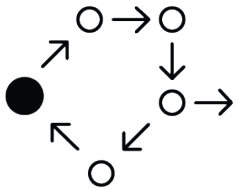


## 28. Internationaler Altkunststofftag

**Global Challenges in the Circular Economy for Plastics - Global Plastics Flow Study and further Topics**





# How can we recycle end-of-life products?

## Circular Economy & Material Flow Analyses

Managing product lifecycles is a constant challenge.

We are specialists for the chemical, plastics and the materials industry in the fields of the environment, recycling and the Circular Economy.

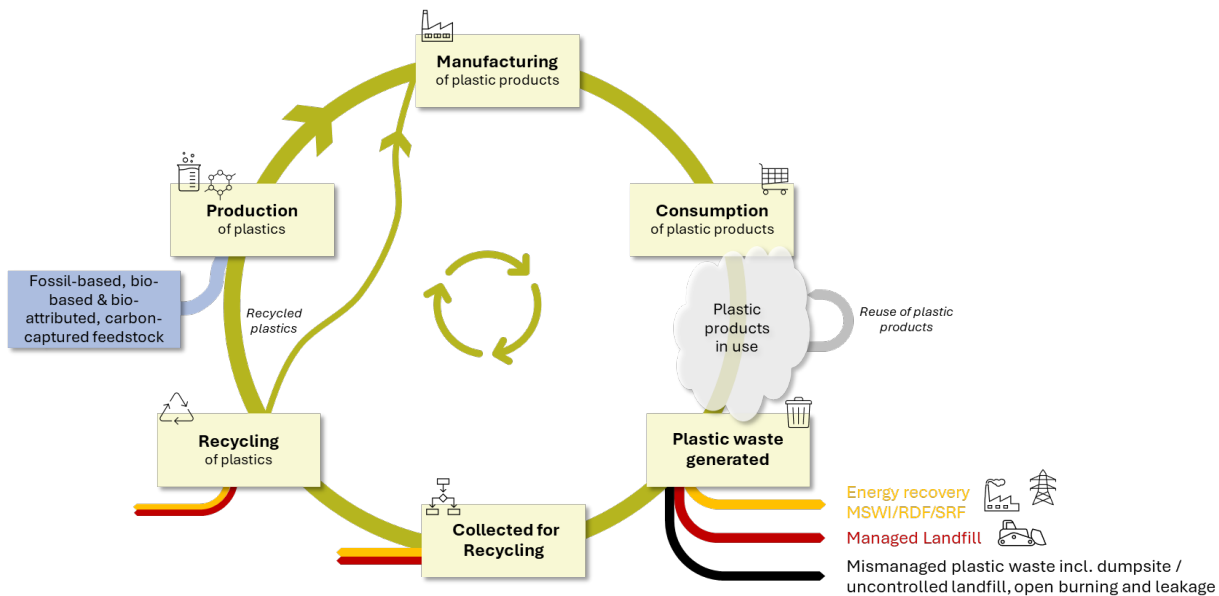
Our global, European and national studies provide a valid data basis for successfully establishing circular approaches.

# Study background and target

The global plastics industry is challenged to further develop and improve the circular economy for plastics and to contribute to establishing global waste management and recycling solutions.

These efforts are also essential for reducing land & marine littering.

## Global Plastics Flow



## Plastics applications included

- Packaging
- Building & Construction
- Electronics
- Automotive
- Others

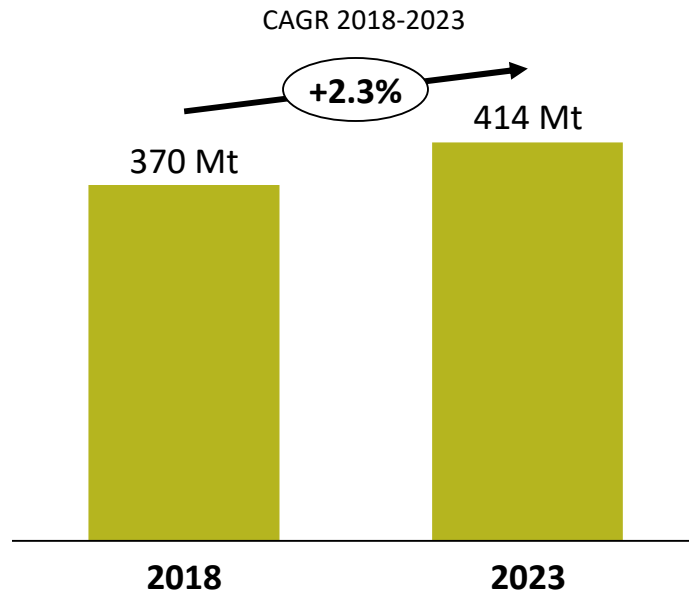
## Countries & regions included



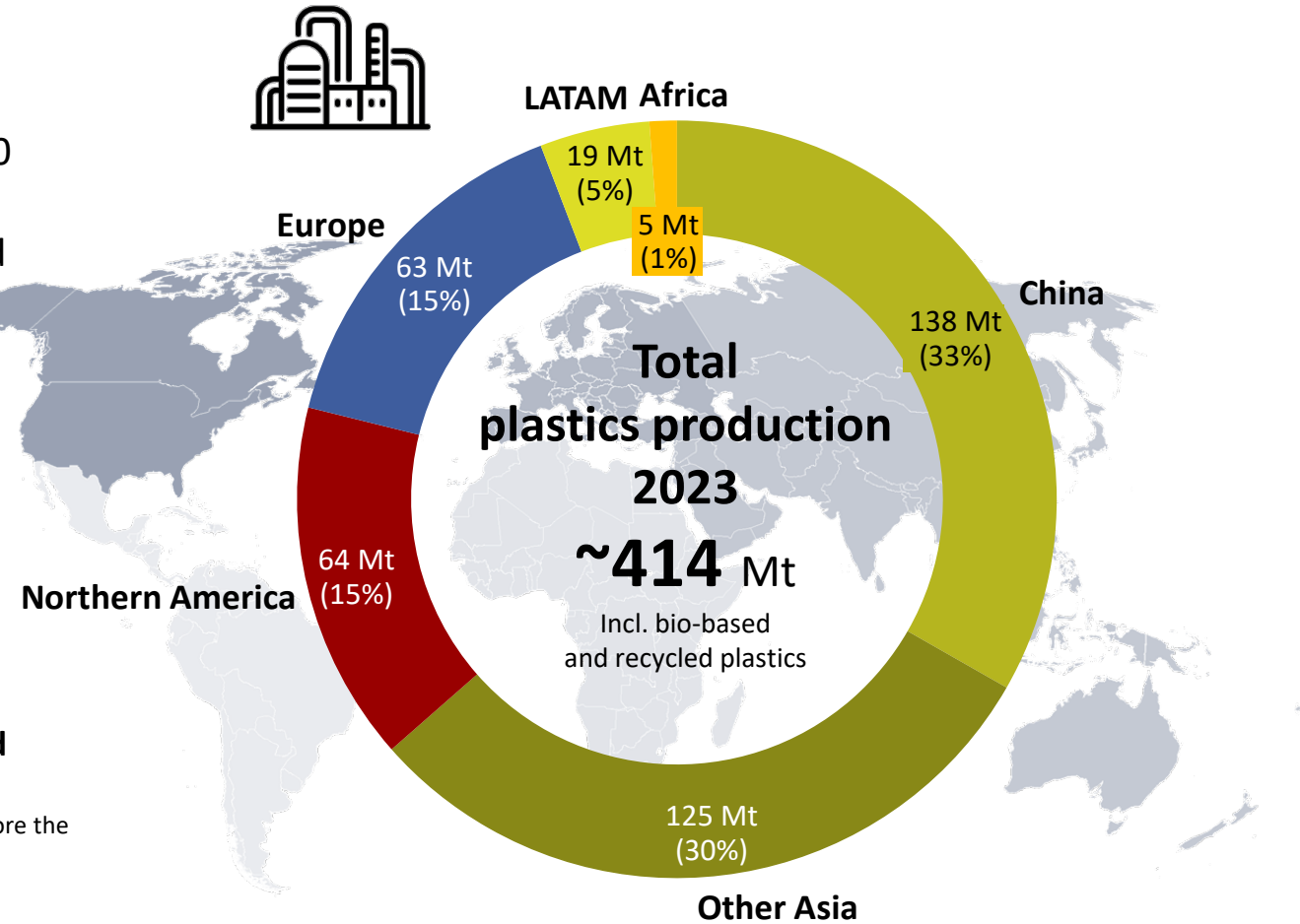
# Global plastics production in 2023 – Asia as the dominant region

## Key insights

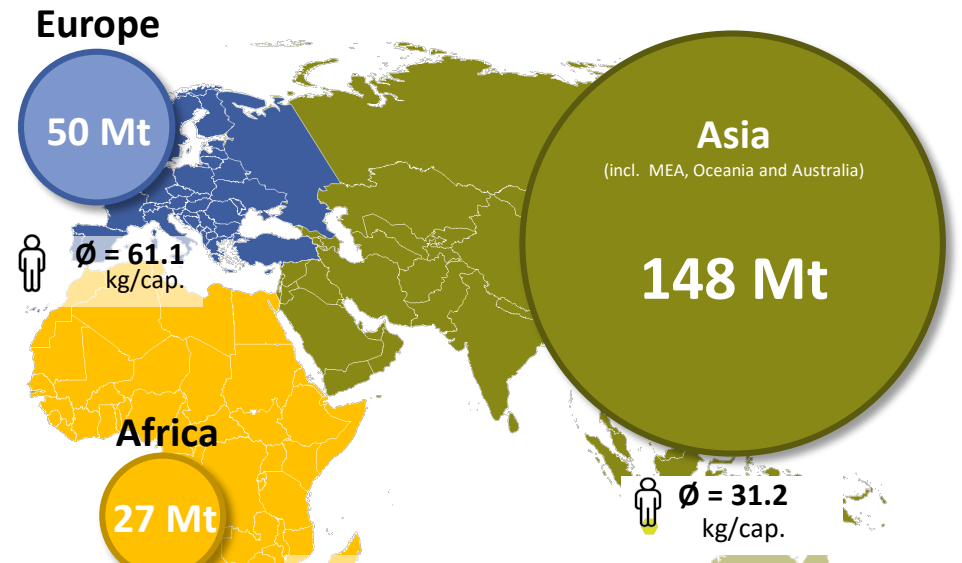
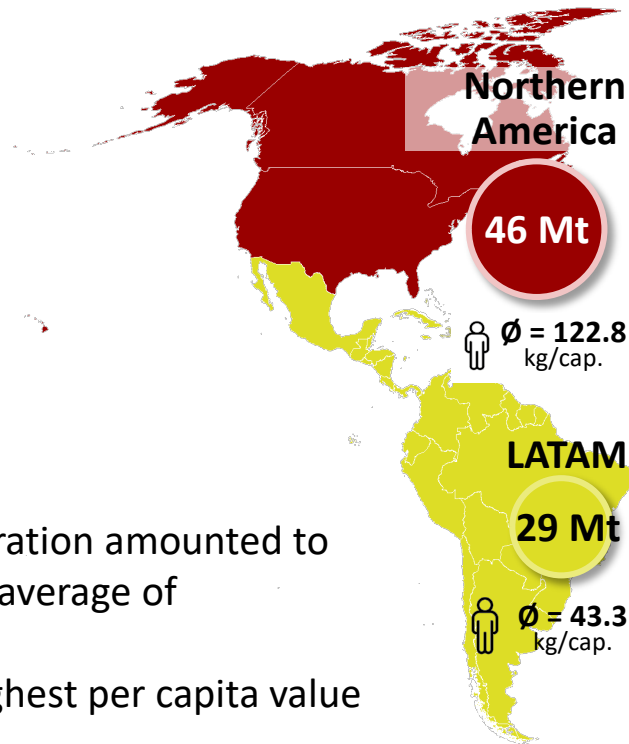
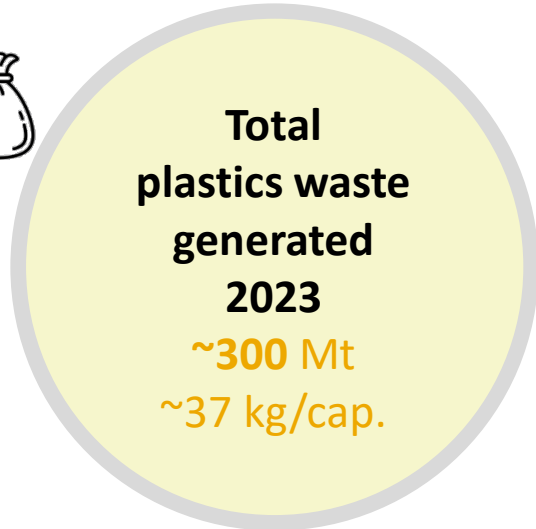
- The global production of plastics (incl. fossil-based, bio-based, recycled and carbon captured) increased from 370 Mt in 2018 to 414 Mt in 2023.
- China was the largest producer of plastics (33%), followed by other Asia (incl. Middle East; 30%), Northern America (15%) and EU 27 + 3 with 12.4%.



**Thereof recycled plastics**  
at melting point / "before the extruder"  
**2023: ~ 37 Mt**



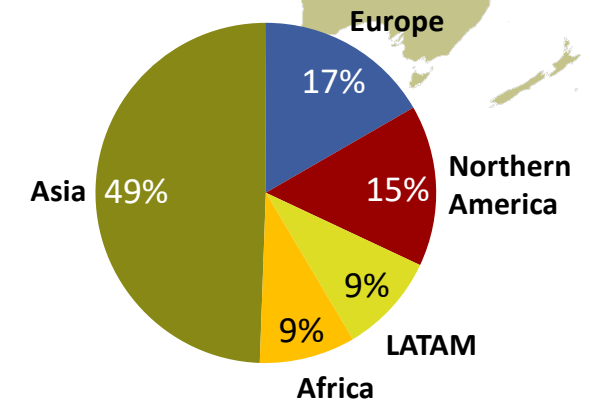
# In 2023, 300 kt of plastics waste generated worldwide



## Key insights

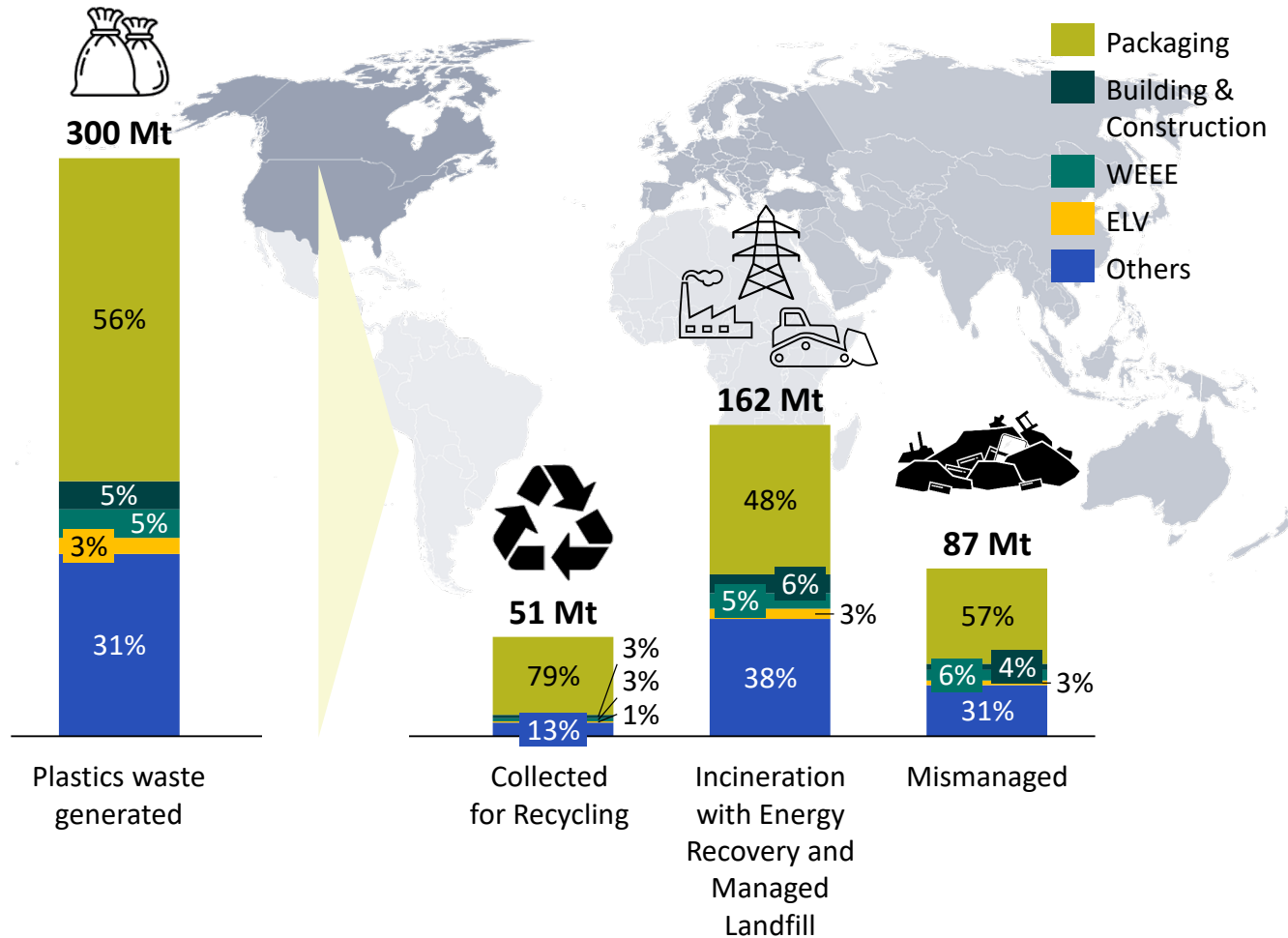
- In 2023, global plastics waste generation amounted to ~300 Mt, which corresponds to an average of 37.1 kg/cap.
- Northern America recorded the highest per capita value at 122.8 kg/cap.
- Europe accounted for 50 Mt of plastics waste (16%) with an average of 61.1 kg/cap.
- Africa contributed 27 Mt of plastics waste (11%) with the lowest per capita waste generation at 18.4 kg.

Plastics waste generated split by region



# Plastics packaging waste generates 56% of the global plastics waste

Plastics applications along the plastics waste value chain in 2023

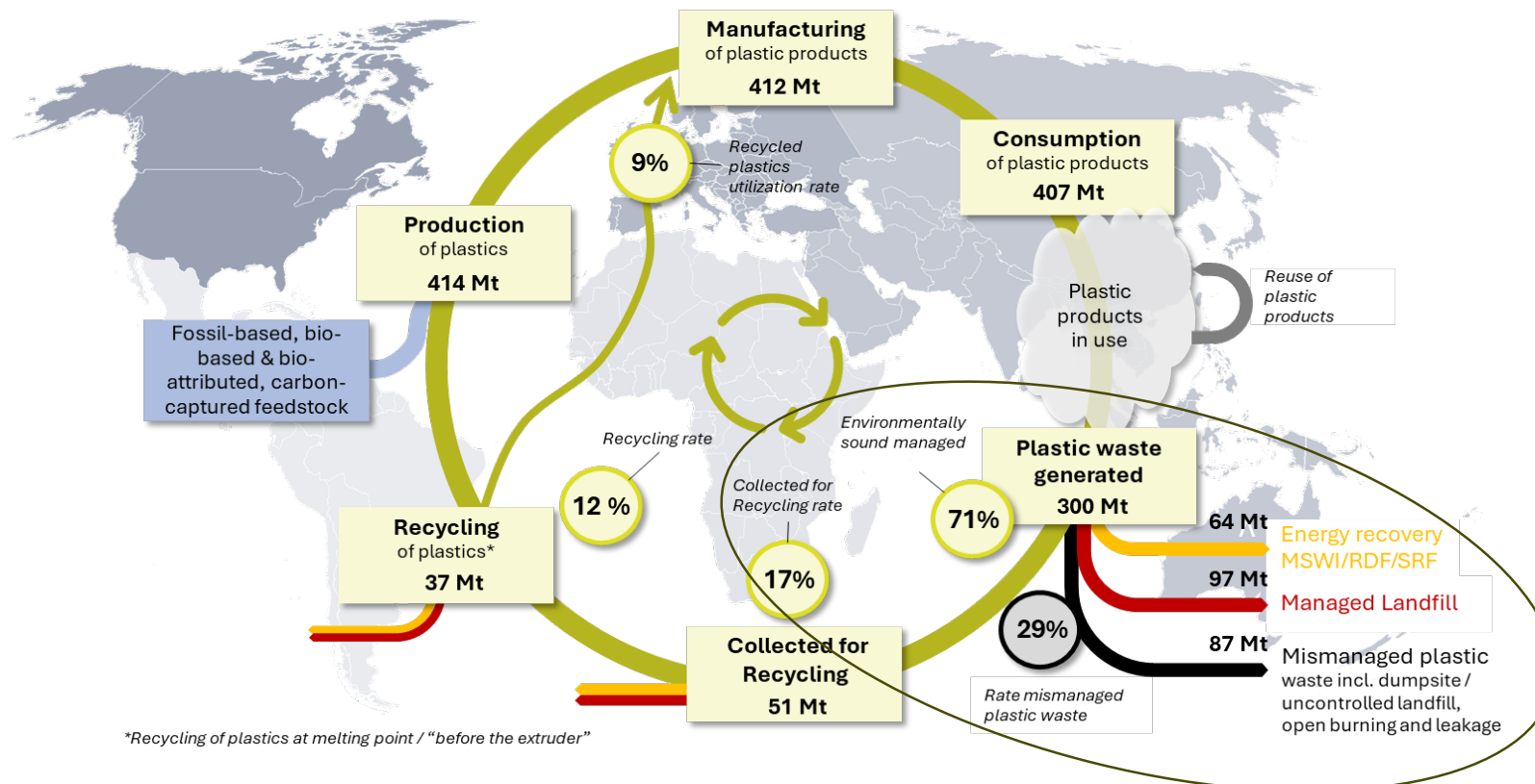


- Most of the plastics waste generated derives from the packaging sector (56% or 168 Mt).
- Plastics packaging waste, composed largely of PET, HDPE, LDPE, and PP, accounts for about 80% of all plastics collected for recycling.
- Plastics packaging waste accounts for the largest share of mismanaged plastics waste (57%, 49 Mt), mainly due to inadequate waste management infrastructure, such as limited formal collection systems, and the low economic value of plastics waste in many regions.

# 71% of the plastic waste are managed in an environmentally sound manner, however, 87 Mt of plastics waste were disposed of under improper conditions

The Global Plastics Flow 2023 – Plastics waste generated and environmentally sound managed vs. mismanaged waste

The figures in this study refer exclusively to waste from post-consumers.

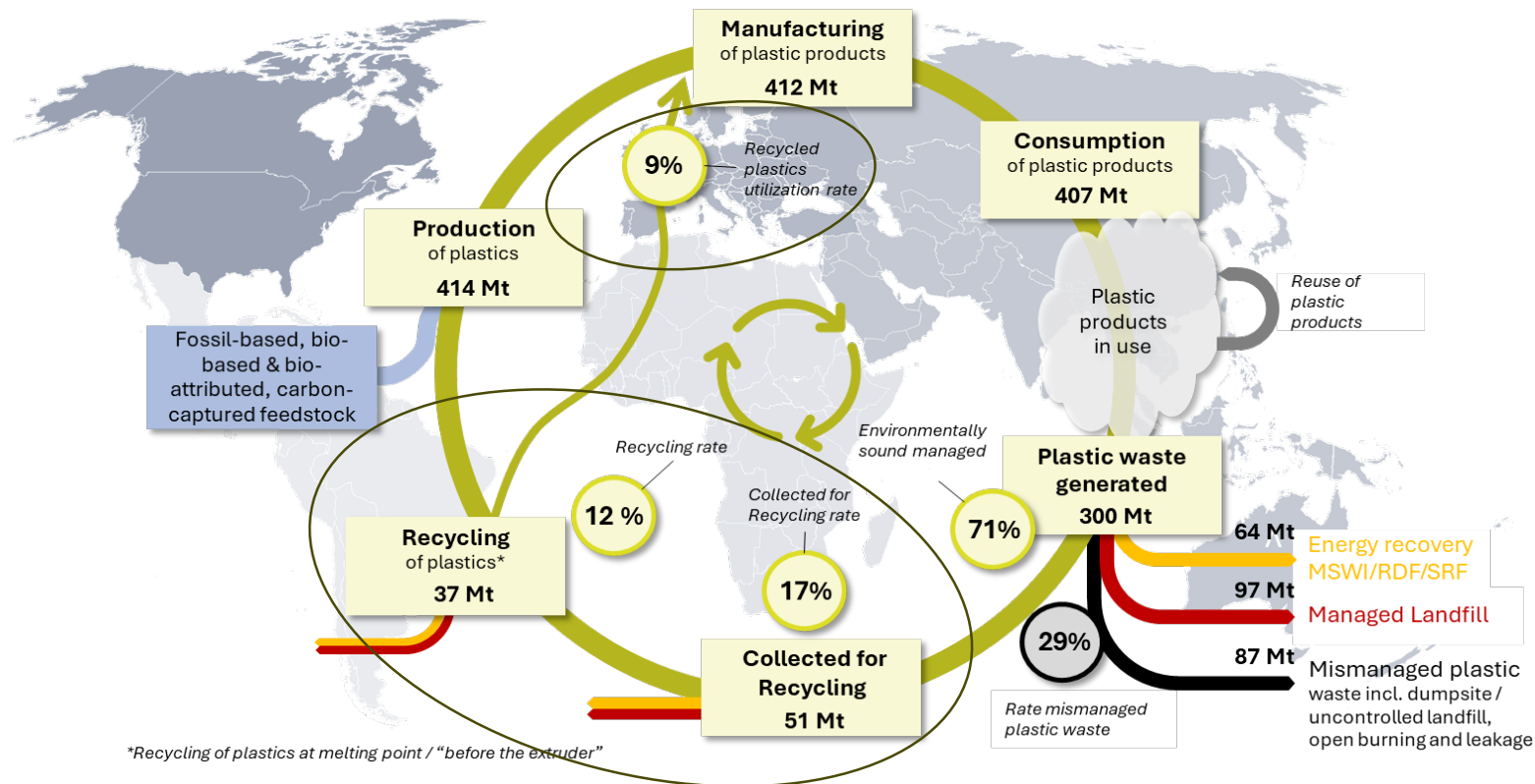


- Most of the plastics waste 71% (212 Mt) is managed in an environmentally sound manner in either managed landfills (97 Mt) or in municipal solid waste incineration plants and cement kilns (64 Mt) (i.e., for heat utilization and energy recovery) or is collected for recycling (51 Mt) and ~37 Mt of plastics prepared for recycling and melting point after post-sorting.
- However, still 87 Mt of plastics waste were disposed of under improper conditions (i.e., unmanaged landfills, open burning, littering or leakage into aquatic and terrestrial environment) translating into a mismanaged plastics waste rate of 29%.

# Global average recycling rate for plastic waste is 12%

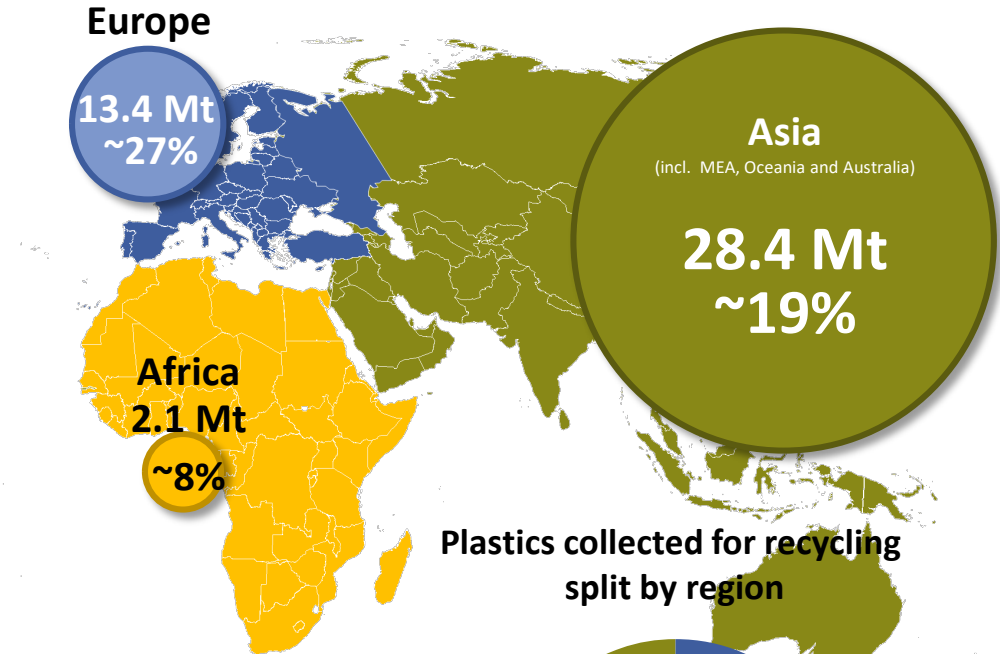
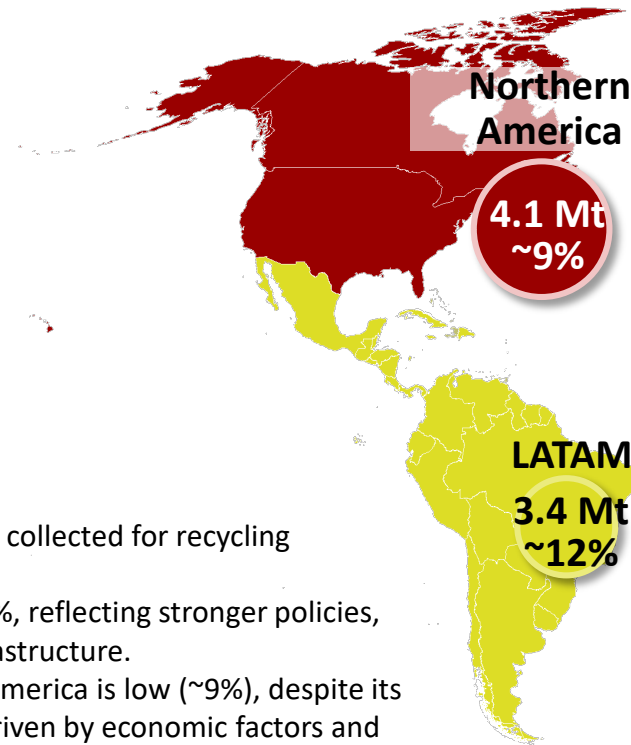
## The Global Plastics Flow 2023 – Recycling of plastics waste

The figures in this study refer exclusively to waste from post-consumers.



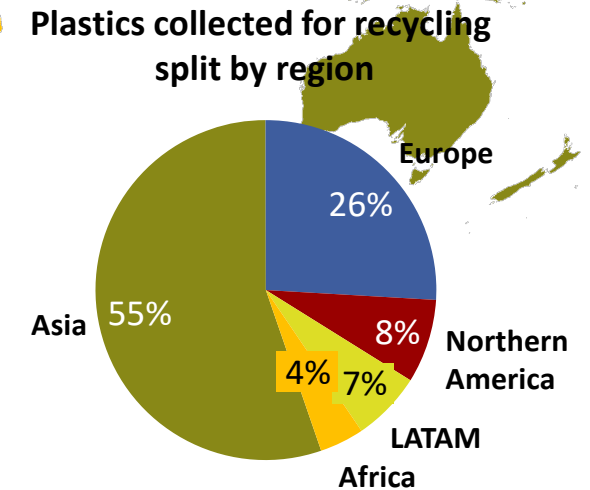
- While formal and informal waste collection and management ensure that 71% of the global plastics waste are environmentally sound managed, only 17% (~51 Mt) are collected for recycling processes.
- Due to further sorting and process losses, the resulting plastics recycling quantity accounted for 37 Mt, which translated into an **average recycling rate worldwide of 12% in 2023.**
- Utilized for the manufacturing in plastics products, this share accounted for ~9% based on the total quantity of 412 Mt of plastics products manufactured.

# In 2023, 51 Mt of plastics waste were collected for recycling worldwide. 80% of post-consumer recyclates were produced in Europe and Asia

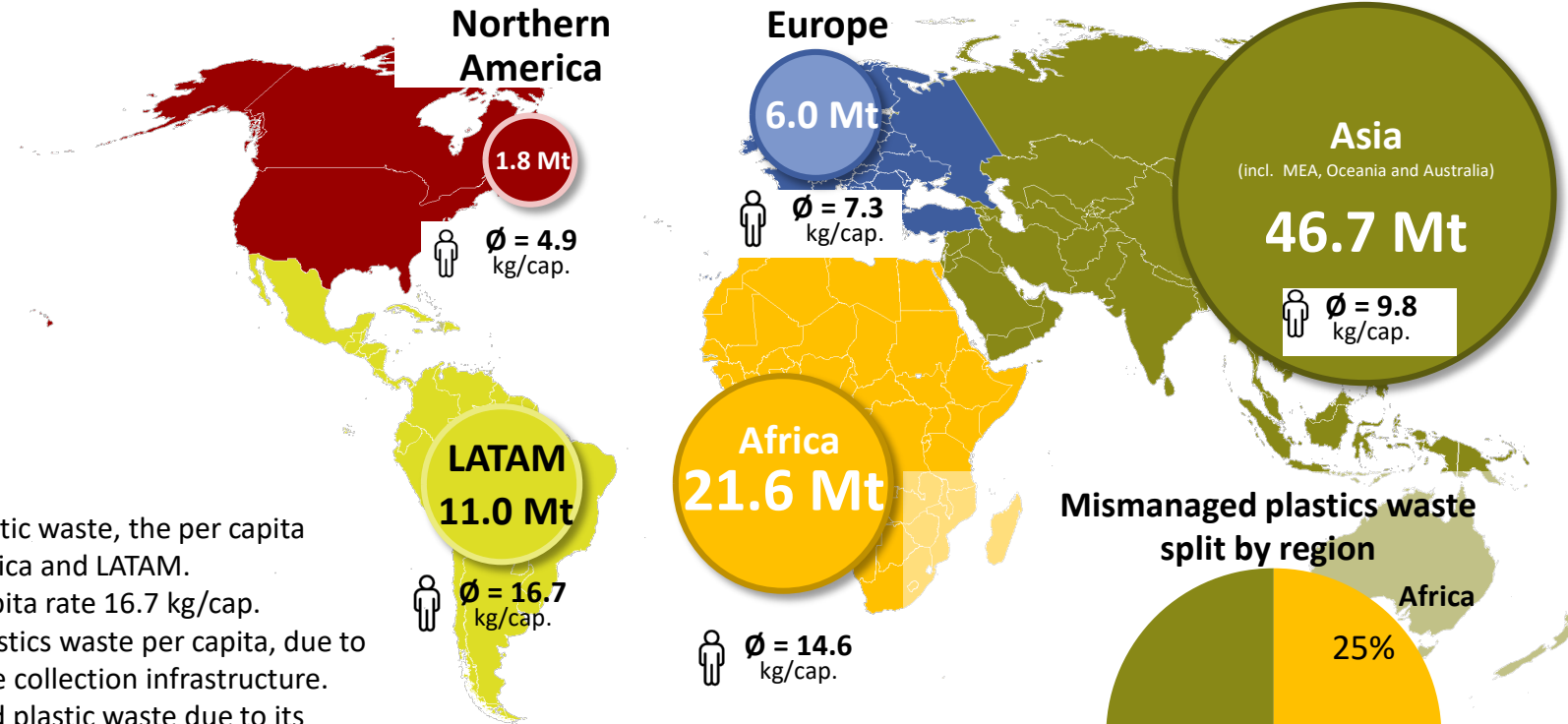


## Key insights

- Asia leads globally in total volumes of plastics collected for recycling (28.4 Mt), achieving a rate of ~19%.
- Europe with the highest recycling rate of ~27%, reflecting stronger policies, overall waste management and recycling infrastructure.
- The collection rate for recycling in Northern America is low (~9%), despite its economic strength, as recycling is primarily driven by economic factors and legislation often does not request higher recycling targets.
- LATAM has a relatively high collected for recycling rate (12%) compared to Northern America, but absolute volumes are lower (3.4 Mt) due to lower usage of plastics.
- Africa's low recycling rate (~8%) reflects gaps in infrastructure and system.

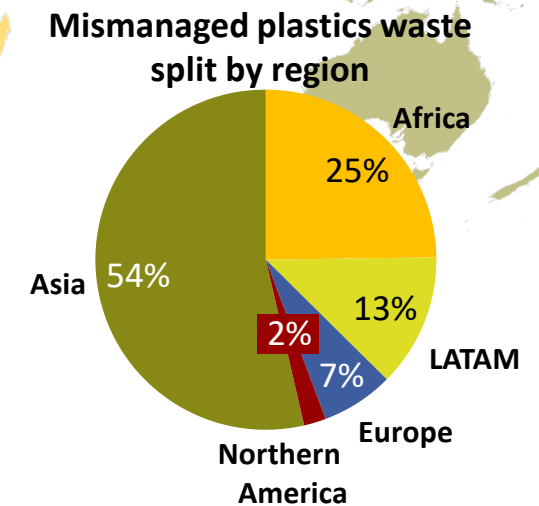


# In 2023, 87 Mt of mismanaged plastics waste worldwide



## Key insights

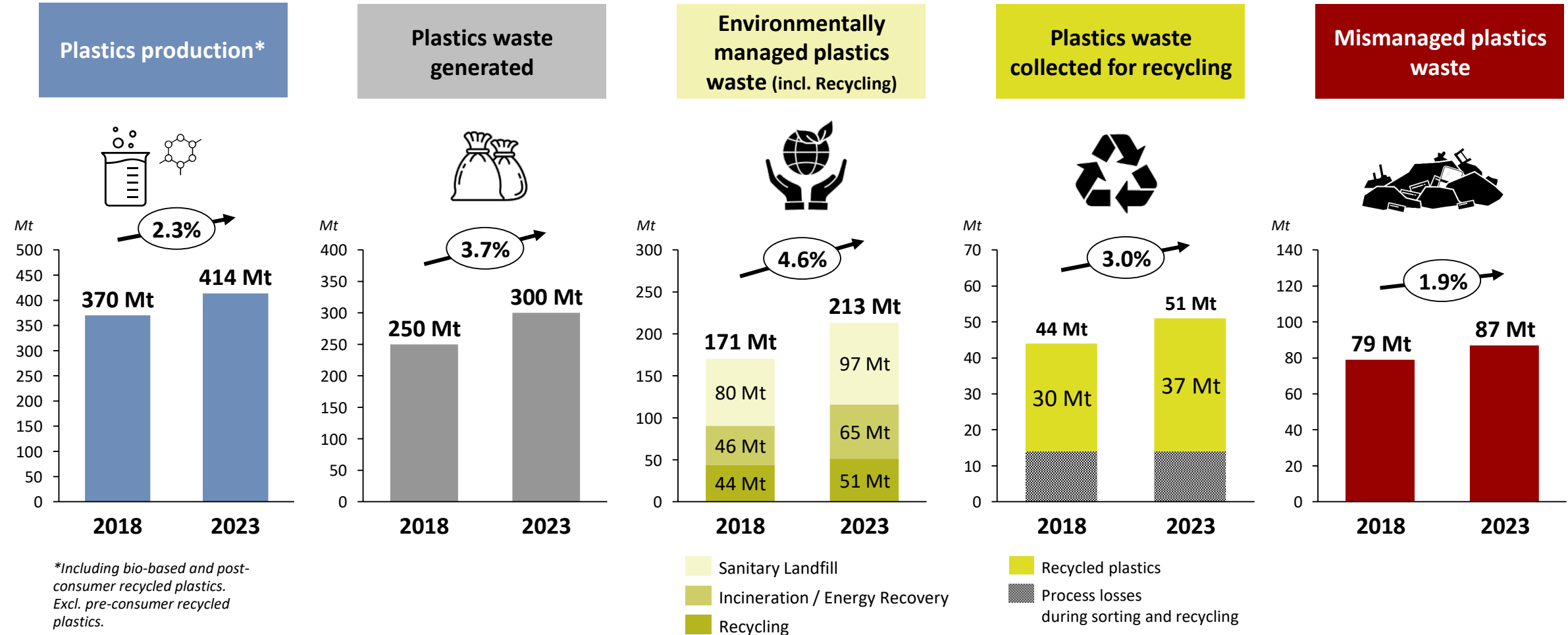
- Although Asia produced most mismanaged plastic waste, the per capita amount of mismanagement is lower than in Africa and LATAM.
- LATAM has the highest mismanagement per capita rate 16.7 kg/cap.
- Africa has the highest share of mismanaged plastics waste per capita, due to the lack of sanitary landfills and adequate waste collection infrastructure.
- Europe has a significant amount of mismanaged plastic waste due to its exports of plastics waste, electronics and cars under the guise of secondary use to countries with inadequate waste management infrastructure.
- The main cause of mismanaged waste in Northern America is the leakage of waste materials into rivers and oceans, as well as the presence of waste litter.



# The circularity of plastic is growing. However, there is still a long way to go to achieve a real circular economy of plastics, in particular, mismanagement must be avoided

Growth dynamics in the Global Plastics Flow with CAGR in % and Total in Mt from 2018 to 2023

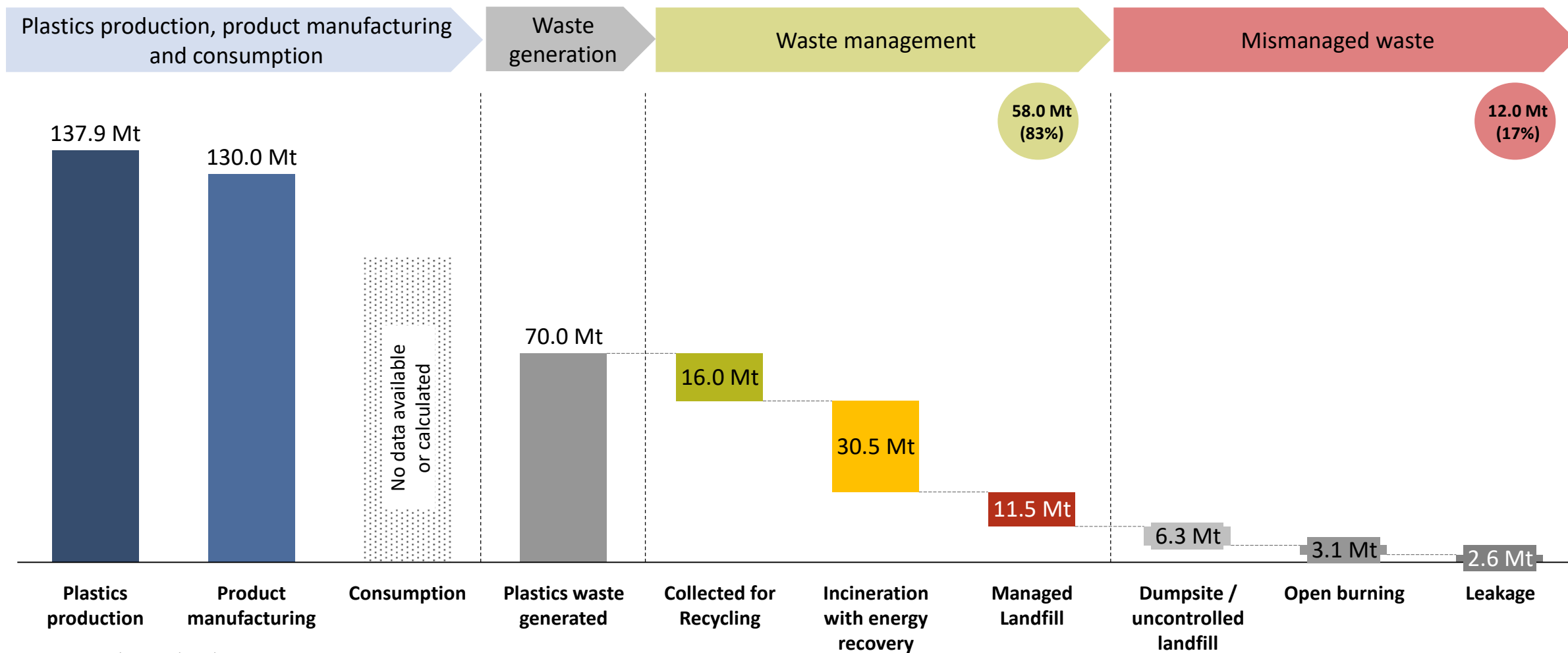
Population growth  
CAGR  
2018-2023  
+0.9%





# Plastics material flow overview China in 2023

Plastics value chain overview total plastics across all applications







Data is export and import adjusted

# Plastics waste and waste management China in 2023



## Overview by application

	Waste Generation & Collection						Waste Management						Mismanaged Waste			
	Generated Plastics waste			Collected Plastics waste*			Environmentally sound waste treatment						Mismanaged			
	Plastics within waste stream			Formal and informal waste collection			Collected for Recycling		Energy Recovery		Managed Landfill		Improper Disposal**		Leakage	
Applications	kt	Share	kg/cap.	kt	Share	kt	Share	kt	Share	kt	Share	kt	Share	kt	Share	
 Packaging	38,000	54.3%	26.9	32,300	85.0%	12,274	32.3%	16,150	42.5%	3,876	10.2%	4,275	11.3%	1,425	3.8%	
 Building & Construction	3,200	4.6%	2.3	2,400	75.0%	384	12.0%	1,200	37.5%	816	25.5%	680	21.3%	120	3.8%	
 Electronics	3,000	4.3%	2.1	2,100	70.0%	457	15.2%	840	28.0%	803	26.8%	765	25.5%	135	4.5%	
 Automotive	1,337	1.9%	0.9	669	50.0%	160	12.0%	134	10.0%	374	28.0%	568	42.5%	100	7.5%	
Others	24,463	34.9%	17.3	20,531	83.9%	2,724	11.1%	12,176	49.8%	5,631	23.0%	3,112	12.7%	820	3.4%	
Total	70,000	100.0%	49.6	58,000	82.9%	16,000	22.9%	30,500	43.6%	11,500	16.4%	9,400	13.4%	2,600	3.7%	

**Note:**

\*Plastics waste collected means that waste is collected for environmentally sound waste treatment. In less developed countries, this may include waste that is collected for recycling by the informal waste sector.

\*\*improper disposal includes not collected plastics waste that is openly burned or disposed on dumpsites or uncontrolled landfills. It further includes illegal waste exports to countries with improper waste treatment.

Reading aid: 38,000 kt packaging waste (i.e., 26.9 kg per capita) were generated in the country/region, which corresponds to a share of 54.3% among all other applications. 85.0% of plastics waste generated, i.e., 32,300 kt were collected via formal and informal channels. 12,274 kt, i.e., 32.3% of plastics waste generated were collected for recycling. Columns for the other treatment options can be read analogous to the column collected for recycling.

Base year 2023



# China recycles more plastics than any other country

## China: Recyclate production & end-use

**16 Mt**

collected for recycling (GPF Study 2023) — the largest largest single-country volume in the study

**+8.3%**

CAGR in plastics collected for recycling in China, 2018–2018–2023 (GPF Study); vs. –9.7% for mismanaged waste

**>50%**

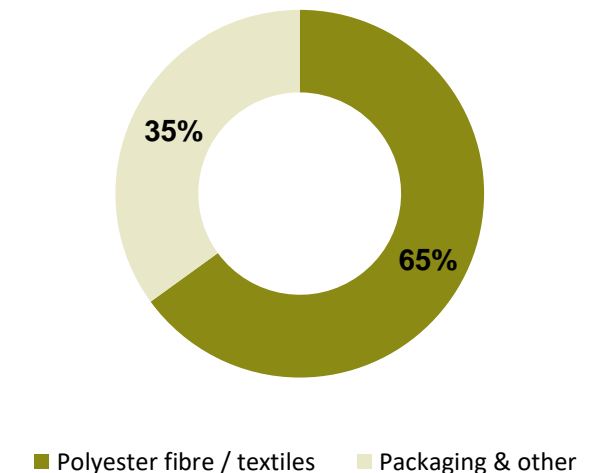
of globally collected PET bottles are processed in China, in China, predominantly into polyester fibre

### 💡 Key insights

- Mechanical recycling is the backbone; chemical recycling is now scaling — a 200,000 t/yr mixed-waste plant in Guangdong entered trial operation in mid-2025.
- China is the world's leading producer of recycled polyester staple fibre, with PET-bottle waste channelled predominantly into textiles — a consequence of food-contact recycled plastic being largely prohibited in China under the existing GB 4806 framework.
- A shift is underway: GB/T 45091-2024 (substance limits for recyclates, in force June 2025) and a suite of nine national recyclate standards (effective Feb 2026) establish the quality and traceability prerequisites that any future food-contact rPET authorisation would require.

### rPET end-use — global reference

(~60–70% to fibre globally; China structurally higher)

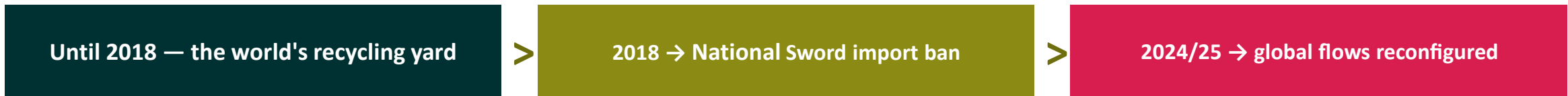


Sources: GPF Study 2023 (Conversio); PlasticsToday Jul 2025 (Jieyang plant); Zhong et al., ScienceDirect 2020 (>50% global PET processed in China); SAMR/CPRA GB/T 45091-2024; Aizenshtein 2016 (fibre share).

# China's plastics trade pivot: from scrap importer to domestic feedstock shortage — and new recycle economics



China: Recyclate trade & outlook



## Outlook — NDRC Action Plan (Dec 2025)

- Target of ~19.5 Mt recycled plastics by 2030;** national standards and certification schemes to be established; higher recycled-content shares in automotive, electronics, textiles and packaging. Signals a deliberate shift from volume-based collection to **quality- and application-oriented recyclate utilisation.** (2023 ~ 11mio t)
- No Polymer-specific recycled materials:** The plan consistently treats recycled plastics as an aggregate category without polymer-specific targets.
- No utilization rates for recyclates by applications:** Numerical utilization rates do not yet exist in Chinese law; the wording consistently states “increase the proportion” without specifying a percentage.



# Overview of material flow in EU27+3 countries

Key figures	2024	2022	CAGR* (2022-2024)
Fossil-based production	<b>43.3 Mt</b>	47.2 Mt	<b>-4.2%</b>
Converting	<b>52.4 Mt</b>	54.1 Mt	<b>-1.5%</b>
...fossil-based plastics	<b>41.6 Mt</b>	43.7 Mt	<b>-2.5%</b>
...circular material	<b>7.9 Mt</b>	7.3 Mt	<b>+4.3%</b>
...pre-con. recycled plastics	<b>2.9 Mt</b>	3.1 Mt	<b>-0.9%</b>
Consumption (estimated)	<b>52.8 Mt</b>	53.3 Mt	<b>-0.4%</b>
PC waste collection	<b>32.7 Mt</b>	32.3 Mt	<b>+0.6%</b>
PC waste sorted for recycling	<b>12.0 Mt</b>	11.4 Mt	<b>+2.7%</b>
PC waste input in EU27+3 recycling facilities	<b>10.7 Mt</b>	11.1 Mt	<b>-2.0%</b>
Output of PCR in EU27+3	<b>8.0 Mt</b>	7.7 Mt	<b>+1.5%</b>
Usage of PCR in manufactured products <sup>3)</sup>	<b>7.3 Mt</b>	6.7 Mt	<b>+4.8%</b>
<b>European PC waste mech. recycling</b> (intra & extra EU27+3)	<b>9.5 Mt</b>	8.5 Mt	<b>+5.3%</b>

## Circular Economy



- **Negative production and converting trends** due to high raw material costs, energy prices and labour costs.



- Despite this, **circular material volumes** have increased over the past two years due to sustainability considerations and future stricter legislation but **have lost significant momentum.**



- **Consumption and the collection of plastic waste** has remained relatively stable over the past two years.



- The increase of separate collection systems (such as LVP collection or PET deposit systems) in many European countries has resulted to an increase in the sorting of plastic waste. **Higher exports of plastic waste** and the closure of some European recyclers over the past two years have led to a decrease in input volumes at recycling plants in the EU27+3.



- However, the amount of recycling output increased slightly due to improved sorting, i.e., purer collection and improved sorting technology, as well as lower process losses in the extruder.

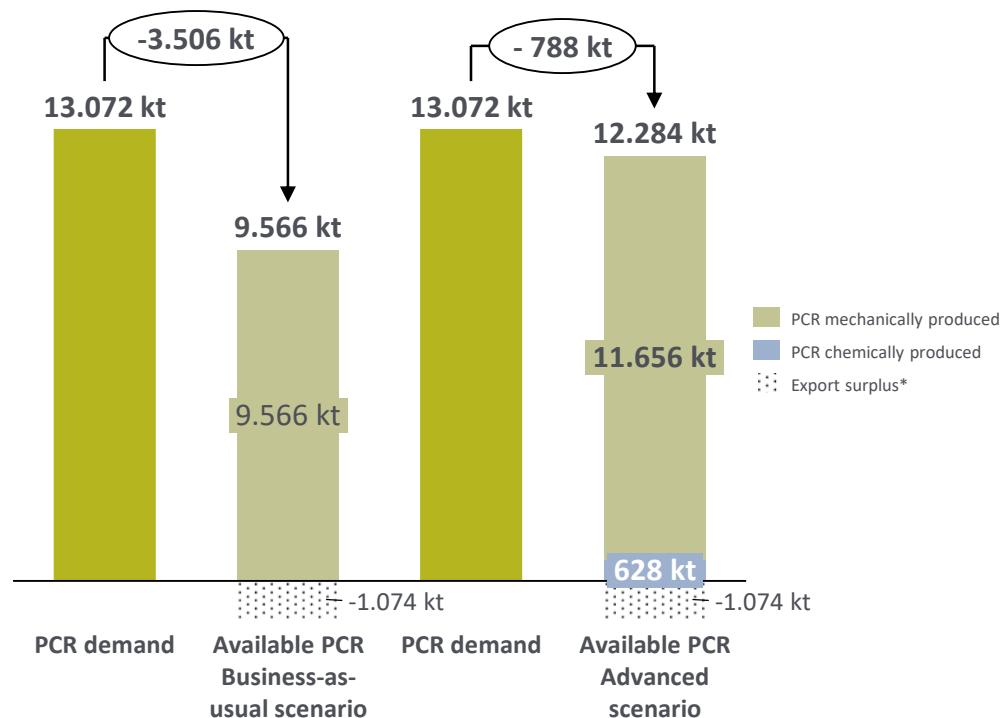


- **Due to rising imports of recycled materials from outside the EU, the amount of mech. PC recycled plastics used in Europe increased from 6.7 Mt to 7.3 Mt, but growth is much lower than in previous years due to strong price competition with virgin materials.**



## Supply gaps - ~ 3.500 kt in the business-as-usual scenario

Summary: Analysis of supply gaps in the scenarios



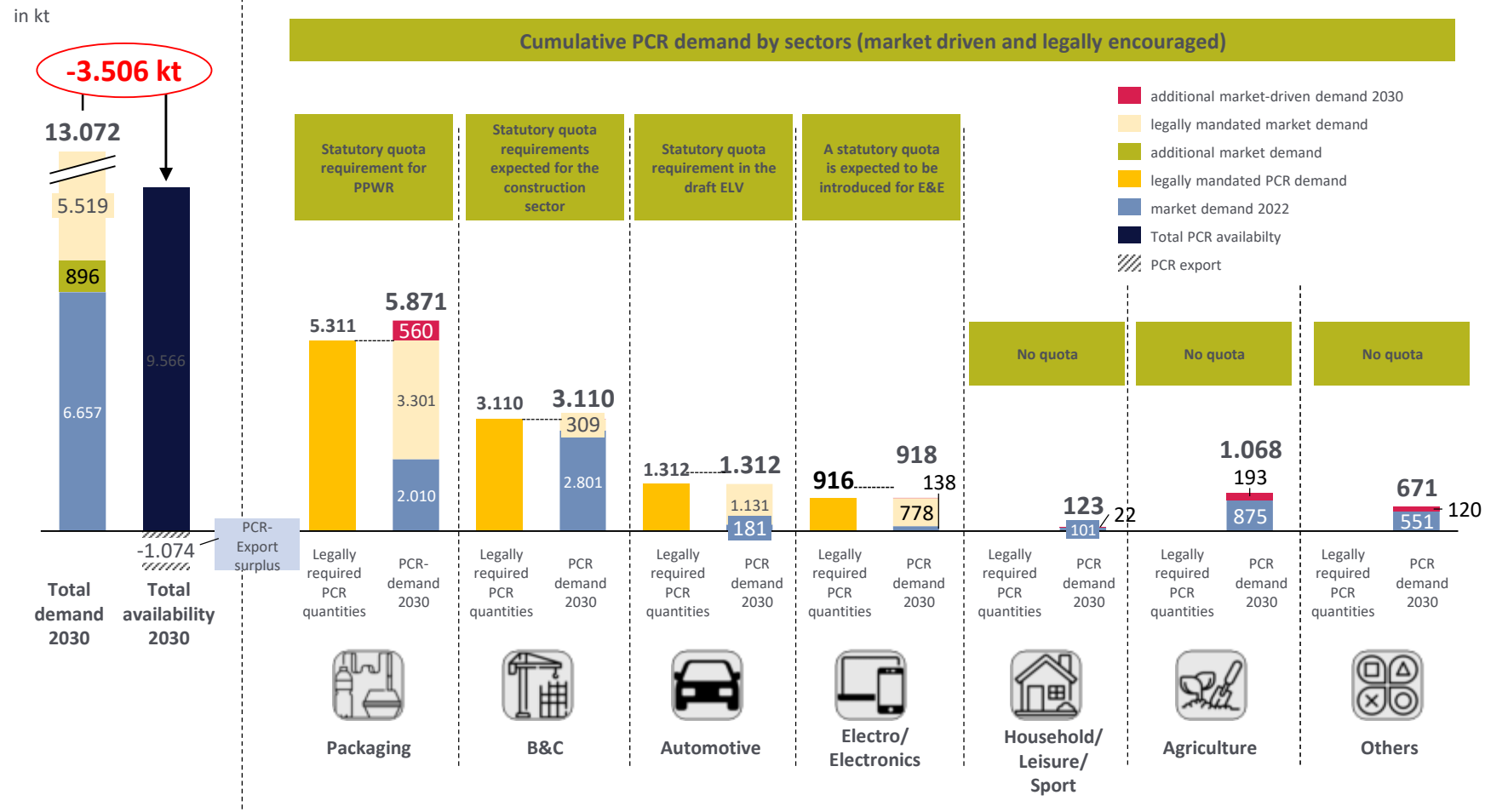
- Despite the extensive expansion of waste collection, sorting and recycling infrastructure across the EU27+3, the volume of post-consumer recycled materials produced in 2030 will not meet demand.
- Taking into account the legal and market-related demand for PCR by sector of application and the corresponding supply of PCR, there is a gap between supply and demand of ...
  - **~3.506 kt in the business-as-usual scenario**
  - **~788 kt in the advanced scenario**

\* In both scenario models, the current export surpluses were projected forward to 2030.



# EU27+3 demand for recyclates

Sector-specific gap analysis in a business-as-usual scenario

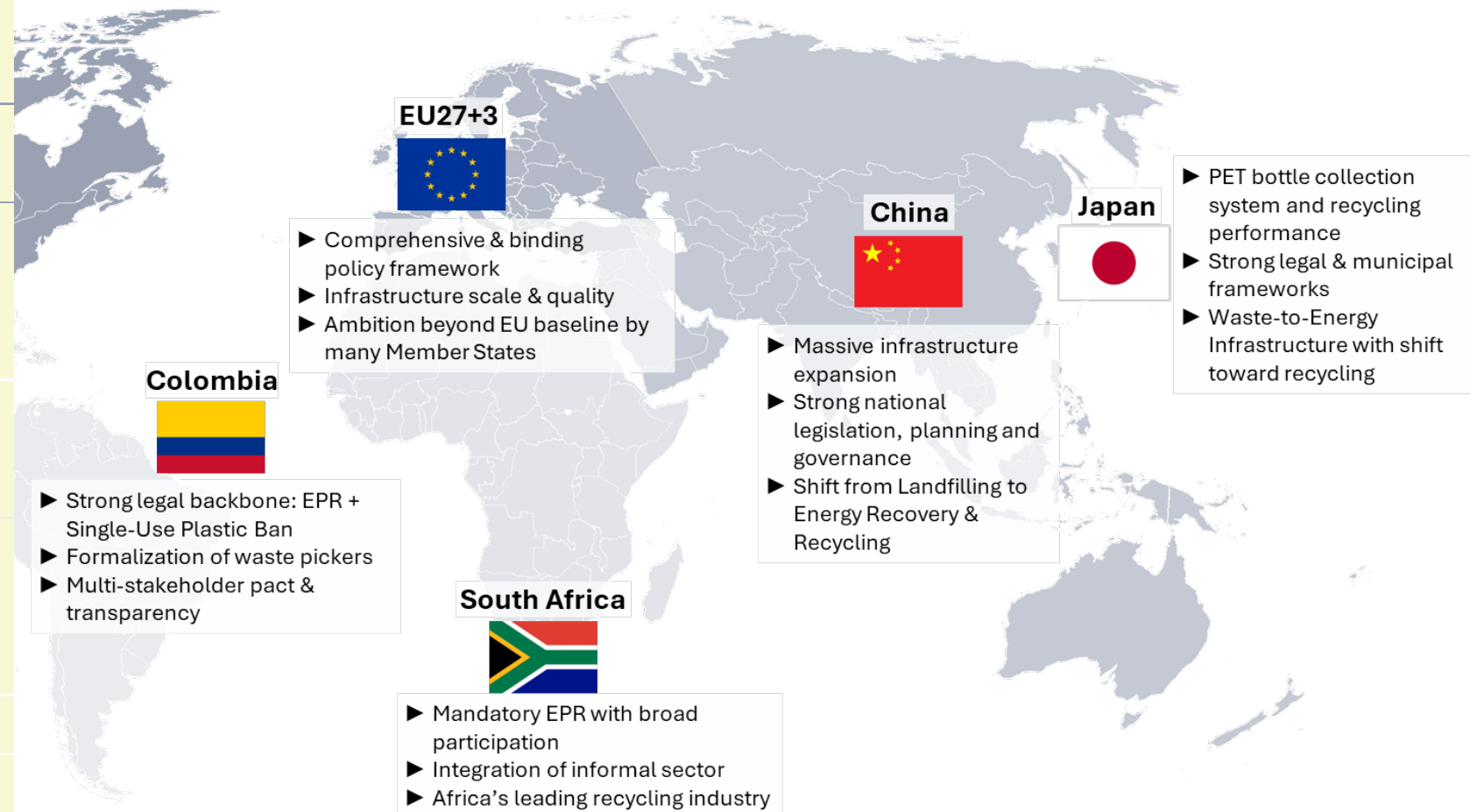


- The total demand for PCR is driven by the legally mandated minimum usage levels for certain sectors and by the industry's organic demand driven by market conditions.
- Considering the current export surplus of ~1,074 kt, the calculations show that, despite a 38% increase in recycling output compared with 2022, there is a total supply gap of -3,506 kt.



# Plastics waste management – best practice examples from around the world

- Establishment of a clear and sustainable policy framework and legislation with clear targets supported by governance and administrative measures.
- Declare recycling and circularity as an important strategic goal.
- Establishment of infrastructure tools such as EPR systems and extensive infrastructures for collection and waste treatment.
- Integration or formalization of the informal sector in low salary countries such as Colombia or India.
- Promoting the **transmission** from mismanaged to managed waste structures, landfills to energy recovery or direct recycling.
- Stimulate the **use of recyclates**.
- Start with **“low-hanging fruits”** such collecting and recycling of PET-bottles.



# Summary and outlook for Europe – 1

## (1) Recycling is stagnating – Significant potential for recycling remains untapped – Stagnation from 2023 to 2025

- ◆ Stagnation or decline between 2023 and 2025, primarily due to low prices for virgin materials
- ◆ Requirements from the recycling industry ...
  - Threat from imports from non-EU countries – market protection and trade controls
  - Financial support for recyclers/reduction in energy prices
  - Market stimulation: Incentives for the use of recycled materials



## (2) Recyclate supply gap by 2030 despite increasing supply of recyclate

The demand for post-consumer recycled materials (PCR) in Europe will not be met by 2030  
 → a **supply gap of about 3,5 Mt** is expected to remain.

## (3) Challenges in collection, sorting and processing, particularly non-packaging waste

There is considerable potential in the separate collection of waste – particularly plastic waste – from household residual waste, the construction and demolition sector, and mixed commercial waste.

## Summary and outlook for Europe – 2

### (4) Chemical recycling

... is an important component but is also unlikely to contribute much more than 10%/15% to recycling in 2030/2025. Only if there is massive investment in large-scale facilities would this proportion increase.

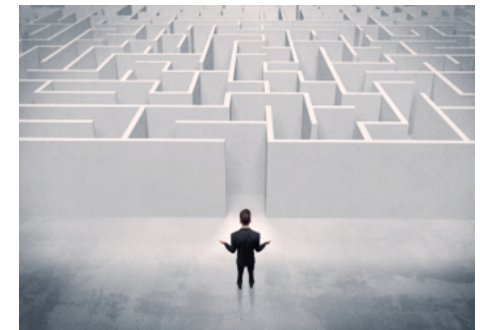
### (5) Meeting the recycled content targets is only partially realistic

The minimum recycling rates set out in the draft EU Packaging Regulation (PPWR) are expected to be met for PET-based food packaging and non-food packaging.

However, there remains a significant supply shortfall which results in a supply gap of 638 kt of PCR for food-contact plastic packaging made from non-PET materials, mainly PE and PP materials

### (6) Outlook

- 2025 and 2026 will be even more challenging transition years
- Expected consolidation in the recycling market
- However, PPWR, ELVR and WEEE regulations, as well as demand from the building & construction sector, will stimulate the market in the medium and long term. But under the current market situation architectural deficits of the regulations hinder a continuous growth.



# EXPERTS ALONG YOUR VALUE CHAIN

**FOR SUSTAINABLE  
BUSINESS SOLUTIONS.**

**Thank you for your attention!**



**CHRISTOPH LINDNER**

Managing Partner (CEO)

**+49 (0) 6021 15067-01**

**[c.lindner@conversio-gmbh.com](mailto:c.lindner@conversio-gmbh.com)**

**[www.conversio-gmbh.com](http://www.conversio-gmbh.com)**