beverage packaging such as refillable beverage containers. For this reason, the amount of the levy should be oriented towards the effect achieved.

The standard price approach shown in Illustration 33 is a pragmatic approach towards achieving a rate of at least 80 % for refillable beverage containers and other ecologically advantageous beverage containers.[720] Accordingly, if the marginal abatement costs are known, the amount of the incentive levy could be determined such that the target parameter striven for is reached. The marginal abatement costs denote the development of the costs incurred by the industry that result from substituting ecologically disadvantageous with ecologically advantageous beverage containers. As this cost development is not known, a trial and error approach must be applied in practice in order to approximate the optimum amount of the levy.[721]
It is expected that levy revenues will decline within the course of approximating the target parameter striven for. This complies with the purpose of the instrument as the focus is on the incentive effect and not on financial revenue.

[719] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 170 f.
[720] Cf. Baumol und Oates, 1971, p. 42–54.
[721] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 169 f.

Illustration 33: Standard price approach according to Baumol and Oates, 1971, p. 42 to 54; source: own presentation.



The lowest estimate regarding the minimum amount of a levy that develops an incentive effect is € 0.10 per litre of filling.[722] A survey carried out by the Austrian Ecology Institute indicated that the amount of the levy should be ca. € 0.20 per litre filling in order to achieve a significant effect.[723] Within the scope of the expert interviews, the amount € 0.20 per one-way beverage container (€ 0.13 to € 0.80 per litre filling; assumed filling sizes 0.25 to 1.5 litres) were determined as the minimum for an adequate incentive effect.[724] Based on these reference values, a targeted representative survey respecting the appropriate amount of the incentive ley should be carried out prior to its introduction. It is important to note that the incentive levy should not have a prohibitive effect. In addition, the question may have to be clarified as to whether a differentiation between the various ecologically disadvantageous types of packaging in terms of their potentially harmful effect (based on independent life-cycle analyses) would be practical and expedient.

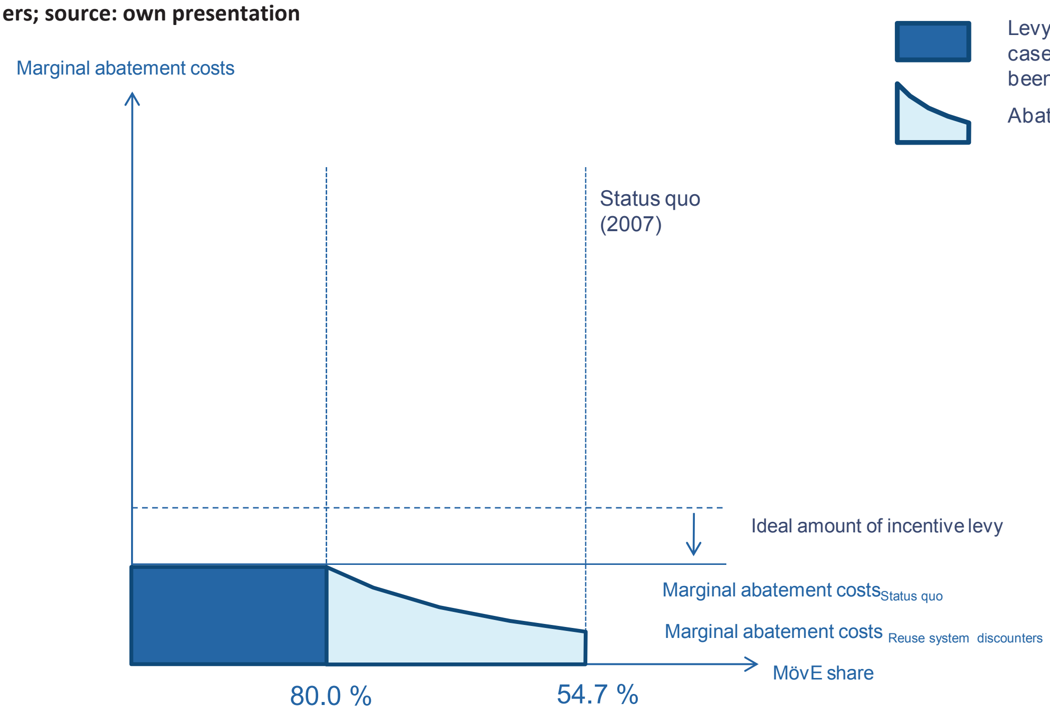
With respect to the acceptance of a possible levy on one-way beverage containers, a current representative Forsa survey found that 86 % of all Germans see an immediate need for action by politicians, and that 80 % of them advocate a levy on one-way bottles. By contrast, only 52 % of those questions opted for a significant increase in the deposit. [725]

It is absolutely essential that, prior to introduction, the findings of representative surveys concerning the appropriate amount of the incentive levy be taken into account and, in addition, that the effects

[722] Cf. IÖW und Öko-Institut, 2009, p. 49.
[723] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 173.
[724] Interview with industry experts.
[725] Cf. FKN, 14.04.2010, p. 2; forsa, 2009.

of the incentive levy be regularly evaluated, for example at annual intervals, and that the amount of the levy be adjusted in terms of a trial and error approach so that the environmental objectives are reached. This is particularly necessary since, when the instrument is being established, it is expected that trade and beverage producers will adjust to the new framework conditions. As the effectiveness of such a measure is assumed, the marginal cost coursel change in the course of the introduction of an incentive levy. This would be the case, for example, if discounters were to include refillable beverage containers to a larger extent in their product range. As a result of this new offer (see framework model in Illustration 29) lower transaction costs or lower efforts, respectively, would be involved for discount customers if they were to decide in favour of refillable beverage containers instead of one-way beverage containers. This case is demonstrated in Illustration 34 and could, ceteris paribus, lead to the incentive levy being reduced.

Illustration 34: Change in marginal abatement costs through the new behavioural option of refillable bottles at discounters; source: own presentation



In summary, we conclude that an incentive levy is generally very well suited for achieving the aim of increasing and stabilising the refillable rate. The pertaining costs for system participants can be determined only after the amount of the levy has been determined (on the basis of respective market research) and the actual design (e.g. differentiation according to the degree of ecological disadvantages or flat rate levy). The fact should be taken into account that the objective stated here, namely increasing the MövE rate to 80 %, is achievable with this instrument only when the required incentive levy is high enough to be effective without having a prohibitive effect.

C 3.3.3.2 Development of littering in the "Levy systems" scenario

The introduction of an incentive levy on ecologically disadvantageous beverage containers is expected to result in a shift in demand towards ecologically advantageous beverage containers and, consequently, an increase in refillable beverage packaging. Since, in such a case, a larger proportion of beverage packaging would be covered by deposit systems, compared to the dual system, an (indirect) positive effect on littering is to be assumed due to perceptibly higher return rates.

However, with respect to littering, the most effective measure is to charge a deposit on all beverage containers: Otherwise, non-deposit bearing, one-way beverage containers would be more expensive as a result of the incentive levy, but there would be no incentive to return them.[726]

C 3.3.3.3 Development of the recovery/recycling rates of one-way beverage containers in the "Levy systems" scenario“

As in the case of littering, an (indirect) positive effect on the recovery/recycling rates of one-way beverage packaging is to be expected due to a shift in demand in favour of ecologically advantageous beverage containers and the associated increase in refillable beverage containers. This results from the fact that, in deposit systems, recovery/recycling rates are significantly higher than in the dual system.

If this goal is to be pursued more strongly, additional measures could be tied to an incentive levy in order to attain this goal. As shown in the above country comparison (see Table 80), the incentive levy could be coupled with additional incentives to increase the recovery/recycling rates for one-way beverage containers. For example, as in the Finish system, an exemption from the levy (or a variable contribution in a negative proportion to the return rate achieved), could be introduced which kicks in when very high return rates for one-way beverage packaging are achieved. This option seems expedient for two reasons: On the one hand, the financial burden on consumers is reduced and, on the other hand, targeted incentives to optimise the existing system are provided.

C 3.3.4 Assessment of the "Levy systems" scenario

Given the aimed-for increase and stabilisation of the refillable rate, the introduction of a levy would appear to be a very suitable instrument for achieving this goal. With respect to littering, indirect potentially positive effects are to be expected. The same applies to the recovery/recycling rates of beverage packaging. The positive effects on recovery/recycling rates can also be increased through corresponding supplementary measures relating to design.

[726] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 177.

Based on the assumptions made, we consider the following developments to be realistic:

Table 81: Effects of the "levy systems" scenario on impact categories

Ecological impact categories	• Given an appropriate amount of the levy, the MövE rate can be raised to the aimed-for level of 80 %. • Incentives for innovations in the ecologically advantageous beverage packaging segment (in particular refillable beverage containers) can be provided. • It is to be expected that the generated waste volume from beverage packaging can be reduced due to indirect effects (in particular, an increase in the refillable proportion). • It is also to be expected that the recovery/recycling rates will increase slightly due to indirect effects (in particular, an increase in the refillable proportion).
Economic impact categories	• Depending on their purchasing behaviour, the incentive levy affects consumers. Basically, a large part of the population considers a levy solution to be expedient. In order to promote acceptance, accompanying information campaigns would be useful (see Section C 3.2). The appropriate use of the revenue achieved should be clearly communicated. • The new system involves additional administrative costs for the required data surveys to structure the levy and steering activities concerning the control and further development of the levy. These depend to a significant extent on the actual design of the levy, and can be reduced, for example, by charging a levy only on ecologically disadvantageous types of beverage containers. • The amount of the levy must be critically reviewed at regular intervals and adjusted correspondingly if targets are not met or if the amount proves to be too high (i.e. to the point of having a prohibitive effect). • Influences on market operators that are aimed at supporting the producers of ecologically advantageous beverage packaging are to be expected. Beverage producers that prefer ecologically disadvantageous beverage packaging will come under pressure to change their production structures and focus on ecological advantages. • Over the medium-term, it is expected that market operators will respond to the new framework conditions with innovations. Improved offers respecting ecologically advantageous beverage containers may lead to consumer preferences shifting to this segment. The associated reduction in the quantity of ecologically disadvantageous beverage containers may result in a reduction in the initially achieved levy revenues.

Social impact categories	• Supporting smaller beverage producers can stabilise or increase product diversity over the medium and long term. • It is to be expected that the littering phenomenon associated with beverage packaging will decrease slightly due to indirect effects (in particular, an increase in the refillable proportion). • An increase in employment in the industries associated with refillable systems is to be assumed while, at the same time, employment in the industries associated with one-way is expected to decline. As one-way is less employment-incentive than reuse, overall positive effects on employment may be assumed.

Over the short to medium term, in the "Levy systems" scenario it is expected that refillable beverage packaging or other ecologically advantageous types of beverage packaging will increase significantly in importance and that, as a result, the current decline can be averted on a permanent basis. Ecologically disadvantageous beverage packaging will be pushed back to beverage segments where the consumers accept higher prices.

C 3.4 Introduction of license models ("license models")

C 3.4.1 The "license models" scenario

Rather than indirectly steering the proportion of ecologically advantageous beverage packaging by means of an incentive levy, there is a possibility to directly steer the amount of beverages produced and brought into circulation in one-way and refillable beverage containers. For this purpose, the economic instrument of license models exists, which is discussed below as the "license models" scenario.

The instrument is based on the principle that licenses are granted for using the environment. As these licenses can be traded, the cost-efficiency of reduction targets is to be ensured. In contrast to the incentive levy, which is discussed in the "Levy systems" scenario, the price for the licenses arises from the market price that is generated assuming a perfect market (e.g. no transaction costs; full information for market operators; no market entry or market exit barriers), as the market equilibrium price. The price corresponds to the levy rate that was sought by means of trial and error within the scope of the incentive levy and which theoretically ensures that the environmental target is achieved with a minimum of macro-economic costs.[727] Whether or not ecological targets can be attained in practice by means of this market instrument must be examined as qualitative targets and price-oriented market dynamics may drift in opposite directions.

In the model, a license system aimed at pursuing environmental targets triggers the following mechanism: The limitation of licenses for a certain ecologically disadvantageous production quantity, e.g. filling ecologically disadvantageous beverage containers, results in scarcity on the market. This, in turn, makes the limited type of production more expensive so that transition to ecologically advantageous production becomes more attractive. A company that votes for an ecologically disadvantageous production method must acquire respective licenses, and this increases the cost of this production method.

The starting point of this scenario, too, is the status quo; i.e. despite the introduction of a mandatory deposit on one-way beverage containers, the proportion of ecologically advantageous beverage containers declines further. It is assumed that licenses for the production or marketing of ecologically disadvantageous beverage packaging are granted in order to counteract this development. To this end, the government authorities determine a maximum quantity of ecologically disadvantageous beverage packaging (e.g. 20 %, according to the current objective of the Packaging Ordinance) and allocate this quantity to the companies subject to a license by means of an allocation procedure.

As in the case of the "Levy systems" scenario, the "License systems" scenario is based on the assumption that a license model is introduced in addition to the current one-way deposit system in Germany and not as a substitute for this system. This assumption is made since a license for ecologically disadvantageous beverage packaging generally does not trigger an immediate incentive effect with respect to littering and the recovery/recycling rates of beverage packaging.

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[727] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 181 ff.

In practice, to date, there are no test cases regarding the implementation of such a license system. Generally, experience gained with environment licenses from other contexts should be used when designing the system. Emissions trading, for example, and in particular its current implementation in the European trading system for greenhouse gas emissions (EU ETS) is an important source of experience. The EU ETS is aimed at ensuring that the EU meets its minimum targets for greenhouse gas emissions as cost efficiently as possible.[728] In addition, specific experience has been gained in Great Britain concerning the use of license models for packaging waste that are aimed at meeting the EU requirements respecting packaging recycling cost-efficiently. In these models, packaging producers must provide proof that they secure Packaging Recovery Notes (PRNs) within the scope of their producer responsibility through the acquisition of recycling licenses.[729] Specific recycling rates for all beverage containers are not known. The general recycling rates for packaging in Great Britain in 2009 were 41.3 % for aluminium, 61.7 % for glass, 83.9 % for paper, and 24.1 % for plastics.[730] On average, Great Britain thus achieved a markedly lower recycling rate than Germany. It is also assumed that the specific recycling rates for beverage containers are significantly below those achieved in Germany for deposit beverage packaging, in particular since there is no separate regulation applying to beverage packaging only. The results of the British licensing system for packaging recycling indicate that an increase in recycling rates can be achieved, but not necessarily optimised very high recycling rates as have already been achieved in Germany.

Experience gained with the EU ETS points, in addition, to several possible problems involved in practical implementation:

- The first EU ETS trading period from 2005 to 2007 saw strong price fluctuations concerning CO_2 emission rights, initially at high prices (the price tripled in the first six trading months) and subsequent sharp drops in the prices in 2007 which are, inter alia, explained by the fact that potential buyers of emission rights (under-equipped with emission rights) were strongly present on the market, whereas potential sellers (over-equipped) initially responded very cautiously. At the end of the trading period, this situation reversed - potential sellers tried to make profits with surplus emission rights, whereas potential buyers had already covered their demand to a great extent. By contrast, more constant price development has so far been observed for the second trading period from 2008 onwards.[731]

  Similar development may occur during the starting phase of a license system for ecologically disadvantageous beverage packaging, in particular, as here, too, market players do not yet have experience and, furthermore, market operators may pursue a strategy of keeping back licenses.

[728] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 181.
[729] Cf. EEA, 2005, S. 54–64.
[730] Cf. Defra-Webseite, Achievement statistics.
[731] Cf. Ellerman. A. D. and Joskow, P. L., 2008, p. 13.

- With respect to the first EU ETS trading period, there was criticism that allocation volumes were too high and that there was thus no scarcity on the market (corresponding price drop in 2007).[732]

  This indicates that the definition of allocated quantities of ecologically disadvantageous beverage packaging (in particular in the introductory phase), also means significant challenges for politics.

- Companies committed to trading frequently pass on the price of emission rights directly to the consumers, irrespective of whether the corresponding costs have actually been incurred. Electricity providers, for example, can generate substantial windfall profits from the difference between additional electricity revenues and the actual costs involved in the purchase of emission rights. According to a current estimate, the windfall profits of selected German electricity providers alone came to a total of € 35.5 billion in the second phase of the EU emission trading system (2008 to 2012).[733] This phenomenon occurs particularly when emission rights are allocated free of charge (*grandfathering*). (, in particular in the event of free of charge allocation of emission rights (*grandfathering*).)

  Windfall profits may also occur in a license system for ecologically disadvantageous beverage containers. For this reason, the auctioning of licenses should be considered in order to fix a price beforehand and thus reduce the possibility of windfall profits.

- Current investigations carried out by Europol detected a tax fraud in the EU ETS. The damage is estimated to be ca. € 5 billion. The basis for this tax fraud were the varying different national taxation rules for emission certificates that were made use of by means of cross-border trading at the expense of the EU countries concerned. Moreover, Europol sees a risk of money laundering and assesses markets with intangible assets as being generally prone to misuse.[734]

  Basically, the risk of misuse would be lower in a strictly German license trading system than in a Europe-wide system such as the EU ETS. However, here too, trading with intangible assets is to be initiated, which requires corresponding (possibly cost-intensive) control mechanisms in order to prevent misuse on a larger scale.

These experiences and associated possible problems must be taken into account when a license model for ecologically disadvantageous beverage packaging is designed. However, with respect to the actual design of a license model, unknown territory would be entered due to a lack of references. It would be necessary to clarify the following design issues:[735]

- Target definition in terms of environmental policy
- Companies subject to licenses

[732] Cf. Ellerman. A. D. and Joskow, P. L., 2008, p. 13.
[733] Cf. Öko-Institut, 2008, p. 14.
[734] Cf. Phillips, L., 10 December 2009.
[735] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 182.

- Market delimitation
- Content of packaging licenses
- Selected allocation procedures

Initially, the quantity of disadvantageous beverage containers to be brought into circulation in absolute terms would have to be determined as a **target definition**. In accordance with the ecologically advantageous beverage containers target of 80 %, the ecologically disadvantageous beverage containers benchmark of 20 % should be determined as the orientation point. As the proportion in the status quo is significantly above the goal of 20 % that is aimed for, transitional solutions should be taken into consideration which, for example, ensure target achievement over the medium term through annual reduction of the permissible quantity of ecologically disadvantageous beverage packaging while, at the same time, giving beverage producers sufficient time to convert their production capacities. The period should nevertheless be short enough to ensure that the companies concerned act within due time. In order to define such a target for the licensing mechanisms, a "baseline" quantity must initially be determined and verified, i.e. the quantity of ecologically disadvantageous beverage containers put into circulation when the instrument is introduced. This quantity must also be determined in the following years in order to ensure steering of the instrument. Since these quantities serve as a basis for the allocation of licenses, appropriate determination is significant with regard to the success of the instrument. The determination of these quantities may require high efforts in practical and in administrative terms.

Alternatively, packaging producers, beverage producers or trade can be included as companies **subject to license**. In general, only minor trading activity is to be expected if there is only a very low number of market participants and if forming a market price that corresponds to the actual conditions seems doubtful. Moreover, such case would involve a risk that individual market participants dominate the market, and this would additionally reduce the proper functioning of the market. A large market with many participants generally promotes the efficiency of the newly created market; on the other hand, administrative monitoring and control efforts rise as the number of market participants grows.[736] Putting trade under an obligation does not seem recommendable given the required very large number of market participants as the administrative expense would be high. (A license model for trade would require trade exemptions or pooling solutions for small trading companies.) Since packaging producers do not directly decide on putting items into circulation and the current legal provisions governing packaging waste in the EU and in Germany mainly concentrate on beverage producers, it appear reasonable that beverage producers should be the licensees. This would ensure a sufficiently high number of market operators without reaching a magnitude where very high administrative efforts are to be expected. This approach seems problematic in the case of imports. With respect to these, trade could be directly included as importers. In general, it is necessary to consider whether certain quantity limits should be introduced which exclude small beverage producers or smaller wholesalers/retailers from the license duty as these producers would be affected to a disproportionately high extent by the additional expense incurred by such system. How-

[736]Vgl. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 184.

ever, consideration should also be given to the fact that exceptions are often difficult to control and may lead to an increased risk of misuse and also the circumvention of legal regulations.

With respect to **market delimitation**, the rule is that a large market enables greater trading volumes and thus more efficient trading. From this viewpoint, a European trading system is to be preferred to a strictly German one.[737] Due to the heterogeneous structure of the systems for dealing with beverage packaging, a European trading system is unrealistic, however. Therefore, a strictly German solution is assumed in the following.

The **content of packaging licenses** may relate to filling volume, packaging weight and the type of the packaging material used.[738] In order to provide maximum innovation incentives (e.g. reducing the weight of ecologically disadvantageous containers), orientation towards the filling volume alone is probably not expedient. Rather, the focus should be on the container weight (e.g. container weight per filling volume) and, if possible, the type of the packaging material used. However, the practicability of the respective approach should also be subjected to an initial critical review within the scope of feasibility studies.

With respect to the **allocation procedure**, the possibility of license auctioning exists, free-of-charge allocation based on the *grandfathering* principle (beverage producers of ecologically disadvantageous beverage containers receive licenses for market launch free of charge), as well as statistically equal allocation to all filling companies (equal allocation irrespective of whether they put ecologically disadvantageous or ecologically advantageous beverage containers into circulation). The auction model has the advantage that companies which are new on the market are not disadvantaged as they can equip themselves with new licenses. In addition, license auctioning generates public revenues that can be invested in the promotion of ecologically advantageous beverage containers such as refillable beverage containers, for example. However, from a corporate point of view this means additional costs regarding license acquisition which are usually allocated to the consumer. While *grandfathering* does not generate public revenues from the granting of licenses, it minimises the burden on companies. However, this allocation procedure has a negative impact in that it makes market access considerably more difficult. A statistically equal allocation of licenses would lead to a substantial impairment of the market for beverage producers and to a significant improvement for beverage producers of ecologically advantageous beverage packaging. The implementation of such a system appears to be improbable against the background of proportionality considerations and expected acceptance problems respecting the affected companies. On the basis of these considerations, a *grandfathering* model is generally assumed for the scenario that, on the basis of a special quota for new market entries, approaches the above-stated problem in a targeted manner. After the instrument has been established, conversion to an auction solution may be an alternative that would reduce the problem of possible windfall profits, among other things.

This regulation may involve a substantial risk of misuse, depending on the design. One possible misuse scenario, for example, would be that the companies concerned increase their one-way rate at

[737] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 183.
[738] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 184.

the cut-off-date in order to be allocated more licenses. This would be to the disadvantage of producers that fill refillable beverage containers and would lead to a delay in the desired effect – to reduce the proportion of ecologically disadvantageous one-way beverage containers - and may initially even have the opposite effect. Moreover, this possibility would be of particular benefit to large beverage producers, which may lead to a disadvantage for smaller producers. Given that the objectives of the Packaging Ordinance are to be attained with such a measure, such misuse would have to be anticipated and ruled out in advance when designing the model.

With respect to the allocation procedure, a decision must also be made as to whether licenses should be valid for a limited or unlimited period of time. In the case of limited validity, e.g. an annual auction, a market price is already formed upon allocation. In the event of unlimited validity, increased secondary trading with own market price determination is to be expected.[739] In general, due to market dynamics and, in particular, in order to maintain the intervention possibilities of government authorities, it is recommended that the validity of the licenses granted be limited. This is the only way to adjust a license system that is oriented towards absolute quantities to the target parameter of a maximum of 20 % of ecologically advantageous beverage containers, e.g. in the event of a change in the total quantity of beverages consumed.

As is the case with the levy system, compliance with EU and national law must be observed in the practical design of the license model. In particular, the target parameter must be determined in such a manner that the Internal EU market is not impaired and that trade barriers within the EU are avoided.[740] For this reason, when an assessment is made, attention should always be paid to the fact that practical implementation can possibly not be realised due to legal difficulties.

C 3.4.2 The system resulting from the "license models" system

In addition to the existing deposit system for one-way beverage containers, a license system for ecologically disadvantageous types of beverage containers is introduced. A limiting, absolute quantity of ecologically disadvantageous beverage containers is determined as an environmental target definition. Beverage producers, as those subject to licensing, bear responsibility. The market is limited to Germany. Based on the *grandfathering* principle, packaging licenses are initially granted free of charge relative to the container weight (possibly, in addition, relative to the type of container). Initially, licenses are issued with a one-year limit to enable subsequent system adjustment.

The following provides an assessment of the direct effect of this system on the refillable rate and the indirect effect on the aspects of littering and recovery/recycling.

C 3.4.3 Assessment of possible effects of the "license models" scenario

C 3.4.3.1 Development of the refillable rate in the "licensing models" scenario

Licensing of ecologically disadvantageous beverage packaging concerns both deposit and non-deposit beverage containers. As in the case of the levy, the respective prices will increase to a certain extent.

[739] Cf. Österreichisches Ökologie-Institut and Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, p. 186 f.
[740] Cf. IÖW and Öko-Institut, 2009, p. 14–29.

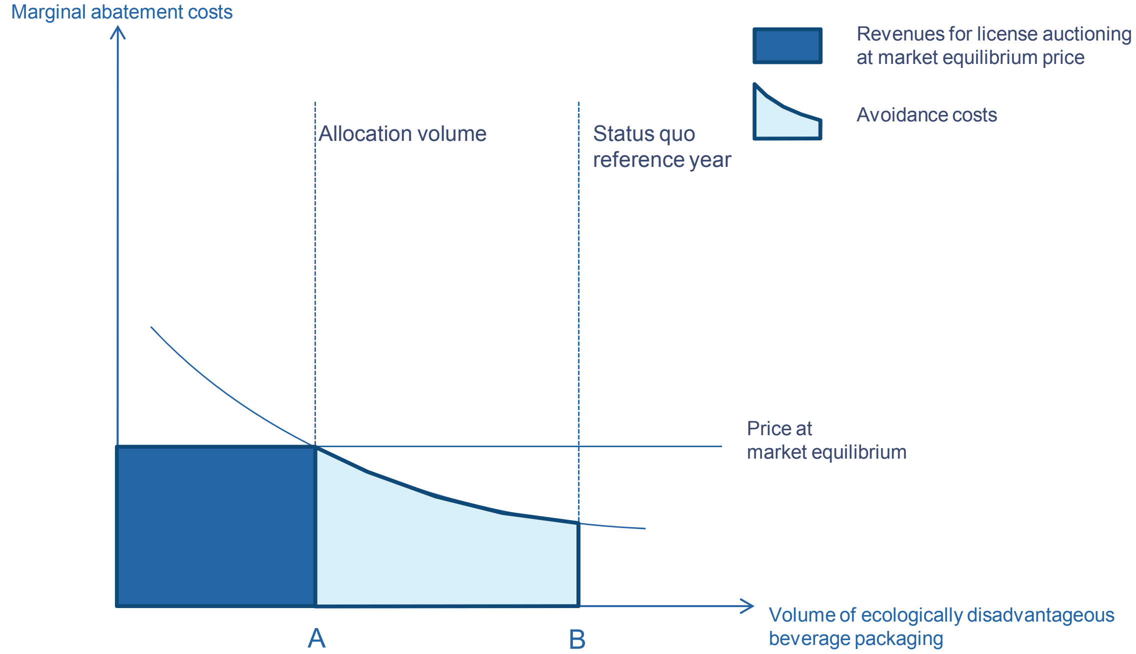
Due to the (free-of-charge) allocation of basic license equipment, the price increase is lower for market operators than in the event of the incentive levy discussed in Section C 3.3.

Theoretically, the ecologic efficiency of the instrument is ensured through direct definition of the admissible production volumes which, however, is linked to systematic enforcement, a high level of transparency and a corresponding infrastructure. It is assumed that efforts relating to enforcement will be comparatively high.

As shown in Illustration 35, the instrument leads - in the theoretical ideal case - to a minimisation of macro-economic abatement costs. A market equilibrium price may arise from secondary trading with licenses among market participants.[741] Knowledge of the marginal abatement costs, i.e. the individual expenses incurred in an industry when ecologically disadvantageous packaging is replaced with ecologically advantageous beverage packaging is not required. Consequently, the trial-and-error search process regarding an optimum levy amount, which characterises the instrument of the incentive levy, does not apply.

In addition, Illustration 35 shows the public revenues to be expected from license auctioning or the costs incurred by the private sector, respectively. These costs do not apply in the event of grandfathering. However, grandfathering is also subject to substantial costs that cannot be assessed in advance as detailed information about the production of individual market operators is required. Further costs are generated in secondary trading as well as due the pertaining necessary control of market operators.

Illustration 35: Marginal abatement costs concerning the license model; source: own presentation



The resulting license price depends to a decisive extent on how ambitious the determined target (Point A) is relative to the status quo (Point B). Depending on the number of allocated licenses and

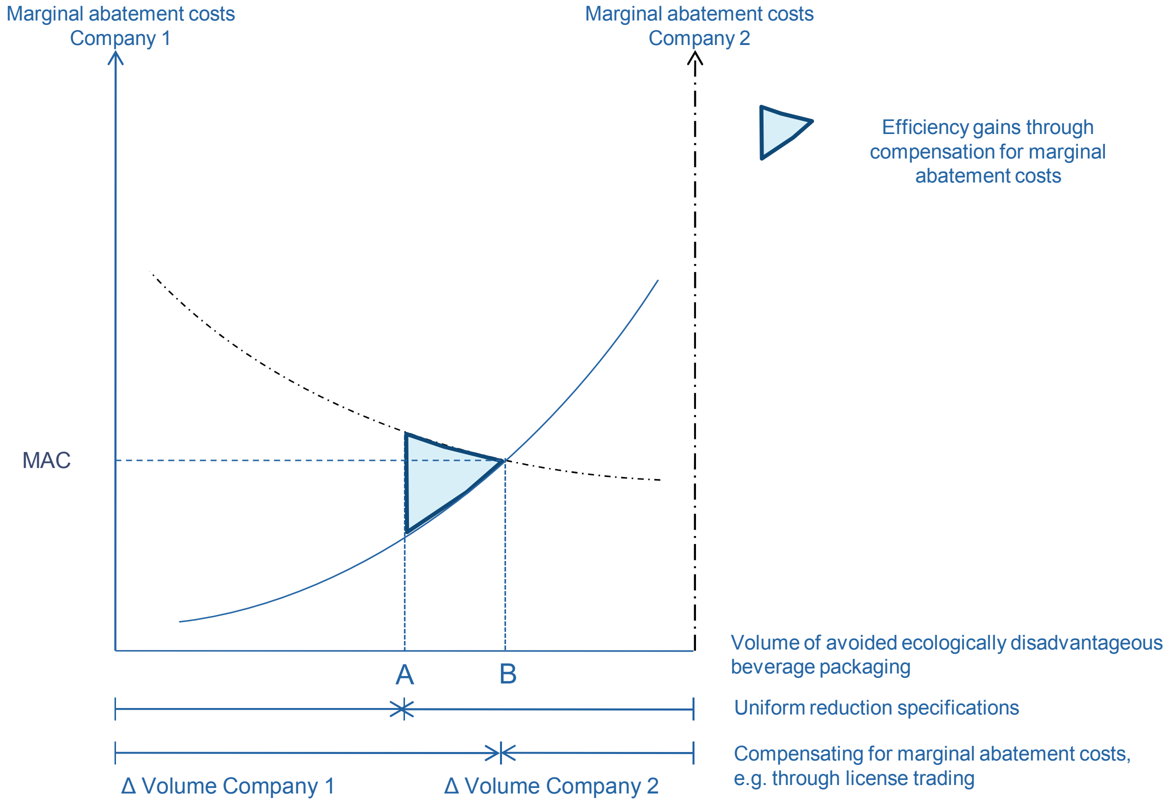
[741] Licenses with limited, one-year validity may, in practice, lead to limitations in the trading volume respecting the secondary market and to pertaining deviations from the market equilibrium price.

the actual marginal abatement costs of the companies involved, a market equilibrium price is established (given a theoretical optimum) that corresponds to the optimum amount of an incentive levy with the same result. As already mentioned, within the scope of target definition it is important that the companies concerned are given sufficient time to enable them to achieve the target, and that the resulting market equilibrium price does not have a prohibitive effect. With respect to the target of stabilising the refillable rate, it is also important to consider that the instrument must take effect within a short period of time in order to avoid a further sharp drop in the refillable rate.

Theoretically, this solution minimises the macro-economic abatement or substitution costs. This advantage is apparent, for example in the case of two companies participating in trade with different marginal cost course.

Illustration 36 shows an example where the marginal cost course of two companies differs. Company 1, for example, has parallel bottling plants for ecologically advantageous and ecologically disadvantageous beverage packaging and can quite easily adjust capacities to new requirements. Company 2 is less flexible and therefore has an unfavourable marginal cost course. If the reduction targets are allocated without the possibility of trading, both companies are affected by the measure to a varying extent (Point A). Company 1 profits more from the lower marginal costs than Company 2. If, however, license trading between the companies were possible, Company 1 would more strongly reduce the extent to which it puts ecologically disadvantageous beverage packaging onto the market (Point B). It would, instead, sell licenses to Company 2 which, as a result, could meet some of its reduction targets. Given an overall equal reduction volume, license trading leads to efficiency gains though balancing out the marginal abatement costs. The underlying trading mechanism generally ensures that prevention or substitution occurs at companies that implement the measure the most cost-efficiently,

Illustration 36: Efficiency gain through balancing out marginal abatement costs



Generally, both the license model and the levy solutions provide innovations for production and trade. Experience gained with the existing license models indicates, however, that a risk is involved in the creative handling of licenses and the resulting profits. As companies that are equipped with licenses trade their licenses via the secondary market, and, in so doing, can use them to achieve profit, the innovation incentive is theoretically stronger compared to the incentive levy, which is only aimed at avoiding costs. Against this background – similar to the description in Section C 3.3 using the example of a change in the offer of discounters, a shifting in the marginal costs course and thus a decline in the market price of the licenses (given the same reduction target) is possible.

A license system may be suitable for achieving the target of increasing and stabilising the refillable rate, to the extent that the permitted quantities can be correctly defined and swiftly implemented. This seems perceptibly easier and more plausible in theory than is expected in practice from the data survey. In addition, if a ratio for ecologically disadvantageous beverage packaging were to be defined, the total filling volume brought into circulation would also play a central role. However, the filling volume can quickly change due to unforeseeable market trends (e.g. a shift in demand from beer to beer-mix beverages) or through external factors (e.g. a hot summer promotes the sale of (non-alcoholic) soft drinks). The costs incurred by the system participants as a result of the definition of permitted volumes depend, on the one hand, on the selected allocation procedure (grandfathering is more cost-efficient than auctioning, from a corporate point of view). On the other hand, they are influenced by further parameters such as the functioning and efficiency of secondary trade and cannot be assessed in more detail at this point. In general, before such a system is introduced, the respective costs should be precisely determined and a cost-benefit calculation should be carried out.

C 3.4.3.2 Littering development in the "license model" scenario

Generally, the substitution of non-deposit one-way containers with refillable beverage containers is associated with an incentive to return packaging, and along with that, there is a positive effect on littering. However, this effect is assessed as being lower than the effect that would be achieved by charging a direct deposit on all ecologically disadvantageous beverage packaging. The price of non-deposit, one-way beverage containers increases, but no incentive to return them is created, however.[742]

C 3.4.3.3 Development of recovery/recycling rates for one-way beverage containers in the "license model" scenario

It is not intended that the license model should impact on the recovery/recycling rates of one-way beverage containers, and such an impact is also not directly or indirectly expected. As the initially described example of the Packaging Waste Recovery Notes (PRNs) from Great Britain shows, license models can be designed with this aim, but the respective efficacy is questionable.

C 3.4.4 Assessment of the "license models" scenario

If the theoretical ideal case is considered, introducing licences would appear to be a possibility for achieving an increase and stabilisation of refillable rates. However, experience with existing license systems shows that practical implementation and, consequently, the achievement of ecological targets is associated with considerable difficulties. In particular, the efforts regarding processes to control and prevent system misuse are assessed as being high. Furthermore, a design that is compatible with both national and EU law involves further challenges.

With respect to littering, as with levy-related solutions, indirect positive effects are possible. An increase in recovery/recycling rates for one-way beverage containers is not to be expected from the basic model; however, theoretically it could also be promoted by a license model that is linked to recovery and/or recycling rates.

[742] Vgl. Österreichisches Ökologie-Institut und Institut für Technologie und Nachhaltiges Produktmanagement der Wirtschaftsuniversität Wien, 2009, S. 188.

Based on the assumptions made, the following developments are assumed to be realistic:

Table 82: Effects of the "license model" scenario on the impact categories

Ecological impact categories	• Theoretically, given corresponding restriction of the number of licenses issued, the MöVE rate could be raised to the aimed-for 80% level. • Theoretically, incentives (due to possible profits from the sale of licenses) for innovations in the ecologically advantageous packaging segment could be created.
Economic impact categories	• More expensive types of beverage packaging that are affected by license trading may lead to acceptance problems. An accompanying information campaign (see Section C 3.2) may contribute to promoting acceptance. • Revenue for the government arises only in the case of license auctioning. By contrast, financial burdens for obligated beverage manufacturers would be minimised in the event of a grandfathering procedure. In the event of an auction, the expedient and clearly communicated use of the revenues achieved is of great importance with regard to acceptance of the procedure. • To ensure functionality, the system requires high to very high administrative costs for data collection and systematic implementation (monitoring and controlling expenses). Compared to the levy system, higher administration costs are to be expected due to the complexity of the instrument in a license model. In this respect, it is necessary to take into account that enforcement of the current Packaging Ordinance has already proven to be difficult. • Effects on market participants are to be expected over the medium term. Smaller beverage producers that fill beverages into refillable beverage containers are supported by the changed set-up (determining conditions), while beverage producers that place emphasis on ecologically disadvantageous beverage containers come under pressure. • Over the medium term, it is to be expected that market participants will respond to the new framework conditions with innovations and that, consequently, the initial license price will decrease.

Social impact categories	• Medium-term stabilisation of product diversity can be assumed due to the medium-term support of smaller beverage manufacturers. • It cannot be ruled out that, due to the Small Quantities regulation, a (difficult to control) grey area of beverage manufacturers that are not obligated to pay a levy will arise or that the regulations will be creatively circumvented. This problem exists in Great Britain, for example.[743] • It is to be expected that the phenomenon of littering in the beverage container segment will decrease slightly due to indirect effects (in particular, an increase in the refillable proportion). • A long-term increase in jobs in more work-intensive sectors that fill beverages into refillable beverage containers is to be assumed, whereas, in comparison, the number of jobs in the segments that mainly fill beverages into one-way beverage containers is expected to decrease.

Given that, despite the above-mentioned challenges, such a license system can actually be designed so that it is feasible in practice, it is expected that refillable beverage containers as well as other ecologically advantageous beverage containers will significantly gain importance and that the current decline can be permanently corrected. Suitable transitional periods must be defined so that this effect is not impaired. Generally, however, the advantages of a license system are limited due to the arising of administrative costs, that cannot be estimated at present and which reduce the advantages of the presented theoretical model.

[743] Cf. EEA, 2005, p. 61.

C 3.5 Abolition of the mandatory deposit regulation ("zero option" scenario)

C 3.5.1 The "zero option" scenario

This scenario describes what would happen if the mandatory deposit on one-way beverage containers that was introduced in Germany in 2003 were to be abolished.

Ecologically disadvantageous beverage containers such as beverage cans and one-way PET bottles that are subject to this regulation would again be collected (as before introduction of the mandatory deposit), via the dual systems and consigned to recovery. No accompanying measures to reduce any possible negative effects of ecologically disadvantageous one-way beverage containers would be in place.

Such a scenario is conceivable if refillable rates should rise above the legally required extent or if ecologically disadvantageous one-way beverage containers were to be substituted systematically with ecologically advantageous one-way containers, and if other return systems were to achieve similarly high return and recycling rates and, on this basis, a political decision were taken regarding abolition of the mandatory deposit for one-way beverage containers. However, this scenario is assessed as being unrealistic given the decline in refillable containers and ecologically advantageous beverage packaging since 2005, and in light of the very high return and recycling rates in the one-way deposit system.[744]

C 3.5.2 The system resulting from the "zero option" scenario

The "zero option" scenario results involves framework conditions and a system that is comparable to the situation before introduction of the mandatory deposit on one-way beverage containers in 2003. A growing trend towards one-way beverage containers had already been determined before introduction of the mandatory deposit on one-way beverage containers. However, due to the mandatory deposit, it was possible to temporarily reverse this trend in most beverage segments; a permanent reversal was possible only in the beer segment. Accordingly, in the "zero option" scenario, a further decline in the refillable rate would be expected. In addition, the further impacts of the deposit system for one-way beverage containers such as a reduction in littering and an increase in recovery/recycling rates for one-way beverage containers would cease to apply. Based on the respective impacts on the targets formulated, the systematic significance of a "zero option" is assessed in the following.

C 3.5.3 Assessment of possible impacts of the "zero option" scenario

C 3.5.3.1 Development of the refillable rate in the "zero option" scenario

The development of the refillable proportion since 1991 (see Illustration 37**)** indicates that the rate of just over 73 % in 1993 dropped continually to 56.2 % in 2002. In 2003, the refillable proportion rose

[744] Cf. GVM, 2009 b, p. 27.

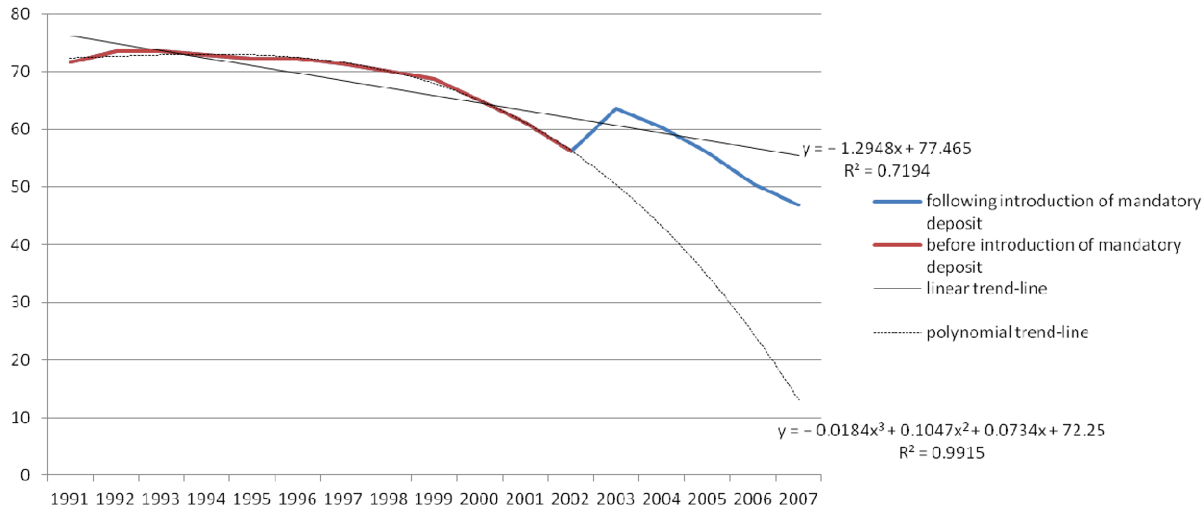
sharply by 7.4 % after the introduction of a mandatory deposit.[745] In the following years, the rate remained almost constant with regard to beer at a level above the 1991 proportion, but it fell again with regard to water, and even more strongly respecting non-alcoholic mixed beverages. As early as in 2005, at 56 %, the refillable proportion in the overall average was therefore 0.2% below the 2002 value and 7.6 % below the 2003 value. Extension of the mandatory deposit to include one-way beverage containers for non-carbonated soft drinks and alcohol-containing mixed beverages in 2006 did not show any considerable effects on the downward trend so that the decline to the currently existing figures for 2007 continued practically unabated.

A description of the "zero option" scenario, abolition of the one-way deposit system, leads to the question as to how the system would have developed if a mandatory deposit had not been introduced. Illustration 37 shows two extremes of the possible development, starting with the refillable rates between 1991 and 2002:

- If the average development of the refillable rate from 1991 to 2002 is extrapolated straight-line through to the year 2007, a refillable rate of approximately 55% would be expected for 2007: At 46.9%, the value actually achieved was lower. This shows that this model is not suitable for describing the development. (see Illustration 37, straight trend line).
- If, by contrast, the development prior to 2002 is extrapolated polynomially up to the year 2007, refillable systems without corresponding measures would already have shrunk to a minimum proportion in 2007 - if they had not already disappeared from the market. The market development in Germany with a largely constant situation up to the mid-1990s and increasing acceleration of the decline as from the end of the 1990s suggests that, on the basis of these assumptions, significantly more realistic development can be shown than the straight trend line shows (see Illustration 37 polynomial trend line). Measured in terms of this course of development, the one-way deposit system has at least effected a marked slowing of the downward trend.

[745] Own calculation based on GVM, 2009 b. (A very long time series was required for the present evaluation. For reasons of comparison, the evaluation systematics used before the third amendment to the Packaging Regulation were therefore drawn upon (cf. for a comparison of the GVM survey procedure; 2009 b, p. 22). For this reason, the development of ecologically beneficial one-way containers, in particular, was not taken into account. The proportion of ecologically beneficial one-way containers dropped from 4.9 % to 3.4 % between 2004 and 2007. There is no systematic distortion of the statements respecting the refillable proportion due to the overall low proportion overall and also the trend towards reduction.)

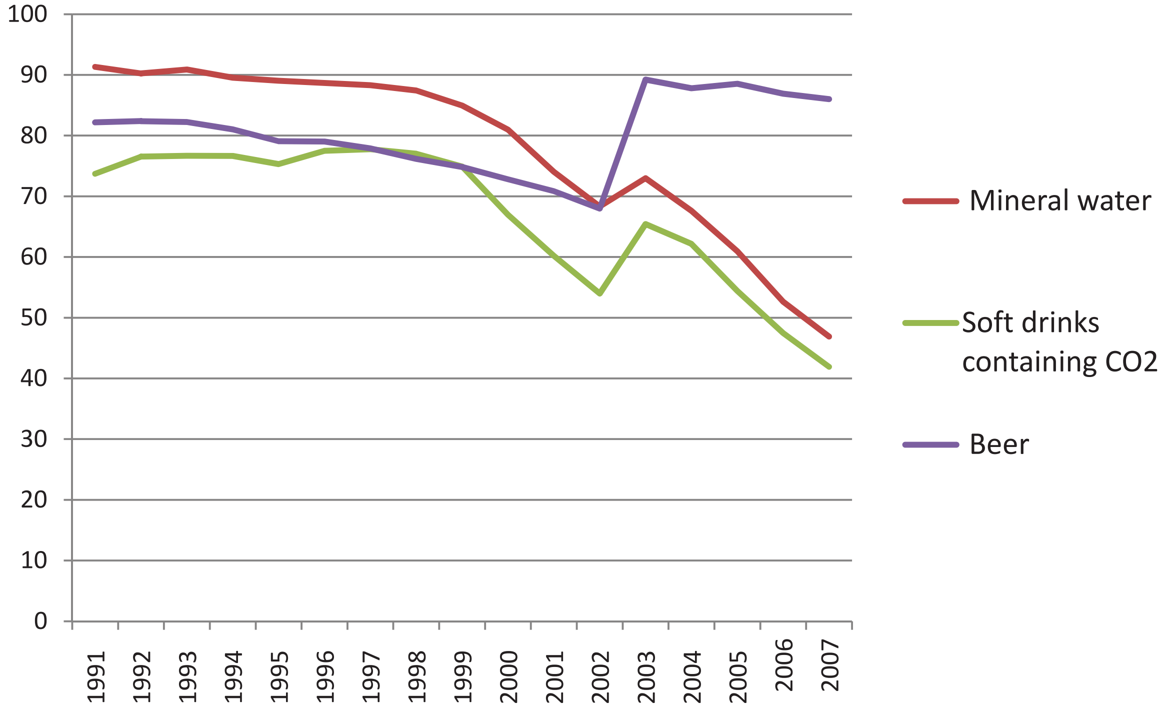
Illustration 37: Development of the refillable rate 1991 to 2007 with trend lines for assessing the development without the introduction of a mandatory deposit; source: own presentation based on GVM data, corrected values for 2006



If the one-way deposit were to be abolished, a corresponding downward movement similar to the initial rapid increase between 2002 and 2003 (+ 7.4 %) would be expected, and probably to an even greater extent. If the already existing negative trend (3.7% decline from 2006 to 2007) is included in the calculation, a drop of more than 10 % in the refillable rate appears possible.

If, individual types of beverages were to be examined instead of the development of total rates, the picture would be quite different (see Illustration 38). While it was possible to stabilise the refillable rate for beer extensively at a level significantly above that reached prior to introduction of the mandatory deposit, the downward trend in the refillable rate for mineral water and non-alcoholic soft drinks could be slowed only to a limited extent, but not stopped or even reversed.

Illustration 38: Development of the refillable rate, 1991 to 2007, for selected beverage types; source: own presentation based on GVM data



If these beverage-specific developments are considered, it can be assumed that abolition of the mandatory deposit would also have a very negative impact on the presently high refillable rates in the beer segment.

C 3.5.3.2 Development of littering in the "zero option" scenario

Before introduction of the one-way deposit, one-way beverage containers contributed significantly to the littering problem. The proportion of beverage containers in littering was above 20 % in 1998, as the Witzenhausen-Institut showed on the basis of an inquiry carried out by the RW TÜV.[746] Approximately one to two billion one-way beverage containers were spread around the countryside as litter in 2002;[747] after the introduction of a one-way deposit and a comprehensive take-back system, littering involving deposit one-way beverage containers was reduced to almost zero.[748]

If the one-way deposit were to be abolished, littering would probably again rise to the former extent and public areas would again be increasingly polluted with one-way beverage containers.

[746] Cf. Witzenhausen Institut, 2001, p.6.
[747] Cf. SIM, o. J., p. 8.
[748] R3 speaks of an almost zero proportion, but does not name any data source for this statement (cf. R3, 2009, Section 10-9). No extensive investigation of littering caused by beverage containers has been carried out in Germany since introduction of the mandatory deposit. In keeping with the determined return rate (see Section 132), a return rate of 1.5 % for PET bottles and below 4 % for tins can be assumed. There are clear indications that a large proportion of littered beverage containers are collected and returned by other people. It can also be assumed that a significant proportion of the beverage containers not returned end up as litter or in residual waste collections as incorrectly disposed of items.

C 3.5.3.3 Development of recovery/recycling rates regarding one-way beverage packaging in the "zero option" scenario

After the 5th amendment to the Packaging Ordinance, beverage manufacturers are no longer obligated to report the quantities of deposit packaging brought into circulation.[749] Deposit one-way beverage containers need not be licensed as they are disposed of through the sales locations and not by means of dual systems. Hence, it is not possible for the authorities (BMU, UBA and the federal states' environmental ministries) to directly compare the quantities that are put into circulation and those taken back. As described on page 129, the return rate for deposit one-way beverage containers is between 96 and 98.5%. These quantities are completely consigned to recovery.[750] The Witzenhausen Institut's determination of the quantity of potentially deposit one-way beverage containers in residual waste prior to introduction of the mandatory deposit showed that 14 to 51 % of these containers ended in residual waste. This means that the dual systems could only cover 49% (city) to 86% (more rural districts) of the PET one-way beverage containers.[751] In 2007, ca. 62 % of all plastic packaging brought into circulation (not only beverage containers), was collected by means of dual systems and was consigned to recycling.[752] 65% of the collected plastic packaging was consigned to recycling,[753] which, together with return rates, corresponds to a total recycling rate of 41%.

An analysis of impact categories (see Section C 2), indicated that deposit systems for both refillable beverage containers as well as for one-way beverage containers realise significantly higher return and recycling rates than dual systems. The deposit system for one-way beverage containers also led to an increase in the bottle-to-bottle recycling rate.

Hence, a "zero option" would lead to deterioration of the collected and recycled quantities. In addition, it can be assumed that the materials quality for recycling would deteriorate and, in particular, that bottle-to-bottle recycling would be reduced.

[749] Cf. BMU, 26.01.2009, p. 6.
[750] Cf. IFEU, 2008, p. 25 and p. 26.
[751] Cf. Witzenhausen-Institut, 2001, p. 14.
[752] Cf. GVM, 2009 a, p. 64; assuming that the recovery rates stated here correspond to the return rates.
[753] Cf. GVM, 2009 a, p. 61 & 63 (805kt recycled domestically, 323.2kt recovered abroad at a recycling rate of 83.6 %; results in a total of 1,075kt of recycled plastic packaging; i.e. a recycling rate of 65 %).

C 3.5.4 Assessment of the "zero option" scenario

With respect to the targets of Packaging Ordinance (i.e. prevention of packaging waste and the environmental impacts caused by packaging waste, stabilisation of the proportion of refillable beverage containers and ecologically advantageous one-way beverage containers as well as the promotion of quantitative and qualitative high-quality recycling), the "zero option" is assessed as being counterproductive. Based on the assumptions made, the following developments are considered to be plausible:

Table 83: Effects of the "zero option" scenario on impact categories

Ecological impact categories	• It is to be expected that the refillable rate will decline strongly. • In addition - as no incentive to return or collect one-way beverage packaging would be provided due to abolishment of the deposit system - the total quantity of one-way beverage containers that is collected separately (return rate) and which is subsequently consigned to recycling and closed-loop recycling (recycling rate), would probably decline. • Littering involving beverage containers, which are then no longer subject to a deposit, would probable increase to the same extent as before the introduction of a mandatory deposit on one-way beverage containers (ca. 20 % of all littering). • PET recyclate from PET one-way beverage containers would no longer be collected as mono material. A decline in the recycling quality regarding PET would probably result as PET collected in dual systems is not consigned to bottle-to-bottle recycling in practice. • Abolition of the already implemented mandatory deposit could trigger a high degree of scepticism about the sense of separating waste and this would have a negative impact on consumer cooperation
Economic impact categories	• It is to be expected that the market for PET recycling would come under pressure and lose volume since, due to lower return and recovery rates, also the number of market participants would decline. • For smaller beverage producers, in particular, market participation would become more difficult due to a further shift from refillable to one-way beverage containers. The survival of small, often reuse-oriented beverage producers would appear to be endangered by the comprehensive spreading of one-way beverage containers throughout all beverage segments.

Social impact categories	• In the event of a decline in the number of smaller beverage producers that participate in the market, a resulting decline in often regionally characterised product diversity is to be expected. • It is expected that littering respecting the beverage packaging segment will again increase massively. • A reduction in jobs in the industry sectors directly associated with a refillable system is assumed whereas employment in industry sectors directly associated with one-way systems is expected to increase. However, since bottling in refillable bottles requires comparatively more personnel, overall, a drop in employment is probable.

In the "zero option" scenario it is expected that, over the medium to long term, one-way beverage packaging will almost completely oust refillable containers from the market, and that this would be accompanied by a corresponding increase in negative ecological impacts. Moreover, lower return- and recycling rates overall are to be expected as well as deteriorated recycling qualities of beverage packaging. Furthermore, it is likely that there would be effects on both consumer behaviour, in particular on nation-wide environmental awareness, and on employment.

C 4 Action options for optimising the return and recycling systems for beverage containers (action plan)

If the additional measures listed in the following action plan are not implemented, it is to be expected that refillable systems for non-alcoholic beverages in Germany will become practically irrelevant in the coming decade and, consequently, the corresponding ecological goals will not be attained.

The action plan presents a set of measures that is suitable for achieving the goals referred to in the Packaging Ordinance. The starting point is the actual situation as presented in the description of the German system and assessed in the "status quo" scenario respecting future development. The success of the measures depends on whether the system participants and government decision-makers support a sustainable beverage packaging return- and recycling solution.

The measures are oriented towards the central objectives of the Packaging Ordinance, i.e., preventing packaging waste as far as possible, increasing and stabilising the MövE proportion, and improving the return and recycling rates for beverage containers. Due to the initial situation of a continually declining MövE proportion, a key point of the action plan is to develop measures to solve this problem. In this respect, the motivation is not only to meet the legal requirements, but also to strengthen the principles of a sustainable economy.

As the analysis showed, the initial situation in Germany is basically solid. Therefore, sets of measures involving coordinated steps are recommended; some of these can effect positive changes with easily manageable efforts. If substantial improvements are to be achieved, the following, in particular, are necessary:

- Improving the comprehensibility and transparency of the system for consumers
- Development of a solid data basis from production and trade for the steering of measures by the public sector
- Clear price signals to influence consumer behaviour
- Purpose-bound use of system revenues

C 4.1 Comprehensibility and Transparency

Acceptance problems and consumers' lack of understanding of the current system are not beneficial to the refillable rate or MövE rate. Therefore, in order to overcome these problems, the comprehensibility and transparency of the system for consumers should be addressed first:

- **Clear and uniform labelling of beverage containers*:***
  Numerous consumers cannot tell the difference between one-way and refillable beverage containers. Therefore, clear and uniform labelling should be introduced for all one-way as well as for all refillable beverage containers. Whether a one-way beverage container or a refillable container is concerned must be clearly apparent from the information on the respective packaging. In order to facilitate recognition for consumers, it would be beneficial to - in addition to textual information respecting the refillable or one-way properties of beverage containers –

also introduce uniform picture marks for deposit one-way beverage containers with deposit, for non-deposit one-way beverage containers and also for refillable containers. Printing the deposit amount on deposit one-way and refillable beverage containers could further increase transparency for consumers.

- **Expansion of the deposit obligation:**
  A lack of clarity during the introductory phase of the mandatory deposit for one-way beverage containers that was caused, inter alia, by a multitude of island solutions and numerous exceptions for certain types of beverages temporarily lowered the acceptance of the one-way deposit system. Many consumers perceived the system as complicated and not very transparent. The island solutions have meanwhile been abolished and the system has been simplified in this respect. Nevertheless, in part, the system is still considered to be complicated and not very transparent. In particular, consumers often cannot comprehend why fruit juices should be exempted from the deposit duty, and this leads to acceptance problems. Some juice spritzers are subject to the deposit some are not , depending on whether, according to legal definition, they fall under the Fruit Juices Regulation. The European Commission recommends that a mandatory deposit be charged on materials and not on beverage segments.[754] Accordingly, exempting some beverage segments from the one-way deposit should be reduced as far as possible, not least for the purpose of simplifying and standardising the regulations for consumers. Exceptions should also no longer be made for certain container sizes. The refillable rate and also the MövE rate (including beverage cartons) for fruit juices has dropped to a level of only about 50 % in recent years, and the proportion of refillable beverage containers to even below 10 %.[755] This rate could be stabilised or increased by including fruit-juice containing beverages in the deposit duty.
- **Information campaigns:**
  As an accompanying measure, the public sector should organise an information campaign to inform consumers about the ecological properties of various types of beverage packaging. In order to achieve the greatest possible effect, these campaigns should be set up for the longer term, should aim at linking positive experiences (and emotions) with MövE packaging, and they should be suitable for addressing the target groups. In this respect, the innovative use of media that are in keeping with current media usage trends is recommended. This should lead to raising consumers' awareness regarding the ecological aspects of their consumer decisions and, consequently, to a shift in the demand away from deposit one-way beverage containers to refillable beverage containers.

C 4.2 Data basis and further formalisation

The implementation and evaluation of targeted governmental measures to improve the promotion of MövE is presently being made more difficult at some points due to an incomplete data basis. A solid data basis and further formalisation in the following segments are necessary for planning and steering further governmental measures:

[754] Cf. Bodies and facilities of the European Commission & European Commission, 2009, C 107/6.
[755] Cf. Vdf website, *Einweg- und Mehrweg-Verpackungen in der Fruchtsaft-Industrie*.

- **Information duties:**
  While a large volume of data is collected in the beverage packaging segment, these data are, however, not always compatible with one another or are characterized by a high degree of intransparency. Plausible data can be procured only with very great efforts. While figures concerning the quantities brought into circulation exist (e.g. respecting the collection of plastics), they are not differentiated according to beverage packaging. The quantity of deposit beverage packaging brought into circulation is not precisely known. For this reason, the legislator should establish standard information duties regarding the quantity of packaging brought into circulation for all beverage segments as these data are a precondition for balanced and targeted decisions. A nation-wide packaging form register, associated with annual reporting of the quantities brought into circulation would be expedient here.
- **Updating the assessment of beverage packaging:**
  In the 90s and at the beginning of this century, the UBA carried out extensive investigations regarding the environmental impacts of various packaging systems. Current life-cycle studies (e.g.from the IFEU Institute) – usually commissioned by the business sector - indicate that the data basis has meanwhile changed greatly and that, in particular, aspects such as different transport distances, varying material compositions and weights are of significance, as well as the differing dynamics of the various systems. Detailed knowledge of the ecological assessment of individual packaging systems is essential for the planning of measures. Therefore, the UBA should carry out extensive and neutral up-dating of the assessment of all relevant types of beverage packaging. This should also include, inter alia, net recovery rates and the recovery quality. As in earlier UBA life-cycle assessments, all relevant stakeholders should be included when life-cycle assessments are being prepared for the purpose of achieving a high level of transparency. In view of the numerous technological innovations in recent years, it is also necessary to regularly update the ecological advantageousness.
- **Supplementing ecological assessment parameters with economic and social sustainability parameters:**
  In order to enable an assessment of packaging systems as well as packaging return and recycling systems from a sustainability viewpoint, economic and social criteria should also be included in addition to ecological criteria. For example, the fact that various enterprises bear differing cost burdens due to the respective systems should also be taken into account. The aim here is to achieve the fairest possible cost allocation in terms of extended product responsibility. Employment effects are also to be taken into account in the assessment.
- **Defined procedure for reassessing packaging:**
  In order to promote innovations respecting ecologically disadvantageous types of beverage packaging, a clearly defined procedure to enable reassessment in the event of substantial product changes should be introduced; e.g. a reduced life-cycle assessment in the event of new market developments that require the updating of data. In addition, a catalogue which determines the properties that permit a container to be classified as ecologically beneficial should be prepared (e.g. minimum circulation rate of refillable beverage containers, minimum proportion of carton with respect to beverage cartons (aseptic)), and minimum requirements regarding all packaging (e.g. prescribed closed-loop recycling rate). Critical appraisal of the assumptions in existing studies and consistency with existing market developments as well as sanctions in the event of data manipulation would be a precondition for this.

- **Accreditation of refillable systems:**
  Given the generally proven ecological advantages of refillable deposit systems, the trend towards individual bottles in some segments is to be viewed in a differentiated manner. Basically, most individual bottles can be refilled just as often as pool bottles. However, if there are a lot of different forms, the exchange of individual bottles among beverage producers becomes increasingly difficult. Against this background and if promotional measures for refillables are being introduced (e.g. a charge on one-way beverage containers), it is recommended that the accreditation of refillable systems be introduced as an accompanying measure. This should not have a prohibitive effect on existing, efficiently functioning refillable systems involving standard bottle pools (e.g. GDB pool, VdF pool and the standard beer bottle pool), which should be subject to a summarised authorisation. However, a minimum number of average circulations and possible return centre should be defined. Compliance with these criteria should be checked on a random sampling basis and misuse should be subject to sanctions.
- **Promotion of refillable systems:**
  Furthermore, the range of refillable beverage containers offered by trade should be promoted from the revenue earned from a levy, for example. The introduction of such a subsidy would require an investigation to check whether it is compatible with EU law and, in particular, with competition law. By this means and assisted by accreditation, ecologically meaningful innovations regarding refillable systems can be established.

C 4.3 Clear price signals for consumers

The difference in the deposit amount of deposit one-way and deposit refillable beverage containers has so far not had a sufficient incentive effect in the non-alcoholic soft drinks segment. Therefore, in order to achieve sustained improvement and a stabilisation of refillable and MövE rates, clear price signals are additionally required for consumers. These could take the form of economic instruments such as an incentive levy or a license model:

- **Introduction of an incentive levy:**
  In order to support reuse, a license model for ecologically disadvantageous beverage containers would appear to be sensible from a market theory viewpoint. However, in practice, deficiencies in the existing data base, opportunities for misuse (which lead to ecological targets not being met), experience with license models in other segments as well as the expected high administrative costs, possible legal uncertainties during introduction and design, as well as a general lack of clarity about the ability to control such a licence model speak against this solution.

  Against this background, the introduction of an incentive levy for ecologically disadvantageous beverage containers is recommended.
- **Amount of the levy between € 0.20 and € 0.30 per one-way beverage container:**
  According to the current state of knowledge, the amount of the levy should be between € 0.20 and € 0.30 per one-way beverage container. Generally, targeted investigations respecting the effect of the various incentive levies should be carried out before introduction and the respective levy rates should be aligned to the results of these investigations. As the actual impact of

such a levy can only be assessed to a limited extent by means of market research, the amount of the levy should be evaluated annually and adapted as required.

- **Incentive levy in retail*:***
  Basically, it can be assumed that the effect of an incentive levy is all the higher the more directly it is experienced by consumers. With this in mind, the levy should be charged directly by retailers and should be shown separately on the consumers' receipt. In so doing, cross financing can be avoided and, in addition, the ecological background would be directly communicated to consumers who, if a price increase is not shown separately, would perhaps assume a general price rise. At the same time, consumers of ecologically beneficial and refillable beverage containers would not be burdened.

An incentive levy and also a mandatory deposit system are compatible with national and international competition law as they prevent market failure in the form of external costs, i.e. costs due to environmental pollution. From an economic and a sustainability viewpoint, the internalisation of costs creates an improved competitive situation. Those who, in an imperfect market, are disadvantaged due to using ecologically advantageous packaging are provided with improved competitive opportunities as a result of the measures taken. For this reason, too, it is important that corresponding price signals are passed on to consumers.

C 4.4 Use of revenue from the incentive levy

An incentive levy on ecologically disadvantageous one-way beverage containers can especially obtain the necessary acceptance by consumers, politics and the business community if, in addition to the direct incentive effect, the obtained revenues are used in a transparent manner that supports the purposes of the Packaging Ordinance. The revenues should therefore be used for measures to promote MövE and return and recycling rates as well as for covering resulting system costs:

- Costs arising due to the introduction of the incentive levy should be covered directly by the arising revenues from the levy. These also include costs for enforcement.
- Costs for the required improvement of the data basis, the regular reassessment of the ecological properties of beverage containers and the accreditation of these systems should be covered by the revenues from the levy.
- In order to strengthen the price signals originating from the incentive levy and to create a positive incentive to change purchasing behaviour in favour of MövE, some of the revenues from the levy should be used to directly benefit MövE (e.g. by means of a direct discount). Here, too, consumers should be informed about the financial benefit by means of the sales receipt. Expansion of such financial benefit to include individual bottles in refillable systems (where the ecological benefit may be impacted by lower circulation rates) should be linked to formal accreditation of the respective refillable system as recommend above. It is necessary to check in advance whether this measure is compatible with EU law and, in particular, with competition law.
- In order to guarantee that refillable beverage containers are returned, also in the event of regional differences and varying retailer offers, the exchange of bottles within the trade sector is to be further optimised. It is recommended that, in connection with the formal accreditation of refillable systems, extensive and standardised nationwide take-back of all accredited refilla-

ble beverage containers are promoted through financial incentives. By this means, retailers could receive financial compensation from the revenues of the incentive levy when taking back refillable beverage containers that they do not carry in their assortment (a type of handling fee, which is usual in northern one-way deposit systems).

- Any revenue for the incentive levy remaining after implementation of the stated measures should be used to promote independent research and development concerning the design and marketability of ecological beverage packaging, and for the optimisation of beverage container return logistics so that targeted innovations are promoted.

C 4.5 Summary

The action plan consists of various measures, some of which are interdependent. As Illustration 39 shows, the measures can be structured sequentially, in particular regarding the possible time of implementation. Measures aimed at transparency and consumer information can be implemented very quickly, while the introduction of an incentive levy requires a longer preparation period. The sequence is not obligatory, so that various measures can be started simultaneously.

Illustration 39: Successive set of measures to promote the aims of the Packaging Ordinance

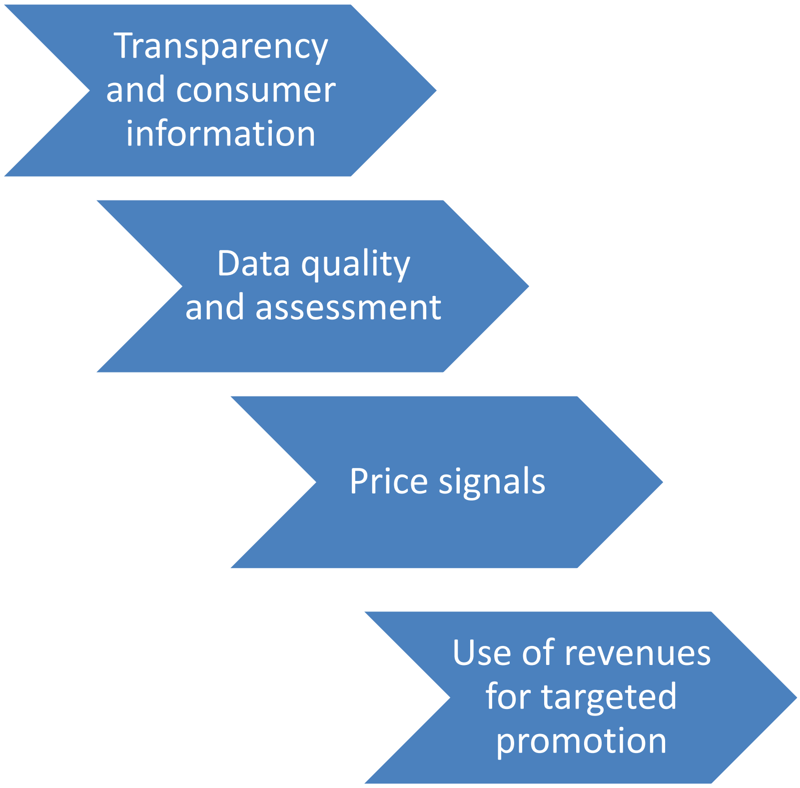


Table 84: Action plan for achieving the targets of the Packaging Ordinance

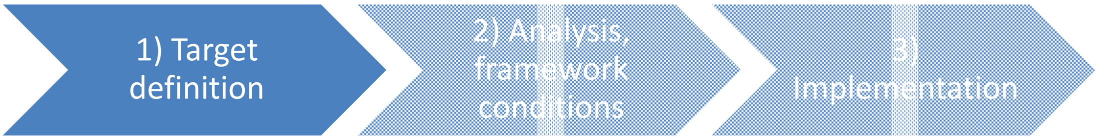
	Benefit	Parties concerned/Addressees (+) positive impacts on (-) negative impacts on
Comprehensibility and transparency of the system for consumers		
• Clear labelling of beverage containers	Improvement of system transparency; increase in the MövE rate	(+) Consumers (+)MövE beverage producers (-) Beverage producers using ecologically disadvantageous one-way packaging
• Inclusion of additional beverage segments in the mandatory one-way deposit system	Improvement of system transparency; Increase in the MövE rate; Increase in return and recycling rates	(+) Consumers (+)MövE beverage producers (+) Recycling companies (-) One-way beverage producers (-) Operators of dual systems
• Information campaigns regarding the ecological properties of different beverage packaging	Improvement of consumer awaremess; increase in the MövE rate	(+) Consumers
Data basis and additional formalisation		
• Information duties regarding the quantities of packaging material brought into circulation	Improvement of the information status of governmental decision makers and market operators regarding packaging quantities	(+) Governmental decision makers (-) Beverage producers
• Reassessment of all relevant packaging forms	Improvement of the information status of governmental decision makers regarding the ecological impacts of types of packaging	(+) Governmental decision makers (+) Innovation leaders inpackaging design
• Supplementing ecological assessment parameters with economical and social sustainability parameters	Structured consideration of macro- and micro-economic as well as social implications	(+) Innovation leaders in packaging design
• Standard procedure concerning re-evaluation in the event of substantial product improvements	Improvement of the adaptability of the system in the event of innovations	(+) Innovation leaders in packaging design
• Accreditation of refillable systems	Precondition for measures aimed at promoting refillable systems; control of individual refillable beverage containers	(+)Refillable beverage producers upon attaining accreditation
Price signals for consumers		
• Incentive levy for ecologically disadvantageous types of beverage packaging; to be charged directly in retail and shown separately on the sales receipt	A flexibly manageable proportion of ecologically disadvantageous one-way beverage packaging due to the levy amount; generation of revenues for measures to promote MövE	(+)MövE beverage producers (+) Consumers with corresponding purchasing behaviour (-) Retail trade segments with a high proportion of one-way beverage containers (in particular, hard discounters)

	Benefit	Parties concerned/Addressees (+) positive impacts on (-) negative impacts on
Appropriation of revenues from the incentive levy		
• Costs of the incentive levy system	Avoidance of costs that exceed the levy	(+) Consumers (+) Beverage filling companies (+) Trade
• Costs for improving the data basis and additional formalisation	Avoidance of costs that exceed the levy	(+) Consumers (+) Beverage filling companies (+) Trade
• Direct financial benefits for MövE	Setting a direct behaviour incentive; Redistributing some of the revenues to consumers; increasing the MövE rate	(+) MövE beverage producers (+/-) Consumers, depending on purchasing behaviour
• Promoting a standardised return (collection) system for refillable beverage containers	Using levy revenues to improve available options for action; sorting, interlinkage; increasing the MövE rate	(+) MövE beverage producers (+) Consumers with corresponding purchasing behaviour (+) MövE trade
• Promotion of independent research and development	Promotion of innovations	(+) Innovation leaders in packaging design (+) Consumers

Given complete implementation of the measures suggested here, an immediate stabilisation of refillable rates and a medium-term increase in the refillable rates is to be expected as well as positive effects on return- and recycling rates.

A weakness in the implementation of the current Packaging Ordinance is its deficient and insufficiently systematic enforcement. The determination of clear sanctions and respective enforcement is of significance for successful implementation of the measures suggested here. The previously described measures for increasing system transparency as well as the generation of clear systematics and an improvement in the data quality can support effective enforcement.

It is expedient to implement the stated measures successively; initially, this means taking steps aimed at system simplification, system transparency and at improving the data basis. These steps are a necessary basis for successfully introducing an incentive levy. At present, it does not appear likely that substantial and long-lasting improvements respecting the aims of the Packaging Ordinance can be achieved without the introduction of an incentive levy and an xpedient use of the obtained revenues.



C 5 Commentary on the UBA study Assessment of the Packaging Ordinance: Evaluating the deposit duty

Against the background of the assessment of the impacts of the mandatory deposit on one-way beverage packaging that was actually planned for 2010, the UBA published the study "*Bewertung der Verpackungsverordnung: Evaluierung der Pfandpflicht*" [Assessment of the Packaging Ordinance: Evaluating the Deposit Duty] in April 2010.[756] This study (in the following, "UBA study"), was prepared by the bifa Umweltinstitut GmbH, Augsburg, as commissioned by the UBA. Due to the contents of the UBA study overlapping with the present study (in the following, "DUH study"), the fundamental approaches and also the central findings of both studies are compared in the following.

For this purpose, the study contents (objectives, research approaches and contents) are compared and the central findings of the UBA study are assessed on the basis of the present DUH study.

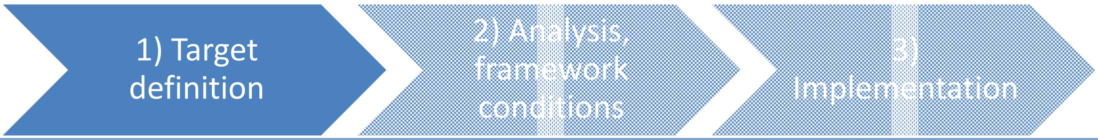
C 5.1 A comparison of objectives

As is apparent from a comparison of the overall objective in Table 85, the UBA study assumes an actual occurrence: the upcoming assessment of the third amendment to the Packaging Ordinance. By contrast, the present DUH study pursues a broader approach with a more general assessment of the efficacy of beverage packaging systems from a sustainability viewpoint. This is reflected in the individual objectives of the study: the UBA study appears to be primarily descriptive and puts the focus on an analysis of the current status. The DUH study also includes a detailed descriptive section, but is more stringently action- and future-oriented due to inclusion of the "Action plan" element. Moreover, other difference relate to the fact that the UBA study is closely focused on the deposit duty for one-way beverage containers, whereas the DUH study is aimed at beverage packaging systems overall.

Table 85: Comparison of objectives

	UBA study	DUH study
Overall objective	Assessing the effects of the deposit duty to assess the 3rd amendment to the Packaging Ordinance	Assessing the effectiveness of beverage packaging systems from a sustainability viewpoint
Individual goals	Recording and processing the current information regarding the deposit duty for one-way beverage containers	Recording and processing the current information regarding systems dealing with beverage packaging in general
	Recommending measures for implementation of the objectives formulated in the Packaging Ordinance	Recommendations for improvement of the present system design and the legal fundamentals in Germany (action plan)

[756] Cf. bifa, 2010.



	Determining important stakeholders' assessment of the existing deposit duty and respecting possible optimisation approaches	Determining important stakeholders' assessment of the existing return and recycling systems for beverage packaging and respecting possible optimisation approaches

C 5.2 A comparison of research approaches

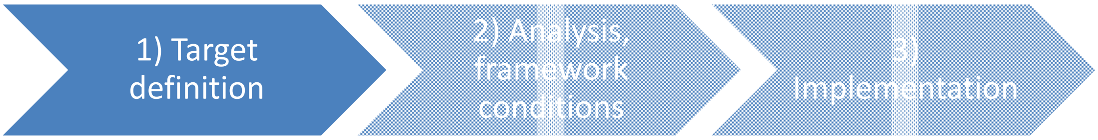
A comparison of the research approaches used in both studies basically indicates similar methods of procedure. Both studies place the emphasis on an analysis of secondary sources and supplement these with targeted stakeholder surveys. Generally, a great deal of conformity respecting the determination of impact categories has been identified, whereby the DUH study takes a significantly larger number of criteria into account.

The DUH study supplements the procedure to include a general model description and scenario analysis and, in so doing, selects a more general, more future-oriented approach. By contrast, the UBA study places greater weight on including the general opinion of stakeholders and, accordingly, with 43 answered questionnaires (from a total of 100 stakeholders addressed), goes beyond the more closely focused stakeholder surveying within the scope of the DUH study.

Differences are also apparent with respect to the stakeholders addressed: the DUH study relates (inter alia) to specialist wholesalers, the beer market, mineral water market and the fruit juices market and directly affected stakeholders. For the UBA study, mainly associations (67), federal state ministries (16), and also the operators of take-back and disposal systems (16) were addressed. Although the UBA study places great weight on surveying stakeholders, stakeholders were also addressed where it was foreseeable "that these parties are not affected by the deposit duty and therefore can only make either a small (or no) contribution to the survey".[757] Hence, within the scope of the UBA study, both affected stakeholders and also those not affected were surveyed without any differentiation respecting the degree to which they are affected being made in the evaluation. It is therefore not possible to differentiate between the judgement of stakeholders that are not affected (with rather abstract knowledge and less influence regarding interests) and the judgment of directly affected stakeholders (with extensive knowledge and a stronger influence regarding interests). In our opinion, this fact makes an interpretation of the findings of the UBA study quite difficult. In addition, this non-differentiation can be countered only to a limited extent by differentiating between opponents to the deposit duty and those in favour of it as deposit duty opponents and advocates are among the affected stakeholders and also those not affected.

To the extent that immediate action recommendations can be derived from the opinions survey in the UBA study, we see possible problems arising from the fact that stakeholder involvement is not clearly taken into account. Stronger thematisation of possible distortions due to the choice of stakeholders and a corresponding degree of interest would have been recommended here in order to substantiate the conclusions reached.

[757] Cf. bifa, 2010, p. 69.



A compilation of subjectively expressed opinions and evaluations cannot lead to an objective result. This must be taken into account in the recommendations for action directly derived from the range of opinions surveyed in the UBA study.

Table 86: Research approach in a comparison

	UBA study	DUH study
Research approach	Analysis of secondary sources (mainly relating to Germany)	Analysis of secondary sources, country comparison (selected OECD countries)
	Supplementary primary research (expert talks and interviews with selected experts from diverse sectors; questionnaires to selected stakeholders)	Supplementary primary research (guideline-supported expert interviews with representatives from companies and interest groups from specialist wholesalers, the mineral water and fruit juices industry)
	Standard impact categories, prioritisation of key factors	Uniform impact categories and definition of corresponding indicators
	Qualitative assessment of alternative steering instruments	Assessment of current and alternative steering instruments within the scope of a scenario analysis

C 5.3 A comparison of study contents

The contents of both the DUH and the UBA study deal with a description and analysis of German beverage packaging systems. Within this common field, the selected approaches differ with respect to scope as well as concerning methodology and the priorities set. The DUH study focuses on the presentation of interrelations to enable the recognition of dynamics inherent in the various systems and, on this basis, to present the impacts of measures within the scope of scenarios. The UBA study, by contrast, while focusing on an evaluation of action options, deals primarily with the findings of stakeholder surveys. Apart from the methodological concerns regarding the evaluation presented above, the two studies supplement one another in this respect.

Table 87: A comparison of study contents

	UBA study	DUH study
Contents	Description of beverage packaging systems with a focus on deposit and return systems for one-way beverage packaging and their connection with systems for refillable beverage packaging	Model description of beverage packaging systems (deposit systems for refillable and one-way beverage packaging as well as curbside collection and recovery systems)
	Description and analysis of the systems for one-way and refillable beverage containers in Germany including a presentation of stakeholder positions, analysis of the target achievement level concerning the deposit duty and also an assessment of alternatives	Description and analysis of German beverage packaging systems with presentation of stakeholder positions, scenarios regarding future development as well as derivation of an "action plan".

With a general model description, the DUH study basically selects a more comprehensive approach. For reasons of comparability concerning the statements made, the following comparison of study findings is limited to Section C of the present DUH study, which deals with the situation in Germany.

C 5.4 A comparison of study findings

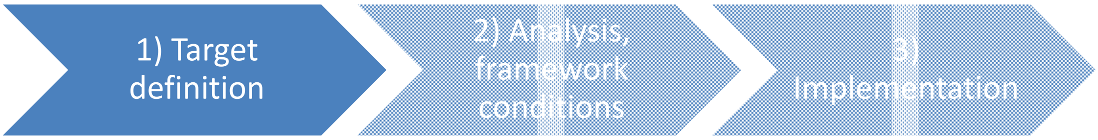
The findings conform in that they recommend that the current one-way deposit system in Germany be retained. On the basis of the following data it has also been consistently determined that the aims of promoting MövE have not been met and that, in this respect, further measures are necessary such as a reasonable extension of the one-way deposit system. Basically, the recommendations of the UBA study are in accordance with Step 1 of the set of measures developed the DUH study.

Table 88: A comparison of findings

	UBA study	DUH study
Findings (overview)	Generally positive assessment of the existing deposit system	Generally positive assessment of the existing deposit system
	Recommendations to strengthen the existing deposit system (in accordance with No.1 in the column on the right with the findings of the DUH study): • Labelling duty with respect to "one-way" or "reuse" • Information campaign aimed at promoting refillable systems • Extension of the deposit duty to include all beverage segments	Recommendations to promote MövE through a coordinated set of measures composed of four sub-steps (action plan): 1. Comprehensibility and transparency of the system for consumers • Clear labelling • Information campaign • Expansion of the deposit duty 2. Further formalisation of the data basis 3. Price signals for consumers (incentive levy) 4. Targeted appropriation of funds arising from the incentive levy
	Not recommended: • Expansion of the deposit duty to include container sizes up to 5 litres (presently, the limit is 3 litres) • Incentive levy on one-way beverage containers (mainly as a result of problems regarding political enforceability)	Recommendations are not excluded

As is clear from Table 88, the studies arrive at different findings, in particular respecting the consequences to be derived. The UBA study advises against expansion of the deposit duty to include larger container sizes and also against an incentive levy on one-way beverage containers. By contrast, the DUH study explicitly recommends the medium-term introduction of an incentive levy (Steps 3 and 4 of the set of measures), as no adequate steering effect is to be expected from Step 1 alone. The DUH study and the UBA study concur with respect to this assessment.

Despite a basically positive assessment of the deposit duty, it is clear from an analysis of the available data within the scope of the DUH study that the basic ecological goals can only be achieved through additional measures in all beverage segments. An incentive levy for one-way beverage containers would appear to be an instrument which, with a high degree of ecological and economic efficacy, can contribute significantly to target achievement. Basically, the UBA study also arrives at the finding that a levy has great potential with respect to the steering effect.



The UBA study does not explicitly assess the effects to be expected from the recommended measures. Rather, with respect to the two measures rejected, the study uses the findings of the stakeholder survey and mainly argues pragmatically by pointing out expected implementation difficulties and the possible creation of unfair competition conditions. While the present DUH study is aware of the expected implementation difficulties, in our opinion, the ecological and economic effectiveness should be of central importance when developing the necessary measures, however. The issue of political enforceability should initially be kept separate from this discussion.

Article 15 of Guideline 94/62/EU stresses that the member states may use market economy instruments to achieve the targets of environmental policy. In its Communication 2009/C 107/01 on the issue of beverage containers, deposit systems and the free movement of goods, the European Commission explicitly determines that the member states may take into account national, tax-based systems as a form of such market instruments and as an alternative option to intervene in favour of sustainable packaging. Furthermore, in Appendix IV to the European Waste Framework Directive (2008/98/EG), economic instruments such as an incentive to purchase environmentally friendly items or the introduction of an extra charge to be paid by consumers for packaging articles or a part of packaging that would otherwise be made available free of charge are recommended as examples for measures to prevent waste.[758] Possible problems respecting fair competition can be dealt with through suitable design of the instrument.

[758] Cf. 94/62/EG; Bodies and facilities of the European Commission & European Commission, 2009; Guideline 94/62/EU.

Table 89: Assessment of the UBA findings from the viewpoint of the DUH study

	UBA study		DUH study
Recommendations of the UBA study respecting the status quo	Continuation of the existing deposit system	→	**Concurring recommendations (**see the “status quo” scenario)
	Measures required to strengthen the existing deposit system		**Concurring recommendations (**see the “status quo” scenario**)**
Recommendations of the UBA study for strengthening the existing deposit system	Labelling duty concerning "one-way" and "reuse"	→	**Concurring recommendations** (see Module 1 of the action plan)
	Extension of the deposit duty to include all beverage segments		**Concurring recommendations** (see Module 1 of the action plan)
	Information campaign to promote re-fillables	→	**Concurring recommendations** (see Module 1 of the action plan)
Measures not rec-ommended within the scope of the UBA study	Extension of container sizes to 5.0 litres (presently limited to 3.0 litres)		**Deviating assessment:** The assessments of sub-categories in the scope of the UBA study are all positive, with the exception of a neutral assessment of economic efficiency, and they generally concur with the estimations of the DUH study. It is not possible to derive from the UBA study why the neutral assessment leads to this measure being entirely rejected. Extension of the deposit duty to include container sizes is recommended within the scope of the general recommendations concerning extension of the deposit duty for beverage containers (which are mainly pur-chased by private end-consumers).
	An incentive levy on one-way beverage containers is not recommended, mainly due to the problematic political enforce-ability	→	**Deviating assessment:** An incentive levy is recommended. Advance studies should be carried out to ensure that the arrangement meets its purpose. Analogous to this, the UBA study determines that “it is too early for a conclusive as-sessment”[759] and that an evaluation based on the experience gained from existing levy systems is rec-ommendable. The DUH study concludes that, based on the findings of the advance studies, the required framework conditions should be created as part of the second module of the action plan in order to establish a levy solution (with appropriate use of the funds) in modules 3 and 4 over the medium term

[759] Cf. bifa, 2010, p. 11.

D Guideline on the Implementation of collection and recycling systems for beverage packaging

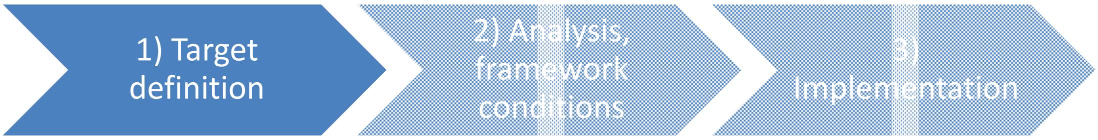
D 1 Introduction

World-wide, clear targets and requirements aimed at increasing resources efficiency and waste prevention play an increasingly important role not only in terms of sustainable environmental policy but also in terms of securing raw materials within the scope of economic policy.[760] The implementation of collection and recycling systems can be an important means of bridging the gap between the strategic orientation and practical implementation of sustainable resources and waste policies. The higher the quality of waste and materials recycling (as, for example, within the scope of closed-loop recycling), the greater the resulting achievable increase in resources efficiency. Against this backdrop, many countries have already undertaken efforts to introduce new systems or to optimise existing systems for the collection and recovery of packaging.

Beverage packaging collection and recycling systems represent easily achievable improvements respecting resources efficiency ("low hanging fruit") which have a significant signalling effect:

- Beverage packaging is a clearly allocable part of packaging waste. Relative to weight, beverage packaging accounts for ca. 20%, which is a relatively small proportion of the total packaging volume.[761] Relative to volume this proportion is assumed to be higher, however, and the volume, in particular, is a crucial cost factor within the scope of waste disposal as empty (not compacted or only partially compacted) packaging involving large volumes requires a lot of space in collection containers and waste vehicles. This, in turn, makes logistics less efficient and thus causes higher costs. In countries where packaging is still dumped in landfills, this also applies to the usually limited landfill capacities.
- A significant proportion of beverages in beverage containers are consumed away from home and are therefore particularly prone to littering: This is not only an environmental problem, it also causes costs regarding subsequent disposal. A significant increase in collection rates (i.e. through the introduction of deposit systems) can reduce littering and also the pertaining costs and environmental impacts.
- Beverage packaging creates a high-value waste flow. It usually consists of metals (aluminium, steel) plastics (PET) and glass: Materials which - if collected separately to ensure mono fraction

[760] The European Commission, for example establishes in the thematic strategy for waste prevention and recycling in the EU that waste prevention and the promotion of waste recycling and recovery increase the resources efficiency of the European economy and lessening the negative effects on the environment that result from the use of natural resources. This contributes to preserving the resources basis that is of fundamental importance for sustainable economic growth. Cf. European Commission, 2005, p. 9-11.
[761] Cf. European Commission, 2006, p. 8.



materials collection– can be consigned to high-value closed-loop recycling. Likewise, the recycling of these packaging materials can contribute decisively to establishing high-value recycling structures ("driver for better recycling“). Ultimately, the introduction and use of refillable beverage packaging provides a practical possibility to avoid waste.

Various systems are used worldwide to collect and recycle beverage containers: Collection via Green Dot systems together with other packaging from private households, return of packaging via deposit systems for one-way beverage containers and the return of refillable beverage containers on the basis of a deposit system. Such systems may provide an initial, manageable and at the same time effective first step for countries that have not yet introduced a packaging collection- and recycling system.

Due to the increasing scarcity of raw materials, the growing waste volume and changed consumer habits, many countries are challenged to take important strategic decisions regarding the design of effective and optimised packaging disposal systems. Converting from waste management to closed substance cycle management, i.e., sustainable resources management, is a continuous learning process. Decisions, based on facts, can be taken if experience gained in the past is taken into account. In order to find the most efficient solutions and avoid unnecessary circumventions and wrong decisions, the experience acquired by third parties should also be included in the decision-making processes.

Within the scope of this study, various beverage packaging systems and the pertaining collection- and recycling systems are described and the respective effects on ecological, economic and social impact categories are examined. In this context, the systems established in Germany were assessed in particular detail. Various case studies facilitated a comparison of the effectiveness achieved through various beverage packaging systems and, in addition, permitted us to assess the impacts of various framework conditions on these beverage packaging systems.

D 2 Target, scope and extension of the guideline

This guideline is intended to assist political decision-makers in the implementation of beverage packaging collection- and recycling systems, both during the introduction of new systems and in the optimisation of existing systems. In addition, the guideline provides input and is a decision aid for business enterprises that aim at designing their products more sustainably in order to comply with their producer responsibility.

The guideline is split into two sections and presents the steps applied in the introduction of a collection- and recycling system in the decision-making phase and in the implementation phase (see Illustration 40).

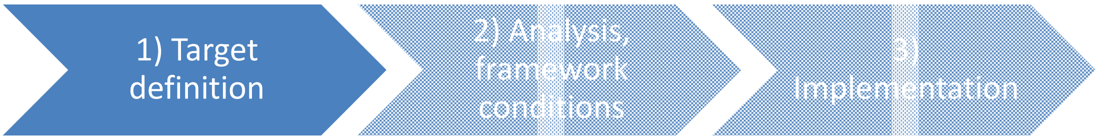
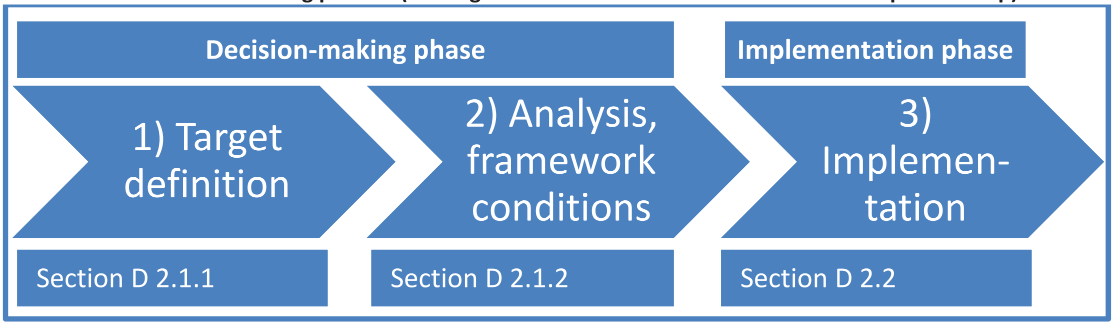


Illustration 40: Decision-making process (clicking on the Section reference leads to the respective step)



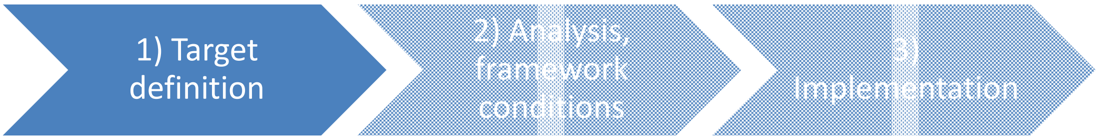
It can generally be assumed that the effects of a collection- and recycling system on the selected impact categories are always more positive than would be the case without such system. In a differentiation of the individual systems, however, the findings of the present study indicate that beverage packaging deposit systems (with respect to both refillable and one-way beverage containers) are advantageous when compared to Green Dot systems in the majority of the impact categories examined and given the framework conditions examined.[762]

For this reason, the guideline is focused on the implementation of deposit systems for reuse- and one-way beverage containers. As many countries have already implemented Green Dot systems for packaging waste to varying degrees, the study also includes the introduction of a deposit system for one-way beverage containers in addition to an existing Green Dot system.

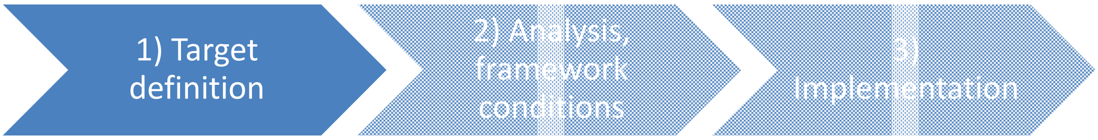
When using this guideline to establish or optimise beverage packaging systems, the respective local starting situation must always be taken into account as this usually impacts on the target definition. Basically, the following three initial situations where a need for action exists are conceivable:

- No collection, reuse, and recycling systems for beverage packaging have been established to date
- One or several collection-, reuse-, and recycling systems for beverage packaging have been implemented but should be further improved - or existing ones should be promoted
- One or several collection-, reuse-, and recycling system(s) for beverage packaging have been implemented but are to be replaced with or supplemented by another system or systems.

[762] As regards the ecological impact categories this applies, in particular, with respect to achieved return and recycling rates and, with respect to the prevention of littering. In the economic impact categories, deposit-based beverage packaging systems are advantageous when compared to Green Dot systems with respect to system stability and fewer start-up difficulties. Deposit systems usually generate higher materials revenues that enable cost-covering or even profitable operations. With respect to the social impact categories, deposit systems are advantageous as they are less susceptible to misuse, implement extended product responsibility more consistently and reduce littering more effectively when compared to Green Dot systems. When differentiating between the various deposit systems, given the framework conditions examined, refillable systems show further advantages such as lower resources consumption, ecological packaging design, the promotion of economic SME structures, promotion of employment and also of product diversity.



The existing framework conditions must be discussed when implementing beverage packaging collection- and recycling systems since some of the impact interrelationships between the systems and some impact categories depend on the specific framework conditions and can only be clearly identified after a respective analysis. An analysis of the framework conditions may indicate, for example, that the identified system that is generally aimed for is not compatible with the existing framework conditions and that another (or a supplementary) system must be introduced. In some cases, initial measures may have to be taken beforehand in order to exert a respective influence on the framework conditions.



D 2.1 The decision-making phase

In this phase a decision is made as to which beverage packaging collection- and recycling system is to be introduced. The starting point for introduction is a clear definition of targets. In the past, some countries had various motives for introducing new systems or optimising the existing systems for beverage packaging collection- and recycling. Some of these systems were aimed at reducing littering, at increasing the collection and recycling rates, promoting high-quality recycling, implementing extended producer responsibility as well as contributing to the medium- and long-term securing of raw materials for the purpose of beverage packaging. Next, the framework conditions are to be analysed. Finally, based on the targets defined and the existing framework conditions, a decision is made as to which beverage packaging collection- and recycling system is to be implemented.

D 2.1.1 Target definition

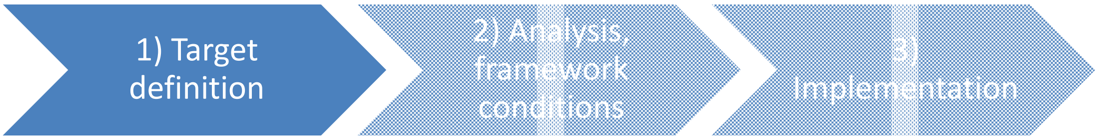
The targets must be put into concrete terms in order to enable successful, target-oriented implementation of the respective measures. In addition, the precise definition of targets facilitates later management of the systems. The targets depend on the currently prevailing condition. If, for example, no beverage packaging collection- and recycling system is in place, the possible targets to be achieved may include the introduction of such a system, the promotion of reuse (refilling) or the achievement of minimum recovery rates for packaging. If systems for beverage packaging collection- and recycling systems have already been established, the focus may be on improving these systems by, for instance, increasing the proportion of separately collected beverage packaging, closed-loop recycling, or system transparency.

The introduction of beverage packaging collection- and recycling systems may be geared towards several, possibly parallel targets, with different weighting. In accordance with the ecological, economic and social impact categories identified in Section C of this study, the present guideline serves to analyse various targets for the introduction of such systems as well as the capacity of these systems to achieve the envisaged goals. A detailed description of impact categories can be found in Section C 2.

Initially, possible ecological targets respecting the introduction of beverage packaging collection- and recycling systems are listed, followed by economic and social targets. In many countries, ecological targets are the paramount reason for introducing beverage packaging collection- and recycling systems. Formulating and defining additional economic and social targets may further increase acceptance of the respective political measures.

D 2.1.1.1 Indicators for determining ecological targets for beverage packaging collection- and recycling systems

Significant ecological impact categories (defined under C 2.1) enable the direct derivation of targets. For more details on impact categories, see C 2.1.



D 2.1.1.1.1 Practical implementation of the waste hierarchy (according to EU requirements)

The European Waste Framework Directive stipulates the following sequence of priorities regarding the implementation of political measures aimed at waste prevention, waste recovery and waste disposal:

- Prevention
- before preparation for reuse
- before recycling
- before other recovery (e.g. energy recovery) before disposal.

Deviations from this five-stage waste hierarchy are admissible only to the extent that this is justified from the assessment of the life-cycle in terms of environmental protection.

Generally, refillable systems are best suited for implementing the above-stated waste hierarchy as packaging waste is avoided through multiple use of refillable beverage packaging (first stage in the waste hierarchy).

Both the deposit systems and the Green Dot systems for the collection of one-way beverage containers facilitate (to different degrees) the recycling of packaging (third stage in the waste hierarchy). Compared to energy recovery and the disposal of packaging, these systems have a generally more positive impact which, however, is less effective than the environmental effect achieved through reuse.

In general, deposit systems for one-way beverage containers are better suited for the practical implementation of recycling than Green Dot systems as they achieve higher collection rates (return rates), higher recycling rates and a higher quality of recycling due to targeted sorting of packaging waste. Beverage containers collected within the scope of a deposit system are usually entirely consigned to recycling due to the purity of sorted packaging waste. The proportion of energy recovery (primarily of plastics) is generally significantly higher when compared to one-way deposit systems (fourth phase in the waste hierarchy). Some of the beverage packaging collected within the scope of Green Dot systems, for example sorting residues, is also disposed of through waste incineration plants or landfills.

D 2.1.1.1.2 Reduction of resources consumption

Refillable systems are best suited for reducing resources consumption since, due to multiple reuse, they use fewer resources in the production of new beverage packaging.[763]

One-way beverage containers must be newly produced for each filling and this requires resources and energy in each case. Accordingly, both the one-way deposit systems and the Green Dot systems have a comparably less positive impact on reducing resources consumption. It should be stressed, however, that deposit systems generate higher return- and recycling rates as well as a higher quality

[763] Modification in the event of high transport distances see Section D 2.1.2.1.

of recycled packaging material when compared to Green Dot systems. Consequently, packaging material from one-way deposit systems is recovered to a greater extent and at a higher quality. By this means, one-way deposit systems make a greater contribution to efficient resources consumption than Green Dot systems.

D 2.1.1.1.3 Reduction of greenhouse gas emissions

Refillable systems can best meet the goal of avoiding greenhouse gas emissions. Due to reuse, a substantial amount of resources are saved, the use of which would otherwise lead to greenhouse gas emissions. Neutral life-cycle assessments indicate that, when assessing the complete life-cycle (from resources recovery through to manufacture, transport, return transport, purification, refilling and disposal) refillable systems can contribute significantly to reducing greenhouse gas emissions.

The impact of one-way deposit systems and Green Dot systems on the prevention of greenhouse gas emissions is less positive, by comparison. As a result of the previously mentioned higher collection- and recycling rates and improved possibilities for closed-loop recycling, a more positive impact (compared to Green Dot systems) is attributed to one-way deposit systems in this impact category also.

D 2.1.1.1.4 Reduction of negative ecological impacts of other impact categories in life-cycle assessments

The potential for "reducing greenhouse gas emissions" (see above) applies analogously to the reduction of negative ecological effects of other impact categories in life-cycle assessments.

D 2.1.1.1.5 Increase in the refillable rate

The refillable rate describes the proportion of refillable beverage containers relative to the total amount of beverage packaging in a given country or beverage segment. The rate therefore depends on the number of reused containers,

Refillable systems usually involve the payment of a deposit as a means to ensure that containers are returned and refilled after use by the consumer. From a consumer viewpoint, the fact that no deposit is charged on one-way beverage containers may represent an advantage over refillable beverage containers. Consequently, there is a risk that consumers buy one-way beverage containers because - other than in the case of refillable containers - they need not return them at the point of sale (POS). The introduction of a deposit system for one-way beverage containers thus creates a balance between the packaging systems and may support the increase or stabilisation of refillable rates.

A positive effect on the refillable rate is not to be expected from the introduction of Green Dot systems.

D 2.1.1.1.6 Increasing the return rate (collection rate) of beverage packaging

Beverage producers usually want deposits to be charged on refillable beverage containers as a means to ensure that bottles are refilled. The deposit on refillable packaging provides a financial incentive for consumers to return the packaging at the POS after use. This incentive leads to very high return rates.

Deposit systems for one-way beverage packaging also provide a financial incentive for consumers to return their used beverage containers at the POS and are also very well suited for achieving very high return rates.

Within the scope of deposit systems, the return rate is, inter alia, also contingent on the amount of the deposit, which should provide sufficient financial incentive for return.

Compared to the deposit systems, the collection rates in Green Dot systems are substantially lower.

D 2.1.1.1.7 Increase and qualitative improvement of packaging waste recovery

This target relates to:

- Increasing the recycling rate (recycling quantity)
- Increasing the proportion of closed-loop recycling (recycling quality)

In the past, the aspect of recycling was mainly assessed in terms of quantity whereas aspects of quality and high-grade recycling were usually ignored. In order to close substance cycles and to increase resources efficiency, quality criteria should increasingly be taken into account, however.

Deposit systems for refillable and one-way beverage containers achieve very high return rates, i.e. a very high proportion of deposit beverage packaging brought into circulation is returned by consumers at the POS and is subsequently consigned to recycling. Moreover, packaging material collected within the scope of deposit systems is usually characterised by a very high purity level respecting the sorted packaging waste. The beverage containers within the scope of deposit systems are usually sorted directly after return according to packaging material (usually PET, glass and aluminium/steel), and sometimes according to colour. In addition, there are no incorrectly disposed of items or residues that might impair the quality of the secondary raw materials in the recovery process. The beverage packaging collected within the scope of deposit systems is almost fully (just under 100%) consigned to recycling. This indicates that deposit systems respecting both refillable beverage containers and one-way beverage containers are excellently suited for increasing the recovery rate in general, and also the recycling rate and the proportion of closed-loop recycling, in particular. Moreover, due to the repeated use of packaging, refillable systems usually generate less packaging waste for recovery.

The collection rates in Green Dot systems are significantly lower than in deposit systems. In Green Dot systems, only a small portion of the packaging brought into circulation can be recycled. In addition, the degree of mixed packaging material as well as the degree of impurities (due to incorrectly disposed of items, content leftovers, residues, etc.) are significantly higher in Green Dot systems. Impurities found in the collected and subsequently sorted packaging material from Green Dot systems are in many cases an impediment to high-value recycling. For example, other than PET beverage containers from deposit systems, PET beverage containers from Green Dot systems cannot be consigned to high-value closed-loop recycling for quality reasons.

D 2.1.1.1.8 Reducing the proportion of packaging consigned to disposal

In accordance with our comments on collection-, return-, recovery- and recycling rates, a very positive effect on reduction of the disposal rate is to be expected from deposit systems for refillable beverage containers due to their being reused and the high recycling proportion of sorted, refillable beverage containers. Although deposit systems for one-way beverage containers do not involve reuse, a very positive effect on reduction of the disposal rate is nevertheless to be expected due to the high return- and recycling rates in the one-way deposit system. With respect to Green Dot systems, a positive effect is also expected here (see the above remarks), but it is usually lower compared to the other systems.

D 2.1.1.1.9 Promoting ecological packaging (re)design

Refillable beverage containers best comply with the principle of ecological packaging (re-)design due to their design, which is optimised for refilling. While the design with respect to refilling requires more weight in comparison to one-way beverage containers of the same materials, which has a negative impact on transport, the ecological advantages of refillable beverage containers are superior when related to the overall life-cycle, as is shown by objective life-cycle assessments.

Potentially, one-way deposit systems are suitable for creating incentives for ecological packaging (re-)design due to the costs arising from these systems and the possibility to generate revenue from recyclable material. In practice, however, such a direct impact interrelation is usually not very pronounced.

A significant impact on packaging design through charging weight- and material-related license fees was also not observed in Green Dot systems.

D 2.1.1.1.10 Reducing the amount of littering

The refund of deposits within the scope of deposit systems provides consumers with a financial incentive to return packaging. Due to the resulting, very high return rates (collection rates) achieved in the deposit systems for refillable and one-way beverage containers, these systems contribute very effectively to reducing the amount of littering resulting from beverage packaging.

Green Dot systems generally do not have a direct impact with respect to reducing the amount of littering.

D 2.1.1.2 Indicators for defining economic targets for beverage packaging collection- and recycling systems

The significant economic impact categories defined under C 2.2 enable direct target derivation. For more details on impact categories, see C 2.2.

D 2.1.1.2.1 Establishing cost-efficient systems

Cost reduction or an increase in system revenues, respectively, does not per se represent a primary political target for beverage packaging return-, reuse- and recycling systems. Rather, they can serve as a means to achieve other defined targets in the most cost-efficient way.

When assessing the cost efficiency of a system, the overall results achieved through the system must be taken into account in addition to the total system costs and revenues. For example, two different systems with equally high operating costs, which achieve different results (cost per result unit), have differing cost efficiency. A system which causes higher system costs (including deduction for system revenues) than another system may still be more cost efficient if significantly better results are achieved.

According to the evaluation of an industry survey carried out within the scope of this study, system costs incurred in the German deposit system for one-way beverage containers, for example, are (theoretically) 14 % lower and up to 23% higher than in the German Green Dot system. While a ca. 98.5 % return-and recycling rate is achieved for PET bottles in the German one-way system, the collection rate for PET bottles in German Green Dot systems comes to an estimated 43 to 54 %, and the recycling rate is estimated to be 25 to 31 %[764]. Assuming a theoretical, linear extrapolation of the costs, the Green Dot system, while achieving equally high collection- and recycling rates, would be more cost intensive. It also seems possible that the costs incurred to achieve very high recycling rates in Green Dot systems do not increase in a linear manner but above-proportionately. Achieving a recycling rate of 98.5 % through a Green Dot system is questionable in practice, however, as the deposit system achieves this rate through the financial incentive.

Refillable systems contribute positively to establishing a cost-efficient system, in particular due to savings in materials procurement and due to the reduced waste volume. Basically, both the one-way deposit systems and Green Dot systems can generate revenue from secondary materials. Due to the higher purity level of the collected packaging material, the material revenues from one-way deposit systems may be higher than those arising from Green Dot systems.

D 2.1.1.2.2 Cost relief for public authorities

According to the polluter pays principle or producer responsibility, respectively, the costs resulting from the environmental impact of packaging waste should be borne by those who cause this impact (i.e. system participants).

The impact interrelation respecting refillable systems is generally very positive as all costs incurred for taking back and disposing of refillable beverage containers are generally borne by the system participants on a voluntary basis. Since refillable systems for beverage packaging are usually introduced and implemented voluntarily, the operation of these systems does not involve any costs, or it involves only minimum costs for public authorities with respect to controlling and enforcement.

In one-way deposit systems, system participants are usually responsible for all costs associated with collection and recovery of the collected beverage packaging. Due to the very high return rates (collection rates) in one-way deposit systems, public authorities incur fewer costs for disposal (e.g. disposal of littering arising from beverage packaging or for the disposal of uncollected beverage packaging in waste incineration plants and in landfills).

[764] See pp. 167–184.

The Green Dot systems also relieve the public authorities of financial burdens as the costs for collection and recovery or the disposal of packaging waste are to be borne by the manufacturers. This applies, in particular, to full cost systems where no costs are incurred for public disposal. In the event of partial cost systems, the cost relief for public authorities is less pronounced.

In comparison to deposit systems, a somewhat higher cost burden for public authorities must be assumed with respect to Green Dot systems. On the one hand, due to predominantly higher return rates (collection rates), deposit systems relieve the burden on public disposal facilities. On the other, practise shows that, in Germany in particular, reviewing compliance with legal regulations concerning the participation of packaging in Green Dot systems requires more efforts than in the case of deposit systems.

D 2.1.1.2.3 Implications for regional, national and international economic zones and for small- and medium-scale enterprises (SMEs) and large companies (LCs)

The impact interrelations concerning these indicators are very complex as these market economy factors are affected by a large number of framework conditions. Experience gained in Germany shows that refillable systems provide advantages for small and medium-scale beverage producers that operate mainly on regional sales markets and that they thus have a positive effect on these enterprises.

Centralised production, by contrast, rather promotes the use of one-way beverage containers (irrespective of whether these are disposed of through one-way deposit systems or Green Dot systems).

The complex impact interrelations are explained in more detail in the description of the framework conditions underlying production and distribution structures (D 2.1.2.2).

D 2.1.1.2.4 Start-up difficulties and system stability

Start-up difficulties are almost unavoidable when new systems are being established.

As described in Section D 3, such start-up difficulties can be reduced and system stability can be increased through a careful design and systematic implementation of the respective systems.

D 2.1.1.3 Indicators for defining social targets for beverage packaging collection- and recycling systems

The significant ecological impact categories defined under C 2.3 enable direct target derivation. For more details on impact categories, see C 2.3.

D 2.1.1.3.1 Product diversity and product price

The factors determining the product price as well as product diversity are very complex. The end-customer price is subject to influences other than just manufacturing costs and the cost of return and recovery of packaging material. Integration of the recycling costs (collection, sorting and recovery costs) in the product price represents, in fact, an internalisation of external costs. Theoretically, these external costs should lead to an overall increase in the product price in the event of both deposit systems and Green Dot systems. Within the scope of this study, however, neither in a deposit system nor in Green Dot systems were product increases identified that are clearly attributable to deposit systems and Green Dot systems. It is therefore assumed that the costs are absorbed by industry and trade within the scope of the overall calculation.

Product diversity is usually positively connected with refillable systems if these increase smaller producers' competitiveness. This connection can be impaired by other market economy factors, however.

D 2.1.1.3.2 Increase in employment

Refillable systems contribute more strongly to increasing employment than one-way deposit systems and Green Dot systems as more jobs are required for the use of refillable bottles both at the beverage producers (due to additional work stages such as cleaning bottles) and at retailers (due to the take-back and return of bottles) when compared to one-way filling, in particular when the latter is in the form of highly automated batch filling. As refillable systems are primarily used by regional beverage producers, jobs in this segment are positively connected with refillable systems.

One-way deposit systems and Green Dot systems for the collection, sorting and recovery of beverage packaging also create new jobs (in particular in the wholesale/retail, logistics, system operators, recycling and mechanical engineering segments) but fewer, overall, when compared to refillable systems.

D 2.1.1.3.3 Avoidance of system misuse

The risks of system misuse are lowest in refillable systems as the incentive to misuse voluntary systems is generally low. Due to the refilling of the refillable bottles, beverage producers have an inherent interest in achieving high return rates (collection rates).

One-way deposit systems, by contrast, have a less self-regulating effect. The possibilities for system misuse by end consumers can be eliminated to a great extent through the requirements defined by system operators (e.g. through prescribing obligatory labelling and bar codes).

By contrast, Green Dot systems are generally more susceptible to system misuse due to the complexity of the controls of curb-side collection and the large number of materials flows that are handled by the system.

D 2.1.1.3.4 Implementation of extended product responsibility

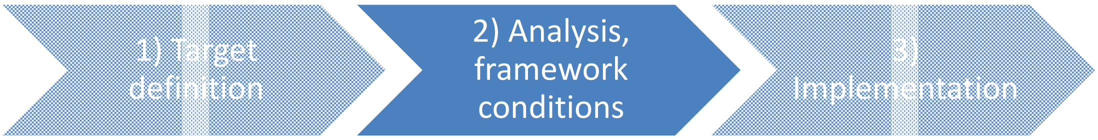
System participants in refillable systems are responsible for the costs resulting from the collection and recycling of beverage packaging and the actual closed substance cycle management of beverage packaging (and, consequently, for the packaging material). Refillable systems are best suited for implementing the principle of extended producer responsibility.

One-way deposit systems also implement extended product responsibility systematically and extensively. Costs incurred for the collection and subsequent recovery of collected beverage packaging is borne in full by beverage producers and trade. As a consequence of the generally very high return rates (collection rates) only a minor proportion of beverage packaging is disposed of through other systems (e.g. through disposal of household waste). For economic considerations, system participants in one-way deposit systems take on responsibility for closed substance cycle management respecting the packaging material used. Packaging materials collected within the scope of one-way deposit systems are generally consigned to high-value recycling to a large extent due to their high inherent value (primarily the high level of mono-fraction packaging waste and the low level of impurities). Green Dot systems focus on cost responsibility respecting the collection, sorting and subsequent recovery of packaging (financial responsibility), and not on the collection and recovery of packaging itself (materials responsibility). Within the scope of Green Dot systems, significant proportions of the packaging brought into circulation is not collected separately (low return rate). Accordingly, extended product responsibility is implemented less stringently in Green Dot systems. In addition, extended product responsibility is further weakened in the Green Dot systems that function on a partial cost basis (shared producer responsibility) and only pay a cost contribution to the municipalities.

D 2.1.1.3.5 Avoidance of littering volume

The deposit refund in deposit systems provides consumers with a financial incentive to return beverage containers. Due the resulting very high return rates (collection rates) achieved in deposit systems for refillable and one-way beverage containers, these systems contribute very effectively to reducing the littering that results from beverage packaging.

Green Dot systems generally do not have a direct impact on reducing the amount of littering.



D 2.1.2 Analysis of selected framework conditions using the example of refillable beverage packaging

When introducing beverage packaging collection and recycling systems, the existing framework conditions must be analysed and appropriately taken into account. The framework conditions in a given country may have a limiting impact on a system that is preferred due to the target definition. Political decision-makers are faced with two options in this respect: They can take measures to change the relevant general setup or they can review system alternatives aimed at achieving the defined targets on the basis of the existing framework conditions. The method for analysing the respecting framework conditions shown in Illustration 41.

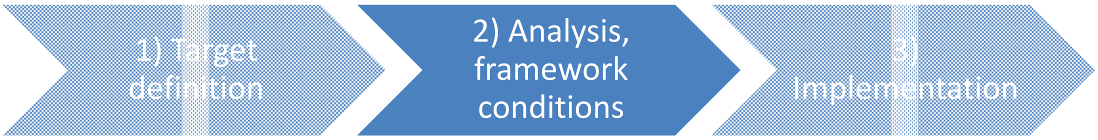
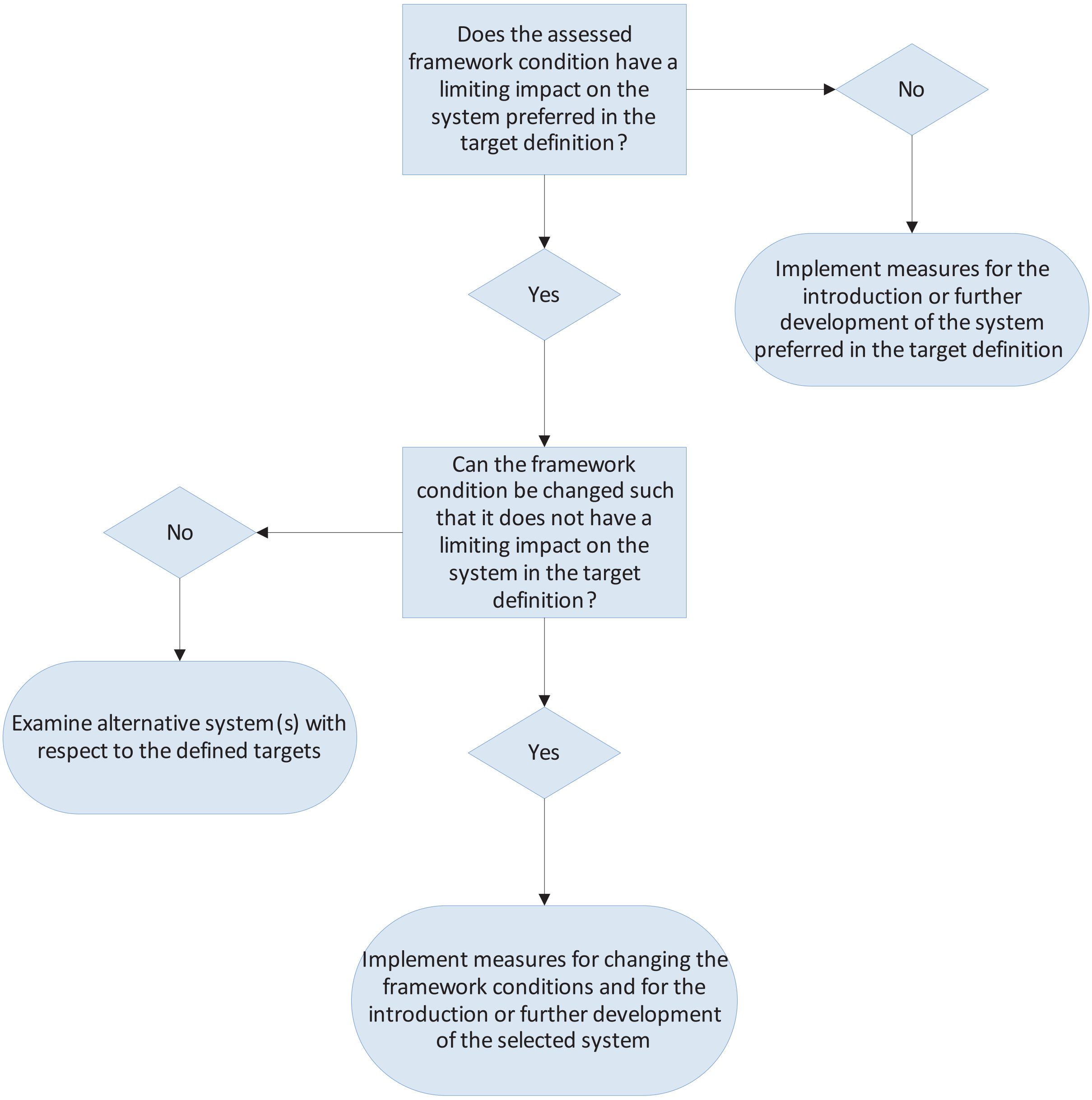
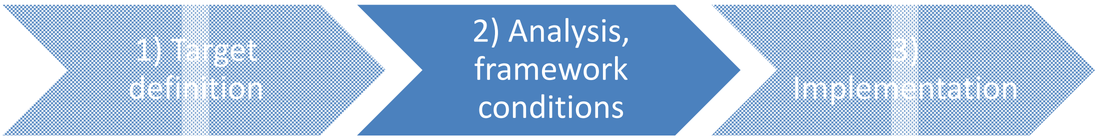


Illustration 41: Method to analyse the framework conditions



It is not possible to analyse all possible framework conditions and combinations of these conditions within the scope of this study. Using examples, we will therefore discuss the influences exerted by certain framework conditions on the introduction of a refillable system. In the process we assess, for example, the case when a refillable system has been identified as the preferred system within the scope of target definition and, in this context, present framework conditions that may impair the introduction of a refillable system or the conditions which could limit the advantages inherent in refillable systems as well as the measures that could be taken to change the framework conditions, if required. This approach can also be transferred to one-way deposit systems and Green Dot systems.



The following framework conditions are presented:

- Transport distances
- Production- and distribution structures
- Recycling markets
- Consumer requirements

D 2.1.2.1 Framework condition: transport distances

The average transport distances impair the ecological efficiency of all packaging systems. Long transport distances generally have a higher impact on the environment. The effects of transporting refillable beverage containers over long distances are usually more negative than the transport of one-way beverage packaging. This is due, on the one hand, to the need to return refillable beverage containers for refilling and the usually higher weight of refillable containers compared to respective one-way beverage containers, in particular when glass containers and the distribution of refillable beverage containers in crates are concerned. Consequently, the basic ecological and economic advantages of refillable systems are shifting towards one-way systems in the event of very long transport distances.

An assessment of whether and under what circumstances transport distances constitute a limiting factor regarding the introduction of a beverage packaging refillable system initially requires an examination of the average transport distances for the beverages sold. Beverages in refillable containers are usually transported over shorter distances than beverages in one-way containers. In addition, and particularly when one-way beverage containers are to be replaced to a certain extent by refillable beverage containers, the average distances of current beverage transports must be examined, and also whether a shift towards shorter transport routes is realistic.

From an ecological viewpoint, refillable beverage containers are generally to be preferred in the event of regional distribution. This is also expected of beverage producers that mainly operate locally, but which also distribute some of their products nationwide. Here, too, negative environmental impacts resulting from transport are more than compensated for by the ecological benefits (relative to the respective life cycles) of refillable beverage containers. Transport distances respecting the cross-regional distribution of refillable beverage packaging can be reduced through the use of standard bottles (pool bottles). The ecological benefit can also be ensured if (average) transport distances are longer. A functioning pool system requires an appropriate number of take-back centres and beverage producers in the respective regions.

An analysis of the influences of transport distances must take into account average transport distances (and not those reached as a maximum) of the beverages brought into circulation. A generally valid statement on the ecological distance limit (break-even point, i.e. up to what distance refillable systems have an ecological advantage over one-way beverage containers) is not possible given the large number of influencing factors. The respective distance limits differ, among other things, according to packaging material, beverage segment, container size, distribution structures and existing infrastructure. The transport distances used below are based on defined distance limits in a life-cycle assessment commissioned by the German Federal Environment Agency in the year 2002.[765] They represent only orientation values and relate to the one-way transport distance to the consumer. It is to be assumed that ecological improvements have been achieved since this life-cycle assessment was prepared, in particular in the transport and energy-efficient cleaning segments that are crucial for refillable systems. These improvements tend to increase the distance limit respecting distance for the ecological benefit of refillable beverage containers.

D 2.1.2.1.1 Average transport distances less than 300 km

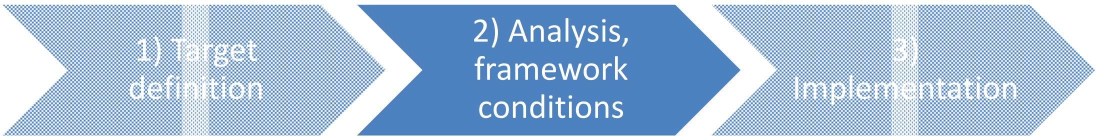
If transport distances are less than 300 km, the framework conditions are advantageous for refillable systems without any limitation. Consequently, the introduction of new beverage packaging refillable systems or a strengthening of the existing ones should be promoted, provided the refillable system is that which is preferred within the scope of target definition.

Basically, standardised refillable bottles that are used by several beverage producers in pool systems can be designed more efficiently due to optimised logistics (e.g. shorter return transport distances). However, the promotion of individual refillable bottles that are used by only one beverage producer may also be an option regarding regional and cross-regional distribution involving relatively short average transport distances. In this context, the promotion of efficient logistic systems for refillable beverage containers (e.g. optimised logistics solutions for producers and trade, setting up a sufficient number of return centres for refillable bottles, coordination of the sorting and exchange of bottles and deposit clearing, etc.) is essential. Section D 2.2 contains further recommendations for the actual design and implementation of refillable systems.

If the proportions of one-way beverage containers are relevant for the market, a deposit system for this type of one-way beverage container should be introduced, which provides purchasers with an incentive to return packaging. An incentive to purchase non-deposit bearing one-way containers that compete with refillable systems and which later are not consigned to high-value recycling would therefore be avoided.

The design of the one-way deposit system should be transparent and consumer-oriented and should be implemented nationwide in a uniform manner to the extent possible. Sufficient transitional periods, clear labelling, a clearing system for administration (payment and repayment) of deposits, exemption regulations, where appropriate, for small enterprises as well as possibilities for the easy import and export of products should be taken into account. Section D 2.2 includes further recommendations for the actual design and implementation of deposit systems for one-way beverage packaging.

[765] Based on Prognos et al., 2002, p. 220.



D 2.1.2.1.2 Average transport distances more than 300 km

Cross-regional distribution involving average transport distances of more than 300km likewise need not necessarily have a limiting effect on the introduction of refillable systems. Refillable systems can continue to be operated efficiently, in particular with standardised pool bottles, from both an ecological and an economic point of view.

An analysis of current and projected transport distances respecting beverages provides information as to whether beverage packaging refillable systems also fulfil their purpose in terms of sustainability in the event of average transport distances of more than 300km (depending on other framework conditions).

An analysis may come to the conclusion that, under the existing framework conditions or the conditions striven for, refillable beverage containers are generally either the preferred system - or are the system preferred in only some beverage segments or some regions. In this case, respective promotional measures for refillable systems can be introduced (see above and Section D 2.2).

Alternatively or additionally, a deposit system for relevant one-way beverage containers (perhaps limited to individual types of packaging or beverage segments) should be introduced (see comments above and in Section D 2.2).

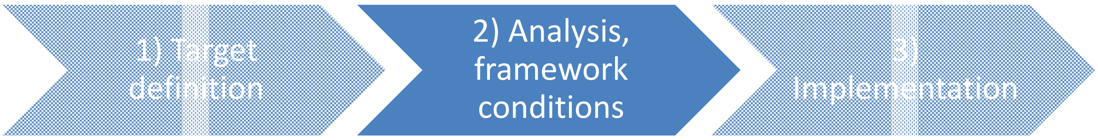
D 2.1.2.1.3 Average transport distances over 600km

In the event of mainly (or to a great extent) centralised distribution with long, average transport distances (e.g. more than 600km) deposit systems for one-way beverage containers probably represent the beverage collection- and recycling system preferred from the target definition. Various factors must be taken into account in the design and implementation of such systems (see above and Section D 2.2).

Alternatively, an examination may be carried out as to whether and to what extent the planned deposit system for one-way beverage containers can be adapted to possible deposit systems in neighbouring countries (e.g. how efficient cooperation of the systems can be achieved for cross-border products).

D 2.1.2.2 Framework condition: Production and distribution structures

The analysis indicates that the use of refillable beverage containers tends to decline whereas the use of one-way beverage containers is increasing strongly in many countries. There are (some) varying reasons for this development in different countries. Frequently, it is due to the centralisation of production and distribution structures that are usually tightly linked to other average transport distances (see Section D 2.1.2.1).



One-way beverage containers were developed, among other things, with a view to optimising the transport of beverages over longer transport distances.[766] This is why one-way containers are (frequently) preferred by larger beverage producers that operate locally but nevertheless aim at tapping new, more distant markets. Beverage producers that produce large volumes may also benefit from economies of scale through the use of one-way containers and may use these to gain a strategic competitive edge over smaller beverage manufacturers. In many countries with a high proportion of one-way packaging, for example, cut-throat competition in favour of larger-scale beverage producers is observed.

In countries with parallel systems – for deposit bearing beverage containers on the one hand and non-deposit one-way containers on the other – trade frequently regards non-deposit one-way containers as an advantage since they require neither space nor personnel for the return of containers at the point of sale. However, in countries with established deposit systems (for refillable and/or one-way beverage containers) trading companies recognise, inter alia, customer loyalty potential as well as the allowances earned from the return of packaging and/or materials revenues as an advantage of deposit systems.

D 2.1.2.2.1 Mainly decentralised production and distribution as well as a large number of beverage producers and filing stations

Decentralised production and distribution structures represent positive framework conditions for refillable beverage packaging. Consequently given these framework conditions, systems for refillable beverage packaging should be introduced or strengthened. In addition, supporting measures should be taken to stabilise and increase the proportion of refillable beverage packaging over the medium to longer term.

If the proportion of one-way beverage containers is relevant in market terms, a deposit system for one-way beverage containers should also be introduced as increasing the proportion of refillable beverage packaging is a continuous process. Introducing a deposit system for one-way beverage containers will then have a balancing effect as not charging a deposit for one-way beverage packaging can then no longer be used as a sales argument.

D 2.1.2.2.2 Mainly central production and distribution and a low number of beverage producers or filling stations

In central production and distribution structures with a low number of beverage producers and filling stations, the proportion of one-way beverage containers is generally high or very high as this type of packaging is preferred by market operators given these framework conditions. In this constellation, a deposit system for one-way beverage containers is probably the solution to be preferred.

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[766] One-way beverage containers without beverage crates usually require less space during transport than refillable bottles.

Among other things, this enables very high return rates (collection rates) as well as a high proportion of bottle-to-bottle recycling.

If production and distribution patterns of individual beverage types or segments differ substantially, a one-way deposit system for specific types of packaging or beverage segments may be useful. In order to attain a high level of acceptance, the focus should be on transparent deposit regulations that are understandable for consumers; exceptions to these regulations should be kept to a minimum (see Section D 2.2).

Over the medium term, measures aimed at promoting regional beverage production and distribution may be introduced if refillable systems were identified as the preferred system in the target definition. This facilitates the use of refillable bottles or the substitution of one-way beverage packaging by refillable beverage packaging. Under the new framework conditions, the introduction of national or regional refillable systems should be reviewed and promoted from a sustainability viewpoint.

D 2.1.2.3 Framework condition: Recycling markets

Beverage packaging collection and recycling systems are generally aimed at achieving high return rates (collection rates) and recycling rates for beverage packaging and attaining a high recycling quality respecting the packaging material collected. When such systems are introduced, the existing recycling markets and also the politically aimed-for expansion of recycling markets constitute significant framework conditions.

Analysis has shown that both the deposit systems for reusable- and one-way beverage containers and the Green Dot systems impact positively on recycling rates. However, the analysis also points to differences between the systems. As described under D 2.1.1.1 , very high recycling rates are achieved in the deposit systems for refillable and one-way beverage containers with respect to all types of beverage packaging material (e.g. PET, glass, aluminium and steel). By comparison, Green Dot systems achieve significantly lower recycling rates for beverage packaging. The difference is particularly noticeable with respect to the relevant recycling rates for plastics (e.g. PET). The varying recycling rates of the respective systems result from different return rates (collection rates) and the quality of packaging material collected in the various systems. As collection or return rates as well as the recycling rates impact on recycling markets, the effects of the systems on these rates are described once again in detail here.

A precondition for the recycling of beverage packaging is that it is collected by consumers seperate from other waste within the scope of a collection system, either together with other packaging waste as in Green Dot systems or as a mono fraction as in deposit systems: the higher the return rate (collection rate) the more beverage packaging can be recycled. Deposit systems for refillable and one-way beverage containers provide consumers with financial incentives to return empty beverage containers at the POS. Accordingly, very high return rates are achieved in deposit systems. As Green Dot systems fail to provide a financial incentive for consumers to separate beverage packaging from other waste and consign it to the Green Dot system, the return rates (collection rates) are significantly lower in comparison to deposit systems. A direct comparison of a deposit system for one-way beverage containers and a Green Dot system for one-way beverage containers indicates that the deposit system – relative to the amount of beverage packaging brought into circulation - generates more packaging material that can subsequently be recycled. In the Green Dot system, a substantial proportion of beverage packaging is removed via residual waste disposal (as incorrectly disposed of items) and municipal city cleaning as litter, usually in waste incineration plants or in landfills rather than being consigned to recycling.

The extent to which beverage packaging collected within the scope of a collection and recovery systems is recycled or the extent of high-value recycling, respectively, depends decisively on the quality of the packaging material collected. The more mono fraction and the cleaner the collected (possibly post-sorted) beverage packaging, the more and better (in terms of quality) it can be recycled. In refillable deposit systems, the respective refillable beverage packaging is taken back as a mono fraction (without incorrectly disposed of items, residues, etc.) at the POS. Refillable beverage containers are pre-sorted by the retailers (according to colour and form) and returned to the beverage producers as a mono fraction (glass bottles separated from PET bottles). Beverage producers generally sort out those bottles (ca. 1-4% in Germany) which, due to wear and tear, can no longer be refilled. The refillable beverage containers sorted out are mono fraction material – not only in terms of the packaging materials glass and PET, but generally also in terms of colour. The materials are then consigned to high-value (closed-loop) recycling.

Within the scope of deposit systems for one-way beverage containers, the containers – as in the case of refillable systems – are also returned at the POS as a mono fraction (without incorrectly disposed of items, residues, etc.). If containers are returned via reverse vending machines, the returned beverage containers are compacted directly on site and sorted according to the respective material fractions (PET, glass and metals). In some reverse vending machines, some packaging materials are sorted directly according to colour (e.g. clear PET and coloured PET). If containers are taken back manually, the respective one-way beverage containers (e.g. PET one-way bottles, aluminium beverage cans, steel beverage cans and one-way glass bottles) are initially collected together without being compacted and are sorted only within the scope of automatic post-sorting according to the respective material fraction (PET, glass and metals). Here, too, with respect to PET, separation by colours is just as common as separation according to aluminium and steel. In both the automatic and the manual take back of deposit bearing one-way beverage containers, mono fraction material is generated which is completely consigned to high-value recycling.

The quality of the packaging material collected within the scope of Green Dot systems is generally worse than that collected within the scope of deposit systems due to incorrectly disposed of items (e.g. food waste, colour residues, etc.) and other residues. One-way beverage containers within the scope of Green Dot systems can either be collected in pick up systems (collection of packaging material directly at the households) or via drop off systems (consumers take the separately collected packaging to special collection containers or to recycling yards). Within the scope of pick up systems, in particular, various types of beverage containers (e.g. beverage cartons, PET bottles and beverage cans) are often collected together in a mixed collection with light packaging made of other plastics, metals or compound material. These types of packaging must be subsequently sorted and this requires additional efforts and is not fully realisable as the level of impurities increases (e.g. due to incorrectly disposed of items and sorting residues). The quality or purity of collected beverage packaging tends to be higher with respect to drop off systems than in pick up systems. Likewise, the quality of collection containers for individual types of packaging (e.g. only glass containers or only PET containers) tends to be higher compared to mixed containers with various types of packaging material.

Some countries try to create incentives with the aim of improving the quality of Green Dot systems. Japanese recycling organisations, for example, pay the municipalities premiums if packaging material is collected as a mono fraction with low impurity levels. Generally, however, it is to be assumed that the lower quality of collected material fractions in Green Dot systems (compared to deposits systems) leads to a lower recycling quality in many cases. This limits the possibility to consign beverage containers from PET collected within the scope of Green Dot systems to closed-loop recycling so that this packaging is instead used for other fields of application (e.g. packing straps as well as textile fibre for car interiors and fleece material).

D 2.1.2.3.1 Either a marginal recycling infrastructure or none at all in place

A lack of, or only a marginally existing, recycling infrastructure does not have a direct, negative impact on refillable systems as the focus is on reuse (refilling) and only minor quantities of rejects are available for recovery. However, given this framework condition, refillable systems can have a positive effect as they can reduce the pressure on existing disposal infrastructures (e.g. disposal of beverage packaging in waste incineration plants or in landfills) due to waste prevention.

Adequate supplies of suitable materials of a consistent quality are a central prerequisite for the medium- and long-term operation of recycling plants. While materials are traded on the global raw materials market, the generation of national (or regional), high value material flows contributes to the continued operation of domestic recycling plants.

In places where there is only very little recycling structure (or none at all), return systems for beverage packaging can provide an initial, manageable and also effective first step towards creating high-value material flows. Achieving high return rates (collection rates) as quickly as possible as well as ensuring the high and consistent quality of collected packaging materials are important success factors in this respect. With respect to beverage containers, this can best be achieved through the introduction of a deposit system for one-way beverage containers. Furthermore, such a system should be introduced when high-value recycling capacities (e.g. for closed-loop recycling) are to be established. Due to the financial incentive to return containers, deposit systems for one-way beverage containers are also effective (e.g. generate high return rates) where there is otherwise only little awareness of the negative environmental consequences of packaging waste.

In countries where no system for curb-side collection of packaging and/or other material exists, Green Dot systems can generate large quantities of packaging waste (not only beverage containers) that can be consigned to recycling. This is more suitable for open-loop recycling, however. The focus should then be on high quality with respect to both collection (e.g. minimising incorrectly disposed of items, maximising return rates, pre-sorting to the extent possible, etc.) and recycling (e.g. obligatory minimum recycling rates and minimum quality criteria for recycling).

D 2.1.2.3.2 Established recycling infrastructure but weak recycling market

High-value secondary raw materials (e.g. PET containers pre-sorted according to colour with only few impurities and practically without any other types of material) generally achieve higher revenues when compared to secondary raw materials of a lower quality (e.g. mixed PET containers from various fields of use with residual contents and other residues). In addition, they are less prone to price fluctuations on the global raw materials markets. High quality secondary raw materials can also be used in several fields of application, which further strengthens the position of secondary raw materials and, consequently, the recycling market.

The introduction of deposit systems for beverage containers promotes both the return rate and the high quality of the collected beverage packaging and thus makes an excellent contribution to promoting high-quality secondary raw material flows and recycling markets.

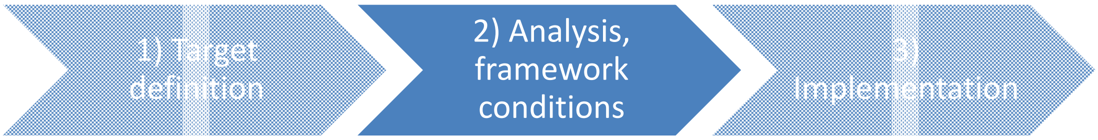
D 2.1.2.4 Framework condition: consumer requirements

Consumers may possibly consider the handling of one-way beverage containers to be easier than is the case with refillable beverage containers (so-called convenience reasons).

On the one hand, one-way beverage containers generally weigh less than the corresponding refillable beverage containers and are frequently offered in smaller sales units. It is worth mentioning however, that light PET refillable bottles as well as easy-to-carry beverage crates and multipacks (six-packs) have been developed and introduced on the market in the refillables' segment in recent years, which fully or partially counterbalance these traditional convenience advantages of one-way containers.

In addition, in order to have the deposit refunded, consumers must return refillable beverage containers to the retailer (POS). This does not apply to one-way beverage containers in Green Dot systems.

Furthermore, products in one-way beverage containers are offered at particularly favourable prices in many countries. The reasons for this are only partially attributable to the type of packaging (one-way beverage containers) and instead tend to be the strategic orientation of producers. This trend



leads to an increasing number of beverages being consumed in one-way beverage containers, and to the product price and not the container being the decisive factor regarding sale.

Consumer preferences that impact adversely on the purchase of refillable beverage containers should elicit a response if the refillable system has been identified as the preferred system in target definition. Possible convenience advantages as well as price advantages respecting products in one-way beverage containers (compared to products in refillable beverage containers) can be partially compensated for, but not fully, by a deposit system for one-way beverage containers. In addition, further measures such as taking external costs into account in pricing and the promotion of refillable system innovations could be taken.

D 2.1.2.4.1 Consumer requirement: transport comfort

Innovations respecting refillable beverage containers may relate to various aspects such as promoting developments towards lightweight, yet sufficiently stable, refillable bottles (e.g. weight reductions concerning existing refillable bottles made of glass and the introduction of bottles made of PET). Likewise, easy-to-carry beverage crates (e.g. low number of bottles, carrying handles for beverage crates or beverage crates that can be separated for carrying, etc.) can be developed. The development of logistic solutions that enable efficient handling of refillable bottles in smaller sales units (e.g. six-packs for beer) also increases the options and thus the convenience for consumers.

In particular, the ecological advantages of refillable beverage containers are generally not reflected in the product price as ecological costs are external costs. In order to enable the internalisation of these external costs, the introduction of an incentive levy or a tax on ecologically disadvantageous one-way containers may be considered.

D 2.1.2.4.2 Consumer requirement: easy return

In order to have the deposit amount refunded, refillable beverage containers must be returned to the retailer. If non-deposit one-way beverage containers are disposed of via curb-side collection or through regular household waste or a Green Dot system, this may be perceived as a convenience disadvantage of deposit refillable beverage containers. Due to the introduction of a deposit system for one-way beverage containers, this perceived convenience disadvantage respecting refillable beverage containers no longer applies.

It is essential that returning refillable beverage containers to the retailer is made easy for consumers. The containers may be returned either automatically or manually. It is also important that refillable beverage containers are taken back wherever such refillable bottles and/or other refillable bottles are sold (i.e. irrespective of where the refillable bottle was purchased). This also applies to the return of deposit one-way beverage containers.

D 2.1.2.5 Excursus: Compatibility of obligatory deposit systems with the free movement of goods and also competition in the EU[767]

In the European Union, the introduction of environmental policy measures must take into account the regulations governing the free movement of goods and also competition as defined in the EU Treaty. In a communication 2009/C 107/01 of the Commission on the issue of beverage packaging, deposit systems and the free movement of goods, the European Commission provides the European member states with a current overview of the principles of EU Law and of the law derived from it.

Deposit and return systems respecting refillable beverage packaging are generally operated on a voluntary basis by the filling companies concerned. The European Commission has established that it is improbable, from a domestic market viewpoint that such voluntary systems lead to trade barriers as they are based on the voluntary decisions taken by the economic players involved.

With respect to one-way beverage containers, the market players have no system-based interest in voluntarily introducing deposit and return systems. These systems are generally introduced through legal provisions. In its communication, the European Commission stresses that, while the introduction of an obligatory deposit and return system for one-way beverage containers leads to trade impediments, such national regulations may nevertheless be justified for reasons of environmental protection. According to the European Court of Justice, the introduction of a beverage packaging deposit and a return system may lead to an increase in return rates and a general improvement in the purity of sorted and collected packaging waste. In addition, a deposit system provides an incentive for consumers to return empty packaging to the point of sale and thus contributes to reducing littering. Moreover, a deposit system for one-way beverage containers can contribute to reducing disposable waste, which is a general objective of environmental policy. In practice, this means that the member states may introduce obligatory deposit systems if a respective member state considers this to be necessary for the purpose of environmental protection.

European member states wishing to introduce obligatory deposit and return systems must observe certain requirements in order to ensure that a good compromise between environmental targets and the requirements of the domestic market can be found. These requirements relate to the following aspects, in particular:

- Suitable transition periods
- Fair, open and transparent system design
- Labelling
- Clearing

[767] Section based on: Bodies and facilities of the European Commission & European Commission, 2009.

- Exemption provisions for small enterprises
- Possibilities of easy import and export of products

D 2.1.2.6 Excursus: Implementation of deposit systems when a Green Dot system is already in place

To a varying extent, many countries have already implemented Green Dot systems for the collection- and recycling of beverage packaging. Experience has shown that many of these systems – relative to the amount of beverage packaging put onto the market – achieve neither particularly high proportions of returned empty packaging (collection rates) nor very high recycling rates, or high quality concerning the packaging materials collected. Therefore, with a view to improving the recycling of packaging in both qualitative and quantitative terms, some countries are also considering introducing deposit systems for one-way beverage containers, in addition to the existing Green Dot systems.

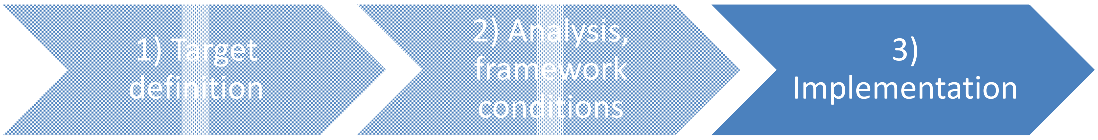
It must be kept in mind in this context that beverage packaging represents only a part of the packaging collected within the scope of Green Dot systems. The evaluation of Green Dot systems with respect to the collection of packaging fractions other than beverage packaging is not the subject of this study. The varying impacts of Green Dot systems and one-way deposit systems on beverage packaging, in particular, have already been discussed in detail. Below, on the basis of the systems reviewed within the scope of this study, we also tackle the question regarding the extent to which the introduction of a one-way deposit system for beverage packaging affects the general operation of Green Dot systems.

Some are of the opinion that the simultaneous operation of Green Dot systems and deposit systems is not expedient for meeting the ecological goals beverage packaging aims for and may even be harmful to the operation of Green Dot systems. The latter statement is based on the view that Green Dot systems can no longer be operated economically when beverage packaging which, as secondary material is economically attractive, is excluded and that this may lead to an increase in the fees for the packaging remaining in the Green Dot systems or even to the breakdown of these systems. Practical experience gained with parallel systems does not confirm these fears, however. For example, a deposit system for one-way beverage containers was introduced in Germany in 2003, which is run parallel to the Green Dot system that has existed since 1991. It is noteworthy in this context that the German Green Dot system continues to exist eight years after introduction of the deposit system, although competition has intensified significantly in this segment as a result of the admission of further providers. Also, it should be noted that the license fees for packaging in the Green Dot system are currently significantly below those charged prior to the introduction of the deposit system. The reduction in license fees is probably mainly due to the intense competition. However, a significant decline would not have been possible if costs had increased substantially. Accordingly, the German situation does not indicate that the introduction of a mandatory deposit system for beverage packaging has a direct, negative impact on the general operation of Green Dot systems.

It is also noteworthy that, in principle, deposit systems and Green Dot systems for one-way beverage containers are aimed at different fields. Green Dot systems are primarily aimed at the use of beverage containers in households. They provide for only limited collection possibilities (e.g. in public areas such as railway stations) in the event of "away from home" consumption. However, beverages in beverage containers, in particular, are consumed to a great extent away from home. A Green Dot system does not give consumers any financial incentive to collect this packaging material separately. Therefore, within the scope of a Green Dot system, when beverages are consumed away from home, it is to be assumed that the containers are almost entirely disposed of together with mixed waste (e.g. from waste bins or from the collection of litter), mainly in waste incineration plants or landfills. Deposit systems, by contrast, provide consumers with a financial incentive not to dispose of beverage containers consumed away from home in waste bins or simply throw them away as litter but rather to keep them until they next visit a retailer and then return them there. Accordingly, a one-way deposit system is targeted to a clearly greater extent at consumption away from home, i.e. in a one-way deposit system, beverage containers are collected that would not be collected in a Green Dot system.

In addition, the return rates (collection rates) in deposit systems for one-way beverage containers are usually significantly higher than in Green Dot systems. In Germany, for example, 98.5% of the PET bottles bearing a deposit are collected in the deposit system and recycled, while only 25-31% of the non-deposit PET bottles are collected and subsequently recycled in the German Green Dot system. Accordingly, in the Green Dot system, the majority of non-deposit PET bottles are not collected and recycled. This means that, here too, the one-way system is targeted at beverage packaging that is not collected and recycled within the scope of the Green Dot system.

In conclusion, we establish that Green Dot systems and deposit systems for one-way beverage containers overlap to a relatively small extent with respect to the beverage packaging collected: The systems are mainly aimed at different types of packaging and can therefore co-exist satisfactorily.

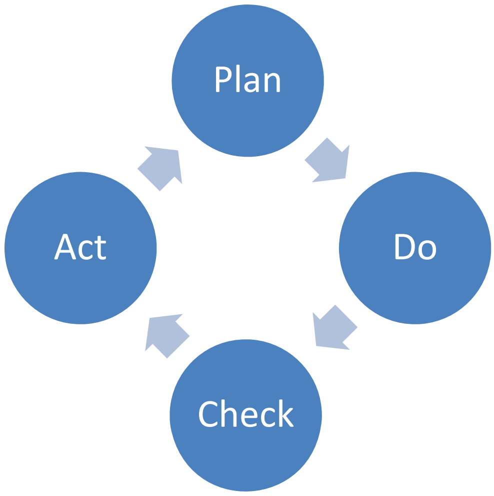


D 2.2 The implementation phase

D 2.2.1 Methodology: Plan-Do-Check-Act

In the following, using the Deming Cycle (PDCA) in accordance with ISO 9001[768] ("*plan-do-check-act*") we provide some random samples regarding the aspects that must be observed when implementing a refillable system, a one-way deposit system and a Green Dot system. It is essential when proceeding in accordance with the PDCA (and is confirmed by practical experience) that target achievement is to be reviewed at regular intervals and that the interim results achieved are responded to accordingly. It is likely that - upon initial introduction – certain adaptation requirements occur, especially during initial implementation and in case of a lack of historical data.

Illustration 42: Deming cycle



The identification and inclusion of stakeholders as early as in the planning phase is important in order to develop the system to be introduced as practically as possible and, consequently, to increase acceptance. A continuous interexchange with stakeholders is essential not only during but also after introduction of the system/system combination in order to prevent undesirable developments as early as possible, to identify potential for improvement, and to implement these improvements effectively.

D 2.2.2 Plan

The implementation of beverage packaging collection- and recycling systems requires the development of a legal basis for the system or the systems selected. This applies, in particular, to Green Dot systems and deposit systems for one-way beverage containers because, in contrast to refillable system, in these systems there is no inherent interest in collecting the empty beverage containers from consumers in order to subsequently refill or recycle them. However, political targets and legal fun-

[768] DIN, DIN EN ISO 9001:2008

damentals are expedient here in order to enforce the creation of incentives to introduce refillable beverage containers.

For the purpose of high transparency and in order to promote a high level of acceptance for the system introduced, the stakeholders concerned (trade, the beverage industry, recycling industry, associations, including environmental and consumer protection associations) should be involved at an early stage.

The legal fundamentals should be designed in such a manner that enforcement and control efforts can be kept as low as possible for national and/or regional public authorities. This is easier to achieve in the case of deposit systems than with Green Dot systems as constant high recycling quantities and qualities are inherent to a once established one-way deposit system.

The following aspects should, in principle, be governed by the legal fundamentals:

- **Clear target formulation**
  In addition to qualitative targets (e.g. prevention of the negative environmental impact of packaging waste, the promotion of refillable beverage containers, promotion of recycling, etc.), quantitative targets should also be defined: Possible approaches regarding such targets are, for example:

  - Minimum return rates (minimum collection rates) relative to the amount of beverage packaging brought into circulation

  - Minimum recycling rates relative to the amount of beverage packaging brought into circulation

  - Minimum proportion of refillable beverage containers relative to the amount of beverage packaging brought into circulation

  The introduction of clearly scheduled interim targets is also recommended. This would support the achieving of the defined targets and improve the subsequent steering of the system. In addition, interim targets motivate stakeholders to speed up the establishment of required infrastructures which, in turn, leads to faster target achievement.

- **Definition of transitional periods and periods for target achievement**
  Clear time schedules should be defined for targets (including interim targets), (target achievement by a defined date). Likewise, a deadline must specify the point in time when the legally prescribed system for the collection- and recycling of beverage packaging is to be introduced and implemented in practice.

- **Specification of definitions**
  All terms must be clearly and unambiguously defined in order to avoid later uncertainties and

unnecessary reworking of the legal fundamentals. This also applies to the defined targets (i.e. the way in which return rates, recycling rates and refillable proportions are to be calculated must be clearly stated). In particular, with respect to the promotion of high-value recycling it is important to state unambiguously which recycling procedures contribute to achieving the recycling rate. In this case, a minimum rate concerning closed-loop recycling may be taken into consideration.

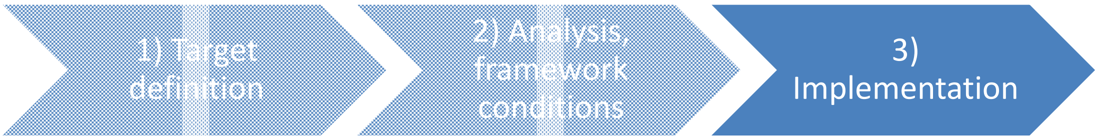
- **Definition of suitable indicators for monitoring**
  Reviewing the success of legal fundamentals requires efficient monitoring. The analysis of certain indicators, which have been specified in advance, makes it possible to determine whether and how fast the legal regulations lead to the defined targets being achieved in practice. This is also required in the event that any subsequent steering of the system should become necessary. The indicators are to include criteria from all three pillars of sustainability (ecology, economy, and social aspects (see Sections D 2.1.1.1 - D 2.1.1.3).

- **Definition of requirements for transparent documentation**
  Transparent documentation of all data relevant to the system as well as the possibility of electronic evaluation concerning these data is required for both monitoring target achievement and monitoring (control) of the legal regulations in practical execution. The documentation requirements should also be specified within the scope of the legal regulations.

- **Definition of dates for checking target achievement and subsequent steering, if required**
  It is necessary to clearly determine the dates when achievement of the defined targets and interim targets (on the basis of the defined indicators) should be analysed and checked; this prevents unnecessary delays and enables early subsequent correction in the event of targets being missed.

- **Definition of responsibilities**
  A transparent and efficient system requires a clear allocation of roles. The legal fundamentals must clearly indicate who is responsible for what. Interfaces where the responsibility shifts from one stakeholder to the other (e.g. for collected packaging material or deposits paid) must be clearly defined.

  This scope can provide regulations as to whether and, if so, to what extent retailers are to be compensated for the costs they incur as a result of the deposit system (e.g. expense allowance in the form of a handling fee per beverage container taken back). In addition, it is necessary to clearly define how the revenues arising from the deposit system (mainly material revenues and revenue from unredeemed deposits) are to be administered and allocated to system participants.



- **Ensuring enforcement**
  It is necessary to ensure in advance that the enforcement of legal provisions can be efficiently implemented, for example, by defining sanctions.

Table 90 contains a listing of significant aspects and measures to be taking into account in the planning phase for the respective beverage packaging collection and recycling systems.

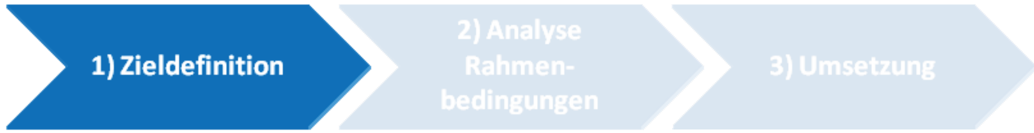


Table 90: Aspects and measures in the planning phase concerning implementation of beverage packaging return and recycling systems (according to the "plan-do-check-act" model)

Refillable system	One-way deposit system	Green Dot system
• Definition of legal framework • Definition of target parameters (e.g. refillable proportion of beverage containers brought into circulation) • Inclusion of stakeholders • Designation of parties responsible for a system or pool operators and definition of responsibilities • Preparing supporting information campaigns as required • Clear definition of roles for all system participants • Consumer-friendly system design • Development of accompanying promotional measures, as required	• Definition of legal framework • Definition of target parameters (e.g. amount of deposit, minimum return rates, recycling rates) • Inclusion of stakeholders • Planning of the clearing process and designation of parties responsible for a system • Preparation of supporting information campaigns as required • Clear definition of roles for system participants and implementation, taking into account the principle of extended product responsibility, costs and material (recycling quality) • Consumer-friendly system design • Establish regulations governing system transparency (distribution of revenues, amount of packaging brought into circulation) • As recommended by the EU Commission, success factors respecting one-way deposit systems include the following:[769] 1. Deposit according to material and not according to beverage segments 2. Taking into account appropriate transition periods 3. Nation-wide, compatible system structure 4. Fair competitive conditions 5. Clear, practical labelling 6. Functioning clearing system	• Definition of legal framework • Definition of target parameters (e.g. minimum return rates, recycling rates, density of collection points) • Inclusion of stakeholders • Preparation of supporting information campaigns as required • Definition of differentiated target parameters (standard use of net recovery rates, clear definition of recovery options, quality criteria for the various recovery options) • Clear determination of roles for system participants. and implementation of the principle of extended product responsibility (full-cost model) in the form of cost responsibility and material responsibility (recycling quality) • Consumer-friendly system design

[769] Cf. Bodies and facilities of the European Commission & European Commission, 2009, C 107/5 ff.

Refillable system	One-way deposit system	Green Dot system
	7. Exemptions for small enterprises as required 8. import-compatible design	

D 2.2.3 Do

The consumer, as the "supplier" of empty beverage packaging, plays a central role in all beverage packaging collection- and recycling systems. The systems must therefore be designed in a consumer-friendly manner in order to achieve high return rates (collection rates). Moreover, the system design must enable practical handling by the system operators, must be transparent, and should permit continuous control by the enforcement agencies.

To this end, the following aspects must be taken into account:

- **Consumer-friendly labelling that enables efficient return.**
  The labelling must inform consumers in a clear and easily understandable manner as to how beverage packaging is to be disposed of. Refillable beverage containers should be marked as refillable and deposit-bearing (including specification of the deposit amount). Deposit one-way beverage containers should be labelled as one-way and deposit-bearing (including specification of the deposit amount). One-way beverage containers in a one-way deposit system should be labelled in such a way that, when returned, they are easily recognisable as deposit beverage containers. This applies to both manual and automatic return. The deposit should be paid out to consumers only when it has been clearly determined that they have paid a deposit for the container. This prevents non-deposit beverage containers being returned (e.g. from a neighbouring country without deposit system) and the unjustified repayment of a deposit for them. Finally, labelling is to enable efficient clearing of the deposits. Deposit one-way beverage containers should be marked with a specific bar code (EAN code) and a clear logo.

  The number of different refillable beverage containers is generally limited in refillable systems. Due to the extensive bottle pool in refillable systems (either standard pool bottles or individual bottles) the design of refillable beverage containers changes relatively seldom and (manual or automatic) the return of beverage containers can be processed on the basis of individual features of refillable beverage packaging (e.g. colour, weight, form, etc.).

  Packaging disposed of via Green Dot systems must be marked with a system participation label so that consumers can easily see that this type of packaging is to be collected separately from residual waste in special waste containers.

- **Establishment of consumer-oriented return structures**
  Deposit systems should provide for sufficiently consumer-oriented possibilities to return empty, deposit beverage containers at the retailers (POS). The containers may be returned either automatically via reverse vending machines or manually. The deposit system should provide for both options. As a general rule, consumers should be able to return empty (deposit) beverage containers wherever these can be purchased (i.e. at every retailer that sells deposit beverage containers of the same material). Exemptions relating to a limited take-back obligation may be introduced for very small businesses.

Sufficiently consumer-oriented curb-side collection structures concerning individual types of packaging should be set up within the scope of Green Dot systems. The collection structures should enable the reliable collection of packaging material separate from household waste in order to permit subsequent high quality recycling.

- **Ensuring transparent and efficient clearing of deposits in deposit systems**
  Consumers should be able to return their empty deposit beverage containers to all retailers, irrespective of where they purchased the containers. This means that under certain conditions retailers also refund deposits that the customers had not actually paid to them. As a consequence, some retailers may be faced with a net deposit minus because they have refunded more deposits than they received, whereas other retailers see a net deposit plus. In order to balance out these additional revenues and the additional costs of some system participants, a transparent and efficient clearing system for deposits received and returned is necessary (see also B 2, C 1.3.2). The legislator may limit this respective measure to generally prescribing that such a clearing system is to be established and that it should be possible for all beverage distributers to participate in the system. Complete implementation of the clearing system should be the responsibility of the stakeholders in order to achieve a great deal of practicability and flexibility in the system design.

Table 91 contains a listing of significant aspects and measures to be taken into account in the Do-phase with respect to beverage packaging return and recycling systems.

Table 91: Aspects and measures in the Do-phase respecting the implementation of collection and recycling systems for beverage packaging (according to the "plan-do-check-act" model.)

Refillable system	One-way deposit system	Green Dot system
• Easy accreditation of refillable systems in order to ensure minimum quality standards (in particular in the event of promotion measures) • Development of consumer-friendly and optimised refillable beverage packaging (including crates and other supporting logistics systems) • Provision of sufficient and easy return options for the consumers • Clear labelling of refillable beverage containers in order to increase transparency for the consumers	• Provision of adequate and convenient possibilities for consumers to return packaging • Clear identification of deposit one-way beverage containers to increase transparency for consumers • Ensuring the possibility for importers and in particular, for minimum quantity importers, to participate without setting up trade barriers • Establishing a reliable clearing system which is not susceptible to fraud	• Provision of adequate and convenient return options • Implementation of a comprehensive control system • Ensure high-value recycling • Ensure the necessary purity of collected materials

D 2.2.4 Check

In order to ensure high transparency and acceptance levels concerning the respective systems and as a prerequisite for efficient and effective system control and monitoring (enforcement), the relevant system data should be clearly and understandably documented. This applies, inter alia, to the amount of packaging brought into circulation, to return rates (collection rates), deposits received and refunded (within the scope of licenses), refunded expense allowances (handling fees), material revenues, allocation and the appropriation of system revenues, recycling rates, recovery channels of collected packaging material, etc. The system data should be reviewed and evaluated by a neutral unit at regular intervals. The evaluations should be made available to system participants for steering purposes and to the public for information.

The responsible enforcement agencies should systematically monitor implementation of the legal provisions. Violations determined (e.g. free riders) within the scope of a Green Dot system, non-labelling, incorrect or faked labelling, failure to charge deposits, failure to refund deposits, non-compliance with prescribed recycling rates or minimum standards for recycling etc.) should be systematically punished (see also Section D 2.2.3).

The legal regulations and the degree of implementation of the beverage packaging collection- and recycling system must be checked and examined regularly with regard to the targets to be achieved (see D 2.2.3). These controls should be carried out on the basis of previously determined control indicators (see Section D 2.2.3). The results of the review should be communicated to the public in terms of high transparency and with respect to the acceptance level regarding the legal provisions.

Furthermore, undesirable developments and indications of misuse must be analysed. When developing solutions, both the system operators concerned as well as environmental and consumer protection associations should be involved in order to secure a high level of transparency.

The evaluation of legal regulations and defined targets includes not only a review of target parameters (e.g. achievement of defined minimum recycling rates). In this context it is also important to determine whether the defined target parameters are sufficiently measurable, whether they are of the desired informative value, and whether the measuring indicators respecting target parameters should be adapted. Some reasons for an inadequate design of measuring parameters may be, in particular, new market developments such as the introduction of a new form of packaging where the pertaining impacts cannot be measured by the initial measuring parameters. An evaluation of the effectiveness of systems must also include all sustainability indicators so that the ecological, economic and also the social impacts can be determined. Such a detailed and complex analysis procedure is to be performed, in particular, during the start-up phase, whereas the level of detail and complexity of the analysis can be reduced in already established and well-functioning systems.

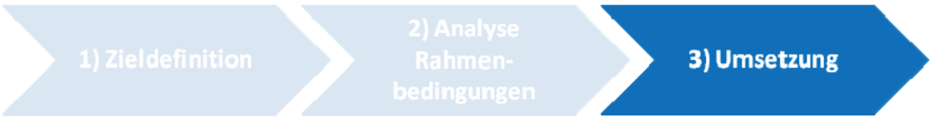
A cause analysis should be carried out if targets and target parameters are not met. In addition, any possible undesirable developments and illegal actions should be examined and analysed.

D 2.2.5 Act

If the defined targets are not met (see Sections D 2.2.3 and D 2.1.1), the legal regulations should be supplemented and/or additional steering mechanisms should be implemented on the basis of the findings gained from the check phase. Table 92 provides some examples of adjustments and measures that may be suitable, depending on which target has not been met.

Table 92: Aspects and measures in the Act-phase respecting the implementation of collection and recycling systems for beverage packaging (according to the "plan-do-check-act" model)

Adaptation / Measure	Target
Change or specification of labelling	• Increase in transparency for consumers • Simplified return to retailers • Reducing the susceptibility to fraud through the introduction of further security labelling (e.g. security colour)
Specific provisions for return options (e.g. definition of minimum amount or precise structure of return options)	• Densification and improvement of return options for consumers • Increased return rates (collection rates)
Extension of the system (e.g. for specific types of packaging and beverage segments)	• Increase in total collected amount of beverage packaging • Adjustment to market developments



Adaptation / Measure	Target
Adjustment or differentiation of the amount of deposits	• An increase in deposits generally leads to higher return rates (collection rates) • Differentiated deposits for different types of packaging (depending on environmental impact) may have a steering effect towards more ecologically advantageous beverage packaging
Introduction of additional financial steering instruments , e.g. taxes or levies on ecologically disadvantageous beverage packaging	• Increase in the proportion of ecologically advantageous beverage packaging • Promotion of ecologically advantageous beverage packaging

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