



Circular Economy in Dispensing Packaging

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1. Executive summary: objective of the whitepaper

The Circular Economy (CE) has fundamentally shifted from an optional sustainability aspiration to a strategic and regulatory imperative for manufacturers operating within the spraying and dispensing packaging sector.¹ This transformation necessitates a definitive pivot away from the conventional linear “take, make, dispose” model towards a regenerative, closed-loop system designed to retain resources in use for the longest possible duration.¹

The central objective of this briefing is to delineate the strategic and technical pathways required for FMCG companies to successfully navigate this transition. Success hinges on a dual commitment: implementing stringent Ecodesign principles and rigorously validating all environmental performance claims using the internationally standardized Life Cycle Assessment (LCA) methodology.²

A robust and prescriptive European regulatory framework underpins the urgency of this transition. Some of these regulations are broad: the CSRD, CSDDD, and the Green Claims Directive, all linked to the European Green Deal and sustainability disclosures. Others are specific to the packaging business, such as:

- The Ecodesign for Sustainable Products Regulation (ESPR)
- The Packaging and Packaging Waste Regulation (PPWR)
- The Extended Producer Responsibility (EPR) schemes

These introduce stricter requirements: for example, recyclability will become a prerequisite for market access, and there are minimum thresholds for recycled content, increasing from 2030 onward.

These regulatory drivers converge with profound economic opportunities. Global projections indicate that the shift from a linear to a circular model could unlock €4.25 trillion in additional economic growth by 2030.³ Furthermore, this transition could generate over €650 billion in material savings within the consumer goods sector worldwide.⁴ This substantial financial potential provides a compelling justification for the capital expenditure necessary for circular transformation.

For B2B component manufacturers, compliance is rapidly evolving into a crucial supply chain differentiator. Brand owners are increasingly subject to mandatory disclosure requirements concerning their resource use and waste generation under directives like the CSRD.⁶ Consequently, component manufacturers who master LCA and Ecodesign are not merely supplying a part; they are strategically providing auditable data that enables their clients' compliance and mitigates regulatory risk.

2. Benefits and challenges of the adoption of the circular economy

The shift to a circular economy presents compelling strategic and economic drivers, positioning circularity as a source of future competitive advantage. However, this transition is complicated by significant systemic barriers that require innovation and collaboration to overcome.

2.1. Quantifying the strategic and economic opportunity

The economic rationale for embracing circularity is overwhelming, justifying the substantial upfront investments required for innovation and infrastructure development. The global projection of €4.25 trillion in potential economic growth by 2030 highlights the macro-level justification for systemic change.³ For component manufacturers specifically, the potential for €650 billion in material cost savings in the consumer goods sector globally is highly relevant.⁴ Securing material supply through robust recycled loops hedges against raw material price volatility, which is a key risk mitigation strategy. This approach also reduces exposure to taxes linked to plastic or carbon emissions, while ensuring compliance with evolving regulatory frameworks and protecting supply chain resilience.

The benefits are already measurable within Europe. Private investments in sectors relevant to the circular economy reached €121.⁶ billion in 2021, equating to 0.8% of the EU's GDP.⁵ The value added by these circular sectors has increased significantly since 2015, rising to approximately €299 billion.⁵ This momentum underscores that circularity is a proven driver of sustainable economic growth and resilience within the trading bloc.⁵

Moreover, the transition to circularity acts as a catalyst for research and development, pushing companies to innovate and develop new technologies and solutions. This not only enhances product performance and sustainability but also fosters long-term competitiveness. Circular strategies also unlock economic opportunities by enabling differentiation in increasingly sustainability-driven markets. Companies that adopt circular models can gain a first-mover advantage, access new customer segments, and improve cost efficiency through resource optimization.

Beyond financial metrics, achieving ambitious circularity goals is essential for meeting climate targets; estimates suggest that doubling global circularity from the current rate (roughly 8%) to about 17% could significantly contribute to limiting global warming to the 1.5°C threshold by reducing resource extraction and associated emissions.¹⁸

Additional strategic benefits include enhanced brand reputation, which plays a critical role not only in customer perception but also in employee engagement and talent

acquisition. Internally, circularity can drive process simplification and efficiency, such as reducing the number of components, using fewer materials, and lowering energy consumption, resulting in reduced complexity and operational costs. Furthermore, companies with credible circular strategies are increasingly attractive to public and private investors, as sustainability-linked funding becomes more accessible.

2.2. The systemic challenge: technical and market barriers

Despite the robust financial and regulatory impetus, complex systemic barriers persist, requiring strategic collaboration and dedicated innovation.

2.2.1. Technical complexities in product redesign

The foundational challenge for B2B manufacturers is redesigning complex, multi-material mechanical dispensing systems (such as pumps) to comply with Ecodesign criteria while rigorously maintaining essential performance standards (e.g., functional compatibility, shelf-life, and safety).⁶

The drive toward same-polymer-family designs, mandated by impending legislation, often requires the substitution of essential metal components (like springs) or rubber seals with specially engineered plastics.⁶ This demands substantial materials engineering and R&D investment to identify polymers capable of providing similar mechanical properties, such as tension and fatigue resistance, and validating that the new designs will survive repeated use and maintain long-term product integrity. Furthermore, incorporating high levels of Post-Consumer Recycled (PCR) plastic often necessitates significant process adaptation, including re-tooling manufacturing lines or modifying injection moulding parameters to account for the greater variability in PCR resins, which can affect flow behaviour, colour uniformity, and surface finish.⁶

2.2.2. Supply Chain reliability: securing high-quality PCR material

One of the most immediate threats to achieving regulatory targets, such as minimum recycled content quotas, is the persistent difficulty in securing consistent, high-quality PCR materials.¹⁴ Demand for food-grade or medical-grade recycled plastics is rapidly outpacing the current supply capacity of the recycling infrastructure.

High-quality PCR suitable for new dispensing packaging must meet strict standards regarding colour, absence of contaminants, and mechanical properties. The inherent variability in PCR supply introduces significant operational complexities and a hidden operational cost.¹⁴ Manufacturers must expend considerable resources on dedicated R&D, quality management, and enhanced quality checks to accommodate this material variation, which often involves blending recycled resin with virgin material to stabilise performance. The legal and safety hurdles are compounded by regulatory compliance for sensitive applications, such as the EU's stringent rules for food-con-

tact materials, which only a fraction of recycled plastics can currently clear.¹⁴ Until recycling technology and infrastructure catch up to regulatory demands in terms of quality and quantity, securing standardised, certified secondary raw materials will remain a critical bottleneck.

2.2.3. Regulatory fragmentation and infrastructure gaps

Operational effectiveness is further complicated by external systemic factors, notably regulatory fragmentation and gaps in recycling infrastructure. The coexistence of divergent national regulations across Europe, with differences in labelling, collection systems, and deposit schemes, creates significant operational uncertainty and cost inefficiencies for multinational businesses.¹² This instability tends to penalise large-scale adoption of circular innovations.

2.2.3. Mass-balance tracking

Mass-balance tracking for bio-based or chemically recycled materials adds further complexity in terms of traceability and certification. Companies also face high upfront investments to develop new products, validate alternative materials, and adapt supply chains and production processes. These financial burdens are often compounded by strategic uncertainty: businesses are hesitant to commit to specific circular pathways due to concerns about regulatory shifts or market dynamics that could render early investments obsolete.

2.2.4. Consumer behaviour

Finally, consumer behaviour and the lack of adequate recycling infrastructure remain persistent barriers. Without widespread consumer participation and robust collection systems, the circular loop cannot be effectively closed, limiting the scalability and impact of circular solutions.

3. Legislation: latest updates

The European Union has established an advanced regulatory framework that accelerates the transition to circularity by creating a powerful enforcement loop, linking technical product design standards to mandatory corporate financial transparency.

3.1. Prescriptive design regulations: PPWR and ESPR

The foundation of the technical requirements rests on two core regulations that dictate how dispensing components must be designed.

The Packaging and Packaging Waste Regulation (PPWR) is the central sectoral regulation.⁶ It sets EU-wide targets for recycling, reuse, and waste reduction, and critically, it directly compels manufacturers to adopt specific eco-design strategies.⁶ This includes mandating minimum Post-Consumer Recycled (PCR) content requirements and setting strict recyclability criteria, which forces component suppliers to prioritize same-polymer-family designs and lightweighting.⁶ The compliance burden is enforced financially via Extended Producer Responsibility (EPR) schemes, which mandate that producers bear the operational and financial responsibility for their packaging's end-of-life management.¹⁰ Consequently, complex or multi-material designs incur higher fees, establishing a direct financial incentive to simplify components and drive circular design improvements.¹⁰

Complementing the PPWR is the Ecodesign for Sustainable Products Regulation (ESPR), adopted in 2023.⁹ The ESPR establishes a unified framework that extends eco-design requirements beyond energy efficiency to virtually all product categories, focusing on durability, reparability, upgradability, and overall resource efficiency.⁹ For dispensing systems, this translates to designing components, such as pumps and valves, to be robust enough to withstand multiple use cycles, supporting the adoption of refillable systems. The ESPR will also introduce the Digital Product Passport (DPP), requiring comprehensive digital transparency regarding material composition and lifecycle impacts.⁹ Component suppliers must therefore be prepared to generate and manage detailed, auditable data throughout their supply chain to meet these new transparency demands.

3.2. Substantiating market claims: the Green Claims Directive

The proposed Green Claims Directive (GCD) requires that any voluntary environmental claims made by companies must be substantiated with robust, verifiable, and scientifically proven data.¹¹ This legislation aims to combat greenwashing by demanding that claims like "100% recyclable" or "low-carbon footprint" be backed by quantitative evidence.¹¹

This mandates scientific rigour in market communications, making objective methods like Life Cycle Assessment (LCA) indispensable.¹³ The LCA expert, capable of providing ISO-compliant validation, thus becomes a critical legal and commercial gatekeeper. Without scientifically quantified proof, sustainability assertions remain anecdotal and risk regulatory challenge, potentially leading to significant fines (up to 4% of total annual turnover in the Member State concerned in cases of widespread infringement).¹³

Table 4: EU Regulatory Synergy: Design Mandates and Transparency Requirements

Regulation	Primary Focus (Technical Design Requirement)	Compliance Mechanism (Reporting/Enforcement)	Strategic Implication
PPWR 6	Mandating same-polymer-family designs, lightweighting, and minimum PCR content.	Extended Producer Responsibility (EPR) fees incentivise design improvements and reduce end-of-life costs.	Defines the technical compliance bar for market access.
ESPR 9	Setting criteria for durability, reparability, resource efficiency, and Digital Product Passports (DPP).	Links product lifecycle data to corporate reporting frameworks (CSRD).	Expands circularity definition from end-of-life to product longevity and information transparency.
CSRD 8	N/A (Focus is on disclosure of performance metrics).	Mandatory, audited public disclosure of resource use, waste generation, and CE initiatives.	Creates the enforcement loop: Non-compliance with design rules leads directly to mandated negative public disclosure, impacting financial credibility.
GCD 11	N/A (Focus is on verifying claims).	Requires scientific substantiation (LCA/PEF) for all voluntary environmental claims.	Mandates scientific rigor; LCA becomes a prerequisite for market communication credibility.

4. Tools

The practical realisation of the Circular Economy's strategic intent relies upon rigorous technical frameworks that guide product innovation and verify performance. These two foundational pillars are Ecodesign and Life Cycle Assessment (LCA).

4.1. Ecodesign: the principle of design for circularity

Ecodesign is the systematic integration of environmental considerations into product development from the very beginning, ensuring resources are used efficiently and the product's lifecycle impact is minimised.¹³

4.1.1. Core strategies for dispensing products

Prioritisation of Same-Polymer-Family Designs: This approach, compelled by the PPWR, requires designing complex component assemblies using materials from the same polymer family (e.g., all polyolefin, such as PP or PE).⁶ This simplifies the recycling process by enhancing the efficiency of automated sorting technologies and maximising the yield of recovered material.⁶ The technical challenge lies in replacing complex, multi-material functional elements, such as metal springs or specialised seals, with robust, engineered plastic alternatives that maintain equivalent functional performance.⁶

Strategies for Lightweighting and Component Reduction: Lightweighting involves optimising product geometry to use the minimum amount of material necessary to achieve required strength and functionality.⁶ This practice directly reduces raw material consumption and lowers the carbon emissions associated with production and transport.⁶ Component reduction is equally critical, simplifying design to reduce the total number of parts, which minimizes assembly complexity and facilitates easier material recovery at the product's end-of-life.⁶

Innovation in Refillable and Reusable Systems: Aligning with the ESPR's focus on durability⁹, component manufacturers are developing robust pump systems designed to endure multiple consumer use cycles.⁹ This shifts the component's commercial model from a disposable item to a long-life functional asset, significantly extending the product's functional life and potentially opening new service-based revenue streams through the sale of refills.⁹

4.2. Life Cycle Assessment (LCA): standardised scientific validation

Life Cycle Assessment (LCA) is the internationally accepted, objective methodology for quantifying a product's environmental impacts across its entire lifespan, from raw material extraction ("cradle") through manufacturing, use, and end-of-life ("grave").¹³

Standardisation and Rigour: LCA must adhere to the internationally standardized framework of ISO 14040/14044.¹³ This standardisation ensures that results are scientifically credible, comparable, and legally defensible under increasing regulatory scrutiny. LCA provides the scientific evidence required to identify where the highest environmental burdens occur (hotspots) and to verify whether a change, such as material substitution, lightweighting, or incorporating PCR content, truly yields a net environmental benefit.¹³

The Credibility Mandate: Under the proposed Green Claims Directive, LCA results become the required evidence to substantiate environmental claims.¹¹ A packaging component manufacturer claiming a specific carbon reduction achieved by a new mono-material component, for instance, must back this claim with an ISO-compliant LCA study to avoid allegations of greenwashing and severe regulatory penalties.¹¹ The strategic value of LCA extends beyond compliance; by quantifying the environmental benefits of circular components, manufacturers provide their B2B clients with the auditable ESG data required for their own CSRD reporting, thus enabling data-driven product differentiation.

4.3. Strategic tools: operational efficiency and collaboration

While product design tools are critical, systemic success requires operational excellence and strategic engagement beyond the factory gate.

Operational Excellence: Zero Waste to Landfill (ZWL): Achieving Zero Waste to Landfill (ZWL) certification provides tangible evidence of a commitment to operational circularity, demonstrating a resource efficiency model where 90–99% or more of manufacturing waste is diverted from landfill. This metric provides concrete data for sustainability reporting (CSRD) and acts as a powerful trust signal to brand owners.¹⁵ In a B2B context governed by supply chain due diligence (CSDDD), ZWL status assures clients that the component manufacturer is robustly managing its own operational environmental risk.¹⁷

Collaboration as a Strategic Imperative: The most significant challenges to circularity, namely the quality of PCR supply, insufficient recycling infrastructure, and required consumer behaviour change, cannot be solved in isolation. Successful B2B manufacturers must engage in strategic collaboration both upstream (with material suppliers to develop and secure certified PCR feedstock) and downstream (with brand owners and recyclers to ensure new eco-designs function optimally within existing or emerging recycling systems).¹⁶ This engagement is not merely collaborative; it is a critical form of systemic risk mitigation, ensuring that investments in circular design are matched by functional closing of the loop in the marketplace.

5. Coster Group's key solutions for the circular economy

5.1. Operational Excellence

Coster demonstrates a practical commitment to sustainability by embedding circular economy principles within its daily operations. The company places particular emphasis on the efficient and responsible management of resources, especially throughout its moulding processes. By employing advanced internal recovery systems, Coster is able to reclaim and reuse around 50% of the plastic generated during production. This proactive approach not only significantly decreases reliance on virgin materials but also strengthens resource circularity across its operations.

In 2024, Coster attained Zero Waste to Landfill certification for all its Italian packaging facilities. Out of nearly 1,860 tonnes of waste produced, an impressive 90.2% was recycled, with the remainder utilised for energy recovery. Remarkably, only 97 kilograms were incinerated, and no waste was consigned to landfill, highlighting the company's dedication to minimising its environmental footprint.

5.2. Products

- **Leaf** – ultra-light and recyclable dispenser pump: Leaf is Coster's newest dispenser pump designed for minimal environmental impact. It is a full-plastic pump made entirely of polyolefin resins (about 85% polypropylene and 15% PE and TPO) with no metal parts, so it can be easily recycled along with plastic bottles. Weighing only 10.5 grams, Leaf is one of the lightest 28/410 lotion pumps on the market, significantly reducing material usage. Despite its light weight, it delivers standard performance and is certified recyclable in common PET/PP/HDPE streams (RecyClass rating "A" with a PET bottle). Leaf exemplifies "design for recyclability" and lightweighting, exactly meeting new EU criteria. By eliminating multi-material complexity (no metal springs or other contaminant resins) it avoids the recycling issues of traditional pumps and pre-empts upcoming EU rules that might restrict non-recyclable components.
- **GMPO (Alba "Twist")** – refillable screw-on perfumery pump: GMPO is the screw closure version of Coster's MPO fragrance pump, developed in response to premium brands seeking refillable and recyclable packaging. Traditionally, perfume pumps are crimped onto bottles permanently, making removal and recycling difficult. The GMPO (Alba Twist) instead uses standard threaded closures. This allows end-users to unscrew the pump from a used perfume bottle – facilitating easy bottle refilling or proper recycling of glass and plastic components separately. The GMPO pump retains the high performance of the crimped MPO (compact

profile, fine spray quality, very soft actuation) but adds the advantage of reusability. From a circular design perspective, GMPO enables a closed-loop system for premium perfumes – the valuable glass bottle can be kept in use, and the pump isn't disposed of with the bottle.

- **Daphne 1" single-piece actuator** – lightweight aerosol solution: Daphne is a newly launched one-piece actuator for 1-inch aerosol valves that lightweights the traditional aerosol actuators. Made of polypropylene, Daphne comes in two versions (for AP and for deodorant) and weighs only 2.7 grams – considerably less than a typical two-piece actuator + cap set. Despite its ultra-light design, it has a high top-load resistance of >200 N and fits standard 1" aerosol valves (3.9 mm stem).
- **Use of PCR (Post-Consumer Recycled)** plastics in components: In addition to new product designs, Coster embraces the use of recycled resins to reduce virgin plastic consumption. Many of Coster's standard actuators, spray caps, and even certain pump parts are now also offered in PCR plastic versions (discover the offer of stock PCR items on Coster's website).
- **LCA studies** on demand to substantiate sustainability claims in compliance with directives such as the Green Claims regulation, ensuring scientific rigor and mitigating regulatory risks.

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	Report Content / Claim	Source (Bibliography No.)
1	CE is defined as keeping materials in use vs. the linear “take–make–dispose” model	European Parliament – Circular economy: definition, importance and benefits
2	CE is now a strategic/regulatory imperative; European Green Deal & CE Action Plan	European Commission – European Green Deal (2019) & Circular Economy Action Plan (2020)
3	€4.25 trillion by 2030, global economic potential from the circular economy	EU Circular Economy Stakeholder Platform; World Business Council for Sustainable Development (WBCSD)
4	€650 billion material savings in consumer goods worldwide	Ellen MacArthur Foundation (EMF) research; European Commission
5	EU circular economy metrics: €121.6B investment, €299B value added, 4.3M jobs	European Commission (Eurostat data, 2023)
6	PPWR design mandates: mono-material, lightweighting, minimum PCR content	Draft Packaging and Packaging Waste Regulation (PPWR)
7	CSRD requires detailed public disclosure of resource use and CE initiatives	EU Corporate Sustainability Reporting Directive (CSRD, 2022)
8	CSRD deadlines postponed (Omnibus I, 2025 update), but obligations remain	Norton Rose Fulbright; Sidley Update (2025 Omnibus analysis)
9	ESPR framework: durability, reparability, resource efficiency, and DPP	EU Ecodesign for Sustainable Products Regulation (ESPR, 2023)
10	Extended Producer Responsibility (EPR) incentivizes eco-design	EPR schemes
11	Green Claims must be backed by scientific evidence (e.g., LCA/PEF)	EU Green Claims Directive (proposed)
12	Fragmented national laws push unified high-standard design across markets	Institute for European Environmental Policy (IEEP) policy overview
13	LCA methodology standardised (ISO 14040/14044) and requirements	ISO 14040:2006 and ISO 14044:2006

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14	Challenges: securing a high-quality PCR supply	Ellen MacArthur Foundation (EMF) reports
15	Zero Waste to Landfill certification (≥99% waste diversion) as a credibility metric	Intertek – Zero Waste to Landfill Certification Program
16	Importance of value-chain collaboration (infrastructure, consumer behaviour)	OECD – The Circular Economy in Cities and Regions (2020)
17	CSDDD mandates due diligence throughout the supply chain	EU Corporate Sustainability Due Diligence Directive (CSDDD, proposal)
18	About 17% could significantly contribute to limiting global warming to the 1.5°C	Circularity Gap Report 2025 (by Circle Economy)

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