Focus

Roland Berger

Plastic recyclates: The new gold |
Leveraging new dynamics in recycling regulations and technologies

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- Plastics are highly versatile materials with unlimited uses. But, as consumption rises, they present a sustainability challenge because of their fossil-fuel origin and mismanagement of waste

- Recycling of plastic waste is a key lever to reduce virgin plastic production and cut plastic littering, landfilling and incineration, thus also reducing emissions

- Currently, around 10% of global plastic waste and 25% of European Union plastic waste is recycled. Rates are low due to poor consumer awareness, limited regulation outside of the EU and poor collection and sorting (infrastructure)

- However, two key factors are now driving a new momentum in EU plastics recycling:
  - EU recycling targets are being tightened (for example, 55% of plastic packaging to be recycled by 2030, recycled content increased and more collection scheme mandates) and regulation is being expanded to cover non-packaging plastics
  - New digital technologies and the scaling up of new recycling processes (advanced mechanical and chemical recycling) are improving yields, quality and the value/price of recyclates

- Based on this new momentum, plastic recyclates have the potential to become the "new gold" with strong volume growth and very attractive margins

- Companies along the plastics value chain must act now to take advantage of new opportunities, such as harnessing the sustainability trend and securing upstream feedstock and downstream profits

- M&A presents significant opportunities for players across the value chain, with many industry players recently moving to consolidate or integrate

- Actions to exploit the opportunities include pushing for improved separate-source collection schemes, investing in advanced technologies (sorting, chemical) and scouting for partnerships along the value chain

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Cover photo Koron/gettyimages

Introduction

They are hailed as one of the greatest inventions of all time. Strong, light, cheap, safe and durable, plastics are found in everything from bottles and toys to water pipes and car components. Indeed, their versatility has made them ubiquitous.

But there's also a problem. Plastics create enormous amounts of waste and generate around 4% of total manmade CO_2 emissions. And their use is only expected to grow in the future.

Recycling of plastic waste is a key lever to improve waste management and reduce plastic emissions. While currently only capturing 10% of global plastic waste, the momentum behind recycling is strengthening. Two new dynamics are driving the shift. First, the rise in environmental concerns has led to a tightening of sustainability targets. Second, the introduction of new sorting and recycling technologies is improving the economics of recycling and creating new profit pools.

The result is that plastic recyclates have the potential to become the "new gold". But what do industry players need to do to secure a share of the prize? In this report we look at the sustainability challenges behind recycling, the new dynamics driving it and how companies can profitably exploit the upcoming business opportunities around plastics recycling.

1 / The sustainability challenge

WHY PLASTICS NEED CLEANING UP

Plastics have excellent functional characteristics, making them suitable for a broad range of applications. They are used to package billions of goods every day, are the key component in millions of products and even helped take man to the Moon. But today, it is their oil-based origin and environmental impact that is talked about more than potential use cases.

EMISSIONS AND WASTE

Plastics account for around 2 billion tons of CO_2-equivalent (greenhouse gas, GHG) emissions per year, around 4% of the global total. In the EU, they make up 9% of emissions due to the bloc's position as a leading producer and converter of plastics.

The material's CO_2 footprint is driven by three key factors: the energy-intensive process of producing resins from polymers (the building blocks of plastics); the energy-intensive requirements of converting plastics (for example, injection molding); and emissions from the open burning or incineration of used plastics. Emissions stem from across the value chain. → A

Plastic waste is another major environmental issue. Currently, around 50% of global plastic waste is sent to landfill, 20% incinerated (waste-to-energy conversion) and another 20% littered or burned in the open. Just 10% is recycled. Plastic packaging takes around 250 years to naturally decompose. This means littering, on land and in water, represents a particularly challenging environmental problem, especially for wildlife.

RISING DEMAND

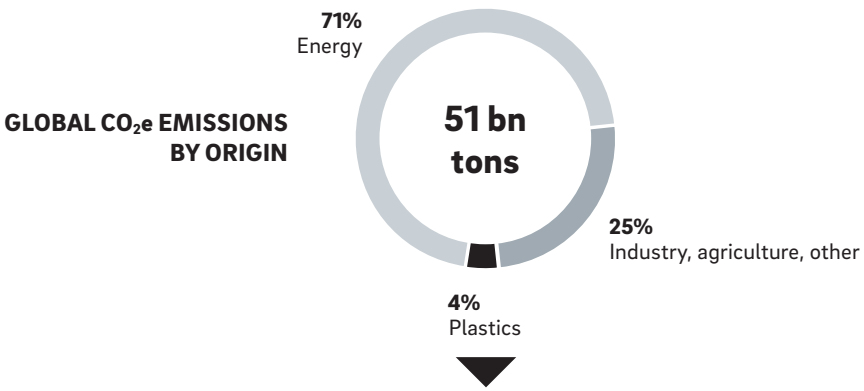
Despite these challenges, demand for plastic, particularly in packaging, is expected to remain strong. The material is cheap and convenient for consumers, and burgeoning populations are driving consumption and waste. A trend towards lightweight packaging, smaller packs and packaging-free products in developed countries should

limit the volume growth per capita. But the overall global demographic and wealth expansion will continue to drive volumes in developing countries, and therefore plastic waste growth. → B

The key levers to address plastic's sustainability challenges are the three Rs – reduce, reuse, recycle. This study focuses on the latter. The main benefits of recycling are that it cuts GHG emissions by prolonging the lifecycle of plastics, and uses less energy-intensive reprocessing rather than making plastics from virgin materials. However, no matter what the raw material, plastics recycling is no easy matter.

A: The challenge

Plastic's GHG emissions stem from production, conversion & incineration – recycling reduces the CO_2 footprint



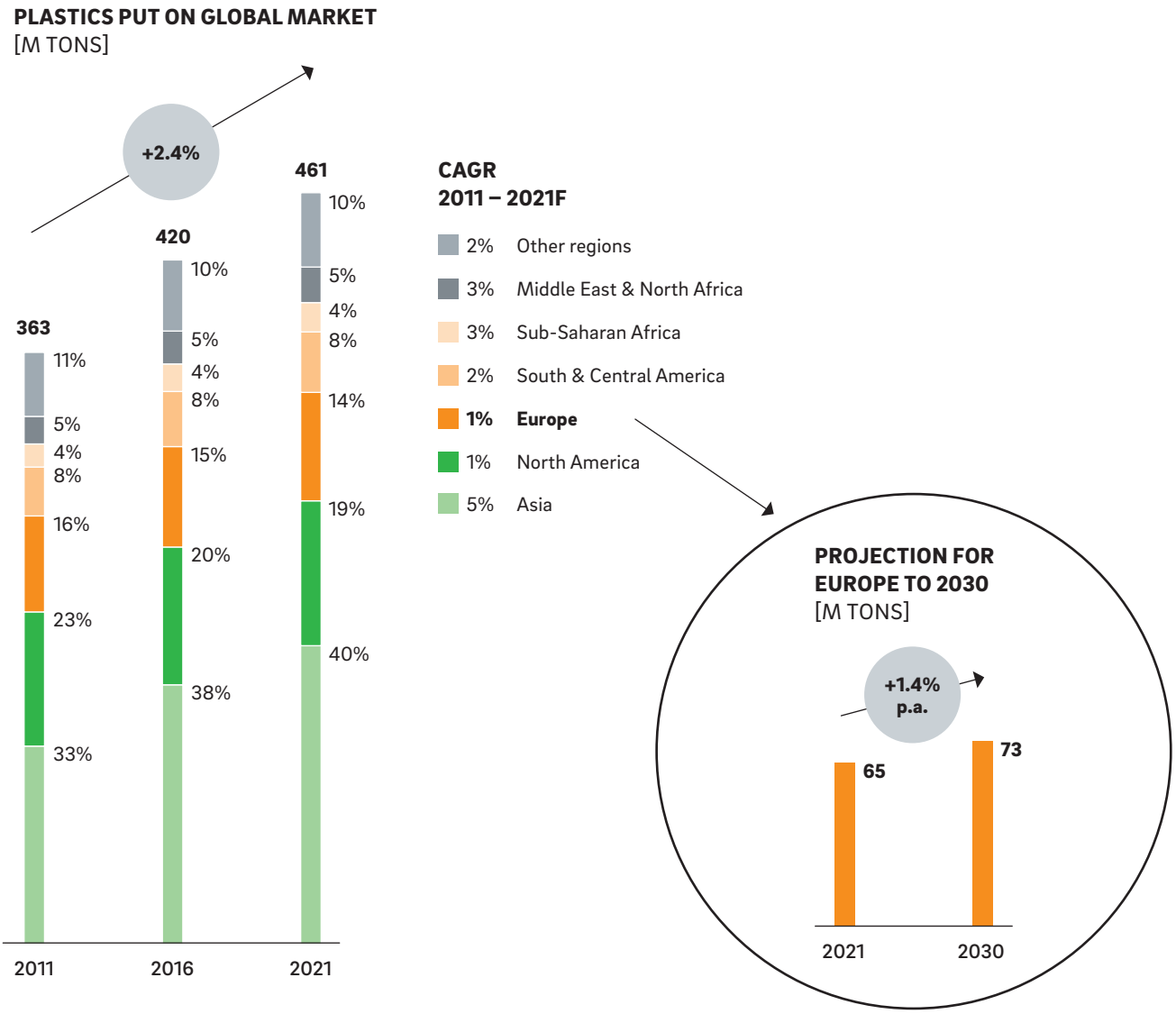
PLASTIC CO_2 FOOTPRINT ACROSS VALUE CHAIN
[KG CO_2e/KG]

	Production	Conversion	Use phase	Collection	End of life	Total
Recycling	2.0	1.4	0.15	0.15	-0.75	**3.0**
Landfilling/ littering	2.0	1.4	0.15	0.15	0.1	**3.8**
Incineration	2.0	1.4	0.15	0.15	2.0	**5.7**

Source: Climate Watch, World Resources Institute, NOOA, COMET, OECD, Roland Berger

B: Plastic economy

Global plastic volumes have grown at GDP growth levels and are expected to continue to grow in Europe



Source: OECD, Plastics Europe, Roland Berger

2 / Plastic regulations

TARGETS ARE AN EFFECTIVE WAY TO INCREASE RECYCLING

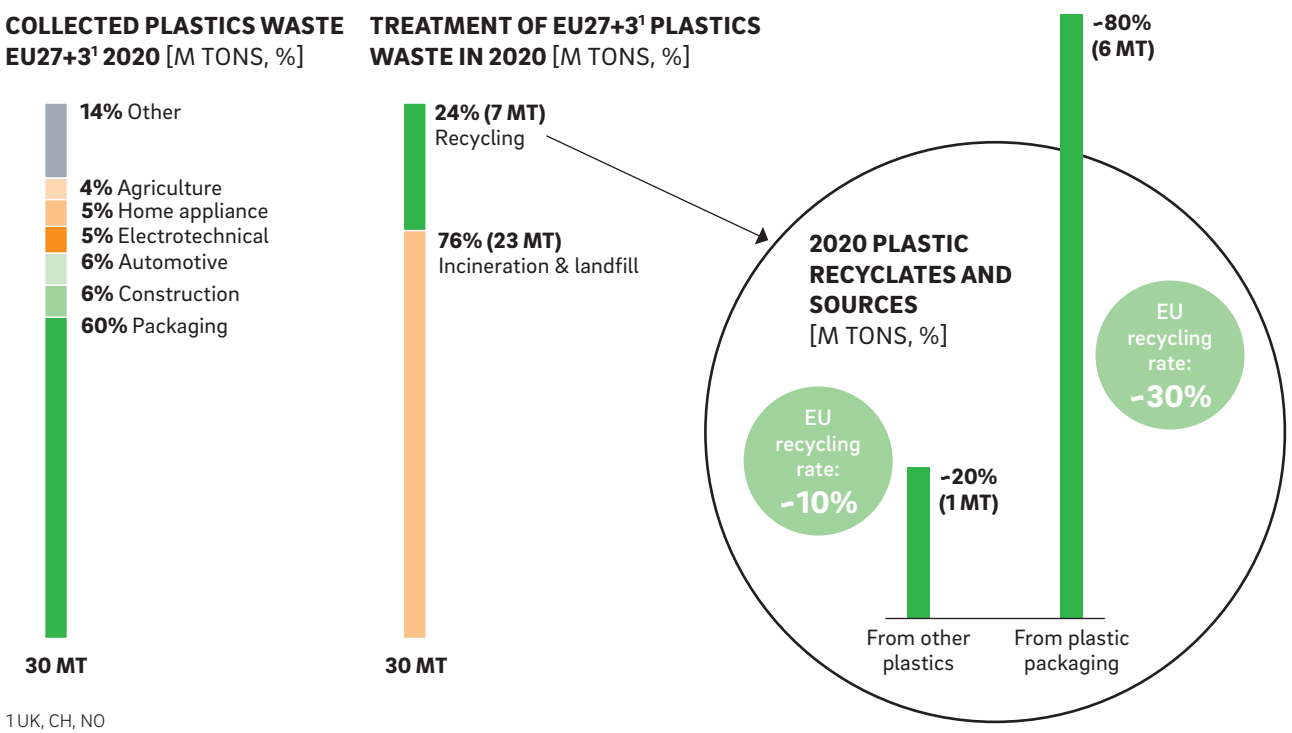
Key technologies required to recycle plastics have been around for decades, even if some types of plastics – like films and foams – have so far been difficult to process. However, currently only about 10% of global plastic waste is recycled.

Regulations to tackle plastic waste, such as recycling targets and collection schemes, have been in place since the 1990s, in particular in Europe. Today, around 70% of plastic waste is in some way covered by EU regulations designed to improve sustainability. These include applications such as consumer and transportation packaging, consumer products, textiles and electronics (packaging accounts for most plastic waste). But this means that 30% of plastic waste in Europe, mainly from the construction, automotive/manufacturing and agricultural sectors, is not covered by any regulatory targets.

So not only is the world a long way from having a recycling economy, but there are also huge gaps in the regulatory frameworks designed to get us there. Why? → C

C: Long way to go

In 2020, 30 megatons of plastic were collected in the EU, of which only 24% was recycled



1 UK, CH, NO

Source: Plastics Europe, Roland Berger

"The low oil price before Russia's invasion of Ukraine incentivized production and use of virgin plastic rather than more expensive recyclates. Companies preferred the lower-cost but less sustainable virgin option."

Oliver Herweg
Partner

In 2020, 24% of the EU's plastic waste was recycled, with the rest going to landfill or incinerated. The rate was higher for plastic packaging, at 30%. This is no surprise as almost all of the EU's plastic regulations – for example, on recycling targets, minimum recycled content in new products, etc. – have so far focused on packaging. There are three main reasons for this.

First, packaging makes up 60% of plastic waste in the EU. Second, it has a very short turnaround rate (time between consumption and disposal) compared to other plastics. Packaging is normally disposed of within a year, whereas plastic pipes in buildings, for example, can be in place for 50 years. This fast turnover results in significant littering, seen and unseen, with a substantial impact on the environment.

While higher than the overall rate of recycling in the EU, the 30% figure for packaging is a long way off the targets set in the Packaging and Packaging Waste Directive in 2018. They aim for a target of 50% by 2025 and 55% by 2030.

THE PROBLEMS WITH RECYCLING

So what's holding back the EU's recycling rate, and those of other regions? The reasons are myriad and related to shortcomings across the entire value chain:

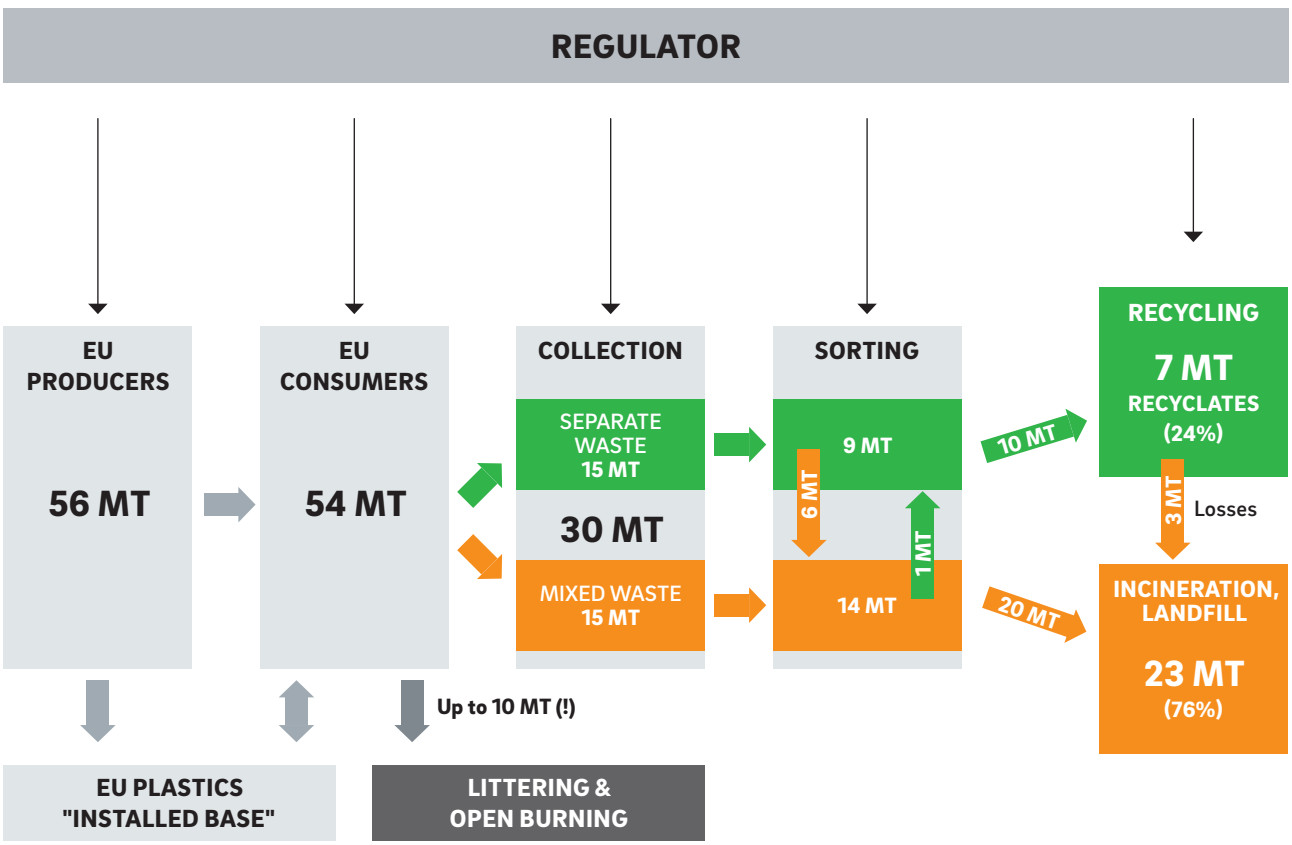
1. Previous recycling targets (for example, 23% recycling rate for plastic packaging) were set decades ago, and focused almost exclusively on the collection and recycling of rigid plastics (mainly bottles) from households, as well as films from the industrial-commercial stream (retailers, warehouses and factories).

2. The low oil price before Russia's invasion of Ukraine incentivized production and use of virgin plastic rather than more expensive recyclates. In the absence of recycled content targets to create demand for recyclates (and close the economic loop in the value chain), companies preferred the lower-cost but less sustainable virgin option.

3. The separate-source collection infrastructure, for example for lightweight fraction or deposit schemes for drinks packaging, is still weak, especially in Southern and Eastern European countries. This forces households to dispose of the majority of plastics waste in the residual stream. Less than 20% of this waste can be recovered.

D: Mismanaged

Disposal, collection and sorting are key shortcomings in the EU plastics recycling value chain



Note: All figures are 2020

Source: Plastics Europe, Roland Berger

4. In addition to the limited infrastructure in many countries, consumers are not yet disciplined or coached enough to correctly dispose of plastics in specialized collection schemes, even where they are available.

5. Although profit margins in recycling and conversion are up to 15%, margins in collection and sorting are very low, at around 2-5%. This is because collection is typically carried out by providers who also collect low-value general waste. This has resulted in limited investment in collection. But with the increasing value of plastic recyclates, which require high-quality feedstock, the dynamics are expected to shift.

6. In the past, waste sorting has not attracted significant technology investment, due to the limited applicability/demand for sophisticated solutions. But with increasing demand for high-quality sorting output, advanced technologies have been developed to allow for granular sorting (for example by polymer, grade and other packaging attributes). This creates the prerequisites for high-quality recyclates and thus substantial value added for the entire value chain.

7. Recycling capacity has historically been limited to mechanical recycling of rigid plastics (mainly drinks packaging) and basic monolayer films, thus only covering a small part of the recycling potential in Europe. → D

"In light of the increasing pressure for decarbonization, EU plastic regulations are expected to strongly drive future recycling dynamics for plastic materials. This will create multiple challenges, but also holds opportunities for market stakeholders."

Dragos Popa
Principal

Despite these challenges, and in light of the increasing pressure for decarbonization, EU plastic regulations are expected to strongly drive future recycling dynamics for plastic materials. For example, in addition to the Packaging and Packaging Waste Directive, the Single Use Plastic Directive has a 90% collection target for plastic bottles by 2030. And targets for minimum recycled content in applications such as automotive are in the pipeline. This will create multiple challenges but also holds opportunities for market stakeholders.

3 / New dynamics

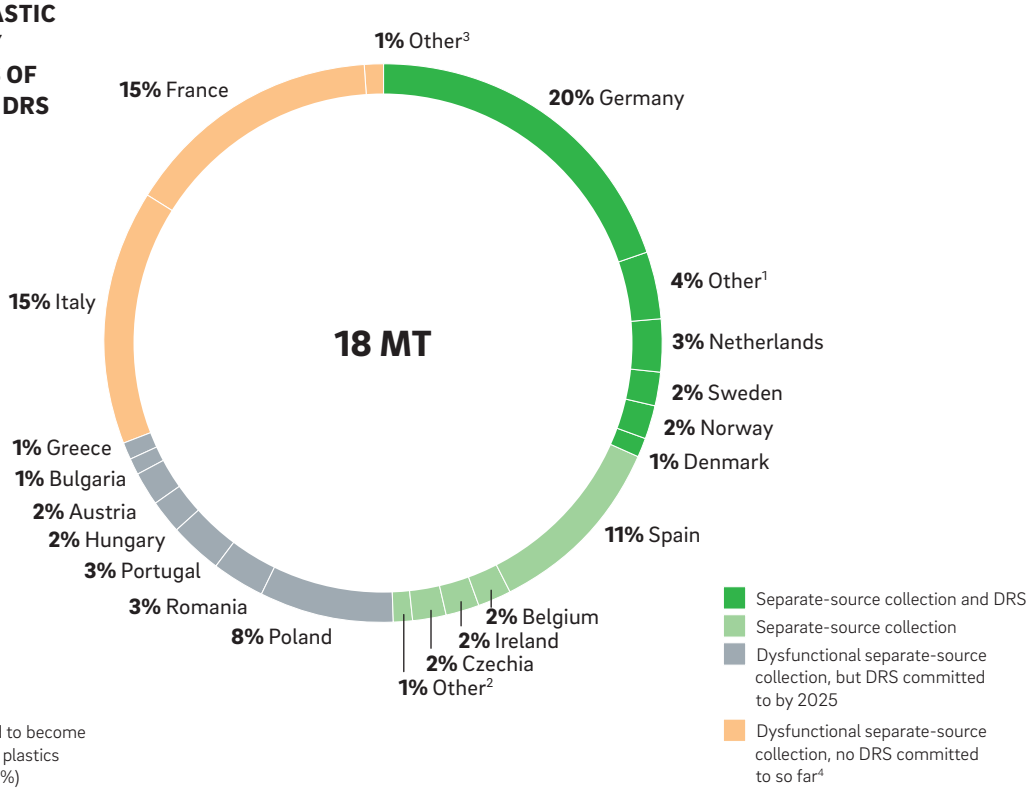
REGULATIONS AND NEW TECHNOLOGIES ARE DRIVING CHANGES IN RECYCLING

The rise in the number and force of regulations has catalyzed a new set of dynamics in EU plastics recycling. Collection and sorting is a key example, with the number of specialized collection chains for plastic packaging growing. Seven European countries – Poland, Romania, Portugal, Hungary, Austria, Greece and the UK – have committed to introducing deposit return schemes (DRSs) for plastic bottles by 2025. The new DRS systems, which build on those already in place in EU countries such as Germany and Sweden, will drive recycling rates for PET-based plastics above 80%. In addition, the stricter enforcement of separate-source collection of plastics across the entire EU, coupled with the recycled content targets for most polymers, will further drive the amount of quality plastics feedstock available for recycling. → E

E: Good intentions

The number of EU countries planning specialized collection chains for plastic packaging is rising

CONTRIBUTION TO PLASTIC PACKAGING WASTE BY COUNTRY AND STATUS OF MID-TERM PLANS FOR DRS SCHEMES



1 Finland, Baltics, Croatia, Slovakia
2 Slovenia, Luxembourg
3 Cyprus, Malta
4 However, DRS systems expected to become mandatory in the EU by 2030 (if plastics recycling rates achieved are <90%)

Source: Eurostat, Roland Berger

But perhaps the real driving force behind the new momentum in recycling is the development of a host of innovative technologies.

NEW SORTING TECHNOLOGIES

Governments and industry players like DRS systems because they are generally based on collecting very similar products, typically PET-based plastic bottles. This highlights a fundamental weakness in plastics recycling – the inability to efficiently sort materials. Sorting plants are generally limited in their sorting quality, efficiency and yield because they are reliant on old systems. The poor margins involved in sorting suggest some may have become victims of underinvestment.

But new digital sorting technologies are emerging that enable substantial improvements in yield and quality of recyclates. Process automation, for example, drives recycling volumes, while new sorting capabilities, such as object recognition or digital watermarks, offer sorting by color or polymer, enabling closed-loop systems. Such technologies have the potential to increase current "sorted for recycling" rates by 10-20%. The result is fewer losses, better-quality sorting and recyclates, and therefore higher recyclate prices.

These systems will require changes along the value chain at brand owner and sorter level (for example integrating digital watermarks in their plastic packaging), as well as significant investments. But they already have a high maturity level and the potential to become a game changer.

ADVANCED MECHANICAL AND CHEMICAL RECYCLING TECHNOLOGIES

New sorting technologies are, however, redundant without efficient systems to actually break down old plastic and create new plastic from it. Two technologies exist – mechanical and chemical recycling. Mechanical recycling is well established and is the mainstay of current recycling systems. Chemical technologies, meanwhile, are still emerging but hold great promise. Both types will benefit from improved sorting, and the two can be complementary.

In mechanical recycling, plastic waste is cut into polymer granulates without altering its chemical or polymeric structure. The process is less energy intensive than chemical recycling, potentially meaning lower CO_2 emissions. It requires high-purity/granular sorted plastic feedstock, which can in the future be produced using the advanced sorting technologies described above. Enhanced/advanced mechanical recycling combines high-quality feedstock with hot washing and odorization processing steps to produce high-quality recyclates. These can even originate from the household stream, and thus enable a shift away from downcycling (suitable only for low-quality applications) into a closed/open-loop chain (applications of similar economic value to the original feedstock of the recyclate).

Chemical recycling, on the other hand, breaks down plastic polymer chains into their constituent monomers, the base hydrocarbons used to make plastics. This has several advantages. For example, it allows for mixed-waste streams, meaning contamination is less of a problem, and permits the recovery of high-quality polymers. However, chemical recycling requires large volumes and high CAPEX, and is very energy intensive. While its CO_2 footprint is therefore less favorable, chemical recycling will be critical to further drive recycling, as it allows the processing of plastics that are not suitable for mechanical recycling.

4 / The new gold

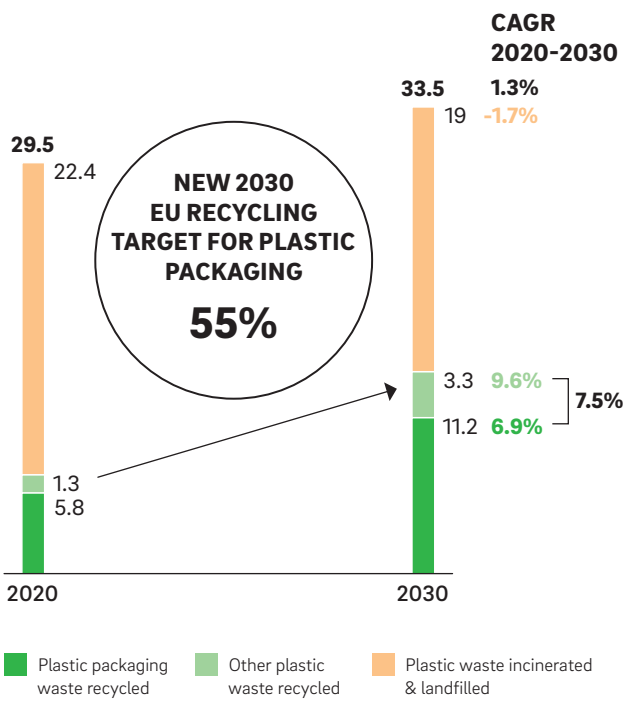
FEEDSTOCK VOLUME AND QUALITY GROWTH WILL BOOST RECYCLATE PRICES

While the EU targets on recycling are driving recyclates volumes, capacity is struggling to keep up. To achieve the bloc's 55% target for plastic packaging recycling, recyclate volumes will have to almost double from ~6 MT in 2020 to ~11 MT in 2030. Other plastic recyclate volumes will need to triple from ~1 MT to ~3 MT. This gives respective growth rates of ~7% and 10%, and overall annual growth of plastic recycling volumes of 8%. Packaging recycling will grow from a large base, while the recycling of other plastics will grow from a small base. The same can be said of the growth potential of mechanical and chemical recycling. To process the increased volume of feedstock, and taking into account process losses, recycling capacities will need to rise by at least 150%. → F

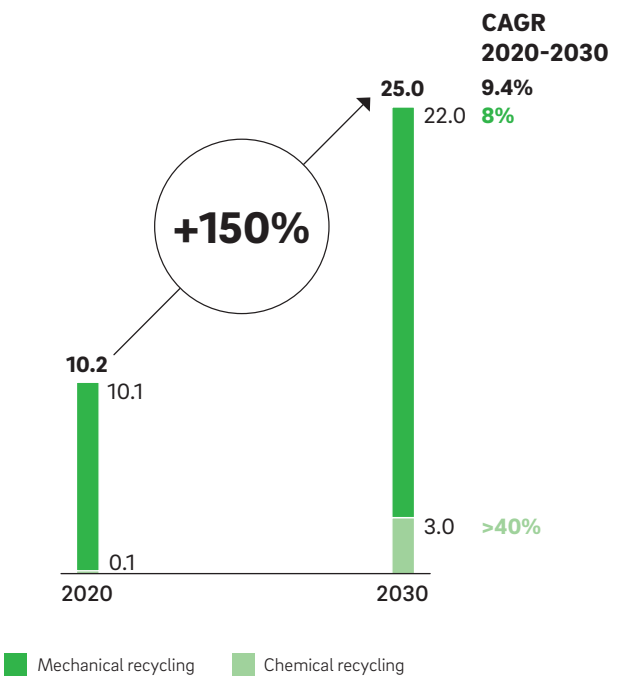
F: Capacity gap

New dynamics will drive feedstock volumes and quality – EU recycling capacity will need to jump by 150%

PLASTICS WASTE EU27+3[1] AND RECYCLED VOLUMES
[M TONS]



RECYCLING CAPACITY PROJECTIONS EU27+3[1]
[M TONS]



1 UK, CH, NO – based on current level of recycling losses

Source: Plastics Europe, OECD, Roland Berger

WHY RECYCLATES ARE WORTH MORE

The prices of virgin plastics are directly related to the price of oil, their base material. Recyclates, although made from plastic waste and not directly correlated with day-trade oil prices, have been trading slightly above virgin prices in recent times. This is the result of a sustainability premium, whereby prices for recyclates have increased due to higher sustainability awareness and targets. For example, significant mark-ups have been established on high-purity, food-grade recyclates.

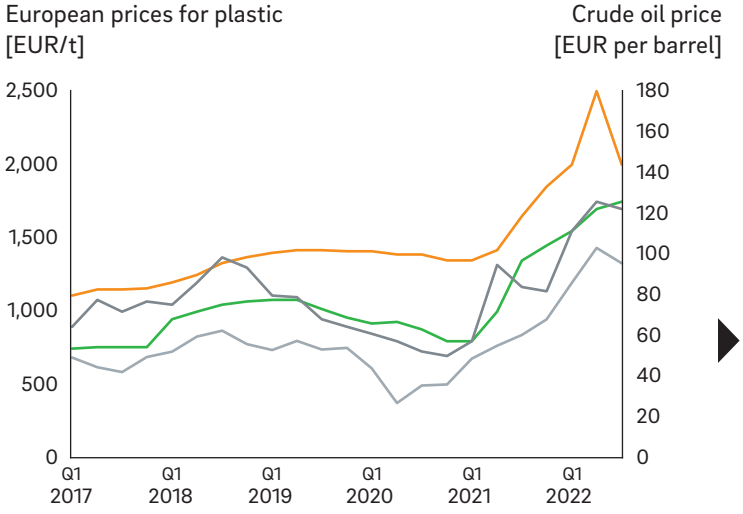
Prices for virgin plastics are likely to have peaked in 2022 as a result of the energy crisis that followed Russia's invasion of Ukraine. They are now expected to experience a correction in the short term. However, the price differential between virgin plastics and recyclates is expected to increase as sustainability awareness grows, recycling targets bite and new technologies improve recyclates quality. This also means bigger margins for producers. → G

Given this price effect and the substantial increase in their volumes, recyclates are expected to become the new gold – in demand and with growing volumes, even if current peak prices gradually fall in line with declining oil and virgin plastic prices.

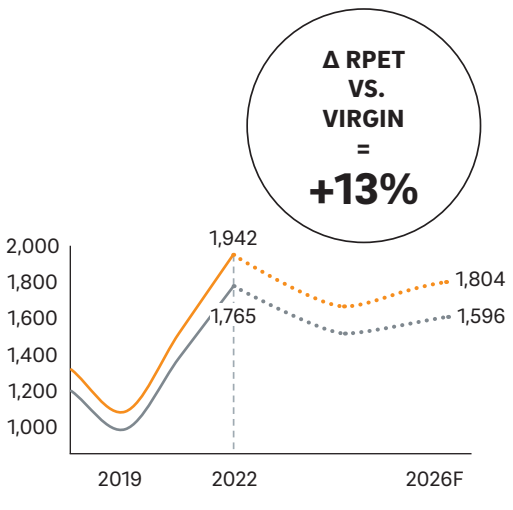
G: New gold

Prices for recyclates have increased and are projected to remain well above virgin prices

HISTORIC PET VIRGIN AND RECYCLATE PRICE EVOLUTION VS. OIL



PRICE FORECAST FOR PET VIRGIN AND RECYCLATES



rPET, food-grade, EUR/t — rPET, non-food-grade, EUR/t — Virgin PET, food-grade, EUR/t — Crude oil price, EUR/barrel

Source: S&P Global Platts, ICIS, Czarnikow Group

5 / Seize the opportunity

ACT NOW TO SECURE FEEDSTOCK AND PROFIT POOLS

With a large volume of high-value recyclates set to hit the market in the coming years, now is the time for industry players to act. Companies need to define how to position themselves to leverage the opportunities, then execute strategic measures to exploit them.

THE OPPORTUNITIES

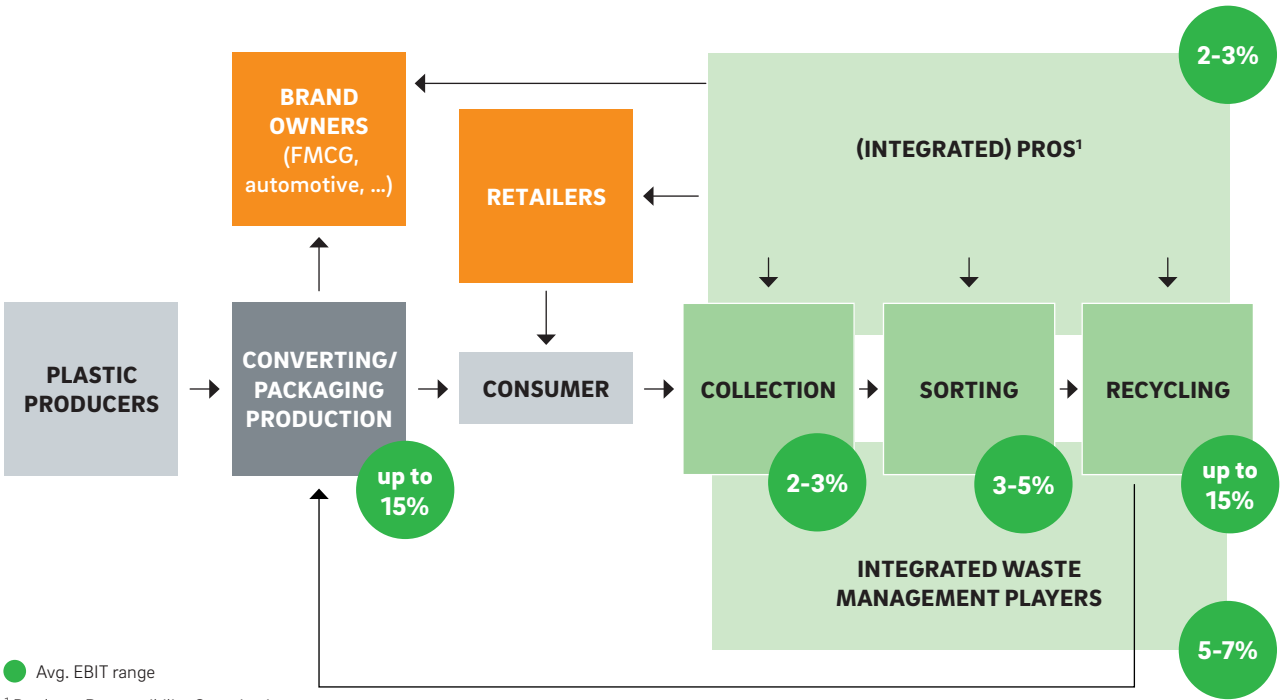
As noted above, profit levels vary according to the activity along the plastics recycling value chain (2-5% EBIT margins for collectors and sorters; up to 10-15% for recyclers and converters due to the high price of recyclates). However, the bigger earners are reliant on collectors and sorters to ensure the supply of plastic waste feedstock. The profit levels of integrated waste players are diluted by their broad coverage of the value chain. Margins for all players will increase as sorting technology advances and volumes of higher-purity recyclates rise. → H

This very fragmented market offers multiple opportunities, dependent on the company's current position and business focus within the plastics value chain.

Key objectives of such expansion strategies, typically implemented via M&A, are:

H: Profit pools

Higher margins in recycling & conversion – margin upside in collection & sorting as feedstock provider



[1] Producer Responsibility Organizations

Source: Roland Berger

"There is great potential for all stakeholders within the plastics recycling value chain. We see a broad range of strategic actions to drive business, strengthen market position and maximize margins. These are based around expanding collection chains and processing capacities, leveraging new technologies and consolidation."

Oliver Herweg
Partner

- Expand own value added to activities that drive sustainability
- Harness growth dynamics from current sustainability trend
- Secure raw material feedstock and set up closed-loop systems
- Access profit pools in downstream processes
- Drive own market share

Many industry players across Europe, from producers to PROs and multinationals to regional players, have already moved to take advantage of these lively M&A dynamics.

Recent examples include: ALPLA Group, the Austrian packaging player, acquiring the recyclers Texplast and BTB Recycling; the Thai PET recycler Indorama consolidating by taking over the Czech recycler UCY; and a vertical integration deal between the Spanish recycler Circular Resources and German PRO Der Grüne Punkt. M&A activity is only expected to accelerate in the future.

WHAT PLAYERS NEED TO DO

It is clear that there is great potential for all stakeholders within the plastics recycling value chain. So how can players exploit the opportunities? We see a broad range of strategic actions to drive business, strengthen market position and maximize margins. As outlined in the table overleaf, these are based around expanding collection chains and processing capacities, leveraging new technologies and consolidation. → I

Exact focus areas for strategic development will depend on the stakeholder type and specific positioning and business model. But whatever form it takes, players need to be aware that the timeframe to exploit upcoming opportunities is limited, and first movers are likely to capture most of the value. Defining a sound strategic agenda now is critical to future success in this small and fragmented industry.

I: Strategic levers

Companies have multiple options to act depending on their positioning and business model

ACTIONS TO EXPLOIT RECYCLING OPPORTUNITIES	Plastic producers	Convert./ packaging producers	Brand owners & retailers	PROs	Waste mgmt. players	Collectors	Sorters	Recyclers
Push for additional specialized collection schemes (Gelbe Tonne, DRS, ...)			!	!	!	!		
Invest/adopt/integrate advanced identification & sorting technologies		!	!	!	!		!	!
Expand capacities in collection, sorting & recycling				!	!	!	!	!
Define target position in recycling process technologies (i.e., mechanical, chemical)	!	!			!			!
Scout for M&A and partnering opportunities (feedstock, market share, profit pools)	!	!	!		!	!	!	!

Source: Roland Berger

Conclusion

Recycling of plastic waste is a key lever to reduce virgin plastic production and cut plastic littering, landfilling and incineration, thus also reducing emissions. Currently, around 10% of global plastic waste and 25% of European Union plastic waste is recycled. Rates are low due to poor consumer awareness, limited regulation outside of the EU and poor collection and sorting infrastructure. However, two key factors are now driving a new momentum in EU plastics recycling:
First, EU recycling targets are being tightened. For example, 55% of plastic packaging will have to be recycled by 2030, and regulation is being expanded to cover non-packaging plastics. **Second**, new digital technologies and the scaling up of new recycling processes (advanced mechanical and chemical recycling) are improving yields, quality and the value of recyclates. Based on this new momentum, plastic recyclates have the potential to become the "new gold" with strong volume growth and very attractive margins. Companies along the plastics value chain must act now to take advantage of these new opportunities. Actions to exploit the opportunities include pushing for improved separate-source collection schemes, investing in advanced technologies and scouting for partnerships along the value chain.

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