



Nordic Council
of Ministers

Towards Ending Plastic Pollution by 2040

15 Global Policy Interventions
for Systems Change

Summary Report

Acknowledgements



Nordic Council of Ministers

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Objective and Scope

United Nations Environment Assembly Resolution 5/14, *End Plastic Pollution: Towards an International Legally Binding Instrument*, champions the goal of ending plastic pollution, including through 'sustainable production and consumption of plastics' (Resolution 5/14, paragraph 3b). The prospective introduction of an international, legally binding instrument on ending plastic pollution presents UN member states with a unique opportunity to scale the level of international action, coordination and collaboration needed to move towards this goal.

The paper *Potential options for elements towards an international legally binding instrument* – by the Intergovernmental Negotiating Committee (INC) ahead of INC-2 – presents diverse options for debate among negotiators.^a However, it was not designed to provide negotiators and stakeholders with an understanding of potential environmental, social and economic implications of different policies. Questions such as, 'What would be the impact of a set of policies on the stocks and flows of plastics?', 'What would be the impact on virgin plastic production and greenhouse gas (GHG) emissions?' and 'How much could it cost to implement these policies?' were not meant to be covered by the INC-2 paper. The objective of this report is thus to contribute to the debate by **defining 15 far-reaching policy interventions across the plastic lifecycle and estimating its impact on plastic stocks and flows** (including virgin plastic production, consumption, circularity, controlled disposal, mismanaged plastics^b and releases into the environment), **GHG emissions, costs and jobs**. The focus behind these policies is on minimising the negative impacts of mismanaged plastics and plastic releases into the environment – including microplastics – by 2040.



This report aims to provide a starting point for policy interventions to minimise impacts from plastic pollution

In this report, these 15 policy interventions are assumed to be adopted in all jurisdictions, with each policy calibrated for different local contexts. While these policies would be enacted at a national level, the report assumes that this level of global adoption **would be achievable only under a set of common**

^a The Options Paper (UNEP/PP/INC.2/4) was developed by the United Nations Environment Programme at the request of UN member states, using state and stakeholder submissions as a basis.

^b Mismanaged plastics, in the context of this report, refers to any macroplastic or microplastic volume that does not end recycled or disposed of in a controlled manner. It would include those in unsanitary landfills / dumpsites, burned in open pits, or released into land or water environments.

global rules set out in an international, legally binding instrument on ending plastic pollution. Without common global rules and harmonised action, coordination and collaboration, the plastics policy landscape would likely remain fragmented, the adoption of far-reaching policies limited and the system's ability to deal with complex international plastic value chains insufficient.

The scope of this report in relation to the broader issue of plastic pollution:

According to the Organisation for Economic Co-operation and Development (OECD), 'plastic pollution' encompasses '**all emissions and risks resulting from plastics production, use, waste management and leakage**'.¹ The authors of this report support this broad and holistic definition of 'plastic pollution', in recognition of the fact that solutions to end plastic pollution should address multiple areas. These include hazards from plastics and additives to human health and biodiversity across the plastic lifecycle; the contribution of plastic to climate change; impacts on the informal sector and local communities; as well as mismanaged plastics and releases into air, land and water environments.

The scope of this report is centred on the results of a modelling exercise that estimates the impact on plastic stocks and flows, GHG emissions, costs and employment of implementing 15 far-reaching policy interventions across all geographies. The report presents these policy interventions and their estimated effects, with a focus on minimising the impact of mismanaged plastics and plastic releases into air, land and water environments. Although not all elements of plastic pollution could be quantified in the model, aspects such as hazards to human health and biodiversity, and the impact on the informal sector, are presented qualitatively to provide relevant context to the reader when necessary.

The findings presented in this report should thus be complemented by further sources of insight on these additional aspects of plastic pollution. Put simply, this report aims to provide a starting point for policy interventions and their required scope, while recognising that further changes to the plastic system are needed to fully address all aspects of plastic pollution.

The model presents two alternative scenarios of how the plastic system could evolve by 2040:

- The **Business-as-Usual Scenario** shows the impact on plastic stocks and flows, virgin plastic production, mismanaged plastics, GHG emissions, financial costs and employment of continuing on the current trajectory of plastic consumption and waste management.
- The **Global Rules Scenario** assumes that common global rules set out in the international, legally binding instrument would trigger far-reaching policy interventions across the plastic lifecycle, adopted across all geographies. The Global Rules Scenario should not be understood as the only policy package that could achieve these outcomes, but rather as a modelling of a set of far-reaching policies to showcase the level of reach needed to make a significant impact.

The **model underlying this report covers all geographies and all main economic sectors and plastic applications**, including packaging, household and consumer goods, textiles, fishing and aquaculture, agriculture, construction, transportation and electronics. The model acknowledges the different local contexts in diverse parts of the world by conducting the analysis across eight geographic regions: 1) Europe, including Türkiye; 2) the USA and Canada; 3) Japan, the Republic of Korea, New Zealand and Australia; 4) Central and South America and the Caribbean; 5) China; 6) South/Southeast Asia and Eurasia (excluding countries in other groups); 7) India; and 8) Africa and the Middle East. The analysis also includes primary microplastics from paints, tyre abrasion, textiles, pellets and personal care products.

The model underlying this study has important limitations:

- The model is not designed to estimate hazards and impacts of plastic on human health and biodiversity. This is because these hazards can depend on factors such as the level and frequency of exposure to specific substances or toxins, or intrinsic properties of a chemical, and do not have a linear relationship to plastic stocks and flows, which is the focus of the model.
- The model does not include global production caps, moratoriums or quotas. Incorporating these into the model would have necessitated highly uncertain assumptions – for example, on how quotas would be allocated to producers or which markets would have to limit consumption once production was capped. Instead, the Global Rules Scenario includes targets for virgin plastic reduction, which could be achieved through different mechanisms, including production caps and virgin plastic fees applied to local producers. The Global Rules Scenario results in a reduction of virgin plastic production that could serve as ranges if global caps were to be implemented, as these policies are not exclusive to the policy interventions outlined in this report.
- The Global Rules Scenario would not achieve net-zero GHG emissions or alignment with the Paris Climate Agreement. While the model estimates the GHG emissions from both scenarios, it does not include additional levers such as further reducing virgin production, decarbonising energy sources, switching feedstock or capturing end-of-life emissions.
- The model does not feature the remediation of legacy plastics already in the environment, covering this qualitatively instead.

The model draws from available sources and past modelling exercises but also differs from previous models as explained in Box 1 below. The analysis and figures in this report are estimates and approximations for the purpose of the modelling exercise, and are not statistical reporting. Therefore, the figures in this analysis reflect directional model outputs, not precise measurements, and should be interpreted as such. Despite these limitations, the model results are informative of the extent of the problem and the general level of reach that will be required to meaningfully reduce mismanaged plastics.



Executive Summary

Plastics are used in a wide range of applications across the world due to their high versatility, durability and relatively low cost. The use of plastics can also reduce GHG emissions by, for example, extending food shelf life or reducing the weight of vehicles. However, the plastic industry has not borne the cost of plastic externalities; on the contrary, it has benefited from public subsidies, for example in regards to oil exploration.⁵ In addition, adequate controls on how plastics are produced, used and managed have been lacking, generating hazards to human health and biodiversity across the plastic lifecycle; contributing to climate change; impacting the informal sector and local communities; and resulting in the release of large volumes of mismanaged plastics into the environment. With a legally binding instrument on plastic pollution now under negotiation, governments have a unique opportunity to address these systemic challenges through common global rules.

The objective of this report is to define a package of far-reaching policies and estimate how, if implemented globally and concurrently, this could minimise the impacts of mismanaged plastics and plastic releases into the environment, including microplastics, by 2040. Two scenarios – the **Business-as-Usual Scenario** (current trajectory) and the **Global Rules Scenario** – are presented to depict two possible states of the plastic system by 2040. The Global Rules Scenario represents a future in which common global rules based on the international legally binding instrument would trigger a far-reaching package of policy interventions across the plastic lifecycle, adopted in all geographies. The analysis estimates the impact of these policy interventions on plastic stocks and flows, as well as on environmental, economic, and social implications. These policy interventions are not presented as the only set of policies that could achieve similar outcomes. Instead, the Global Rules Scenario simply models a package of far-reaching policies to showcase the level of reach needed to make a significant impact.

This section presents the report's main insights from the modelled scenarios:

FAST FACTS

↑86%

increase in annual mismanaged plastic volumes by 2040 (Business-as-Usual relative to 2019)

↑66%

increase in annual virgin plastic production by 2040 (Business-as-Usual relative to 2019)

↓90%

reduction in annual mismanaged plastic volumes by 2040 (Global Rules Scenario relative to 2019)

Business-as-Usual Scenario

Without global action, the annual levels of mismanaged plastics would continue to rise and could almost double from 110 million tonnes (Mt onwards) in 2019 to 205 Mt by 2040, a 86% increase. Annual production of virgin plastics would increase from 430 Mt in 2019 to 712 Mt by 2040, a 66% increase. GHG emissions from the plastic system could further increase from 1.9 gigatonnes of carbon dioxide equivalent (GtCO_{2e}) per year in 2019 to 3.1 GtCO_{2e} by 2040, an increase of 63%. This trajectory is incompatible with the goals of the Paris Climate Agreement.

The world produced ~460 Mt of plastics (430 Mt estimated to be virgin and 29 Mt recycled) and generated 385 Mt of plastic waste^c in 2019. The global plastic system is currently unable to manage this waste and thus approximately 28% of plastic waste ends up mismanaged, resulting in 110 Mt in 2019. Of this, it is estimated that 43 Mt ended up in dumpsites; 39 Mt were burned in the open; and 28 Mt were released into land or water environments. Packaging and consumer goods, microplastics and fishing and aquaculture are the main sources of mismanaged plastics, followed by agriculture and textiles.

In the Business-as-Usual Scenario, the annual volume of plastics entering the system could rise from 460 Mt in 2019 to 764 Mt by 2040 (712 Mt virgin and 52 Mt recycled). As production and consumption increase, annual plastic waste generation could grow from 385 Mt in 2019 to 646 Mt by 2040. This trend is driven by population and consumption growth, which are also proportionally higher in regions that currently lack the necessary resources and infrastructure to manage waste, thus exacerbating the consequences of an already flawed plastic system over time.

Global Rules Scenario

A set of far-reaching policies across the plastic lifecycle, adopted globally, could reduce annual mismanaged plastic volumes in 2040 by 90% relative to 2019. This set of policies would reduce annual volumes of virgin plastic production in 2040 by 30% relative to 2019. A reduction of this level would be needed to address the issue of mismanaged plastics through solutions across the plastic lifecycle, rather than simply expanding waste management.

^c Plastic waste, in the context of this report, encompasses any plastic volume that has ended its use-phase or that has been lost or released during any other phase. This would include any plastic no longer in use-phase, microplastic releases, mismanaged pellets, or loss of fishing / aquaculture gear.

↓30%

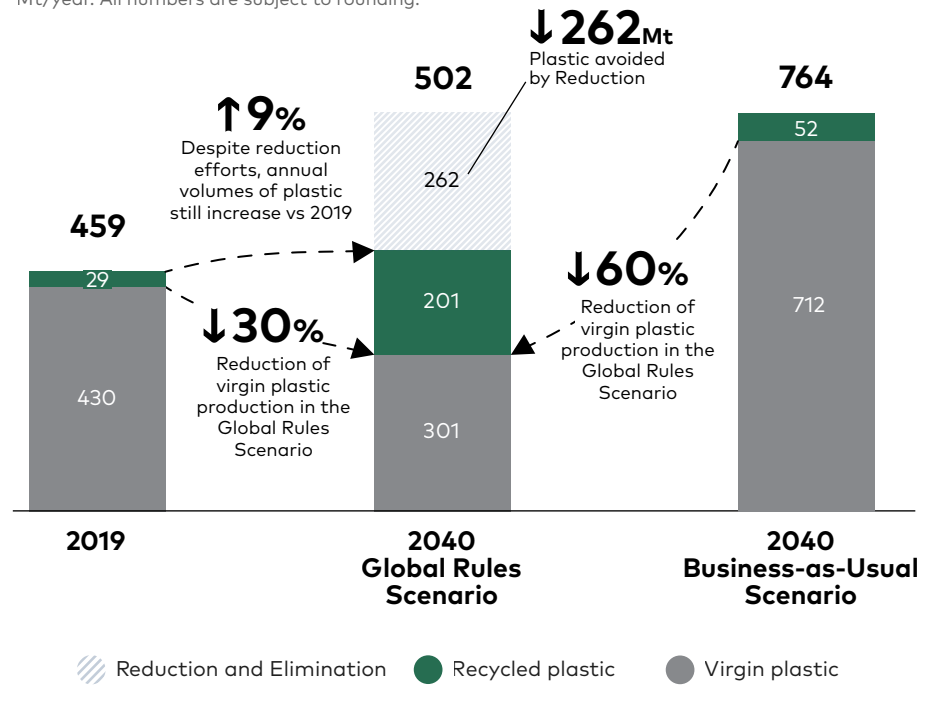
reduction in annual virgin plastic production by 2040 (Global Rules Scenario relative to 2019)

The Global Rules Scenario would reduce annual volumes of virgin plastic production and consumption by applying targets, fees and demand reduction policies; eliminating avoidable single-use plastics on certain applications; mandating substitution where alternative materials would yield better impacts; and expanding safe reuse, recycling, durability and repair. By 2040, annual virgin plastic production would decrease by 30% relative to 2019 levels, equivalent to a 60% reduction relative to the 2040 levels in the Business-as-Usual Scenario. When counting both virgin and recycled plastics, annual production by 2040 would still result in a increase of 9% relative to 2019 levels (with a significant increase in the share of recycled plastics), as expected population and consumption growth outpaces reduction levers in some regions. Figure 1 below displays these results.

FIGURE 1 Annual plastic production under the Business-as-Usual and Global Rules Scenarios

The Global Rules Scenario would result in a 30% reduction in annual virgin plastic production by 2040 relative to 2019 levels.

Mt/year. All numbers are subject to rounding.



x7

increase in global recycling output by 2040 (relative to 2019)

The Global Rules Scenario would prevent 184 Mt of plastic waste annually by 2040. These policies could also result in an increase in recycling output to 201 Mt by 2040, relative to 29 Mt in 2019. This is equivalent to global recycling output increasing sevenfold by 2040. However, to achieve these results, the policy package laid out in the Global Rules Scenario would need to be implemented across all jurisdictions. If some large countries did not engage in this level of adoption, the result would significantly worsen.

Plastic volumes ending in controlled disposal (2040 Global Rules Scenario relative to 2019)

↓ 46%

Declining in regions with well-developed infrastructure

↑ 74%

... but increasing where infrastructure is lacking today

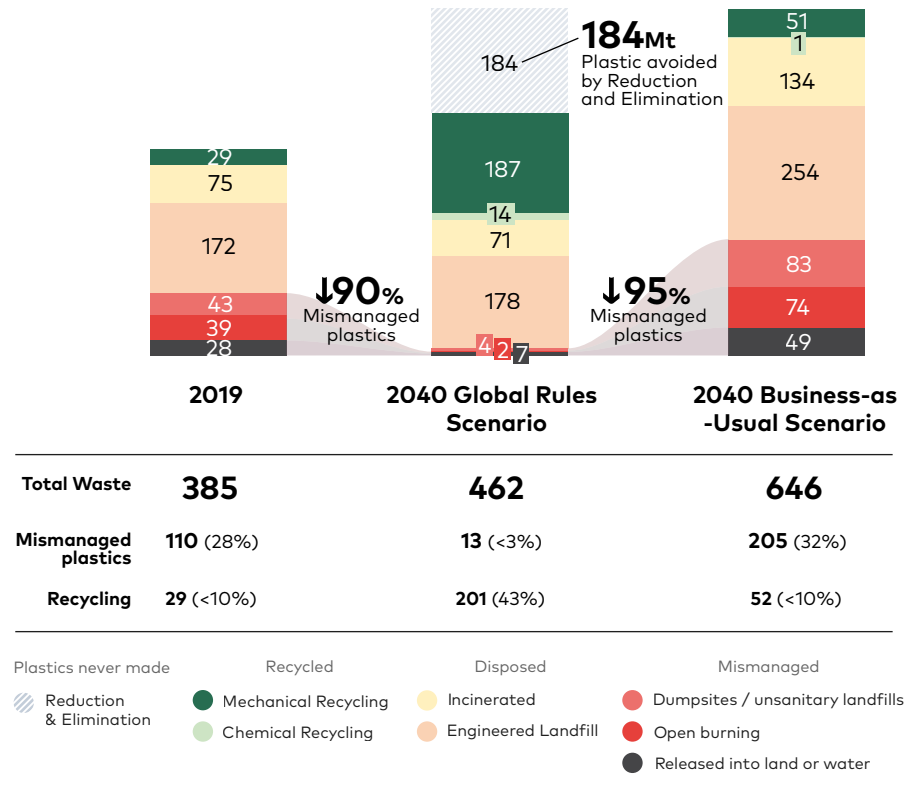
Despite the scale-up of reduction and recycling, some plastic waste still would not be prevented or recycled. This volume is estimated in the Global Rules Scenario at 249 Mt of plastic waste in 2040, which would thus be subject to controlled disposal.^d The projected trends vary by region: controlled disposal volumes in Europe, the USA, Canada, Japan, the Republic of Korea and Oceania would decrease by 46% by 2040 relative to 2019 levels. However, annual controlled disposal volumes in other regions would increase by 74% by 2040 relative to 2019 levels, due to these regions already lacking waste management infrastructure.

The annual volumes of mismanaged plastics in 2040 would decrease by 90% relative to 2019 levels and by 95% relative to the 2040 levels in the Business-as-Usual Scenario. However, 13 Mt of mismanaged plastics would remain annually by 2040, with 4 Mt ending up in dumpsites, 2 Mt burned in the open and 7 Mt released into land or water. Out of these 7 Mt released into land and water environments, microplastics would represent 5 Mt. Figure 2 below displays these results.

FIGURE 2 End of Life fate of plastic waste in 2019 and 2040 in the Business-as-Usual and Global Rules Scenario

The Global Rules Scenario would result in a 90% reduction in annual mismanaged plastic volumes relative to 2019 levels

Mt/year. All numbers are subject to rounding



^d Controlled disposal prevents plastic waste from being mismanaged and includes engineered landfills (but not dumpsites), incineration with energy recovery and plastic-to-fuel technologies.

~0%

increase in GHG emissions by 2040 (Global Rules Scenario relative to 2019)

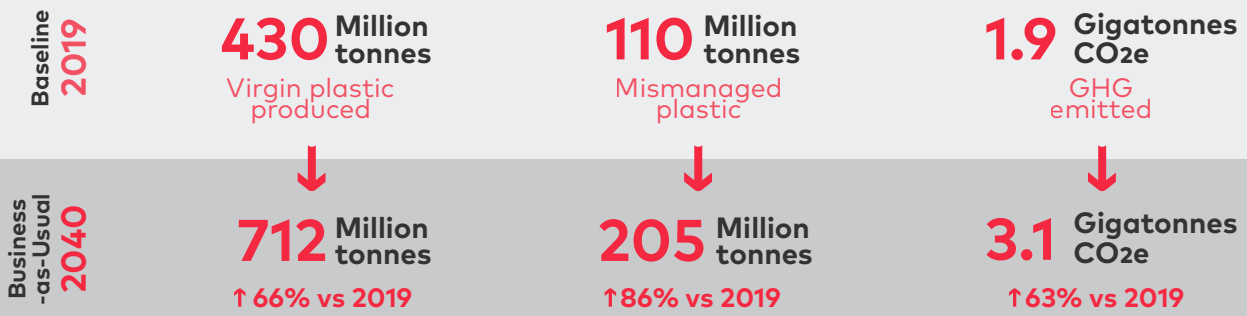
The Global Rules Scenario would result in an estimated 1.9 GtCO_{2e} per year by 2040, which is equivalent to 2019 levels but would represent a mitigation of GHG emissions from the global plastic system of 40% relative to the 2040 levels in the Business-as-Usual Scenario (3.1 GtCO_{2e}). This decline in the Global Rules Scenario compared with the Business-as-Usual Scenario would mainly be driven by a decline in virgin plastic production. To achieve full alignment with the Paris Climate Agreement, further reduction in virgin production or additional decarbonisation levers would be needed beyond the reduction and circularity expansion outlined in the Global Rules Scenario.



A key driver to reduce plastic production and consumption is a shift away from single-use plastics

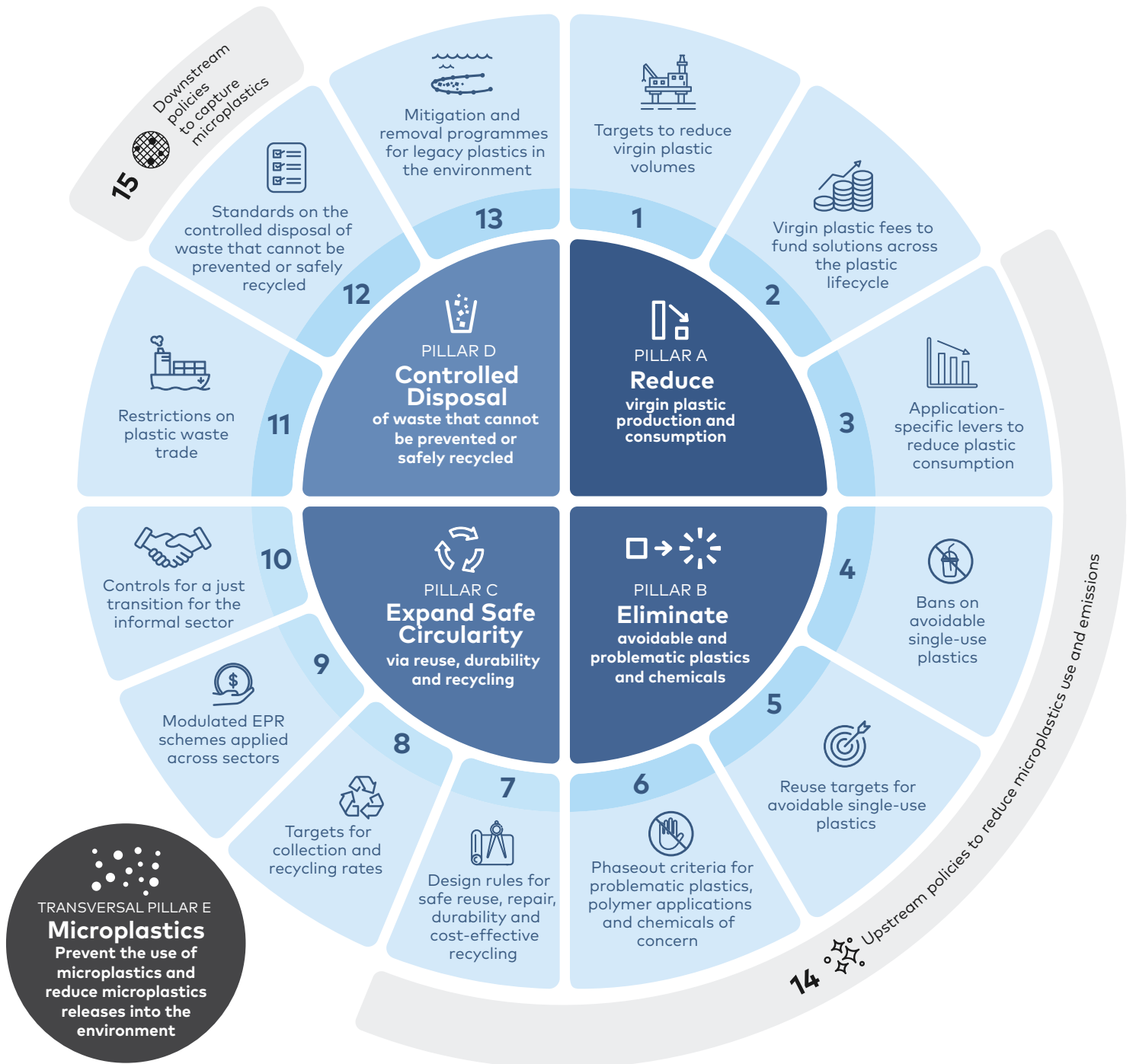
The results in the Global Rules Scenario would be achieved through a package of 15 far-reaching policy interventions across the plastic lifecycle, structured across five pillars. The set of policies selected draws on submissions from UN member states and other organisations ahead of INC-2, interviews and open consultations. The next infographic (see below) summarises these results and presents the policy interventions. This report's approach to determining the scale of each pillar is discussed in the report (see Box 5).

The Business-as-Usual Scenario would lead to a substantial increase in plastic production, mismanaged plastics and GHG emissions

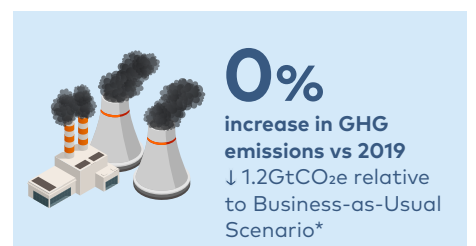
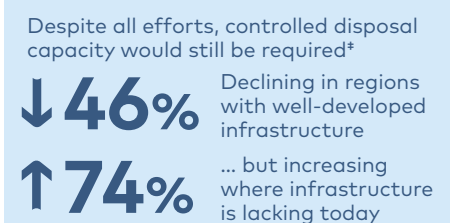
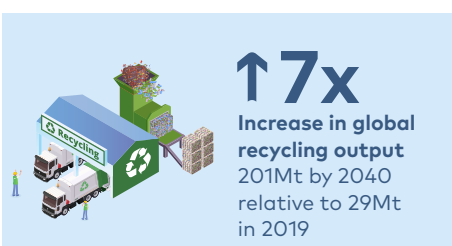


The Global Rules Scenario involves 15 global policy interventions

Assumed to be legally-binding, concurrent, implemented across all regions, and across the plastic lifecycle:



The Global Rules Scenario would result in...



*The Global Rules Scenario would result in controlled disposal (landfill and incineration) decreasing by 2040 relative to 2019 levels in regions that currently have well-developed waste management infrastructure. However, in regions currently lacking infrastructure, despite all efforts, the scenario would result in increased controlled disposal. * Further intervention is required to meet the targets set by the Paris Climate Agreement.

Pillar A



Reduce

virgin plastic
production and
consumption

Reduce plastic production and consumption

A significant reduction in virgin plastic production and consumption would be needed in order to substantially reduce mismanaged plastic levels. The Global Rules Scenario would result in a 30% reduction in annual virgin plastic production by 2040, relative to 2019 – equivalent to a 60% reduction relative to the Business-as-Usual Scenario. This would require policy interventions aimed exclusively at reducing virgin plastic volumes in the system.

The key policy interventions on which Pillar A is based are reduction targets, virgin plastic fees and application-specific demand interventions:

1



Targets to reduce virgin plastic volumes

calibrated by sector and local context

Targets to reduce virgin plastics volumes would signal the level of change needed to industry and governments. The reductions in virgin plastic achieved by 2040 under the Global Rules Scenario would vary geographically. Europe, the USA, Canada, Japan, the Republic of Korea and Oceania would see the highest reductions in consumption, since these regions are starting from high consumption per capita. In these regions, the Global Rules Scenario would result in a reduction in annual virgin plastics use of 51% to 63% by 2040 relative to 2019 levels. Regions such as China and Central and South America would see lower – although still significant – reductions in annual virgin plastics use, of 36% to 39% by 2040 relative to 2019 levels. This is due to lower consumption per capita today and their expected economic and demographic growth. Finally, regions with lower consumption per capita today but high forecasted economic and demographic growth – such as India, South and Southeast Asia, Africa and the Middle East – would see annual virgin plastics demand increase by ranges between 8% and 57% by 2040 relative to 2019 levels. These reductions could be aggregated to a global target, to signal the level of action required and communicate global action under a single objective.

2



Virgin plastic fees to fund solutions across the plastic lifecycle

with fees ranging from \$1000 to \$2000/tonne by 2040, calibrated by region

Virgin plastic fees to fund solutions across the plastic lifecycle could help to reduce the volume of virgin plastics in the system. This policy would level the playing field, internalise externalities and incentivise shifts away from virgin plastic. The Global Rules Scenario applies fees to virgin plastic volumes entering the system, calibrated by region and increasing progressively. The model follows the OECD's Global Ambition Scenario in its Global Plastics Outlook: Policy Scenarios to 2060, with adaptations by region and set to 2040. The modelled fees vary from US\$500 per tonne to US\$1,000 per tonne by 2030, and from US\$1,000 per tonne to US\$2,000 per tonne by 2040, depending on the region.

3



Application-specific levers to reduce plastic consumption

in textiles, fisheries and aquaculture, transportation and construction

Application-specific levers to reduce plastic consumption are included for certain sectors. For example, for textiles, the Global Rules Scenario assumes a ban on the destruction of overproduced and returned items. This is already underlined in the EU's Strategy for Sustainable and Circular Textiles,⁶ which seeks to address overproduction in the apparel industry. For fishing and aquaculture, the Global Rules Scenario includes policies aimed at reducing intentional abandonment, unintentional gear losses and gear conflict, and introducing gear marking and tracking. For construction and transportation, the analysis leverages the Overseas Development Institute's (ODI) Phasing Out Plastics report on the potential opportunity to reduce plastic consumption.⁷ When implementing policy interventions that could trigger the replacement of plastics with other materials, it would be necessary to run a comprehensive case-by-case analysis in the local context – for example, product lifecycle assessments (LCAs) – to prevent unintended consequences.⁸

Pillar B



Eliminate
avoidable and
problematic
plastics and
chemicals

Eliminate avoidable and problematic plastics and chemicals

The Global Rules Scenario would eliminate certain avoidable single-use plastic applications through bans and reuse targets. Avoidable or unnecessary plastics include plastic applications that can be reduced or replaced with non-plastic alternatives or eliminated entirely without undesirable outcomes. In the case of problematic plastics – those which present hazards or risks to human health or biodiversity, or which hinder circularity – global criteria would be required in order to determine which substances should be phased out.

The key policy interventions on which Pillar B is based are bans and reuse targets for single-use applications and phaseout criteria for problematic plastics:

4



Bans on avoidable single-use plastics

to incentivise elimination, shift to reuse models and substitution

Bans on avoidable single-use plastics would shift certain packaging applications to safe multi-serve formats, reuse or refill alternatives; or replace plastic for other materials with superior environmental performance. In the Global Rules Scenario, these bans are applied to a broad range of applications such as single-use plastic bags; food service disposables and takeaway items; pots, tubs and trays for fruit and vegetables; plastics in logistics and business-to-business applications (eg, films to wrap pallets, e-commerce plastics); and multi-material/multi-layer sachets where better alternatives exist. Before banning a single-use plastic application, it would be necessary to run a comprehensive case-by-case analysis that considers the

local context to prevent unintended consequences. To this end, product LCAs could be conducted to determine whether the alternatives will improve overall environmental, health and social impacts across their full lifecycle.^e

5



Reuse targets for avoidable single-use plastics

between 15% to 100%, calibrated by applications

Reuse targets for avoidable single-use plastics would promote the scaling of new delivery models that replace single-use plastic packaging with alternatives that are used across multiple consumption cycles. The Global Rules Scenario leverages similar ranges to those reuse targets discussed under EU Packaging and Packaging Waste Regulation drafts,⁹ for example, assuming reuse targets for 2040 between 15% and 25% for beverages containers (sodas, water, alcohol) and household products (eg, cleaning, personal care). The scenario assumes higher targets than those in the European Union drafts for other categories, for example, 100% for plastics used in logistics and transport packaging. Takeaway food and beverage containers (which also fall within the scope of single-use bans) either would be eliminated or would shift to safe reuse models. These targets would rest with final distributors (retailers and food service providers).

6



Phaseout criteria for problematic plastics, polymer applications and chemicals of concern

including bans and moving to 'safe lists' progressively

Problematic plastic products, polymer applications and chemicals of concern would be phased out according to common global criteria encompassing all those that create hazardous conditions, pose a risk to human health or the environment, impede safe reuse or recycling, or have high likelihood of releasing into the environment. For example, for several groups of chemicals used in plastic products (eg, bisphenols, flame retardants and phthalates), there is evidence pointing to human health hazards.¹⁰ Other examples in packaging include problematic labels, adhesives and pigments (eg, carbon black or pigmented polyethylene terephthalate (PET) bottles); as well as polystyrene, polyvinyl chloride (PVC), polyethylene terephthalate glycol (PETG), polylactic acid (PLA), intentionally added per- and polyfluoroalkyl substances, and oxo-degradable additives^{11,12}.

^e Conducting LCAs was not part of this report, which instead leveraged past studies to determine what bans would be applicable and whether the outcome would be elimination, shift to reuse or substitution

Pillar C



Expand Safe Circularity

via reuse,
durability and
recycling

Expand safe circularity via reuse, durability and recycling

Products would be redesigned for safe reuse, durability, repair, and recycling with common design rules, adjusted for local contexts. In the Global Rules Scenario, the world's recycling output would increase sevenfold by 2040 relative to 2019 levels, requiring collection rates to be over 95% globally by 2040 and recycling rates to range between 15% and 67% for specific plastic applications. To support this, extended producer responsibility (EPR) schemes would be implemented, with fees designed to operate on a net cost basis towards the development of the necessary infrastructure. These policies could impact the livelihoods of workers in the informal sector, so controls would be required for a just transition.

After reducing the volumes of plastic in the system (Pillars A and B), the Global Rules Scenario prioritises the expansion of circularity in those plastics that remain. The key policy interventions on which Pillar C is based are product design rules, waste collection targets, EPR schemes and protections for the informal sector:

7



Design rules for safe reuse, repair, durability and cost-effective recycling

calibrated by application and by local context

Design rules for safe reuse, durability, repair and cost-effective recycling in local contexts would be introduced under the Global Rules Scenario. These rules should ensure that plastic products in all sectors of the economy are designed for safe reuse and recycling. The rules would differ by plastic application. For example, for packaging, the Global Rules Scenario assumes improvements in sorting and recyclability due to better designs following the Golden Design Rules,¹³ along with local calibrations that reflect differences in systems and infrastructure (eg, the guidelines of the Association of Plastic Recyclers in the USA and RecyClass in Europe). For durable applications, better designs would include improved repairability of electronics; a shift to recyclable mono-materials; the phaseout of additives that inhibit recyclability; and an overall increase in durability and lifespans in electronics, agriculture and fisheries and aquaculture applications.

8



Targets for collection and recycling rates

including segregated collection for plastics

Targets for collection and recycling rates would seek to maximise collection of plastic waste and increase the supply of recycled plastics. The Global Rules Scenario would result in waste collection rates of more than 95% across all geographies for all sectors considered. In low and middle-income countries, substantial development and resources would be needed to reach these levels. Globally aligned targets towards this goal would send an important signal to central governments, local authorities and the private sector.

The Global Rules Scenario prioritises safe mechanical recycling as the main method of recycling (prioritised over chemical recycling), resulting in a global plastics recycling rate of 43% by 2040 (compared to less than 10% in 2019). The Global Rules Scenario would expand recycling infrastructure capacity to 201 Mt globally (compared to 29 Mt in 2019). Chemical recycling technologies are still in development and present drawbacks such as higher energy consumption, lower material-to-material yields, increased GHG emissions and greater investment requirements that could create 'lock-in' effects, disincentivising better solutions in the future. For plastic waste that is not suitable for mechanical recycling, the Global Rules Scenario includes limited use of chemical recycling, which would account for approximately 3% of the total plastic waste generated in 2040. Because of the risks and uncertainty associated with chemical recycling, a Global Rules Scenario without chemical recycling was also modelled (see Box 4).

9



Modulated EPR schemes applied across sectors

with fees of \$300 - \$1000/tonne calibrated by region and by product

Modulated EPR schemes applied across all sectors are applied under the Global Rules Scenario, calibrated by region and product, to promote better designs and fund solutions across the plastic lifecycle. Fees should be defined to account for the costs of infrastructure in the local context, calibrated by application, and should operate on a net cost basis, to incentivise better designs and penalise the use of hard-to-recycle materials or designs. The fees modelled vary per product and region, but range from US\$300 per tonne to US\$1,000 per tonne by 2040, starting in 2025 and increasing gradually. Common rules within a global framework would also help to harmonise national approaches while still allowing for context-specific adaptation.¹⁴

10



Controls for a just transition for the informal sector

enhancing their labour and human rights

Controls for a just transition for the informal sector would enhance workers' labour and human rights, as global, national and local interventions – especially the adoption of policies such as EPR and deposit return schemes – could disrupt the livelihoods of these communities. Therefore, the Global Rules Scenario assumes the adoption of these policies to ensure a just and inclusive transition for the informal sector. These should be defined through close collaboration between governments and stakeholders to ensure the inclusion of the informal sector in the waste management system and in relevant policy discussions; and to facilitate the formulation of effective policies to improve incomes and working conditions, and protect the health and human rights of this community.¹⁵

Pillar D



Controlled disposal

of waste that cannot be prevented or safely recycled

Ensure the controlled disposal of waste that cannot be eliminated, reduced or safely recycled

Some plastics in use feature intricate designs that can hinder safe recycling, while some plastic waste may not be collected properly segregated to allow for recycling. In these cases, controlled disposal is the last resort to avoid mismanagement. The Global Rules Scenario would result in a 46% reduction in annual controlled disposal volumes in Europe, the USA, Canada, Japan, the Republic of Korea and Oceania by 2040 relative to 2019 levels. However, in regions^f that currently lack waste management infrastructure and where population and consumption growth is expected to outpace the speed at which better solutions can be rolled out, there would still be an 74% increase in annual controlled disposal volumes by 2040 relative to 2019 levels.

The key policy interventions on which Pillar D is based are export restrictions on plastic waste, global standards on controlled disposal and removal programmes for legacy plastic:

11



Restrictions on plastic waste trade

to prevent exports to areas with limited capacity

Restrictions on plastic waste trade would prevent the export of plastic waste to regions with limited capacity or resources. In the Global Rules Scenario, trade restrictions are assumed to expand beyond the Basel Convention to all plastic waste exports, to prevent the transfer of responsibility from advanced waste management systems to underdeveloped systems. Exemptions may exist in the case of shared agreements and small countries and islands without sufficient capacity or scale to develop their own infrastructure.

^f In low, middle and upper-middle income regions in Central, South America and the Caribbean; China; South/Southeast Asia and Eurasia; India; and Africa and the Middle East

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Standards on the controlled disposal of waste that cannot be prevented or safely recycled

as last resort option to prevent plastic mismanagement

Standards on the controlled disposal of waste that cannot be prevented or safely recycled would be fully implemented globally to ensure that waste is not mismanaged. Landfill and incineration are the main options for controlled disposal; with landfills considered preferable in the Global Rules Scenario given lower GHG emissions and costs in comparison to incineration. Incineration of plastics can create 'lock-in' effects, as plants require a constant input of plastic waste to provide returns on investment over time, which can disincentivise recycling. Also, there is evidence of negative environmental impacts from incinerators due to inadequate emission controls of pollutants.¹⁶ Controlling these requires extensive management, which can be problematic in areas with limited resources or regulation.¹⁷ Landfills also require environmental standards, for example to include systems to capture liquids and gases, and to prevent land usage to impact biodiversity. The Global Rules Scenario assumes the split between engineered landfills and incineration that each region has today, prioritising landfills in regions without incineration when new capacity is required.

13



Mitigation and removal programmes for legacy plastics in the environment

although still prioritising solutions that prevent releases in the first place

Mitigation and removal programmes for legacy plastic in the environment should be pursued, however the Global Rules Scenario priority is on addressing the root causes of mismanagement and focuses on solutions that prevent releases to the environment in the first place. Removal programmes for legacy plastics would still have a role to play: For example, beach clean-ups are an effective way of raising awareness and may be an enabler for prevention. Data obtained from clean-ups can identify the items that are most likely to end up mismanaged and can inform policy accordingly.

TRANSVERSAL PILLAR E



Microplastics

Prevent the use of microplastics and reduce microplastics releases into the environment

Prevent the use of microplastics and reduce microplastics releases into the environment

An estimated 9 Mt of primary microplastics were released into the environment in 2019; and without effective policy, this figure is projected to increase to 16 Mt by 2040 under the Business-as-Usual scenario. Through a series of policies to prevent the use of microplastics and capture emissions, the Global Rules Scenario would see microplastic releases fall to 5 Mt per year by 2040. Although this represents an important improvement relative to 2019, further solutions and innovation would be required.

The analysis includes primary microplastics from personal care products, pellets, tyre abrasion, paints and textile use; but excludes secondary microplastics.

14



Upstream policies to reduce microplastics use and emissions

through bans, substitution, better product designs, preventive maintenance, and behavioural change

Upstream policies to reduce microplastics use and emissions should be introduced. The analysis assumes microplastics from personal care products are completely eliminated through bans on intentionally added primary microplastics. The model also estimates reduction of microplastics creation and emissions through better designs in textiles and tyres. Finally, the estimate assumes enforcement of a wide range of upstream interventions, such as practices and technologies for the application, maintenance and removal of paints.

15



Downstream policies to capture microplastics, followed by controlled disposal

prioritising capture at source over capture through wastewater treatment systems

Downstream policies to capture microplastics, followed by controlled disposal would avoid the release of microplastics into the environment. The model prioritises capture of microplastics at source, estimating the potential of enforcing certain technologies and industry practices – for example, practices to prevent the release of pellets, microplastic filters in washing machines and paint removal technologies. If capture at source is not possible, the analysis estimates the potential of downstream capture through waste and wastewater systems, although this is left as a last resort option due to requiring substantial infrastructure and investment.

Costs and employment implications

The Global Rules Scenario would yield important savings in public expenditure relative to the Business-as-Usual Scenario. The cumulative^g public expenditure from 2025 to 2040 in the Global Rules Scenario would total US\$1.5 trillion, compared to US\$1.7 trillion in the Business-as-Usual Scenario. The savings would mainly accrue from reductions in plastic volumes, resulting in less plastics to collect and manage. However, this would primarily apply to regions with well-developed infrastructure; other regions would still need to invest more in expanding their waste management systems.

The analysis estimates both public expenditure for governments and costs and investments required from the private sector in the Business-as-Usual Scenario and the Global Rules Scenario. Public expenditure in this analysis accounts for the costs of collecting, sorting and disposing of plastic waste. The Global Rules Scenario would result in lower public expenditure relative to the Business-as-Usual Scenario, mainly due to reductions in plastic use, and thus in the volumes to collect and manage.

US\$1.5tn

cumulative public expenditure from 2025 to 2040 (Global Rules Scenario)

^g Present value, using a discount rate of 3%.

However, the trends would differ by region. For regions with well-developed infrastructure,^h public expenditure in the Global Rules Scenario is estimated at US\$0.8 trillion (2025 to 2040 present value); whereas the equivalent figure for the Business-as-Usual Scenario is US\$1.1 trillion.

For regions that currently lack infrastructure,ⁱ public expenditure in the Global Rules Scenario is estimated at US\$0.7 trillion (2025 to 2040 present value) – a slight increase on the US\$0.6 trillion estimated in the Business-as-Usual Scenario. These estimates however do not include cost implications from mismanaged legacy plastics or any other externalities from plastics, and therefore these estimates could bring savings if those externalities were accounted for.

With regard to employment, it is estimated that both the Business-as-Usual Scenario and the Global Rules Scenario would support 12 million jobs globally by 2040. This suggests that the Global Rules Scenario could be achieved without any decrease in global employment. However, it would require a shift in jobs away from virgin plastic production; a shift in industry towards new business models (eg, reuse) and alternative materials; and improved recycling, collection and waste management systems. Importantly, this transition may not be balanced from a geographical perspective; and it would be essential to put in place controls to ensure a socially just transition, particularly in relation to vulnerable communities.

Priorities for further innovation, research and data

The extent of the issue is such that, even after implementation of the 15 far-reaching policy interventions in the Global Rules Scenario, 13 Mt of plastic would remain mismanaged annually by 2040, requiring further solutions, research, data gathering and innovation.

In the Global Rules Scenario, the impact of the 15 policy interventions is limited by technological, economic and behavioural constraints. By 2040, the scenario would still lack solutions for 13 Mt of annual mismanaged plastic, of which it is estimated that 4 Mt would end in dumpsites, 2 Mt would be burned in the open and 7 Mt would be released into land or water. Out of these 7 Mt released into land and water environments, microplastics would account for 5 Mt; this therefore remains a key area in which solutions are lacking. Innovation would thus be required to improve the design of tyres, paints and textiles to minimise microplastics emissions. The remaining mismanaged plastic volumes would comprise a mixture of all other sectors. To address this, further solutions would need to be incentivised – for example, scaling recycling and collection systems in rural areas of low and middle-income regions to overcome the challenges of remoteness and low population density. Reuse models would require private sector innovation to further reduce costs and GHG emissions. Sorting and recycling technologies should focus on improving yields. Innovation on alternative materials with better impacts and possessing comparable properties to plastic should also be explored.

^h Europe; the USA and Canada; and Japan, the Republic of Korea, New Zealand and Australia.

ⁱ Central and South America and the Caribbean; China; South/Southeast Asia and Eurasia; India; and Africa and the Middle East.

Further access to information and scientific guidance and research would also be needed. The establishment of a harmonised knowledge base for taking informed action, measuring progress and refining policies would require a globally coherent approach to monitoring and reporting. At present, much of the approach to managing plastics is based on incomplete information, which constrains effective action and the scale-up of solutions. A scientific panel with the appropriate mandate could be instrumental in facilitating such harmonisation.



Paints and tyre abrasion are estimated to be the main sources of microplastic releases

Concluding Remarks

To be effective, the 15 policies in the Global Rules Scenario should be complemented by enablers that would close governance and institutional gaps globally, regionally and nationally. These could relate to financial assistance, capacity building, technical assistance and technology transfer, as well as national action plans, national reporting, compliance and periodic assessment and monitoring. The results presented assume that these would be put in place; otherwise, it is unlikely that the assumptions around compliance, enforcement and effectiveness of policies estimated in the analysis could be achieved.

It is clear the current approach to tackling global plastic pollution is not working and incremental policy improvements will be insufficient to solve the problem. While most of the policy interventions proposed in this report would be taken at a national level, unlocking the necessary global adoption and international collaboration would require **global rules**.

It is also crucial to acknowledge that plastic pollution is a broad problem; and that critical issues such as health risks, chemicals of concern and negative impacts on biodiversity – which are not discussed in detail in this report – must also be addressed. **Hence, the Global Rules Scenario is intended merely a starting point for systems change in the global plastics system, rather than as a comprehensive solution.**

Yet this report shows that implementing 15 far-reaching policy interventions could take us a long way in the journey towards ending plastic pollution by 2040.

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These 15 far-reaching policy interventions could take us a long way towards ending plastic pollution by 2040, requiring further efforts to address it fully


15 policy interventions in the Global Rules Scenario

<p>PILLAR A</p>  <p>Reduce virgin plastic production and consumption</p>	<p>1</p>  <p>Targets to reduce virgin plastic volumes</p> <p>calibrated by sector and local context</p>	<p>2</p>  <p>Virgin plastic fees to fund solutions across the plastic lifecycle</p> <p>with fees ranging from \$1000 to \$2000/tonne by 2040, calibrated by region</p>	<p>3</p>  <p>Application-specific levers to reduce plastic consumption</p> <p>in textiles, fisheries and aquaculture, transportation and construction</p>
<p>PILLAR B</p>  <p>Eliminate avoidable and problematic plastics and chemicals</p>	<p>4</p>  <p>Bans on avoidable single-use plastics</p> <p>to incentivise elimination, shift to reuse models and substitution</p>	<p>5</p>  <p>Reuse targets for avoidable single-use plastics</p> <p>between 15% to 100%, calibrated by application</p>	<p>6</p>  <p>Phaseout criteria for problematic plastics, polymer applications and chemicals of concern</p> <p>including bans and moving to 'safe lists' progressively</p>
<p>PILLAR C</p>  <p>Expand Safe Circularity via reuse, durability and recycling</p>	<p>7</p>  <p>Design rules for safe reuse, repair, durability and cost-effective recycling</p> <p>calibrated by application and by local context</p>	<p>8</p>  <p>Targets for collection and recycling rates</p> <p>including segregated collection for plastics</p>	
<p>PILLAR D</p>  <p>Controlled disposal of waste that cannot be prevented or safely recycled</p>	<p>11</p>  <p>Restrictions on plastic waste trade</p> <p>to prevent exports to areas with limited capacity</p>	<p>12</p>  <p>Standards on the controlled disposal of waste that cannot be prevented or safely recycled</p> <p>as last resort option to prevent plastic mismanagement</p>	<p>13</p>  <p>Mitigation and removal programmes for legacy plastics in the environment</p> <p>although still prioritising solutions that prevent releases in the first place</p>
<p>TRANSVERSAL PILLAR E</p>  <p>Microplastics Prevent the use of microplastics and reduce microplastics releases into the environment</p>	<p>14</p>  <p>Upstream policies to reduce microplastics use and emissions</p> <p>through bans, substitution, better product designs, preventive maintenance, and behavioural change</p>		<p>15</p>  <p>Downstream policies to capture microplastics, followed by controlled disposal</p> <p>prioritising capture at source over capture through wastewater treatment systems</p>

This report's approach to prioritising each pillar

When determining the optimal scale and priority of different solutions across the plastic lifecycle, a number of constraints and trade-offs must be considered in regards to their economic, environmental, and social impacts.

 PILLAR A Reduce virgin plastic production and consumption	
Why is this pillar included?	Past studies ^{179, 180} have shown that a substantial reduction in virgin plastic volumes is required in order to significantly reduce mismanaged plastic volumes. Such a reduction would also have benefits in terms of GHG emissions and risks to health and the environment.
What are the limitations when scaling this pillar?	<p>These solutions would result in the elimination of plastic, a shift to less consumption-intensive models or the replacement of plastic with other materials of equivalent utility.</p> <p>Options to reduce virgin plastics can be limited by their technical and economic feasibility. For instance, the ramping up of reuse models can be limited by the economics and the pace of deploying reverse logistics infrastructure at scale. If other materials replace plastics, better environmental, health and social performance should be ensured – for example through case-by-case LCAs. If this is overlooked, there is a risk of forcing regrettable substitutions and unintended consequences (eg, higher GHG emissions, food waste, and land or water use). Finally, limitations can also be social or behavioural if affordability, safety or convenience is compromised; or if livelihoods are negatively impacted.</p>
Approach in this report	Reduction of virgin plastic volumes should be maximised as long as regrettable substitutions are avoided and a just transition is ensured.

 PILLAR B Eliminate avoidable and problematic plastics and chemicals	
Why is this pillar included?	In addition to posing direct risks to human health and the environment, avoidable and problematic plastics and chemicals can hinder circularity and have a higher likelihood of being mismanaged. If plastic production increased as projected in the Business-as-Usual Scenario, these impacts would heighten.
What are the limitations when scaling this pillar?	<p>The elimination of avoidable plastics has similar constraints to those outlined in Pillar A, requiring that regrettable substitutions be avoided and a just transition ensured.</p> <p>The phaseout of problematic plastics and chemicals should also ensure product safety (eg, performance of fire retardants or tyres); and time and resources would be required to test substances through a scientific process to identify which should be classified as problematic and phased out.</p>
Approach in this report	The Global Rules Scenario calls for the introduction of common global criteria and the phaseout of avoidable and problematic plastics .



PILLAR C

Expand safe circularity via reuse, durability, and recycling

<p>Why is this pillar included?</p>	<p>Expanding a product’s use phase through reuse models or durable designs prevents plastic waste. Once a product has become waste, the alternatives are either collection and recycling or controlled disposal through engineered landfills or incinerators. Recycling is preferred over controlled disposal as it prevents the production of new virgin plastic, emits less GHG and requires less capital and operational costs.</p>
<p>What are the limitations when scaling this pillar?</p>	<p>The main constraint to scaling circularity is inadequate product design, which often hinders reuse or recyclability. Another constraint is the speed at which collection and sorting systems can grow and recycling capacities scale, driven by investment and the viability of the recycled plastic market (today only certain polymers in some markets are economically recyclable).</p>
<p>Approach in this report</p>	<p>Collection, sorting and recycling should be maximised for all plastics not prevented, to minimise controlled disposal and reduce virgin plastic volumes.</p>



PILLAR D

Ensure controlled disposal of waste not prevented or recycled

<p>Why is this pillar included?</p>	<p>Controlled disposal methods (engineered landfill and incineration with energy recovery) are linear solutions that lead to higher resource use and worse environmental impacts (eg, GHG emissions, land use, risk of water/land contamination if improperly managed) and health impacts. However, for waste that cannot be prevented or recycled, controlled disposal would remain the last resort to prevent mismanaged plastic waste.</p>
<p>What are the limitations when scaling this pillar?</p>	<p>The pace at which collection and controlled disposal infrastructure can scale limits control disposal. Trade-offs between incineration with energy recovery (GHG emissions, cost, "lock-in" effects) and engineered landfills (land utilisation) are presented in Policy Intervention #12.</p>
<p>Approach in this report</p>	<p>Controlled disposal would be used only for plastic waste that cannot be prevented or recycled, assuming the same split between landfill and incineration for each region as of today. Regions without incineration would rely on engineering landfill for any incremental capacity needed.</p>



PILLAR E

Prevent the use of microplastics and reduce microplastics releases into the environment

<p>Why is this pillar included?</p>	<p>Microplastics present hazards and risks to humans and wildlife, as well as a high probability of being released into the environment.</p>
<p>Limitations to scaling this pillar?</p>	<p>There is a lack of available solutions to prevent microplastics releases, or at least to maximise capture, as well as enough data and research.</p>
<p>Approach in this report</p>	<p>The priority is on preventing the use of microplastics and reducing microplastic releases. Where microplastic emissions cannot be reduced, capture at source is considered the most efficient and less costly option, leaving capture through downstream wastewater management systems as a last resort.</p>

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Towards Ending Plastic Pollution by 2040

15 Global Policy Interventions for Systems Change

'Towards Ending Plastic Pollution by 2040' was commissioned by the Nordic Council of Ministers for the Environment and Climate and produced by Systemiq. The report presents a set of 15 far-reaching policy interventions towards ending plastic pollution by 2040. If universally adopted and supported by comprehensive globally binding rules in the upcoming international instrument on ending plastic pollution, these could cut annual mismanaged plastic volumes by 90% and annual virgin plastic production by 30% by 2040 relative to 2019 levels. Yet, the report highlights that more ambitious efforts are needed to align with the Paris Climate Agreement and holistically address plastic pollution.

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