ELLEN MACARTHUR FOUNDATION

DESIGNING FOR CIRCULARITY

The current landscape and future path of China's recyclable plastic packaging design standards

MARKET INSIGHTS BRIEF

MARCH 2026

WHY IS PLASTIC PACKAGING DESIGN THE KEY TO TACKLING THE PLASTIC POLLUTION CRISIS?

Against the backdrop of accelerating global efforts to address plastic pollution, **design-driven approaches have become a dominant trend in packaging governance.** The EU's Packaging and Packaging Waste Regulation (PPWR),[1] formally adopted in 2024, stipulates that **by 2030 all packaging placed on the market must be "designed for recyclability". Starting in 2035, packaging will also be assessed based on its actual large-scale recyclability in real-world conditions.** In China, as the concepts of green design and eco-design[2] become an integral part of the national "Dual Carbon" (carbon peaking and carbon neutrality) strategy, policies and industry standards related to plastic packaging design are advancing at an accelerating pace.

Product design includes all the early decisions on materials, structure, and functionality, and sets out the conditions for whether packaging can be effectively reused, recycled, or otherwise circulated back into the economy. Once packaging enters the market, its reusability, recyclability, and compostability all depend on whether its design follows circular economy principles and it is compatible with corresponding infrastructure.

GLOBAL LANDSCAPE: THE EVOLUTION OF DESIGN STANDARDS

As global regulatory frameworks for packaging undergo rapid transformation, the international community is advancing design-oriented legislation and standards. Regions including the EU and the UK have introduced mandatory requirements for plastic packaging design, providing businesses with clearer compliance pathways.

The EU has moved **beyond voluntary guidance to binding law** with the **PPWR,** which makes **"design for recyclability" a legal obligation** for packaging placed on the market. In addition, broader ecodesign legislation in the EU is being strengthened to require products — including packaging — to meet sustainability criteria, such as durability, repairability, and recyclability, throughout their lifecycle. Alongside design requirements, the EU is strengthening economic incentives through mandatory **post-consumer recycled (PCR) content requirements** and a reinforced **Extended Producer Responsibility (EPR)** framework, linking packaging design choices to recyclability performance, recycled material uptake, and producer cost obligations across the full lifecycle.

European industry organisations have established a range of sectoral guidelines, rating systems, and certification frameworks to support packaging design, such as the Circular Economy for Flexible Packaging (CEFLEX)[3] programme and the RecyClass[4] platform. These initiatives provide important technical foundations, but are expected to be progressively superseded as European standardisation bodies (CEN/CENELEC) are mandated to develop harmonised standards to ensure compliance with PPWR obligations.

Under CEN/TC 261/SC 4/WG3, new European Standards will unify "design for recycling" criteria, establish common assessment methods for packaging recyclability — particularly for plastics — and support mandatory market requirements from 2030, including alignment with recycled content and circularity objectives.

The UK, through the Plastic Packaging Tax,[5] requires minimum recycled content in plastic packaging or imposes additional taxes.

US plastic packaging regulation is primarily state-led. Washington State's SB 5022,[6] for example, mandates PCR content and bans expanded polystyrene (EPS) food service foam packaging, while industry-led APR[4.1][5.1] design guidelines[7] provide an important reference to the global market.

Additionally, at the industry self-regulation level, the Consumer Goods Forum's Golden Design Rules[8] promote optimal design for plastic packaging by eliminating unnecessary, non-recyclable materials, and serve as a key reference for global companies' procurement, design evaluation, and supplier management.

OVERVIEW OF CHINA'S PLASTIC PACKAGING DESIGN STANDARDS

TIMELINE OF POLICY DEVELOPMENT ON PLASTIC PACKAGING DESIGN IN CHINA

1999

Catalogue for the Elimination of Outdated Production Capabilities, Technologies, and Products
Phase out single-use foam plastic tableware by the end of 2000

2001

Emergency Notice on the Immediate Cessation of Production of Single-Use Foamed Plastic Tableware
Production, sales/use of disposable foam plastic tableware is prohibited, mandatory biodegradable and paper substitutes required

2007

Notice of the General Office of the State Council on Restricting the Production, Sale, and Use of Plastic Shopping Bags
Government-mandated fee for plastic shopping bags.
Ban ultra-thin (<0.025 mm) plastic shopping bags

2008

Catalogue for the Elimination of Outdated Production Capabilities, Technologies, and Products
Phase out single-use foam plastic tableware by the end of 2000

2009

Notice of the General Office of the State Council on Governing Excessive Packaging of Commodities
Propose measures to address excessive packaging, specifying three key requirements: reduce the number of packaging layers, minimise packaging voids, and lower packaging costs

Requirements of restricting excessive package — Foods and cosmetics
National standard for excessive package (now replaced by GB 23350-2021)

2020

Opinions of the NDRC and the MEE on Further Strengthening Plastic Pollution Control
Further prohibit producing ultra-thin plastic packaging, update the list of banned and restricted plastic products as appropriate, and develop green design guidelines for plastic products

2021

Action Plan on Plastic Pollution Control for the 14th Five-Year Period
Promotes a full-chain governance of plastic pollution and strengthens green design and source reduction

14th Five-Year Circular Economy Development Plan
Promotes original shipment, packaging reduction, certification, and scaled adoption of reusable express packaging

Requirements of Restricting Excessive Package - Food and Cosmetics (GB 23350-2021)
National mandatory standard for restricting excessive packaging of food and cosmetics

2023

Requirements of restricting excessive package-Fresh edible agricultural products (GB 43284-2023)
National mandatory standard for restricting excessive package of fresh products

2024

Requirements of restricting excessive packaging in express delivery (GB 45186-2024)
National mandatory standard for excessive packaging in express delivery

2025

Interim Regulations on Express Delivery (2025 Revision)
Promote green, reduced, and reusable express packaging; support the R&D and production of green express packaging and encourage using certified green packaging materials

China's technical standards operate within a tiered framework:

- Mandatory national standard (GB) = legally binding. Compliance is compulsory once the standard enters into force.
- Recommended national standard (GB/T) = Voluntary in principle, but widely referenced in regulations, public procurement, certification schemes, and industry compliance frameworks. In practice, many GB/T standards exert strong quasi-mandatory influence.
- Industry Standards (e.g., QB, HJ) = Voluntary and sector specific. They often serve as operational guidance where national standards are absent or too general, and can carry significant de facto authority within particular industries.
- Group/Association Standards (T/XXX) = Developed by industry associations with niche technical specs. Although nominally voluntary, they are frequently used in certification programs, pilot projects, and government-supported initiatives. These standards often function as innovation platforms or precursors to future national standards.

National standards (GB and GB/T) are intentionally principles-based and broadly applicable. Their development process is relatively rigorous and can take 18 months or longer, reflecting the need for cross-sector consensus and regulatory stability.

With an industry/group standard, more granularity is defined targeting different materials/sectors. They are developed more rapidly, allowing stakeholders to respond to evolving technologies, new materials, and emerging recycling practices. This layered structure enables flexibility: national standards provide stability and policy alignment, while industry and group standards support experimentation and technical refinement.

Over the years, China's policies have evolved from targeting individual plastic products, such as Expanded Polystyrene food containers and ultra-thin plastic shopping bags, with bans and restrictions to establishing **a full-chain governance framework** for single-use plastics. Since enacting the Circular Economy Promotion Law in 2008 — the first of its kind globally — China has emphasised packaging design that prioritises recyclability, disassembly, degradability, non-toxicity of materials, and reduction of excess.[9] During the 14th Five-Year Plan (2021–2025), policies further stressed optimising green packaging design to minimise waste, improve recyclability, reusability and compostability, and developing a comprehensive green design and product standards system.

In line with these policy directions, China has introduced **mandatory national standards** to limit excessive packaging. In 2021, a standard targeting key categories such as food and cosmetics set detailed restrictions on packaging layers, void ratio, and the proportion of packaging cost, in order to effectively prevent packaging waste from improper design.[10] This requirement later extended to fresh products, such as vegetables and meat, in 2024.[11]

Although the law does not reference specific standards, recommended national standards (GB/T) provide technical guidance and measurable criteria to operationalise its principles. The existing GB/T 16716 “Packaging and the Environment” series provides the technical pathways and qualitative criteria for assessing the environmental performance of packaging, which takes a lifecycle perspective and sets out principle-based expectations for packaging reduction, restrictions on heavy metals and hazardous substances, and requirements related to reusability and recyclability (which include material recycling, energy recovery and biodegradability).[12]

Building on this foundation, **GB/T 33761 General principles for green product assessment**[13] establishes a unified national methodology for assessing green products. It introduces a common evaluation framework based on resource efficiency, energy use, environmental impact, product quality, and low-carbon performance, providing a consistent logic for green assessment across all product categories, including packaging and plastics.

Within this overarching framework, two GB/T standards translate green design principles into more operational and assessable standards for packaging, defining quantitative indicators such as use of recycled content, design for recyclability, actual recycling rate, reusable cycles, and environmental impact control.[14] In addition, multiple industry associations have also released standards for **low-carbon packaging,** providing companies with more practical and operational reference frameworks.

While national standards provide the overarching framework, three key sets of group standards have emerged to drive the specific requirement for plastic packaging recyclability:

THE CHINA NATIONAL RESOURCES RECYCLING ASSOCIATION (T/CRRA SERIES)

CORE STANDARD

"General guidelines for the evaluation of plastic products' easy-to-collect and easy-to-regenerate design" (T/CRRA 0302-2020) — the first domestic group standard for evaluating recyclable plastic products, applicable to a wide range of plastic items, including packaging containers. Based on the general guideline, the association, together with companies from different sectors, has developed detailed standards for specific categories such as single-use takeaway packaging, dairy packaging, beverage packaging, and personal care packaging.

EVALUATION SYSTEM

The standard establishes five primary indicators — **main material, auxiliary materials, easy-to-collect (compatibility with collection systems), easy-to-regenerate (compatibility with available recycling processes), and environmental friendliness and safety.** It has a scoring system (Excellent, Qualified, and Non-compliant) and a "Double E" product label that companies can use by certifying products through a third-party certification system.

Although the standard does not provide a unified definition of "recyclability" or "design for recycling", it outlines practical guidance in its detailed provisions. "Easy to collect" refers to **products that are convenient to collect and supported by a relatively mature collection system.** "Easy to regenerate" refers to **products that are easy to recycle and have a relatively established end market for secondary use.** The evaluation process incorporates feedback from recyclers to ensure practical applicability.

The new label will be implemented together with the national standard starting May 2025

CHINA SYNTHETIC RESIN ASSOCIATION (T/CSRA SERIES)

CORE STANDARDS

- Recyclability design guide for PET packaging containers (T/CSRA 16-2022) — focuses on common PET container packaging, such as beverage bottles and cooking oil bottles.
- Recyclability design guide for HDPE packaging containers (T/CSRA 17-2022) — focuses on common HDPE rigid containers, such as bottles for personal care products and cleaning agents.

Both standards provide clear design recommendations centered on recyclability and material compatibility, covering:

- **Material selection:** base materials, additives, and coatings
- **Colour control:** encouraging the use of light or colourless materials
- **Attachment design:** including caps, pumps, labels, inks, and adhesives
- **Structural optimisation:** to enable easy separation and sorting

SUPPORTING MECHANISM

The association has also established a recycling and reprocessing simulation laboratory to support testing. Based on the standards, it conducts recyclability testing and product evaluations, issuing technical assessment certificates for recycling-friendly design. This provides companies with quantitative feedback to guide the development of new packaging products.

The standard sets a clear definition of **recyclability,** which must meet all of the following four conditions:

- The raw materials used in the product must be recyclable, excluding any materials where recyclability is restricted by physical properties, chemical compositions, environmental regulations, or health and safety factors.
- The product must be compatible with existing **collection and sorting infrastructure** and must be widely processed within current recycling systems.
- The recycling and reprocessing must be commercially viable.
- The recycled plastics must be capable of being converted back into raw materials for manufacturing new products. These materials must also retain market value. In instances where the recycling cost exceeds the material's market price, the material is still deemed to have value if its use is **legally mandated** by policy or regulation.

CHINA PACKAGING FEDERATION (T/CPF SERIES)

CORE STANDARD

Design Requirements and Evaluation Methods of Easy Collection and Easy Recycling for Plastic Packaging Products (T/CPF 0054-2023).

This standard focuses specifically on **plastic packaging products,** distinguishing between **flexible** and **rigid** packaging. It evaluates recyclability and reprocessability based on two main categories: **primary packaging materials** and **auxiliary materials,** and incorporates a scoring mechanism.

- The **easy-collection** assessment primarily focuses on factors such as the use of mono-material structures, additives, and whether attachments (e.g. caps, labels) can be easily removed.
- The **easy-recycling** assessment mainly considers the potential for incorporating recycled content into packaging.

The three sets of group standards are highly aligned in promoting design-for-recycling. Key shared requirements include:

- **Encouraging** mono-material packaging
- **Reducing** or avoiding additives that hinder the recycling process
- **Prioritising** transparent or colourless materials by minimising the use of pigments
- **Designing** components like labels, caps, and seals to be easily detachable or made from compatible materials
- **Increasing** the proportion of recycled content in packaging

Across all three frameworks, there is a clear stance against non-separable composites, PVC labels, direct ink printing, and metal barrier coatings, as these elements significantly interfere with the recycling process. Despite these technical similarities, however, the three systems diverge when it comes to their **scope of application, definition, and evaluation metrics.**

As China's standards system matures, **some group and industry standards are being taken up, revised, and reissued as national standards,** signalling that recyclable design is moving beyond pilot practice towards **formal institutionalisation.**

- Two material-specific recyclable design standards developed by the **China Synthetic Resin Association for PET and HDPE** were revised and reissued as **recommended national standards (GB/T)** in August 2025. However, overall progress across material categories remains uneven, while technical guidelines for other major packaging plastics (e.g. PP and PS) are still limited or underdeveloped.
- The **China National Resources Recycling Association**–led Evaluation Guidelines for the easy-to-collect and easy-to-regenerate Design of Plastic Products has also been approved as a **national standard project** and recently released a draft for public consultation.

The fast-track of group standards into national standards marks the elevation of industry technical requirements into regulatory norms, signaling that **"design-for-recycling" is becoming an important technical focus of policy and regulation.** As the regulatory and standard landscape matures, it is anticipated more companies will integrate recyclability considerations into the early-stage design, accelerating the development of a more coordinated plastic packaging management system from production to end of life.

However, there is still a lack of unified standards, definitions, and regulatory requirements with mandatory enforcement. Standards developed by different departments and industry stakeholders exhibit discrepancies in scope and fragmented indicator systems, and an industry consensus has yet to be formed.

Although some companies have experimented with circular design in product innovation, broader transformation remains limited due to insufficient policy incentives, cost pressures, and underdeveloped recycling systems. These challenges lie largely outside the design process, yet they strongly influence whether circular design choices are economically viable and practically effective. This highlights that product design alone cannot drive systemic change, but must operate as part of a broader policy and system-level toolkit.

Advancing to the next stage will require coordinated standards, unified technical definitions, and clear operational policy guidelines, all of which embed design requirements within a wider policy and system framework. For companies, integrating circular economy considerations at the earliest design stage is therefore not only about compliance, but a strategic approach to manage cost, reduce future regulatory risk, and strengthen market competitiveness.

INSIGHTS FROM GLOBAL TRENDS: FROM DESIGN TO SYSTEMATIC CIRCULARITY

International experience indicates that the effective implementation of design standards must be built on unified definitions, transparent evaluation, and a regulatory framework that the industry can rely on with predictability.

Policies in the EU and other regions generally impose requirements on packaging minimisation, recyclability, and recycled content. In some cases, reuse targets are also embedded in legally binding regulatory frameworks, rather than left to industry discretion. Design is no longer framed as a best practice, but as a compliance condition.

A second defining feature is the linkage between design and market access. In the EU, for example, packaging that fails to meet recyclability performance criteria will face restrictions on being placed on the market, while eco-modulated EPR fees create direct financial incentives for better design. This **integration of standards, certification, and economic instruments** ensures that circular design choices carry tangible regulatory and commercial consequences.

Third, global systems increasingly rely on harmonised terminology and unified assessment methodologies. Concepts such as “recyclability”, “recycled at scale”, and performance grades are defined within common frameworks, reducing ambiguity for businesses and enforcement authorities. Industry guidelines and certification schemes are progressively aligned with formal standardisation bodies, creating coherence between technical guidance and legal obligations.

Finally, these frameworks are accompanied by clear timelines and upgrade pathways. Transitional periods are defined, performance thresholds tighten over time, and long-term signals are sent to industry, allowing companies to plan investments and redesign cycles with regulatory certainty.

In contrast, China’s current approach remains primarily focused on addressing excessive packaging. Requirements related to recyclability and reuse are largely driven by policy guidance and industry standards rather than enforceable legal obligations. Important progress through a dynamic ecosystem of group standards — such as those developed by CRRA, CSRA, and CPF — has been made, which are increasingly converging with international technical approaches. However, these standards remain largely voluntary and are not yet systematically integrated into legally-binding market-entry requirements. Crucially, key concepts such as “recyclability” and “recycling at scale” have yet to be defined in a unified, legally-binding manner or linked to market access. As a result, packaging design in China is still treated mainly as a **voluntary technical improvement** rather than a binding compliance requirement.

These differences point to several **structural challenges** for China’s next phase of reform:

1. Fragmented core definitions and assessment logic

Core concepts, such as “recyclability” and “recycled-at-scale”, remain inconsistently defined across different standards and initiatives. While China’s group standards are increasingly aligned in technical direction, they adopt varying terminologies, grading methods, and evaluation criteria.

Without unified definitions and a harmonised assessment framework, it is difficult to:

- establish a clear compliance benchmark for industry;
- integrate design standards into regulatory instruments;
- or enable consistent certification, labelling, and market recognition mechanisms.

2. Limited alignment between standards and regulatory Instruments

Although China has developed a dynamic ecosystem of group standards for recyclable packaging design, the linkage between standards and binding regulatory tools remains limited. The absence of such linkage in China weakens the incentive structure for companies to prioritise circular design beyond reputational or voluntary commitments.

3. Insufficient system-level support and market integration

Design standards alone cannot drive systemic change. Effective circular packaging governance requires coordinated support across:

- recycling infrastructure capacity;
- recycled material quality and grading systems;
- traceability and certification mechanisms;
- and economic incentives through EPR fee modulation or related policy preferences.

Currently, these system-level elements are developing unevenly. As a result, even well-designed packaging may not achieve its intended environmental performance in practice, and companies face uncertainty regarding the economic return of higher-standard design choices.

The global and Chinese plastics industries are entering a critical window of transition. Over the past two years, international negotiations on the Global Plastics Treaty have created an unprecedented foundation for industry consensus and dialogue. As China's full-chain plastic pollution governance moves towards consolidation phase under the 15th Five-Year Plan, the development of packaging design standards will increasingly shape the scale and effectiveness of plastics circularity. The immediate priority is not only to close technical gaps in standards, but also to build cross-sector consensus, clarifying shared definitions, aligning design requirements with recycling system capabilities, and creating a coherent pathway from standards to policy implementation.

This means:

1. Strengthen top-level design and legal clarity

At the national level, China would benefit from establishing a coherent framework for circular packaging design that provides unified, science-based, and legally recognised definitions of core concepts such as "recyclability", "recycled content", and "reuse". At present, varying interpretations across standards create uncertainty for both regulators and businesses. A common terminology and evaluation foundation would enable standards to function not merely as technical references but as instruments of governance. Only when companies, regulatory authorities, and all the system actors share a common understanding of "what constitutes good design" — across reduction, reuse, and recycling — can standards move beyond guidance and become an effective driver of system-level change.

2. Integrate design standards with regulatory and market instruments

Design standards should not remain purely technical norms. They must be systematically connected to regulatory and economic instruments, such as mandatory recycled content requirements, public procurement criteria, green product certification schemes, and market access conditions in priority sectors. Currently, even when companies proactively adopt higher-performing recyclable or reusable packaging designs, they often struggle to obtain tangible economic returns or reputational benefits from the market. This weakens investment incentives and slows transformation.

By embedding design performance into policy and economic instruments, circular packaging design becomes not only a technical choice but a competitive and compliance necessity. At the same time, clearer policy signals and unified evaluation criteria would reduce investment uncertainty. Given that recycling and reuse systems are still developing in most regions, design improvements alone may not translate into measurable environmental outcomes. Establishing a positive linkage between standards, certification, and market recognition is therefore critical to creating a self-reinforcing "standards–certification–market" cycle that makes circular design investable and value-generating.

3. Build a clear, phased roadmap for industry transition

Industry transformation requires predictability. A structured transition pathway — with defined timelines and progressively stricter requirements — would provide clarity for long-term planning, reduce uncertainty and allow industry to plan investments accordingly. An effective pathway could begin with voluntary adoption and pilot certification, move towards formal integration into national standards, and gradually link performance criteria to binding regulatory requirements for selected packaging categories.

Such a roadmap would help shift industry expectations from incremental, short-term compliance adjustments towards long-term structural transformation. Clear milestones are essential to align capital investment, technology development, and supply chain restructuring with national circular economy objectives.

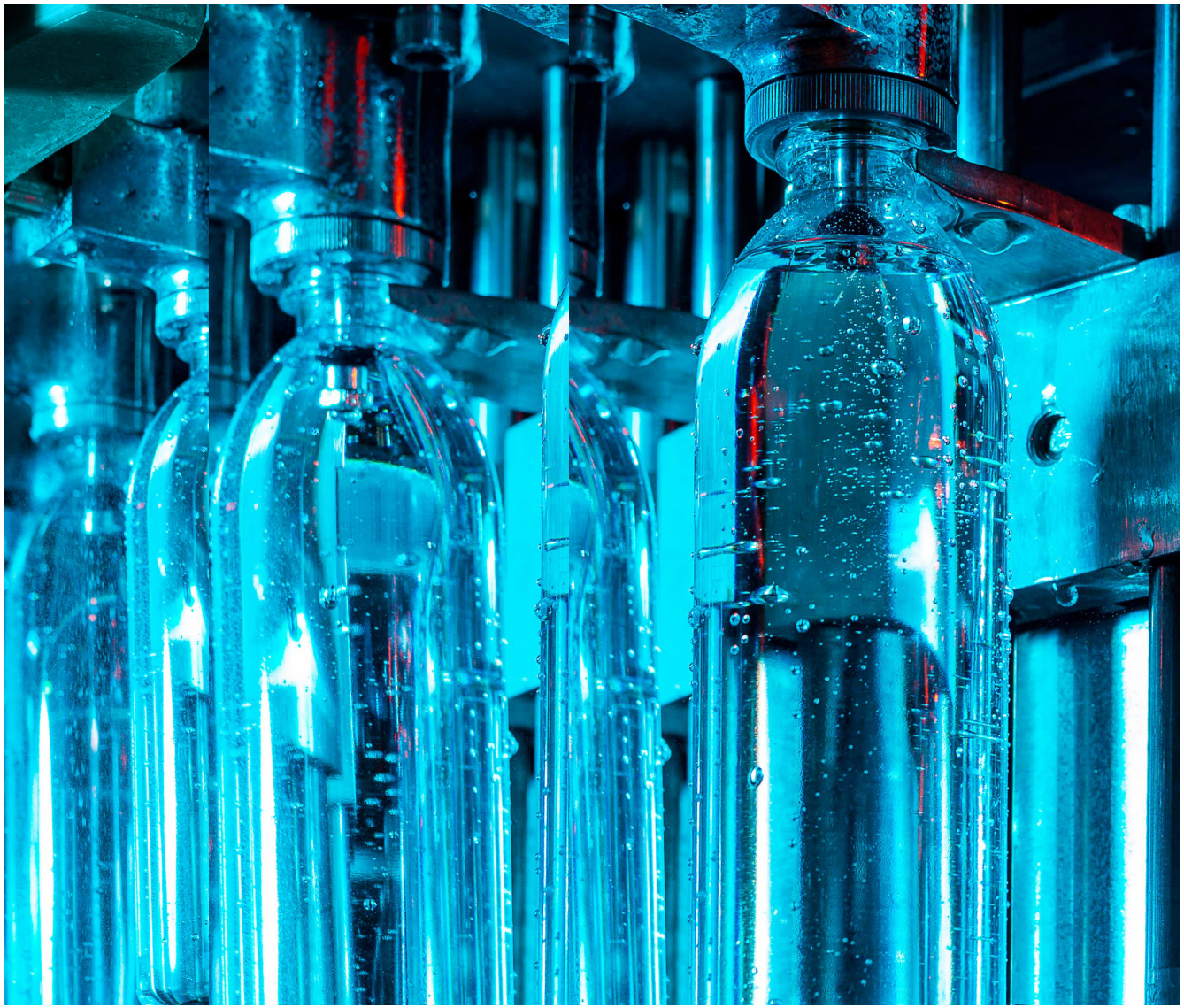
4. Reinforce system-level infrastructure and value chain coordination

The success of circular packaging design must be supported by parallel improvements in recycling facility capability and sorting technology, national grading systems for recycled materials, and digital traceability mechanisms. Strengthened coordination among producers, recyclers, regulators, and certification bodies is equally important to ensure that design standards correspond to actual system capabilities.

Only when design requirements, infrastructure capacity, and policy instruments evolve in coordination can circular packaging move from conceptual alignment to measurable environmental and economic outcomes. Without such system-level reinforcement, even well-designed standards risk remaining aspirational rather than transformative.

China's packaging design standards are evolving rapidly and increasingly converging with international technical principles. The critical question is no longer whether circular design should be promoted, but how to institutionalise it — through unified definitions, regulatory integration, economic incentives, and a phased national roadmap. The next stage of reform will determine whether circular packaging design remains a voluntary technical improvement or becomes a structural pillar of China's circular economy governance framework.

Globally, plastic packaging design policies are moving decisively towards legally binding requirements on minimisation, reuse, recyclability, and recycled content. Compliance expectations are becoming more detailed and category-specific, placing growing pressure on companies operating across markets. In this context, building a standard system that is internationally interoperable, covers mainstream packaging formats, and supports credible certification will be critical for China's plastic pollution control and green packaging transition. As domestic regulations tighten, recycling systems mature, and global brands demand greater design consistency, Chinese companies that align early with global benchmarks and embed circular design principles into product development will be better positioned to compete in the accelerating green transition.



ENDNOTES

1 EUR-Lex, Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste, European Union (2025)

2 Green design (eco-design) in China refers to a lifecycle-based approach taken during product design and development that systematically considers impacts across raw material selection, production, sales, use, recycling and disposal to minimise resource consumption, reduce pollutant emissions, avoid or reduce harmful substances, and protect the environment.

3 CEFLEX, An essential tool to meet your goals (2025)

4 RecyClass, About Us (2026)

5 Fofana. O., UK: is your packaging subject to plastic tax, Packaging Gateway (2025)

6 Washington State Legislature, Engrossed Second Substitute Senate Bill 5022: An Act Relating to Managing Solid Waste (2021)

7 Association of Plastic Recyclers (APR), APR Design® Guide Overview (2026) https://plasticsrecycling.org/apr-design-hub/apr-design-guide-overview/

8 Golden Design Rules, For optimal plastic design, production and recycling, 2024-Plastics-All-Golden-Design-Rules-One-Pager.pdf

9 China's National People's Congress Standing Committee, Circular Economy Law of the People's Republic of China (2008)

10 Standardisation Administration of China, GB 23350—2021, Requirements for Restricting Excessive Packaging — Food and Cosmetics (2021)

11 Standardisation Administration of China, GB 43284—2023, Requirements for Restricting Excessive Packaging — Fresh Edible Agricultural Products (2023)

12 Standardisation Administration of China, GB/T 16716.1-2018, Packaging and the environment — Part 1: General rules (2018)

13 Standardisation Administration of China, GB/T 33761—2024, General principles for green product assessment (2024)

14 Standardisation Administration of China, GB/T 37422-2019, Method and criteria for green packaging assessment (2019).
Standardisation Administration of China, GB/T 37866-2019, Green Product assessment – Plastic Products (2019)

© COPYRIGHT 2026
ELLEN MACARTHUR FOUNDATION

www.ellenmacarthurfoundation.org

Charity Registration No.: 1130306
OSCR Registration No.: SC043120
Company No.: 6897785