Global Plastics Outlook

Economic Drivers, Environmental Impacts and Policy Options

POLICY HIGHLIGHTS

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Global plastics production has grown significantly in recent decades. Highly versatile, light and affordable, plastic materials are employed in countless industrial applications and have become extremely useful for modern society. They help us preserve food, insulate buildings, make electronics work and increase the fuel efficiency of our vehicles, among other things. Yet, the sheer magnitude of our societies' consumption of plastics bears important drawbacks. Plastics use results in a high production-related carbon footprint, high volumes of waste, persistent pollution and harm to wildlife and ecosystems when leakage to the environment occurs, and considerable socio-economic costs due to the negative impacts of plastic litter on tourism and fisheries.

In recent years, the growing awareness of plastic pollution has alerted public opinion and paved the way for stronger policy intervention on this front. Many OECD countries and emerging economies have been implementing policies that specifically aim to reduce the negative environmental impacts associated with different stages of the plastics lifecycle. In addition, global fora like the G7 and the G20 as well as the United Nations Environment Assembly are increasingly focusing on marine litter and plastic pollution. The Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options seeks to inform and support these efforts.

This is the first report to comprehensively take stock of current plastics production, use and waste generation, uncover the underlying economic drivers and map the related environmental impacts on a global level. The report also presents four key levers that are essential to bend the plastic curve: markets for recycled (secondary) plastics, technological innovation in plastics, domestic policy measures and international co-operation, including international financing. Our findings point to the need for a whole of life-cycle approach requiring policy interventions both downstream of the value chain, such as end-of-life management, and upstream, like product design, for an effective policy mix.

The Outlook can help decision-makers understand the direction in which we are heading and help to assess which policies can support a more sustainable and circular management of plastic materials. The OECD stands ready to assist governments in making this transition by designing, developing and delivering better policies to eliminate the negative environmental impacts of plastics production and ultimately achieve plastics-free oceans and rivers for future generations. As the challenges associated with plastics production, namely growing leakage and greenhouse gas emissions, are transboundary in nature, it will also be crucial that countries respond to the challenge with coordinated and global solutions.

Mathias Cormann
Secretary-General, OECD

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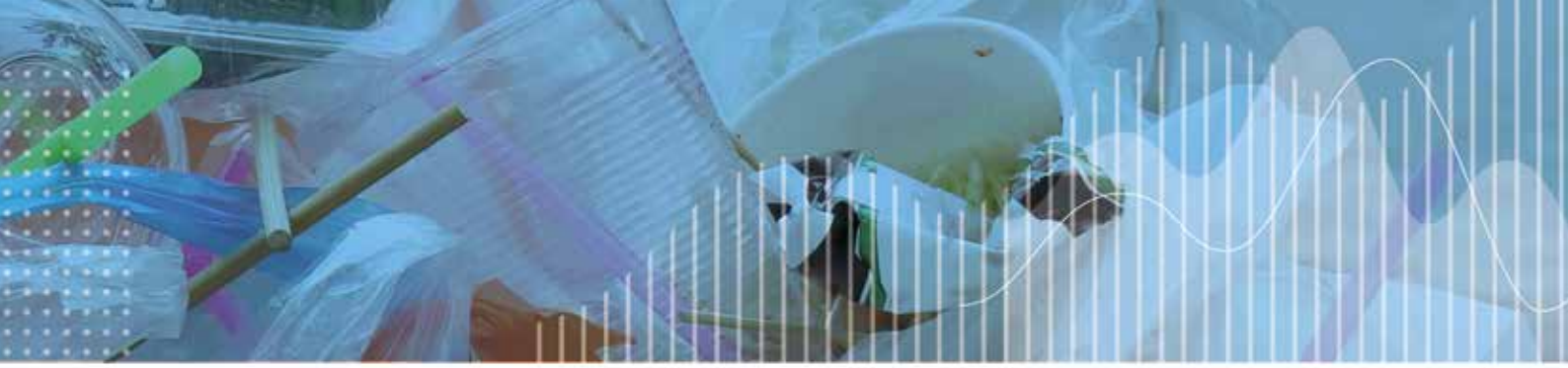
1. Key findings

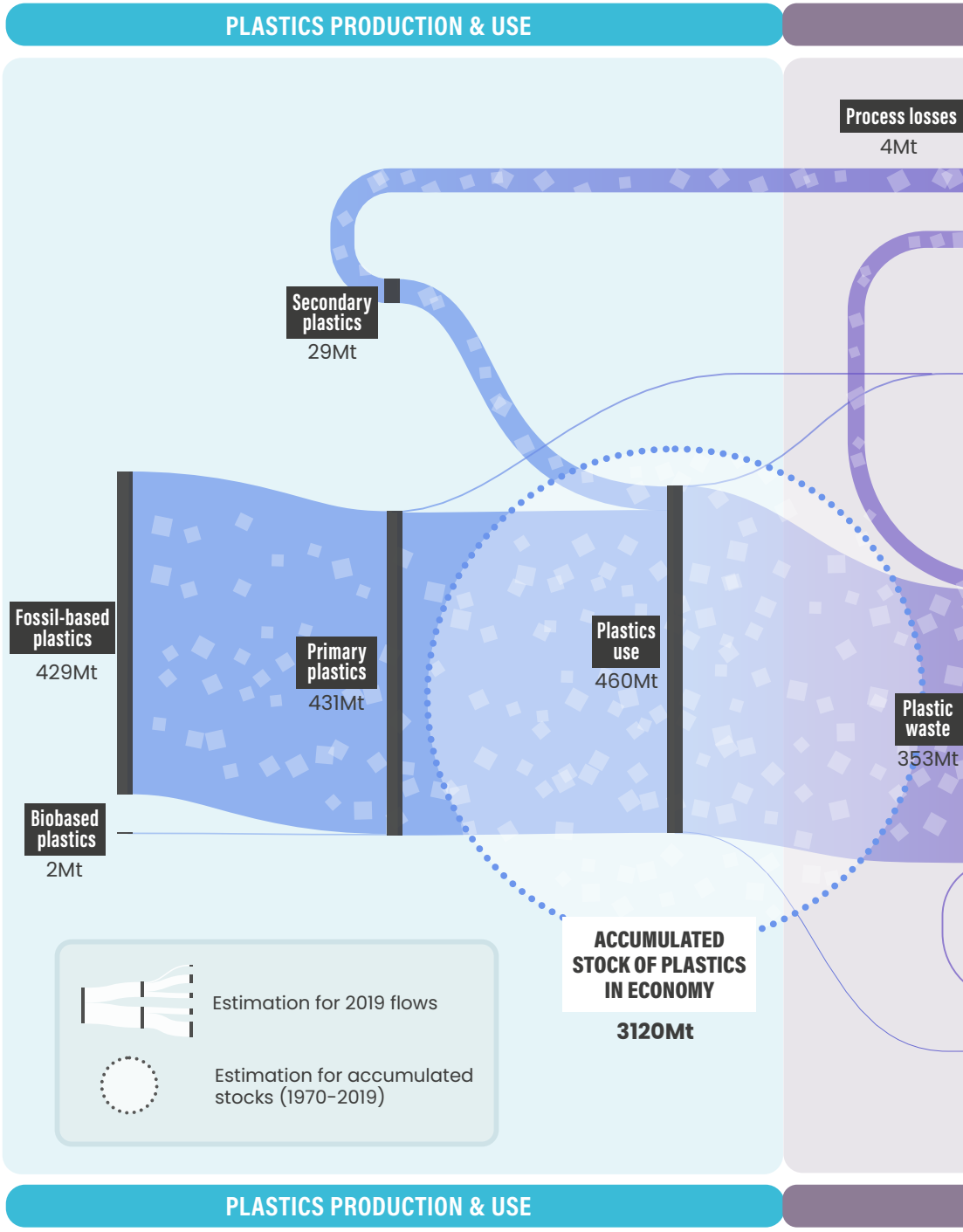
- **The current plastics lifecycle is far from circular.** Globally, the annual production of plastics has doubled, soaring from 234 million tonnes (Mt) in 2000 to 460 Mt in 2019. Plastic waste has more than doubled, from 156 Mt in 2000 to 353 Mt in 2019. After taking into account losses during recycling, only 9% of plastic waste was recycled, while 19% was incinerated and almost 50% went to sanitary landfills. The remaining 22% was disposed of in uncontrolled dumpsites, burned in open pits or leaked into the environment.
- **COVID-19 increased single-use plastic waste, though plastics use fell overall.** The lockdowns and decline in economic activity during 2020 reduced plastics use by 2.2% from 2019 levels. However, the increase in the use of protective personal equipment and single-use plastics has exacerbated plastic littering. As the economy rebounds, plastics use is projected to pick up again, leading to a renewed growth of plastic waste and related environmental pressures.
- **Mismanaged plastic waste is the main source of macroplastic leakage.** In 2019 alone, 22 Mt of plastic materials leaked into the environment. Macroplastics account for 88% of plastics leakage, mainly resulting

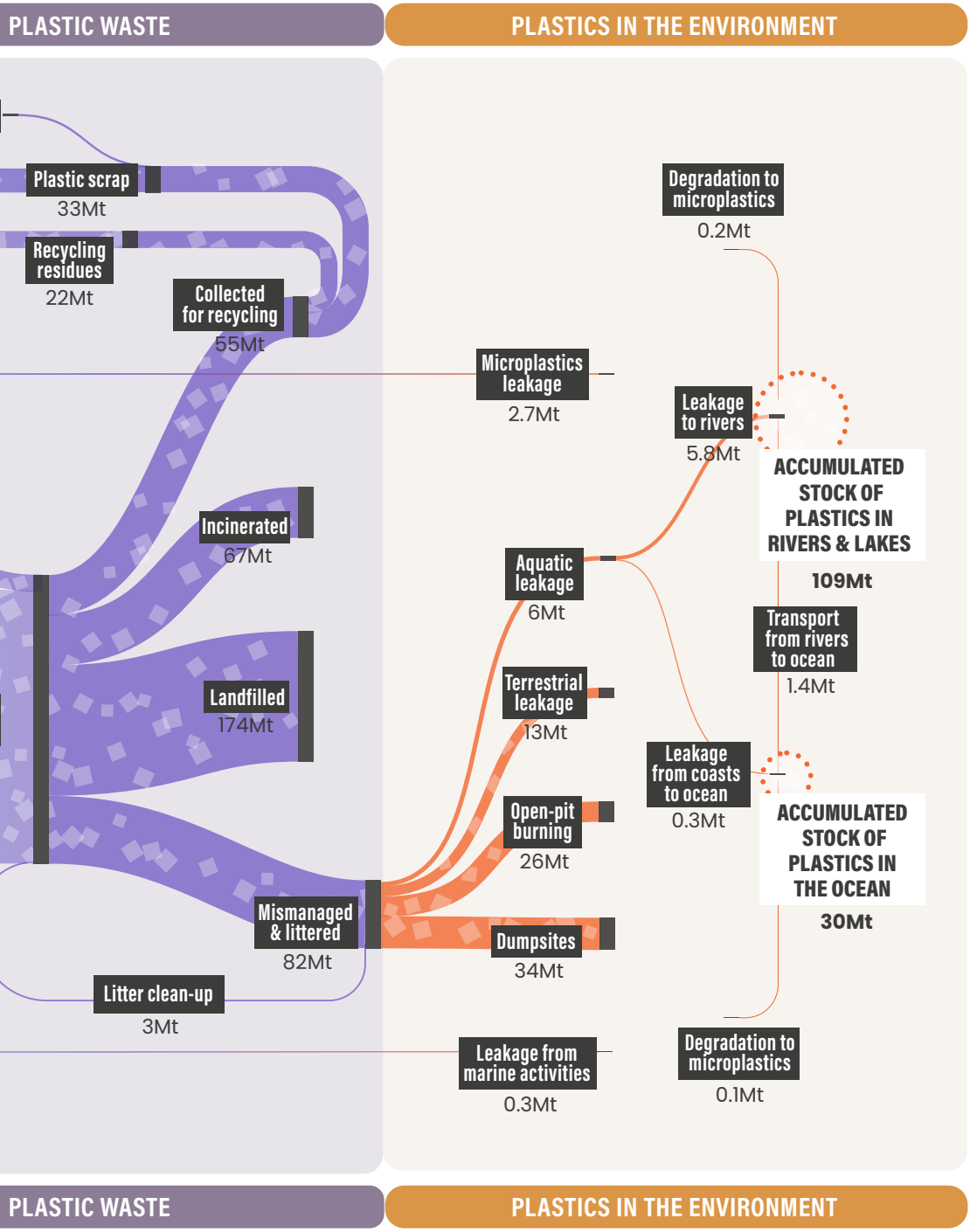


from inadequate collection and disposal. Microplastics, polymers with a diameter smaller than 5 mm, account for the remaining 12%, coming from a range of sources such as tyre abrasion, brake wear or textile washing.

- **Significant stocks of plastics have already accumulated in aquatic environments, with 109 Mt of plastics accumulated in rivers, and 30 Mt in the ocean.** In 2019 alone, 6.1 Mt of plastic waste leaked into rivers, lakes and the ocean. The build-up of plastics in rivers implies that leakage into the ocean will continue for decades to come even if mismanaged plastic waste was significantly reduced. Furthermore, cleaning up these plastics is becoming more difficult and costly every year, as plastics fragment into ever smaller particles.
- **The carbon footprint of the plastics lifecycle is significant.** Plastics have a significant carbon footprint, contributing 3.4% of global greenhouse gas emissions throughout their lifecycle. In 2019, plastics generated 1.8 Gigatonnes (Gt) of greenhouse gas emissions, with 90% coming from their production and conversion from fossil fuels. Closing material loops could reduce this footprint substantially.

Figure 1. **Globally, only 33 million tonnes (Mt), or 9% of the 353 Mt of plastic waste, were recycled in 2019**





Source: OECD Plastics Outlook Database

2. Critical levers to reduce the environmental impacts of plastics

- **Develop recycled plastics markets by combining push and pull policies.** While global production of secondary plastics from recycling has more than quadrupled in the last two decades, they are still only 6% of the total feedstock. Some countries have successfully strengthened their markets by "pushing" secondary plastics supply – for example, through extended producer responsibility schemes – as well as "pulling" demand via recycled content targets.
  The recent decoupling of prices for primary and secondary polyethylene terephthalate (PET) in Europe and increasing innovation in recycling technologies are positive signs that the combination of these policies is working.
- **Boost innovation for a more circular plastics lifecycle.** Innovation can deliver significant environmental benefits – by reducing the amount of primary plastics needed, prolonging the useful life of products and facilitating recycling.
  This report shows that patented environmental plastics technologies increased more than threefold between 1990 and 2017.
  Yet environmentally relevant innovation makes up only 1.2% of all plastics-related innovation. More ambitious policies are needed including a combination of investments in innovation and interventions aimed at increasing demand for circular solutions while restraining plastics consumption overall.
- **Strengthen the ambition of domestic public policies.** An inventory of key regulatory and economic instruments developed for this report suggests that the current plastics policy landscape is fragmented and can be strengthened significantly. A policy roadmap is proposed for countries to reduce the leakage of macroplastics. It involves three increasingly ambitious phases:
  - **Close leakage pathways.** Build sanitary waste management infrastructure,

organise waste collection and structurally reduce plastics littering by enlarging the scope of anti-littering policies (bans or taxes of frequently littered items) and enhancing implementation of legislation.

- **Create incentives for recycling and enhance sorting at source.** The required measures include extended producer responsibility schemes, landfill taxes and incineration taxes, as well as deposit-refund and Pay-as-You-Throw schemes.
- **Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive.** Instruments such as plastics taxes and recycled content targets can create financial incentives to reduce use and foster circularity. Their impact could be improved considerably by extending them to more product types and more countries.

- **Strengthen international co-operation to make plastics value chains more circular and achieve net zero plastic leakage.**

Considering global value chains and international trade in plastics, aligning design approaches and the regulation of chemical substances across countries will be key to improving the circularity of plastics globally. Moreover, with mismanaged waste a widespread problem, especially in developing countries, major investments in basic waste management infrastructure are needed. To finance the required estimated costs of EUR 25 billion a year in low and middle-income countries, all available sources of funding will need to be mobilised including official development assistance which currently covers only 2% of the financing needs. Efficient use of such investments will also require effective legal frameworks to enforce disposal obligations.

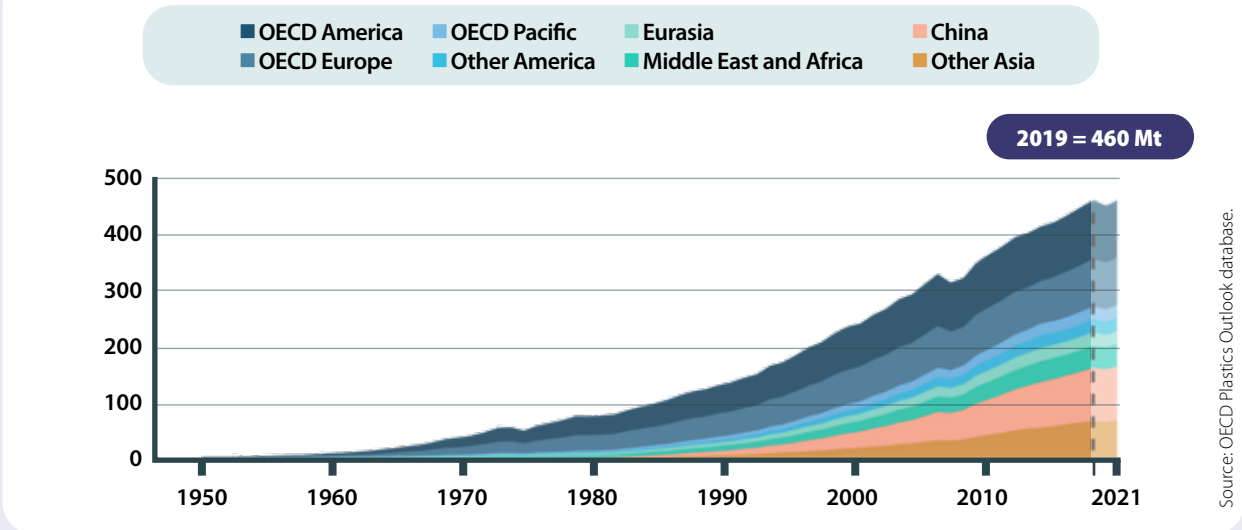
3. The current plastics lifecycle is far from circular

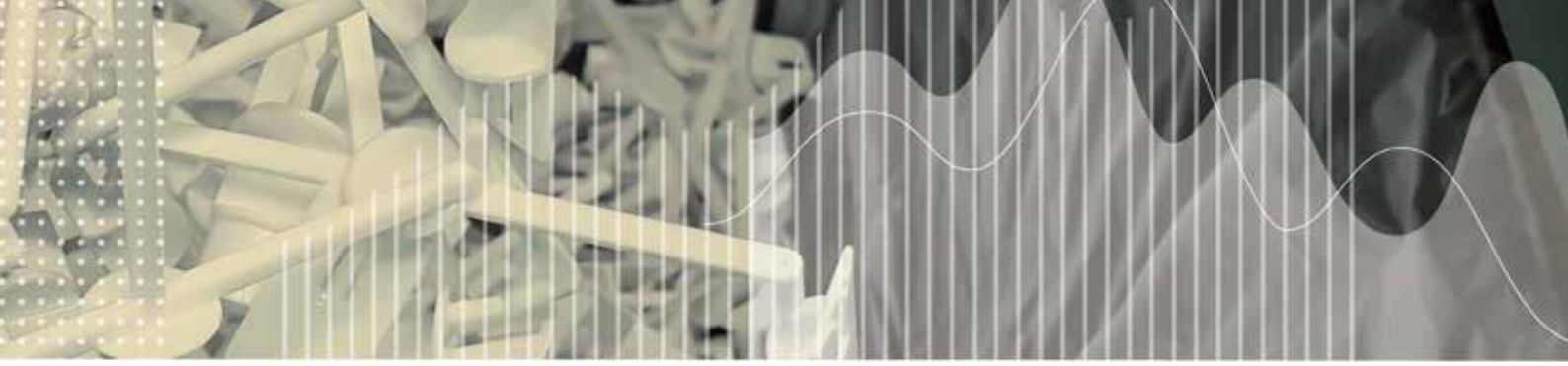
Population growth and higher incomes have driven up global plastics production, which doubled between 2000 and 2019, soaring to 460 million tonnes (Mt). In this same period, the growth of plastics volumes outpaced economic growth by almost 40%. While COVID-19 temporarily curtailed this growth (Box 1), it is likely to rebound once again.

DID YOU KNOW THAT… ?

The largest users of plastics are OECD countries and China (together 66% of global use) with the packaging (31%), construction (17%) and transportation (12%) sectors as main consumers.

Figure 2. **Global plastics use has doubled between 2000 and 2019**
Million tonnes (Mt), 1950-2021





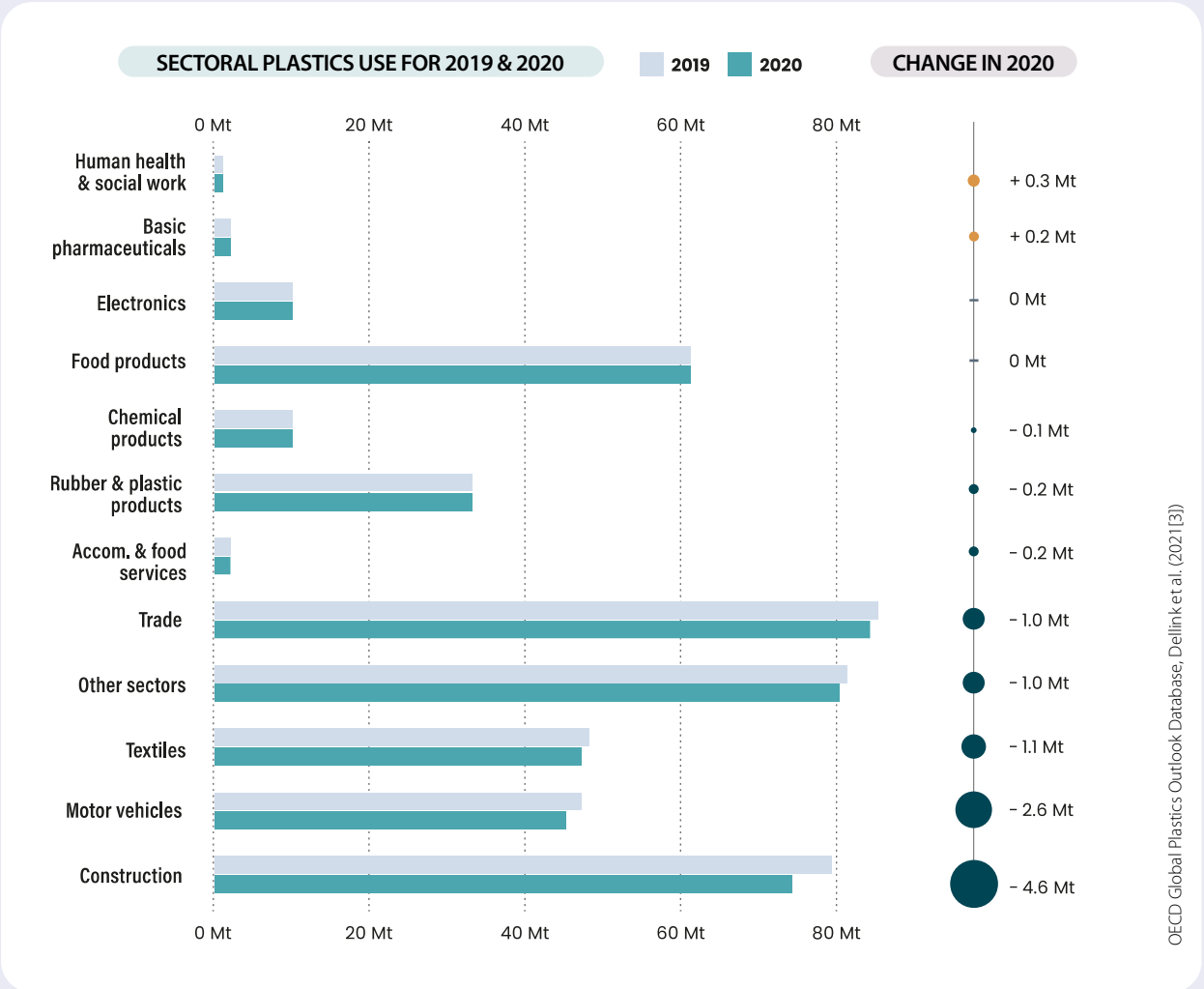
Box 1. HOW HAS THE COVID-19 PANDEMIC AFFECTED PLASTICS USE?

The pandemic has altered previous patterns in plastics use in myriad ways, but there are two main, and opposing, trends:

- Global demand for plastics applications in the healthcare sector, take-away foods and e-commerce increased significantly.
- The substantial decrease in overall economic activity during the pandemic saw use of most plastics fall, with especially large reductions in wholesale and retail trade, motor vehicle manufacture and construction. These three sectors alone reduced plastics use by an estimated 8.2 Mt in 2020.

The overall effect of these countervailing trends was that 2020 saw plastics use decrease overall from 2019 levels by an estimated 2.2%, although data sources are still relatively weak.

Figure 3. **Global plastics use declined in 2020 by 12 million tons (Mt) relative to 2019**



Global annual plastic waste has more than doubled, from 156 Mt in 2000 to 353 Mt in 2019. Almost two-thirds of all plastic waste comes from applications with lifespans of less than five years: packaging (40%), consumer products (12%) and textiles (11%).
Only 55 Mt or 15% of this waste was collected for recycling, but 22 Mt ended up as a recycling residue that needed further disposal. Ultimately, 9% of plastic waste was recycled, 19% was incinerated and almost 50% went to sanitary landfills. The remaining 22% was disposed of in uncontrolled dumpsites, burned in open pits or leaked to the environment.

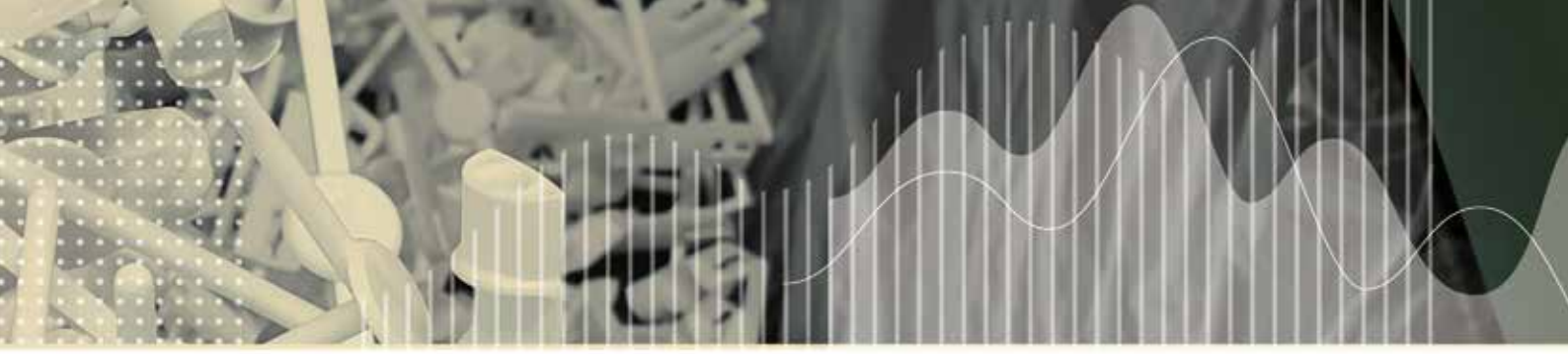
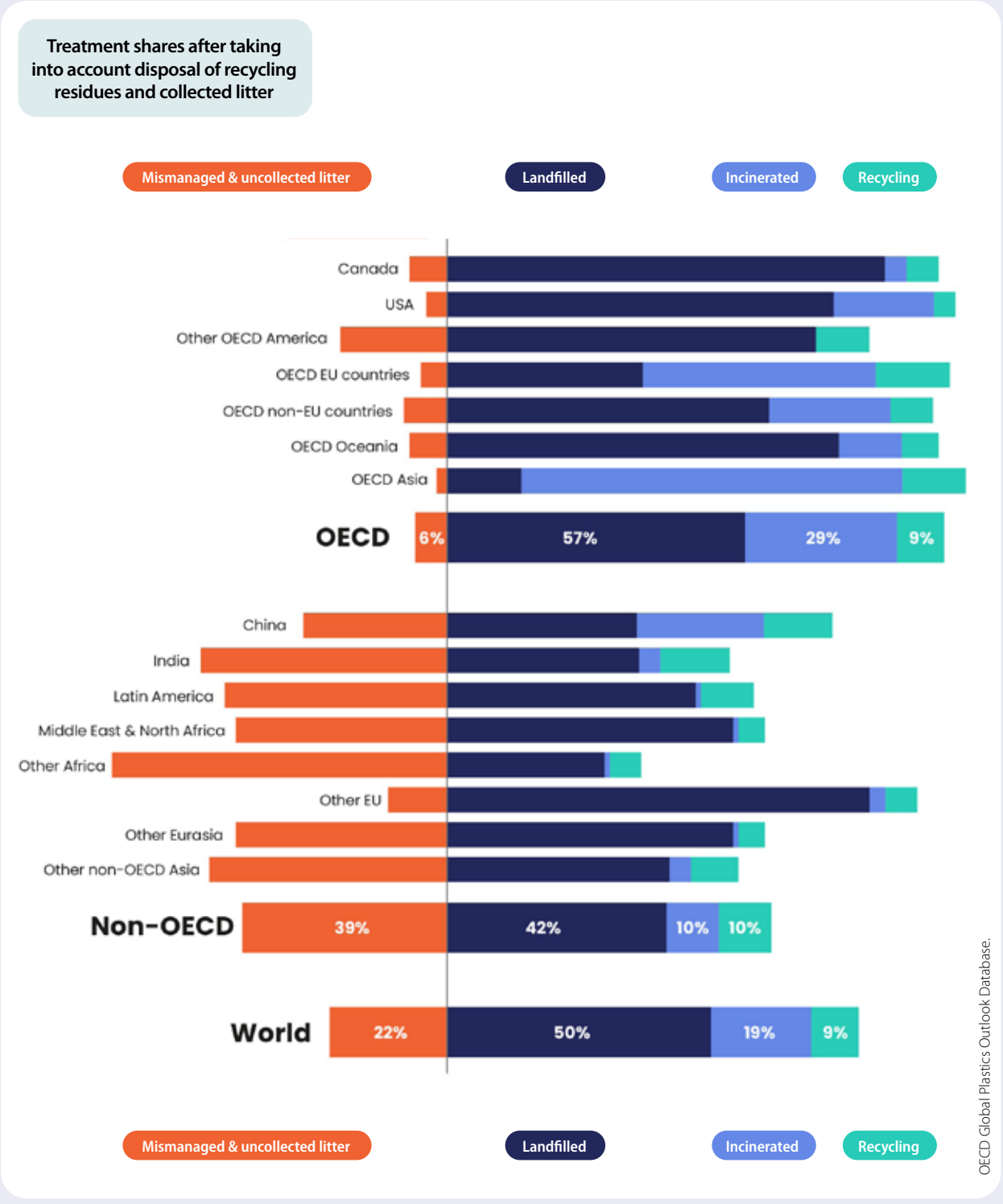


Figure 4. **In 2019, only 9% of plastic waste was recycled while 22% was mismanaged**



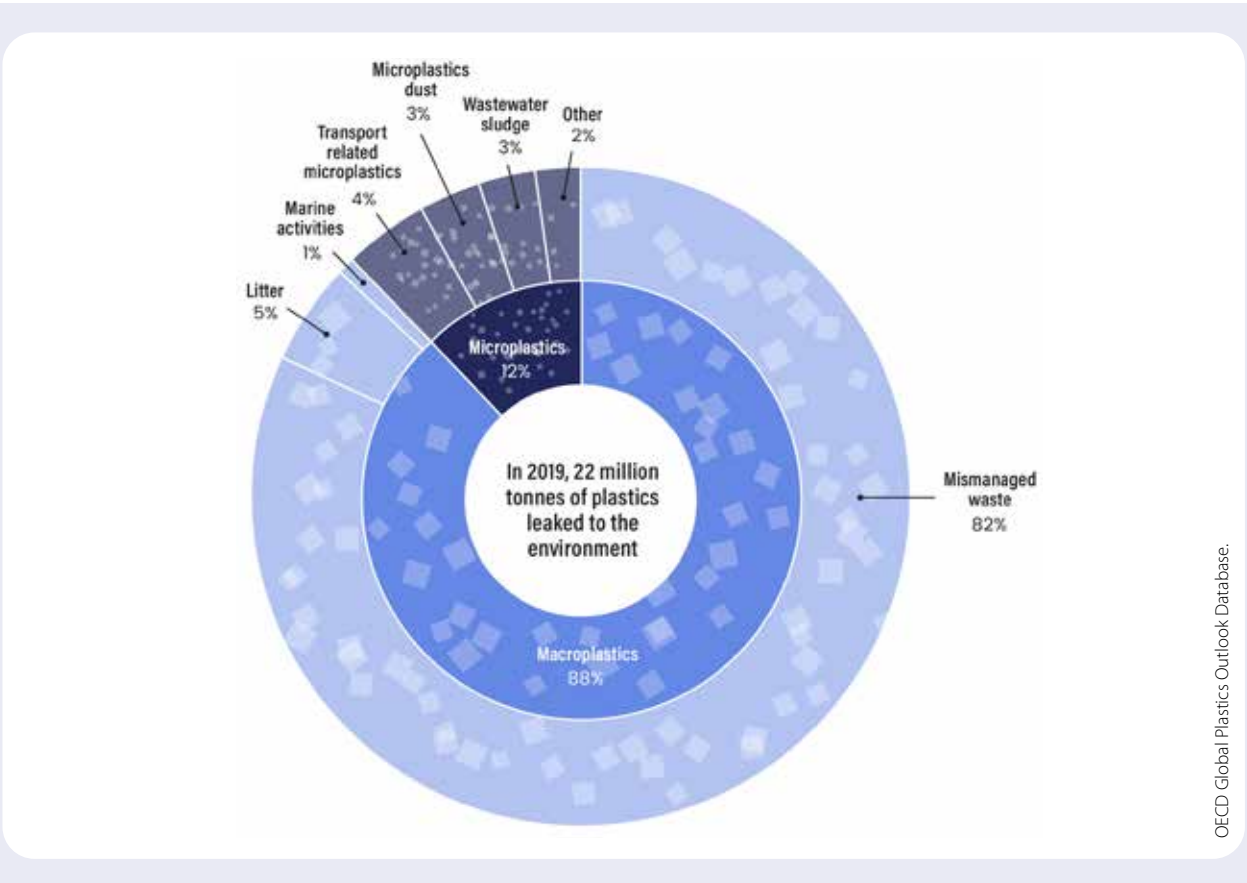
4. Plastic leakage and greenhouse gas emissions are increasing

Mismanaged plastic waste is the main source of macroplastic

Widespread plastics use coupled with inadequate end-of-life disposal resulted in 22 Mt of plastic materials leaking into the environment in 2019 (Figure 5), contributing to persistent plastic pollution. The vast majority (19.4 Mt) are macroplastics, and most (82%) found their way into the natural environment as a result of inadequate collection and disposal. Other leakage routes include littering or fly-tipping (5%), and marine activities (1%). Microplastics also make up a sizeable share of total leakage (12%), largely reaching the environment through wear to tyres and road markings, as well as the accidental loss of plastic pellets and washing of synthetic textile fibres. These numbers stress the urgency of addressing waste management practices, while taking into account littering, leakage from marine activities and the steadily increasing microplastics leakage around the world.

A MICROPLASTIC is a solid synthetic polymers smaller than 5mm in diameter.

Figure 5. **Global leakage of macro-and microplastics to the environment is estimated at 22 million tonnes**
Million tonnes (Mt), 2019



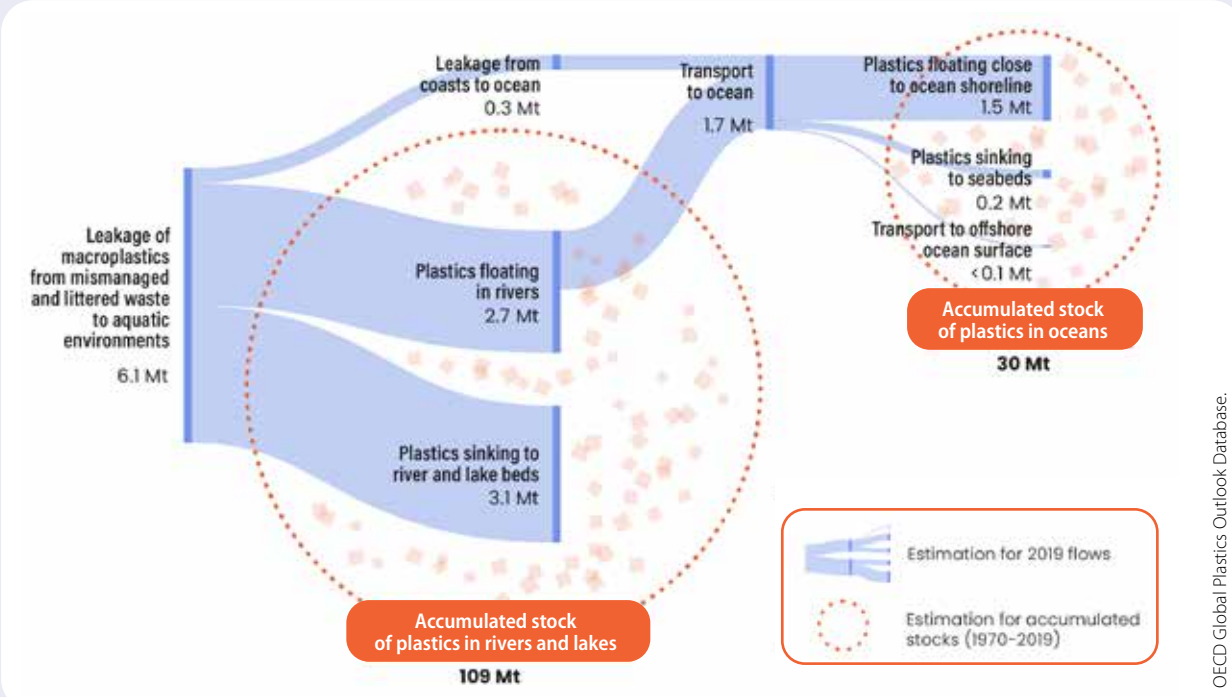
The 30 Mt of plastics accumulated in the ocean, and 109 Mt in rivers, will pollute aquatic environments for decades to come

Plastic leakage is altering marine and terrestrial ecosystems, whilst also posing substantial risks to human livelihoods that depend on the integrity of such environments, such as tourism and fishing. In 2019 alone, 6.1 Mt of plastic waste leaked into rivers, lakes and the ocean. As the bulk of plastics reach the ocean through rivers via a slow process that can take years or even decades, 109 Mt of plastics are estimated to have accumulated in rivers globally to date, with 1.7 Mt flowing into the ocean in 2019 (Figure 6). While inflow estimates are lower than earlier studies that do not account for the residence time of leaked plastics in rivers, the amount is still alarming. Cleaning up these plastics from nature is becoming more difficult and costly every year, as plastics fragment into ever smaller particles.

DID YOU KNOW THAT… ?

The average lifetime of plastic products is almost 10 years. However, the variation in the lifetime between products is high. For example, packaging applications are typically short-lived while plastic applications in construction may be in use for several decades.

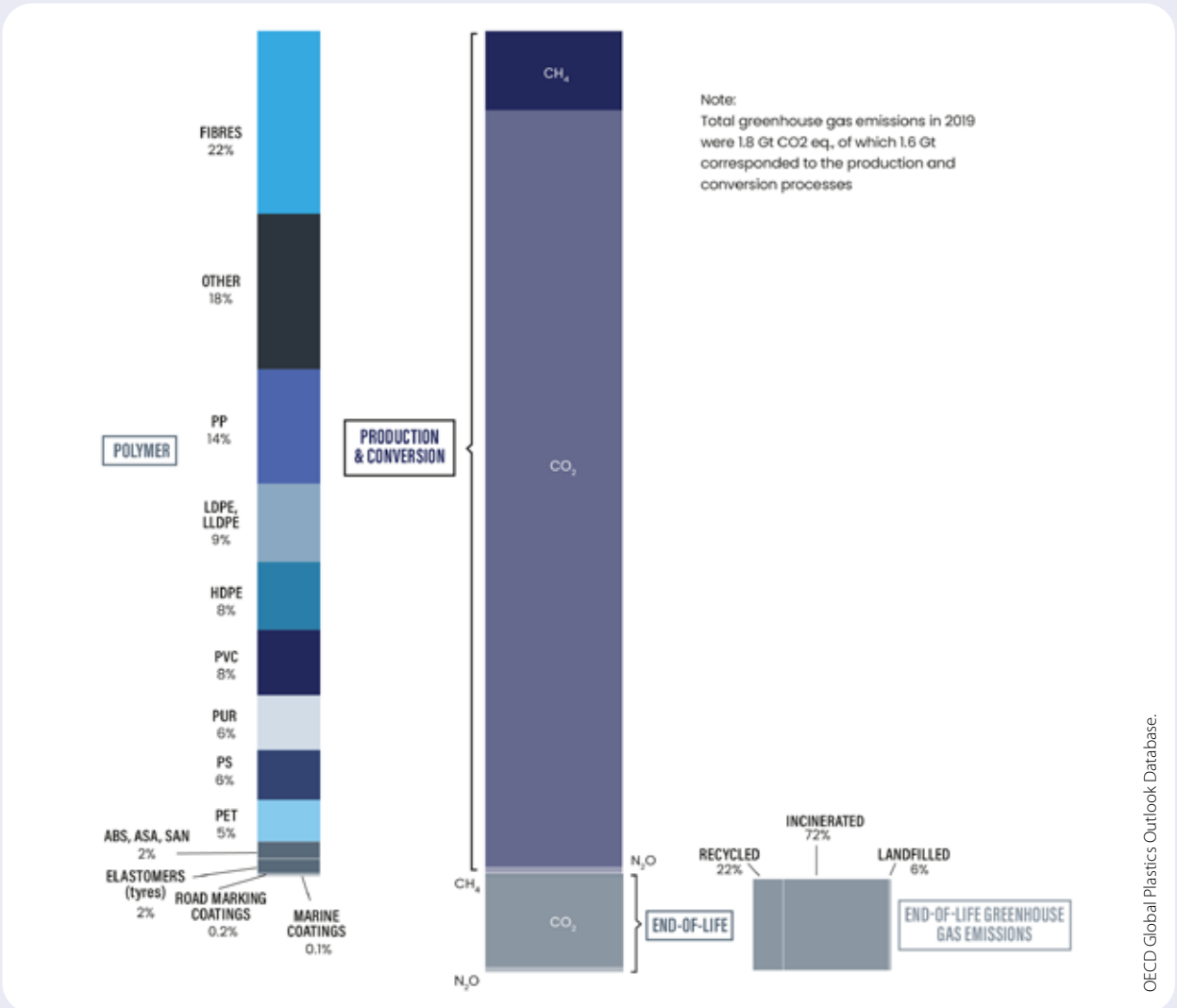
Figure 6. **Rivers accumulate leaked plastics and are pathways to the ocean**
Million tonnes (Mt), 2019



The carbon footprint of the plastics lifecycle is significant

Beyond the hazards posed to the marine and terrestrial environment as well as to humans, plastics are also a substantial contributor to global greenhouse gas emissions. In 2019, plastics generated 1.8 Gigatonnes (Gt) of greenhouse gas (GHG) emissions – 3.4% of global emissions – with 90% of these emissions coming from their production and conversion from fossil fuels. Furthermore, airborne microplastics have been found in remote regions, including the Arctic, where they may contribute to accelerated warming through absorbing light and decreasing the surface albedo of snow.

Figure 7. **Greenhouse gas emissions along the lifecycle of fossil-based plastics**
Shares of greenhouse gases by polymer, gas and lifecycle stage, 2019



5. What can policy makers and stakeholders do?

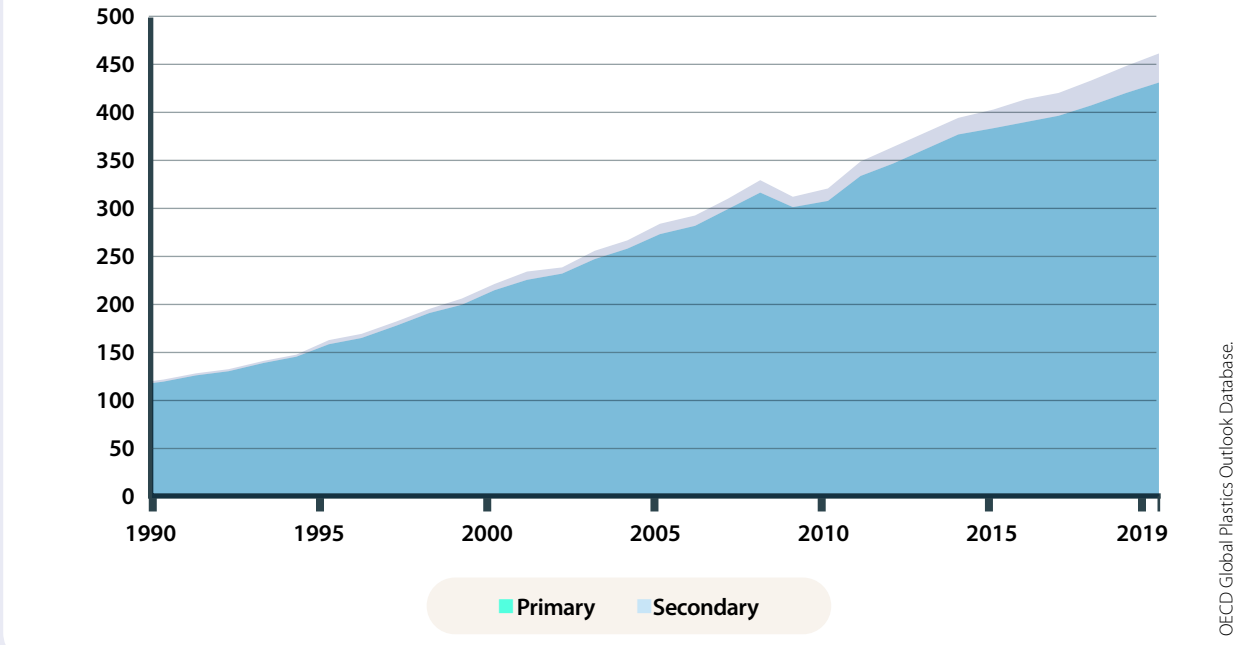
The Global Plastics Outlook identifies four key levers for "bending the plastic curve": recycled (secondary) plastics markets, technological innovation for more circular plastics value chains, more coherent and ambitious domestic policy measures and greater international co-operation.

Give economic incentives to support recycled plastics markets

Recycling has an important role to play in lowering the environmental footprint of plastics, diverting material from more harmful waste management practices and helping to decrease demand for primary equivalents.

Yet, despite its strong growth from 6.8 Mt in 2000 to 29.1 Mt in 2019, secondary plastics from recycling, currently only account for 6% of the feedstock for new plastics produced globally.

Figure 8. **Secondary production is growing, but makes up only six percent of total plastic production**
Million tonnes, 1990-2019



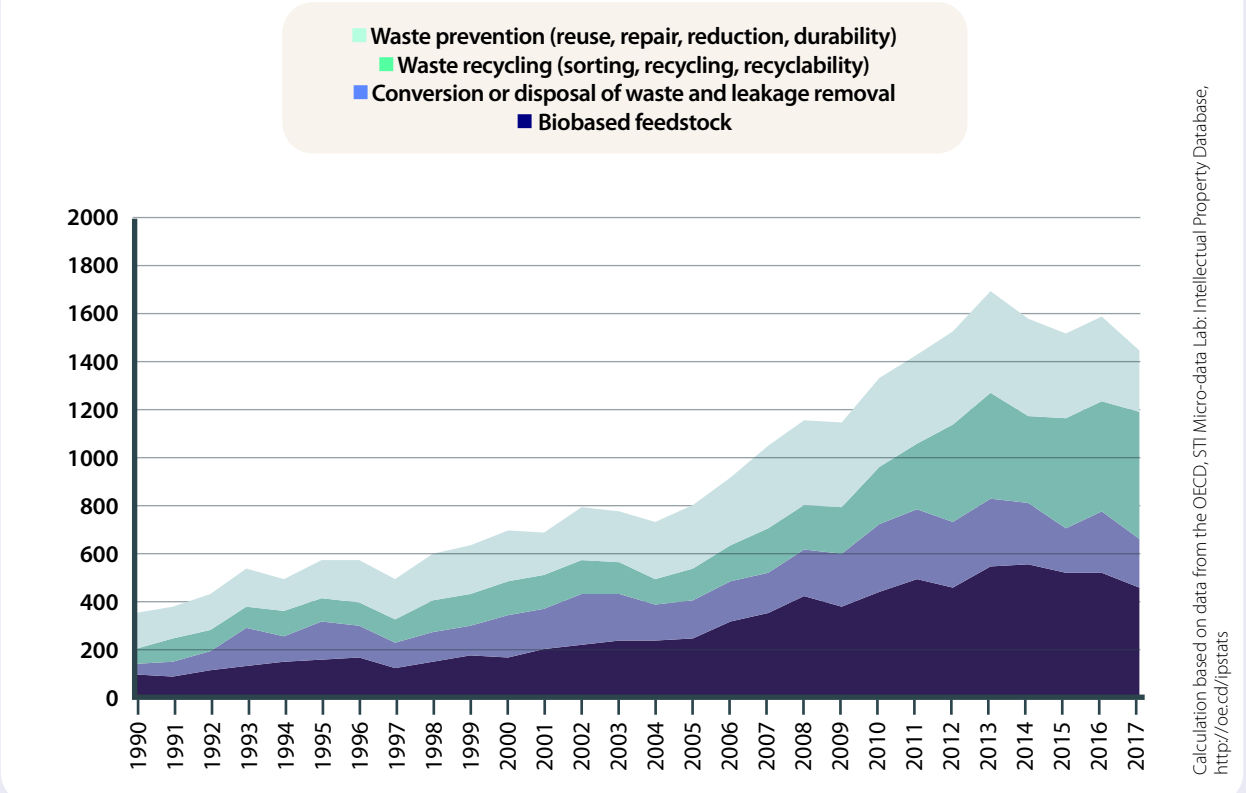
Plastics are only recycled on a large scale if it is profitable to do so. Regulation strongly affects the business case for recycling and the market for secondary plastics. Economic and regulatory policy instruments can give incentives to ensure the financial viability of collecting and recycling plastic waste. Moreover, incentivising sorting at source is a critical lever because the quality of sorting determines the purity and value of recycled materials, and therefore the profitability of recycling operations.

Do more to boost innovation for a more circular plastics lifecycle

Innovation can deliver significant environmental benefits throughout the lifecycle of plastics, for example by reducing the amount of virgin material needed, prolonging the useful life of materials and facilitating recycling. An analysis of patent and trademark data done for this report shows that innovation for more sustainable plastics is increasing, with patented technologies in this area multiplying by a factor of 3.4 over 1990-2017 (Figure 5.9).

Although innovation in environmentally relevant plastics technologies is growing, it still only makes up a minor share of all plastics-related innovation. Indeed, innovation in waste prevention and recycling accounted for only 1.2% of plastics innovation in 2017. More ambitious policies are needed to orient technological change towards closing plastics loops and reducing leakage to the environment.

Figure 9. **Worldwide patented inventions in environmentally relevant plastics technologies**
Worldwide number of patented inventions, 1990-2017



Strengthen the ambition of domestic public policies

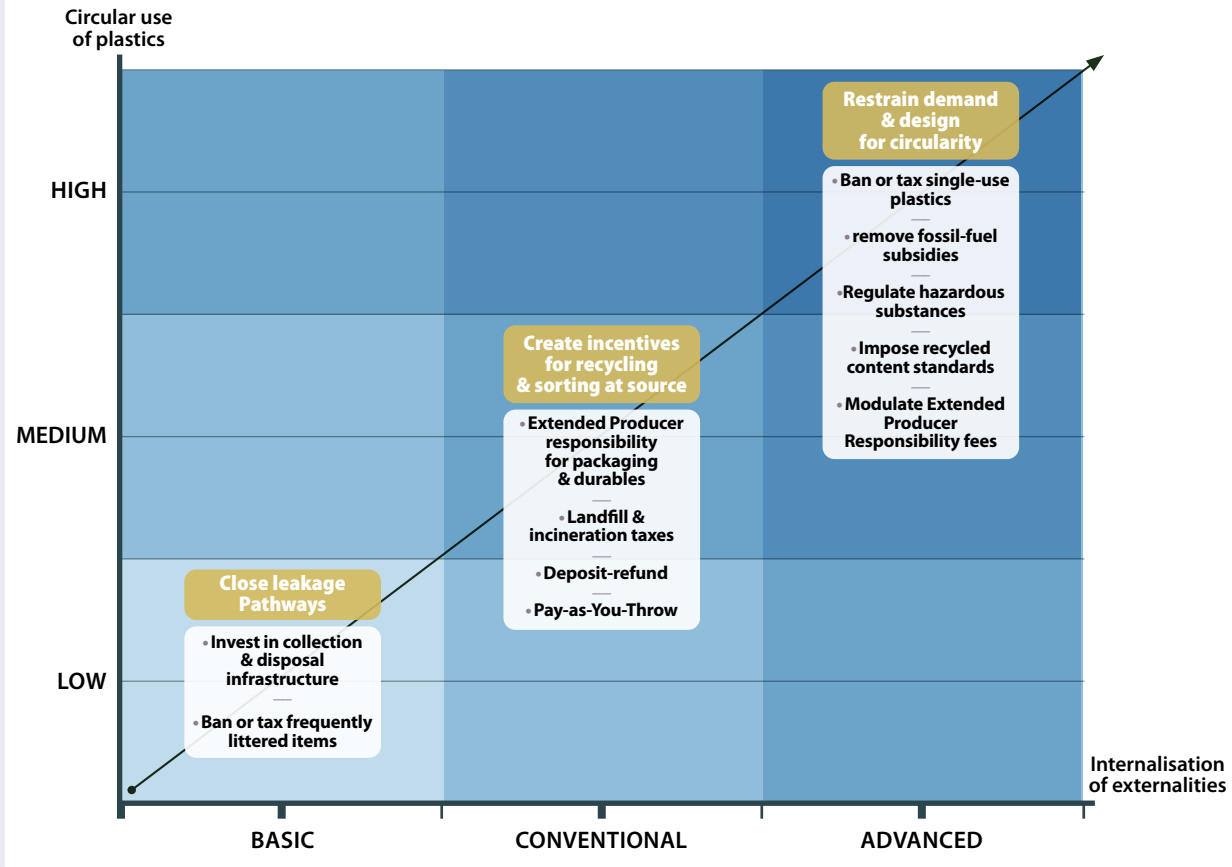
Public policies are a key lever for reducing the environmental consequences of plastics use. However, the current plastics policy landscape is fragmented and can be strengthened significantly.

A larger rollout of well-known economic instruments such as Extended Producer Responsibility schemes for packaging and durables, landfill taxes, deposit-refund and Pay-as-You-Throw system, is needed to improve recycling rates and reduce leakage. Moreover, upstream policy instruments, such as recycled content targets and plastics taxes are emerging as innovative tools to restrain consumption and incentivise design for circularity.

The impact of these instruments could be improved considerably by extending coverage to more product types and more countries.

To make the lifecycle of plastics more circular and reduce leakage, a policy roadmap for countries is proposed with three increasingly ambitious phases.

Figure 10. **A policy roadmap for a more circular use of plastics use can involve a stepped approach**

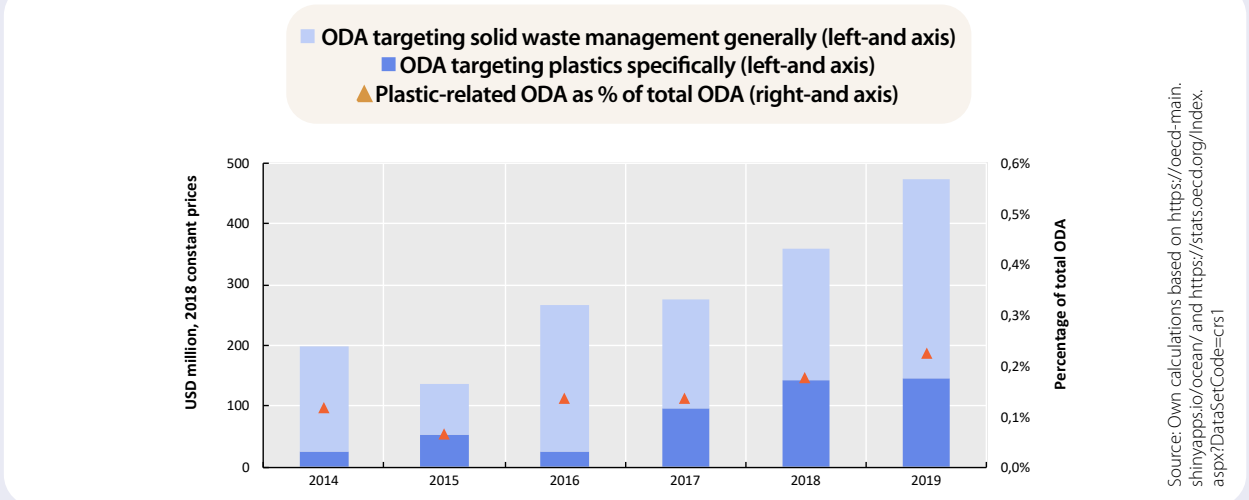


Strengthen international co-operation to make plastics value chains more circular and achieve net zero plastic leakage

The design process of globally traded plastic materials and products needs to consider the health and environmental impacts across the life-cycle and embed approaches such as sustainable chemistry thinking in order to improve the safety and circularity of materials. Policy interventions and co-operation across borders are needed to support this process. Moreover, the international community has recognised improving waste management to reduce land-based sources of marine plastic as one of the priorities for action, alongside upstream preventative measures. Since the bulk of mismanaged waste occurs in low and middle-income countries, the investments needed in these countries are particularly large. International support will be instrumental in accelerating the investments required in infrastructure and changes to waste management practices, policies and governance. Official development assistance (ODA) could be one avenue for such support. However, the share of plastic-related ODA in total ODA spending remains marginal, accounting for only 0.2% of ODA gross commitments in 2017 2019 (Figure 11). Moreover, the available budgets are only a fraction of total financing needs.

Beyond ODA, additional sources of funding will need to be tapped into, including revenue from households and firms benefiting from public waste management services, as well as domestic government subsidies and private sector investment. International support and local political leadership will be crucial to put in place policy frameworks and governance mechanisms that provide adequate and sustainable levels of funding.

Figure 11. **Plastic-related gross commitments for Official Development Assistance (ODA) have increased steadily but remain small**



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To access the full report: https://read.oecd.org/10.1787/de747aef-en

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These Policy Highlights are based on the OECD publication *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options.*

While plastics are extremely useful materials for modern society, the current linear model of mass plastics production, consumption and disposal is unsustainable. Plastics production and waste generation continue to increase with worsening environmental impacts. Growing awareness of these environmental pressures has strengthened the consensus around the need to make the lifecycle of plastics more circular. Despite international, national and local policy responses, as well as industry commitments, there is an urgent need to expand national policies and improve international co-operation to mitigate environmental impacts all along the value chain.

Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options intends to inform and support policy efforts to combat plastic leakage. The report quantifies the current production, use, disposal and key environmental impacts throughout the entire plastics lifecycle and identifies opportunities for reducing the negative externalities. It also investigates how plastics use and waste have been affected by the COVID-19 pandemic across sectors and regions. The Outlook identifies four key levers for bending the plastics curve: stronger support for recycled (secondary) plastics markets; policies to boost technological innovation in plastics; more ambitious domestic policy measures; and greater international co-operation.

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February 2022