TOMRA

EPR Unpacked

A Policy Framework for a Circular Economy

Designing High-Performing Extended Producer Responsibility Schemes for Consumer Packaging

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Executive Summary

Global consumer packaging waste is surging, even in the world's most remote areas. There has never been a greater need for waste prevention and systems for packaging that enable reusability, recyclability, and recycled content. Rising to the challenge of achieving circular packaging requires industry and governments to take strategic action in creating effective systems for the collection, sorting, and recycling of post-consumer waste. For decades we have left the responsibility of dealing with an ever-increasing amount of non-recyclable and mismanaged waste to the market, communities, consumers, and ultimately, the environment itself.

Systemic change that advances the circular economy demands in-depth knowledge of the myriad of waste management and recycling practices worldwide. As a global impact leader with 50 years of experience in circular resource management, TOMRA offers decision-makers a unique perspective on well-designed policies that lead to high-performing Extended Producer Responsibility (EPR) schemes for packaging.

We take inspiration from leadership, learnings, and best practices found throughout the world. Nations that pioneered EPR schemes for packaging decades ago have continued to innovate and update their approaches, serving as a beacon for new policy and legislation. These trailblazers have set the precedent for EPR, proving that legislation that includes clear targets and transparent reporting requirements has significantly increased the circularity of consumer packaging.

As the second in a series of TOMRA white papers on EPR, this paper focuses on the elements necessary to support the overall implementation of high-performing systems for consumer packaging utilizing curbside and drop-off collection services. By considering each of the elements we have identified, mature programs can revise their existing systems to achieve even greater performance, whereas new and developing programs have the opportunity to leapfrog more mature ones by adopting circular recycling practices.

This paper presents a holistic and economically feasible approach to EPR schemes for consumer packaging, highlighting the importance of increasing circularity through closed-loop recycling systems where materials are used for multiple cycles. TOMRA encourages policymakers, governments, industry, brands, municipalities, the waste management sector, NGOs, and other stakeholders to reference this document as a blueprint when designing EPR policy and the ensuing infrastructure development.

Design Principles of High-Performing EPR Schemes

The combination of these five principles advances the circular economy through the high-quality recycling of consumer packaging.

#1 Circularity

Create a framework that reduces reliance on virgin materials by emphasizing resource efficiency and quality. Circular systems prioritize the waste hierarchy, incentivize eco-design, and utilize reliable measurement protocols.

#2 Performance

Set binding targets and define system boundaries to provide certainty for long-term planning and investments for green infrastructure. High-performing systems have a well-defined scope, clear roles and responsibilities, and comprehensive targets that scale up over time.

#3 Convenience

Design easy-to-use and universally accessible collection systems to maximize the quantity of captured materials. Convenient systems ensure resources are effectively collected and processed, help reduce contamination, and enable higher recycling rates.

#4 Producer Responsibility

Establish clear obligations for producers to manage the entire lifecycle of the packaging they place on the market. Effective legislation designates the coverage of costs, stimulates infrastructure improvements, and provides administrative guidance for fulfilling obligations.

#5 System Integrity

Build a governance structure based on transparency and compliance to support the achievement of targets. Robust systems balance government oversight with industry-driven management and require standardized reporting, monitoring, and controls.

Introduction

This white paper addresses key elements of an EPR scheme for consumer packaging, excluding beverage containers, for both mature and developing waste management infrastructures. While policy alone is not a panacea, well-designed EPR schemes for consumer packaging support the overall implementation of curbside and drop-off collection systems and the necessary infrastructure for quality recycling processes. With a comprehensive approach, EPR schemes set performance standards for consumer packaging, enable materials to be used for multiple cycles, and have the potential to adopt reuse models.

What is EPR? What can it Achieve?

EPR is an environmental policy principle according to which companies that place products on the market are responsible for those items over their entire lifecycle – from the initial design phase until they reach end-of-life and are prepared to be used in a new lifecycle. Once consumers dispose of the products, the company – referred to as the producer – is responsible for the collection, sorting, and recycling of its waste. Essentially, the producer takes financial and organizational responsibility for the waste it produces and contributes to the setup and infrastructure necessary for circular resource management.

EPR should be seen as a guiding principle for preventative environmental policymaking.[1] Since EPR schemes obligate producers to manage the entire lifecycle of their products, they are a catalyst for systemic change both upstream and downstream. Producers are incentivized to rethink the design of their products to achieve sustainable resource management – and maximum circularity after they reach the end-of-life.

EPR can be implemented in various ways to adapt to different local contexts. The resulting framework and organizational arrangements are referred to internationally as “EPR schemes” or “EPR systems.” For the purposes of this paper, we use both interchangeably.

In high-performing EPR schemes for consumer packaging, producers finance the collection, sorting, and recycling of their packaging. Based on global experiences, EPR is the only proven way to provide dedicated, ongoing, and sufficient funding to ensure the circularity of packaging is meaningfully scaled.[2]

More than 150 leading organizations worldwide call for the implementation of mandatory EPR schemes for packaging as a necessary part of the solution to create a circular economy.

Ellen MacArthur Foundation
Extended Producer Responsibility Statement

In theory, the EPR principle requires individual producers to manage their products after use and ensure appropriate processing. However, when it comes to post-consumer waste, individual fulfillment is often neither economical nor feasible in practice. Hence, producers are often given the option of collective fulfillment through an entity commonly known as a Producer Responsibility Organization (PRO). Companies contribute financially through cost-allocated fees submitted to the PRO based on the products they place on the market. The PRO is contracted to assume the responsibility of meeting legislative obligations on their behalf.

EPR History and Global Trends

EPR policies for packaging started appearing in the early 1990s, and their use spread through the following decades, expanding to cover other products, including electronics, tires, and batteries.[3] Today, global EPR trends go in three main directions:

- The introduction of EPR in markets that currently lack effective legislation to tackle waste.
- Strengthening existing EPR regulations to increase impact (e.g., introducing obligations for high-quality recycling targets, promoting reuse, and curbing litter).
- Expanding the scope of products that are covered under EPR (e.g., textiles, construction materials).

The European Union (EU) has been a frontrunner in the adoption of EPR policies. Germany is famous for implementing its landmark EPR scheme for packaging, Der Grüne Punkt (The Green Dot), in 1991 in response to requirements for collection and recycling obligations under the German Packaging Ordinance.[4] In 1994, packaging legislation followed at the EU level, and the PRO-based model spread to all other European countries. PROs took on responsibilities that were initially performed by local authorities – financing and sometimes also operations. Over time, the ambitions and functionality of PROs have shifted: from setting up functioning collection and waste processing infrastructure to effectively managing resources with an increasing focus on circularity.

EPR for Packaging: A Unique Approach for Beverage Containers

There is no one-size-fits-all approach to EPR for packaging. Beverage containers are a prime example of why multiple EPR systems are necessary to maximize packaging circularity and reduce litter. Glass bottle deposit schemes date back to the late 19th century, and aluminum cans and plastic bottles with a deposit are among the most recycled packaging worldwide today. Deposit Return Systems (DRS), one particular type of EPR scheme for packaging, have proven to be the global best practice for beverage containers.

Numerous EPR schemes have included beverage containers within curbside and drop-off collection systems, but DRSs continually outperform them,

achieving exceptionally high collection and recycling rates. Therefore, when drafting policy for packaging, it is strongly recommended to have multiple EPR systems based on products, materials, and consumption patterns. Under a DRS, consumers pay a small deposit on a beverage container at the point of purchase. Consumers receive the deposit amount back when they return the empty container to a designated collection point, usually the retailer. In 2021, TOMRA published "Rewarding Recycling: Learnings from the World's Highest-Performing Deposit Return Systems." [5] As the first in a series of white papers covering EPR schemes, it addresses the policy and framework conditions for establishing a DRS for beverage containers.

The scope of this paper is all consumer packaging, excluding beverage containers. However, both white papers share many of the same principles for maximizing circularity and offer instrumental criteria for effective policy design and implementation.

The Role of EPR in Holistic Resource Systems

TOMRA's Holistic Resource Systems approach provides a framework for collecting, sorting, and recycling waste to achieve the highest recycling rates and associated carbon benefits.[6] Comprised of three complementary collection methods, this model approach captures post-consumer packaging even if it is disposed of in unintended waste streams.

Deposit return systems are the global best practice for collecting and recycling beverage containers. Separate collections rely on consumers to separate certain materials from their general waste in a dedicated bin which is then collected at the curbside or drop-off points. Separate collections improve the quality of materials to enable maximum recycling yields. Mixed Waste Sorting (MWS) captures valuable packaging materials that consumers inevitably do not separate for recycling, either by mistake or from a lack of willingness to participate in the program.

Modernizing existing or building new waste management infrastructure to close the loop on packaging and produce high-quality recyclates for the supply chain requires dedicated funding. Mandatory EPR schemes are the most effective mechanism for providing this funding and are therefore a fundamental element of successful holistic resource systems.

This white paper serves as a resource for legislative and regulatory drafters as well as for stakeholders affected by EPR to address the complex challenges posed by post-consumer packaging waste. It outlines the design principles of effective EPR policies and the key elements of high-performing EPR systems.

Holistic Resource Systems approach to capturing high volumes of recyclable packaging

CHAPTER ONE

Circularity

Create a framework that reduces reliance on virgin materials by emphasizing resource efficiency and quality. Circular systems prioritize the waste hierarchy, incentivize eco-design, and utilize reliable measurement protocols.

Waste Hierarchy

The waste hierarchy is an internationally accepted standard that aims to keep materials at their highest and best use, and establishes an order of waste management options from most to least preferred based on the ecological and social impact. Prevention and reduction of waste are given top priority, and leakage of waste into the environment is deemed unacceptable. The waste hierarchy is fundamentally aligned with the circular economy and serves as a guide to policymakers on how to maximize resource productivity and minimize environmental impact.

EPR schemes play a critical role in accelerating the transition to a circular economy. They provide the framework and economic incentives for producers to choose packaging that can be managed using the most preferred options (prevention, reuse, and recycling) over the least preferred options (energy recovery, incineration, landfill, pollution). EPR schemes for consumer packaging in Europe have proven successful as a tool for capturing materials for recycling. Today, there is increased focus on high-quality recycling to maximize material circularity and reuse.

A stable supply of quality materials is needed to deliver scalable solutions that close the loop on packaging. Closed-loop recycling systems that combine effective collection, sorting, and recycling of packaging waste are key enablers in a circular economy. In practice, closed-loop recycling is still in its infancy, with recycled polyethylene terephthalate (rPET) at the forefront of sustainable plastic packaging. While open-loop recycling, such as making clothing fibers out of water bottles, reduces dependency on virgin resources, the missed opportunity to keep materials at their highest and best use offers fewer environmental benefits than closed-loop recycling.

The TOMRA waste hierarchy serves as the foundational basis for establishing policies to incentivize the recyclability of packaging and ensure materials retain their highest and best use. The waste hierarchy is a guide for policymakers when designing an EPR scheme, especially when establishing definitions, setting targets, and measuring performance.

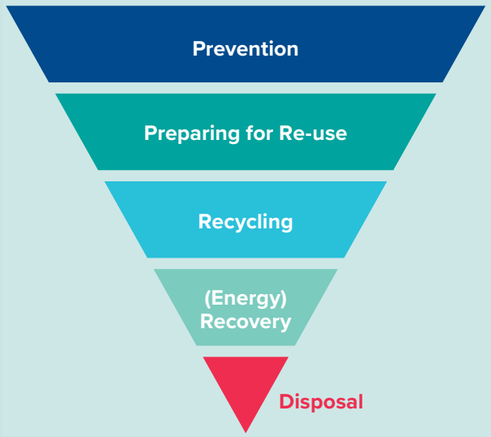
When it comes to recycling, the best processes enable materials to be continually turned back into new products of the same or similar application, employing the least energy and resource-intensive processes. While mechanical and chemical recycling are complementary processes in the circular economy, mechanical recycling typically takes precedence due to it smaller ecological footprint, making it the preferred method. The original material is eventually exhausted through cumulative process losses over time, recycling processes depend on high quantity and quality material flows to ensure economies of scale.

Due to a confluence of forces – including volatile commodity markets, insufficient investment in infrastructure, and lack of comprehensive recycling policy – plastic packaging recovered from household waste has typically been downcycled, incinerated, or sent to landfill. EPR solves for these key issues by bringing balance to the economics of recycling, relying on high targets and dedicated funding to stimulate demand and provide the necessary resources for infrastructure development. In combination with incentives for upstream design changes that meet recyclability criteria, effective collection systems, sensor-based sorting technology, and advanced mechanical recycling processes can deliver high-quality recycled content for the future of sustainable packaging.

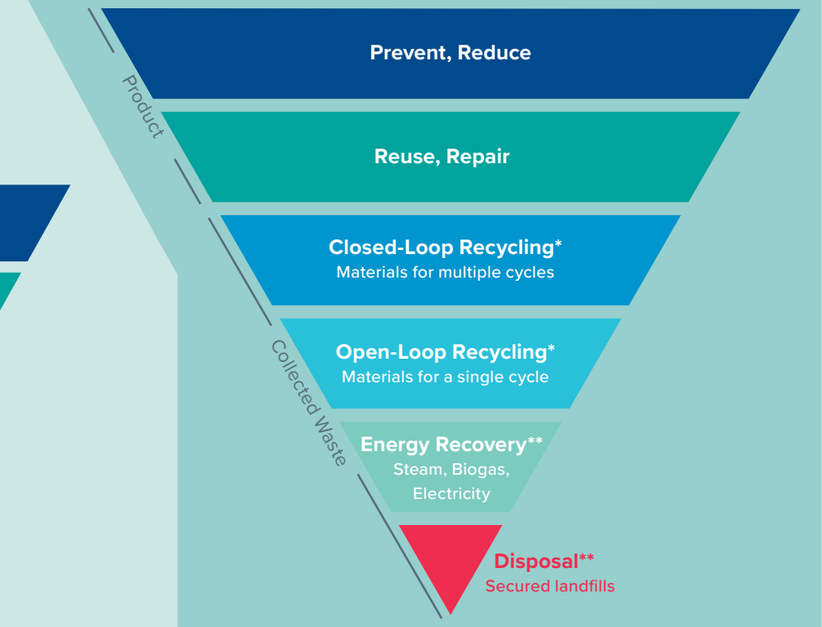
Definitions and Measurements

To provide a level playing field and harmonize measurement across stakeholders, it is necessary to estab-

EU waste hierarchy [7]



TOMRA waste hierarchy



* *Mechanical recycling preferred*
** *Additional sorting recommended*

lish key definitions such as the terms referred to in the waste hierarchy. Also, the legal framework needs to state how performance against requirements will be measured over time to demonstrate the achievement of targets. Clear and meaningful definitions provide the foundation for a successful system and ensure that the intended objectives are met.

It is strongly recommended that the market amount, i.e., the total amount of packaging placed on the market, is used as the basis measurement point for monitoring performance. Since companies report sales quantities to statistic offices, the data is easy to collect. A measurement point based on the market amount offers the most accurate representation of the volume entering the waste stream, enabling better planning for infrastructure requirements.

European countries that have used licensing or waste collection data as the basis for measurement are now adapting their approaches. Any measurement basis except for the market amount proves challenging in providing transparent reporting. Data submitted to PROs by obligated companies, known as 'licensing amounts,' often exclude packaging under de minimis thresholds and free riders (companies that do not pay EPR fees for the packaging they place on the market). Collected amounts, i.e., data submitted by waste collection organizations, only reflect properly managed waste. Without further compositional analysis of the waste stream, it is difficult to determine the exact quantities of post-consumer packaging by material.

Due to the limited geographical coverage of collection systems, using the collected amounts of post-consumer packaging only reflects properly managed waste and makes it difficult to determine if material targets are being achieved. Generally, the global trend in EPR schemes is to use the total amount of packaging placed on the market as the basis measurement point, which offers a more robust performance metric.

Recycling

An effective EPR policy stipulates what does and does not count toward recycling. For instance, in line with the principle of circularity, targeted materials that are effectively collected, sorted, and reprocessed into secondary raw materials count toward recycling. This is a critical step in the value chain, where post-consumer waste materials are prepared for reuse in new products, and achieving the ultimate objective of recycling. If materials are merely processed but not returned to the supply chain, then circularity has not been achieved. High-quality recycling processes that enable resource utilization over multiple cycles play a vital role in the circular economy, whereas incineration (with or without energy recovery) and landfills are hallmarks of a linear economy.

The EU Waste Framework Directive (WFD) defines recycling as: "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations." [8]

It is important to clearly define how performance against the recycling targets is measured and verified to avoid inconsistencies and potentially fraudulent interpretations, whether intentional or not. While targets can be set and measured at different points in the value chain – mainly collection, sorting, or recycling – the calculation point to support real progress toward a circular economy should be as close to the final recycling step as practical. This ensures that contamination, pre-treatment losses, and residues are not included in the recycling performance numbers.

The recommended calculation point for recycling targets is where sorted materials are sent for reprocessing. Depending on the material, this could be the point before sending it for remelting, extrusion, pulping, etc. This calculation point conveys a system's ability to capture and maintain the quality of collected materials for recycling. It provides feedback not only on the circularity of the packaging, but also on the performance of the system itself. Data supplied by performance metrics and sorting technology enabled with deep learning applications gives stakeholders valuable insight into the operational reality of the system. Data analytics further enable decision-makers to closely monitor and optimize the system as needed.

Until 2019, the EU measured the output streams of sorting plants (materials sent for recycling) to calculate an estimated packaging recycling rate. This point of calculation risked an overestimation of materials actually recycled. The point of calculation was reset in 2020 to reflect the input of secondary production, which creates incentives to limit losses during pre-treatment and yields more accurate recycling data. [9, 10]

Calculation formula for recycling rates

$$= \frac{\text{Input to recycling}}{\text{Packaging placed on the market}}$$

Recyclability

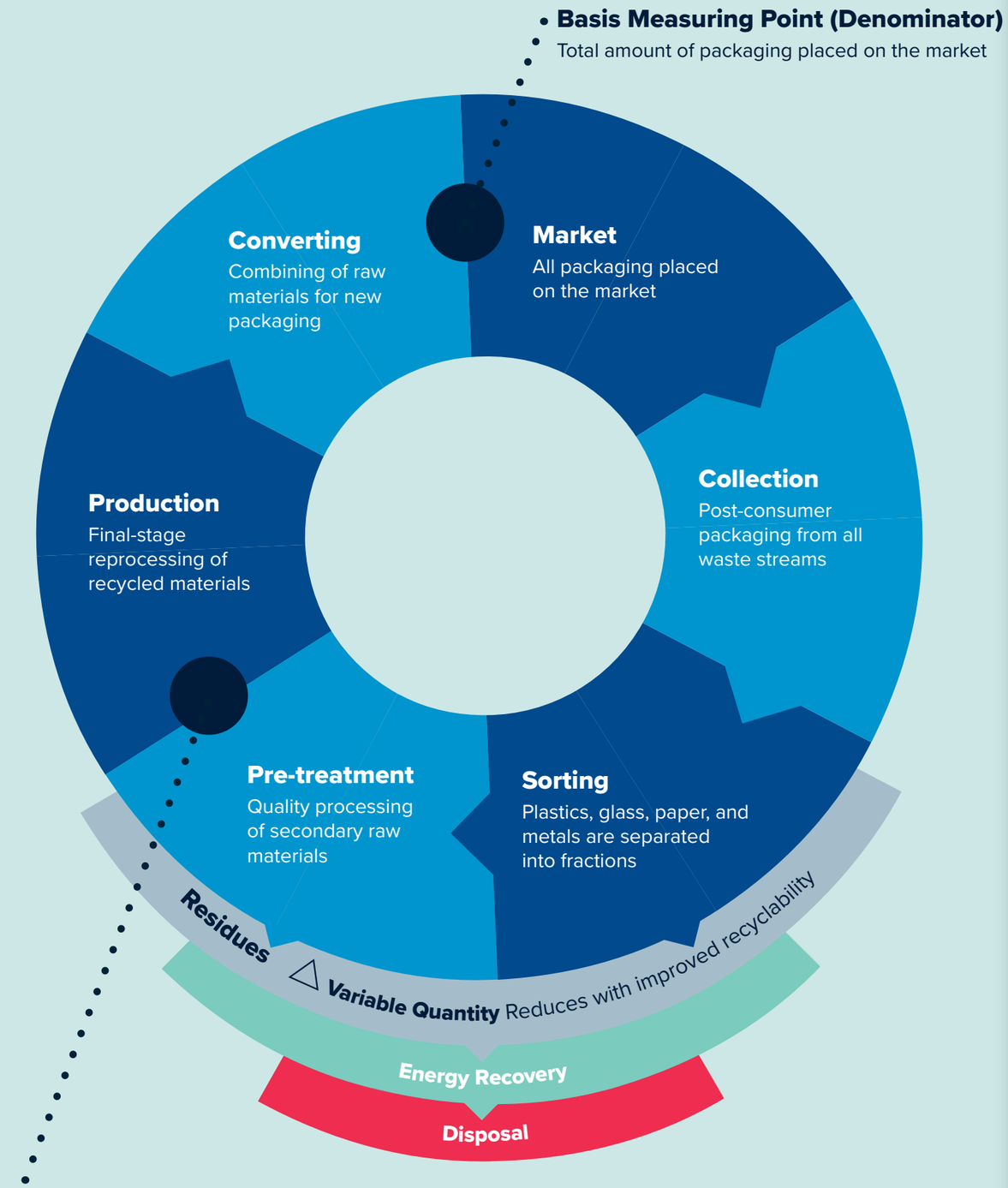
There are two key interrelated factors that determine whether packaging is recyclable:

1. Production phase: Alignment of the composition, material properties, and design features to the capabilities of the localized waste management infrastructure.

2. Infrastructure landscape: Effective collection, sorting, and recycling systems to ensure feasibility and economic viability in the respective market.

Designing packaging for recycling is a positive and significant step towards circularity. However, the capabilities of existing local infrastructure are an equally important factor in ensuring that packaging is effectively recycled. While design guidelines for sustainable packaging can improve the recyclability of packaging worldwide, EPR plays a pivotal role in balancing this disparity. When designed properly and with relevant incentives in place, an

Recommended Calculation for Recycling Rates



EPR scheme brings harmonization to the entire value chain, driving transparency and ensuring alignment between packaging design and infrastructure.

To increase the recyclability of packaging, collaboration and the exchange of information are essential throughout the value chain. From upstream (material suppliers, producers, manufacturers) to downstream (sorting, recycling, reprocessors) stakeholders, transparency of packaging composition and material properties enables optimized resource management.

Currently, a universal legal definition for recyclability does not exist. The EU has noted that the lack of a clear definition has been an obstacle in aggregating and comparing performances across jurisdictions. It is currently considering a revision to the packaging waste legislation that will define ‘recyclable packaging’ or a minimum standard of recyclability, which once in place, is expected to improve packaging design and recycling rates across the region. Moreover, these system improvements are likely to have a positive ripple effect across global markets as large corporations see value in standardizing their international operations.

Eco-Design

Decisions made in the design stage of a package play a critical role in determining its recyclability and potential to displace virgin raw material. Therefore, to achieve circular economy goals and keep valuable resources in a closed-loop system, careful consideration for the full product lifecycle must be taken very early in the design process. Product lifecycle considerations should go beyond conventional usage and consumption measurements, and strive to ensure end-of-life products are ultimately recycled into secondary raw materials. Design-for-recycling criteria are key considerations of eco-design, shifting the focus of end-of-life management back upstream rather than as an afterthought. While the goal of design-for-recycling is for a product to be both technically recyclable and effectively recycled, the integration of recycled content into a product goes a step further in achieving circularity.

Although recyclability depends largely on local circumstances including the infrastructure that exists for the collection, sorting, and recycling of waste, packaging should foremost follow general design-for-recycling principles. This approach ensures the packaging follows industry guidelines and has a clear path to being recycled. Mono-material packaging or materials that can be easily separated, for instance, are generally easier to sort and recycle.

All aspects of the packaging should be considered, including size, shape, material, labels, adhesives, caps, closures, contents, utilization, etc. The advantages and disadvantages of each design element must be weighed against the intended utility of the package. Should any element prove problematic in achieving full recyclability, it either needs to be eliminated from the design altogether or minimized as much as possible. In keeping with the principles of the waste hierarchy, packaging design should first aim to prevent waste, then reduce excessive

material usage, and finally ensure the packaging can be effectively recycled in the markets where it is placed.

Assessing the recyclability of packaging is a complex task that sometimes results in difficult or unexpected trade-offs that must be reconciled in the design phase. Lightweight packaging, for example, can seem like a good option when accounting for the reduction in transportation-related emissions. However, if the material composition (e.g., multi-material, multi-layer) complicates the sorting and recycling processes and inhibits circularity, it has not successfully incorporated eco-design principles.

Ideally, internationally harmonized criteria would facilitate producers in designing recyclable packaging. Today, the wide-ranging variations in collection and recycling infrastructures from region to region require adaptiveness and some degree of localization on the part of producers. The funding that EPR provides can be used to expand recycling capacity and improve performance.

As more policymakers implement EPR legislation, there will be accompanying growth in collection and recycling infrastructure, facilitating a more harmonized approach across jurisdictions. Furthermore, the benefits of harmonization across markets should serve as an incentive for producers to support EPR internationally.

Recycled Content

As part of an eco-design strategy, incorporation of recycled content plays an important role as it directly stimulates the effective remanufacturing of resources into new products. Post-consumer recycled content (PCR) mandates are the best way to achieve circularity and effectively displace the excessive greenhouse gas (GHG) emissions of virgin material production.

There are several main challenges to increasing the uptake of recycled content, including:

- Economic prioritization of recycled content
- Infrastructure to ensure high quantity and quality supply to meet demand
- Universally accepted standards and credible information to ensure quality and facilitate acceptance

By incentivizing producers to use recycled content in their packaging, EPR schemes reduce reliance on virgin materials and enable circularity. Additionally EPR schemes with mandatory targets for recycled content are the key enablers in creating market certainty and stimulating investment.

Strong end markets for recycled content also require collaboration across the value chain so that all parts of the system complement each other. Quality recycling processes with a stable supply of collected materials and the appropriate infrastructure are necessary to meet future demand. Systems need to prioritize quality and be designed to effectively collect, sort, and recycle post-consumer packaging waste in a way that preserves material characteristics, thus maximizing reutilization for every renewal cycle.

Eco-Modulation

Eco-modulation incentivizes eco-design by reducing fees for packaging that has lower waste management and recycling costs, improving the economic performance of the entire value chain. The more sustainable the packaging, the lower the fees: the EPR scheme assigns producer's fees based on design-for-recycling criteria and/or the percentage of recycled content.

Materials that are difficult to recycle would therefore incur higher EPR fees, while mono-material or mono-layer packaging that is easier to sort and recycle would result in lower fees. Additional regulatory measures such as incentives and bans are intended to recalibrate the economics of recycling.

Such measures make higher ranking options in the waste hierarchy (reduce, reuse, recycle) more financially attractive than the lower ranking options (energy recovery, disposal).

France is a prime example of incentivizing eco-design through its bonus-malus method as part of the EPR scheme for packaging. In addition to basic EPR fees, it rewards packaging that meets sorting guidelines and penalizes packaging that interferes with the recycling processes.

When producers integrate post-consumer recycled content into their packaging, they can receive a bonus of up to 50 percent, reducing their financial contribution to the system.[11]

CHAPTER TWO

Performance

Set binding targets and define system boundaries to provide certainty for long-term planning and investments for green infrastructure. High-performing systems have a well-defined scope, clear roles and responsibilities, and comprehensive targets that scale up over time.

Scope of Packaging

Definitions

Legislation should define the term “packaging.” Often such definitions refer to the functionality and intended use of an item to determine whether it is considered packaging or a product. Legislation should strive to use the most precise language as possible. When definitions are formulated, an accompanying list of illustrative examples is helpful for items for which there is no straightforward application.

The European Packaging and Packaging Waste Directive defines packaging as: “All products made of any material of any nature to be used for the protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer.” [12]

Under the EU Packaging Directive, a single-use cup is considered packaging if it is used for coffee on-the-go (filled at the point of sale), but the very same item sold in packs in a supermarket would be considered a product and not packaging.

It is essential to distinguish between single-use and reusable packaging. The definition of reusable packaging should reflect a highly durable design, meet the necessary health and safety standards, and specify the systems required to manage multiple reuse cycles. Modern reuse systems require a comprehensive infrastructure, including effective take-back programs, sanitizing processes, refilling, and logistics. Ideally, the definition for reusable packaging would encompass two aspects that enable effective reuse systems: financial incentives and the necessary infrastructure.

The German Packaging Act defines reusable packaging as: “Packaging that is intended to be reused several times for the same purpose after use and the actual return and reuse of which is made possible by sufficient logistics and promoted by suitable incentive systems, usually a deposit.” [13]

Packaging Materials

It is important that legislation explicitly requires all packaging materials to be covered in an EPR scheme to ensure a level playing field and avoid material substitutions. Legislation can set different recycling targets based on the recyclability of the packaging. For instance, composite (multi-material) and multi-layer packaging is generally more difficult to recycle and will have correspondingly lower recycling targets and higher fees, whereas mono-material and mono-layer packaging (PET, HDPE, aluminum) will typically have higher targets, lower fees, and often relatively high market values.

Categories of Packaging

Packaging is typically categorized by its functionality and the origin of its waste. When defining the scope of an EPR scheme, it is helpful to consider these categories. The most effective EPR policies mandate collecting, sorting, and recycling post-consumer packaging waste from household and public waste bins.

Packaging categorization according to functionality

In terms of functionality, packaging is typically segmented into three categories:

1. Primary Packaging (sales packaging) – packaging offered as a sales unit that contains and protects the product and can be used for consumer communication purposes

2. Secondary Packaging (grouped packaging) – guarantees the safe delivery of goods to the customer and facilitates the grouping of primary packaging units

3. Tertiary Packaging (transport packaging) – transportation packaging used to facilitate the delivery of large quantities of products or distribution units

Certain types of packaging require a more targeted approach based on consumption patterns, recyclability, and other factors. Single-use

Categories of Packaging by Functionality

Primary Packaging | Secondary Packaging | Tertiary Packaging

beverage containers, for example, are a significant source of litter, accounting for 5 of the top 10 items collected globally from beach clean-ups.[14] Around the world, DRSs have proven to reduce litter caused by beverage containers significantly. Furthermore, they achieve higher collection and recycling rates for beverage containers than EPR schemes with curbside and drop-off collection systems.

Refillable beverage containers also play an essential role in circular packaging and are most effectively managed under DRSs. Through leveraging synergies across collection infrastructure, logistics management, and other functionalities, DRSs are the optimal type of EPR scheme for both single-use and refillable beverage containers.

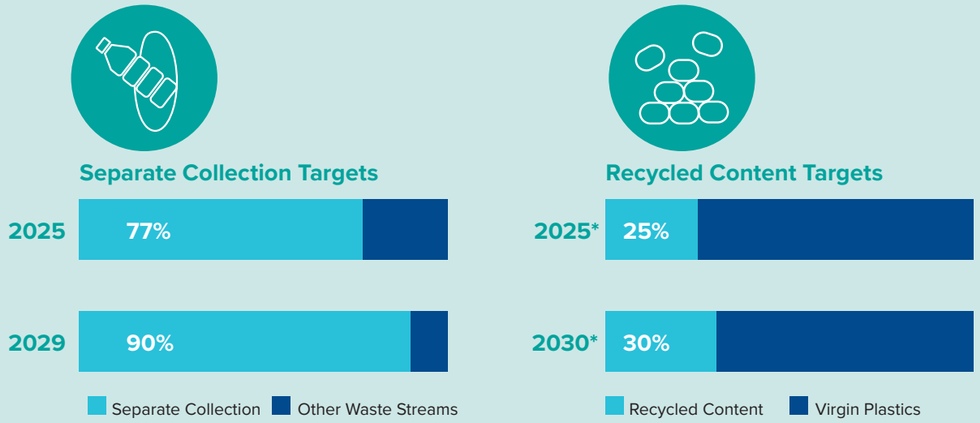
A holistic approach to EPR for packaging can be achieved using complementary legal acts and policy tools. For example, the EU Packaging Directive that mandates EPR schemes for all types of packaging is supplemented by another piece of legislation – the Single-Use Plastics Directive (SUPD).[15] The SUPD introduces additional requirements for specific categories already covered under the scope of the EPR scheme. Single-use plastic beverage containers, for example, are now subject to increased collection targets (90% by 2029) and recycled content requirements (30% by 2030).[16] The SUPD also introduces EPR requirements for specific products excluded under the packaging directive. For example, single-use coffee cups sold in packs in stores are considered a product rather than packaging.

Packaging categorization according to origin

In terms of the origin of packaging waste generation, it is typically divided into three categories: household, commercial, and industrial waste.

Household packaging waste results from the normal activities of households. Packaging generated by public institutions, schools, and community centers is comparable

Targets for single-use plastic beverage bottles under the EU's SUPD



* 2025 target for PET beverage bottles only.
2030 target for all plastic beverage bottles.

in composition to the household packaging waste stream and is therefore treated the same way. This stream is highly complex, dynamic, and variable, making it difficult and expensive to collect, sort, and recycle. EPR schemes provide the funding necessary to address these challenges with high-performing systems that can effectively manage the packaging, achieve circularity, and avoid disposal in incinerators or landfills.

Commercial packaging waste is generated by retail stores, restaurants, and other businesses. Industrial packaging waste, on the other hand, is generated by manufacturing facilities. These two categories are typically composed of mono-materials, generated in large quantities at specific locations, and therefore tend to have a higher degree of regularity and predictability as compared to household waste. The properties and composition of commercial and industrial packaging waste are significantly different from post-consumer waste streams and therefore require other collection systems and processing methods.

The latest revision of the EU Packaging Directive regulates all packaging regardless of origin, requiring the establishment of EPR schemes and the achievement of specific recycling targets by 2025. To date, individual EU countries have mainly focused on EPR schemes for post-consumer packaging from households and less on commercial and industrial packaging. Irrespective of the exact arrangement in a country, establishing EPR schemes designed to manage the complexities of household waste streams is paramount for circularity.

When defining the scope of an EPR scheme, it is important to clearly distinguish the management of household waste from commercial and industrial waste streams to allow for accountability and accurate performance monitoring.

Belgium has set a leading example by introducing separate household and industrial waste policies, including two independent PROs and appropriate targets for each.[17]

Roles and Responsibilities

The success of an EPR scheme does not depend solely on producers, as many other actors are involved. It is important to identify and clearly define the roles and responsibilities of all key stakeholders and affected parties. This will vary depending on the local context and circumstances; however, consistency and alignment need to be considered paramount when setting up a system.

Producers

In most regulatory approaches, a producer is defined as the company that first places products on the market and is considered to be the obligated party. By this definition, producers are typically brand owners or importers. However, retailers are also considered producers for their private label brands. A clear and well-defined producer responsibility to finance the EPR scheme is essential for a functioning system.

A different definition of producer is applied to packaging that is designated as service packaging which is intended to be filled at the

point of sale – such as pizza boxes, to-go coffee cups, and plastic bags for loose produce (fruits, vegetables). Here an exception is made, and the obligated party is the manufacturer of the packaging rather than the producer of the packaged product.

Typically, fees are paid by the obligated party to the PRO based on packaging amount and material type to help finance the waste management and recycling systems for packaging waste.

Producer Responsibility Organization (PRO)

A producer responsibility organization is an entity established to collectively implement the EPR policy on behalf of the individual producers. PROs are responsible for meeting legislative obligations such as the financing of collection, sorting, and recycling of the targeted waste stream.
While producers can fulfill an EPR scheme's obligations individually or collectively, they typically join a PRO for operational efficiency.
PROs collect fees from individual producers and allocate funds to appropriately manage materials and fulfill recycling targets while also managing data and organizing operations. Over the years, the role of PROs has expanded to include operational interventions and a broader scope of actions. From holistic communication campaigns and eco-consulting services, ownership of secondary raw materials and even recycling plants, to audits of waste management operators, the evolutionary function of PROs demonstrates that EPR schemes are a powerful force in driving circularity.

Municipalities

Around the world, municipalities are commonly responsible for organic and residual household waste (the waste that remains after separating hazardous and recyclable materials). The introduction of EPR legislation typically does not impact municipalities' responsibilities for waste management; their obligations for organic and residual waste streams continue. Given this capacity, it is not uncommon for municipalities to invest in infrastructure for the collection and processing of municipal solid waste.

As the primary information source on services available to residents, municipalities play a pivotal part in communicating the role of waste management and its impact on the environment. They can also implement localized measures to incentivize and steer consumer behavior toward recycling. Therefore, incorporating the interests of municipalities is essential for a successful implementation of an EPR scheme.

Municipalities in Belgium have introduced localized measures to complement the nationwide EPR scheme for packaging waste. The transparent bags that residents must use to contain packaging waste are less expensive than the bags required for general household waste disposal. The price incentive and the transparency of the bags has proven to have a steering effect on consumers to maximize recycling.

The involvement of municipalities in an EPR scheme can take different forms. The most common approach is that a municipality is a service provider, which defines, plans, and sometimes also executes the collection of waste. Municipalities can choose to participate in an EPR scheme, where the PRO compensates them for waste collection and any sorting or recycling services they provide. Alternatively, the PRO can select another waste collection service provider if the municipality opts out.

This approach establishes a second collection system for post-consumer packaging that is run by the PRO separately but similarly to the existing household waste collection system. Contracts are made with municipalities only to serve as coordination partners. Private waste management companies are the more relevant stakeholders in this case, since the PRO compensates them for their services.

Paper-based packaging requires separation from other packaging items to reduce contamination and maximize recycling rates. Separate collections for all paper and cardboard waste are strongly recommended. Since municipalities typically manage waste paper collections, PROs reimburse a percentage of the collection costs depending on the share of packaging vs. non-packaging material in the respective territory.

Only when municipalities' interests are safeguarded and are sufficiently incorporated into the planning can such a system meet with acceptance. Most municipalities determine the type of collection offered to their residents (curbside service and drop-off points), the form of collection (bin, cart, bag), and collection frequencies, which are all key performance characteristics. The role of the government is to ensure consistency and alignment in how roles and responsibilities are allocated among the different players. Municipalities, for example, cannot be held accountable for achieving recycling targets that include packaging waste if this falls entirely under the responsibility of producers. On the other hand, if producers are obligated to finance the collection and sorting of packaging, they should have a say in how it is run operationally. This ensures adequate service levels and cost-effective delivery. The level of service will depend on the local context and has to be decided on a case-by-case basis.

Consumers

The success of an EPR scheme for packaging waste depends partly on consumers. Recycling programs and infrastructure can vary significantly from region to region, which presents challenges for consumers in understanding how different systems operate and how they need to adjust their behavior. It is not uncommon for consumers to place items in the wrong bin even if they genuinely want to do the right thing for the environment. Consumer awareness and participation are critical factors in running an efficient system that yields a high quantity and quality of recycled content.

It is essential to keep a wide variety of consumer behaviors in mind and not expect perfect participation when designing an EPR scheme. If consumers are unclear on how to sort their recyclables or do not wish to participate in recycling, valuable packaging materials end up in household waste. Therefore,

in addition to funding curbside and drop-off collection systems for post-consumer packaging, high-performing EPR schemes are designed to cover the costs of sorting recyclables from mixed municipal solid waste. A well-designed EPR scheme facilitates user participation without depending on high motivation levels; a simple and consumer-friendly system accommodates a variety of consumption habits.

Informal Sector

The International Labour Organization (ILO) refers to the informal economy as: “all economic activities [...] that are not covered or insufficiently covered by formal arrangements.” People are engaged in informal waste picking and recycling activities in many countries around the world. However, the size of the informal sector and the way it is organized vary widely.

Countries with strong informal sectors currently developing or implementing EPR schemes: *Brazil, Chile, India, South Africa and Vietnam*

The informal sector plays a crucial role in waste management in many regions around the world. Workers in the informal sector are compensated relative to the value of the material they recover and therefore they primarily focus on collecting materials with strong end markets (e.g. PET, HDPE, cardboard, metals). The income for workers are heavily dependent on the supply and demand for recyclables. As market prices for raw materials fluctuate, the informal sector’s participation varies. When designing an EPR scheme for markets with an informal sector, policymakers should consider an index-based EPR fee structure that reflects the actual costs of waste management and is not dependent on fluctuating prices for secondary raw materials. Such a structure will fairly compensate the informal sector for the environmental services rendered. In addition, the policy can include mandatory integration or formalization of informal workers as part of the approval process for PROs. Compensation structures aligned with eco-modulated fees can create a monetary incentive to support the collection and processing of all packaging waste rather than only those with the highest market values.

As part of its regulations, South Africa has mandated integration of the informal sector as a part of the plan to be submitted by PROs/ producers for approval by the relevant state authorities.[18]

Careful consideration of the informal sector’s needs and safety is necessary to ensure acceptance and equity. Performance criteria for informal sectors are best developed in direct cooperation with PROs, who are responsible for submitting plans to the relevant authorities for approval and regular accreditation.

Furthermore, the acceptance of material from the informal sector to fulfill legislative targets is crucial for system integration. Measures to avoid double counting and fraudulent behavior can help to maintain a functioning system.

Targets

The government is responsible for setting legislated targets in line with the waste hierarchy and promoting circularity. Measurable, realistic, and ambitious targets are needed along the entire value chain to accelerate the transition to a circular economy.

Landfill and Incineration Targets

Landfill use and incineration of untreated waste (not pre-sorted for recycling) are unfortunately standard practices in developed and developing nations. The absence of appropriate waste management and recycling infrastructure is often due to a lack of investment, and EPR schemes help address these challenges. In many areas of the world, it is less costly to burn or bury waste instead of recycling. Appropriate policies are required to balance the economics of managing resources and provide for the proper lifecycle management of packaging.

A combination of landfill reduction and material recycling targets ensures valuable resources do not end up in incinerators and landfills thereby increasing circularity and significantly reducing GHG emissions. Research by sustainability consultancy Eunomia analyzed the effects of mixed waste sorting from waste streams intended for incineration, to increase recovery and recycling of polypropylene (PP) and high-density polypropylene (HDPE). Assuming a plastic composition containing 34 percent HDPE and 66 percent PP, the study shows a savings of 1.895 metric tons of carbon dioxide equivalent (CO_2e) for every ton of HDPE/PP in municipal solid waste.[19] In addition to banning specific items such as textiles, food waste, and e-waste from landfills, legislation should promote circular waste practices and help develop domestic end markets. Legislation to prohibit the export of untreated waste is crucial to retain domestically the packaging in the scope of the EPR scheme and build equity into the system.

Recycling Targets

Worldwide, the performance of an EPR scheme is predominantly driven

Recycling targets for packaging under the EU Packaging DIrective

	Today	*2025[1]*	*2030[1]*
All Packaging	**55%**	**65%**	**70%**
Plastics	22.5%	50%	55%
Wood	15%	25%	30%
Glass	60%	70%	75%
Paper & Cardboard	60%	75%	85%
Metal	50%	70%[2]	80%[2]
Aluminum	-	50%	60%

[1] Member states can postpone attainment of targets by up to 5 years (derogation limited to max. 15 percentage points from a single target or divided between two targets; recycling rate for a single target cannot be reduced below 30% or below 60% in case of glass and paper).
[2] Ferrous metals

and measured by recycling targets, either on a national level or adapted to regional considerations. The recycling targets need to be ambitious to drive change in the system, but they also need to be attainable so that the obligated parties can successfully achieve the desired outcomes.

In setting numerical targets, the capabilities of the existing infrastructure should be considered, as well as the types of systems and investments needed to meet the future targets. Staggering the recycling targets to increase over time drives investments into sustainable infrastructure, advances technological innovation, and gives industry time to adapt and scale up.

When establishing recycling targets for plastic packaging waste, it is essential to set an overall collective target in addition to targets for specific polymers. Broad targets can drive change in the system but should become more granular over time as the system evolves and can accommodate improved processing and data capture.

Targets that are varied based on the recyclability of a type of plastic (PET, HDPE, PP, etc.), when accompanied by robust data capture and reporting, allow for greater accuracy and transparency in how materials perform in the system. This data can help in determining where investments are needed to improve the system, whether it be from a change needed in the packaging and/or investments in infrastructure to process packaging waste better.

Recycled Content Targets

Post-consumer recycled content (PCR) targets are a powerful tool in advancing circularity and reducing dependency on virgin resources. From an environmental policy point of view, PCR targets strengthen and stimulate the demand for recycled materials. Recycled content targets should specify ‘post-consumer’ material, i.e., only materials that were utilized and discarded of by a consumer and then recycled and made into a new product should count toward recycled content targets. Allowing scrap material from production (pre-consumer) to count toward recycled content targets does not align with the principle of circularity and is generally considered a design flaw.

This detail-specific policy measure has been most commonly applied to recycled content targets for PET beverage containers. As an EPR scheme matures, the use of recycled content in a broader of range of packaging is facilitated as more material is circulated in the system.

The most ambitious targets for PCR standards were recently established in the state of California in the USA. The legislation set PCR standards for plastic beverage containers of 15% by 2022, 25% by 2025, and 50% by 2030.[20]

In 2022, the state of Washington in the USA set similar targets for beverage containers, as well as targets for trash bags and containers for household and personal care products. Setting PCR targets in legislation is critical to ensuring stable demand and providing certainty to the market, enabling investment and growth throughout the value chain.[21]

CHAPTER THREE

Convenience

Design easy-to-use and universally accessible collection systems to maximize the quantity of captured materials. Convenient systems ensure resources are effectively collected and processed, help reduce contamination, and enable higher recycling rates.

Access and Ease of Use

Collection systems for packaging waste under an EPR scheme require comprehensive geographical coverage and access for everyone. While a collection system must address the challenges of urban settings, a high-performing EPR scheme must also include convenient solutions for rural and remote areas.

A combination of collection methods that adapts to local conditions is the most effective way to maximize the capture of materials. In areas with high population density, a system might offer curbside collections for packaging waste. In contrast, drop-off points within a maximum distance range could serve remote and rural populations more effectively.

All packaging materials covered by the EPR scheme must be addressed by some type of collection system. The frequency of collection services can vary, but consumer access and convenience are paramount. Complimentary collection services for all consumers should be made available to maximize participation and build equity.

A convenient waste management system strongly depends on the societal acceptance of collection methods and varies greatly depending on the country or region. In addition to offering sufficient drop-off points options within a reasonable distance, collection systems should be intuitive. To avoid contamination of the recycling stream, consumers should easily understand which items go in which bins.

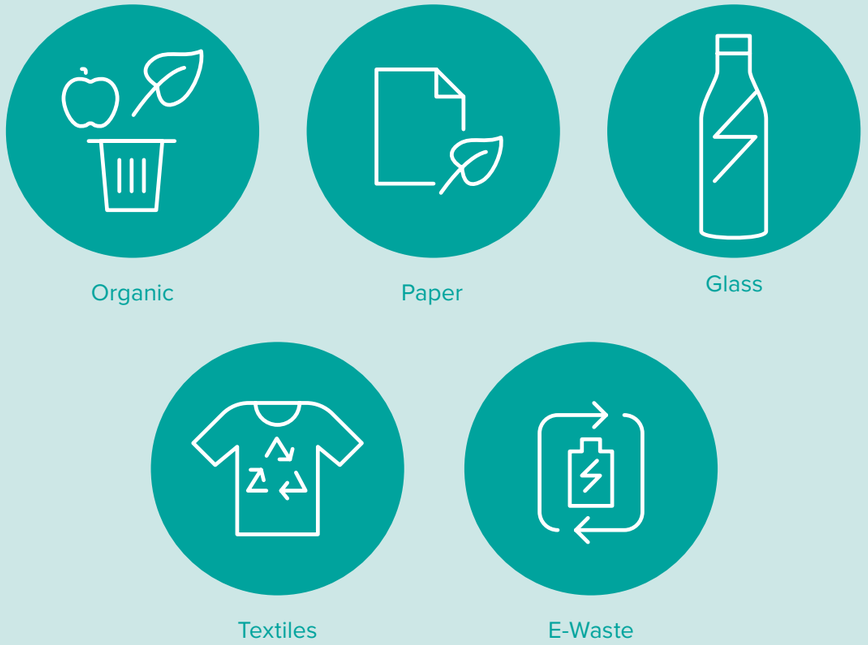
If consumers are not clear on how to use a system, they might cease to participate or accidentally place items in the wrong bins, leading to an increase in contamination and operational costs. The more materials to be separated by the consumer, the higher the collection costs and effort required from consumers. The specifics of the collection setup will depend mainly on the type and extent of existing infrastructure, along with consideration for what is needed to meet the targets of the EPR scheme.

In countries with long-standing separate collection systems, consumers are accustomed to manually sorting packaging waste at home. When these systems were established, automated sorting systems for municipal solid waste were not yet available. Today, there is a tremendous opportunity to leapfrog legacy systems using advanced sensor-based sorting technologies that maximize material recovery from municipal solid waste.

Mixed waste sorting (MWS) recovers recyclable materials from municipal solid waste. Even with well-designed collection systems, there is a high degree of user error and, therefore, the need to recover recyclable material from mixed municipal solid waste. MWS before incineration and disposal in landfills is necessary to maximize recycling, boost resource efficiency, and significantly reduce GHG emissions.

Global GHG emissions can be reduced by 2.76 billion metric tons CO_2e per year by increasing recycling captures and improving resource management practices.[6]

Recommended separate collection streams to maximize recycling and resource utilization



Communication

There are several tools and strategies to help steer consumer behavior in the desired direction when it comes to sorting waste. Education and outreach programs are necessary to make people aware of how the systems work and the associated environmental benefits.

Clear and consistent communication is essential in achieving high participation among residents and minimizing contamination of the recycling stream. Programs focusing on young people, such as educational material for schools and kindergartens, offer a more entertaining way to establish positive recycling behavior with long-lasting effects. As an EPR scheme evolves due to changes in packaging materials and technological advancements, those changes should be communicated regularly to consumers to ensure the best possible performance.

Consumer communication can be carried out by the PROs, municipalities, or the relevant industries. It is possible to commit the producer to informing consumers by introducing obligations for the labeling of packaging. Visual markings printed directly on labels communicate to customers if the packaging is reusable or single-use, has a deposit value, and whether it belongs in a take-back system or in a dedicated bin.

A successful consumer awareness initiative in Germany, Mülltrennung wirkt (translation: waste separation works), was funded by an alliance of packaging PROs to align on coordinated communication and cost sharing.

Adequate funding should be earmarked for communication and education purposes in an EPR scheme. Producers should cover the costs of communication relevant to their packaging. Direct communication to consumers by PROs can be legally established or with an option to transfer the communication to municipalities, which are compensated accordingly. Coordination with municipalities to ensure a holistic communication campaign is highly recommended.

CHAPTER FOUR

Producer Responsibility

Establish clear obligations for producers to manage the entire lifecycle of the packaging they place on the market. Effective legislation designates the coverage of costs, stimulates infrastructure improvements, and provides administrative guidance for fulfilling obligations.

Defining Responsibility

Cost Coverage

According to the principle of EPR, producers should be responsible for the end-of-life management of the products or packaging they place on the market. In practice, this means that they have to cover certain costs related to the collection, sorting, and recycling or recovery operations of their packaging once consumers dispose of it.

In addition to driving performance using comprehensive targets, EPR also shifts the financial burden for the management of packaging waste from municipalities (most commonly) to producers. The cost coverage structure should align with the intention of an EPR scheme, where producers internalize end-of-life costs and eco-modulated fees incentivize circular packaging. However, well-designed EPR goes beyond merely shifting costs and takes measures to tackle packaging waste problems more holistically.

In high-performing EPR systems, producers are responsible for a range of costs related to the effective management of their packaging. Typically, this is calculated using the "net operational costs" of the system (collection, sorting, recycling, recovery) and other expenditures (administration, reporting, communication) minus revenues from the sale of recycled materials. For policymakers interested in going beyond minimum performance requirements, the scope of cost coverage can also include measures to mitigate problems with packaging waste (litter clean-up, prevention, monitoring, consumer awareness campaigns, etc.). Legislation should determine the relevant costs and the share that falls under the responsibility of the producers.

Generally, the global trend is for EPR schemes to evolve toward "full cost coverage," where producers cover the entire net operational costs. In the case of partial cost coverage, the remaining costs fall on municipalities and taxpayers and by principle is not considered full EPR.

In the EU, legislation sets minimum requirements for EPR including full cost coverage under which producers are required to pay for the following costs:

- Separate collection, transport, and treatment to reach at least the relevant waste management targets set in legislation, net of revenues from sales of secondary raw materials.
- Communication of practical information to consumers such as availability of take-back and collection systems and prevention of litter.
- Data gathering and reporting of how much packaging was placed on the market and the respective collection and recycling rates.
- Litter clean-up resulting from certain single-use plastic products, including food and beverage containers, and the subsequent transport and treatment of that litter.

Source: Article 8a 4 of the European Waste Framework Directive, Article 8 (2) of the Single-Use Plastics Directive

Mandatory EPR schemes have proven to achieve significantly higher recycling rates than relying on the private sector to willingly move toward sustainable packaging. The Extended Producer Responsibility position paper by Ellen MacArthur Foundation illustrates how even greater performance results are realized when cost coverage is expanded to full producer responsibility instead of voluntary or public funding.[1] Full-cost coverage models have enabled the recent expansion of the role of PROs to include operational interventions, holistic communication campaigns, and a wide range of actions across the value chain to drive circularity.

Material Ownership

The question of who owns packaging materials once they enter the waste stream is an increasingly important topic and signifies a shift in traditional thinking. Material ownership was previously considered a risk due to potential environmental liability claims. As numerous jurisdictions and companies implement circular economy policies, the demand for recycled content has increased. Material ownership is now becoming a strategic move toward meeting PCR targets. In particular, high-value plastics and aluminum have seen significant demand increases, making ownership of these secondary raw materials even more advantageous.

Material ownership in EPR schemes typically lies with the party who is physically handling the material at any given time. This party has the authority to organize subsequent operations and then transfers the right of ownership to the next party downstream.

Material ownership is often undefined in legislation and is frequently subject to contracts with some combination of municipalities, haulers, material recovery facilities, and recycling plants. Efforts on behalf of individual producers to claim ownership are legally and logistically very complex, as the mixing of the packaging does not allow tracing and allocation to individual companies. Instead, producers can claim a "first right of refusal" where they are granted fair access to quality

recycled materials proportionate to the share they have placed on the market.

As the value of packaging material increases, whether through the impacts of recycled content targets set in legislation (increased demand) or other market forces, clearly outlining who owns the material and at which point in the value chain is of critical importance to a fair and well-functioning system.

Geographic and Packaging Coverage

Policymakers should consider creating geography-neutral and material-neutral approaches when setting targets to avoid distortions in the market. Policies should obligate producers to collect the same tonnages and materials as they place on the market throughout the given jurisdiction. Without well-defined measures, producers will naturally focus on materials with the highest collection efficiencies and the lowest cost instead of acting responsibly for the packaging materials and tonnages they place on the market.

PRO Structure

Producer responsibility organizations have proven to be powerful forces in the collective implementation of EPR schemes for packaging. Initially, a single PRO structure can most effectively help establish a nationwide program and allow stakeholders time to adjust to the new system. Governments can consider implementing a competitive structure with several PROs once the EPR scheme matures to drive performance even further. The challenge of a competitive structure is maintaining an environmental focus (recycling targets, closing the loop), since businesses tend to favor pricing over sustainability. Adding incentives to adopt innovations and new models can help ensure a future-proof EPR scheme.

It is common for EPR schemes to require producers to collect their packaging after use to achieve specific recycling and recovery targets. In theory, EPR dictates that producers take individual responsibility – meaning each producer should collect the packaging they place on the market and ensure it is treated appropriately at the end-of-life. However, individual fulfillment is often neither economical nor feasible in practice. Hence, producers typically fulfill their EPR obligations by joining a PRO, to which they contribute financially through cost-allocated fees based on the quantity of material they place on the market. The PRO is contracted to assume the responsibility of meeting the legislative obligations on behalf of affiliated producers. The PRO finances the activities needed to achieve targets set in legislation through the financial contributions made in the form of EPR fees.

Alternatives to a PRO-based model have been unsuccessful in implementing an EPR scheme for packaging waste, which include:

Individual Producer Responsibility

IPR is based on the idea that each producer takes individual responsibility for their own packaging placed on the market, making sure it is collected and treated appropriately. Attempts with individual compliance proved unsuccessful for consumer packaging waste for reasons of practicality, cost-efficiency, and lack of effective application and control.

Individual compliance could be relevant when applied to commercial packaging. The material composition of commercial packaging waste is predominantly homogeneous (plastic film, cardboard, paper), making collection and recovery operations simpler and easier to control.

Producer Recovery Notes (PRN)

The PRN system is based on the use of tradable credits. Accredited waste management operators collect a specific amount of packaging from municipalities or private generators, process it, and generate credits. Producers join specific trading organizations that purchase credits on their behalf in order to comply with their EPR obligations. However, there is a disconnect between producers and the actual waste management costs of the packaging they have placed on the market. This approach is also quite vulnerable to fraudulent behavior.

To date, this model has only been implemented in a few countries, such as the United Kingdom and Poland, and has not proven to be successful.

A PRO-based model is the preferred implementation approach when designing EPR schemes for consumer packaging. The PRO plays a central role in the system and generally has the following main tasks:

- Registration of all obliged companies and collection of EPR fees
- Organization and financing of operational activities (collection, sorting, and recycling or recovery) necessary to reach the legislative targets
- Communication and public outreach
- Reporting to the supervisory authorities

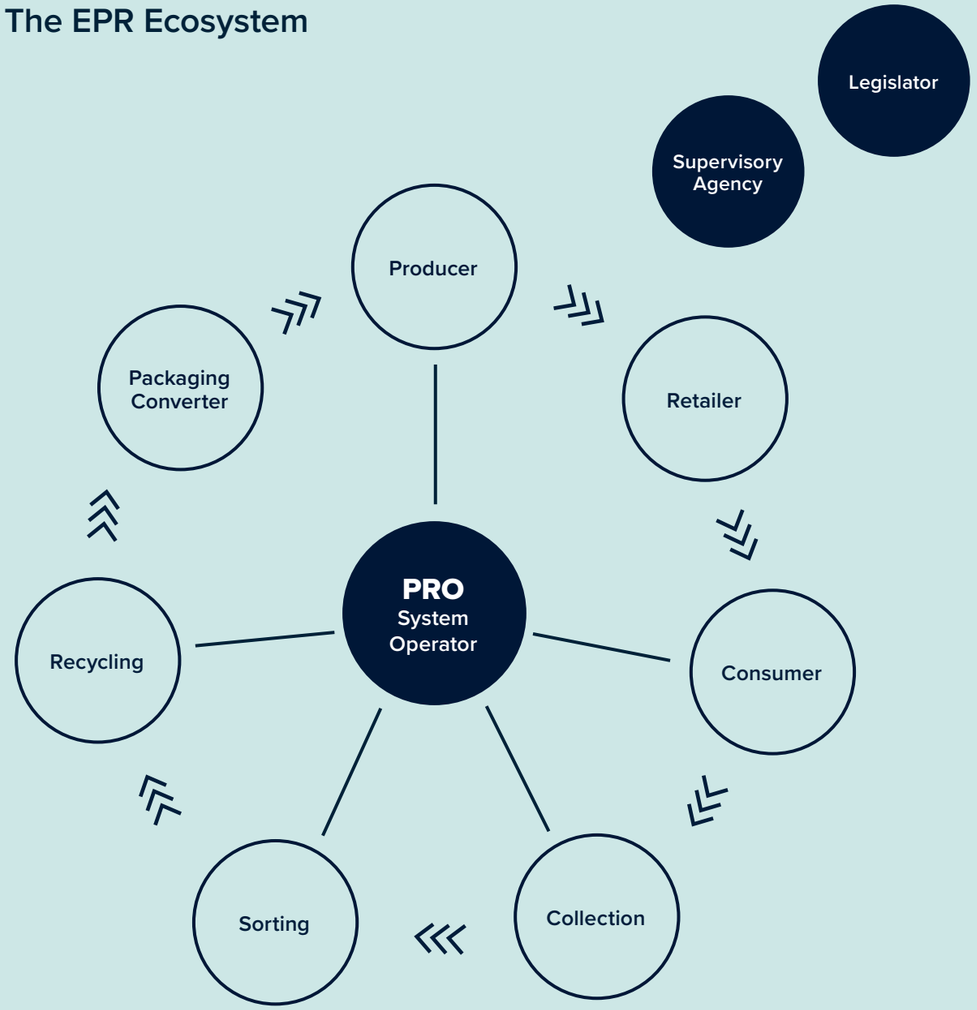
Although the functions of a PRO are generally the same across jurisdictions, its setup can vary according to several main interrelated aspects, including:

- Whether the PRO is industry-run or government-run
- Whether there is a single or several PRO(s), typically referred to as monopoly or competitive structures
- Whether the PRO is a non-profit or for-profit entity

In the early years of EPR policies, the predominant setup was a single (monopoly), non-profit, producer-run PRO. In due time, policy revisions allowed for multiple PROs and a competitive structure. These tend to be for-profit entities run by private actors that are not necessarily the obliged parties. There are a few exceptions, like in Austria, where a former single PRO retained its non-profit status as the system transitioned to a competitive landscape with for-profit PROs.

The history of EPR has shown that there isn't one single setup for success. Rather, the benefits and risks of each aspect have to be evaluated on a case-by-case basis to determine the combination that is best-suited for a specific local context.

The EPR Ecosystem



Legislator
Defines the policy framework, sets binding targets, and establishes a supervisory agency.

Supervisory Agency
Authorizes and continuously monitors the system performance. The PRO provides annual reports and information required for accountability.

Producer
Pays EPR fees to the PRO to cover the net operational costs for collection, sorting, and recycling. The retailer is also considered producer for its own brands.

Consumer
The PRO organizes and finances consumer communication and marketing initiatives to promote recycling.

Collection, Sorting, Recycling
The PRO finances the net operational costs of collection, sorting, and recycling of post-consumer packaging based on relevant material data from service providers. The PRO collects the revenues from selling recycled materials to offset net operational costs.

Industry-Run vs Government-Run PRO

Industry-run PROs are established and managed by the private sector, including obligated producers and other stakeholders. They are subject to monitoring and control by public authorities to ensure they fulfill their obligations, but public authorities are not involved in the day-to-day operation of the PRO. It is argued that due to their capability, expertise, and resources, private actors are well-placed to run the PRO, provided there is sufficient government oversight.

Starting from the basic idea that producers are responsible for the end-of-life processing of the packaging they place on the market, the first collective PROs were owned and run by the obligated parties. This is often the case today in jurisdictions where a single PRO is in place, as this setup is seen as a way to strengthen the interests and involvement of producers in the end-of-life management of their packaging.

For PROs run by the industry, it is important that the producers' data is properly safeguarded in order to protect competitive information. The PRO needs to follow standard data management and privacy protocols which include anonymizing aggregated data and restricting access to a limited set of agreed upon parties. This avoids making competitors' information visible and is especially important in jurisdictions where only a single PRO operates as a monopoly.

Although government-run PROs are much less common than industry-run PROs, the government can take a direct role in collecting funds from producers and using them to manage packaging waste. The typical PRO functions are then performed by government authorities, for instance, by a department within a ministry or a public agency.

Such setups entail specific considerations:

- The potential risk for funds collected by the government to be diverted to other purposes or absorbed into the general budget (administered like taxes), and therefore these funds should be earmarked, i.e., allocated explicitly and exclusively to expenses related to packaging waste management.
- The potential risk of a lack of transparency when the government controls or fulfills the function of the PROs.
- The absence of scope for the participation of producers, whose only contribution is paying the fees, therefore limiting the incentives for them.
- The potential limitations in terms of technical and managerial know-how within the public administration.

Government-run PROs are rare because fee-paying producers have limited incentives and no influence in optimizing the system outside of political lobbying. Therefore, government-run PROs are vulnerable to regulatory capture, weakening the conditions that are key for circularity. It is sometimes questioned whether they should even qualify as an EPR scheme. For instance, in Canada, only those systems where producers are involved in the collection and management are considered an EPR scheme, whereas government-run systems are not.

Single Non-Profit PRO

Typically run by the obligated parties, this PRO operates on a non-profit basis, where in principle, the revenues should not exceed the costs the PRO has to cover.

Advantages: Simple structure, implementation, and control

A certain level of transparency is possible thanks to its non-profit status (e.g., EPR fees are made public). With only one single PRO managing operations, it offers better traceability of registered companies and the fulfillment of their obligations, as well as easier control of free-riding. Streamlined processes make it simpler for authorities to oversee. This stable structure is favorable for long-term focus and offers incentives for investment.

Disadvantages: Diminished incentives for efficiency and higher prices

While monopoly structures could lead to higher prices for producers, in theory, the non-profit status of the PRO should offset this risk, since producers will only invest what is needed to optimize operations. Due to a lack of other options, there is a potential risk of poor customer service for producers affiliated with the PRO. A dominant position and strong negotiation power could result in limited alternatives for other actors and thus require mechanisms to mitigate potential abuse of monopoly power.

Competing For-Profit PROs

In a competitive setup, PROs are run by private actors, which are not necessarily the obligated parties. Competition creates downward pressure on prices, and PROs typically operate on a for-profit basis.

Advantages: More choices, better service, and performance

Obligated parties can choose from multiple organizations and find the most suitable entity to fit their needs. Since there are many entities to choose from, this usually results in better service toward the obligated parties. Market pressure and a competitive environment could deliver higher efficiency and reduced costs.

Disadvantages: Reduced transparency and increased complexity

Business-sensitive data and information are not disclosed, leading to a generally reduced level of transparency. The competition puts pressure on prices that could affect the quality, and activities considered non-essential to business (such as consumer communication) are the first to be cut back to minimize expenditures. Competitive pressure can result in the failure of some PROs and lead to an excessive focus on investments for short-term achievements. With multiple actors in play, this leads to increased complexity and the need for a higher level of monitoring.

A competitive setup makes the system more complex due to several actors and the need for additional organizational and coordination bodies (clearinghouses), which come at an additional cost. The main functions of a clearinghouse are to:

- Collect and aggregate information for purposes of reporting, monitoring, and verification. For example, the clearinghouse can create annual reports and verify that obligated companies have met all the requirements.
- Determine market shares for each PRO. The clearinghouse can calculate the amount of packaging affiliated with each PRO as a share of the total.
- Split the shared costs and define the obligations of each PRO with regard to collection and recycling. Splitting costs is typically necessary for collection expenditures, where all PROs share the same collection infrastructure. Defining clear obligations helps mitigate “cherry-picking” behavior, whereby a PRO might only concentrate on a limited territory or types of packaging which are profitable while neglecting others.
- Undertake collective tendering of collection services that require coordination and establish clear rules to provide a level playing field for all PROs.

In jurisdictions with a single PRO setup, a clearinghouse is not required because it performs the data collection and reporting in-house.

PRO revenues come from two primary sources: 1) EPR fees collected from obligated parties and 2) potential revenues from the sale of secondary raw materials.

PRO costs can typically be segmented into three main categories:

- Operational waste management: collecting, sorting, and recycling or recovery (including intermediate transport). These represent a significant share of the total costs.
- Administrative: general management, including personnel, rent, and operational costs for running the PRO itself. These represent a relatively small share of the total costs.
- Other: communication, audits.

Whether running a non-profit or for-profit system, the highest portion of costs is related to collection, sorting, and recycling or recovery. Ensuring competition in these waste management services is particularly important to control costs and drive innovation. Bidding contracts for waste collection, material sorting, recycling services, and recovery operations should be open and fair.

A single PRO structure offers a simple implementation and a high level of control. Therefore, countries with little or no experience with EPR schemes can initially benefit from such a structure. Governments can consider implementing a competitive landscape later, once the EPR scheme matures. A robust regulatory framework is necessary, and the potential benefits of having several PROs would ideally outweigh the increased complexity and associated costs.

Innovation Clauses & Adaptability

Clauses related to the innovation and adaptability of a system are often specified in the law. In addition to new developments, these clauses are intended to incentivize and drive the entire system's performance. Innovation clauses can be on a project basis or directed toward PROs to develop solutions that optimize collection and recycling systems, for example.

The Continuous Improvement Fund (CIF) in Ontario, Canada provides grants and loans to local municipalities to execute projects that improve the effectiveness and efficiency of the Blue Box recycling program that includes curbside collection of post-consumer packaging.[22]

An adaptive EPR policy framework enables the system to adjust to dynamics and complexities building on operational experience over time. Multi-stakeholder collaboration is a key principle for an adaptive policy, as it is essential to share learnings and perspectives when addressing an issue. Adaptive policy allows for re-evaluations and revisions after a defined period. This is important for a system to remain up to date with the latest packaging and infrastructure developments.

One possibility is for the jurisdiction to increase recycling targets to stimulate the waste management and recycling industry to optimize and grow. Another consideration is for producers and/or PRO(s) to make improvements to the system or introduce new elements. As sorting technology and packaging recyclability continue to advance, alternative systems for material recovery may be introduced if proven to help achieve targets.

CHAPTER FIVE

System Integrity

Build a governance structure based on transparency and compliance to support the achievement of targets. Robust systems balance government oversight with industry-driven management and require standardized reporting, monitoring, and controls.

Government Oversight

The participation of the government is inevitable for a fair and well-functioning system. The obligated parties should be allowed a certain degree of flexibility in how they achieve these targets within a clearly defined framework and control by the government.

Striking a balance between industry-led organization and government oversight requires framework conditions and defined targets. Specific monitoring, control, and enforcement procedures need to be defined in legislation to:

- Identify and register obligated parties and ensure they participate in a PRO with rightfully declared packaging amounts.
- Authorize and continuously monitor the performance of the PROs, including their fulfillment of recycling and other targets.
- Enforce compliance with EPR scheme obligations among all obligated parties.

Supervisory Agency

A dedicated body in charge of maintaining regulatory compliance ensures obligated parties meet performance standards. It also establishes a competitive level playing field and provides a sufficient level of transparency and communication. This body should be granted the legal authority to impose penalties according to enforcement mandates to uphold the system's integrity.

The appointed government agency must always remain neutral to avoid the risk of conflicts of interest. Usually, the corresponding department or ministry (e.g., environment ministry) is responsible for agency supervision. Rarely, the ministry performs the supervisory functions itself and there is no separate agency.

Regardless of the form of public entity, the costs to oversee the PRO should be considered and clearly assigned. Agencies can be financed directly by the PROs, whereas funds from the federal budget often cover the costs if the public body is ministry-based.

Control of Obligated Parties

The control of obligated parties involves two main aspects:

1. Identification
The obligated parties should be required to register according to procedures specified in legislation. A public register of obligated producers provides the necessary oversight, creates transparency, ensures fair competition, and provides a basis for the control of free-riders. It can be administered by a public agency, ministry, or third party. However, the register must be designed to guarantee the confidentiality of data and protect proprietary information. Aggregated and anonymized data could be made available to the public where relevant.

2. Fulfillment of obligations
Obligated parties may fulfill the obligations individually or collectively by joining a PRO. In the latter case, they pay EPR fees corresponding to the quantities and types of packaging they place on the market. Therefore, controlling the participation in a PRO typically involves an audit of the packaging they have declared. Legislation should define audit guidelines and principles, and certified accountants/auditors should conduct compliance audits. Generally, the obligated party covers the costs for the audit. In cases where the PRO or the public agency hire a certified accountant to conduct ad–hoc audits, an obligated party is only responsible for the costs if they have incorrectly declared packaging data.

While generally all producers are obligated to meet the requirements of an EPR scheme, some are exempt from the obligations of reporting and providing detailed evidence. These exemptions are typically meant to alleviate the regulatory burden on small businesses. Called de minimis exemptions, they are based on a threshold of annual revenue and/or the amount of packaging placed on the market.

Control of PROs

Legislation should set the rules necessary to monitor and control the operation of PROs and how they fulfill the defined targets. This should include formal authorization and regular accreditation procedures for the PRO:

- Authorization (initial process): A potential PRO submits an application or tender with detailed plans on how it intends to fulfill a set of requirements (e.g., draft contract, methodology, financial guarantees, etc.). The supervisory agency authorizes the PRO based on this application.
- Accreditation (recurring process): A PRO must fulfill requirements at all times and is subject to controls, including reporting. In some jurisdictions, PROs are required to regularly renew their license to operate, typically every 5-7 years, subject to approval by the supervisory agency. This involves a formal process in which the PROs revise and update their plan based on evolving circumstances (e.g., stronger or additional targets).

Authorization and accreditation plans prepared by the PRO should be comprehensive and go beyond the mere fulfillment of EPR in terms of numbers

and meeting minimum requirements. They should also consider broader sustainability, circularity, and social equity aspects, for instance:

- Promotion of higher levels of the waste hierarchy in fulfillment of obligations (prevention, reduction, reuse/refill, recycling)
- Eco-design of packaging
- Waste management capacity and infrastructure development needed to effectively collect, sort, and recycle packaging waste
- Where relevant, integration of the informal sector with formalized job creation, health and safety measures, and access to social security systems
- New product and packaging initiatives using recycled materials
- Consumer awareness and educational programs
- Consideration and inclusion of a broad range of stakeholders beyond the waste management value chain, including community groups and other public entities, to address equity in the system (e.g., convenient access to recycling, facility siting, etc.)

The EPR fees are subject to control and approval by the public agency. There is a tendency to require fee information be made publicly available to ensure all producers are treated equally. An exception to requiring the publication of EPR fees is made in the case of competing PROs.

By giving authority to the supervisory agency to revoke accreditation at any time, PROs are incentivized to comply and perform. The possibility of revocation serves as an even stronger incentive when there are multiple competing PROs. If one of the PROs loses its license to operate, then the other PROs have the opportunity to expand their market coverage by incorporating the stranded producers into their PRO. The threat of revocation might be less credible in the case of a single PRO because there is no alternative, but it could also force the creation of a new PRO. Authorization and accreditation should therefore include requirements for the PRO to have a contingency fund that covers operating costs for a minimum period of time, should the PRO cease operations because of non-compliance.

It is also important to consider which parties are eventually liable if the PRO does not fulfill its responsibility. Ultimately, producers remain individually liable for the packaging they place on the market should the PRO not fulfill its obligations or claim bankruptcy.

In general, with stricter conditions and detailed requirements, a public agency can apply a higher level of control and enforcement. Having more detailed requirements and conditions also functions as a control for numerous PROs to enter the market in competitive structures.

The control of the performance of a PRO depends on the requirements specified in legislation, usually measured across two core areas:

1) Collection: Assurance of the fulfillment of collection targets. Ensuring collection within the legally prescribed framework, for instance, nationwide coverage, collection frequency, separate collection of specific materials or categories, or other requirements.

2) Recycling: Assurance of the fulfillment of recycling targets. These can be calculated in aggregate and separately by material type.

The performance of the PRO is systematically controlled as defined in legislation, for example, through regular mandatory reports and audits. Controls for fulfilling recycling targets are based on the quantities of packaging materials entering the final recycling stage as defined in the legislation.

Enforcement

Enforcement procedures should be clearly stated in legislation, including applicable penalties and identifying the enforcement authority, which is typically a dedicated enforcement agency. The monitoring and enforcement functions could also be shared between the enforcement agency and the PRO if relevant (for instance, if the PRO is better positioned to oversee certain issues such as reported quantities by obligated parties). If this is the case, the functions and responsibilities of the PRO regarding enforcement should be laid out in the authorization and accreditation agreements. Enforcement is important to ensure compliance with EPR obligations and create a level playing field among competing producers, PROs, and service providers. For instance, free-riders are companies that are obligated under an EPR scheme but who evade paying EPR fees for the packaging they place on the market. As a result, they have an unfair competitive advantage from the reduced costs while increasing the burden for companies that comply by paying their share of costs.

Penalties should be adequate and act as a deterrent. Depending on the degree of non-compliance, penalties can include civil or criminal measures, revocation of accreditation, banning producers from access to the market (i.e., producers will no longer be permitted to sell their packaged goods), and/or public disclosure of non-compliant entities.

If a producer has failed to register in Germany, their products and the relevant packaging are subject to a distribution ban. In addition, a producer who has committed an administrative offence by failing to register may be subject to a fine of up to 100,000 EUR.

Transparency

Data Management

PROs need to fulfill requirements for proof of the ownership structure, financing plan, and, in some cases, EPR fee calculations. Non-profit PROs typically have higher data transparency, whereas some data is not available for disclosure in a competitive PRO structure because of business-sensitive considerations. In any case, transparency requirements need to be clearly defined – which data should be made public, reported, or considered business-sensitive.

EPR legislation in the European Union sets minimum requirements for public disclosure:

- *Information relevant to the achievement of the set waste management targets*
- *Ownership and membership*
- *Financial contributions paid by producers*
- *Selection procedure for waste management operators*

Source: Article 8a 4 of the European Waste Framework Directive [8]

The primary need for data transparency regarding the obligated parties is to identify the producers, their performance, and whether their legal requirements under the EPR scheme are being fulfilled.

Reports and Consumer Communication

Annual reports from the PRO provide both information on system performance and accountability towards the public and the obligated parties who finance the system. Reporting raises awareness and keeps the public informed about the success of the EPR scheme, which improves the confidence in the system.

Legislation can also mandate some specific forms of communication, for instance, consumer communication to educate the public on the correct use of waste and recycling bins. Marketing initiatives can be very effective at increasing participation rates and should also be organized and financed by the PRO. Consumer information on other waste and recycling topics such as reusable packaging, littering, and the impact of waste on the environment can also be part of communication obligations.

Stakeholder Dialogue and Cooperation

When establishing an EPR scheme, it is paramount to have in-depth conversations with stakeholders and consult with the public. Open dialogue about the advantages and challenges of an EPR scheme and how the setup could look in the specific jurisdiction is necessary. This will secure stakeholder buy-in and help ensure a successful implementation.

Once an EPR scheme has been implemented, multi-stakeholder dialogues continue to play an important part in the overall success and performance. PROs take up a very central role in engaging stakeholders throughout the value chain. They maintain a business relationship with the obligated parties, coordinate several waste management services, and communicate to public authorities and residents.

Dialogue among packaging manufacturers, suppliers, brand owners, sorting specialists, and recycling operators is vital for packaging recyclability. Improving the circularity of packaging and increasing recycled content are just a few key benefits of an EPR scheme, but its positive contribution to the environment is most impressive. Collaborative engagements across the value chain are central to developing and implementing holistic solutions that achieve circularity. As the public interest in sustainability grows and strategic decision-making focuses on the circular economy, supporting policies and systems that maximize resource efficiency has become a business imperative.

Conclusion

The problem with packaging waste is that it is ubiquitous – there has never been a greater need, first and foremost, for waste prevention. Swift action is needed to improve the circularity of the consumer packaging that protects and contains the everyday products people depend on. Systems that enable reusability, recyclability, and recycled content are paramount to the circular economy.

A high-performing EPR scheme for consumer packaging addresses the complexity of waste management systems and obliges producers to be responsible for the packaging they place on the market. By prioritizing the waste hierarchy and incentivizing eco-design, policymakers can design a framework in which packaging materials are effectively reused or recycled.

Legislation should be carefully engineered to define the scope of packaging and clearly distinguish the roles and responsibilities of all key stakeholders. Using ambitious and attainable targets to drive performance outcomes, governments can implement well-designed EPR schemes to enable the circularity of packaging and develop domestic end markets to meet the demand for high-quality recycled content.

With 50 years of experience in circular resource management, TOMRA's global expertise is a testament to sustainability. We help policymakers and stakeholders strike a balance between the effectiveness and efficiency of an EPR scheme, which often depends on evaluating existing waste management structures, consumer behaviors, and the willingness to embrace technology.

Our five fundamental principles of **circularity, performance, convenience, producer responsibility, and system integrity** guide policymakers drafting or developing EPR schemes. Whether defining roles and responsibilities or dedicating funds to system improvements, TOMRA offers valuable and practical insights to help programs realize the best possible results.

Together, we can enable the recycling of packaging waste as we transition to a circular economy. Let us collaborate with members of the value chain to achieve high recycling rates, reduce waste-related emissions, and create a more sustainable future that starts now.

Glossary

Bonus-malus system: A system with monetary rewards and penalties paid by producers according to eco-design standards for packaging.

Carbon dioxide equivalent (CO_2e): The standard unit of measurement, using carbon dioxide (CO_2) as the basis, to enable comparison between different greenhouse gases (e.g., methane (CH_4), nitrous oxide (N_2O), etc.).

Chemical recycling: The conversion of waste into chemical building blocks (oil, naptha, or fuels) by changing the chemical structure of the material.

Circular packaging: Packaging that can be reused or recycled multiple times with a systems-based approach for collecting and processing materials after being used or discarded.

Clearinghouse: An institution that facilitates the exchange of data, manages fees and net operating costs, and government reporting.

Closed-loop recycling: A system in which materials are collected, sorted, and recycled for the highest quality and used over multiple cycles for the same or similar application (e.g., bottle-to-bottle recycling).

Curbside and drop-off collection systems: Services established to collect general household waste and recyclables at the doorstep (curbside) or a designated location (drop-off).

Deposit return system (DRS): A type of EPR scheme for beverage containers in which a small deposit is placed on the price of a beverage and repaid when the consumer returns the container for recycling. Also known as deposit return schemes, container deposit schemes, or bottle bills.

Design-for-recycling: An eco-design strategy intended to ensure a product can be effectively recycled, with the goal of improving its environmental impact.

Disposal: The burning or landfilling of residual materials that cannot be recycled or recovered from waste.

Downcycling: The process in which materials are downgraded to low-quality recycled content and used for a single cycle or less demanding application.

Dual system: A separate collection system for the recycling of post-consumer packaging that runs separately but similarly from the collection of general waste.

Eco-design: A principle and approach to designing packaging, products, systems, and services at the development stage to reduce their environmental impact.

Eco-modulation: A financial instrument to incentivize the eco-design of packaging by implementing a refined fee structure for a design that meets specified criteria.

Energy recovery: The conversion of waste that generates energy in the form of steam, fuel, or electricity.

EPR fee: The price paid by a producer to the PRO to finance the activities needed to achieve the targets set in legislation such as collection, recycling, and recycled content rates. Fees are based on eco-design standards as well as the quantity and material composition of the packaging placed on the market.

EPR scheme or EPR system: A system set up to implement the EPR principle. It can be an individual system (or individual compliance system) where a producer organizes its own system, or a collective system (collective compliance system) where several producers decide to collaborate and thus fulfill their responsibility in a collective way through a specific organization (e.g., a PRO).*

Extended producer responsibility (EPR): An environmental policy principle in which a producer's responsibility is extended to the entire lifecycle of their products.

Free riders: Producers that intentionally evade EPR fees for the packaging they place on the market.

Holistic Resource Systems: A framework approach to improving resource utilization through a combination of well-established waste management techniques, including deposit return systems, separate collections, and mixed waste sorting.

Informal sector: All workers in unincorporated enterprises that are active in waste management but are not formally registered.**

Innovation clause: A legislative provision that allows adaptability to address issues in the system or take advantage of new developments.

Mechanical recycling: The conversion of waste into secondary raw materials through mechanical processes such as sorting, washing, extrusion, decontamination, purification, and reprocessing.

Mixed waste sorting (MWS): The high-efficiency separation of recyclable materials from mixed municipal solid waste before incineration and landfill.

Obliged producers / parties: The companies obligated under an EPR scheme to pay fees for the packaging they place on the market.

Open-loop recycling: A system in which materials are collected, sorted, and recycled for a single cycle instead of multiple cycles.

Packaging converter: Manufacturers specializing in the combination of various raw materials and industrial-scale conversion or adaptation of materials into packaging.

Post-consumer packaging: Waste produced by the consumer once packaging has served its intended purpose or reached end-of-life.

Post-consumer recycled content (PCR): Packaging that was utilized and discarded of by a consumer and then recycled and made into virgin-like material for new products and packaging.

Pre-treatment: Various process methods, depending on the application, to ensure the high-quality secondary raw materials that can be reprocessed into recycled content. For example, post-consumer plastic packaging is shredded into flakes, washed, and sorted by color.

Producer: A company or importer that places products on the market.

Producer responsibility organization (PRO): A collective entity set up by producers, usually through legislation, which becomes responsible for meeting the collection, sorting, recycling, and energy recovery obligations of the individual producers.

Recyclability: The ability for a product or packaging to be technically and feasibly recycled at scale, which is dependent on both the design of the product and the local infrastructure for collection, sorting, and recycling.

Recycled content: Virgin-like materials that have been made from pre- and post-consumer waste.

Recycling: The process of converting waste into secondary raw materials.

Return to retail: A type of redemption model in a deposit return system that relies on beverage retailers to take back deposit containers.

Reusable packaging: A package or container with a highly durable design that is intended to be used multiple times.

Reuse systems: A closed-loop system for reusable packaging that includes take-back programs, sanitizing processes, refilling, and logistics.

Secondary raw materials: Recycled materials that can be used in manufacturing processes to replace virgin materials.

Sensor-based sorting technology: High-precision sorting systems that use a variety of sensors to detect and sort recyclable materials from waste.

Separate collections: The collection of used goods according to material type for recycling. Organic waste, paper, glass packaging, textiles, and e-waste are commonly targeted for separate collections.

Single-use plastic: A product or packaging made of plastic that is intended to be used once and then discarded.

Sorting: The process which separates waste according to material properties for recycling.

Source separation: An action taken by consumers, where they sort recyclable materials from their general waste and discard them in a dedicated container.

Supervisory agency: A dedicated body, often from the government, in charge of maintaining regulatory compliance.

Take-back systems: A method for the collection of used products or materials where the consumer brings or sends them back to a specified drop-off point.

Waste hierarchy: An internationally accepted standard for the circular economy that aims to keep materials at their highest and best use, and establishes an order of waste management options from most to least preferred based on their environmental impact.

Waste management: A collective term for the collection, transportation, processing, and disposal of waste.

* Based on the definitions of the UNEP/Basel Convention entitled 'Draft practical manuals on Extended Producer Responsibility and on financing systems for environmentally sound management' (2018). www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-OEWG.11-INF-7.English.pdf

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Key Resources

OECD

The Organization for Economic Co-operation and Development (OECD) is a forum where several governments with market-based economies collaborate to develop policy standards to promote sustainable economic growth.

www.oecd-ilibrary.org/environment/extended-producer-responsibility_9789264256385-en

Ellen MacArthur Foundation

Working to accelerate the transition to a circular economy, the Ellen MacArthur Foundation works with business, academia, policymakers, and institutions to mobilize systems solutions at scale, globally.

plastics.ellenmacarthurfoundation.org/epr

About Us

TOMRA

TOMRA is a global impact leader in the resource revolution, creating and providing sensor-based solutions for optimal resource productivity. Founded in 1972 on an innovation that began with the design, manufacture and sale of reverse vending machines (RVMs) for automated collection of used beverage containers. Today, TOMRA provides technology-led solutions that enable the growth of the circular economy with advanced collection and sorting systems that optimize resource recovery and minimize waste in the food, recycling, and mining industries.

www.tomra.com

ReSociety

ReSociety is a global collaborative platform initiated by TOMRA. With passion for sustainability and expertise in circular waste management, ReSociety brings people and organizations together to address the holistic management of resources. Leveraging the skills and expertise of the collective for climate action, we aim to implement Holistic Resource Systems throughout the world. Join us today to network, exchange ideas, and establish a more sustainable future!

www.resociety.net

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