



The Circular Economy for Plastics

A European Analysis

MARCH 2024

About the report

The 2024 edition of this report is a contribution towards a better understanding of the circular economy for plastics, and its evolution over the years. It provides an overview of European plastics production, conversion into products and components, consumption, waste management. It also addresses the different recycling technologies and plastics production from non-fossil based resources, i.e. bio-based and bio-attributed and carbon captured plastics.

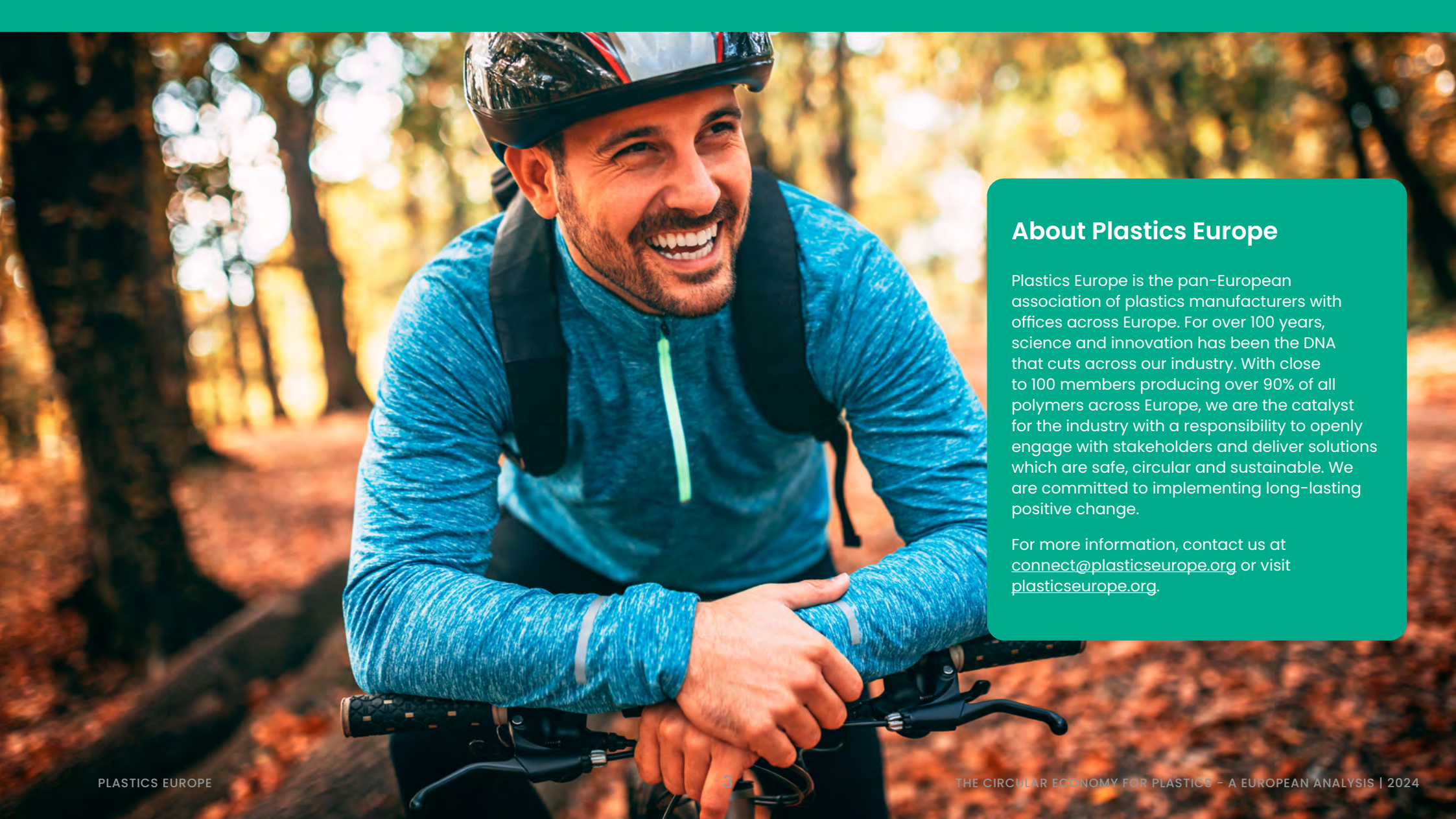
The report shows 2022 estimated data.

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About Plastics Europe

Plastics Europe is the pan-European association of plastics manufacturers with offices across Europe. For over 100 years, science and innovation has been the DNA that cuts across our industry. With close to 100 members producing over 90% of all polymers across Europe, we are the catalyst for the industry with a responsibility to openly engage with stakeholders and deliver solutions which are safe, circular and sustainable. We are committed to implementing long-lasting positive change.

For more information, contact us at connect@plasticseurope.org or visit plasticseurope.org.

Foreword

Our vision is to create a European plastics system that continues to meet society's needs in a sustainable way by reducing waste, resource use and greenhouse gas emissions. To do so, we need to transition from a linear, fossil-fuel based system to a circular plastics economy – and this transformation needs to be accelerated.

Data-driven approach to circularity

“The Circular Economy for Plastics: A European Analysis” provides a European overview of plastics production, conversion, consumption, and waste management. It also addresses the different recycling technologies and plastics production from non-fossil feedstocks.

It is the latest in a series of Plastics Europe initiatives that includes the “Plastics Transition” roadmap and ‘ReShaping Plastics’ report. A red thread that cuts across these is the importance of a data-driven approach to managing the circularity transition.

Our aim is to strengthen and continually update a common circularity dataset to promote dialogue and inform evidence-based decision-making by our members, value chain partners and policy-makers.

I am, therefore, proud of our latest Circular Economy for Plastics report, which is broader in scope and contains more in-depth data than ever before.

Circularity picks up pace but challenges remain

Overall, the findings from the report are encouraging. It confirms the transition to circularity is firmly established and is picking up pace. The use of recycled plastics has increased by 70% since 2018, and circular plastics now make up 13.5% of all plastic resins converted into new products and components in Europe. When benchmarked against our “Plastics Transition” roadmap, the plastics system is more than halfway towards realising the ambition of achieving 25% circular plastics by 2030.

In total, 26.9% of European plastics waste is now recycled, meaning that, for the first time, more plastics waste is recycled than is put into landfill; an important circularity milestone.

The report also reveals that serious barriers and bottlenecks remain and progress is not uniform across the plastics value chain.



Virginia Janssens, Managing Director Plastics Europe

Whereas the packaging, building and construction, and agriculture sectors, for example, are making good progress on the use of recycled plastics, certain sectors, including automotive and electricals and electronics, are falling behind. We are also still incinerating and landfilling too much plastics waste in general, and the rate of incineration is going in the wrong direction – it has increased by 15% since 2018.

We need a massive upscaling of collection and sorting of post-consumer plastics waste, and to increase the availability of biomass and captured carbon, if we are to meet the growing demand for plastics manufactured from circular feedstocks.

Incentivising investment and innovation

We need a harmonised and enforceable EU policy and regulatory framework that enables the transition.

Legislative measures, such as mandatory recycled content targets and design for recycling guidelines, are vital for incentivising investment in waste management infrastructure and recycling technologies and, thereby, increasing circular

feedstock availability. Public authorities should also harness the economic power of public procurement by prioritising circular plastics content in public tenders.

It is frustrating that we still landfill and incinerate so much plastics waste when this potential feedstock is desperately needed by our industry to accelerate the transition. The EU has ambitious legislation in place to reduce landfilling – this needs to be effectively implemented and enforced. Additionally, to rapidly reverse the increase in incineration, mandatory measures to encourage mixed waste sorting should be implemented and incineration included in the revised EU ETS system.

Mechanical recycling (post-consumer) accounted for 13.2%, compared to only 0.1% for chemical recycling, of European plastics production in 2022. Chemical recycling is a complementary solution to mechanical recycling and will enable the full transition to the circularity of plastics. Upcoming EU regulation will have a direct impact on the level of chemical recycling investment and innovation in Europe, and the speed and scale at which it is deployed.

We can no longer overlook the competitive pressures faced by the European plastics sector. Our share of global production decreased from 22%

to 14% between 2006 and 2022. If this continues, Europe will become increasingly dependent on imports, and our ability to invest in circularity will be undermined. Restoring our competitiveness must be a priority.

Deepening value chain and policy-maker collaboration

The European plastics system is too big, complex, and interconnected for any part of it to successfully address these challenges alone. That is why deepening our collaboration with our value chain partners is so important.

To boost this collaboration, we are calling on the European Commission to urgently establish a Clean Transition Dialogue to look at the roadblocks and solutions for creating a competitive circular plastics system in Europe together.

The plastics sector, and our partners, are already driving major advances in circularity. With closer collaboration and the right type of policy-maker support we still have an opportunity to accelerate and lead the transition to a circular plastics economy.



Table of contents

Executive summary	8
European circular economy for plastics in 2022	26
European plastics production	32
European plastics conversion	44
European plastics consumption	60
European plastics waste management	66
European plastics waste management by application	80
Appendix	98

Executive summary




Introduction

Plastics Europe and its members recognise and share societal concerns about the European plastics system's contribution to climate change, the challenge of plastics waste, and the need to ensure the sustainable use of plastics.

Plastics continue to be critical and irreplaceable materials for almost every sector of the European economy, including automotive, construction, packaging, consumer goods, healthcare and renewable energy. They will continue to play a key role in meeting a wide range of functional needs, while enabling circularity and delivering emissions savings for a wide range of sectors.

Plastics Europe's vision is to create a sustainable plastics system that continues to meet consumer and societal demands, supports the transitions of many downstream industries, and remains a strategic asset for the European economy. Realising this vision requires the European plastics system to shift from a linear fossil-fuel based feedstock model to one based on circularity: the circular plastics economy.



The “Circular Economy for Plastics – A European Analysis” report aims to support this transition by increasing all stakeholders’ understanding of the developments and trends within the circular plastics economy. The data it provides is vital for guiding and benchmarking the transition of the plastics industry and wider plastics system against its transition ambitions, and has an important role to play in supporting evidence based policy-making.

The report looks at the production of plastics, their conversion into products and components and their consumption by end-users, as well as plastics waste collection and treatment, including recycling. It also covers the production of recycled plastics and their use in different applications and import and export data. For the first time, the report covers production and conversion of plastics from bio-based feedstock and chemical recycling.

Whilst Plastics Europe supports the role of reuse to achieve circular targets, as most reuse systems will be managed by other actors further in the plastics value chain, and generating accurate data is currently extremely challenging, the report focuses on the circularity of plastics converted into products.

Pathway to a circular plastics economy

The plastics circular economy is a sustainable model where plastics remain in circulation longer; their use is reduced¹, and they are reused and recycled at the end of their life span. It allows to retain the value of plastics waste as a resource, whilst reducing CO₂ emissions and preventing plastics from ending up in landfill, being incinerated or polluting the oceans.

The “ReShaping Plastics” report, published in 2022, confirmed circularity is the fastest, most affordable, effective and reliable method for reducing plastics waste and GHG emissions from the plastics system. Creating a circular plastics economy is also central

to the EU’s Plastics Strategy and is a key element of the EU’s Circular Economy Action Plan and the Green Deal.

Essential to the circular plastics economy is the need to significantly reduce Europe’s dependency on fossil feedstocks, and switch to circular feedstocks. These include recycled plastics waste, sustainably sourced bio-based feedstock, and CO₂ captured from industrial processes.

The transition will also require the plastics system to be redesigned using circular business models, design for recycling, new infrastructure and

technical innovations; as well as major advances in the collection, sorting and recycling of plastics waste, and the energy efficiency of plastics production processes (including through the use of more low carbon and renewable energy).

The complex and inter-connected nature of the plastics system means that the transition to a circular plastics system cannot be achieved without close collaboration with converters, brands, waste collection businesses, recyclers and other value chain actors.

To support this transition, European plastics manufacturers published their “Plastics Transition” roadmap in 2023 (called “roadmap”). The roadmap establishes a pathway to reduce greenhouse gas emissions from the overall plastics system by 28% by 2030 and towards net-zero by 2050. In parallel, it predicts the gradual substitution of fossil-based plastics, and that circular plastics could meet 25% of European demand in 2030 and 65% by 2050. Cumulated additional investments and operational costs to reach these ambitions are projected to be at least €235 billion.

The roadmap identifies the key levers and enablers, and details the immediate, short, and medium-term milestones and actions, for plastics manufacturers, policy-makers and the wider value chain, for accelerating the transition to a circular plastics economy.

“The Plastics Transition”
roadmap

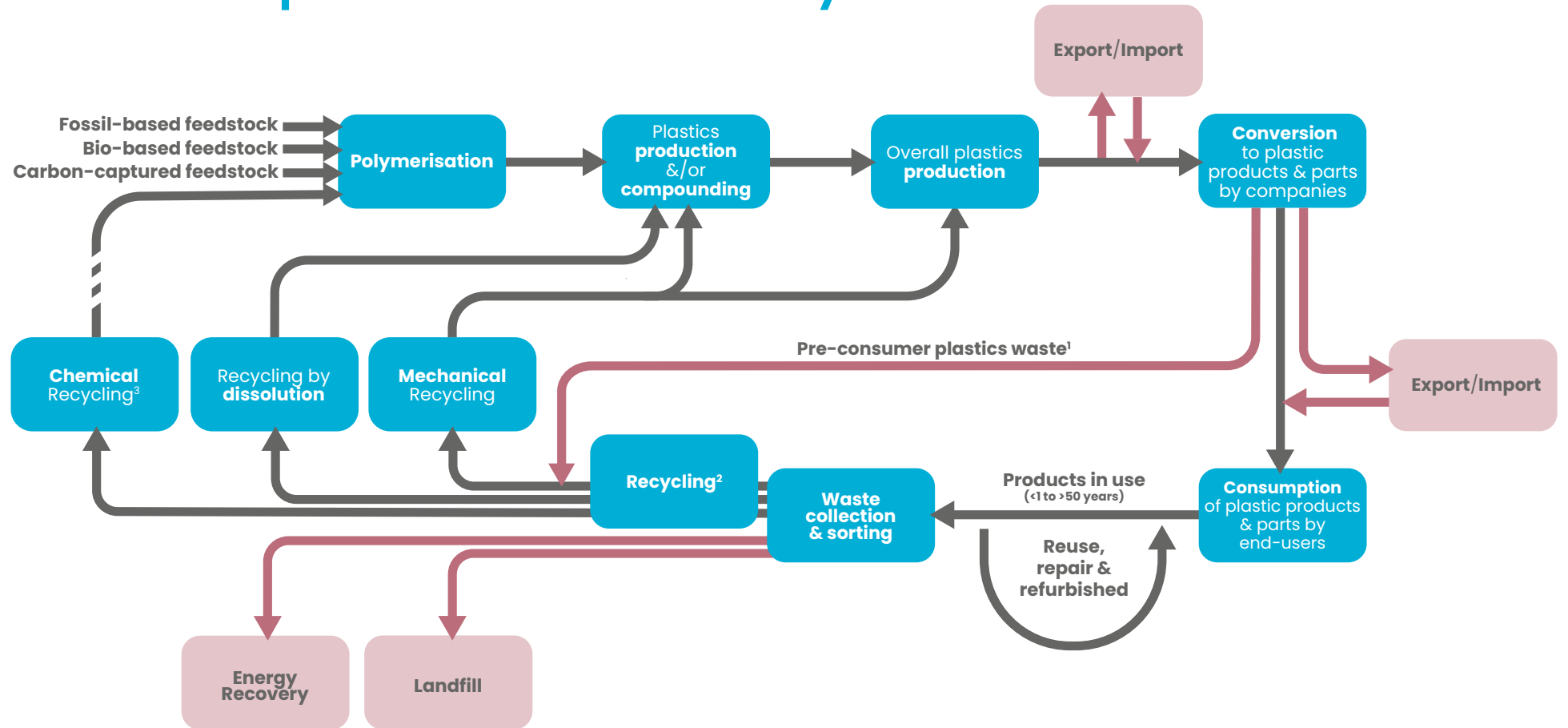


Case studies to
increase circularity



¹ It is important that any consideration of reductions of plastics applications is science-based, material neutral and considers the role of these applications. Any such measures must be accompanied by a clear impact assessment, that includes all environmental indicators (including environmental footprint, water consumption, land use, etc.).

Circular plastics economy



Executive summary

1. Pre-consumer plastics waste is mainly originating from the plastics conversion activities, and production to a lesser extent.

2. Including recycling of EU27+3 plastics waste abroad.

3. Several steps are needed between the input of plastics waste into chemical recycling and the input into polymerisation, also depending on the chemical recycling technology.

Key report figures

Since 2018,
the use of post-consumer
recycled plastics
increased by
+70%
reaching 6.8 Mt.

Circular plastics content
in new products was
13.5%¹
in 2022 (7.3 Mt).

Plastics recycling
rate reached
26.9%².

Plastics waste
incineration
with energy recovery
increased by
+15%³
since 2018, reaching 16 Mt.

Almost
25%
of plastics waste is
still sent to landfill.

Europe's share of global
plastics production
dropped from
22% in 2006 to
14% in 2022.

1. This number excludes pre-consumer recycled plastics content (pre-consumer recycled plastics means recycled plastics from waste arising from the plastics production and converting processes). The "Plastics Transition" roadmap defines 'circular plastics' as an overarching term including post-consumer recycled plastics, plastics from bio-based feedstock, and from carbon-capture. To measure progress towards the 25% and 65% circular plastics content ambitions by 2030 and 2050 set in the roadmap, pre-consumer is excluded.
2. Recycled quantities were previously measured upon leaving the sorting centres. The measurement is now done when the recycling actually takes place, according to the Packaging and Packaging Waste Directive (PPWD) (EU) 2018/852. The calculation point therefore lies after impurities and unsuitable substances have been removed from the sorted materials.
3. The vast majority of plastic waste incineration in the EU27+3 is with energy recovery.



Key report findings

The report confirms that the **transition towards higher circularity increased significantly** between 2018 and 2022.

The availability of post-consumer **recycled content has**, for example, **increased by 70%** since 2018 (6.8 Mt in 2022), and **circular plastics now make up 13.5%¹ (7.3 Mt) of all plastic resins converted into new products** and components in Europe. The plastics sector is more than halfway towards realising the roadmap ambition of 25% circular plastics by 2030.

The report also found that the **recycling rate reached 26.9%² in 2022** (8.7 Mt), and for the first time more plastics waste is being recycled than put in landfill. Although this is an important circularity milestone, further investment in sorting and recycling infrastructure and technologies, including chemical recycling, are required to increase the recycling rate and ensure that the demand for recycled content can be met.

However, despite the overall progress, **the report identifies issues and challenges that need to be addressed.**

Incineration³ has, for example, **increased by more than 15%** since 2018 (16 Mt in 2022), and **about 25% of plastics waste is still sent to landfill** (7.6 Mt in 2022). The report also confirms the growing competitiveness gap between Europe and the rest of the world which, unless addressed, will undermine the transition to a circular plastics economy.

1. This number excludes pre-consumer recycled plastics content (pre-consumer recycled plastics means recycled plastics from waste arising from the plastics production and converting processes). The "Plastics Transition" roadmap defines 'circular plastics' as an overarching term including post-consumer recycled plastics, plastics from bio-based feedstock, and from carbon-capture. To measure progress towards the 25% and 65% circular plastics content ambitions by 2030 and 2050 set in the roadmap, pre-consumer is excluded.
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3. The vast majority of plastics waste incineration in the EU27+3 is with energy recovery.

Significant advances in circularity but challenges remain

Circular plastics production

Circular plastics production in Europe continues to increase and represented 14.3%¹ of European plastics production in 2022. 'Circular plastics' is an overarching term that includes recycled plastics, plastics from bio-based feedstock, as well as plastics derived from carbon capture.

Recycled plastics

Plastics production via mechanical recycling has increased by more than 57% since 2018 (7.7 Mt in 2022).

Although chemical recycling is a complementary recycling solution and a key building block of the circular plastics economy, it currently accounts for only 0.1% of European plastics production (~0.1 Mt).

Further increase of plastics production via mechanical and chemical recycling requires policy measures that stimulate demand for recycled plastics content and major investments in waste management infrastructure and all recycling technologies.

Plastics Europe member companies have already announced investments of more than 8 billion euros in chemical recycling projects to produce 2.8 Mt of recycled plastics per annum by 2030.



¹ This number excludes pre-consumer recycled plastics production (pre-consumer plastics waste recycling means recycling of waste arising from the plastics production and converting processes). The "Plastics Transition" roadmap defines 'circular plastics' as an overarching term including post-consumer recycled plastics, plastics from bio-based feedstock, and from carbon-capture, and excluding pre-consumer recycled plastics.



Plastics from bio-based feedstock

Biomass used as feedstock for plastics production can significantly reduce CO₂ emissions and, in applications with long life cycles, can even serve as a form of carbon storage. This biomass can either be generated from primary sources (e.g. crops) or secondary (e.g. organic waste such as compost or cooking oils, crop and farm residues, animal fats, forestry waste and sewage sludge).

Whilst production of plastics from bio-based feedstock still accounts for only 1% of the plastics produced in Europe, bio-based feedstock availability is steadily increasing and plastics production from bio-based feedstock has significant growth potential.

Carbon Capture and Usage (CCU):

The use of captured carbon to manufacture plastics can prevent CO₂ from being emitted during the plastics production process.

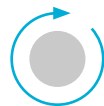
Despite its potential, CCU based plastics production in Europe remains negligible. This confirms the importance of providing support for CCU-related investment, research and innovation if the potential of this circular feedstock is to be realised.

Circularity in new plastic products

Data measuring the proportion of circular plastics converted into products and components is an important benchmark of the development of the circular economy for plastics and will be used to assess progress towards the 25% (by 2030) and 65% (by 2050) circular content ambitions set out in roadmap.

In 2022, circular plastics content, as defined in the roadmap reached 13.5%¹ of converted plastics (of which 12.6% of post-consumer recycled plastics and 0.9% of plastics from bio-based feedstock). This figure highlights the significant effort still required to meet the roadmap's 2030 ambition.

The process of turning plastic resins into plastic products or components is called "conversion". In 2022, the biggest markets for converted plastics in the EU27+3 were packaging, building and construction, and automotive.



Circular plastics content
in new products was

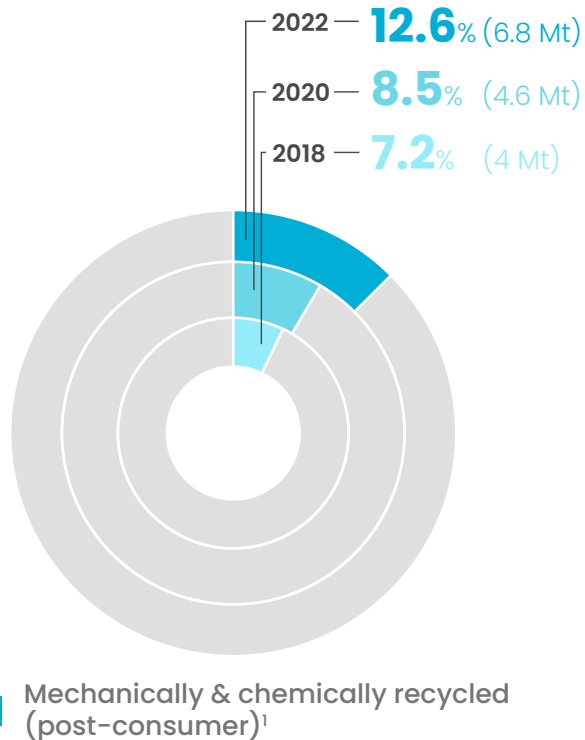
13.5%

in 2022 (7.3 Mt).



¹ This number excludes pre-consumer recycled plastics content (pre-consumer recycled plastics means recycled plastics from waste arising from the plastics production and converting processes). The "Plastics Transition" roadmap defines 'circular plastics' as an overarching term including post-consumer recycled plastics, plastics from bio-based feedstock, and from carbon-capture. To measure progress towards the 25% and 65% circular plastics content ambitions by 2030 and 2050 set in the roadmap, pre-consumer is excluded.

Post-consumer recycled content in new products



Since 2018,
the use of post-consumer recycled plastics
increased by
+70%
reaching 6.8 Mt.

The report also gives an overview of the recycled content state-of-play, enabling to assess progress towards future mandatory recycled content targets².

In 2022, post-consumer recycled plastics represented 12.6% of converted plastics in Europe (or 6.8 Mt). This represents a 70% recycled content increase since 2018.

In terms of recycled content rates, some sectors, such as packaging (9.7%), building and construction (22.7%) and agriculture (37.5%), are more advanced compared to others, such as automotive (4.6%) and electricals and electronics (3.2%). To encourage the rapid transition of all markets, Plastics Europe supports legislative measures that set ambitious targets for the different sectors.

The report also shows that the proportion of plastics from bio-based feedstock in converted plastics remains low: 0.9% (0.5 Mt).

1. For data availability reasons, mechanically and chemically recycled plastics data (post-consumer) cannot be shown separately. Chemically recycled plastics represent a small share of the total post-consumer recycled plastics.
2. For example, in the context of the Packaging and Packaging Waste Regulation, or the End-of-Life Vehicles Directive revision.

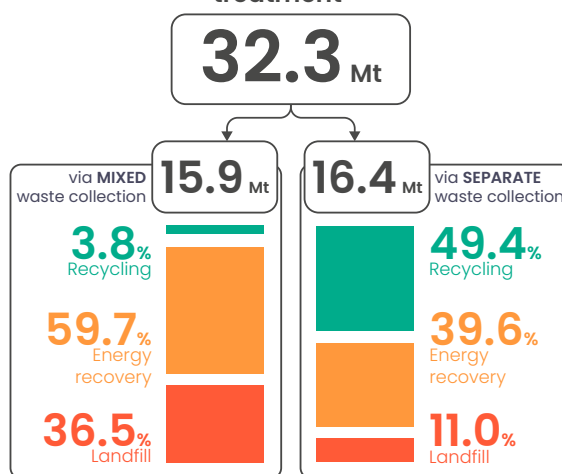
Plastics waste sorting and recycling

It is estimated that 32.3 Mt of post-consumer plastics waste¹ was collected in 2022.

The report shows that, for the first time, the share of post-consumer plastics waste collected separately is slightly higher compared to mixed collection streams, reaching 50.7% (16.4 Mt). This is a positive development since recycling rates for separately collected plastics are 13 times higher than those collected via mixed streams. In the case of plastics packaging, post-consumer waste is currently almost only recycled if collected separately.

For the first time, more post-consumer plastics waste is being recycled than sent to landfill, accounting for 26.9%² (8.7 Mt) of waste treated in 2022.

Post-consumer plastics waste collection and treatment



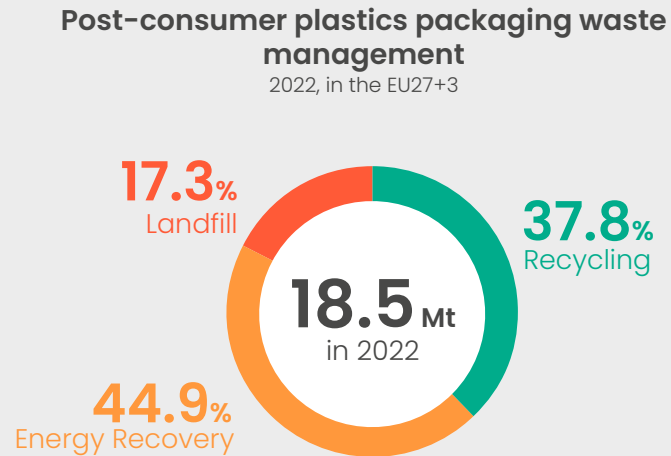
Plastics recycling rate reached **26.9%**.

“Separate collection” means separation of waste by end-users into different collection containers to facilitate recycling.

1. Post-consumer plastics waste: waste generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain or the installation of plastic products (e.g. cut-offs of insulation, flooring or wall-covering boards).
 2. Recycled quantities were previously measured upon leaving the sorting centres. The measurement is now done when the recycling actually takes place, according to the Packaging and Packaging Waste Directive (PPWD) (EU) 2018/852. The calculation point therefore lies after impurities and unsuitable substances have been removed from the sorted materials.

PACKAGING

For plastics packaging waste, the recycling rate reached 37.8% in 2022¹ (7 Mt) . This rate will need to improve even further within the next 3 years to reach the 2018 Packaging and Packaging Waste Directive² targets of 50% by 2025, and stay on track for 55% by 2030.



To maximise recycling rates we need to significantly increase investment in sorting and recycling capacities, including in chemical recycling.

Extended Producer Responsibility (EPR) schemes to increase separate waste collection and other mandatory measures to incentivise mixed waste sorting³ will be very important. Fostering market demand for circular plastics resins can also play a vital role in encouraging the necessary investment.

Chemical recycling, as a complement to mechanical recycling, is essential to maximising the resource potential of plastics waste currently being sent to landfill and incineration. The transition to a plastics circular economy cannot be achieved without a continent-wide roll-out chemical recycling technology.

1. Recycled quantities were previously measured when they were sent to recyclers. The measurement now takes place at the final step of the recycling process, according to the Packaging and Packaging Waste Directive (PPWD) (EU) 2018/852. The calculation point therefore lies after sorting and post-sorting, when plastics waste enters a recycling process.
2. Directive (EU) 2018/852.
3. Mixed waste sorting of residual municipal waste is defined as the sorting system to recover recyclable materials that would otherwise be sent to landfill or incineration.

Incineration and landfilling of plastics waste

In addition to the negative environmental impact, incineration¹ and landfilling of plastics waste results in the loss of a valuable raw material and key circular feedstock for the plastics system transition.

The report found that the quantity of post-consumer plastics waste sent for incineration is not going in the right direction; with an increase of over 15% since 2018.

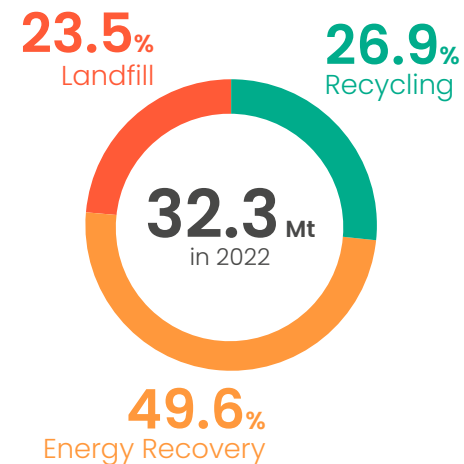
On the other hand, landfill of post-consumer plastics waste maintains its decreasing trend (-6% since 2018). Although a move in the right direction, landfill nonetheless continued to account for close to 25% of plastics waste treatment in 2022. Despite the Landfill Directive imposing a ban on landfilling of separately collected waste by 2030, 11% of it is still landfilled in 2022.

2018–2022 evolution



Post-consumer plastics waste treatment

2022, in the EU27+3



1. The vast majority of plastics waste incineration in the EU27+3 is with energy recovery.

Weakening European competitiveness: a threat to the transition

The report findings should be considered against the backdrop of a growing competitiveness gap between Europe and the rest of the world. Europe's share of global plastics production decreased from 22% in 2006 (53.9 Mt) – when Plastics Europe began tracking global production data – to 14% in 2022 (58.8 Mt), with China, North America and the Middle East accounting for 32%, 17%, and 9% respectively.

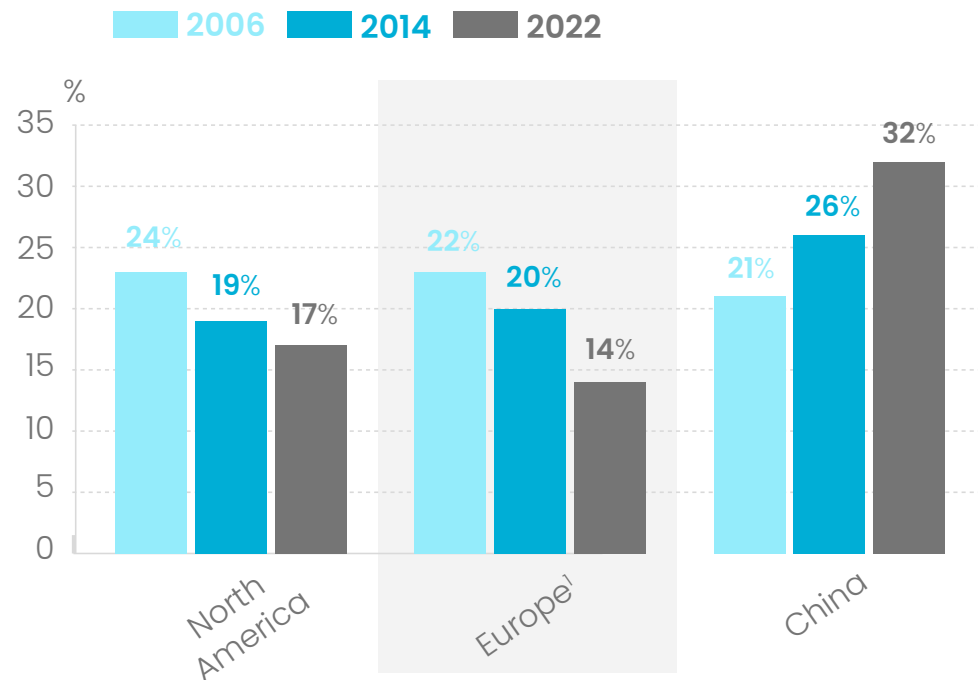
If this continues, Europe will become increasingly dependent on imports which do not necessarily meet EU sustainability standards, and the ability of European plastics producers to invest in circularity, and the transitions of the many sectors that rely on plastics, will be undermined. It is essential that the competitiveness of the European plastics sector is restored.

Click or scan here to access more detailed World production data.



"Plastics – the *fast* Facts 2023".

Europe in the global production



1. EU25+2 in 2006, EU28+2 in 2014, EU27+3 in 2022.

Intensifying policy-maker and plastics value chain collaboration

Plastics Europe's members are already driving major advances in the circularity of their operations, including investing in cutting-edge recycling technologies, renewable energy and producing more plastics from biomass and CO₂. They are also working closely with their value chain partners to deliver new systems thinking, higher performing products, eco-design innovation and new infrastructure.

The roadmap prioritises what the industry, as plastics producers, can do to further accelerate this transition, but also provides recommendations to policy-makers as to how they can support the transition through the creation of an enabling policy and regulatory framework:

- **Incentivising circular plastics production and conversion:** increasing the availability of circular feedstock for plastics production and setting minimum mandatory circular content targets in new plastics products is essential for incentivising investment and innovation, and key in sectors such as automotive and electrical and electronics.



- **Chemical recycling:** to unlock investments and stimulate innovation, policy-makers need to give a green light to this essential technology. To do so they should, for example, adopt a Mass Balance attribution method¹ (as already used in sectors like renewable energy and wood, and for fair trade cocoa and chocolate) for calculating chemically recycled content in new plastic products, and introducing more ambitious recycled content targets for sensitive applications.
- **Phase-out of landfill and incineration:** to accelerate this process, whilst avoiding the shifting of plastics waste from landfill to incineration, existing EU legislation, including the Landfill Directive, needs to be properly implemented and enforced. Minimum and steadily increasing landfill and incineration taxes should be introduced on all waste streams containing plastics, and mandatory measures to incentivise mixed waste sorting should be implemented. Municipal waste

incineration should also be included in the revised EU ETS system, the potential of chemical recycling as an alternative to landfilling and incineration should be properly recognised and carbon capture should be obligatory for remaining waste incinerators after 2040.

- **European competitiveness:** a level playing field needs to be urgently created to restore the plastics sector's competitiveness through, for example, the development of a comprehensive EU equivalent to the US Inflation Reduction Act, and the creation of a harmonised and consistent regulatory framework across the EU Single Market.
- **Public procurement:** considering its economic importance, it can play a crucial role in promoting circularity by, for instance, prioritising circular plastics content in public tenders.

- **Waste management and recycling:** incentivising the massive additional investments in separate collection, sorting and recycling infrastructure and technologies that are required is vital. More specifically, separate plastics waste collection needs to be significantly increased through, for example, Extended Producer Responsibility schemes, and mandatory measures to incentivise mixed waste sorting as a complementary solution to separate collection of plastics waste.

Collaboration between all actors within the European plastics system, and with policy-makers and regulators, needs to be intensified. To support this objective, the European Commission should urgently initiate a Clean Transition Dialogue with the plastics industry, which looks at the enablers, investments, roadblocks and solutions for reaching a circular, net zero and sustainable plastics system in Europe.

1. Plastics Europe supports a fuel-use exempt Mass Balance attribution model because it would provide for a robust system, which is viable with chemical recycling routes, and will allow producers and users of recycled content to reach the levels expected by the market and required by EU legislation in a timely manner.

European circular economy for plastics in 2022



Introduction to the 'Circular Economy for Plastics' 2024 report

Plastics are strategically important for the European economy, with applications in almost every sector, including automotive, construction, packaging, consumer goods, healthcare and renewable energy. They continue to be an irreplaceable material for many products, components and industries. Characteristics of plastics like lightness, durability, flexibility, customisability and recyclability enable many sectors to continue to offer high performance while enabling their own transitions to a circular, net-zero economy.

However, Plastics Europe and its members also recognise and share societal concerns about the contribution of the plastics system to climate change and the challenge of plastics waste. That's why the industry's vision is to create a sustainable plastics system that continues to meet consumer and societal demands by transitioning from a linear fossil-fuel based feedstock model to a circular plastics economy.

The 'ReShaping Plastics' report, published in 2022, confirmed circularity as the fastest, most affordable, effective and reliable method for reducing plastics waste and GHG emissions from the plastics system.

To support this transition, European plastics manufacturers published their "Plastics Transition" Roadmap in 2023 which establishes a pathway to reduce greenhouse gas emissions from the overall plastics system by 28% by 2030 and towards net-zero by 2050.

The 'Circular Economy for Plastics – A European Analysis' is the latest in a series of reports that provide an overview of the European circular economy for plastics. It is based on the «Plastics Circular Economy 2022 in the EU27+3» study that was commissioned by Plastics Europe and carried out by Conversio Market & Strategy GmbH, in partnership with the nova-Institute.

The report aims to support the circular plastics economy transition by increasing all stakeholders' understanding of the development of, and trends within, the circular plastics economy. The data it provides, for period 2018–2022, is vital for benchmarking and guiding the transition of the plastics industry and wider plastics system against its transition ambitions. It also has an important role to play in promoting dialogue and supporting evidence based policy-making.

It looks at the production of plastics, their conversion into products and components, plastics consumption trends, as well as plastics waste collection and treatment, including recycling. It also covers the production of recycled plastics and their use in different applications.

As with previous Circular Economy reports it covers some of the following key data-points:

- How plastics production and the use of fossil-based and circular plastics feedstocks (recycled plastics, biomass and captured carbon) evolved since 2018.
- The conversion of circular plastics content into components and applications, including the evolution of post-consumer recycled content, since 2018.
- How plastics consumption has changed across all and specific end-user markets since 2018, and details whether Europe is a net importer or exporter in relation to these markets.

- Examining waste collection and treatment (recycling, energy recovery and landfill) by plastics applications and by country (EU27+3).
- Looks at how Europe's share of global plastics production has evolved since 2006, including data on key competitor markets.

For the first time, the report covers production and conversion of plastics from bio-based feedstock, and chemical recycling. It does not however cover other aspects of circularity such as repair, reuse or organic recycling, primarily due to the difficulty of generating accurate data in these areas.

To help build understanding of what is a complex topic, the report contains more illustrations and 'educational' pages than previous editions. The topics addressed include the 'Circular Plastics Economy' and 'Circular feedstocks', revised recycling calculation methodology, and the use of different polymers for different products.



Introduction to the circular economy for plastics

The plastics circular economy is a system capturing the value of plastics as a resource, preventing it from ending up in landfill, being incinerated, or polluting our oceans while having a positive impact on people and planet. Circularity is also one of the fastest, most affordable, effective and reliable methods for reducing emissions from the plastics system.

From plastics producers to recyclers, the entire plastics value chain must harness the power of collaboration and innovation to transition the plastics system to circularity.

To do so, a multitude of industry actions need to be taken, ranging from improved plastics waste collection and sorting, and more innovative recycling, to eco-design and the increased use of circular feedstock including biomass and CO₂.

Plastics Europe recognises that faster systemic change is essential to successfully meet the 2050 net-zero and circularity ambitions set in its “Plastics Transition” roadmap. The roadmap proposes a package of measures to help the sector accelerate its transition.

Click or scan to access the “Plastics Transition” roadmap towards 2050, and the dedicated content hub.



The “Plastics Transition”



Content hub

2018–2022 evolution

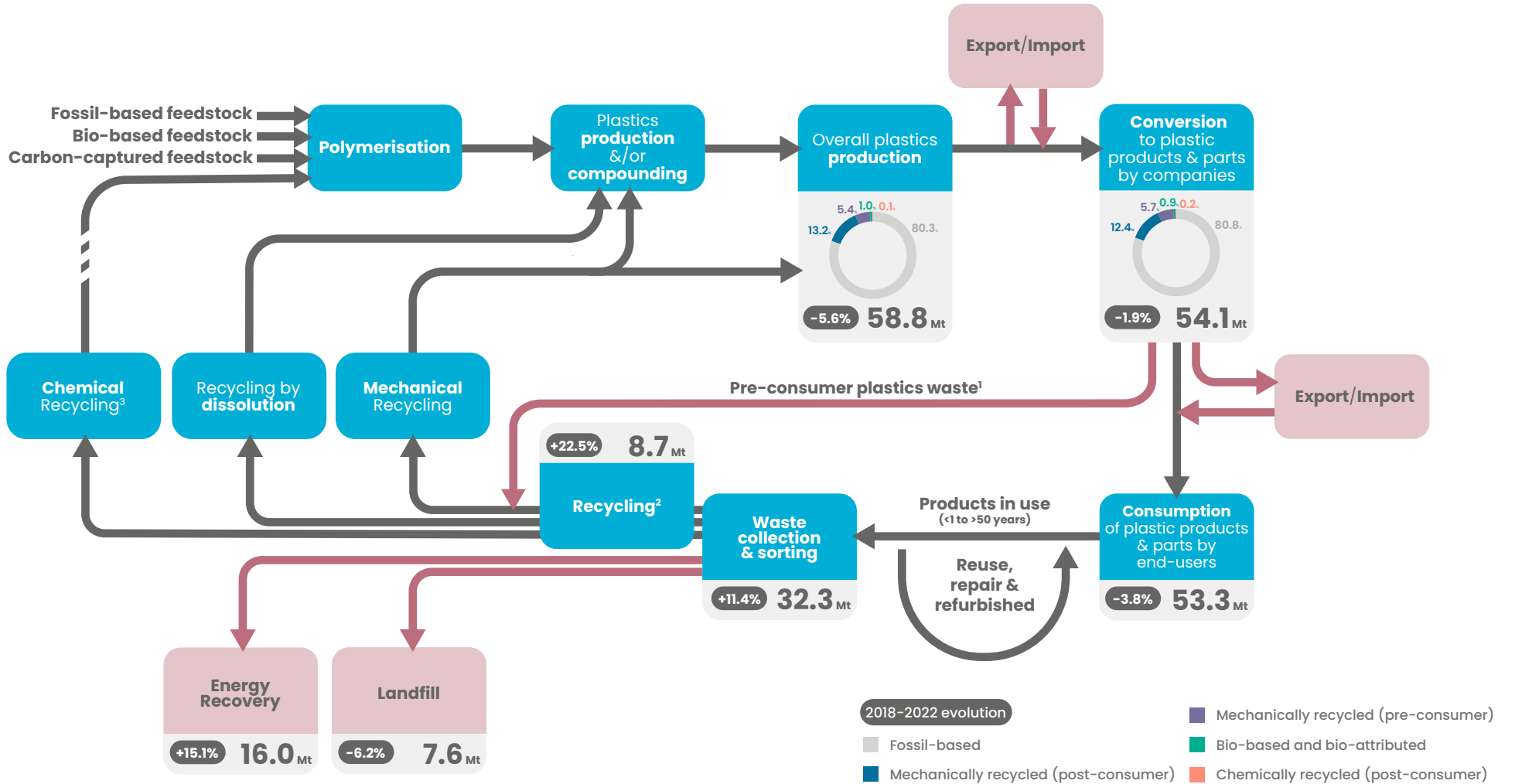
In 2022, the positive trend towards higher circularity continued.

Circular plastics production increased by 30.3% since 2018.

The share of circular plastics in the manufacturing of new products also continued its upward trajectory, reaching 13.5% in 2022 (when benchmarking with the “Plastics Transition” roadmap). Post-consumer recycled plastics content into new products rose from about 4 million tonnes in 2018 to 6.8 million tonnes in 2022 – an increase of 70%.

Recycling of post-consumer plastics waste increased by 22.5% since 2018, and landfill decreased by -6.6%. However, energy recovery increased by 15.1%.

Plastics waste export from the EU27+UK also decreased by 31.2% since 2018.



The above data are rounded estimations.

1. Pre-consumer plastics waste is mainly originating from the plastics conversion activities, and production to a lesser extent.

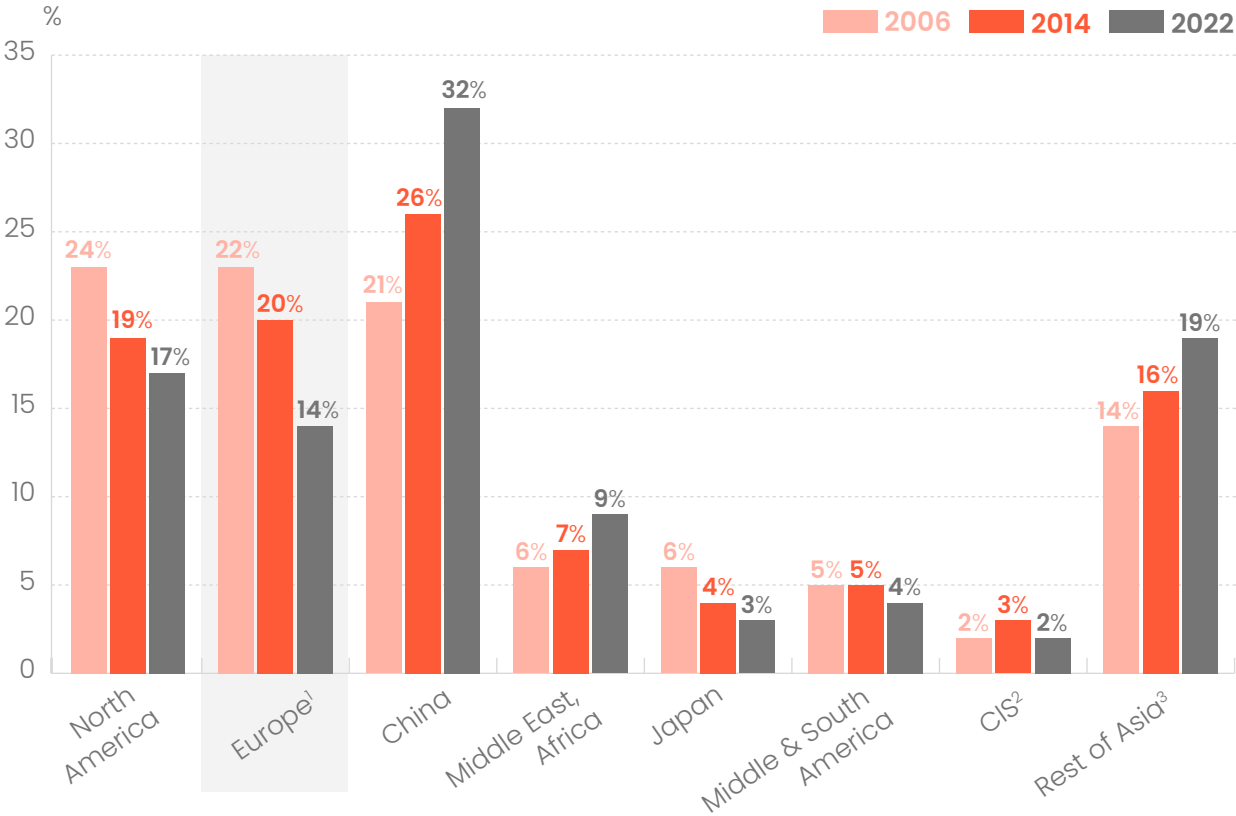
2. Including ~0.8 Mt recycling of EU27+3 plastics waste abroad. For more details, see page 71.

3. Several steps are needed between the input of plastics waste into chemical recycling and the input into polymerisation, also depending on the chemical recycling technology. A more detailed diagram is available on pages 42-43.

European plastics production

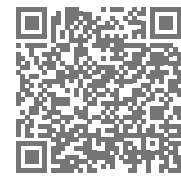


Europe's share of global plastics production



World plastics production reached **400.3** Mt in 2022.

Click or scan here to access more detailed World production data.



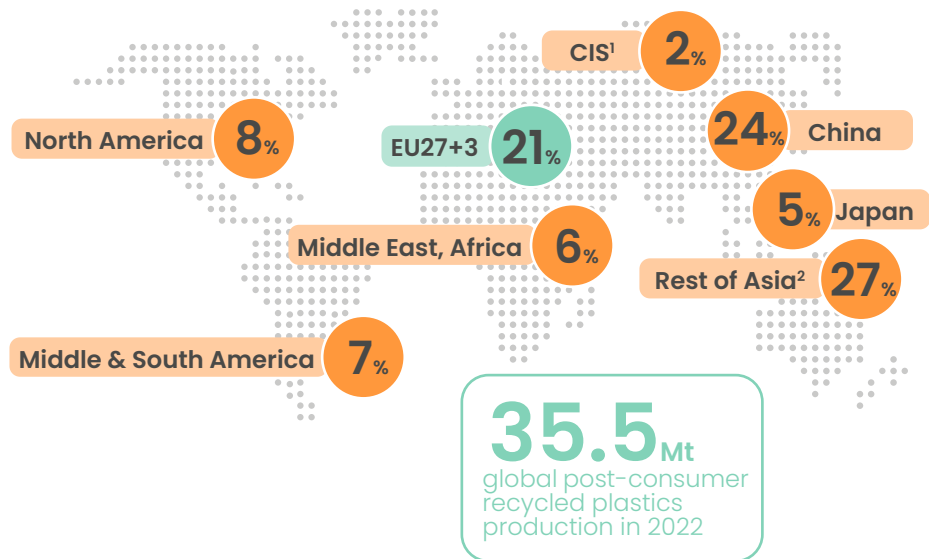
"Plastics - the *fast* Facts 2023".

The above data are rounded estimations.
 1. EU25+2 in 2006, EU28+2 in 2014, EU27+3 in 2022.
 2. Commonwealth of Independent States : Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan and Uzbekistan.
 3. Includes Asian countries (except China & Japan), Oceania, Turkey and Ukraine.

Europe's share of global circular plastics production

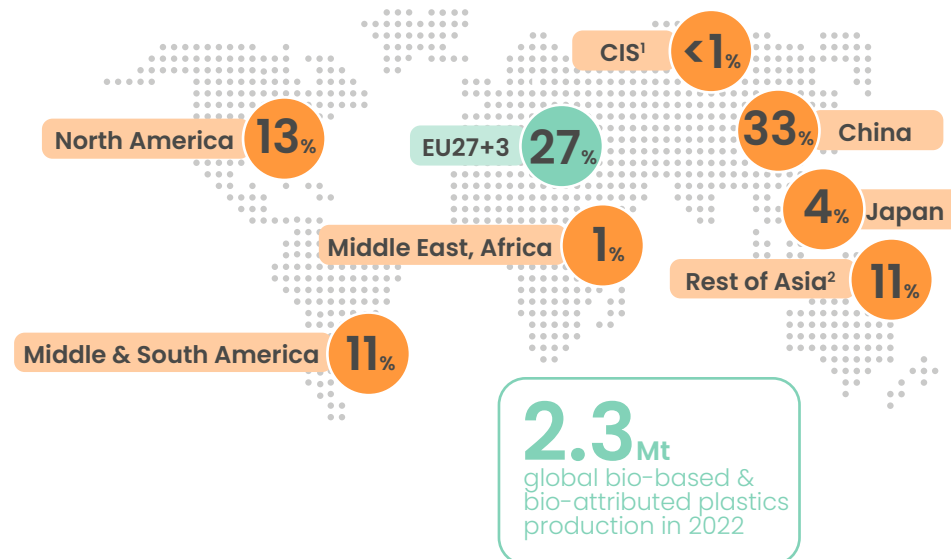
Post-consumer recycled plastics production (mechanical & chemical)

2022, by regions of the world



Bio-based & bio-attributed plastics production

2022, by regions of the world



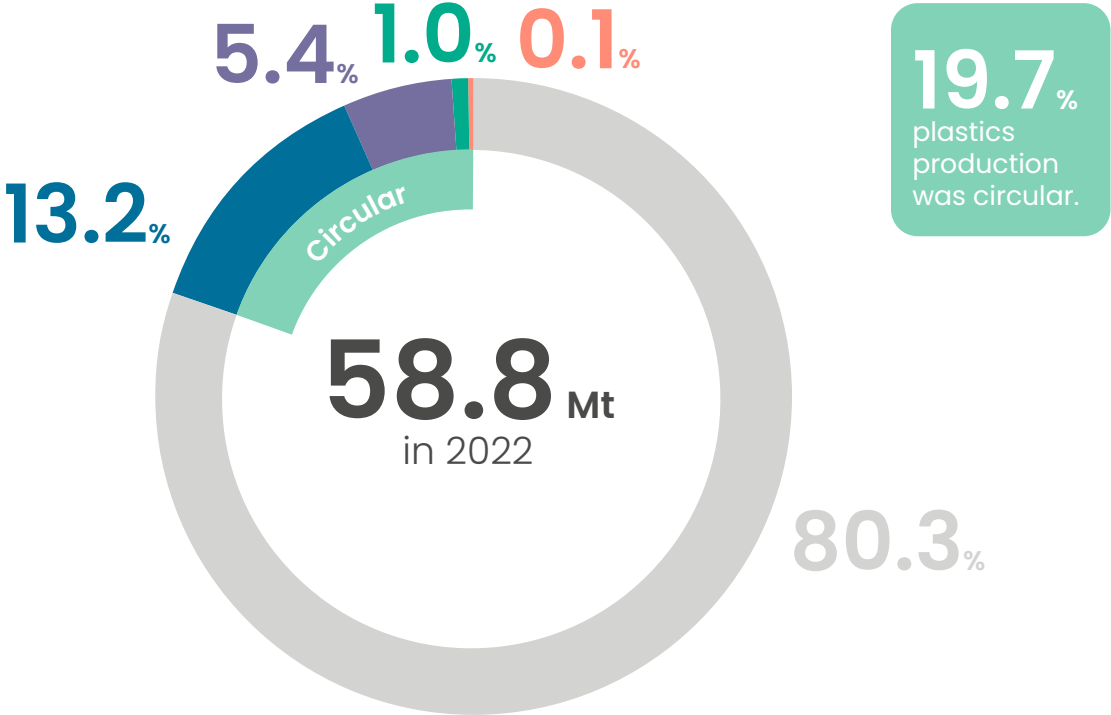
The above data are rounded estimations.

1. Commonwealth of Independent States : Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan and Uzbekistan.

2. Includes Asian countries (except China & Japan), Oceania, Turkey and Ukraine.

European circular plastics production

In 2022, European production of circular plastics reached 11.7 Mt. This accounted for 19.7% of European plastics production in 2022.



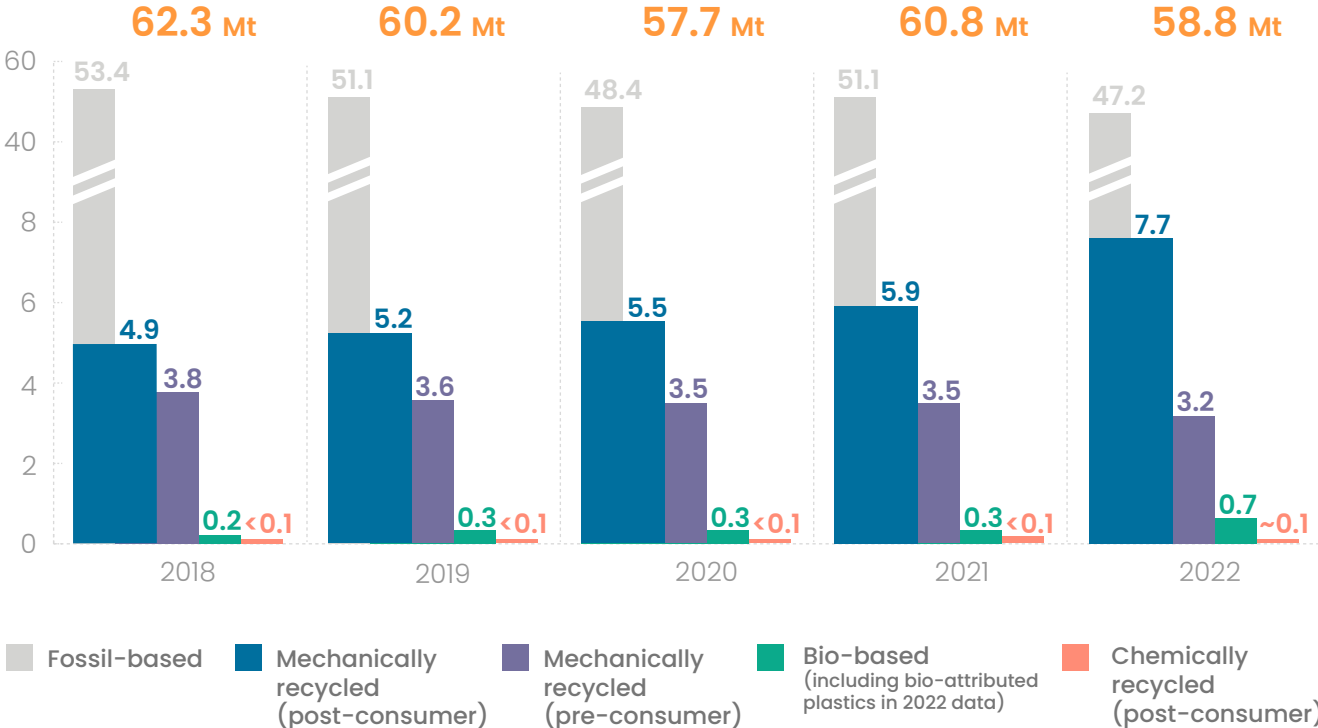
- Fossil-based
- Mechanically recycled (post-consumer)
- Mechanically recycled (pre-consumer)
- Bio-based and bio-attributed
- Chemically recycled (post-consumer)

European plastics production evolution

2018-2022 evolution

Total production	-5.6%
Fossil-based	-11.6%
Circular	+30.3%
Mechanically-recycled (post-consumer)	+57.1%
Chemically recycled (post-consumer)	+300%
Mechanically recycled (pre-consumer)	-15.8%
Bio-based (bio-attributed plastics not included)	+100%

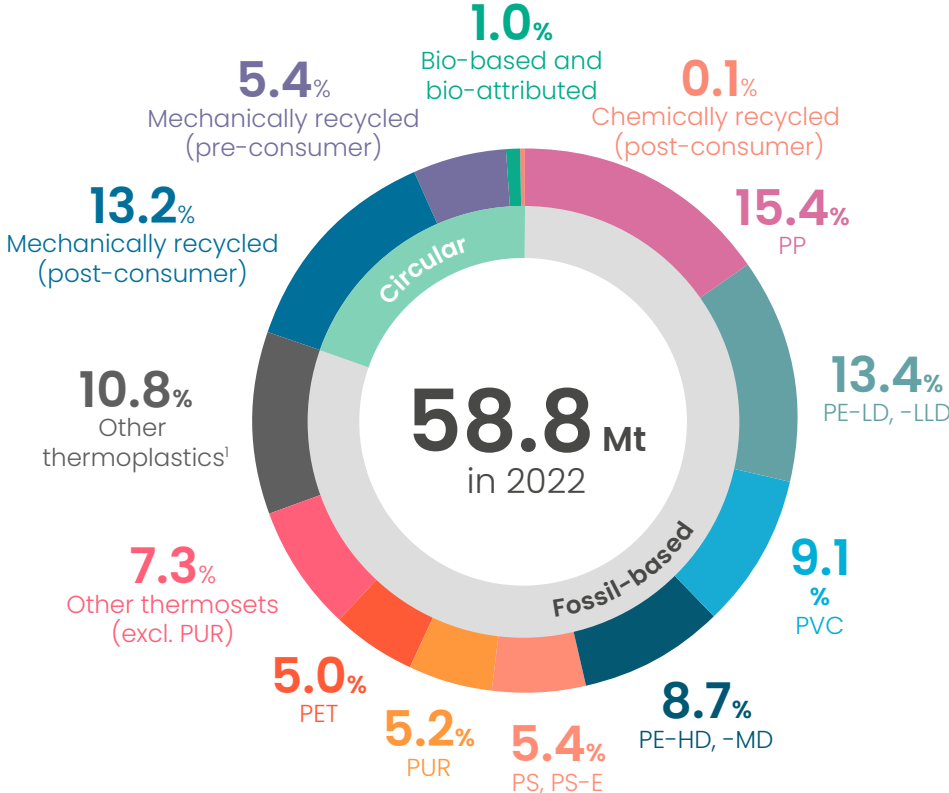
In 2022, circular plastics production increased by over 30% despite total plastics production falling by more than 5%.



The above data are rounded estimations.

European plastics production by polymer

In 2022, polypropylene (PP) and polyethylene (PE) continued to represent a significant share of European plastics production, with a share around 37%.



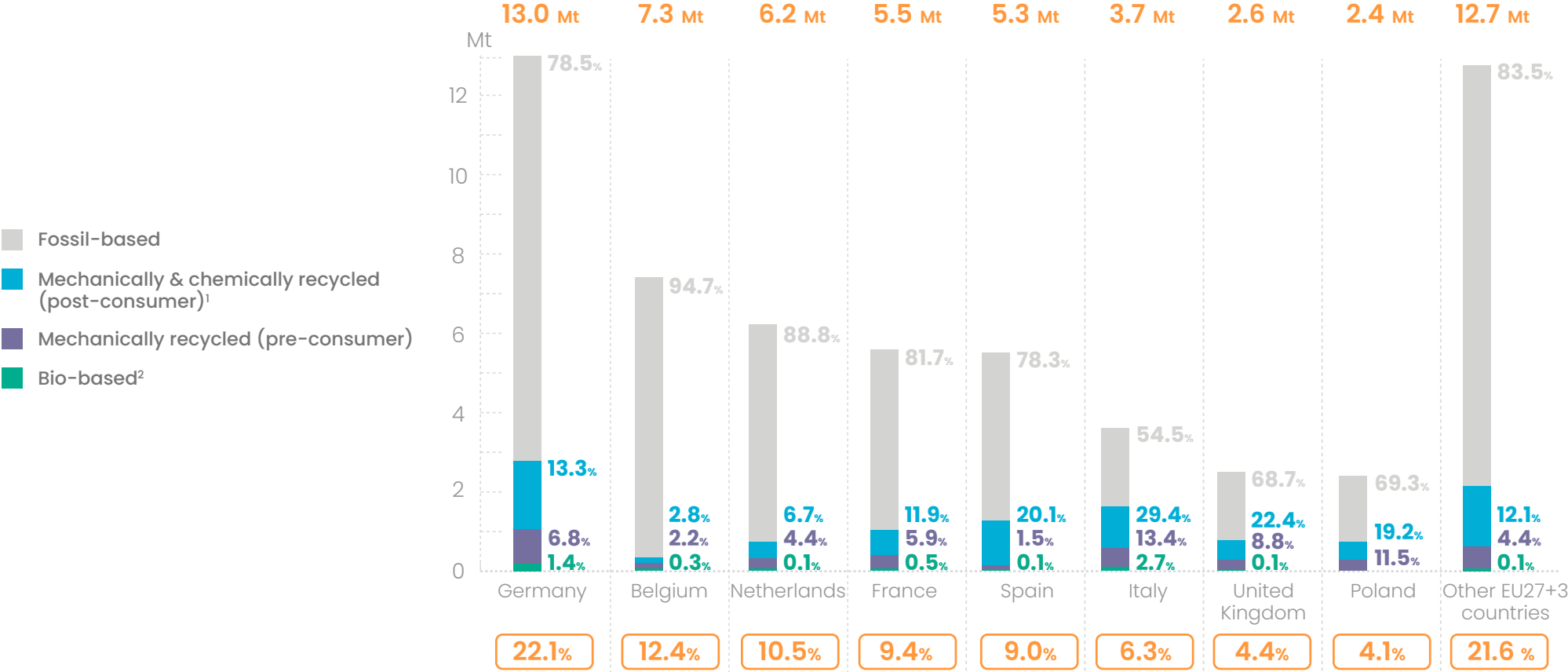
Click or scan here to find out more about European plastics production.



"Plastics - the fast Facts 2023"

The above data are rounded estimations. For data availability reasons, the polymer breakdown for circular plastics cannot be shown.

European plastics production by country



The above data are rounded estimations.
 1. For data availability reasons, mechanically and chemically recycled plastics data (post-consumer) cannot be shown separately.
 2. For data availability reasons, bio-attributed plastics are not included in the country data.

Feedstock of the future

To reach its own circularity and net-zero ambitions by 2050, the European plastics industry needs to significantly reduce its dependency on fossil-based feedstock, and switch to circular feedstock (i.e. recycled feedstock, bio-based feedstock or carbon-captured feedstock).

The Plastics Europe's "Plastics Transition" roadmap projects, in terms of circularity, that the substitution of fossil-based plastics will be gradual and could reach 25% in 2030 and 65% by 2050.

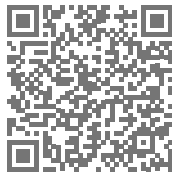
Investments in recycling capacities and technologies are needed to increase the quantity and quality of recycled plastics. Today, mechanical recycling is the recycling process that provides the highest quantities of recycled plastics. To accelerate circularity, this technology needs to be further enhanced. To complement it, different chemical recycling technologies have been developed and are currently being used at smaller scale, while awaiting the necessary legislation to unlock investments. Recycled feedstock can also be obtained via dissolution techniques.

Bio-based feedstock, although currently still accounting for a small percentage of plastics production, are increasingly available and have a

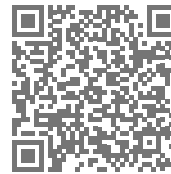
significant growth potential. Bio-based feedstock can either be generated from primary (e.g. crops) or secondary sources (e.g. organic waste such as compost or cooking oils; crop and farm residues; animal fats, forestry waste and sewage sludge). When sustainably sourced and managed, they can contribute to an efficient use of resources and to a reduction of GHG emissions.

Carbon Capture and Use (CCU) is also a promising technology, supported by the plastics industry, to create new feedstock while capturing CO₂ emissions and preventing their release into the environment.

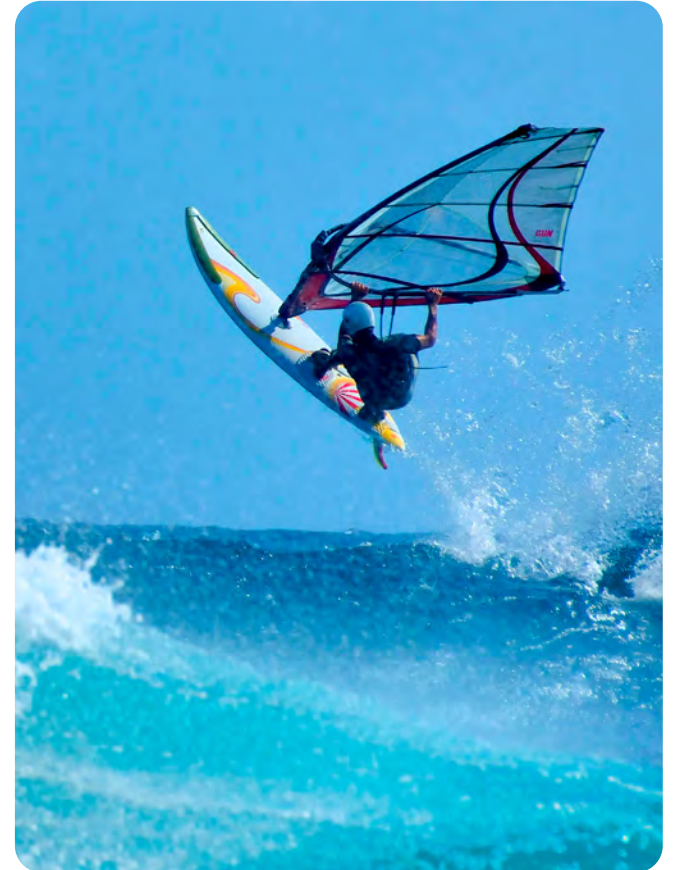
Click or scan here to read "The Plastics Transition" roadmap and the case studies of Plastics Europe's members and discover their initiatives to increase circular feedstock use.



The "Plastics Transition" roadmap



Case studies



Circular feedstock as alternative to oil and gas

Bio-based feedstock

Forestry waste



Crops



Food waste



Crop residues



Animal manure



Sewage sludges

Plastics waste
for mechanical recycling



Plastics waste
for chemical recycling



Captured carbon



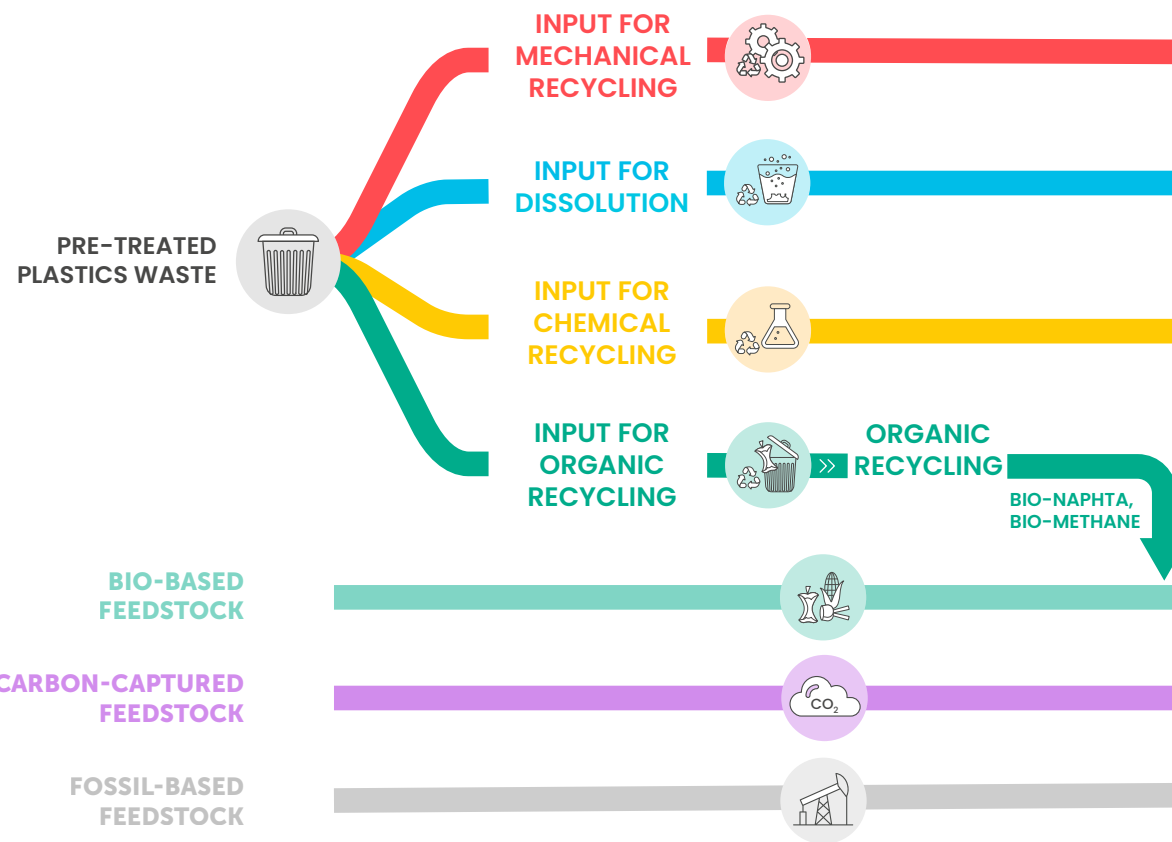
Integrated circular plastics production processes for a faster transition

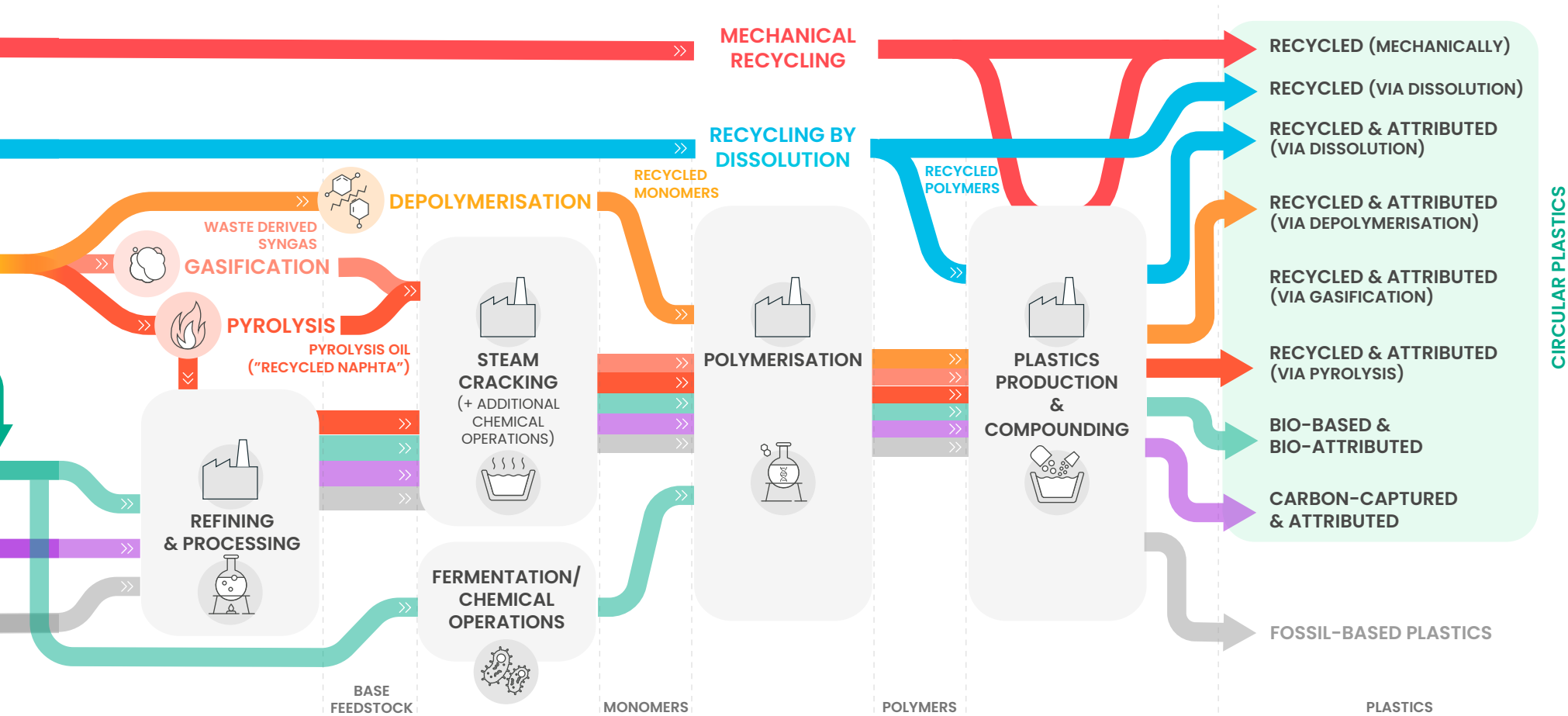
Different complementary pathways exist to help the plastics industry replace fossil-based feedstock, accelerate circularity and reach net-zero. Different waste treatment technologies are required to optimise the recycling of the various types of waste.

As shown in “The Plastics Transition” roadmap, mechanical recycling will not be sufficient to reach our industry’s targeted circularity rate of 65%; it therefore needs to be complemented with other technologies such as chemical recycling.

However, the transition is a gradual process. It will be necessary to mix fossil-based and recycled feedstocks. Otherwise, the cost of separate production lines would be prohibitively high and lower technical efficiencies would lead to an increased environmental burden.

As a result, it is essential to establish a transparent methodology to account for the recycled feedstocks along the full value chain. Mass Balance avoids double counting of recycled feedstocks, and other circular feedstocks in the end product while at the same time allowing final consumers to see whether their purchasing decision contributes to the circularity of the system.





European plastics conversion

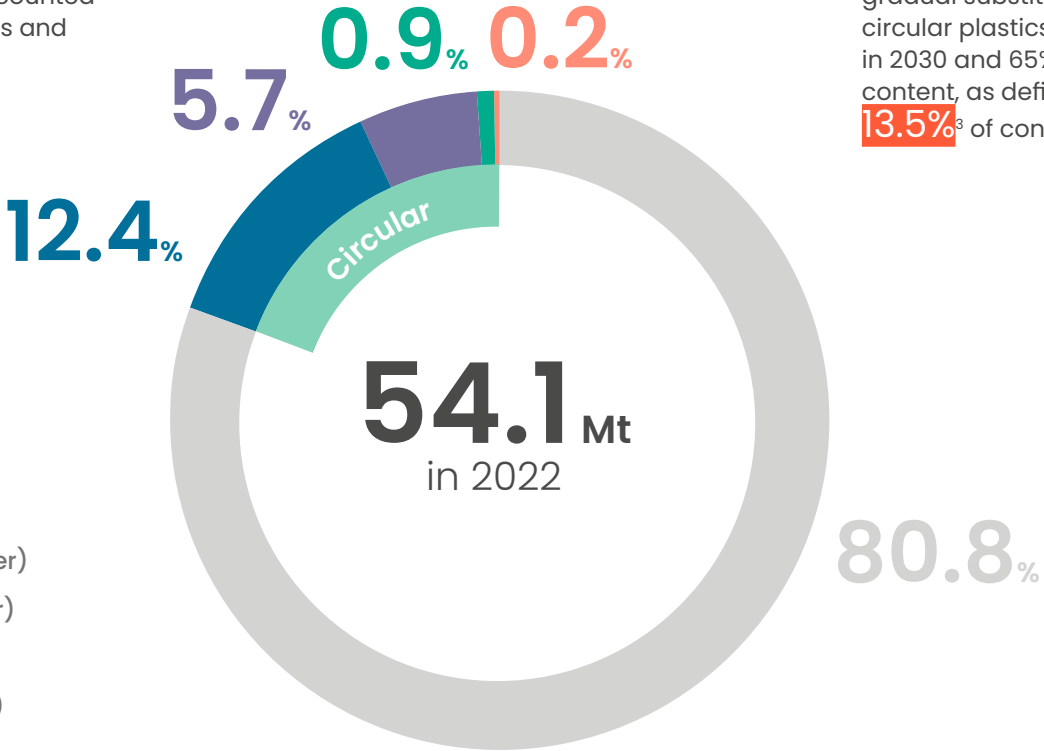


European plastics conversion

In 2022, 10.4 Mt of circular plastics was converted into plastic products and components. This accounted for 19.2% of plastics converted into products and components in Europe.

19.2%
of converted plastics in Europe was circular².

- Fossil-based
- Mechanically recycled (post-consumer)
- Mechanically recycled (pre-consumer)
- Bio-based¹
- Chemically recycled (post-consumer)



“The Plastics Transition” Roadmap predicts the gradual substitution of fossil-based plastics, and that circular plastics could meet 25% of European demand in 2030 and 65% by 2050. In 2022, circular plastics content, as defined in Roadmap reached **13.5%**³ of converted plastics (7.3 Mt).

The above data are rounded estimations.
 1. For data availability reasons, bio-attributed plastics are not included in conversion data.
 2. Including the production of pre-consumer recycled plastics.
 3. To measure progress towards the 25% and 65% circular plastics content ambitions by 2030 and 2050 set in the “Plastics Transition” roadmap, only post-consumer recycled plastics, bio-based and bio-attributed content can be considered.

European plastics conversion evolution

In 2022, European plastics conversion remained stable overall. Fossil-based plastics conversion dropped by 8.2%. However, circular plastics conversion increased by almost 37%.

2018-2022 evolution

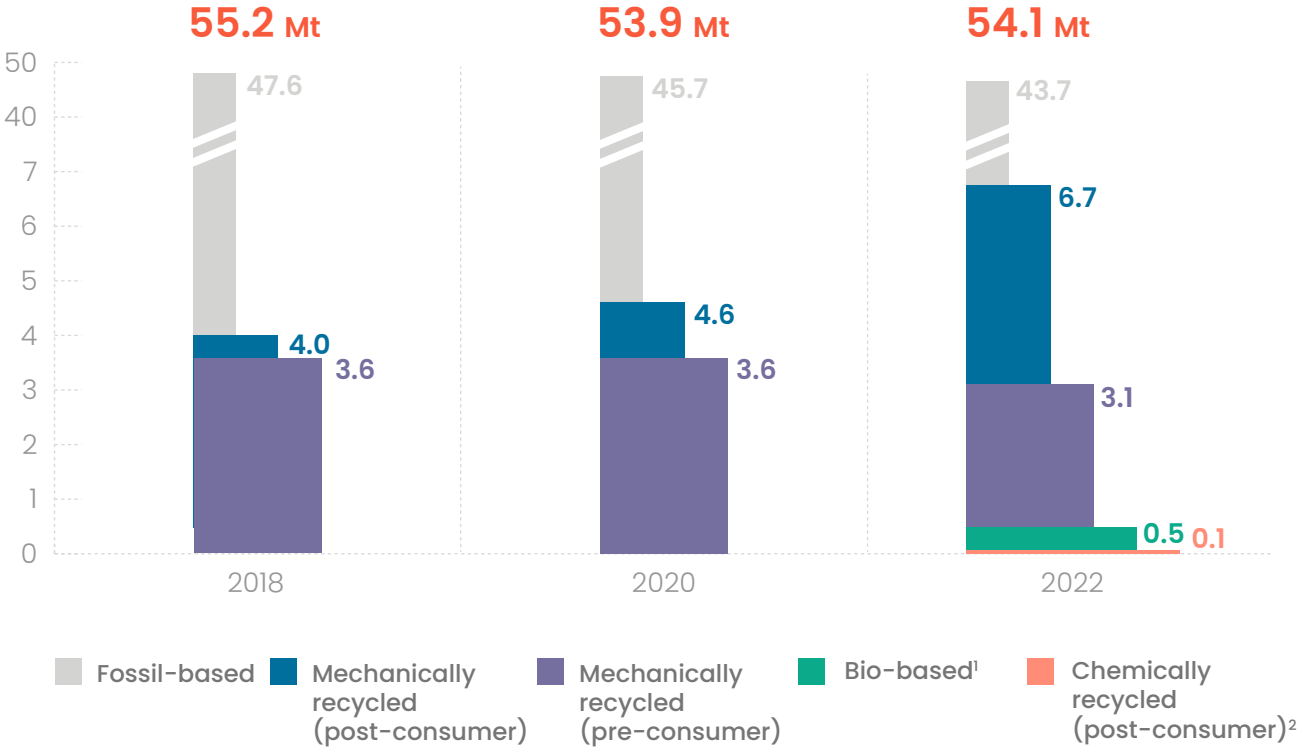
Total conversion **-1.9%**

Fossil-based **-8.2%**

Circular **+36.8%**

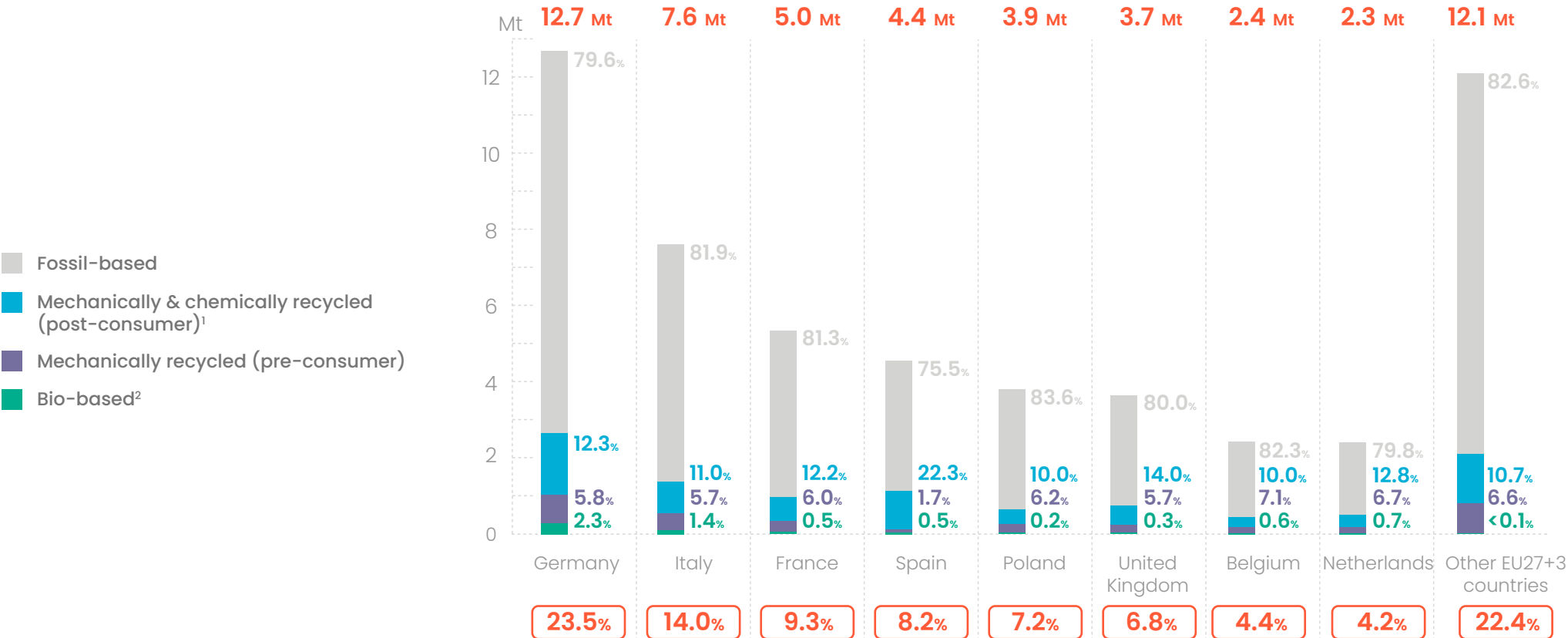
Mechanically-recycled (post-consumer) **+67.5%**

Mechanically recycled (pre-consumer) **-13.9%**



The above data are rounded estimations.
 1. For data availability reasons, bio-attributed plastics are not included in conversion data.
 2. For data availability reasons, chemically recycled plastics are only included in the 2022 data.

European plastics conversion by country



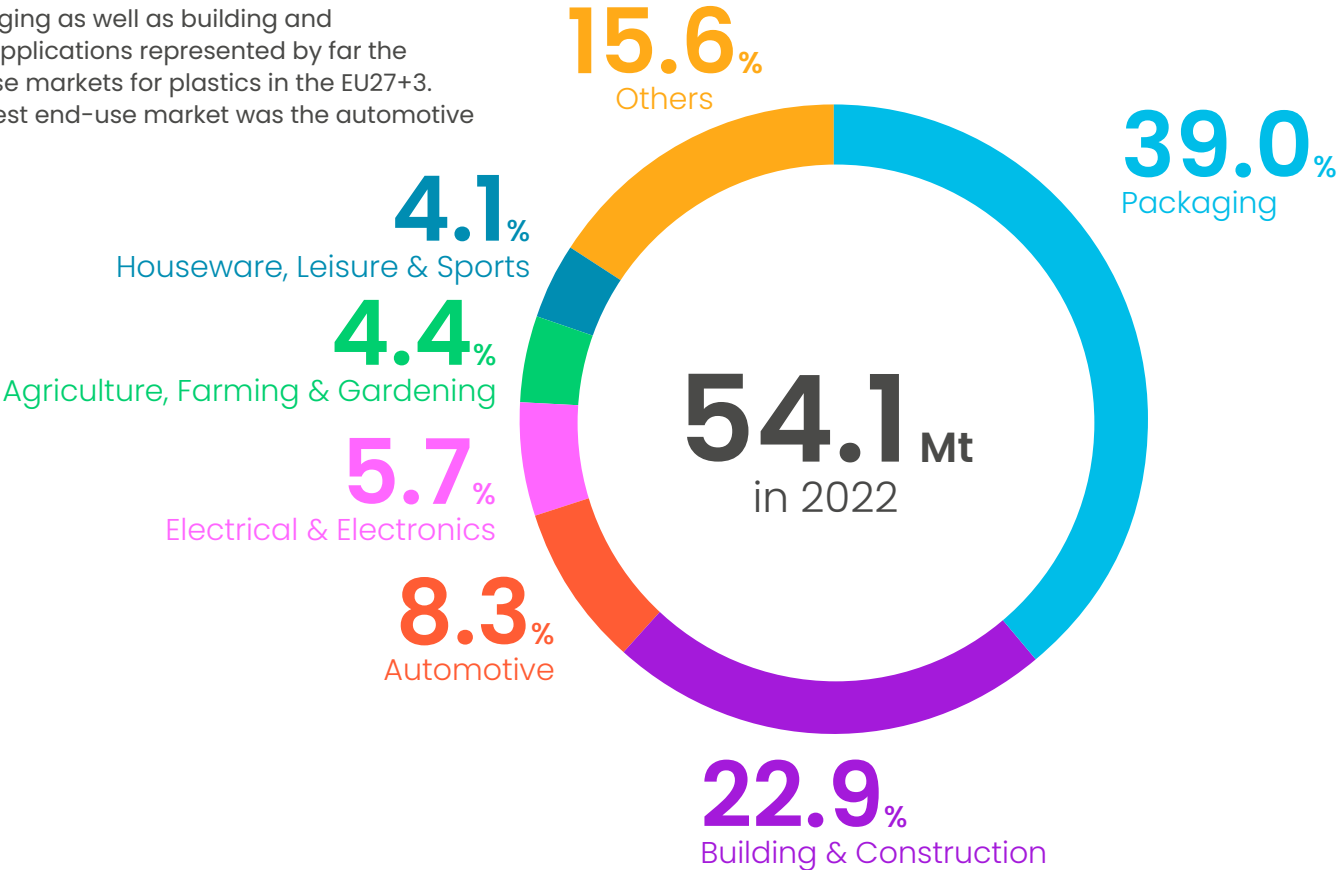
The above data are rounded estimations.

1. For data availability reasons, mechanically and chemically recycled plastics data (post-consumer) cannot be shown separately. Chemically recycled plastics represent only a small share of the total post-consumer recycled plastics.

2. For data availability reasons, bio-attributed plastics are not included in the country data.

European plastics conversion by application

In 2022, packaging as well as building and construction applications represented by far the largest end-use markets for plastics in the EU27+3. The third biggest end-use market was the automotive sector.



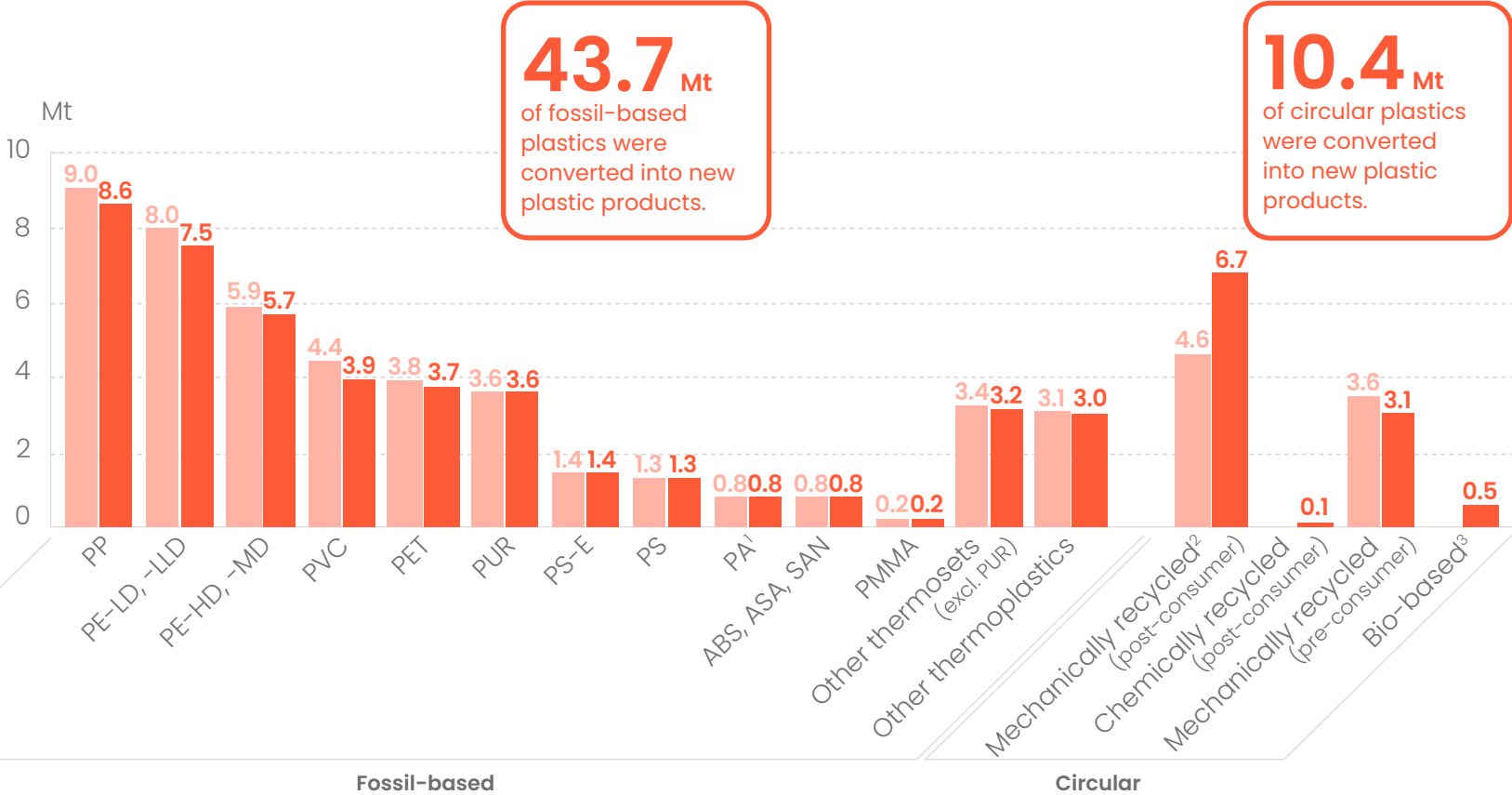
To better understand what type of products are included in each application sector, see pages 100-103.

The above data are rounded estimations.

European plastics conversion by polymer

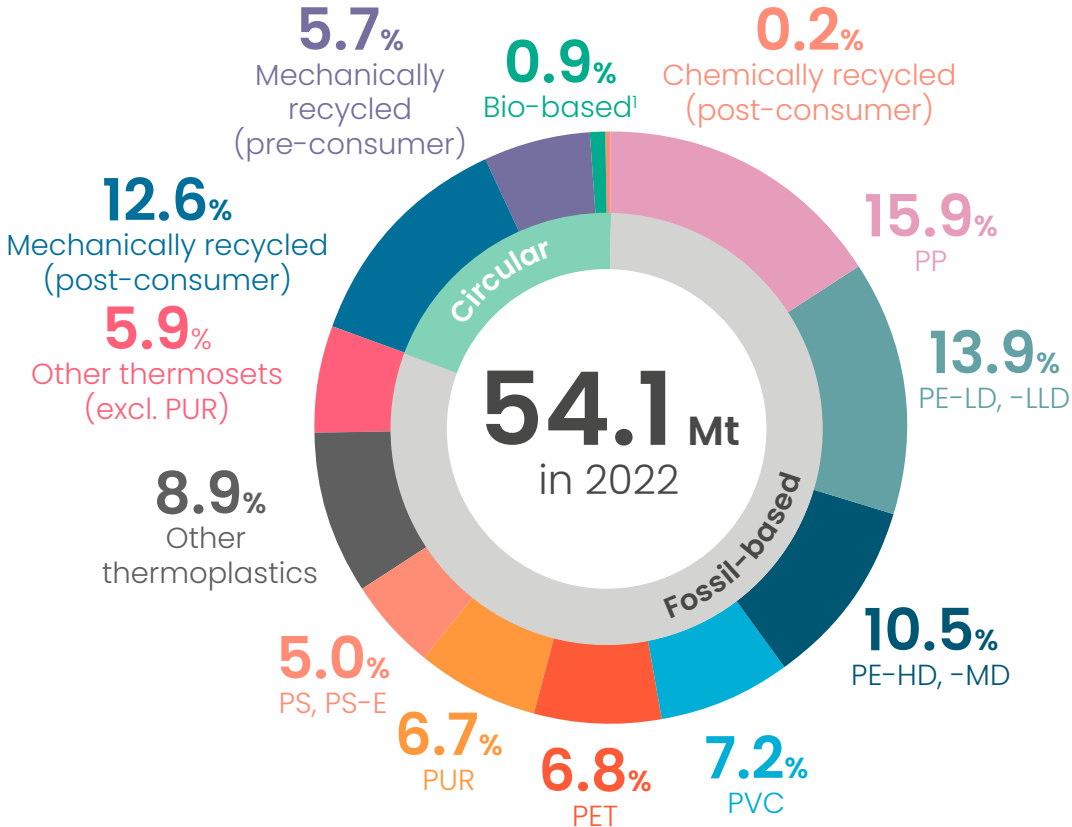
In 2022, conversion of plastics made from circular feedstocks into new plastic products and components increased, while conversion of fossil-based plastics decreased.

2020
2022



The above data are rounded estimations.
 1. PA only covers PA6 and PA66.
 2. For data availability reasons, mechanically and chemically recycled plastics data (post-consumer) cannot be shown separately.
 3. For data availability reasons, bio-attributed plastics are not included, and bio-based plastics are not shown for 2020.

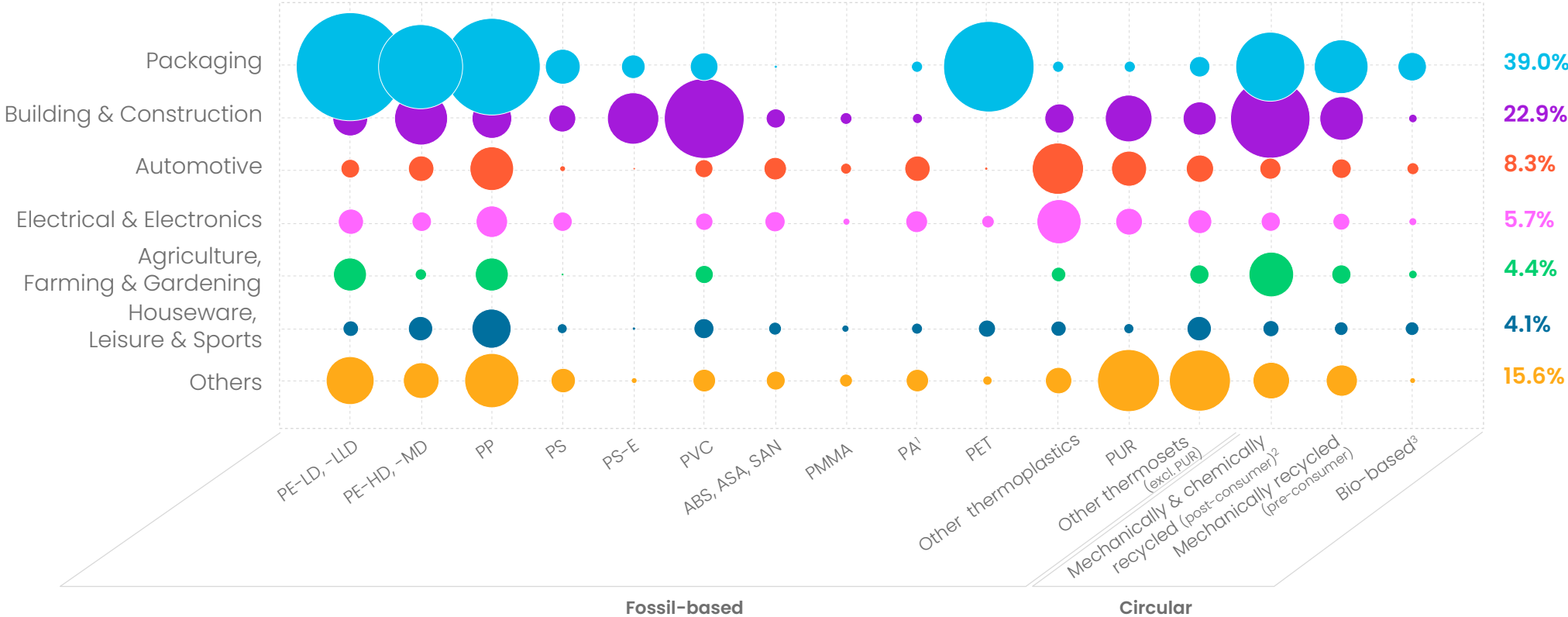
European plastics conversion by polymer



The above data are rounded estimations.
 For data availability reasons, the polymer breakdown for circular plastics cannot be shown.
 1. For data availability reasons, bio-attributed plastics are not included.



European plastics conversion matrix

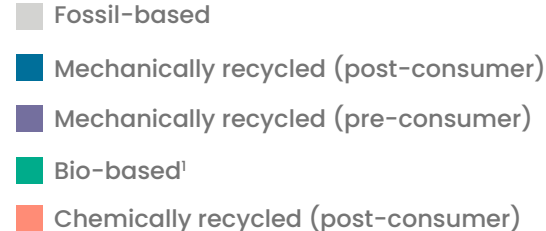


The above data are rounded estimations. Numbers behind this graph are available upon request. More information regarding the methodology used for the development of the graph available in the appendix.
 1. PA only covers PA6 and PA66.
 2. For design reason, mechanically and chemically recycled plastics data (post-consumer) are shown together. Chemically recycled plastics represent a small share of the total post-consumer recycled plastics. For more details about the share of chemically recycled plastics content by application, see page 54.
 3. For data availability reasons, bio-attributed plastics are not included.

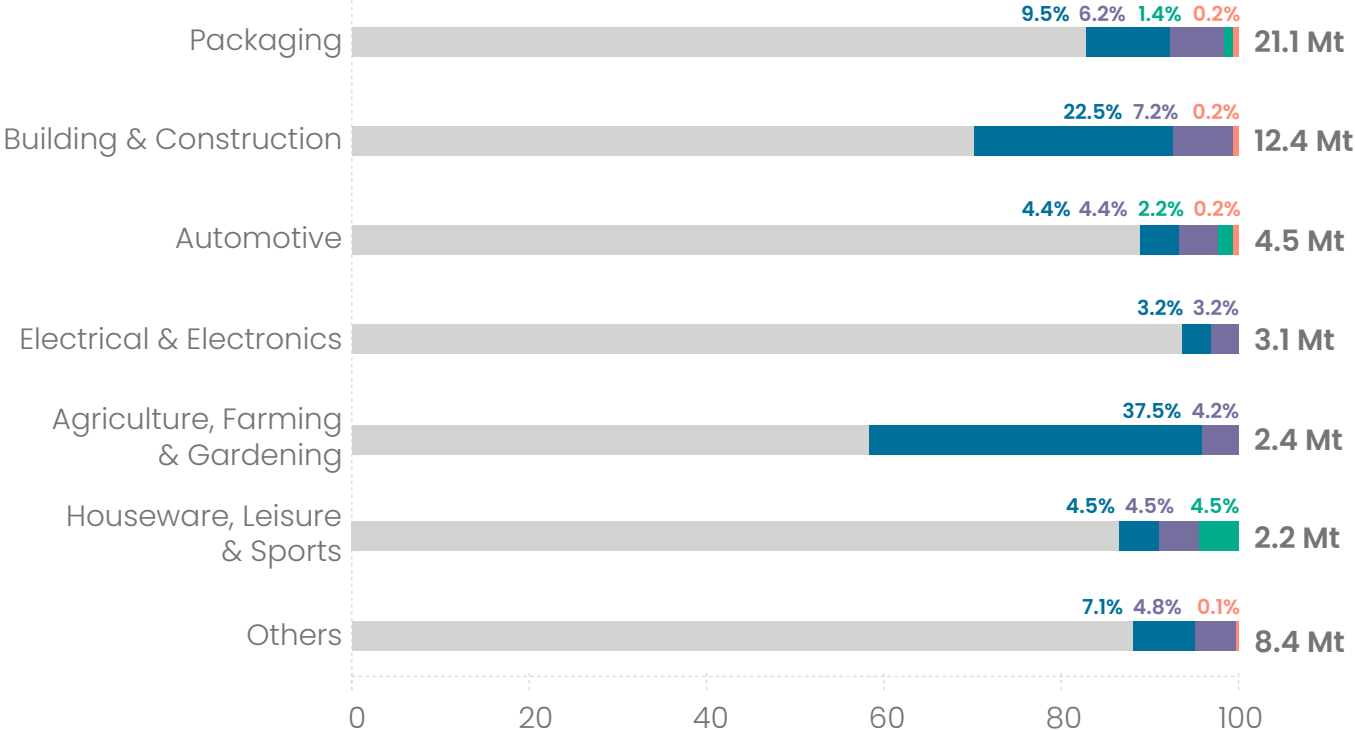
Circular plastics in conversion

Agriculture, farming and gardening applications have the highest proportion of circular content (41.7%), followed by building and construction applications (29.9%).

Recycled plastics content from chemical recycling remains at a low level, although it is used in applications for the packaging, automotive and building and construction sectors (including those that require high quality/performance plastics).



Circular plastics in conversion
2022, in the EU27+3



¹ For data availability reasons, bio-attributed plastics are not included.

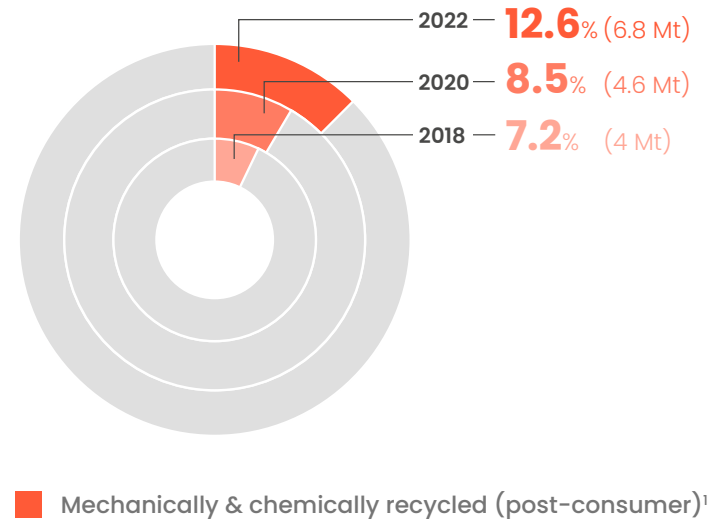


Post-consumer recycled plastics in conversion

In 2022, European converters used 6.8 Mt post-consumer recycled plastics, representing a 12.6% of total plastics converted into new products and components. This represents an increase of 70% since 2018. If this positive trend continues at the same pace, the target of the plastics value chain's initiative "Circular Plastics Alliance" – 10 Mt post-consumer recycled content in new plastics products and components by 2025 – is within reach.

+70%
increase of
post-consumer
recycled content
since 2018.

Post-consumer recycled content in new products



The above data are rounded estimations.

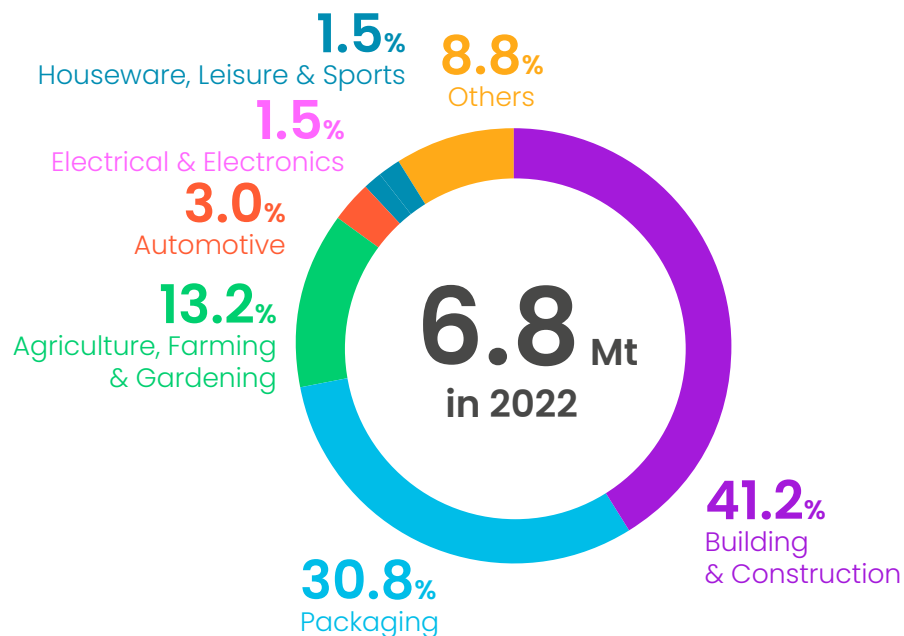
1. Chemically recycled plastics represent a small share of the total post-consumer recycled plastics. For more details about the share of chemically recycled plastics content by application, see page 54.



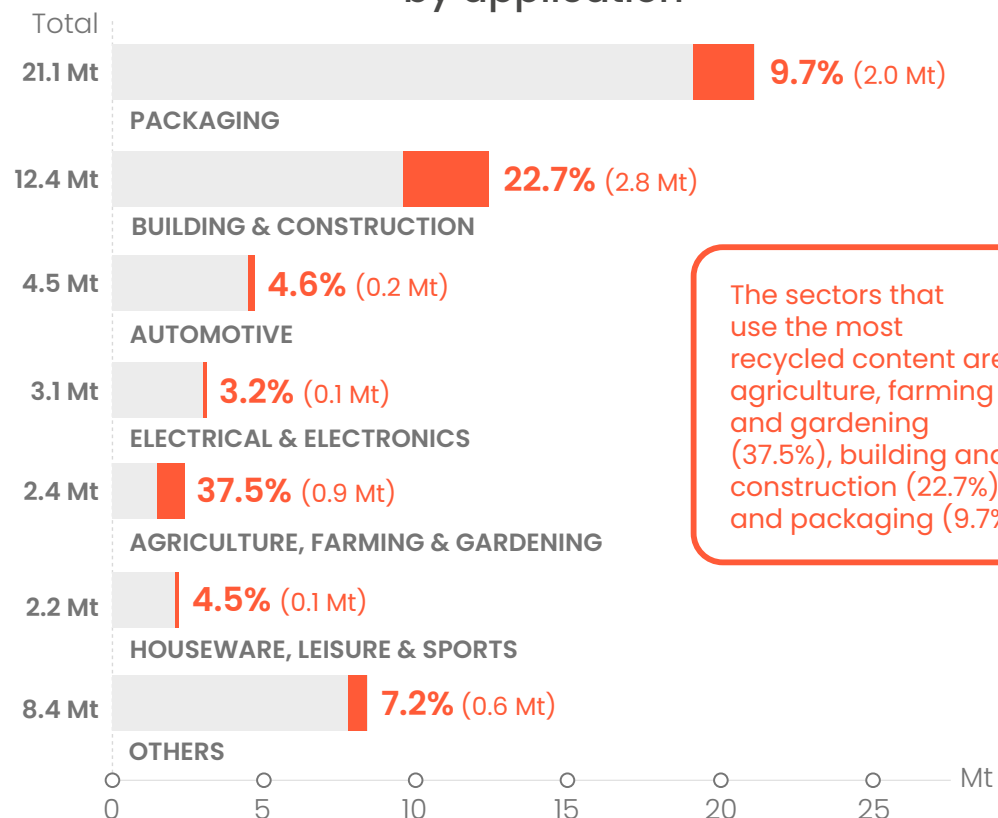
Post-consumer recycled plastics in conversion

Post-consumer recycled plastics in conversion by application

2022, in %



Share of post-consumer recycled plastics in conversion - by application



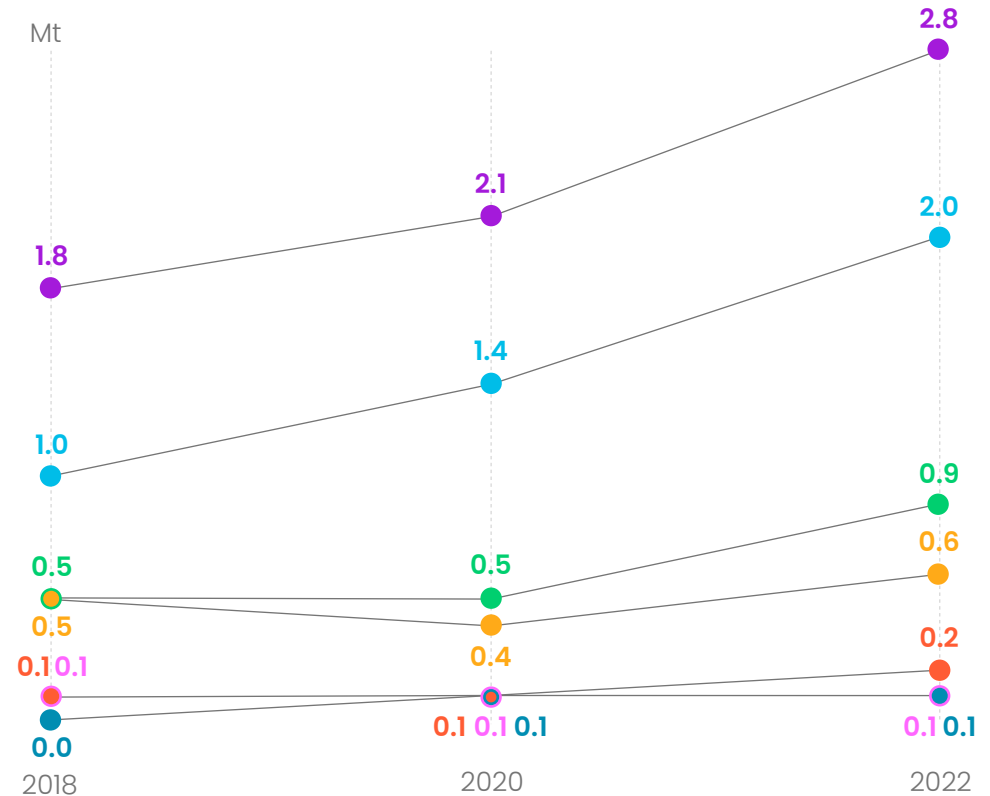
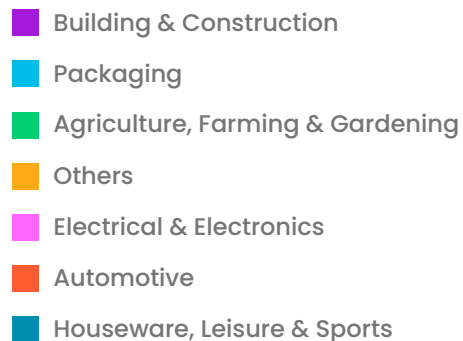
The sectors that use the most recycled content are: agriculture, farming and gardening (37.5%), building and construction (22.7%), and packaging (9.7%).

The above data are rounded estimations.

Evolution of post-consumer recycled plastics in conversion by application

In 2022, post-consumer recycled content continued to grow in all sectors.

Building and construction and packaging are the sectors in which the evolution of recycled content increased the most (+1 Mt each), followed by agriculture, farming and gardening (+0.4 Mt).

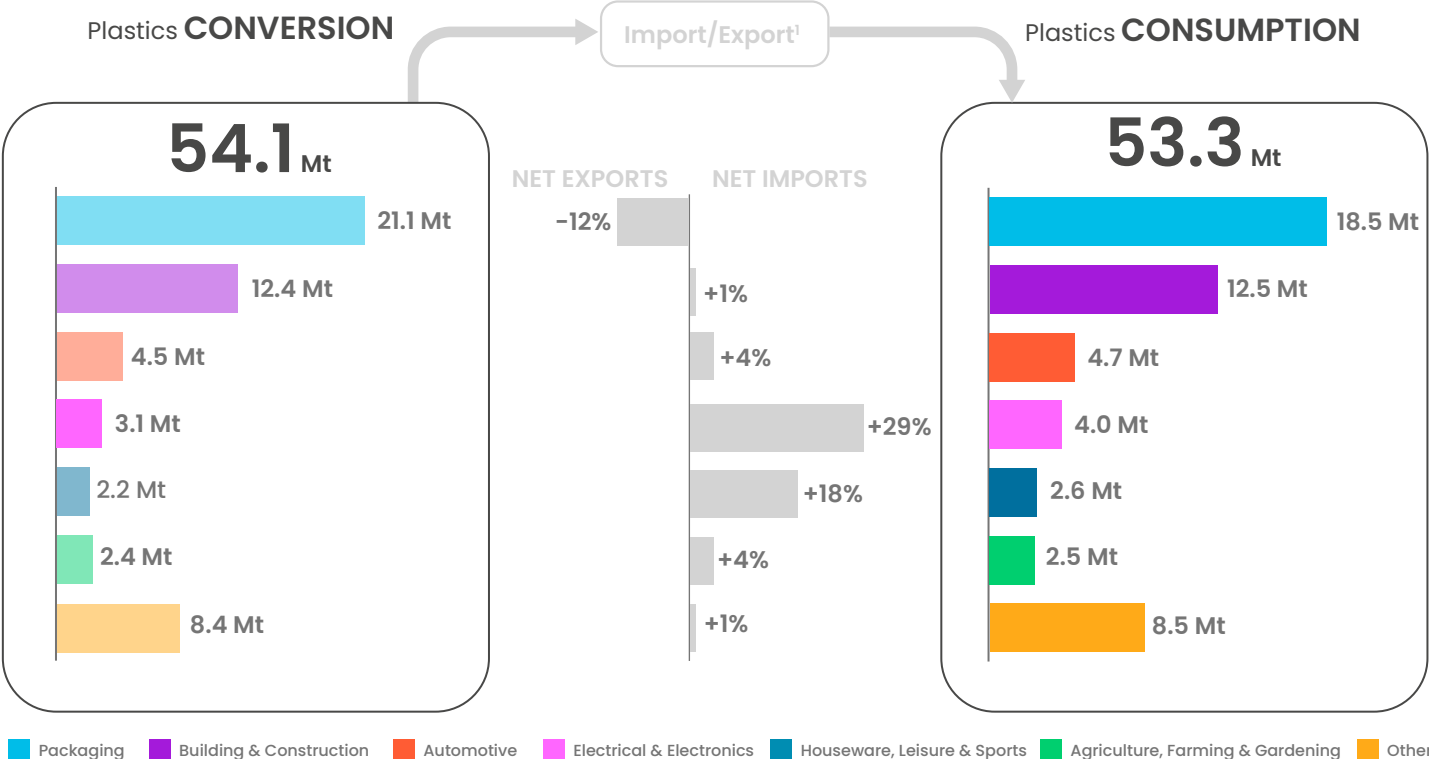


The above data are rounded estimations. For data availability reasons, the above post-consumer recycled plastics quantities include mechanically and chemically recycled data, which cannot be shown separately.

European plastics consumption



Plastics consumption in Europe



Plastics consumption refers to every plastic product (e.g. a pipe, a bottle, etc.) or component embedded in larger products (e.g. the dashboard of a car), which is used by the end-user for household, commercial and/or industrial activities.

European plastics consumption includes products and components converted in Europe or imported from other markets.

In 2022, with the exception of packaging, Europe was a net importer of plastic products and components. The sectors in which Europe's net imports are highest include electrical and electronics, houseware, leisure and sports.

The above data are rounded estimations.
1. Extra EU27+3 trade.

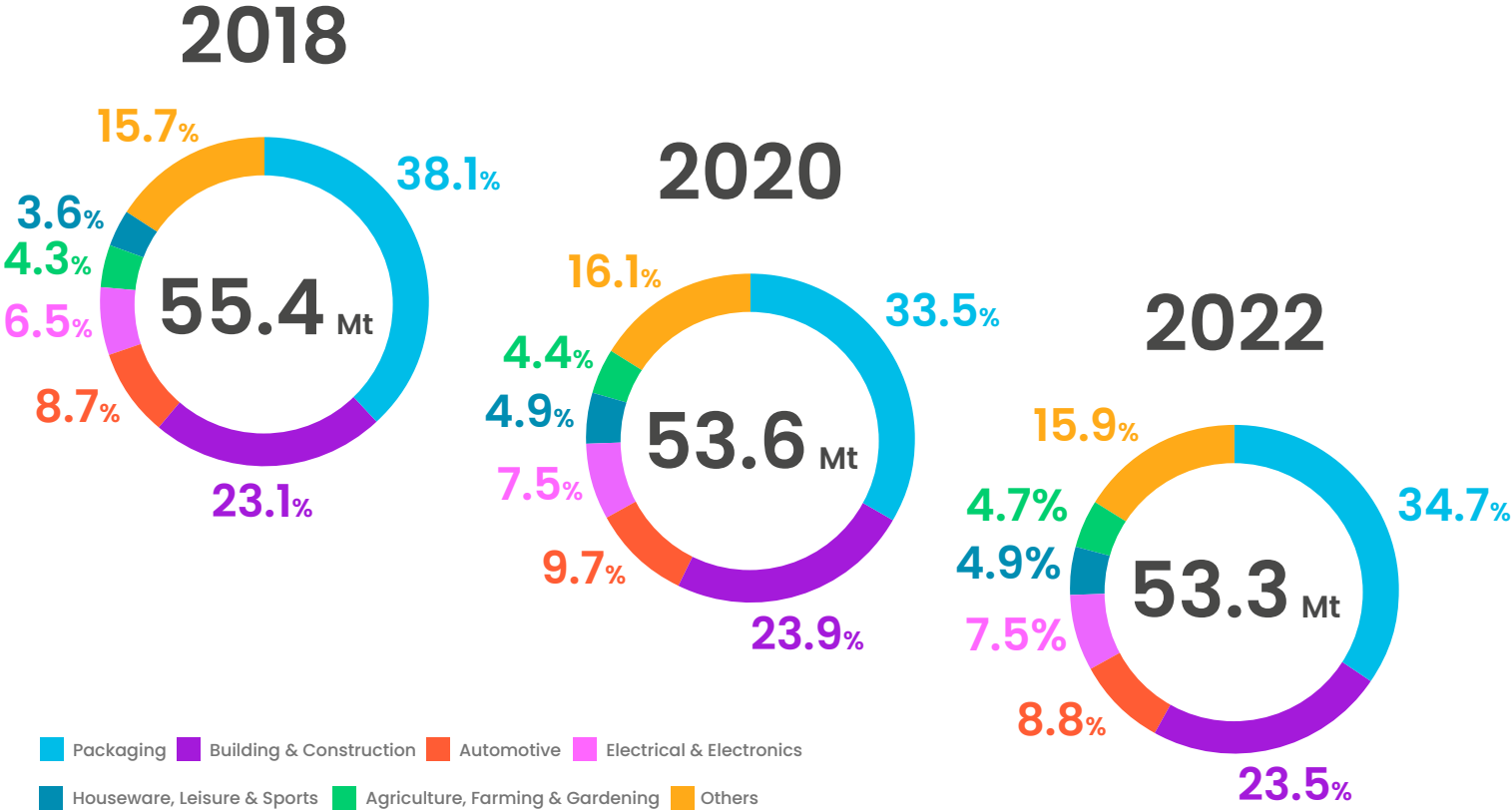
Evolution of the European plastics consumption

Since 2018, the consumption of plastics products and components by European end-users has slightly decreased (-3.8%), reaching 53.3 Mt.

End-users' consumption of plastics packaging decreased from 38.1% in 2018 to 34.7% in 2022 (as a share of total consumption) – a decrease equivalent to 2.7 Mt.

Meanwhile, consumption of plastics in the houseware, leisure and sports sectors has increased (as a share of total consumption) to 4.9%. The share of electrical and electronics products decreased, reaching 7.5%.

-3.8%
decrease in
total European
consumption.



The above data are rounded estimations.

Average life spans of plastic products

Plastic products and components that enter the market have different life spans. Many of them do not become waste in the same year that they entered the market as they remain in use for years (e.g. pipes, insulation boards, cables, cars, electrical and electronics devices, etc.).

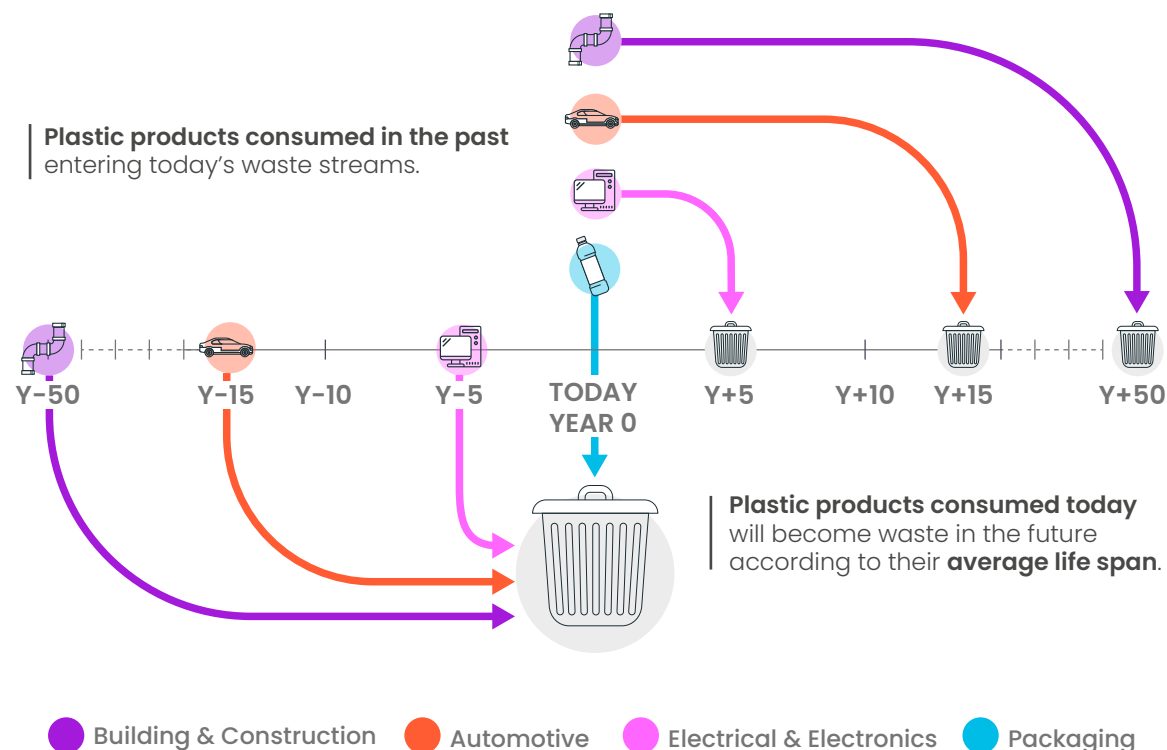
Some plastic products and components are exported for a second life, and therefore never become waste in Europe (e.g. exports of used cars). Other products, such as furniture and toys, may be resold, used second hand or stored for many years, and do not become waste for a very long time.

Similarly, plastic products and components, being collected today and recorded in contemporary statistics, may have entered the market decades beforehand (e.g. old appliances, construction materials, etc.).

The variable lifespans of different plastic products and components help to explain why waste quantities for a given year are considerably smaller than the total plastic products and components entering the market for the same year.

However, more research is needed to ensure we have robust data and an accurate overview of the amount plastic products and components currently in use, as well as unreported plastics waste in available statistics (e.g. mixed with other waste streams, stored plastic products, construction materials left in situ).

When do plastic products become waste?





European plastics waste management



Different recycling techniques to turn waste into new resources

No waste treatment solution fits all plastics waste types. In order to accelerate the circularity of plastics, a set of different technologies is needed. By combining them, it is possible to optimise the treatment of plastics waste and turn it into a valuable output that can be reintegrated into the circular economy for plastics. (for more detailed information, see pages 42–43).

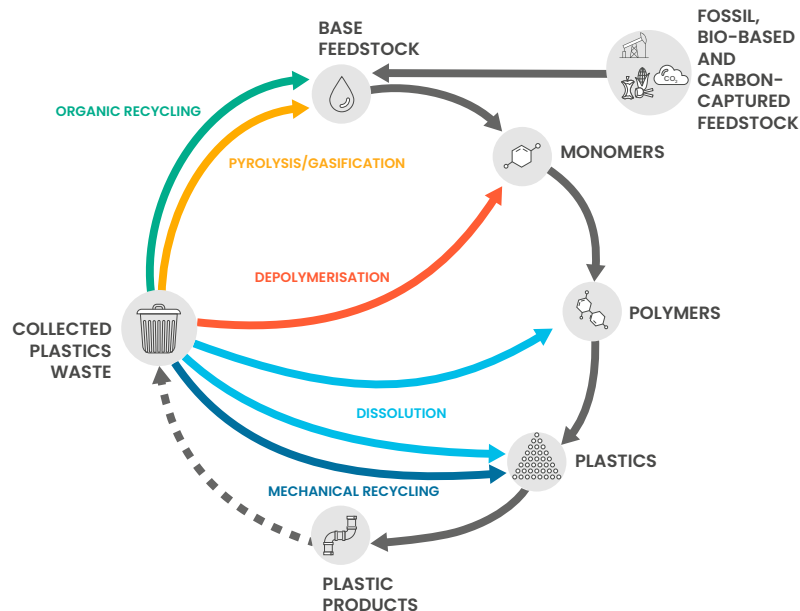
In mechanical recycling, plastics waste is grinded, washed and frequently extruded and pelletised. Mechanical recycling provides the majority of today's recycled plastics output, enabling plastic waste to be recycled several times, however, with a progressive loss of quality.

As a complement, chemical recycling offers the possibility to recycle mixed plastics waste, back into high quality plastics for sensitive applications (e.g. in health and food packaging) as if manufactured for the first time. Chemical recycling technologies are currently being used at a smaller scale and need to be rapidly scaled up for Europe to reach higher recycling rates, and prevent mixed plastics waste being sent to incineration or landfill. Chemical recycling infrastructure in Europe is mainly built for depolymerisation and pyrolysis technologies.

- The depolymerisation of plastics waste leads back to monomers, building blocks for plastics production.
- Pyrolysis and gasification create recycled intermediate substances such as pyrolysis oil or syngas to substitute fossil-based feedstock.

Dissolution is another recycling process separating polymers from other substances (e.g. additives) with solvents.

Finally, biodegradable and compostable plastics waste can be transformed into new bio-based feedstock thanks to organic recycling (e.g. via bio-naphtha production or anaerobic digestion).





Plastics Europe's member companies announced investments of more than **8 billion euros**, in **44 planned chemical recycling projects** in **13 EU countries**, to produce **2.8 Mt of recycled plastics** per annum by 2030.

For this output to be secured, a legal basis for chemical recycling and the mass balance with credit methodology (fuel-use exempt attribution model) urgently needs to be established.

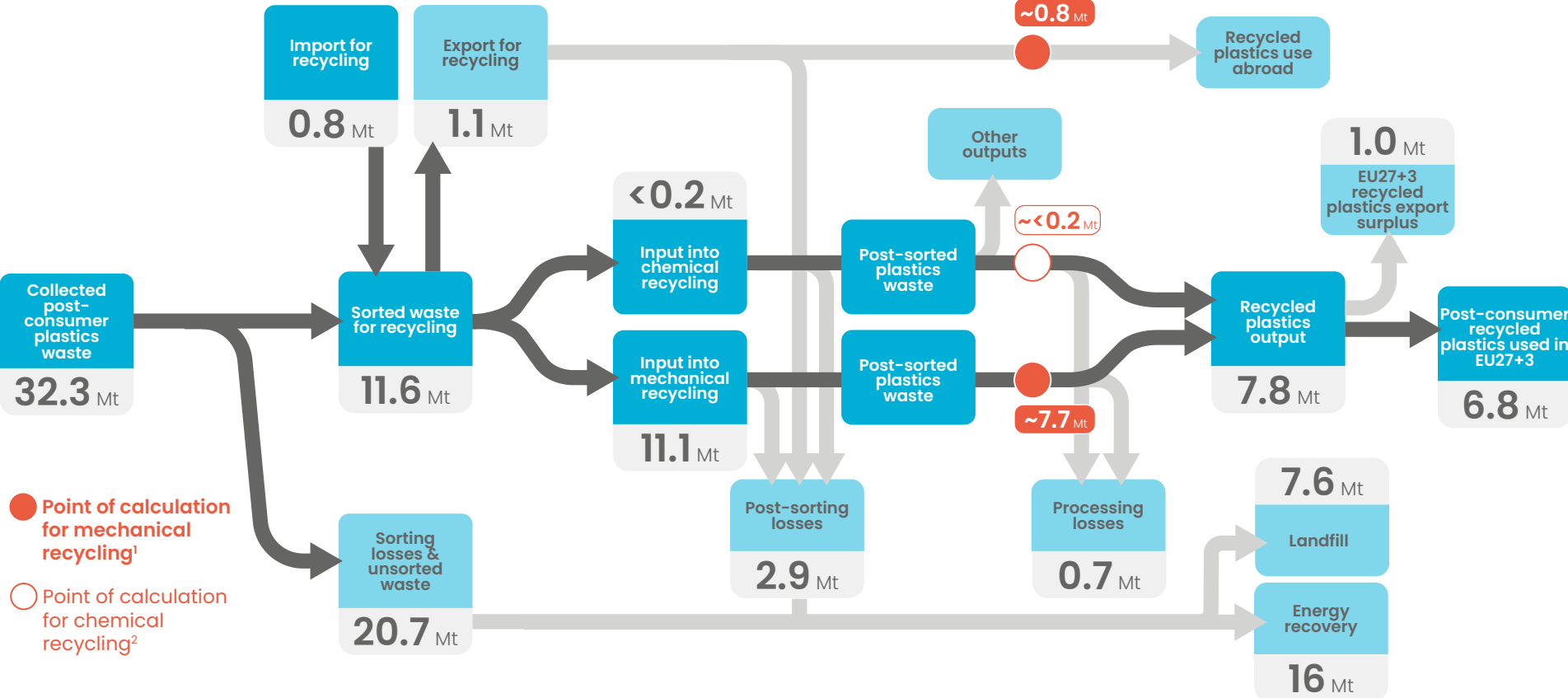
Click or scan here to learn more about chemical recycling and the role of mass balance.



Chemical recycling and mass balance explained



From plastics waste collection to recycled plastics



● Point of calculation for mechanical recycling¹

○ Point of calculation for chemical recycling²

The above data are rounded estimations. 2022 waste treatment data were calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 1. Materials entering a recycling process - Directive (EU) 2018/852.
 2. The official methodology to calculate chemical recycling rates is still under discussion by the European Commission and the EU Member States.

New measurement point for mechanical recycling rates

In 2018, the adopted Packaging and Packaging Directive (Directive (EU) 2018/852) (PPWD) changed the methodology for calculating mechanical recycling rates for plastics packaging waste as of 2022. The new measurement point has been moved from the beginning to the final step of the recycling process (materials entering pelletisation, extrusion and moulding processes).

The 2018 and 2020 plastics recycling rates published by Plastics Europe in former editions were calculated following the old methodology. In this edition, for the first time, plastics recycling rates are calculated following the new methodology.

While legally this change of methodology only impacts packaging, Plastics Europe has decided to change the recycling measuring point for all types of plastics waste. This way, plastics packaging waste recycling data are aligned with the new requirements of the Directive, and easily comparable with recycling rates of all plastics applications. Historical waste treatment data in this edition were also adapted accordingly.

Recycling rates shown in the present report may therefore also differ from officially reported recycling rates (e.g. for End-of-Life Vehicles and Waste from Electrical and Electronic Equipments).

Why plastics waste collection and recycling output quantities do not match?

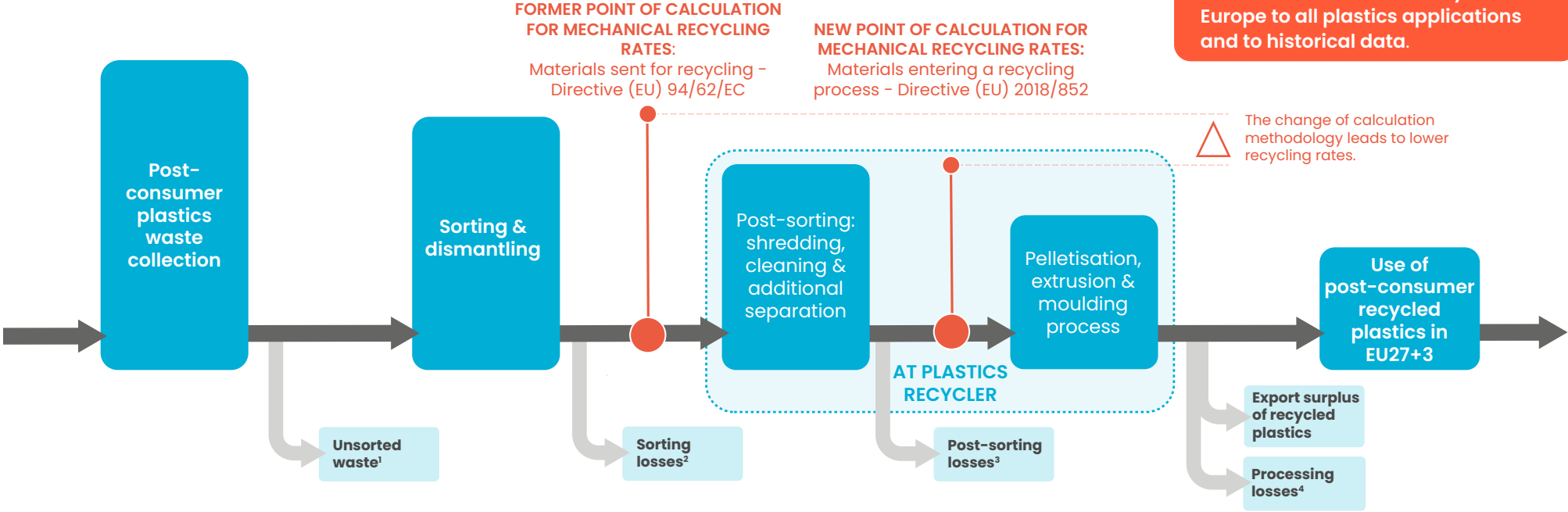
As with any type of recycling process of any kind of material, plastics waste needs to be separated from other non-plastics materials and organic residues. This is needed to transform waste into valuable recycled plastics. Some collected plastics wastes can also be discarded during this process for quality and size reasons, or due to a lack of available recycling streams or capacity.

In addition, at the end of the recycling process, minor process losses occur due to plastics which are melted with residual dirt.



New measurement point impacts recycling rates

The new legal point of calculation for plastics packaging waste recycling rates has been **extended by Plastics Europe to all plastics applications and to historical data.**



1. Unsorted waste: discarded plastics waste for quality and/or size reasons, but also because of possible lack of available recycling streams.
 2. Sorting losses: non-plastics materials such as wood, glass, paper, textiles, rubber, composites, metals, etc.
 3. Post-sorting losses: non-plastics materials such as wood, glass, paper, textiles, rubber, composites, metals, etc.; organic residues such as water, milk, yoghurt, etc.
 4. Processing loss: small and mostly non-plastics residues (e.g. wood, paper, aged rubber particles, fillers) and dirt.

European plastics waste collection

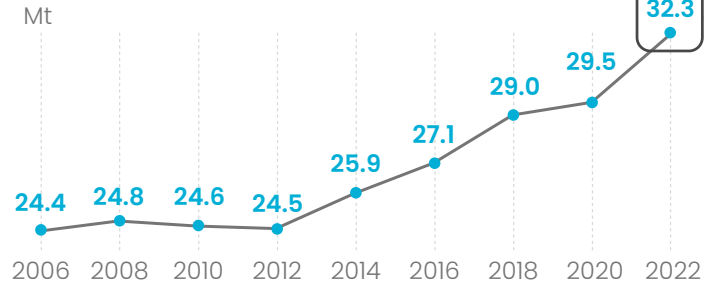
It is estimated that 32.3 Mt of post-consumer plastics waste was collected in 2022. First insights show an increase in the return of products with long lifespans reaching their end-of-life – mainly from building and construction, houseware, leisure and sports applications.

For the first time¹, in 2022, the share of plastics waste collected separately is slightly higher compared to mixed collection streams. To maximise recycling, separate waste collection should be increased, for example via Extended Producer Responsibility (EPR) schemes, and complemented by more mixed waste sorting.

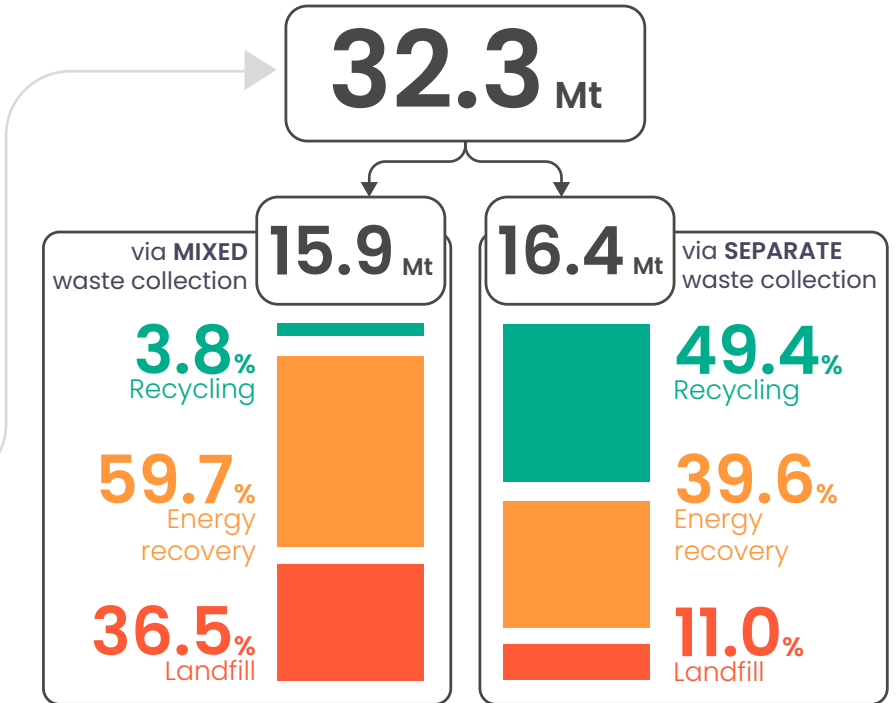
Plastics waste recycling rates are **x13 higher** when collected **separately** compared to mixed collection streams.

Evolution of post-consumer plastics waste collection

2006–2022, in the EU27+3



Post-consumer plastics waste collection and treatment

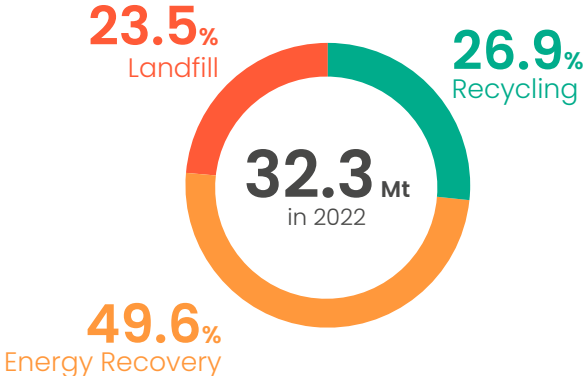


The above data are rounded estimations.
 2022 waste treatment data were calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 1. Since the change of methodology for calculating mechanical recycling rates.

European plastics waste treatment

Post-consumer plastics waste treatment

2022, in the EU27+3

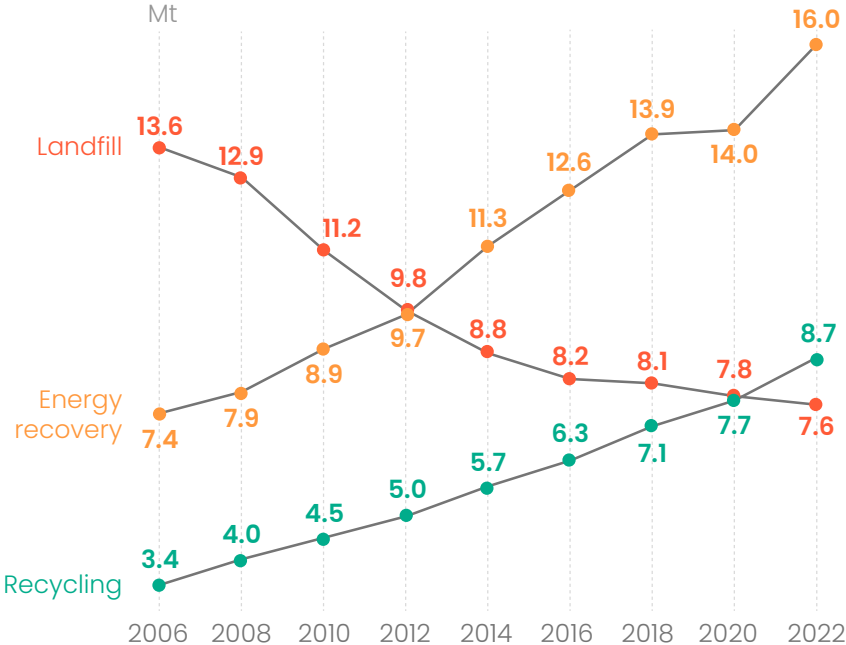


2018-2022 evolution



Evolution of post-consumer plastics waste treatment

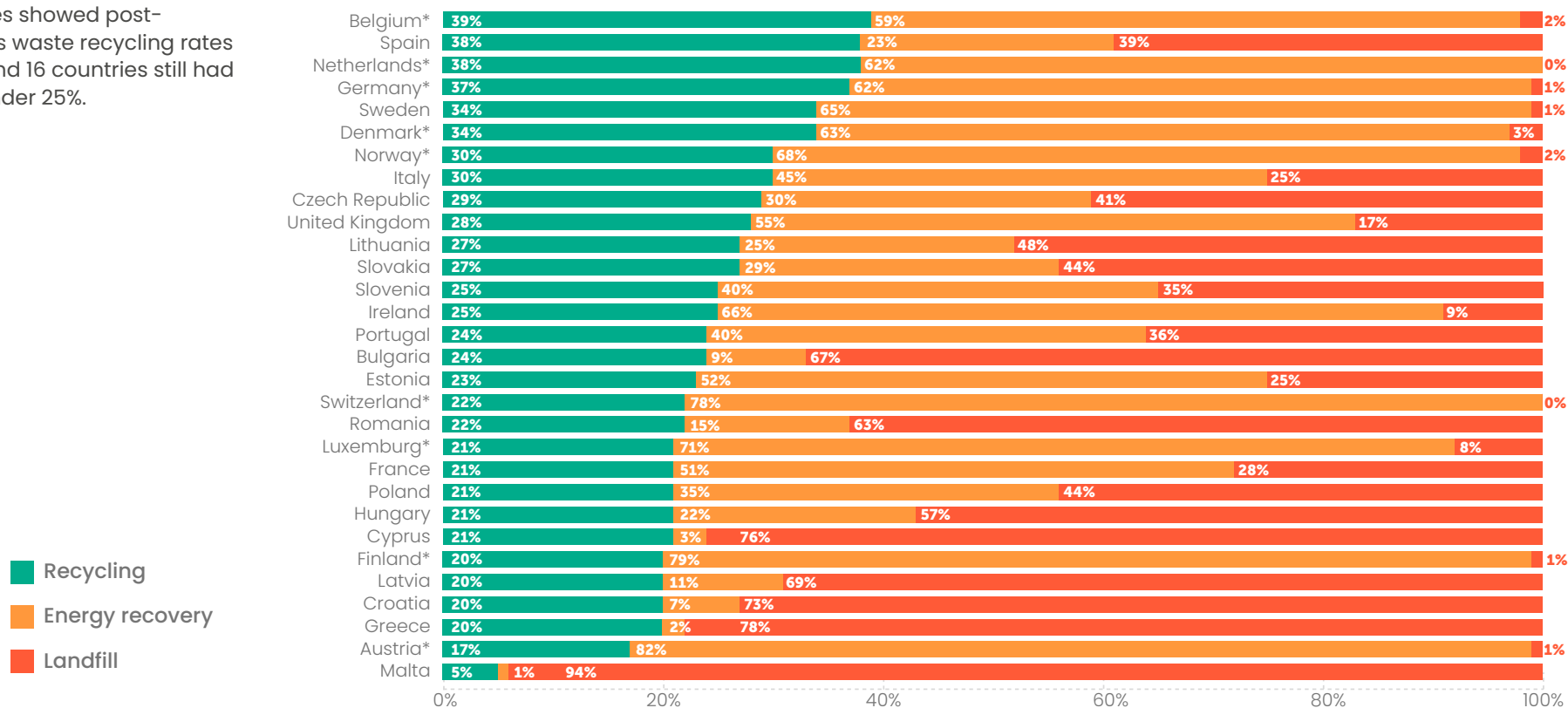
2006-2022, in the EU27+3



The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).

Plastics waste treatment by country

In 2022, 4 countries showed post-consumer plastics waste recycling rates exceeding 35%, and 16 countries still had recycling rates under 25%.



The above data are rounded estimations.
 2022 waste treatment data were calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 *Countries with landfill bans.



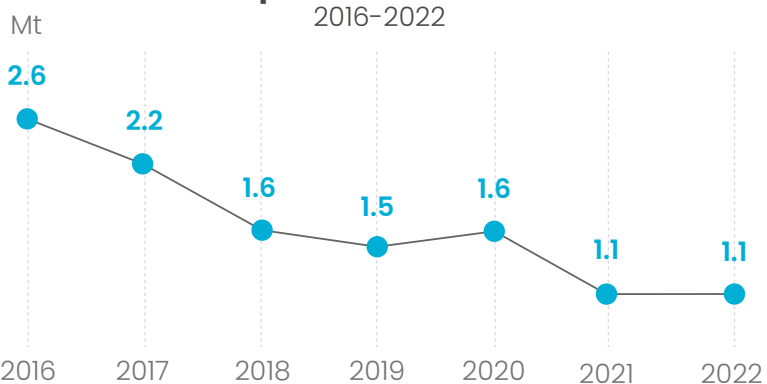
Plastics waste exports

Plastics waste exports outside the EU27+UK have been reduced by 58%, from 2016 to 2022. The main destination countries remain Turkey (~0.35 Mt) and Malaysia (~0.18 Mt).

Import bans in destination countries, trade restrictions for plastics waste outside the OECD, and the need for recycled plastics in Europe may partly explain this trend.

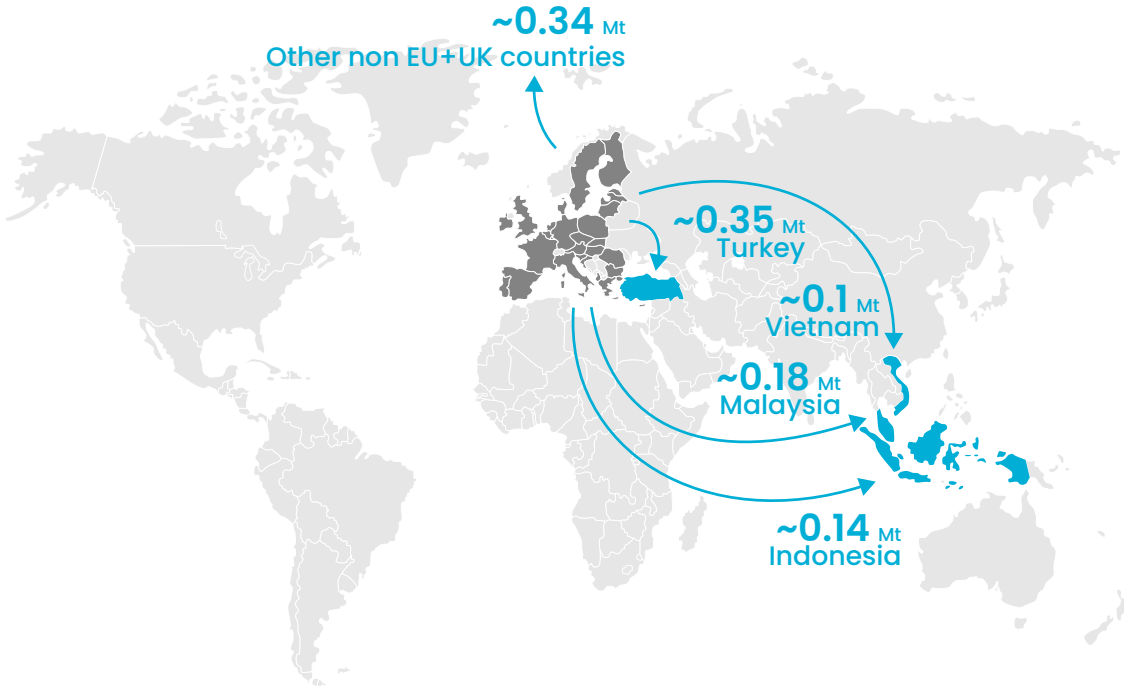
However, 1.1 Mt plastics waste were still exported in 2022 – a missed opportunity to transform plastics waste into new resources within the European economy.

EU27+UK post-consumer plastics waste exports evolution



Source: Eurostat. For data availability reasons, plastics waste exports data are limited to the EU27+UK.

EU27+UK post-consumer plastics waste exports in 2022





European plastics waste management by application



European plastics waste collection by sector

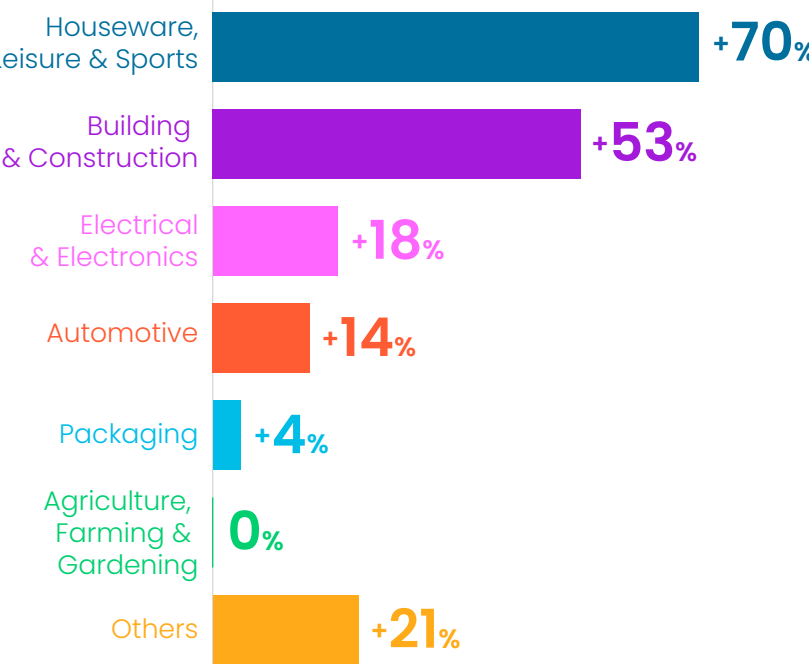
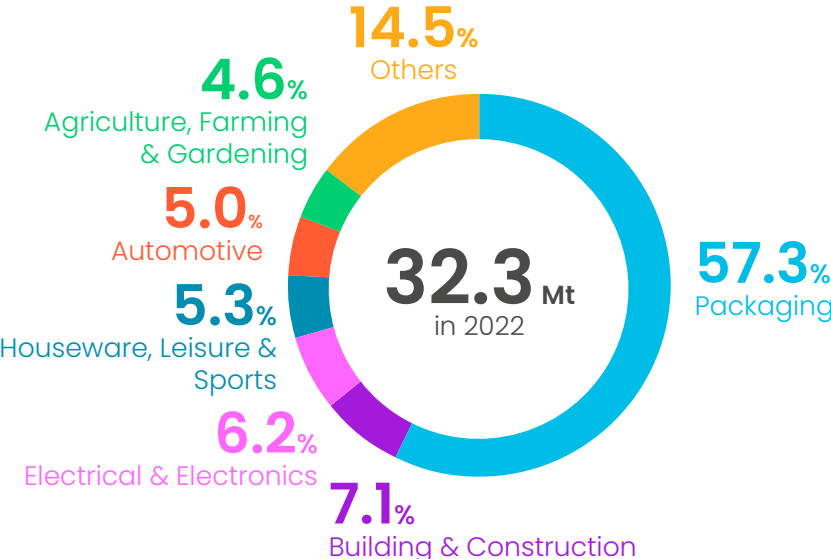
In 2022, more than half of collected post-consumer plastics waste came from packaging applications. The next largest sources were building and construction, and automotive applications.

Evolution of post-consumer plastics waste collection by sector

2018-2022, in the EU27+3

Post-consumer plastics waste collection by application

2022, in the EU27+3



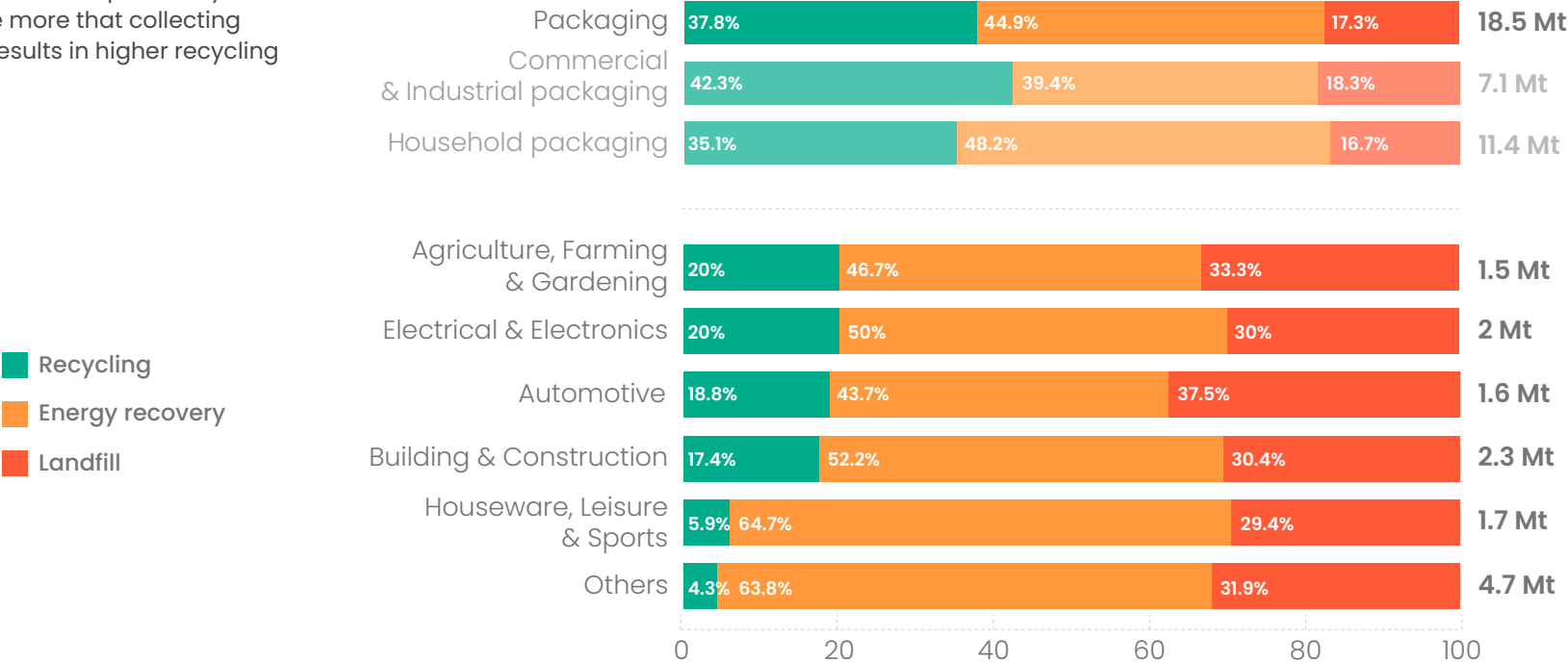
The above data are rounded estimations.

Plastics waste treatment by sector

Plastics waste from packaging, electrical & electronics, as well as agriculture, farming, gardening applications historically have the highest recycling rates. Those sectors benefit from separate collection systems (e.g. Extended Producer Responsibility schemes), confirming once more that collecting plastics waste separately results in higher recycling rates.

Post-consumer plastics waste treatment by sector

2022, in the EU27+3



The above data are rounded estimations. 2022 waste treatment data were calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).

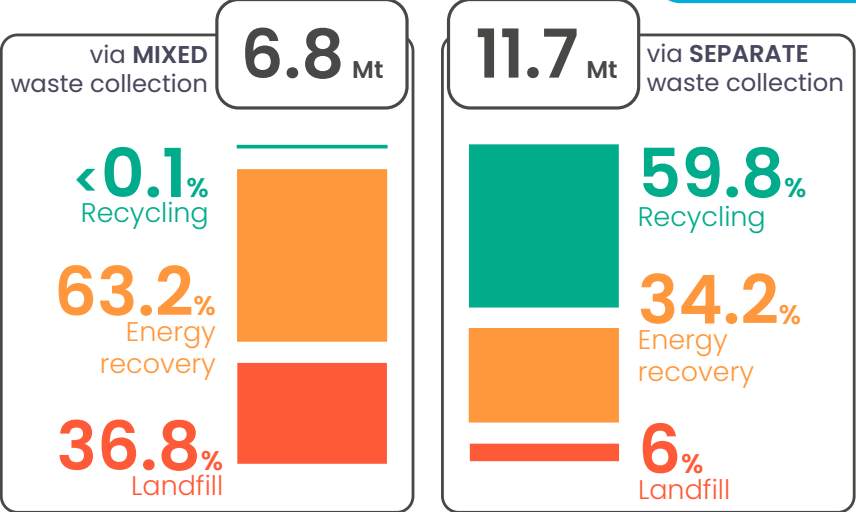
Plastics waste management – Packaging*

Post-consumer plastics waste collection and treatment

2022, in the EU27+3

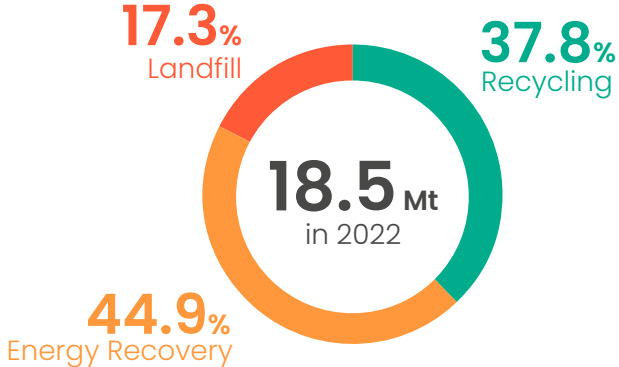
18.5 Mt

Plastics **PACKAGING** waste recycling rates are **60% higher** when **collected separately** compared to mixed collection streams.

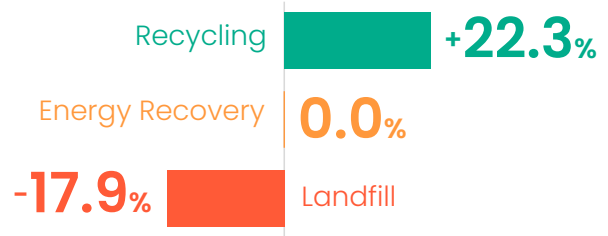


Post-consumer plastics waste management

2022, in the EU27+3



2018–2022 evolution

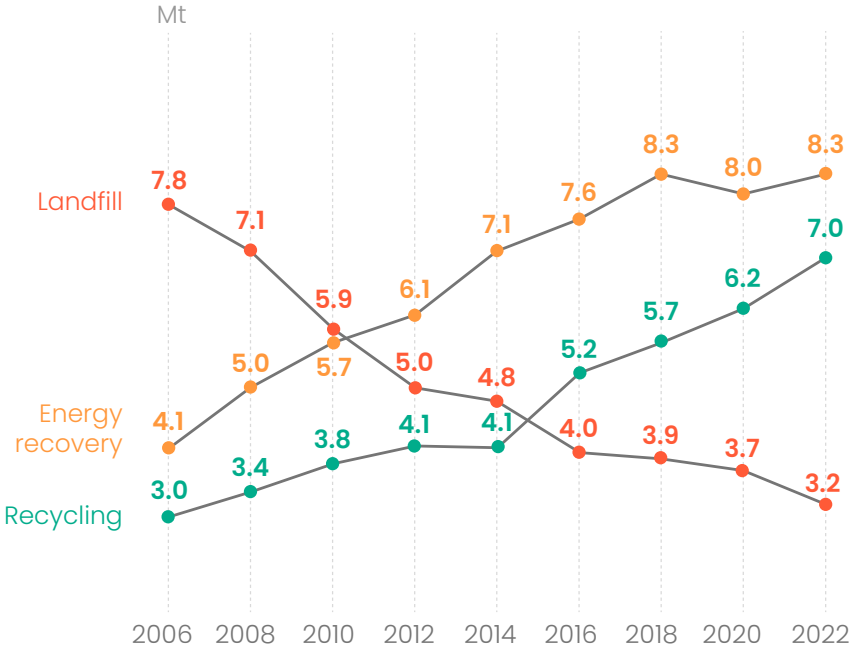


The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73). *From household, industrial and commercial plastics packaging.

Plastics waste management – Packaging*

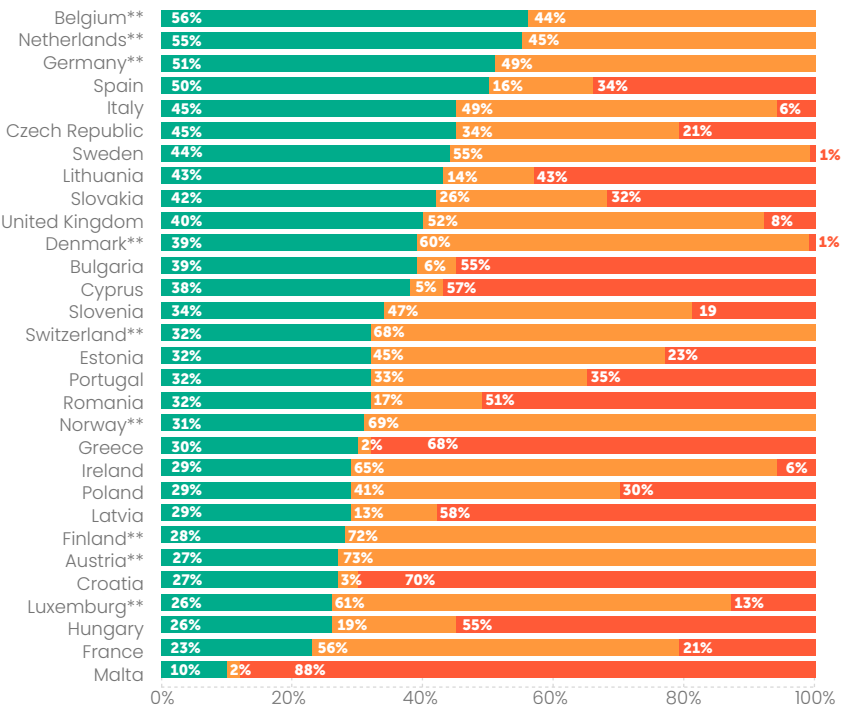
Evolution of post-consumer plastics waste management

2006–2022, in the EU27+3



Post-consumer plastics waste management by country

2022, in the EU27+3

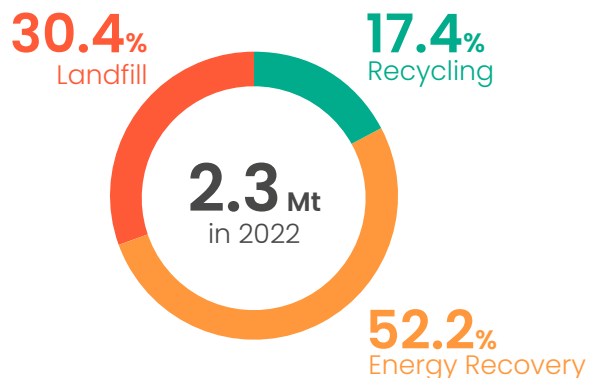


The above data are rounded estimations.
 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 *From household, industrial and commercial plastics packaging.
 **Countries with landfill bans.

Plastics waste management – Building & Construction

Post-consumer plastics waste management

2022, in the EU27+3

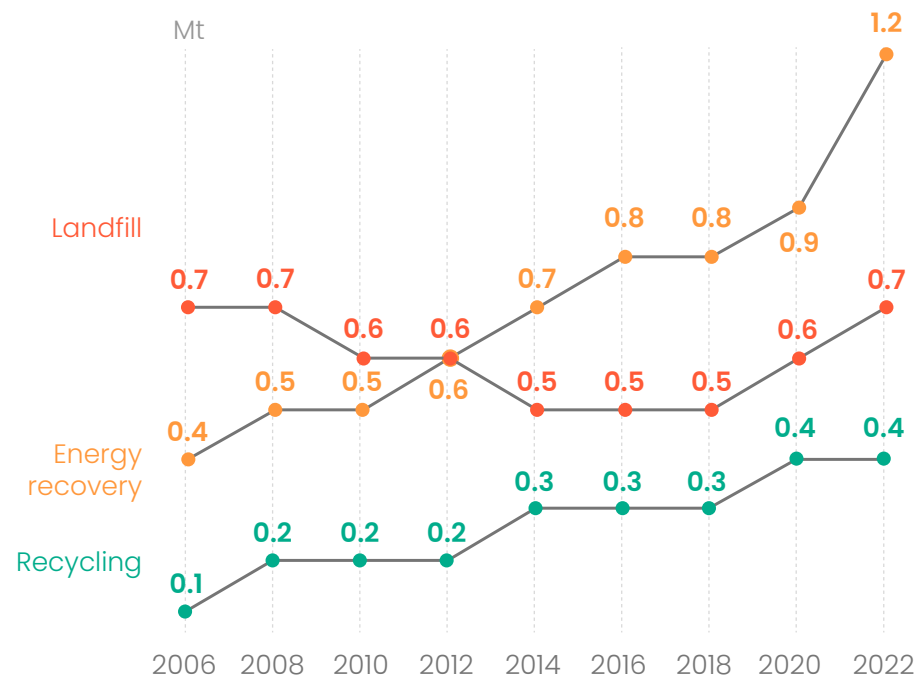


2018-2022 evolution



Evolution of post-consumer plastics waste management

2006-2022, in the EU27+3



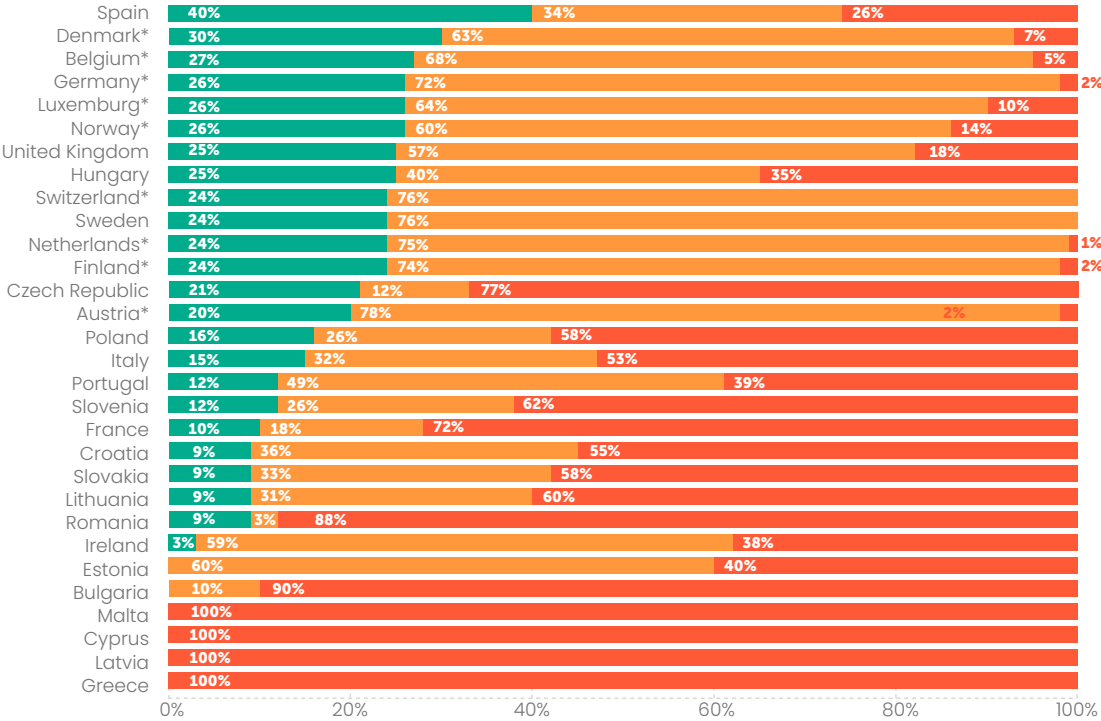
The above data are rounded estimations.

2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).

Plastics waste management – Building & Construction

Post-consumer plastics waste management by country

2022, in the EU27+3

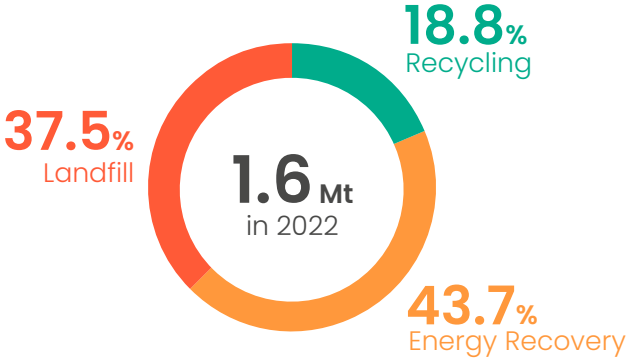


The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73). *Countries with landfill bans.

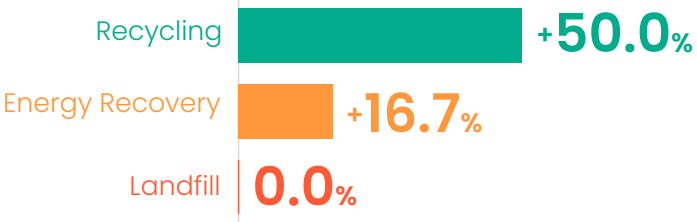
Plastics waste management - Automotive

Post-consumer plastics waste management

2022, in the EU27+3

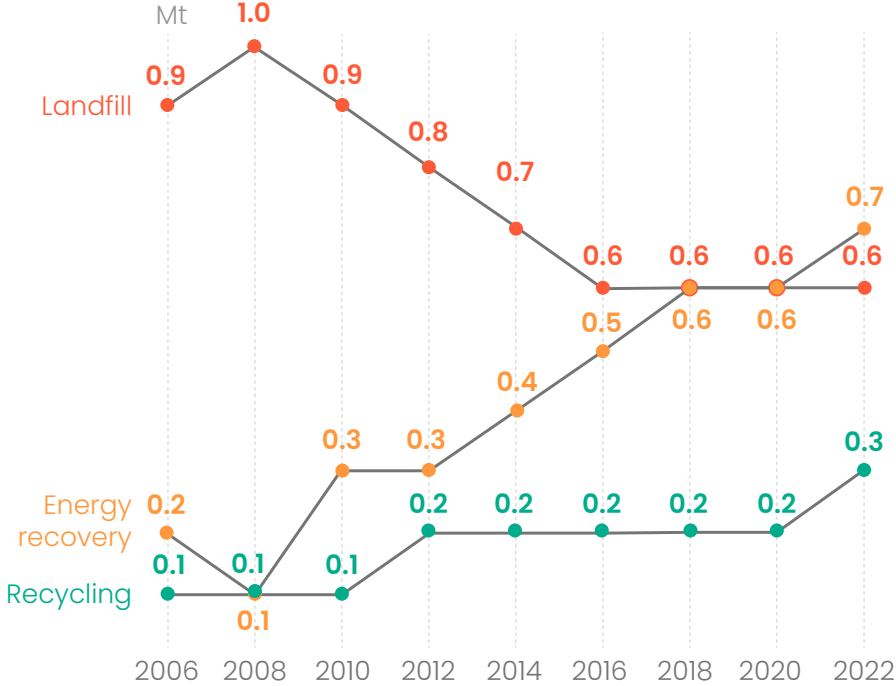


2018-2022 evolution



Evolution of post-consumer plastics waste management

2006-2022, in the EU27+3

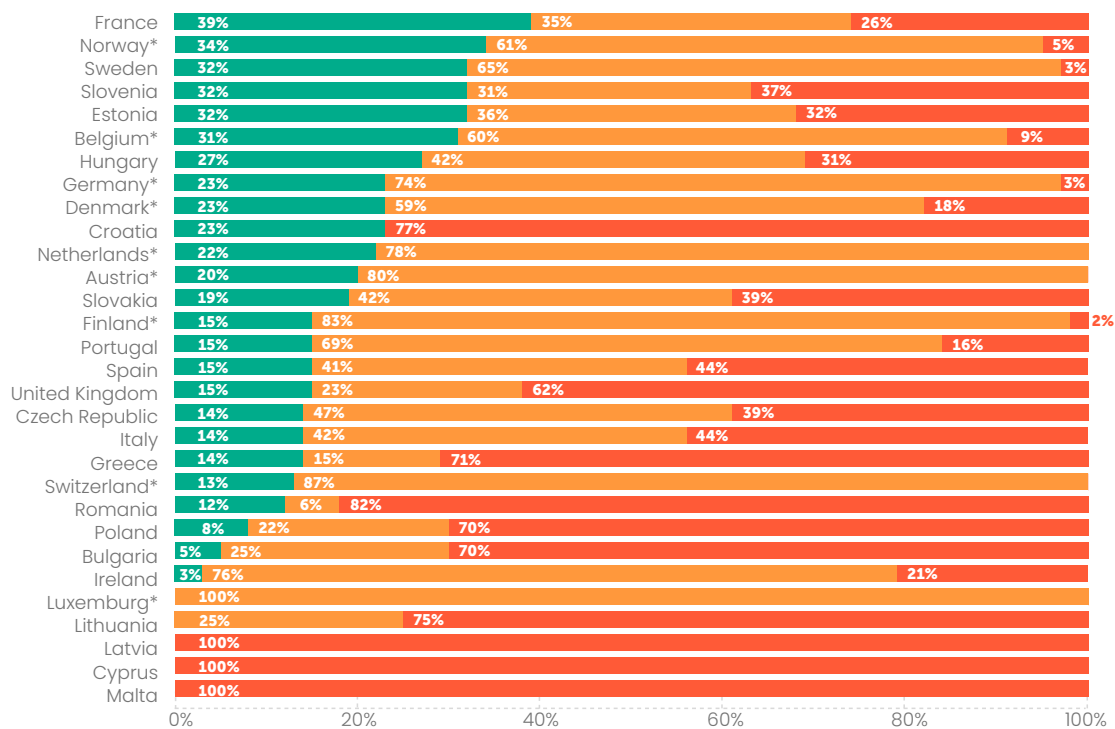


The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).

Plastics waste management – Automotive

Post-consumer plastics waste management by country

2022, in the EU27+3

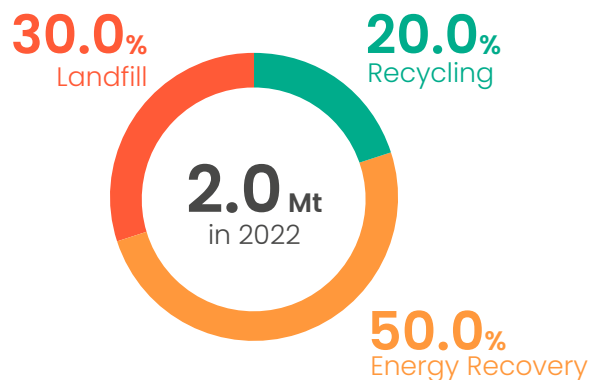


The above data are rounded estimations.
 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 *Countries with landfill bans.

Plastics waste management – Electrical & Electronics

Post-consumer plastics waste management

2022, in the EU27+3

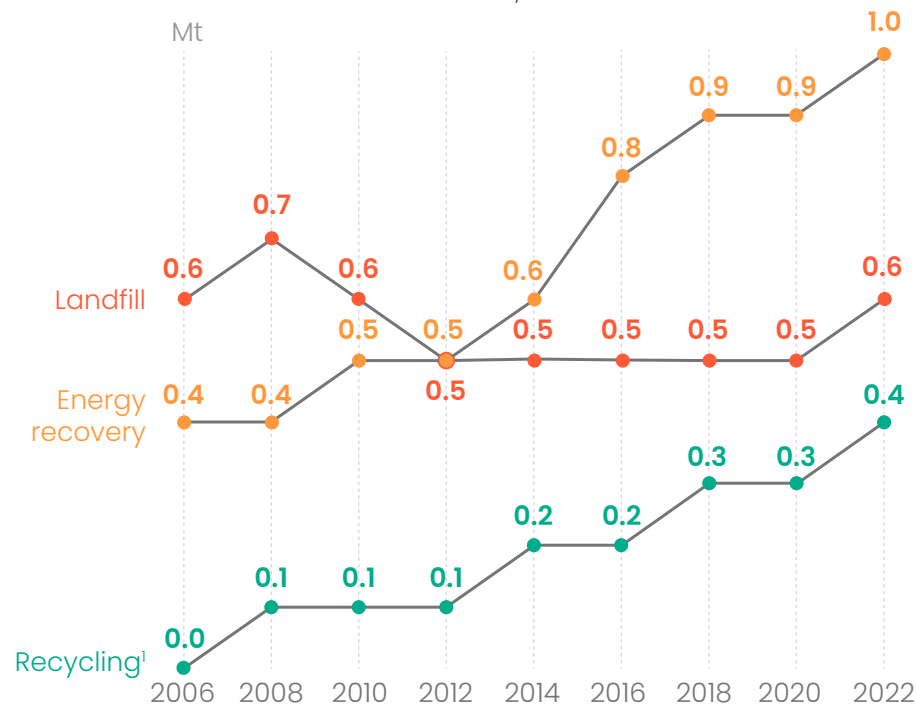


2018–2022 evolution



Evolution of post-consumer plastics waste management

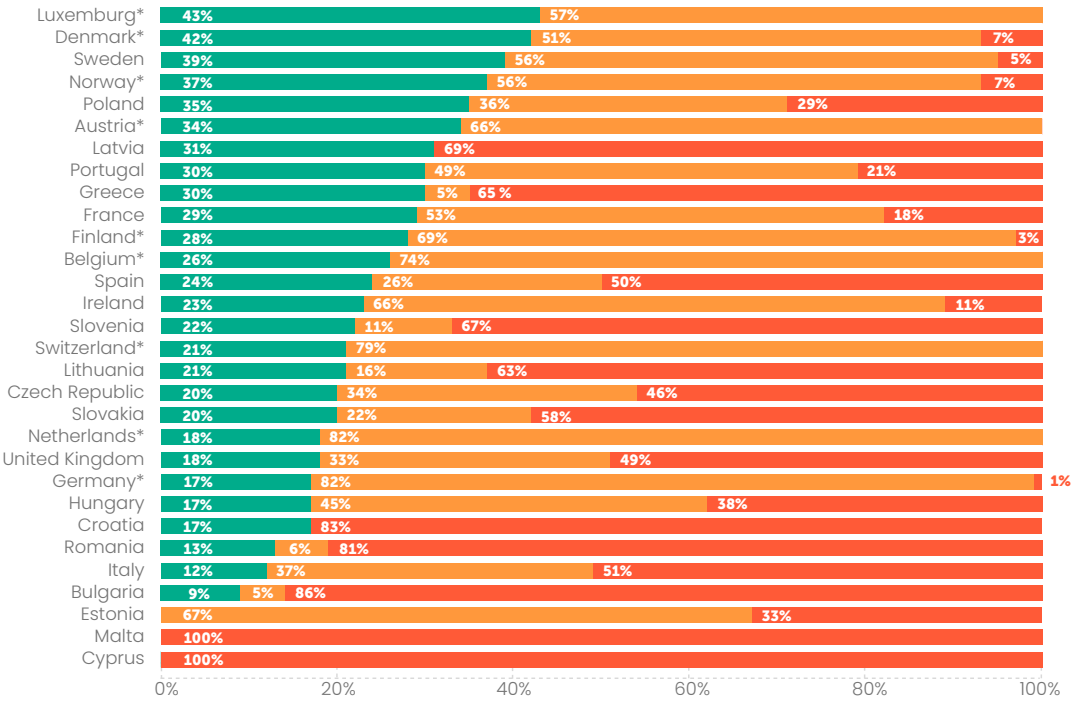
2006–2022, in the EU27+3



The above data are rounded estimations.
2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
1. Recycling evolution only available as of 2008.

Plastics waste management – Electrical & Electronics

Post-consumer plastics waste management by country
2022, in the EU27+3

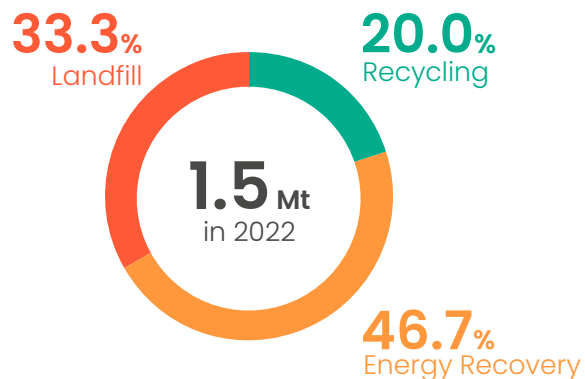


The above data are rounded estimations.
2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
*Countries with landfill bans.

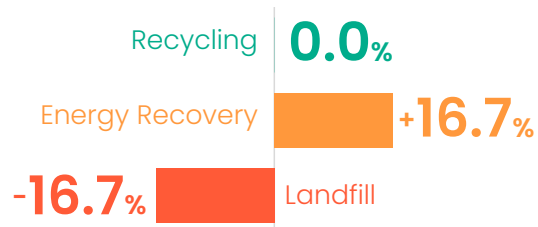
Plastics waste management – Agriculture, Farming & Gardening

Post-consumer plastics waste management

2022, in the EU27+3

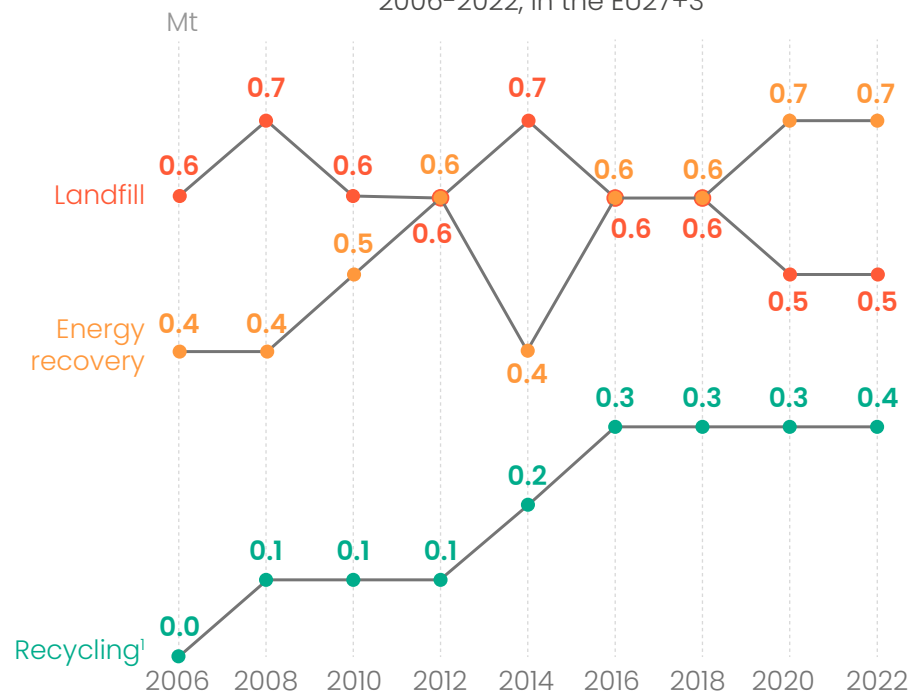


2018–2022 evolution



Evolution of post-consumer plastics waste management

2006–2022, in the EU27+3

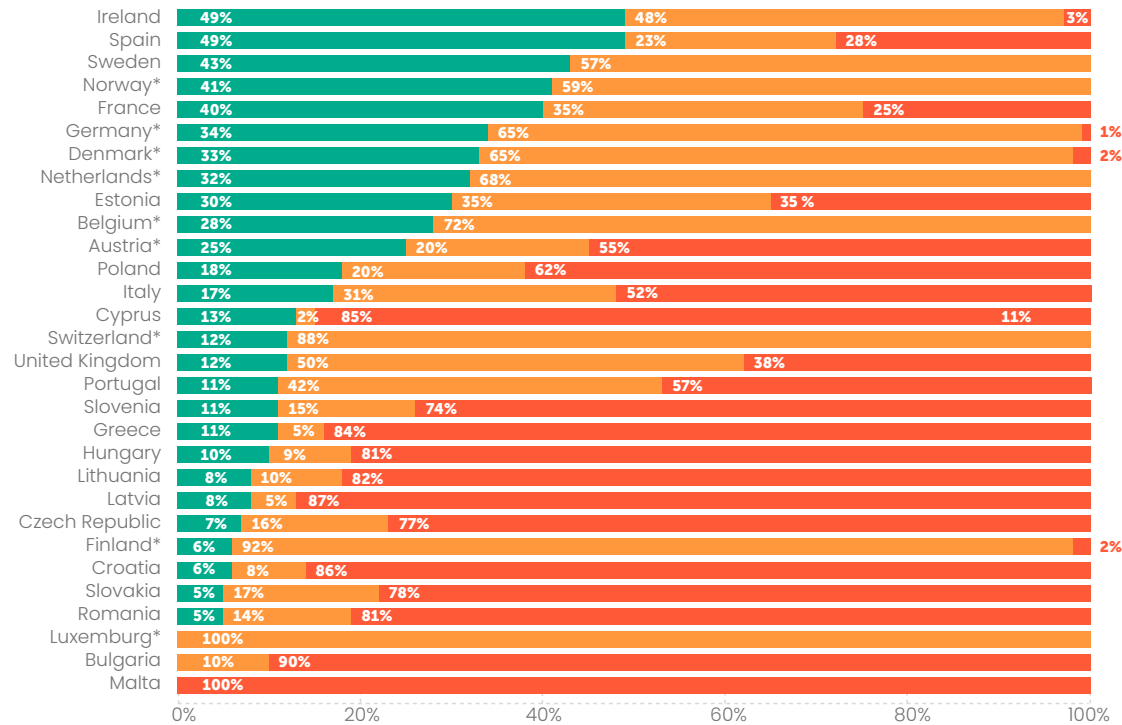


The above data are rounded estimations.
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1. Recycling evolution only available as of 2008.

Plastics waste management – Agriculture, Farming & Gardening

Post-consumer plastics waste management by country

2022, in the EU27+3

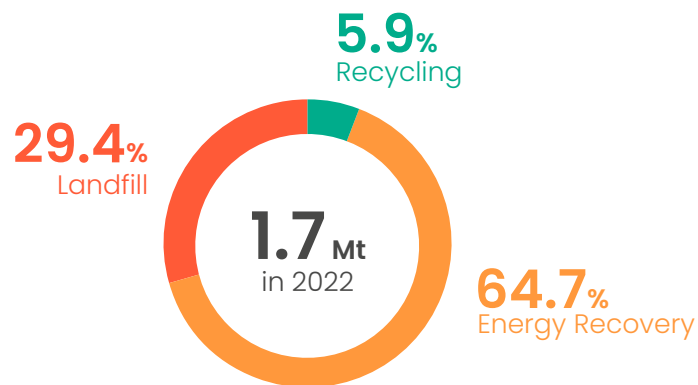


The above data are rounded estimations.
 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 *Countries with landfill bans.

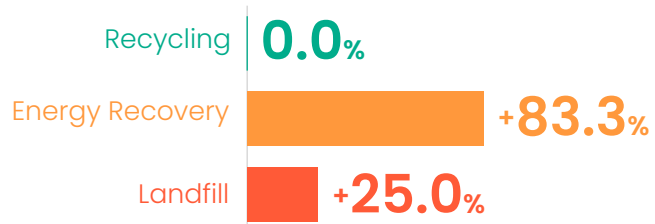
Plastics waste management – Houseware, Leisure & Sports

Post-consumer plastics waste management

2022, in the EU27+3

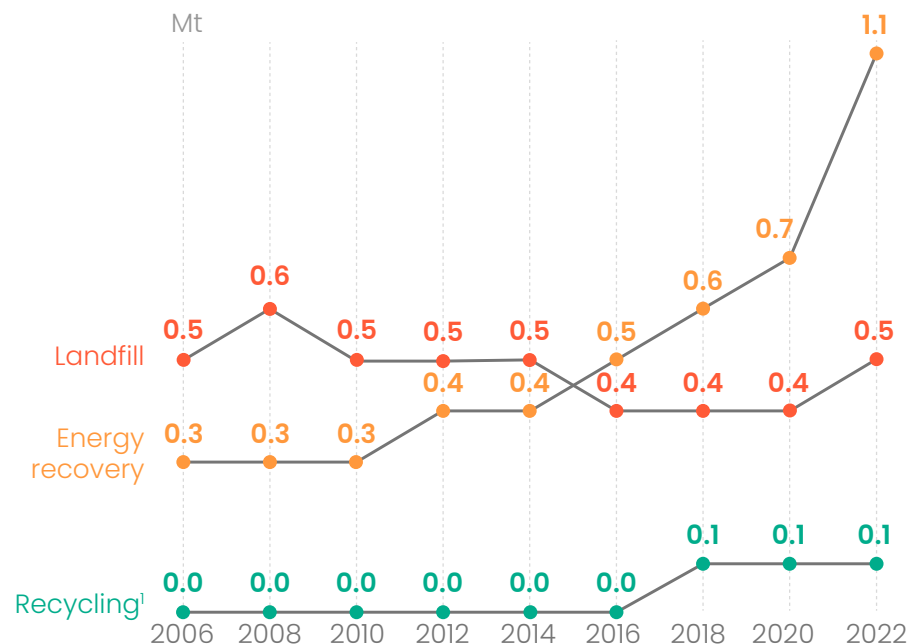


2018–2022 evolution



Evolution of post-consumer plastics waste management

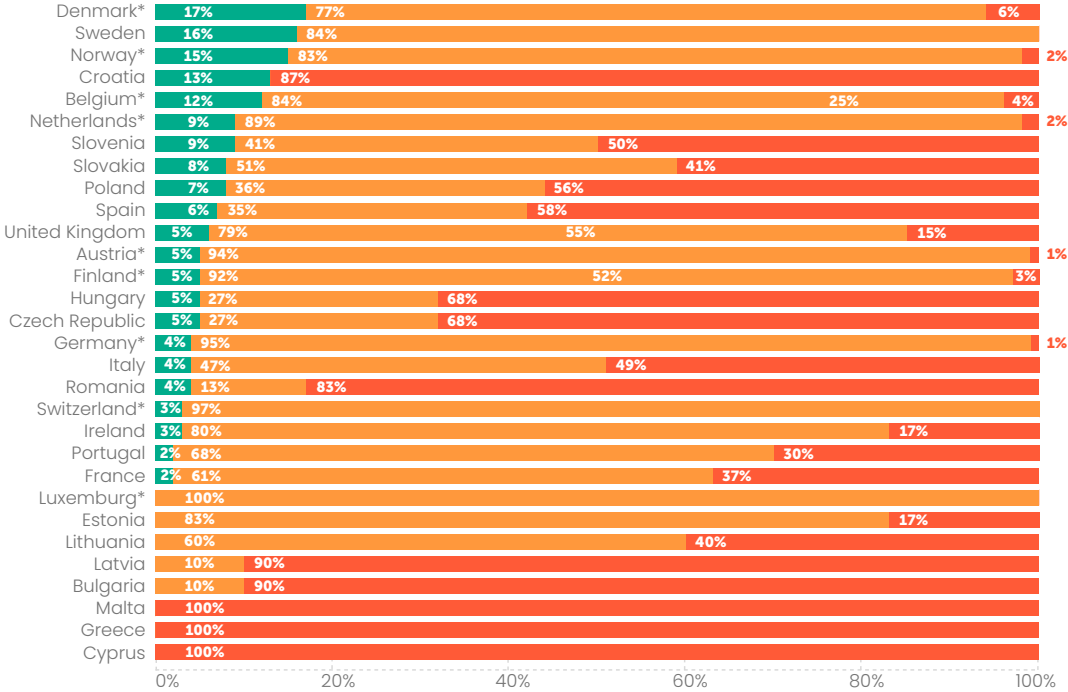
2006–2022, in the EU27+3



The above data are rounded estimations.
 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
 1. Recycling evolution only available as of 2008.

Plastics waste management – Houseware, Leisure & Sports

Post-consumer plastics waste management by country
2022, in the EU27+3

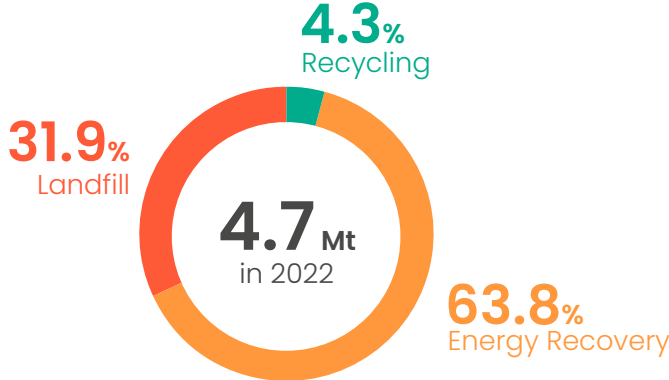


The above data are rounded estimations.
2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).
*Countries with landfill bans.

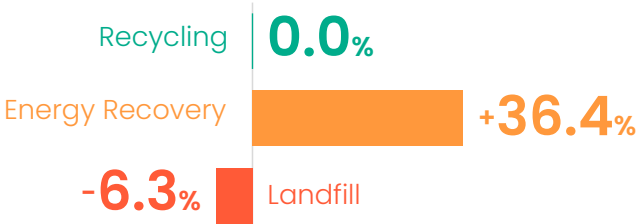
Plastics waste management - Others

Post-consumer plastics waste management

2022, in the EU27+3

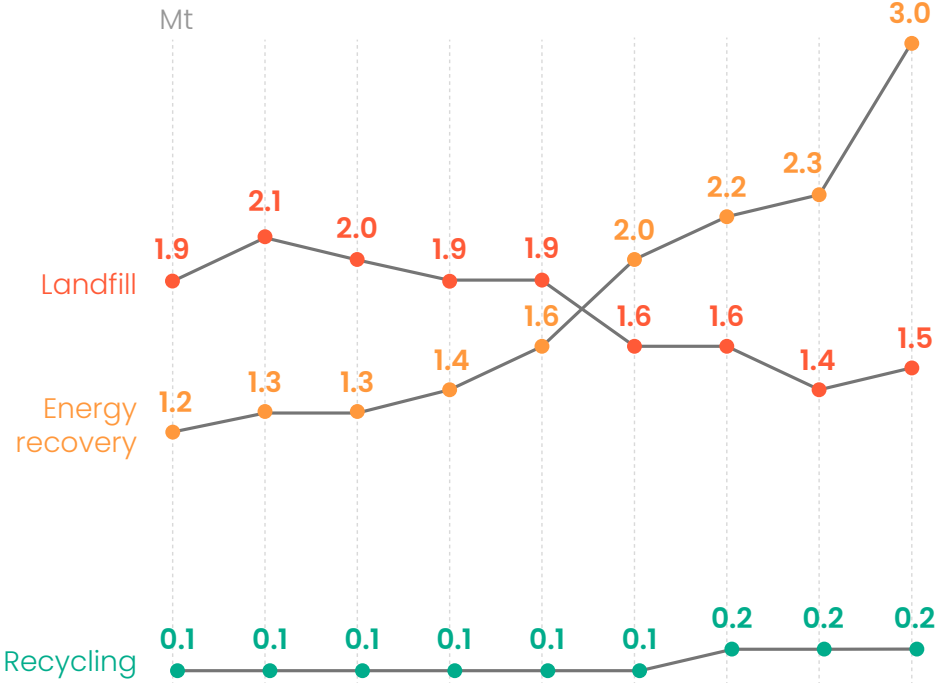


2018-2022 evolution



Evolution of post-consumer plastics waste management

2006-2022, in the EU27+3

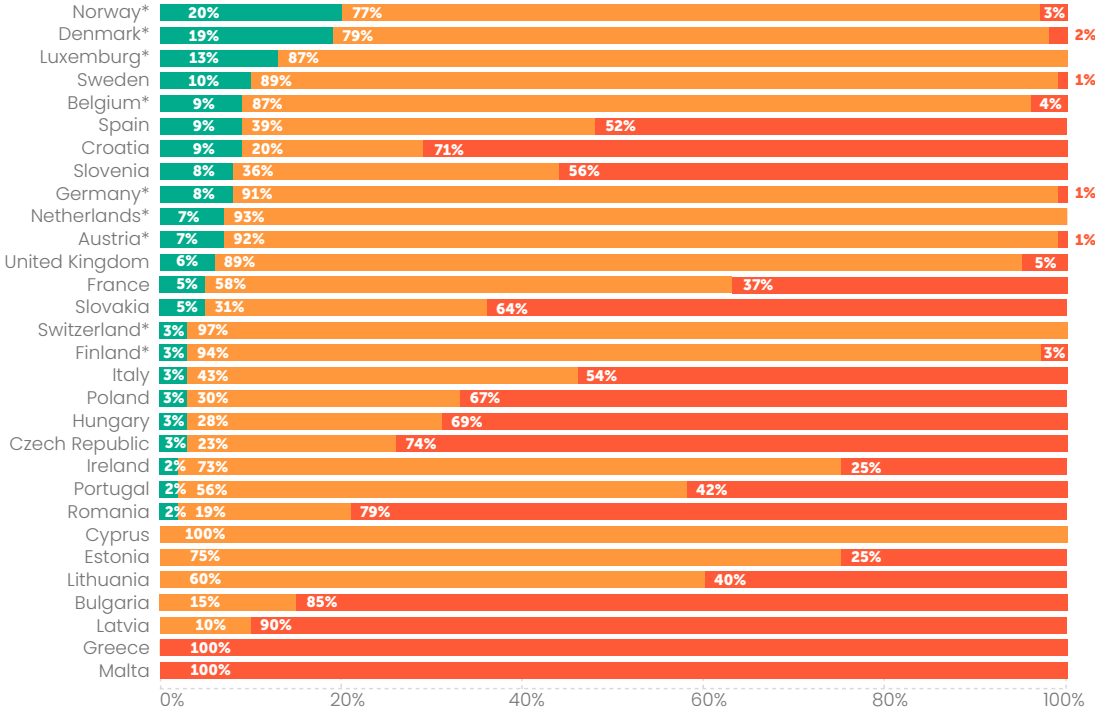


The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73).

Plastics waste management - Others

Post-consumer plastics waste management by country

2022, in the EU27+3



The above data are rounded estimations. 2022 and historical waste treatment data were (re)calculated according to the new methodology under Directive (EU) 2018/852 (for more information: see pages 72 and 73). *Countries with landfill bans.

Appendix



Plastic applications and products

Packaging

Packaging foils/films (incl. shrink and stretch films, bubble wrap, shipping foil etc.), household films (clingfilm, bags and sacks (excluding garbage sacks)), bottles (incl. drinking bottles and other bottles for non-food applications), caps, seals and closures, tubs, cans, trays (e.g. presentation and collection trays), blister packs (for pharmaceutical and other applications), spools, crates, plastic containers (incl. storage containers for food applications), barrels, canisters, buckets (for packaging purposes, e.g. paint buckets), transport packaging (e.g. plastic pallets, IBC's/intermediate bulk containers, transport boxes, packaging tapes, technical packaging). Packaging can be used for households consumption, or for industrial and commercial activities. The latter may include secondary and tertiary packaging for a wide range of products, such as stretch films around bricks pallets or packs of drinking bottles.



Building & Construction

Pipes and fittings (e.g. for drinking water, gas or sewage), window profiles and other plastic profiles, roof/rainwater gutters, drainage systems (drainage boxes), cladding, shutters, flooring, wall covering, roofing and weatherproofing membranes, sheets (e.g. corrugated sheets and other sheets), wallpapers, toilet lids/seats, films for construction applications, storage containers (e.g. for oil), construction cables, road safety, road construction products (e.g. base plates, pillars, traffic cones/traffic cylinders, barriers).



Plastic applications and products

Automotive

Parts in passenger cars and light commercial vehicles, such as battery housings, connectors, wire harnesses, automotive cables, lights and other “under the hood” applications in road vehicles, interior trim, dashboards, window seals and gaskets, specific automotive profiles, mirrors, bumpers and other exterior components, foamed films, coated fabrics, tarpaulins for lorries.



Electrical & Electronics

Components in all types of electrical and electronic devices, such as major household appliances (e.g. washing machines, dishwashers, refrigerators etc.), small household appliances (microwave ovens, coffeemakers, food processors, toasters, vacuum cleaners, electric heating devices, fans, lighting equipment etc.), consumer electronics (partially also described as “brown goods”, e.g. telecommunication devices, radio sets and HiFi-equipment, television sets, housings and components for computers/laptops, keyboards etc.), electrical power tools, electrical driven lawn-movers, electrical/electronic devices for medical applications, other components for electrical devices or electrical engineering (e.g. plugs, switches etc.).



Plastic applications and products

Agriculture, Farming & Gardening

Includes plastic products and components for agricultural applications (e.g. vegetable/animal production), gardening/horticulture and forestry. Typical product segments are agricultural foils/films (e.g. greenhouse films, mulching films, silage films, stretch films etc.), bale nets, farm technology (mobile cabinets for calves, greenhouses), flower pots and planting pots, cultivation pallets, watering cans, rain barrels and irrigation systems, composters, raised beds, gardening hand tools, garden hoses, gardening decoration articles and other gardening articles.



Houseware, Leisure & Sports

Includes tableware and kitchen utensils (e.g. mixing bowls, stirring spoons, spatulas/flippers etc.), bath equipment and toiletries (e.g. toothbrushes, soap dispensers, etc.), combs and hair clasps, housekeeping articles (e.g. boxes/cases for the storage of food or other articles, folding boxes, waste containers), clothes-hangers, decorative articles, sport/leisure/camping accessories, bathing and swimming articles, swimming pools, toys, etc.



Plastic applications and products

Others

Medical applications (e.g. hoses, blood bags, orthopaedic and sanitary equipment etc), furniture (e.g. garden furniture, plastic chairs, furniture fittings), office and school supplies, waste disposal bags, plastic components for heavy trucks, coaches, motorcycles/bicycles, e-scooters, agricultural machinery and tractors, construction vehicles, railways, aviation and shipping, technical components for machines and mechanical engineering, petrol driven tools for gardening/forestry/agricultural applications (e.g. lawnmowers, chain saws etc.), compact discs and vinyls, etc.



Polymers and plastic products: matchmaking

PP



Furniture, food containers and packaging, pipes and fittings, automotive components, etc.

PE-LD, -LLD



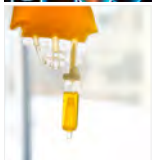
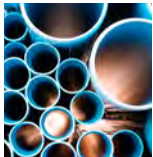
Reusable bags, agricultural film, food packaging film, etc.

PE-HD, -MD



Toys, pipes and fittings, fuel tanks, wiring and cables, milk and shampoo bottles, sun cream tube, inflatable pools, etc.

PVC



Blood and transfusion bags, floor and wall covering, window profiles, screens, pipes and fittings, cable insulation, garden hoses, inflatable pools, etc.

PS, PS-E



Inner liner for fridges, safety helmet, food packaging, building insulation, electrical & electronic equipment, glass frames, etc.

PUR



Building insulation, pillows, mattresses, car and office seats, insulating foams for fridges, etc.

PET



Beverage bottles, cleaning spray bottles, ready meal trays, etc.

Other thermo-plastics



Hub caps, optical fibers, roofing sheets, touch screens, etc.

Thermosets (excl. PUR)



Flooring, coatings, wind turbine blades, laminates, binders, furniture, reusable tableware, etc.



Scope

This report provides an overview of the European circular economy for plastics, based on the “Plastics Circular Economy 2022 in the EU27+3” study that was commissioned by Plastics Europe and carried out by [Conversio Market & Strategy GmbH](#), in partnership with the [nova-Institut](#).

The report provides a detailed analysis of the plastics material flow in the European Union, Switzerland, Norway and the United Kingdom (EU27+3), for the reference year 2022. All figures and graphs in this report show data for EU27+3, which is referred to as Europe for the purposes of abbreviation – other country groups are explicitly listed.

The report looks at the production of plastics, their conversion into products and components, plastics consumption trends, as well as plastics waste collection and treatment, including recycling. It also covers the production of recycled plastics and their use in different applications, including imports and exports data. For the first time, the report covers production and conversion of bio-based (and bio-attributed) plastics, as well as chemical recycling. The report does not cover other aspects of circularity such as repair, reuse or organic recycling.

The study was conducted from January 2023 and October 2023. The scope of the study mainly focused on post-consumer plastics waste and recycled plastics. Indeed, the various targets put on the industry (for recycling and recycled content) mainly focus on post-consumer waste and recycled plastics. However, conscious that pre-consumer plastics waste flux is part of the circular economy, the study provides some general estimations of pre-consumer waste recycling and pre-consumer recycled plastics content, which are shown in the present report. As official data for plastics packaging consumption and waste in 2022 was generally not available at the time of publication, most of the data on plastics packaging consumption and waste in this report is an extrapolation of the figures available for 2021.

The study has some limitations in so far as it does not include waste that was not officially collected, stored or was littered. Plastics waste exports data is limited to the EU27+UK for data availability reasons, and intra-EU shipments of post-consumer recycled plastics are also not shown as no trade statistics are available. Estimates are based on mass balance and market surveys. The report does not show polymer specific data for plastics waste and circular plastics, but only aggregated data.

This study focuses on the following plastic materials: PE-LD/ LLD, PE-HD/MD, PP, PVC, PS, EPS, PA, PET, ABS/ SAN, PC, PMMA, PUR, other thermoplastics, and other thermosets. Elastomers, and polymers that are not used in the manufacturing of plastics (i.e., quantities used for adhesives, sealants, coatings, paints, varnishes, textiles waterproofing, or within the production of cosmetics, medicines or chemical processes) are excluded from the scope as the study focuses on plastic materials. PVC-, PO- and PU-fibers are included, whereas PA, PET-, PBT-fibers, or acrylic polyesters are not included.

All figures in the report are rounded up.

Methodology

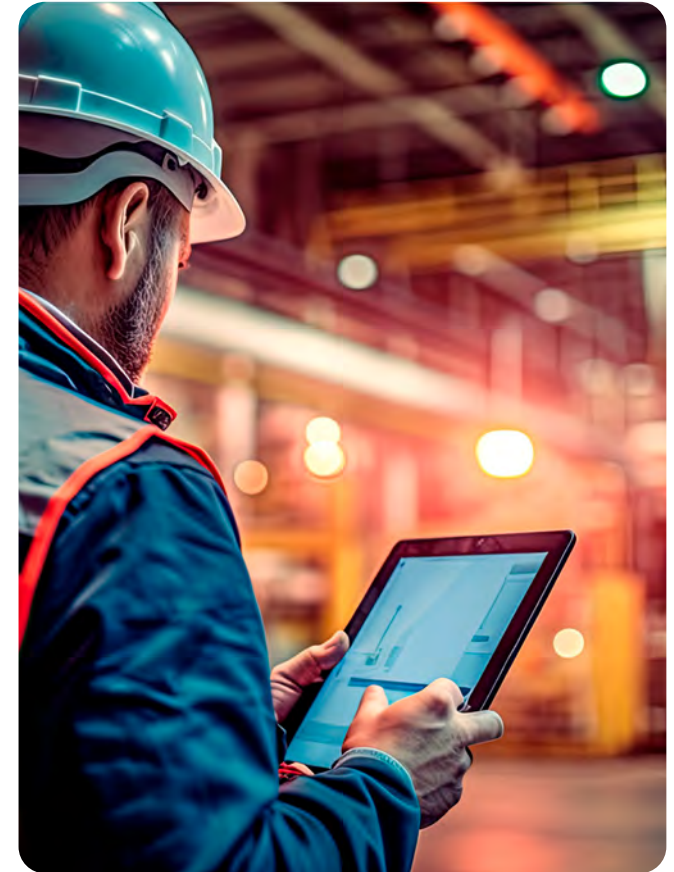
The multi-methodological approach used for this study – modellisation based on both primary and secondary data research – leads to the best possible estimations.

Primary research includes data collection from European and national authorities (e.g. Eurostat), Extended Producer Responsibility (EPR) systems, waste management as well as sector organisations. Plastics Europe's Market Research Group (PEMRG) also provided input on the demand for fossil-based plastics by European converters. Additionally, interviews were conducted with stakeholders along the plastics value chain: 400 in-depth interviews with plastics converters in several European countries – to get a better and more nuanced view of how plastics (including recycled materials) are used to manufacture plastic products and components – and 100 additional in-depth interviews with plastics producers, compounders, brand owners, extended producer responsibility (EPR) schemes, sector federations, waste management companies, sorting plants and recyclers, ministries and market experts – to complement the research and data collection.

Third party reports, statistics and publications were analysed in the secondary research. This includes the collection of data from EPR schemes and other

sector organisations to analyse existing waste streams at national and European levels. Additional datasets were also used, such as official ELV (end-of-life vehicles) and WEEE (waste from electrical and electronic equipment) data, industry databases and statistics from European associations, private entities, environmental statistical agencies as well as from NGOs and academics.

Historical and 2022 recycling rates, were (re)calculated according to new methodology mandated by Packaging and Packaging Waste Directive to calculate mechanical recycling of plastics packaging waste. Although only applicable for packaging, the methodology has been applied, in this study, to mechanical recycling of all types of plastics waste. Historical recycling rates shown in the present report may therefore differ from previous publications, and from officially reported recycling rates (e.g. ELV and WEEE). For more information, see page 72-73.



Glossary of terms

Base chemicals: Chemicals obtained via processing and/or refining of fossil-based or circular feedstock.

Bio-attributed plastics: Plastics with attributed bio-based content. The determination of bio-based content can be done via feedstock attribution (Mass Balance).

Bio-based feedstock: Raw materials of biological origin, that are grown, naturally replenished at human time scale, excluding materials embedded in geological formations and/or fossilised. It can either be produced from grown crops (so-called “first-generation” such as maize, rapeseed) or organic residuals and waste (“second-generation” such as agricultural waste, frying oils, manure).

Bio-based plastics: Plastics fully or partially produced from bio-based feedstock.

Carbon Capture and Usage: Process of capturing CO₂ from potential system emissions streams before it enters the atmosphere or from the atmosphere itself (Direct Air Capture). Captured CO₂ can then be used as a feedstock to produce plastics.

Carbon captured feedstock: Raw material derived from technically captured CO₂ from air or industrial processes used as a feedstock.

Chemical recycling: Chemical recycling converts e. g. polymeric waste by changing its chemical structure to produce products (e. g. waxes) or substances (e.g., oil and gas) that are used as raw materials for the manufacturing of plastics or other products. Products exclude those used as fuels or means to generate energy. There are different chemical recycling technologies such as pyrolysis, solvolysis, gasification, hydro-cracking and depolymerisation.

Chemically recycled feedstock: Feedstock derived from waste through chemical recycling.

Circular feedstock: Circular feedstocks are recycled feedstock, bio-based feedstock, carbon captured feedstock. Note: The definition is based on the feedstock used and does not refer to the end-of-Life of the plastics.

Circular plastics: Group of plastics fully or partially produced from circular feedstock including recycled plastics, bio-based plastics, bio-attributed plastics and plastics derived from carbon-capture. Note 1: Antonym of fossil-based plastics. Note 2: The definition is based on the feedstock used and does not refer to the End-of-Life of the plastics.

Consumption: Every plastic product (e.g. a bottle) or component embedded in larger products (e.g. a plastic component in a car), which is used by the end-user for household, commercial and/or industrial activities.

Conversion: Manufacturing of plastic products and components.

Depolymerisation: Transformation of a polymer to its monomer(s) or to a polymer of lower relative molecular mass. The process can be mediated by e.g. heating, chemical solvents or enzymatic/catalytic reactions. Note: The process belongs to chemical recycling processes.

Dissolution: A purification process through which the polymer present e. g. in a mixed plastics waste or in a multi-layer formulation/ composite is selectively dissolved in a solvent, allowing it to be separated from the waste and recovered in a pure form without changing its chemical nature.

Eco-design: The integration of environmental aspects at all stages of the development process of a product, striving to generate the lowest possible environmental impact throughout the product life cycle.

Glossary of terms

Energy recovery: The use of combustible plastics waste to generate energy through direct incineration, with or without other types of waste, for electricity and/or heat conversion. Energy recovery also includes high-grade energy recovery in industrial facilities, if the main purpose of the operation is to replace fossil fuels (e.g. cement kilns, pulp mills, gasification plants).

Extended Producer Responsibility (EPR): Set of measures taken to ensure that products manufacturers bear operational responsibility or finance an organization for the management of the waste stage of a product's life cycle.

Extrusion moulding process: Manufacturing process that consists of melting plastics that are extruded and cooled into various solid shapes.

Feedstock: Raw material or material that is the principal input for an industrial production process.

Fossil/fossil-based feedstock: Raw material that is derived from fossil resources (crude oil, natural gas, coal).

Fossil-based plastics: Plastics produced directly and fully from fossil feedstock.

Gasification: A process where mixed after-use materials, such as polymeric waste, are heated in the presence of limited oxygen to produce primarily syngas that can be converted into polymers again. Note: The process belongs to chemical recycling processes.

Incineration: Process of burning plastics waste. In the EU27+3, the vast majority of plastics waste incineration is with energy recovery.

Landfill: A waste disposal site for the deposit of waste onto or into land (i.e. underground). In Europe, landfill are controlled (in opposition to uncontrolled landfill) to avoid significant negative environmental effects in terms of greenhouse gas emissions and pollution of surface water, groundwater, soil and air.

Mass Balance: Set of rules that enables traceability of different types of feedstocks, between their input and output, along the value chain to the manufacturer of the final plastic products or components.

Mechanical recycling: A method of processing by which plastics are recovered from plastics waste without changing the basic polymeric structure of the material. Plastics waste undergoes sorting processes in specialised sorting facilities to separate different

plastics streams. After cleaning and grinding the sorted plastics waste, the material is recovered by melting and reshaping (e.g. regranulating) processes (pellets, flakes or powders), to be used in the manufacture of plastic products and components.

Mixed waste collection: Collection of waste without pre-sorting of plastics or other materials by the end-user (e.g. household residual waste, municipal waste).

Monomer: Molecule that is used to produce polymers. Monomers are the main building blocks of polymers.

Organic recycling: Recycling (e.g. via composting or anaerobic digestion) of biodegradable/compostable organic waste including biodegradable/compostable plastics under controlled conditions using microorganisms to produce, in the presence of oxygen, stabilized organic residues, carbon dioxide and water or, in the absence of oxygen, stabilised organic residues, methane, carbon dioxide and water.

Pelletisation: The action of producing plastics pellets, i.e. granulates. These pellets are then used by plastics converters to manufacture plastic products and components.

Glossary of terms

Plastics production & compounding: Manufacturing of material which contains as an essential ingredient an organic polymer and which at some stage in its processing into finished products can be shaped e.g., by flow, extrusion, or moulding.

Plastics: Material which contains as an essential ingredient an organic polymer and which at some stage in its processing into finished products can be shaped e.g., by flow, extrusion, or molding.

Polymer: Means a substance consisting of molecules characterised by the sequence of one or more types of monomer units.

Polymerisation: Process in which monomer molecules are combined to form polymers via a chemical reaction.

Post-consumer plastics waste: Waste generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain or the installation of plastic products (e.g. cut-offs of insulation, flooring or wall-covering boards).

Post-sorting losses: Losses occurring in the plastics waste recycling process, i.e. when plastics are further separated from impurities and residues. Those losses usually are non-plastics materials such as wood, glass, paper, textiles, rubber, composites, metals, etc.; organic residues such as water, milk, yoghurt, etc.

Pre-consumer plastics waste: Waste arising from the plastics manufacturing (production and converting) processes (e.g. faulty production and sprues, edge sections of plastics sheets, production left overs). Note: This term excludes re-utilised material, such as rework, regrind or scrap that has been generated in a given process and is capable of being reclaimed within that same manufacturing process.

Processing loss: Losses occurring at the end of the plastics waste recycling process, i.e. when plastics are melted or extruded. Those losses usually are small and mostly non-plastics residues (e.g. wood, paper, aged rubber particles, fillers) and dirt.

Products in use: See the “consumption” definition.

Pyrolysis: A thermal process of heating up polymeric waste (e.g., plastics) under the absence of oxygen. It converts polymers into a range of simpler hydrocarbon compounds mainly in the form of liquid

pyrolysis oil. Note: The process belongs to chemical recycling processes.

Recycled plastics: Plastics fully or partially produced from waste via utilizing a recycling process. Recycled plastics can be used as feedstock in the manufacture of plastic products and components. Recycled plastics may be produced either from post-consumer waste or pre-consumer waste.

Repair: Operation by which a faulty or broken product or component is returned back to a usable state to fulfill its intended use.

Residues: Together with impurities, residues are material losses in a recycling process. The typical composition of the residues is moisture, organics (e.g. water, milk, yoghurt), textiles, composites, paper, adhesive, metals and plastics residues discarded from the recycling process.

Reuse: Reutilisation of plastic products or components without undergoing a recycling process or significant modification.

Separate waste collection: Collection of pre-sorted waste on a product level (e.g. household lightweight packaging, WEEE collection, container park).

Service life: The life-span of a product.

Sorting: Physical processing techniques and processes to separate materials in waste streams. Sorting is typically performed in Material Recovery Facilities (MRFs) or specific Plastic Recovery Facilities (PRFs). Sorting can be performed automatically with sorting technologies or manually.

Sorting losses: Losses occurring at the sorting of collected plastics waste, when plastics are separated from other waste that have been jointly collected. Those losses usually are non-plastics materials such as wood, glass, paper, textiles, rubber, composites, metals, etc.

Unsorted waste: Discarded plastics waste for quality and/or size reasons, but also because of possible lack of available recycling streams or capacity.

Use: The time span during which a product is utilised by the end-user. Every plastic product (or part embedded in larger products) that is still utilised, independently of when it was put on the market.

Acronyms

ABS/SAN:

Acrylnitril-Butadien-Styrol/Styrol-Acrylnotril

ELV:

End-of-Life Vehicles

EPR:

Extended Producer Responsibility

EU27+3:

27 European Member States + Norway + Switzerland + the United Kingdom

kt:

kilo tonnes

Mt:

million tonnes

OECD:

Organisation for Economic Co-operation and Development

PA:

Polyamide

PBT:

Polybutylene terephthalate

PE-LD/LLD:

Polyethylene Low Density/Linear Low Density

PE-HD/MD:

Polyethylene High Density/Medium Density

PET:

Polyethylene Terephthalate

PMMA:

Polymethylmethacrylate

PP:

Polypropylene

PPWD:

Packaging and Packaging Waste Directive

PPWR:

Packaging and Packaging Waste Regulation

PS:

Polystyrene

PS-E:

Expanded polystyrene

PU(R):

Polyurethane

PVC:


Polyvinyl Chloride

WEEE:

Waste from Electrical and Electronic Equipment



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