

# The Plastics Transition



Our industry's roadmap for plastics  
in Europe to be **circular** and have  
**net-zero emissions** by 2050

Executive Summary





## 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.



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# Foreword

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**Virginia Janssens,**

Managing Director  
Plastics Europe

“ The roadmap is our North Star designed to guide us for the years to come. It is an invitation to our value chain and to policymakers to reflect on our ambitions, respective roles, and the enabling conditions required to make this transition a reality. It is an opportunity to challenge our thinking and identify areas where we can join forces and progress faster. ”



**Marco ten Bruggencate,**

President Plastics Europe

“ We need a thriving and competitive European plastics industry that allows us to increase investment and innovation in circularity and decarbonisation. We are at an inflection point. The decisions we collectively make today will determine our ability to continue to serve the many downstream industries with the sustainability solutions they need. ”



**Rob Ingram,**

Vice-President Plastics Europe  
and Chairman of Roadmap  
Task Force

“ The Plastics Transition roadmap is a reflection of a fundamental cultural change happening within our industry, driven by the people working within it. It captures their dynamic approach to problem solving, and their commitment to addressing the issue of waste and reducing our carbon emissions thereby transforming the European plastics system. ”

Society's relationship with plastics is complicated.

We share and take very seriously societal concerns about the contribution of our industry to climate change, the challenge of plastics waste, and the need to ensure the safety of plastics.

However, it is also important to recognise that plastics have a vital role to play in enabling the sustainability transitions and supporting the competitiveness of many sectors in Europe. The reality is that plastics will remain irreplaceable for many applications and sectors that underpin our changing world.

The Plastics Transition roadmap is our North Star, designed to inform and guide us for the decades ahead. It reinforces the commitment of European plastics manufacturers to addressing these concerns by making plastics circular, driving lifecycle emissions to net zero, and fostering the sustainable use of plastics. For the first time, our members are united around a common vision and ambitions which reflects the cultural change that has taken place in our industry and organisation. It is a major step forward for our industry, one which has the power to shape our future.

It establishes an ambitious but realistic pathway to net zero and circularity, including milestones for 2030, key actions and indicators. In terms of circularity, it projects that the substitution of fossil-based plastics will be gradual and could reach 25% in 2030 and 65% by 2050. It also sets-out a potential pathway to reduce greenhouse (GHG) emissions from the overall plastics system by 28% by 2030, and towards net-zero by 2050.

It details immediate (2023 – 2025), short-term (2025 – 2027) and medium-term (2027 – 2030) industry actions and provides a longer-term perspective on the necessary changes. Our progress against the roadmap's indicators for circularity and GHG emissions will be assessed and transparently reported every two years.

The roadmap is a dynamic process which will be progressively updated based on new insights and changes to our industry environment, the enabling policy framework, and value chain input, as well as industry progress.

Whilst Plastics Europe members are already undertaking substantial investments and driving major advances towards circularity and net zero emissions, we are under no illusions about the scale, complexity, and cost of this transition, and the

barriers and bottlenecks that need to be overcome. This is a generational-scale task.

To overcome these challenges, we need a harmonised and enforceable EU policy framework that fully supports the industry's transition. One that helps to create enough high-quality, sustainably sourced feedstock; supports a massive upscaling of collection, sorting and recycling (both chemical and mechanical); and provides access to a diverse mix of abundant and affordable renewable energy.

We also need EU policymakers to recognise that without measures to safeguard the competitiveness of our industry, Europe will become increasingly dependent on imports from abroad, and our ability to invest in the transition in Europe will be undermined.

Doing so would allow Europe to continue to benefit from the critical role of plastics in delivering on the EU Green Deal in all sectors, secure the future of the 1.5 million people across 52,000 European companies that work in the plastics industry, and ensure the EU continues to lead the global path to plastics sustainability.

As an industry, we know that we need to listen and work much more closely with our value chain to find solutions, and engage on shared initiatives that accelerate change.

We believe the roadmap will make a very important contribution to informing and promoting dialogue and collaboration with all stakeholders with a shared interest in practical solutions to transform the European plastics system.

The European plastics system has reached a decisive moment in its history. Decisions taken in the next couple of years will determine whether and how quickly we can fulfil the ambitions set-out in the European Green Deal and roadmap. The window of opportunity is rapidly closing.

However, with collective ambition and urgency we can create a sustainable plastics system that continues to meet consumer and societal demands, whilst supporting the transitions of many downstream industries, and remains a strategic asset for the European economy.

We need your support. So, join us to help get this done – together.

# Executive Summary

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# About the Plastics Transition roadmap

Plastics Europe and our members recognise the **severity of the climate crisis** and **challenge of Plastics Transition** and that faster systemic change is essential to successfully meet the EU's net-zero and circularity objectives.

The plastics transition roadmap builds upon 'ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe'. Commissioned by Plastics Europe in 2021, the ReShaping Plastics report provides an independent perspective on transitioning to the EU's net-zero carbon emissions and circularity goals by 2050.

Plastics Europe proposed a package of measures to help implement the report's recommendations, including the development of a roadmap, to help the plastics value chain to accelerate its transition towards the EU's 2050 goals.

In this roadmap, developed with the support of Deloitte, **we lay out a potential pathway for a circular and net-zero plastics industry in Europe**<sup>1</sup>. It replaces Plastics Europe's previous 'Voluntary Commitment, Plastics 2030' and puts forward a more comprehensive set of ambitions covering all aspects of the plastics life cycle.

**The roadmap provides a framework, milestones for 2030 and indicators to monitor progress**, identify bottlenecks and find solutions to keep moving forward. Based on aggregated results from a survey of Plastics Europe's members, the industry's progress against these indicators for circularity and greenhouse gas (GHG) emissions, will be assessed and transparently reported to monitor progress, alongside any identified bottlenecks or accelerators, every two years.

The system-wide aspirations and forward-looking indicators show the extent to which **Plastics Europe members aspire to contribute to the ambitions of the EU Green Deal**. Within this framework each member of Plastics Europe will decide how the strategic pillars will be implemented within their company. This provides them with the flexibility to determine plans and company targets independently, in line with their particular circumstances and the market-based landscape within which they are operating.

**Our data-driven roadmap is a living document that will be progressively updated** based on new insights and changes to our industry environment. **It aims to guide, incentivise and accelerate industry action and performance**, and provide an evidence base **to inform value chain dialogue and policy-making**.

“ If we look back at the end of this decade and realise that this was the time where the plastics industry in Europe was unable to evolve, then we will have not delivered for our industry, for our value chains or for the planet. So now is the time to act. Now is the time to make the decisions. ”

**Marco ten Bruggencate**

<sup>1</sup> Subject, of course, to the appropriate legal advice that Plastics Europe and/or its members will seek for the implementation of the different steps and elements in this roadmap.

# A critically important industry for Europe

The European plastics value chain, comprising manufacturers, converters, waste management companies, and machinery manufacturers, employed over 1.5 million people in the EU in 2021. These workers were spread across 52,000 companies, and generated turnover of more than €400 billion.

Plastics are a strategically important material for the European economy, with applications in almost every sector, including automotive, construction, packaging, consumer goods, healthcare and renewable energy.

## RENEWABLE ENERGY

Plastics are critical for the development of clean, efficient and durable alternative and renewable energy solutions, including wind turbines and solar panels, as well as electric and hydrogen powered vehicles. These solutions reduce greenhouse gas emissions and increase resource efficiency.

## BUILDING & CONSTRUCTION

Plastics are increasingly used in building insulation due to their excellent insulating properties, which can help reduce energy demand for heating and cooling. Because they are corrosion-resistant, they are used to create pipes and fittings for plumbing and drainage systems. Plastics are used to make energy-efficient windows and doors as well as weather-resistant roofing and facades.

## HEALTH

Modern healthcare would be impossible without the many plastic-based medical products we take for granted. Plastics are everywhere, from personnel protective equipment, sterile syringes, intravenous blood bags and heart valves, to “artificial skin” for emergency burns treatment and orthopaedic devices. Innovations in plastics are making new advances in healthcare possible and 3D-printing has opened up the possibility of using plastics to print kidneys, skin, bones, cartilage, tissues and blood vessels.

## AUTOMOTIVE

Plastics help to reduce vehicle weights and improve fuel efficiency. They are used in airbag housings, seatbelts, door panels and many other components owing to their flexible, durable and lightweight characteristics. Plastics are ideal for exterior components in vehicles (bumpers, hoods, ...) thanks to their high resistance to impact and corrosion. The materials are also used for battery housing for electric vehicles and help improve energy efficiency, which is key to scaling up e-mobility.

## AGRICULTURE & FOOD

Plastics are used to produce agricultural films, protecting the crops from pests and diseases, minimising water evaporation and improving crop yields. Plastic packaging also reduces food waste by extending shelf life and avoiding damage to fresh produce during transport and storage.

## ELECTRICAL & ELECTRONICS

Plastics provide a protective barrier against moisture and dust that can damage electronic components. Their lightweight properties make them crucial for creating portable electronics. Durable plastics are also key to expand the power transmission infrastructure needed to support the growth of renewables.



Figure 1: Plastics are a strategically important material for the European economy



It is important to recognise that because of the unique material characteristics of plastics **there are no functionally suitable alternatives for many applications**. Substituting plastics with other materials in existing applications will often increase the GHG emissions. Therefore, the “ReShaping Plastics” report confirmed that overall, the substitution of plastics with other materials provides very limited scope for reaching net-zero emissions.

**Plastics applications** will therefore continue to play a key role in meeting a wide range of functional needs, while **enabling circularity, delivering emissions savings for a number of sectors and supporting the development of Europe’s renewable energy sector**.

This includes, for example, enabling safe and emissions-free transportation; providing materials, such as insulation, pipes, flooring and windows, that reduce emissions from buildings; supporting Europe’s digital transformation; the provision of more innovative healthcare and medical device solutions; and the manufacture of solar panels and wind turbines.

**The European industry**, which produced 57.2 million tonnes (Mt) of plastics in Europe (EU27+3) in 2021, **is under significant pressure due to global competition**. In the 1980s, European plastics production held one third of the global share, but this has steadily decreased. While differences in regional population and economic growth can in part explain these trends, a growing competitiveness gap between Europe and the rest of the world (including energy costs, access to raw materials, and the regulatory landscape) is a major factor.

The erosion in global competitiveness means Europe is gradually changing from an export to an import market, with significant implications for its strategic autonomy and the plastics system transition. Unless addressed, this will: increase our dependency on imports of plastics or plastic products which do not necessarily meet EU sustainability standards; and threaten the viability of many downstream industries in Europe. It will also limit the ability of the European industry to invest in the transition.

# Our vision and strategic transition pillars

Plastics Europe and its members have a vision for a sustainable plastics system that continues to meet consumer and societal demands, whilst supporting the transitions of many downstream industries, and remains a strategic asset for the European economy.

Figure 2: Plastics Europe has a vision for a sustainable plastics system



As an industry we are part of the solution which enables a sustainable future. Our vision is to transition the European plastics system to a net-zero and circular model through innovation and investment. This roadmap is therefore built on three ambitious strategic pillars that we view as critical to achieving our vision:

## 1 Making plastics circular

As confirmed by the “ReShaping Plastics” report, **circularity is one of the fastest, most affordable, effective and reliable methods for reducing GHG emissions from the plastics system**, and a key driver of system emissions reduction in the short to medium term.

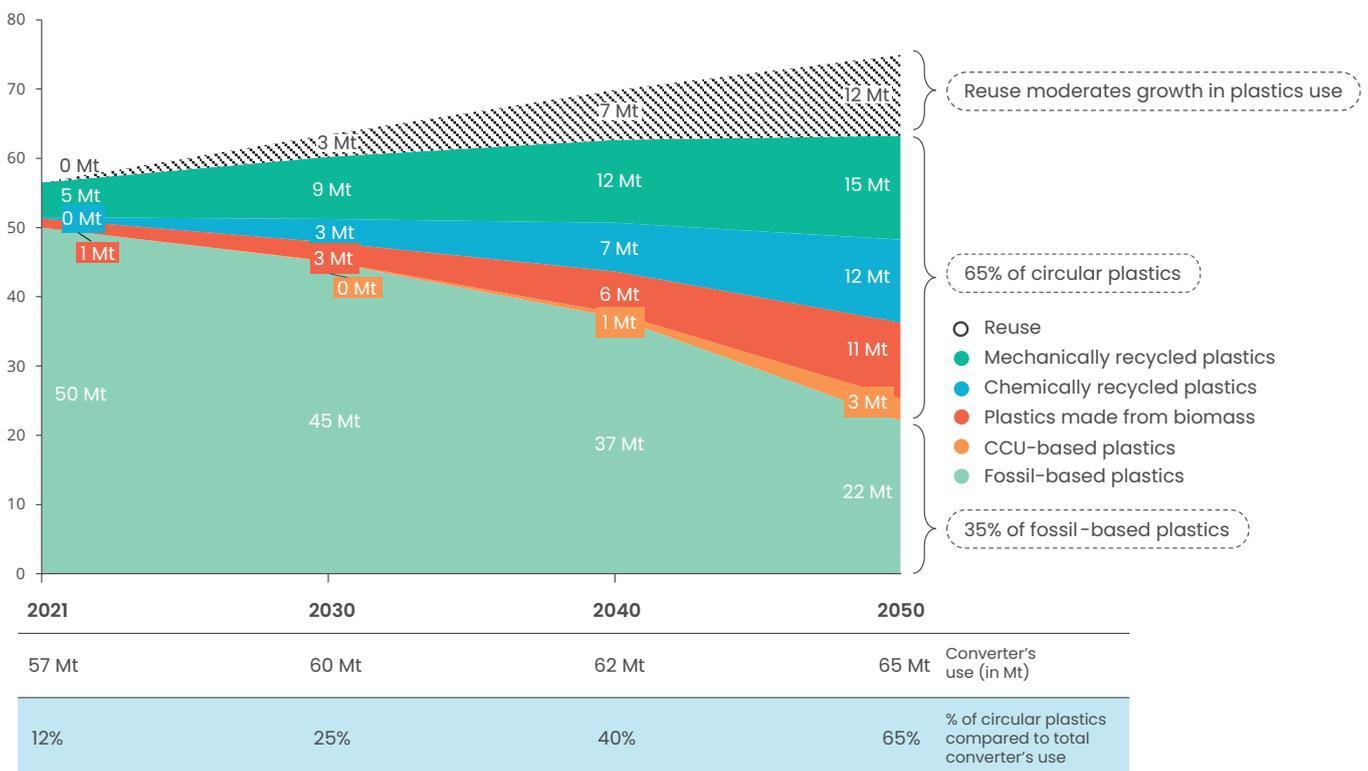
**All up- and down-stream levers need to be engaged, including reuse that reduces single use applications, design for recycling, mechanical and chemical recycling, plastics from biomass and CO2 captured in a carbon capture and utilisation**

**(CCU) process. We need to significantly increase the collection, sorting and use of high-quality circular feedstock** to reduce the dependence on fossil feedstocks and considerably lower the GHG emissions of the plastics system.

With the support of policymakers and increased collaboration with value chain partners, the strong growth in circular plastics will be able to meet an important part of the demand for plastics. Taking into account the expected constraints in availability of sorted plastic waste, sustainably sourced biomass, captured carbon and low-carbon hydrogen, the substitution of fossil-based plastics will be gradual and is projected to reach 65% by 2050 in an ambitious scenario.

Long technology maturity cycles and capex lock-in for large infrastructure investments mean that decisions taken in the 2020s will determine the industry’s chances of reaching net zero GHG emissions by 2050. Thus, the next few years are a critical window for action.

**Figure 3:** With the support of policymakers and increased collaboration with value chain partners, circular plastics will be able to grow and gradually replace fossil-based plastics



## 2 Helping to drive the plastics life cycle to net-zero

Plastics Europe members support the 2050 net-zero objectives of the EU Green Deal. **This roadmap demonstrates a potential pathway to reduce GHG emissions from the overall plastics system by 28% by 2030 (and the enabling conditions needed for such a transition), setting us on the pathway towards net-zero by 2050.**

To meet these objectives impactful measures are needed. Measures to promote reuse and circular business models would improve materials utilisation, lowering the demand for new plastic products, thus cutting production-related CO2 emissions by 35.7 Mt by 2050.

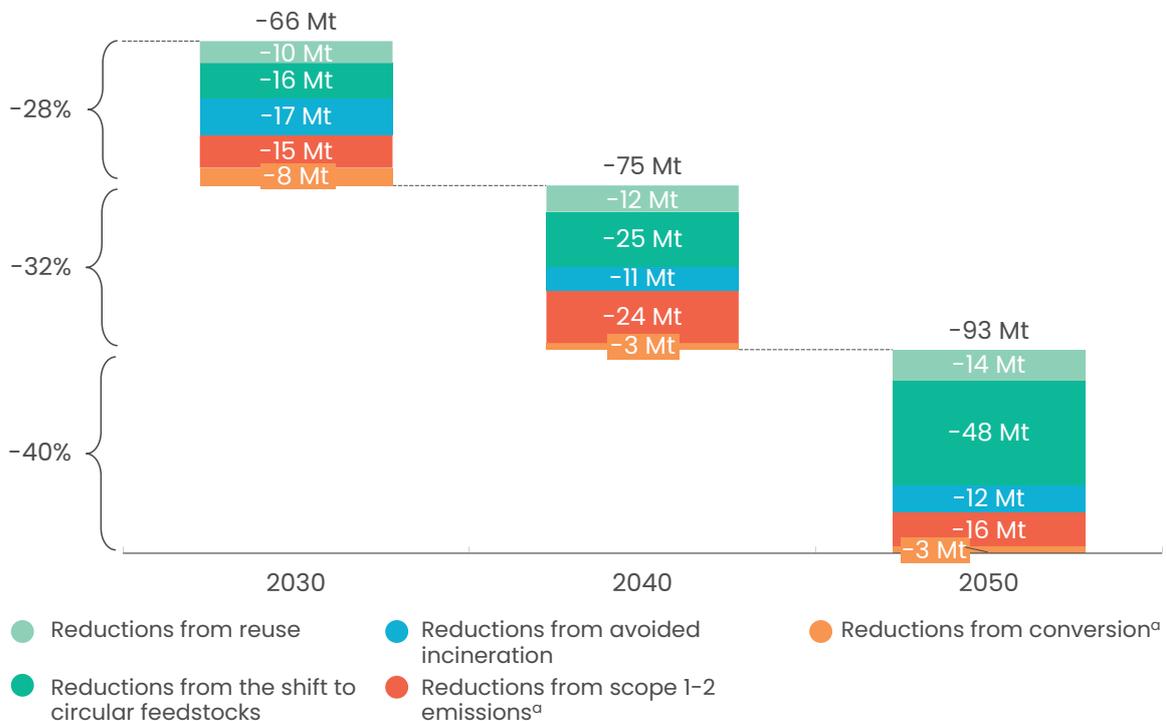
Moreover, shifting towards more circular feedstock will minimise upstream GHG emissions, displacing fossil-based plastics while increasing biogenic carbon from biomass as well as CCU and decreasing downstream emissions when plastic waste is diverted from incineration.

Overall, the sector is projected to reduce total annual GHG emissions by 129 Mt (55%) by 2050, compared to the baseline volume, through circular plastics (excluding reuse) and reductions due to avoided waste incineration.

The roadmap projects that by 2050, after reuse and the circular shift, plastics production needs to reduce the remaining 55 Mt of GHG emissions. The four levers necessary to abate these remaining emissions and achieve net-zero are: energy efficiency measures, use of renewable and low-carbon fuels, electrifying production processes, and utilising carbon capture & storage (CCS). Some of the technologies required to reduce emissions within the industry are currently in the research and development stage, but are expected to scale up in the next decades.

Driving the plastics life cycle to net-zero not only requires investments to reduce GHG emissions during manufacturing, but also further upstream in the feedstock production and downstream in the conversion and end-of-life stages.

**Figure 4:** This roadmap demonstrates a potential pathway towards net-zero by 2050



<sup>1</sup>Calculations based on ReShaping Plastics (2022), European Environment Agency (2021), OECD (2019), Material Economics (2019), Agora (2019)

### 3 Fostering the sustainable use of plastics

**Sustainable use of plastics means producing and using plastics applications in a way that is safe for human health and the environment.**

The members of Plastics Europe are working continuously to ensure the safety of plastics and mitigate their potential impact on human health. This includes developing new actions, tools and methodologies to manage operational risk, providing further transparency towards stakeholders, enhance collaboration with the value

chain. We also recognise that any plastic waste in the environment is unacceptable and concerning. Therefore, we will continue to build intelligence and collaborate closely with scientists to better understand the impact of microplastics on the environment and health, and with policymakers and regulators to introduce measures to help mitigate their release.

Priorities for the industry include mapping and assuring the safe use of chemical additives applied to different polymers for different applications, preventing pellet loss in plastics production, and harnessing tools to share data across the value chain.

Figure 5: Key levers for the transition







## Our industry in transition

**Plastics Europe members are undertaking huge investments and a far-reaching reorganisation of their production and technology base.** This has accelerated in recent years, although long investment cycles mean that it will take a number of years for the full benefits to become apparent.

We are already working with our partners in the plastics value chain to deliver new systems thinking, mindset and behavioural changes, higher performing products, ecodesign innovation and new infrastructure. **Our members are also driving major advances in the sustainability of their operations, including investing in innovation in both mechanical and chemical advanced recycling technologies, renewable and low carbon energy and producing more plastics from biomass and CO<sub>2</sub>.**

**Undertaking this transition is a generational-scale task,** and Plastics Europe is under no illusions about the scale, complexity and cost of this transition. This involves multiple

supply chains, thousands and thousands of products and companies, each with their own business strategies and models.

**The European plastics systems transition will require significant short and longer-term investments** from different private and public actors, as well as new infrastructure and business models, and further technological innovations. cumulative additional investments and operational costs for circular and net-zero production by 2050, for example, are projected by Deloitte to be €235 billion.

**It will also require a supportive regulatory framework and policy incentives to ensure that such a transition for Europe remains viable in response to an ever-growing competitiveness gap compared to other key plastics-producing regions.**

To further accelerate the transition, the European plastics industry has identified key actions.

**Figure 6:** Potential actions for industry members to consider, with an illustrative timeline, that need the collaboration of policymakers and value chain partners

<b>IMMEDIATE</b> <b>2023 - 2025</b>	<b>SHORT TERM</b> <b>2026 - 2027</b>	<b>MEDIUM TERM</b> <b>2028 - 2030</b>
<ul style="list-style-type: none"> <li>• Provide stakeholders with aggregated data and insights on the status and solutions to achieve the industry vision</li> <li>• Partner with waste management organisations to secure circular feedstock and manage investment risks</li> <li>• Invest in new technologies and collaborate to speed up technology development</li> <li>• Prevent plastic leakage in the supply chain through compliance with Operation Clean Sweep® (OCS), and encourage broader value chain adoption</li> <li>• Determine minimum requirements for risk management systems for plastics additives</li> <li>• Experiment with digital product passports and speed up the development of digital tools to share information in the value chain</li> <li>• Utilise power purchase agreements to increase green electricity uptake</li> </ul>	<ul style="list-style-type: none"> <li>• Bring plastics to the market that are functional and affordable but also easy to recycle or repurpose at the end of their life cycle</li> <li>• Shift away from linear practices to circular ones, through new circular business models and technologies such as recycling, plastics from biomass and captured carbon</li> <li>• Invest in joint infrastructure for hydrogen, renewable energy and carbon capture and storage (CCS)</li> <li>• Lead by example and cooperate with stakeholders and value chain partners to overcome hurdles and knowledge gaps to address plastic leakage</li> <li>• Scale up power purchase agreements to accelerate green electricity uptake</li> </ul>	<ul style="list-style-type: none"> <li>• Further the cooperation with suppliers of sustainably sourced biomass to scale up plastics from biomass</li> <li>• Have chemical recycling operational at scale by investing in capacity and partnering with technology providers</li> <li>• Maximise energy efficiency and use carbon capture and storage (CCS) to reduce GHG emissions</li> <li>• Implement third-party verified risk management systems for plastics additives</li> </ul>

# Accelerating systemic change

The speed and extent to which the European plastics system transitions to circularity and net-zero are heavily influenced by three critical factors: the urgent need for more intense and more combined efforts of all parts of the European plastics system and of policymakers and regulators; the ability of the European plastics system to remain globally competitive along this transition; and the creation of a policy and regulatory framework that enables, rather than frustrates, the industry's transition.

In doing so, there are several critical challenges that need to be addressed:

- Incentivise the availability of and demand for circular feedstocks and help industry in developing recyclable products
- Phase out landfilling and incineration of recyclable plastic waste and favour reuse and recycling
- Legally recognise the mass balance approach for both recycled and bio-attributed plastics feedstocks as a key enabler of the plastics transition
- Create a level playing field and regain European competitiveness
- Provide accessible funding opportunities that make circular plastics production in Europe competitive and speeds up the circular transition, and develop a true EU equivalent to the US Inflation Reduction Act
- Make low carbon energy and hydrogen accessible and affordable
- Ensure a harmonised and consistent regulatory framework across the EU Single Market
- Ensure a material-agnostic, science- and data-based approach to policies framing this transition



Figure 7: Asks to policymakers and value chain partners with indicative timeline

<b>IMMEDIATE</b> <b>2023 - 2025</b>	<b>SHORT TERM</b> <b>2026 - 2027</b>	<b>MEDIUM TERM</b> <b>2028 - 2030</b>
<ul style="list-style-type: none"> <li>• Develop an EU equivalent to the US Inflation Reduction Act to make circular plastics production in Europe competitive</li> <li>• Have a material-agnostic view when addressing single-use applications</li> <li>• Codify the fuels-exempt mass balance approach for chemical recycling</li> <li>• Harmonise requirements for recycled content measurement and certification</li> <li>• Impose minimum circular content targets and enforce implementation also for imported plastics</li> <li>• Improve waste collection and sorting and incentivise investments in recycling infrastructure by Extended Producer Responsibility (EPR) and other instruments</li> <li>• Phase out landfilling and incineration of recyclable plastic waste by harnessing instruments such as EU ETS and disposal taxes</li> <li>• Simplify and speed up permitting processes for circular and net-zero infrastructure</li> <li>• Make OCS-like requirements and certification legally binding for all plastics pellets handling actors in the EU</li> </ul>	<ul style="list-style-type: none"> <li>• Promote and enforce design for recycling to improve quality of collected waste</li> <li>• Make shipping of recyclable waste easier within Europe and treat recyclable plastic waste as a secondary raw material destined for recycling, which should be covered by product legislation</li> <li>• Harmonise definitions and improve statistics for plastic waste management</li> <li>• Provide economic incentives to use sustainable biomass as feedstock for plastics and endorse the mass balance approach for bio-attributed plastics</li> <li>• Endorse trustworthy certification systems and standards for the sustainable sourcing of biomass feedstocks</li> <li>• Increase citizens' awareness and leverage public procurement for circularity to create a market pull for circular products</li> <li>• Step up the research for CCU</li> <li>• Include the industry in the impact assessment of the Carbon Border Adjustment Mechanism (CBAM)</li> <li>• Increase renewable energy capacity drastically</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance the quality and quantity of collected biowaste suitable as feedstock for plastics</li> <li>• Provide funding for low-carbon hydrogen production and transportation infrastructure</li> <li>• Create incentives and a legal framework to valorise CO2 emission savings via CCU</li> <li>• Secure long-term contracts for production of basic chemicals from captured CO2</li> <li>• Make risk management systems for plastics systems obligatory for the whole plastics sector</li> <li>• Enable the free flow of electricity between EU countries and ensure competitive renewable electricity prices for industry</li> <li>• Reduce CO2 emissions in plastics conversion</li> </ul>

**Plastics Europe and our members recognise the severity of the climate crisis and the challenge of plastic waste. Faster systemic change is essential to successfully meet the EU's net-zero and circularity objectives.**

In this roadmap, developed with the support of Deloitte, we lay out a potential pathway for a circular and net-zero plastics industry in Europe. The roadmap provides a framework, milestones for 2030 as well as for 2050 and indicators to monitor progress, identify bottlenecks and find solutions to keep moving forward.

Our data-driven roadmap is a living document that will be progressively updated based on new insights and changes to our industry environment. It aims to guide, incentivise and accelerate industry action and performance, and provide an evidence base to inform value chain dialogue and policy-making.



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