SYSTEMIQ

Plastic Treaty Futures

BRIEFING FOR INC NEGOTIATORS

Assessing alternative scenarios for the treaty

About this Publication

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FOREWORD

A world united in the mission to end plastic pollution

As the world grapples with the escalating crisis of plastic pollution, the ongoing United Nations negotiations to develop an international legally binding instrument ('instrument') on this issue represent a pivotal moment: a once-in-a-generation opportunity to forge a path towards a sustainable future. The report Towards Ending Plastic Pollution by 2040, commissioned by the Nordic Council of Ministers, envisioned a ground-breaking treaty underpinned by a comprehensive suite of 15 policy interventions and quantified its environmental, economic and social implications. Despite the ambition encapsulated within the initial findings, the discourse at the Third Intergovernmental Negotiating Committee (INC-3) meeting highlighted a prevailing atmosphere of uncertainty and division, signalling a critical juncture in the journey towards consensus.

As we navigate beyond the midpoint of these negotiations, we hope that this follow-up report will serve as a resource for policymakers and stakeholders, offering insights to support informed decision-making. It seeks to inform negotiators by exploring the environmental, economic and social ramifications of four distinct scenarios for the instrument inspired by submissions from member states, the revised zero draft and insights from informal workshops with negotiators from countries the world over. This endeavour aims to present an impartial, data-driven analysis to help member states evaluate what action is required to fulfil the mandate and promise of United Nations Environment Assembly (UNEA) Resolution 5/14 to end plastic pollution. We will seek to adapt and refine our models and scenarios as the negotiations progress and will make this work fully available to all member states and other stakeholders through a digital platform here.

To truly address mismanaged plastic waste on a global scale, efforts should address the entire plastic lifecycle and include legally binding international measures

The modelling reveals that any scenario that does not include solutions and policies across the full plastic lifecycle will limit the reduction of mismanaged plastic waste by 2040 to 20% globally compared to 2019 levels, under optimistic assumptions. Similarly, any scenario that does not involve global coordination through legally binding measures will limit the reduction of mismanaged plastic waste to, at best, 25% globally compared to 2019 levels. Therefore, to truly address mismanaged plastic waste on a global scale, efforts should address the entire plastic lifecycle and include legally binding international measures – an approach which could achieve a 90% reduction of mismanaged plastic waste by 2040. In simple terms, plastic pollution is the result of a global system failure that requires a coordinated system change response. Waste management alone cannot solve the problem; just as upstream measures on their own cannot solve the problem. Crucially, a coordinated system change response is not only environmentally sound, but also economically advantageous, further strengthening the case for action.

This report aligns with the Organisation for Economic Co-operation and Development's definition of 'plastic pollution', encompassing 'all emissions and risks from plastics' production, use, waste management, and leakage'. However, our model cannot quantitatively assess all aspects of plastic pollution. Our analysis is therefore focused on the outcomes of various policy measures on plastic mismanagement, primary production, greenhouse gas emissions, economic implications and employment. While it qualitatively considers the impacts on human health, ecosystems and biodiversity, and the informal waste sector, the model does not encapsulate the entire scope of plastic pollution challenges. The findings presented in this report should thus be complemented by further sources of insight on these additional aspects of plastic pollution.

While this is a complex topic, the report focuses on the key results of the analysis for negotiators. We have also launched two online tools: A Regional Analysis Tool breaking down the key impacts across nine regions, and a Scenario Explorer Tool that allows stakeholders to explore the impacts of different assumptions and actions at a regional level, accommodating the high degree of uncertainty regarding the instrument's ambition level and implementation.

This report is a call to action, advocating strategic interventions and systemic changes to effectively mitigate the perils of plastic pollution

This report stands as an invitation to dialogue across all member states. It represents not just a culmination of research but a call to action, advocating strategic interventions and systemic changes to effectively mitigate the perils of plastic pollution. For a comprehensive exploration of the methodology, the data and the inherent limitations of our study, we would direct readers to the Technical Annex and the "**Limitations of the model**" section, encouraging a broadened perspective on the challenges and solutions that lie ahead.

Yoni Shiran

Partner Plastic Lead
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EXECUTIVE SUMMARY

Critical Findings

Based on extensive modelling of the environmental, economic, and social implications of four plausible versions of the instrument, this report reveals the following critical findings:

Inaction on plastic pollution is costly: 'Business-as-usual' could lead to a near doubling of mismanaged plastic waste and a 63% rise in greenhouse gas (GHG) emissions by 2040 compared to 2019 levels. Beyond the environmental costs, inaction will also prove costly, as comprehensive action could save $220 billion between 2026 and 2040 in public expenditure by reducing municipal plastic waste management needs. While high-income countries could reduce their waste management spending by about $270 billion, this would be partially offset by a $50 billion increase in spending in low and middle-income countries (LMICs). These figures underscore the urgent need for action – even before the costs of externalities such as health impacts, biodiversity impacts and the social cost of GHG emissions are accounted for.

Only globally coordinated action across the full lifecycle can achieve a significant reduction in plastic pollution by 2040: The 'Global Full Lifecycle Scenario' reveals that a coordinated approach across the entire plastic lifecycle can cut mismanaged plastic waste by 90% by 2040 compared to 2019 levels. This involves upstream action to minimise unnecessary plastic use, alongside coordinated policies to align and streamline standards and regulations in order to reduce compliance costs and boost confidence in new sustainable solutions.

Waste management-focused and less comprehensive and less coordinated strategies will fall short: Even under optimistic assumptions, the 'Global Waste Management Scenario' – featuring coordinated downstream interventions – would achieve only a 20% reduction in mismanaged plastic waste by 2040 compared to 2019 levels; while the 'National Full Lifecycle Scenario' – involving ambitious but uncoordinated domestic action across the plastic lifecycle – could see a 25% reduction.

Employment will increase significantly: Across all scenarios, plastic-related activities are expected to generate about 70% more jobs compared to estimated 2019 levels. In the full lifecycle scenarios, these new jobs are shifted towards recycling, substitutes and new delivery models such as reuse, and waste management.

Fears of economic dislocation are misplaced: The modelling indicates that by 2040, plastic-related activity will shift from production towards circular business models and materials management, especially under the full lifecycle scenarios. This will result in the creation of value pools of $110 billion for recycling, $250 billion for substitutes and $230 billion for reuse – Across all regions, these new value pools more than offset limited declines in plastic production.

Funding mechanisms are needed to address the waste management gap: The scenarios will fail to tackle mismanaged plastic waste without significant funding to scale up effective waste management in LMICs. This will require public spending on collection, sorting and disposal infrastructure of between $300 billion and $900 billion above current spending levels from 2026 to 2040. While the Global Full Lifecycle Scenario assumes the adoption of extended producer responsibility (EPR) and the imposition of national/regional fees on primary polymer production to enable a 90% reduction in mismanaged plastic waste, negotiators could embrace alternative funding mechanisms to achieve this.

The just transition is a critical enabler: Measures to deliver a just transition could not be quantified but are essential to minimise harm to vulnerable communities, and to recognise and reward the key role of informal waste pickers in managing plastic waste.

Further action is required to address all aspects of plastic pollution: Additional measures are required to address other aspects of plastic pollution, such as health and biodiversity risks, and the climate crisis.

The Regional Analysis and Scenario Explorer tools provide further insight: This report is accompanied by online tools which allow stakeholders to explore insights at a regional level and assess the impacts of different ambition levels for different regions. These can be accessed at www.systemiq.earth/ptf

Box 1

How this model differs from previous models

This model builds on previous stock and flow models presented in Breaking the Plastic Wave[1], ReShaping Plastics[2] and Achieving Circularity[3]. In particular, the model expands on **Towards Ending Plastic Pollution by 2040[4]**, which quantified a **Global Rules Scenario (GRS)** encompassing 15 policy interventions for the instrument across all main economic sectors and plastic applications. The **Global Full Lifecycle Scenario** described in this report is the same as the **Global Rules Scanerio** (GRS) described in Towards Ending Plastic Pollution by 2040.

The model incorporates the following innovations and additions:

- modelling of four different scenarios for the instrument;
- in-depth regional analysis, encompassing nine regions;
- a new 'upstream' module that includes flows of the six largest groups of primary plastic polymers from production to conversion;
- an assessment of economic activity across the value chain; and
- the Scenario Explorer online tool, which allows stakeholders to see the impact of making different high-level assumptions.

The model also helped inform the report 'The Plastic Pollution Fee: Closing the financing gap for implementing an ambitious global plastics treaty' (forthcoming) by the Minderoo Foundation outlining potential design options for a Plastic Pollution Fee that serves as an innovative funding mechanism.

We would also like to acknowledge the modelling efforts conducted by others, including the Organisation for Economic Co-operation and Development, the Universities of California Berkeley and Santa Barbara, the Pew Charitable Trusts and the World Bank. Given the importance and complexity of modelling the global plastics system, it is encouraging to see differing approaches resulting in significant alignment in terms of the scale and nature of the policy interventions required.

The model includes all main economic sectors and plastic applications across nine regions:

FIGURE 1 **Sector and geographic scope of modelling**

Framework for modelling alternative scenarios

The goal of this analysis is to encapsulate the diverse perspectives and priorities of member states, offering a comprehensive analysis of possible paths forward in the negotiations. The modelling framework is organised along two critical axes based on fundamental differences in approaches espoused by member states in the negotiations thus far. These axes serve as the foundation for distinguishing between the scenarios modelled:

Scope of action

This axis ranges from comprehensive strategies across the full plastic lifecycle to those with a more focused approach, concentrating on downstream impacts. Both of these represent views that are advocated by a meaningful number of countries. The full lifecycle perspective encompasses the entire plastics journey, from production and use to disposal and recycling, advocating for comprehensive measures that address the root causes of plastic pollution (eg, reduction and redesign). In contrast, the downstream focus targets the latter stages of the plastic lifecycle, emphasising waste management, recycling and reduction of plastic leakage into the environment.

Degree of coordination

This axis contrasts the level of international collaboration and agreement on legally binding global rules and ambitions with approaches that favour national action guided by non-binding targets and guidelines. Again, these represent different visions for the instrument voiced by negotiating member states. At one end, consensus on global rules signifies a unified commitment to ambitious, legally binding targets and policies aimed at achieving significant reductions in plastic pollution on a global scale. At the other, a more decentralised approach favours national action based on non-binding targets, with countries setting their own goals within a framework of international guidelines – which allows for flexibility, but could also lead to varied levels of commitment and effectiveness.

By examining the interplay between these axes, our framework identifies four scenarios that reflect a range of potential outcomes for the instrument (see Annex A for descriptions of each scenario).

FIGURE 2 **Framework for scenarios for the instrument**

Policies under consideration

The policies under consideration for each scenario build on the comprehensive set of 15 policies outlined in the Global Rules Scenario (GRS) described in Towards Ending Plastic Pollution by 2040 (see Figure 3). This is identical to the Global Full Lifecycle Scenario in this report – thus named to clearly distinguish it according to the two axes outlined above. The Global Full Lifecycle Scenario, does not suggest binding global rules in every policy area or the need to sacrifice national sovereignty. Rather, the scenario describes consensus on a consistent and harmonised global approach, particularly in those policy areas where coordination is most critical (see Box 2). Countries will continue to set their own laws and national action plans, adopting regionally appropriate measures in line with agreed ambitions and approaches.

The Global Full Lifecycle Scenario involves 15 global policy interventions assumed to be legally binding, concurrent and implemented in all regions and across the full plastic lifecycle:

FIGURE 3 **Policies included in the Global Full Lifecycle Scenario, as shown in the report '*Towards Ending Plastic Pollution by 2040*'**

The two scenarios encompassing a full lifecycle approach cover all 15 policy areas. In contrast, the downstream-focused scenarios model the adoption of a specific subset of policies advocated by countries that support this approach.

FIGURE 4 **Policies in scope for full lifecycle and waste management scenarios**

Policies included in full lifecycle scenarios

Policies included in waste management scenarios

The impacts of these policies are estimated to vary based on the degree of coordination involved. Under the scenarios assuming global coordination, the estimated policy impacts are assumed to be equal to the ambition outlined in the Global Full Lifecycle Scenario. That scenario was designed to minimise the negative impacts of mismanaged plastics and plastic releases (including microplastics) into the environment by 2040. It assumed adoption across all geographies, while taking account of diverse regional contexts and different starting points and needs. The potential impact of these policies in each sector and region were based on estimates of the maximum feasible impact from academic literature, existing policies and validation with experts (see the Technical Annex). The Global Waste Management Scenario in this report assumes a uniform global ambition level for relevant downstream policies.

It is not possible to empirically establish the impact of an uncoordinated approach on policy effectiveness compared to globally coordinated interventions. By extrapolating from the Paris Agreement's nationally determined contribution (NDC) process, we estimate that the two scenarios emphasising national action without consensus on global rules might at best achieve 60% of the impact per policy intervention of the Global Full Lifecycle Scenario in general (see Annex B). This is an uncertain but critical assumption, which is why the Scenario Explorer tool allows users to adjust this assumption on a regional level.

It is worth noting that these assumptions are optimistic and are based on an ambitious implementation of each scenario. They assume the adoption of significant measures across the globe: for example, the National Full Lifecycle Scenario assumes that countries adopt EPR schemes and impose bans on single use plastics, design for recycling requirements, plastic reduction targets, reuse targets and more – all at 60% of the level assumed under the Global Full Lifecycle Scenario. This is an average level, which means either that all countries adopt the policies at the 60% level or that some countries adopt a lower level of ambition while others adopt a higher level.

Box 2

Policies for which coordination is essential

Plastics are a ubiquitous and globally traded commodity. Consequently, coordinated action at the regional, national and subnational levels is critical to tackle plastic pollution in the most cost-effective manner and secure support from industry. For example, the Business Coalition for a Global Plastics Treaty calls for the adoption of harmonised EPR systems, product design criteria and measures to address chemicals and polymers of concern, as well as avoidable and problematic plastic products. This is because fragmented regulation increases compliance costs and reduces the ability and willingness of businesses to implement new solutions. While some degree of coordination is generally beneficial for all policies, the following classification aims to identify the areas in which such alignment is most critical, based on conversations with academics, practitioners and policymakers:

Tier 1

Global coordination is critical for the harmonisation of definitions and standards across global supply chains, to reduce the cost and complexity of implementation and secure support from industry:

- Bans or restrictions on avoidable single-use plastics and problematic plastics/applications;
- Chemicals of concern (eg, including alignment on criteria and definitions, simplification of polymers, transparency, disclosure and monitoring);
- Design for recycling, durability and repair requirements;
- EPR standards and eco-modulation criteria;
- Recycled content targets;
- Restrictions on the plastic waste trade; and
- Shared metrics and systems for monitoring plastic pollution.

Tier 2

Global coordination is beneficial to enhance the consistency of standards and target-setting methodologies and facilitate the sharing of learning and technologies, while also recognising that locally tailored targets and standards will be required to reflect local contexts:

- Collection and recycling rate targets;
- Primary plastic fees;
- Reduction targets;
- Reuse targets;
- Standards for controlled disposal; and
- Upstream policies to tackle microplastics.

Tier 3

Global coordination is less critical due to divergent socioeconomic contexts and the need for locally tailored approaches:

- Downstream policies to tackle microplastics;
- The just transition; and
- Mitigation programmes to tackle legacy pollution.

Impacts of different plastic treaty futures

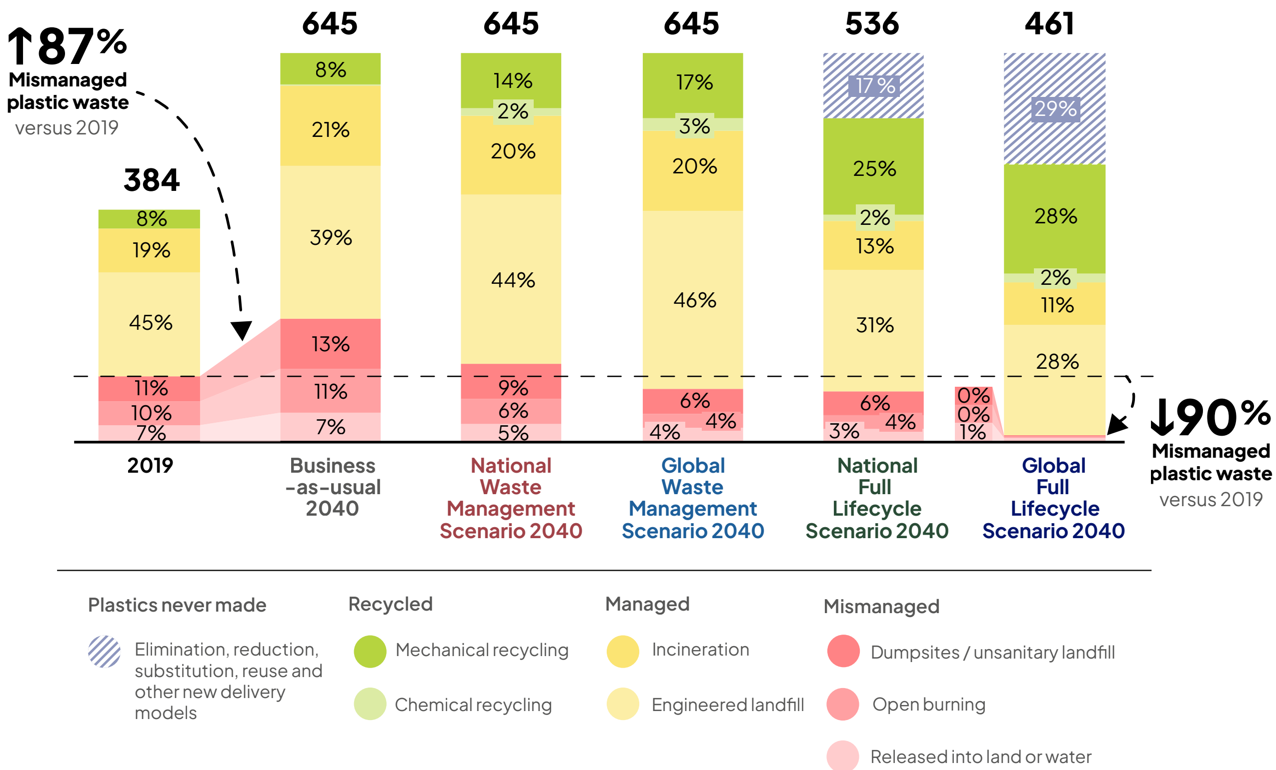
UNEA Resolution 5/14 is a global call that 'Business-as-Usual' on plastic pollution is unacceptable. The linear plastic economy does not make good economic use of valuable resources and results in significant waste.[6] Aligned with other studies, our model projects that the volume of mismanaged plastic will grow by 87% from 2019 to 2040, while GHG emissions from the plastic system are expected to increase by 63% during this period. These trends will exacerbate other risks associated with plastic, including impacts on human health, ecosystems and biodiversity, and communities. *Note: For a full set of regional results, please refer to the Regional Analysis Tool.*

Plastic waste impacts

FIGURE 5 **Only a scenario that combines a coordinated approach with comprehensive action across the plastic lifecycle will come close to ending mismanaged plastic waste by 2040**

End-of-life fate of plastic waste

Mt/year. All numbers are subject to rounding



Note: Totals above bars exclude "plastics never made", whereas the percentages refer to totals including such avoided plastics.

One critical element of plastic pollution is mismanaged plastic waste, including estimated volumes of primary microplastics. We define 'mismanaged plastic waste' as plastic disposed of in dumpsites, burned in the open or released into the environment. **Under Business-as-Usual, mismanaged plastic waste will nearly double**, while the volume of total plastic waste generated is set to increase by 68% by 2040.

In the **National Waste Management Scenario, mismanaged plastic waste will increase by 18% by 2040** compared to 2019 levels – which were already unsustainably high – despite a reduction of 40% relative to Business-as-Usual. **The Global Waste Management Scenario will see a 20%**

reduction by 2040 compared to 2019 levels (60% relative to Business-as-Usual). These reductions will be driven by two factors:

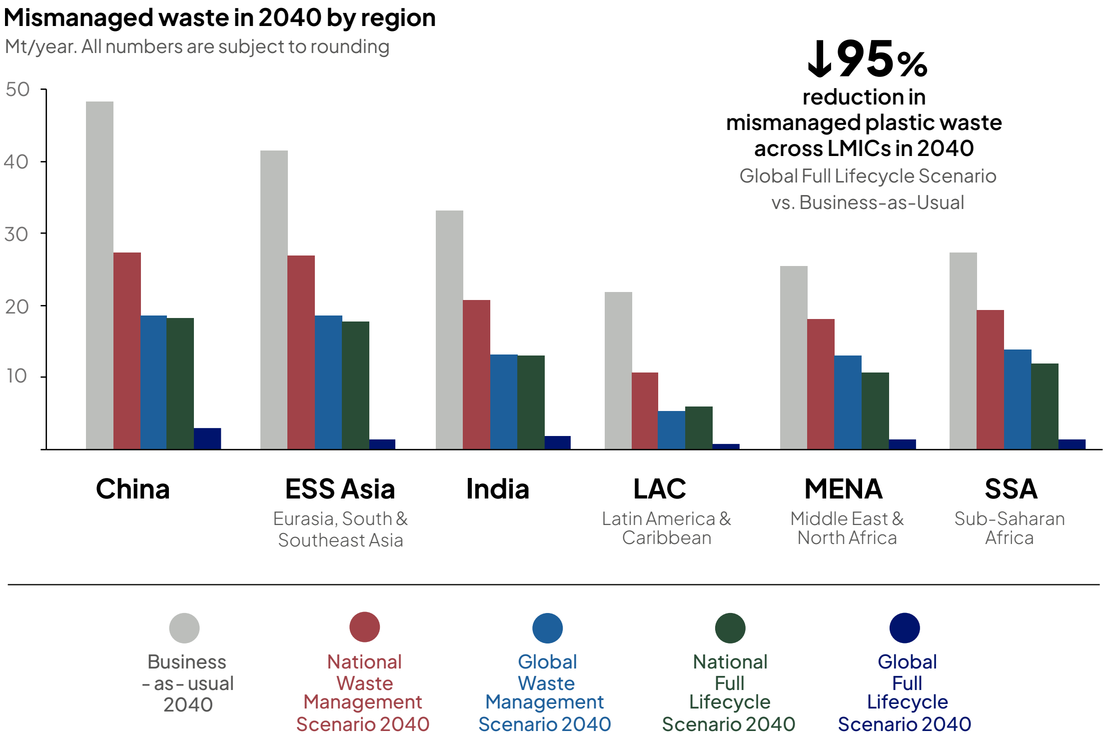
- a decrease in the volume of plastic waste to be disposed of, due to increased recycling; and
- an expansion in waste management infrastructure, financed by the adoption of EPR schemes. This will enable a 60% increase in engineered landfill under the Global Waste Management Scenario compared to 2019 (10% relative to Business-as-Usual).

The scenarios adopting a full lifecycle approach will further reduce the volume of waste requiring controlled disposal due to a **decrease in plastic use**. Under the **National Full Lifecycle Scenario, annual volumes of mismanaged plastics are 24% below 2019 levels**, while requiring significantly less investment in landfill and incineration capacity than the Global Waste Management Scenario.

Under the **Global Full Lifecycle Scenario**, annual volumes of **mismanaged plastics would decrease by 90% by 2040** compared to 2019 levels (97% relative to Business-as-Usual). However, 11 megatonnes (Mt) of mismanaged plastics would remain annually, with 2 Mt ending up in dumpsites, 2 Mt burned in the open and 7 Mt released into land or water. Of these 7 Mt released into land and water environments, microplastics would represent 5 Mt.

Due to inadequate effective waste management capacity, LMICs are the biggest sources of mismanaged plastic waste. However, high-income countries bear a significant share of the responsibility for this, as companies headquartered in these countries design and bring to market most of the products that end up as mismanaged plastic waste in LMICs. In addition, exports of plastic waste to regions without infrastructure to manage this waste has been a persistent problem. The section 'Funding required to tackle the regional waste management gap' explores the amount of funding required to close the waste management gap in LMICs, which is essential for the instrument to succeed in tackling mismanaged plastic waste.

FIGURE 13 **Addressing mismanaged plastic waste in LMICs is a critical challenge, which only the Global Full Lifecycle Scenario comes close to eliminating by 2040**



Note: The model estimates that LMICs account for >95% of mismanaged plastic waste in 2019.

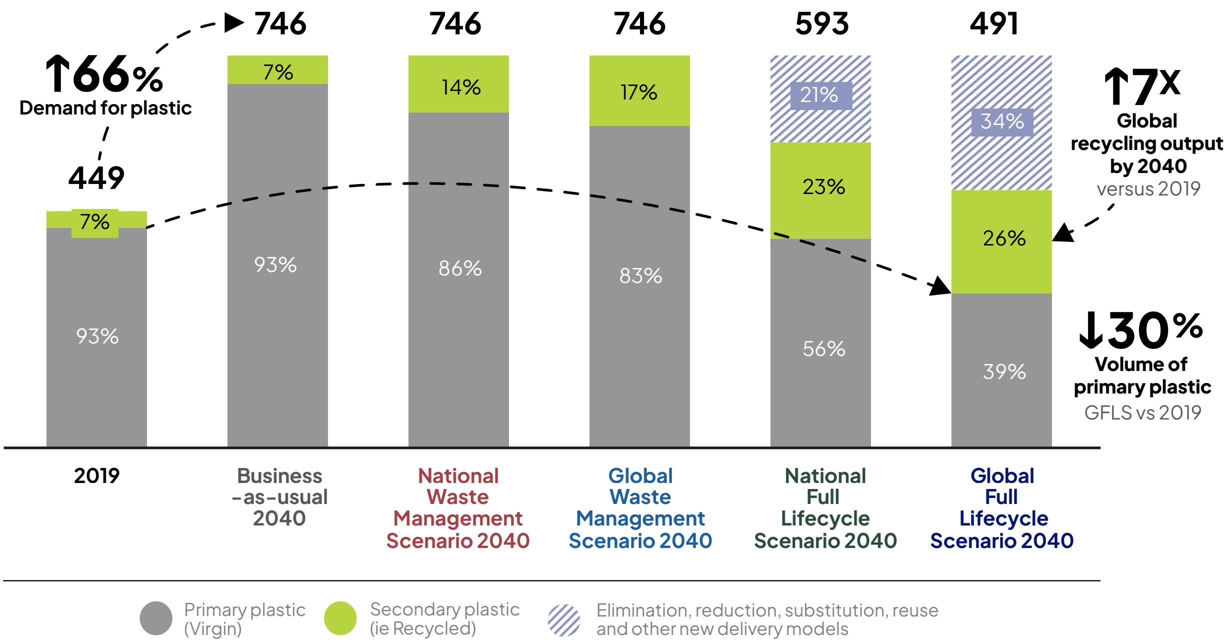
Demand for the services that plastic provides ('plastic utility') is expected to increase by 66% to 746 Mt by 2040, due to growing populations and increasing per-capita consumption as incomes rise, primarily in LMICs. All scenarios in this report meet the demand for plastic utility under Business-as-Usual, so the same level of consumer value is delivered in all scenarios. However, the need for primary plastic may be replaced by secondary (recycled) plastics or alternative materials; by alternative models (eg, concentrate formats or reuse); or by the elimination of unnecessary uses of plastic (eg, overpackaging).

Plastic production impacts

FIGURE 6 **Comprehensive action across the lifecycle, such as limiting unnecessary use as well as adopting design for recycling and circular business models, can reduce demand for primary plastic production by 30% by 2040 compared to 2019**

Sources of plastic utility[a]

Mt/year. All numbers are subject to rounding



Note: Totals above bars exclude "plastics never made", whereas the percentages refer to totals including such avoided plastics.

a 'Plastic utility' refers to the services met by plastic in our economy today. Note that Figure 6 refers to plastic production while Figure 5 refers to plastic waste only. The differences in the volumes in these charts are largely explained by the fact that some plastics stay within the economy for years (e.g., in remainder).

The **National Waste Management Scenario will double the share of recycled plastics** compared to both 2019 levels and Business-as-Usual, mainly due to EPR schemes that fund improvements in collection and sorting. Under the **Global Waste Management Scenario, the share of recycled plastic will rise to 17%**. With neither scenario reducing or eliminating primary plastic demand compared to Business-as-Usual, primary plastic demand will increase to 1.5 and 1.4 times 2019 levels respectively.

In contrast, the **National Full Lifecycle Scenario will reduce plastic demand by 21%** – mainly by promoting reuse and limiting single-use plastics – while also more than tripling the share of recycled plastics compared to both 2019 levels and Business-as-Usual through the introduction of design for recycling requirements and the phaseout of substances that hinder recycling.

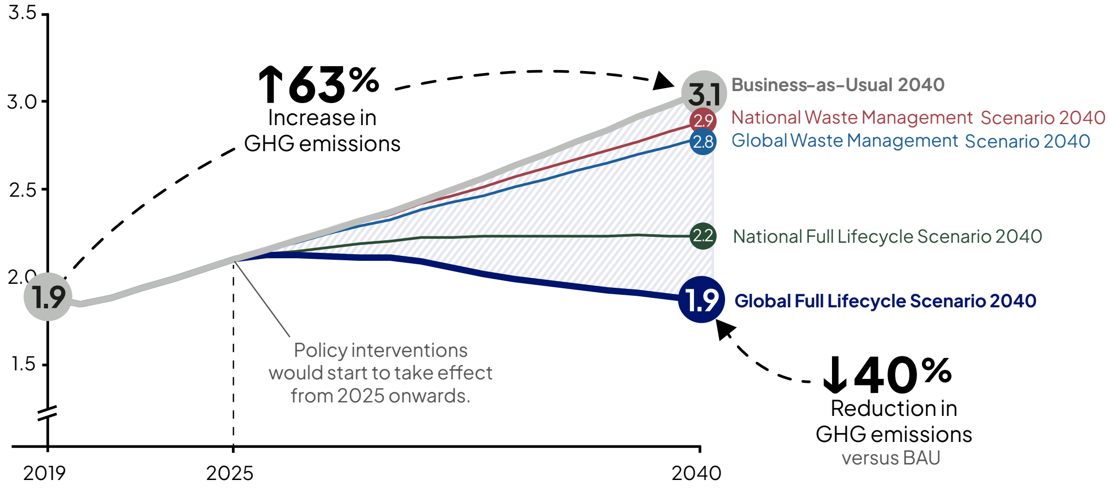
In the **Global Full Lifecycle Scenario, elimination, reduction, substitution, reuse and other new delivery models will meet about 34% of Business-as-Usual plastic utility, while recycled plastics will account for more than a quarter of total utility**. Overall, this scenario could result in a sevenfold increase in global recycling output by 2040, achieved through the implementation of recycling targets, product design rules, EPR schemes and fees on primary plastics. By 2040, annual primary plastic production will decrease by 30% compared to 2019 levels – equivalent to a 60% reduction relative to the 2040 levels under Business-as-Usual. When both primary and secondary plastics are counted, annual production by 2040 will still result in a 9% increase relative to 2019 levels, as expected population and consumption growth outpace reduction levers in some regions.

Greenhouse gas emission impacts

FIGURE 7 **While the Global Full Lifecycle Scenario will reduce GHG emissions[b] by around 40% relative to Business-as-Usual, more action is required to align the plastic system with the Paris Agreement**

Greenhouse gas emissions 2019–2040

GtCO₂e/year. All numbers are subject to rounding



b The analysis of GHG emissions covers the production, without the extraction phase, and end-of-life carbon emissions only. The use-phase emissions benefits of plastic (eg, insulation of buildings, light-weighting of vehicles, and more) are not quantified within this study although they are considered in the analysis (eg, in considering potential substitute materials).

Under Business-as-Usual, annual GHG emissions are forecast to increase to 3.1 gigatonnes of carbon dioxide equivalent (GtCO2e) by 2040. Driven by relative reductions in primary plastic use, the National and Global Waste Management Scenarios will see GHG emissions rise respectively by 47% and 42% compared to 2019 levels.

The National Full Lifecycle Scenario will further reduce GHG emissions to 2.2 GtCO2e by 2040, representing an increase of 15% compared to 2019 levels. Under the Global Full Lifecycle Scenario, GHG emissions will drop back to around the levels seen in 2019 – about 40% below Business-as-Usual. Significant additional measures will be required to align the plastic system with the Paris Agreement, such as further reductions in primary plastic production and decarbonisation of energy supply and production processes.

It is important to note that these projected emission levels may be underestimates, due to recent improvements in the data underlying the lifecycle assessment of fossil fuel-derived products. These corrections reportedly increase the average carbon footprint of fossil-based commodity plastics by around 30%.[7]

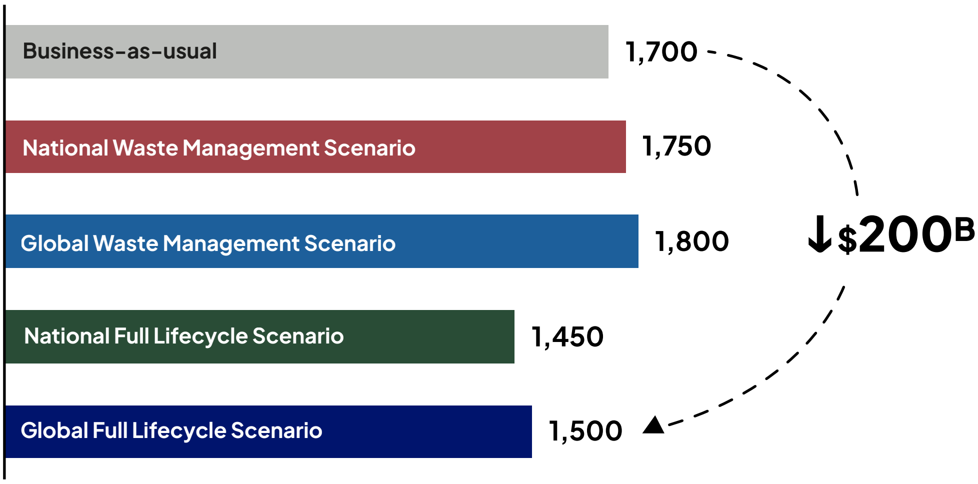
Economic impacts

Action to tackle plastic pollution will not only yield environmental benefits, but also prove more economically efficient than the Business-as-Usual trajectory. Inaction will prove costly, as the Global Full Lifecycle Scenario will yield significant savings in cumulative public expenditure compared to Business-as-Usual between 2026 and 2040.

FIGURE 8 **Inaction will be costly, as the Global Full Lifecycle Scenario will provide savings in cumulative public expenditure of around $200 billion compared to Business-as-Usual between 2026-2040**

Total cost for public sector

USD Billions, present value 2026-2040



Note: Includes spending on CAPEX and OPEX for collection, sorting, and disposal of plastic waste.

While the National and Global Waste Management Scenarios will result in a similar magnitude of public spending to Business-as-Usual, the **National Full Lifecycle Scenario and the Global Full Lifecycle Scenario will achieve public expenditure savings of $200-$250 billion**. These will result mainly from reduced volumes of plastic waste to be collected and managed by municipalities. However, the savings will primarily accrue in regions with well-developed infrastructure; other regions will need to invest in expanding their waste management systems, resulting in $50 billion in additional public expenditure compared to Business-as-Usual.

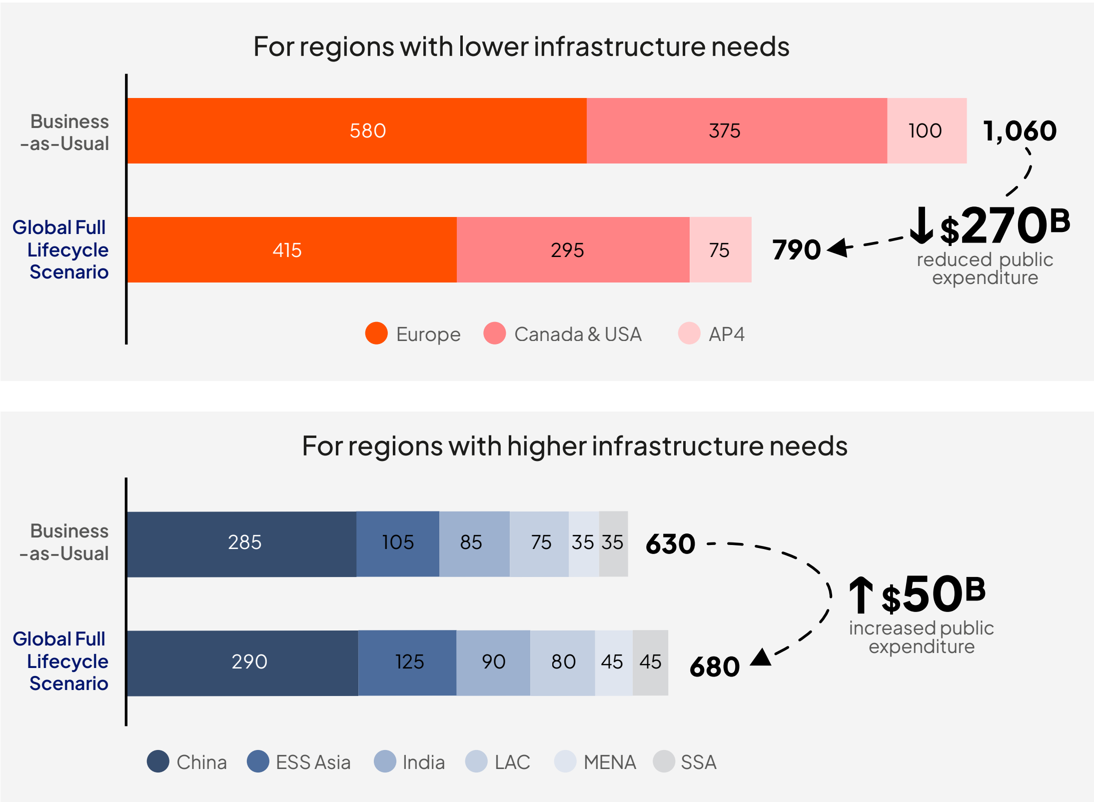
Waste management costs already represent a significant budgetary burden for local authorities, accounting for 10 - 20% of the budgets of municipalities in LMICs

Three **high-income regions will see public spending decline by over 25%** (or $270 billion) compared to Business-as-Usual. By contrast, in the remaining six regions – which account for nearly all mismanaged plastic waste – public spending will **increase by 8% compared to Business-as-Usual (or $50 billion)**. Please see section "Funding required to tackle the regional waste management gap", for an exploration of the funding levels and mechanisms needed for LMICs.

FIGURE 9 **Savings from the full lifecycle scenarios will primarily accrue to regions with developed infrastructure; other regions will need to invest in expanding their waste management systems, resulting in $50 billion in additional public expenditure compared to Business-as-Usual**

Total cost for public sectors

USD Billions (rounded to the nearest five billion USD), present value 2026–2040



These costs represent a significant budgetary burden for local authorities, especially as waste management already accounts for a large part of their expenditure – for instance, between 10% and 20% of the budgets of municipalities in LMICs is spent on waste management. In providing these services, local authorities in LMICs receive vital assistance from the informal sector: today, an estimated 15–20 million informal waste pickers[8] globally account for more than half of all collected and recycled plastic waste.[9] At the same time, informal workers help reduce public sector expenditure on waste management.[10] These crucial roles of the informal sector in waste management underscore the need for an inclusive just transition.

While the overall level of investment required varies, each scenario will require significant capital from the public and private sectors. The analysis assumes that governments will cover the costs of expanding collection, sorting and disposal infrastructure; while the private sector will cover investment in the production of primary plastics and alternative materials, recycling infrastructure and the expansion of new business models (eg, reuse).

Box 3

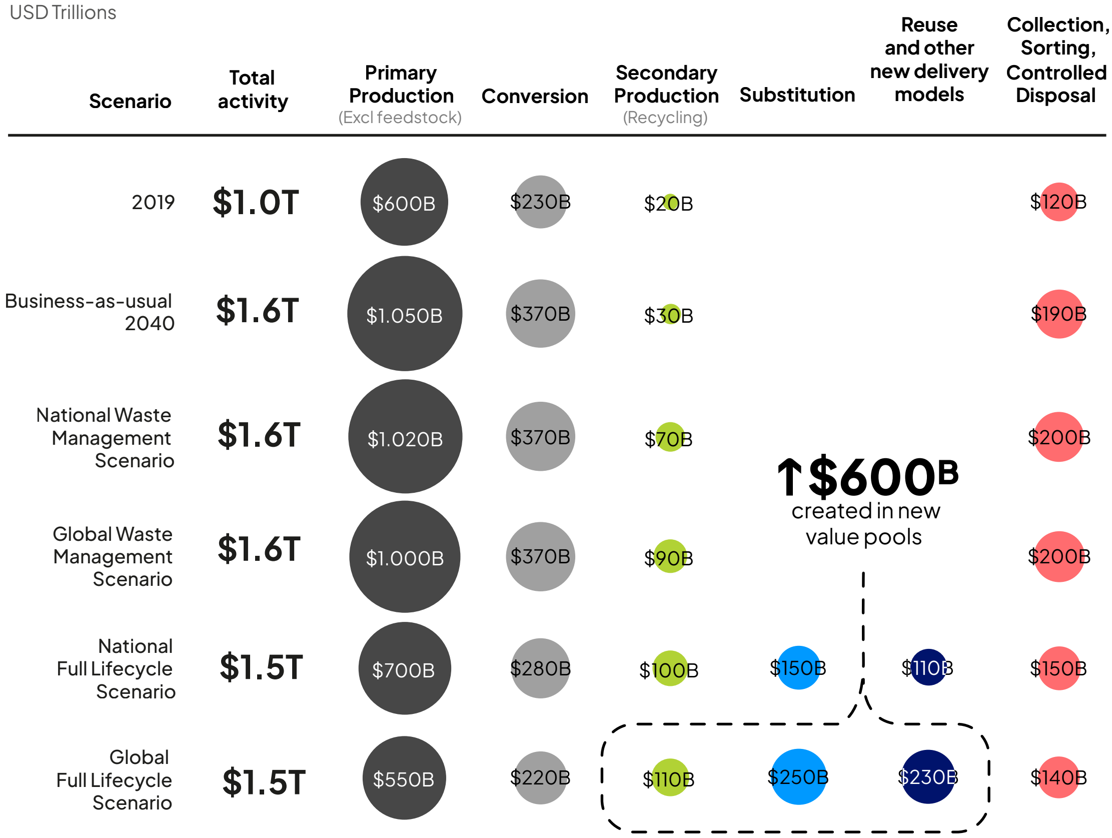
Costs of externalities

The economic case for action becomes even stronger when the costs of externalities are considered. The modelling for this report does not include the environmental and social externality costs related to plastic pollution, such as the costs of dealing with legacy plastics; the human and ecological impacts of chemicals (see Box 4); the social cost of GHG emissions; and the impact of mismanaged plastics on different industries (eg, fisheries, tourism, infrastructure). While they are complex to quantify and the scientific understanding is still evolving, it is clear that these externality costs are significant. For example, studies of the health impacts of plastic pollution point towards potential annual costs in the hundreds of billions in the United States alone.[11, 12, 13] As these estimates are based on a limited subset of plastic chemicals and the associated health impacts, they likely understate the total health costs of these chemicals – let alone those ensuing from all plastic-related chemical exposures. These figures do not include other externality costs – such as the health impact of air pollution through open burning of waste, which disproportionately affects LMICs, or the contribution of plastics to climate change[c] – and may thus underestimate the full economic losses resulting from the negative effects of plastics on human health and the environment.

FIGURE 10 **Plastic-related economic activity will increase by 2040, and shift from plastic production to circular business models and materials management under full lifecycle scenarios compared to Business-as-Usual, resulting in value pools of $110 billion for recycling, $250 billion for substitutes and $230 billion for reuse**

Economic activity in 2040 across the value chain

USD Trillions



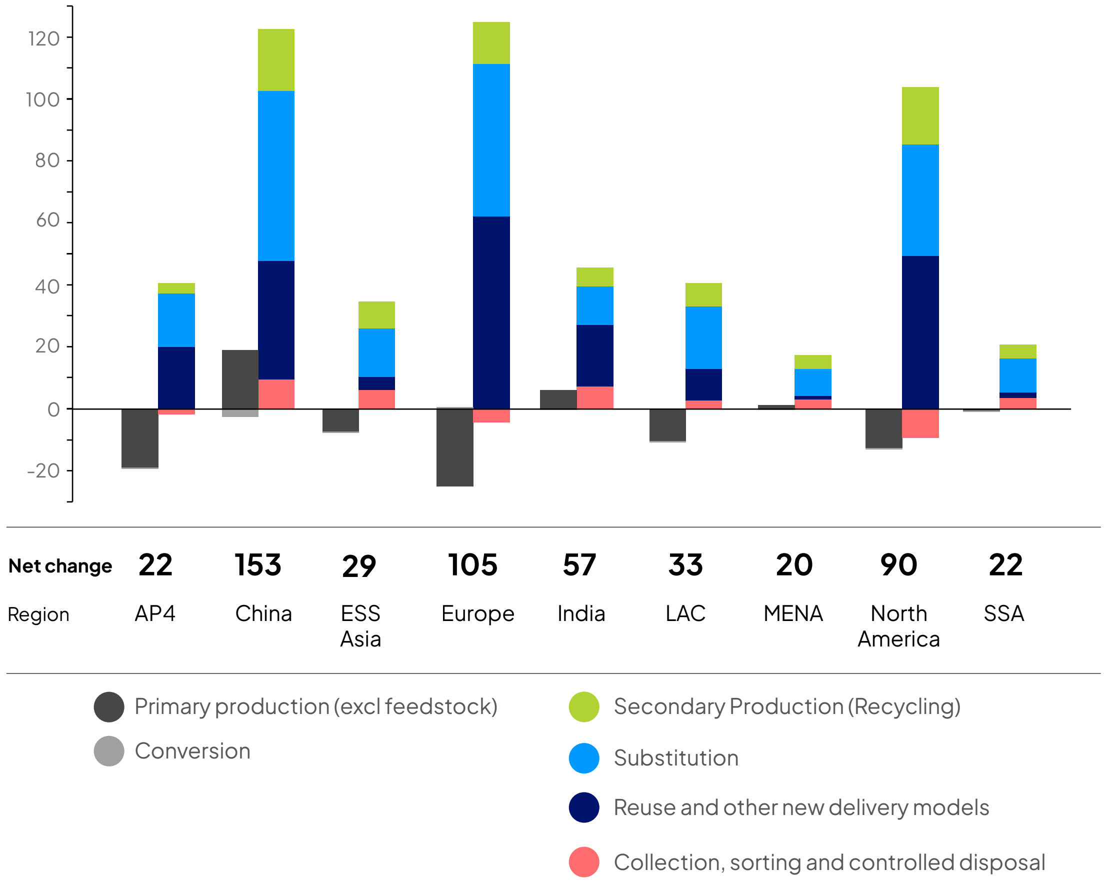
c The Minderoo Monaco Commission report estimates the cost of GHG emissions from plastic production but does not account for GHG emission savings enabled by plastics, so the net impact is difficult to estimate.

Overall, the levels of plastic-related economic activity[d] by 2040 – measured here by the value pools for different steps along the value chain – are comparable across all scenarios. However, activity will shift from primary production towards circular business models and materials management, especially under the two full lifecycle scenarios. For instance, while primary production and conversion account for almost 70% of activity in 2040 under Business-as-Usual, this drops to 46% and 40% under the National Full Lifecycle Scenario and the Global Full Lifecycle Scenario respectively. This will result in the creation of value pools of $110 billion for recycling, $250 billion for substitutes and $230 billion for reuse.

FIGURE 11 **New value pools more than offset relative declines in selected activities across all regions, presenting opportunities for firms to diversify away from primary production**

Change in economic activity in 2040 under Global Full Lifecycle Scenario compared to 2019

USD Billions. All numbers are subject to rounding



Plastic production[e] is regionally concentrated. Across all regions, reductions in upstream activities under the Global Full Lifecycle Scenario compared to 2019 are more than offset by gains in circular business models. Furthermore, even under the Global Full Lifecycle Scenario – which will lead to the biggest fall in primary plastic production and conversion – these will be only marginally lower by 2040 than current levels, so economic and social dislocation should be limited.

d Our measure of economic activity includes annualised capital expenditure as well as operational expenditure, excluding costs of inputs. The exclusion of input costs aims to avoid double counting (eg, including the cost of polymer both in production and as an input in conversion), and to focus on activity that is part of the plastics system.

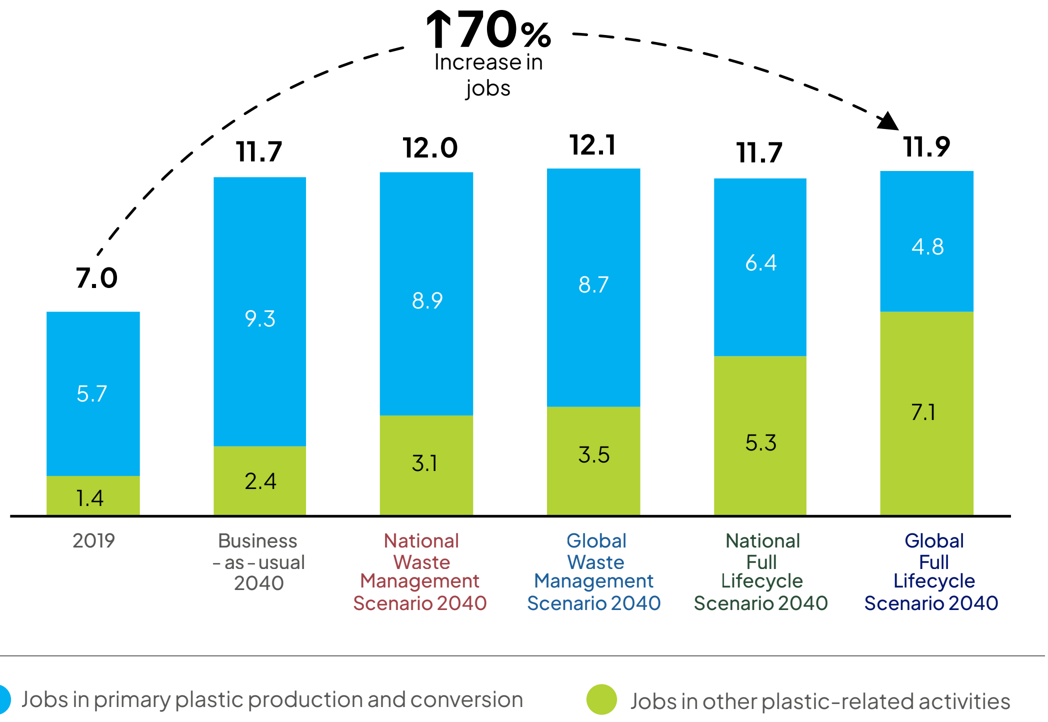
e To estimate where plastic production is taking place, the model translates demand for plastic utility into polymer demand by region, using a matrix of polymer share for specific applications. This demand is translated into origin of polymer production, assuming that current market shares stay constant and apply in every region. For more details, see the Technical Annex.

Employment impacts

Another critical factor in assessing the economic and social impacts of the different scenarios is the impact on jobs. While there is significant uncertainty surrounding job estimates, all scenarios are expected to result in a similar level of direct employment, at around 12 million jobs globally. For example, in the Global Full Lifecycle Scenario, jobs across the value chain will increase by 70% compared to 2019 levels. This increase in overall employment across the plastic lifecycle reflects the growing demand for the services that plastic provides. Similar to the shift in economic activity outlined above, the focus of these jobs will shift from production to recycling, circular business models and waste management.

FIGURE 12 **All future scenarios are expected to result in a similar level of direct employment, representing an increase in the number of jobs of around 70% compared to 2019**

Employment across the plastic value chain by 2040
In Million jobs



Note: This includes jobs in virgin plastic production and conversion, secondary production, mechanical and chemical recycling, new business models and substitution, as well as collection, sorting and disposal of plastic.

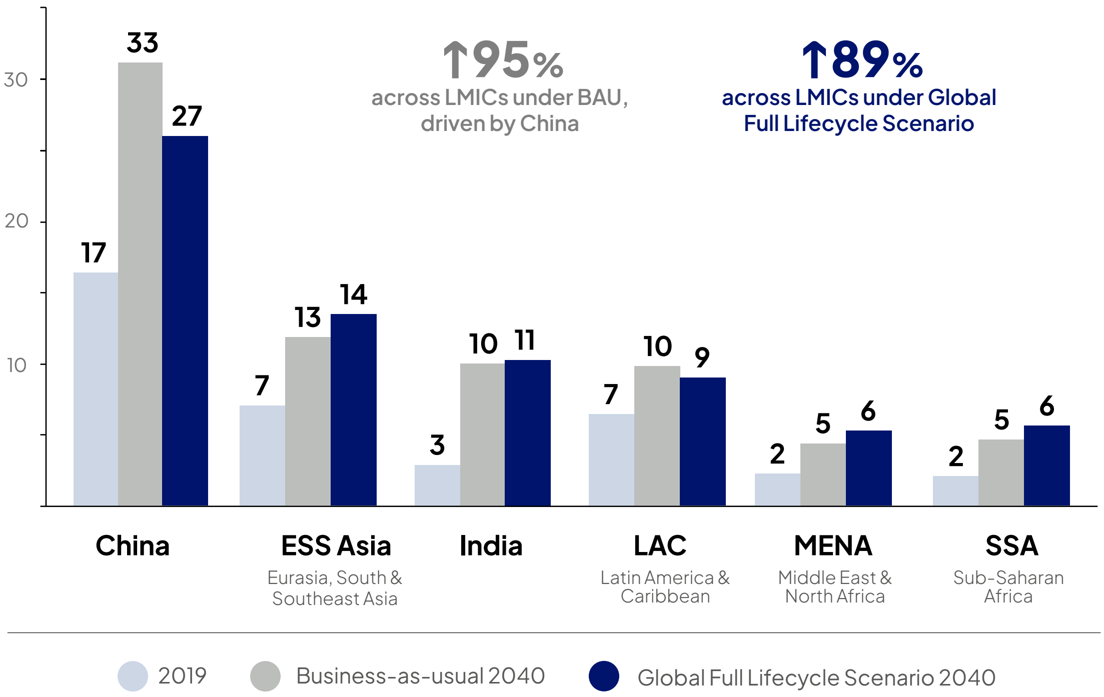
Funding required to tackle the regional waste management gap

As noted above, a critical driver of addressing mismanaged plastic waste is LMICs capacity to manage growing volumes of waste. High-income countries have a responsibility to support them in this challenging task, due to their longstanding role in driving production, regulation and trade of plastics and plastic waste.

FIGURE 14 **Public spending on plastic waste management by LMICs will need to almost double compared to 2019 levels to keep pace with population growth and increasing prosperity**

Annual public spending required by low- and middle-income regions

USD Billions. All numbers are subject to rounding



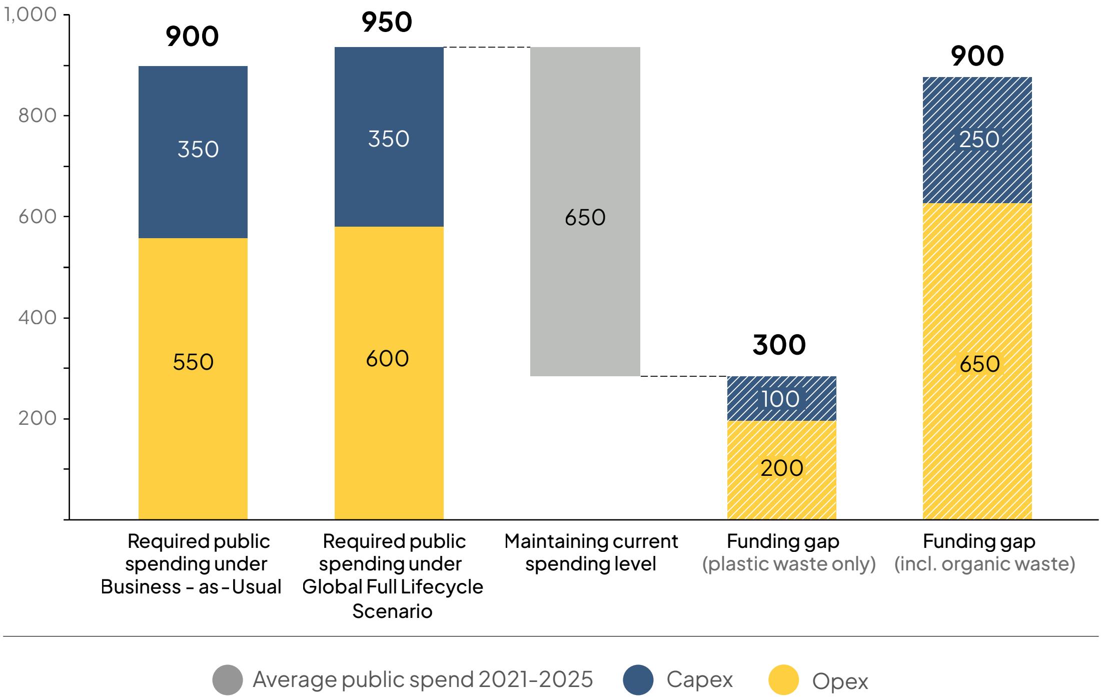
Note: Includes spending on CAPEX and OPEX for collection, sorting, and disposal of plastic waste.

Assuming that LMICs maintain current levels of public spending, there is a $300 billion funding gap for plastic waste collection, sorting and disposal infrastructure and operations from 2026 to 2040 (or $900 billion including costs of managing organic waste) to enable the 90% reduction in mismanaged waste by 2040 envisaged under the Global Full Lifecycle Scenario. This represents an average increase of almost 50% on current annual public spending levels across LMICs between 2026 and 2040.

FIGURE 15 **LMICs face a funding gap of $300 for public plastic waste management between 2026 and 2040 ($900 billion including organic waste), above current spending levels to reduce mismanaged plastic waste by 90% by 2040**

Cumulative public spending required in LMIC regions by scenario

Public spending, present value 2026–2040. USD Billions. All numbers are subject to rounding



Note: Includes spending on CAPEX and OPEX for collection, sorting, and disposal of plastic waste.

The lower estimate accounts for the direct cost of managing plastic waste only; however, as plastic can rarely be collected in isolation, the higher estimate also takes into account the cost of collecting organic waste.[f] While appropriately managing organic waste has several important benefits, including significant reductions in greenhouse gas emissions as well as improved health and environmental outcomes, it represents a cost to overstretched public services in many LMICs. As plastic waste cannot generally be collected in isolation, ensuring sufficient general waste management capacity is also critical to enable successful management of plastic waste. Negotiators may therefore consider to what extent the wider costs of expanding waste management should be considered as part of designing financing mechanisms.

Mobilising funds of this magnitude should be a critical priority for negotiators in order to effectively address mismanaged plastic waste. A mix of funding mechanisms will likely be needed – for example, national and subnational government budget funds; direct service fees; EPR fees and fees on primary plastics; bilateral and multilateral funding; and increased revenues from plastic recycling enabled by eco-design requirements, recycled content mandates and improved recycling technologies.

f It is assumed that other waste materials (eg, glass, metals, paper) can be monetised effectively to fund their management.

The scenarios vary in terms of the funding mechanisms they envisage. The Global Full Lifecycle Scenario assumes the global adoption of EPR schemes and the imposition of national/regional fees on primary polymer production as part of a wider package of policies. However, due to their national/regional nature, these schemes do not allow for funds to be channelled to the regions where they are needed most. Instead, the measures encompassed in this scenario will result in a financial surplus – even once all waste management (ie, not just for plastics) has been funded and 30% of the revenues generated have been invested in de-risking circular economy solutions. By contrast, a similarly designed fee assumed under the National Full Lifecycle Scenario[g] will fall far short of generating the funds needed to close the waste management gap outlined above.

Mobilising funds of this magnitude should be a critical priority for negotiators in order to effectively address mismanaged plastic waste

Negotiators may thus wish to consider various alternative funding mechanisms. For example, the report The Plastic Pollution Fee[14] (forthcoming) by the Minderoo Foundation outlines potential options for a fee that would serve as an innovative funding mechanism alongside EPR to meet these and other implementation costs (including supporting circular economy solutions, promoting a just transition, tackling legacy pollution and rolling out health initiatives). The proposed plastic pollution fee would redistribute revenues generated from global plastic production to LMICs and Small Island Developing States, ensuring that funds are available where they are most needed. A fee level of less than $100 per tonne on primary plastic polymer production globally would suffice to fund all of these implementation activities in LMICs to meet the objectives of the Global Full Lifecycle Scenario. The Minderoo paper is based on the same model and methodology as the scenarios presented in this report and was developed with analytical support by Systemiq.

Different funding mechanisms may have significant implications in terms of, for example, fiscal sovereignty or the ability to target spending towards waste management; but an exploration of these is beyond the scope of this report. Similarly, given the scale of the funding required, particularly in LMICs, the mix of funding mechanisms should consider and aim to minimize accessibility and affordability risks. For example, by relying more on redistributive measures rather than policies that affect prices in low income countries directly (e.g., EPR and Fees).

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g Given the imposition of fees on primary polymer production would be innovative and unprecedented, the 'National Full Lifecycle Scenario' assumes that the fee is adopted at a low level of $50 per tonne across the globe by 2040. As this represents an average, it could also be considered the adoption of a $100 per tonne fee by countries accounting for half of plastic consumption.

Box 4

Health and environmental hazards, risks and impacts of plastics and associated chemicals

If plastic pollution continues at current levels and production increases as per the Business-as-Usual trajectory, the negative impacts on health, ecosystems and biodiversity could grow. Given the existing evidence, policies to address plastic pollution should take into account these risks across the plastics value chain. Regulation and business practices should aim to increase transparency and work towards eliminating or mitigating these risks (eg, through better management or innovation).

Chemicals and polymers of concern

Overall, more than 16,000 chemicals are potentially used or present in plastic materials and products. Over 4,200 of these are chemicals of concern due to their hazardous properties. Critically, hazard information is lacking for over 10,000 chemicals.[15] Hazardous properties in this context include associated effects such as cancer risks, mutagenicity, reproductive toxicity, endocrine disruption and ecotoxicity to aquatic organisms, impacting human health, ecosystems and biodiversity. Yet only 128 of these chemicals are regulated internationally.[16]

There is an urgent need to tackle the use of chemicals that have the potential to cause human and environmental harm. The *Scientists' Coalition for an Effective Plastic Treaty*[17] and the recent *State of the Science on Plastic Chemicals*[18] report outline the relevant issues and how the instrument can address them. Recommendations include comprehensive and efficient regulation of plastic chemicals – for example, by grouping chemicals based on their structure to simplify categorisation and hazard-based prioritisation while avoiding regrettable substitutions (eg, to less well-studied chemicals presenting similar hazards). Another critical step will be to dramatically increase transparency ('no data, no market'), to ensure that essential information about plastic chemicals is publicly available (eg, through a global inventory and comprehensive definitions). Measures such as negative lists of chemicals based on recognised hazard criteria and positive lists of chemicals that comply with hazard and safe-by-design criteria could be used to promote the redesign and simplification of plastics and the transition to a non-toxic plastic economy. Policies to increase capacity to effectively manage plastic chemicals and innovate for safer and sustainable plastics (eg, through knowledge sharing and cooperation) will also be needed. Similarly, various reports have called for the creation of a strong science-policy interface as part of the instrument (eg, through a subsidiary scientific body) to facilitate the regular, independent and evidence-based refinement of assessment criteria.[19,20] Similar measures may also be needed for other material types, to guard against undesirable substitutions.

Plastic production

Virtually all plastic is made from fossil fuels such as crude oil, natural gas and coal. The environmental concerns associated with these industries are thus closely linked to plastic production – for example, negative impacts on workers exposed to hazardous substances; and on ecosystems and biodiversity through the contamination of water from fossil fuel extraction and spillage and the release of toxins during production. There is also evidence that production facilities expose surrounding communities to hazardous substances and cause adverse health effects.[21,22]

Plastic use

Consumers are constantly exposed to plastics and plastic-associated chemicals. For example, of 419 chemicals found in plastic children's toys, 126 were identified as of potential concern; while over 1,000 chemicals have been found to have migrated into food.[23,24,25]

Mechanical recycling

Studies underline the need for further research on the possible negative impacts of mechanical recycling on human health, ecosystems and biodiversity, including the risk of reintroducing chemicals of concern as unwanted contaminants during the sorting and recycling process[26] These studies indicate that informal workers are especially vulnerable to health impacts through unprotected exposure to heated plastics, plastic dust and fine particles, and to chemical pollution in the air. Finally, a recent study has indicated that recycling facilities – especially at the washing stage – can end up releasing microplastics into wastewater systems which, without filtration and controlled disposal, can then make their way into oceans and waterways.[27]

Chemical recycling[h]

Two main concerns have been raised regarding the potential negative impact of chemical recycling on human health. First, the emissions and discharge from chemical recycling processes contain hazardous chemicals, which may impact on nearby communities and environment; and second, substances of concern from feedstock waste can be reintroduced into output recyclates. Further research on both issues is needed.[28]

Incineration

Historically, there is evidence that incinerators contribute to environmental impacts due to inadequate emission controls.[29] This can result in the release of pollutants (eg, dioxins, furans, polycyclic aromatic hydrocarbons and particulate air pollutants) linked to a range of adverse health effects. Well-managed incinerators can minimise emissions by controlling combustion temperature, input composition, material flow speeds and gas flow cleaning;[30] but this requires extensive management, which can be problematic in regions with limited resources or regulation.

Open burning

One self-management strategy which is frequently adopted by the roughly 2 billion people worldwide who lack formal waste collection services is to burn discarded plastic on open, uncontrolled fires.[31] This contributes significantly to GHG emissions and the release of particulate matter, reactive trace gases and toxic compounds.[32] These pose significant health risks, with waste pickers who lack safe workplaces and protective equipment most at risk.

Landfill

Sanitary landfill standards vary and many countries have struggled to implement globally accepted standards, leading to post-landfill leakage of materials and leachates containing pollutants and microplastics. Measures including landfill liners can mitigate this risk somewhat. However, while macroplastics are unlikely to breach landfill liners, microplastics may pass through them; and even modern sanitary landfills present a risk of leachate contaminating groundwater. The long-term stability of landfill liners is unknown, but they are unlikely to function fully beyond 100 or 200 years. [33]

Plastic alternatives and substitutes

As plastic alternatives are not without risk, a case-by-case analysis to prevent unintended consequences of substitution will be required in each context.[34] As best practice, product lifecycle assessments (LCAs) should be conducted to measure the overall environmental, health and social impacts. This is also the case for safe reuse and refill models, and food contact materials that may go through multiple use cycles. Transparency on the types of substances used in plastic alternatives and their potential toxicological properties should also be considered[35] (see note on 'Chemicals and polymers of concern' above).

Microplastics

Microplastics present a significant potential health risk without established safety thresholds, and have reportedly been detected in human placentas, blood, expressed breast milk, lungs and the plaques that block blood vessels in cardiovascular disease.[36,37] Although the precise impact of this exposure remains unclear, the evidence calls for further examination of the potential threats that microplastics pose to human health. Ingested microplastics have been shown in vitro, in diverse human cells in culture, and in vivo, in diverse model organisms, to induce alterations in gene and protein expression, inflammation, disrupted feeding behaviour, growth inhibition, modifications in brain development and impaired filtration and respiration rates. Studies also suggest that nanoplastics[i] may pose greater hazards than microplastics due to their higher likelihood of translocating beyond the gastrointestinal tract and acting as transmitters for chemical contaminants.[39, 40, 41]

Ecosystems and biodiversity

Extensive accumulation of plastic in the oceans and on land poses threats to ecosystems and biodiversity.[42] Marine plastic pollution is reported to negatively affect over 800 species.[43] From coral reefs to deep sea trenches and from remote islands to the Poles, plastic alters habitats, harms wildlife and can damage ecosystem functions and services. Macroplastic waste in the environment can lead to fatalities, injuries and indirect harm such as malnutrition through ingestion or entanglement. Microplastics have been forecast to cause pervasive ecological damage if current or increased levels of release into the environment persist.[44] Plastic-associated chemicals are known to bioaccumulate and biomagnify in marine food webs, while bioaccumulation of micro and nano-plastics has been demonstrated in some studies. Microplastics and the chemicals they contain can also move up the food chain.

h 'Chemical recycling' refers to plastic-to-plastic conversion technologies such as pyrolysis, gasification and depolymerisation.
i Plastic particles which are smaller than microplastics, usually within a size range of 1 nanometre to 1 micrometre.

Limitations of the model

This report's findings, derived from our modelling exercise, are subject to limitations that stem from both data availability and quality, as well as the scope of the model itself. The insights presented should be viewed as directional estimates aimed at guiding understanding and discussions around plastic pollution management strategies.

While a mix of promising solutions is emerging, all are subject to significant possible limitations. For an exploration of the potential and risks of these solutions, as well as the approach taken for the modelling exercise, see Box 5.

Data limitations: The analysis leverages the best available data on plastic stocks and flows, which is often fragmented and limited. In instances of data gaps, assumptions were made with input from subject-matter experts. As a result, the figures and analyses within this report serve as approximations rather than precise statistical outcomes.

Forecasting plastic stocks and flows to 2040 is rife with uncertainty and requires significant assumptions. Furthermore, projecting the potential policy impacts of a global instrument and accompanying national action plans adds a further layer of social and political complexity. Frankly, these cannot be empirically established today. To account for this uncertainty, the methodology and accompanying documentation aim to outline critical assumptions transparently and simply. As a guiding principle, we seek to provide directional results based on simple assumptions in an effort to avoid false precision. The Scenario Explorer tool also allows stakeholders to assess the potential impact of altering assumptions around regional policy ambition and impact.

The authors welcome suggestions for improving the methodology, data and assumptions, to be reflected in future updates to the modelling.

Model scope limitations: The risks from the plastic system extend beyond mismanaged plastic waste and GHG emissions. In this analysis, we have focused on these measures as they are front and centre for negotiators and the easiest to model. However, we recognise that the current plastic system includes a number of other risks that cannot be ignored:

- **Human health, ecosystem and biodiversity impacts:** The model does not estimate the impacts of plastic on human health, ecosystems and biodiversity, as these effects can vary widely based on exposure levels and the presence of specific substances or toxins, and are not directly correlated with plastic stocks and flows. Furthermore, transparency about the chemicals contained in plastics is severely lacking; and testing of the toxicological properties of chemicals – in isolation, let alone in combination – is incomplete (see Box 4).
- **The just transition:** While all scenarios call for controls for a just transition for the informal waste sector, this policy is not quantified. This is a critically important principle for the design of other policies (eg, EPR schemes) – not only for the 15–20 million informal waste pickers[45] globally, but also because they account for more than half of all collected and recycled plastic waste.[46] Alongside formal recognition, ensuring that informal waste pickers earn a living income should be prioritised. Together with the Fair Circularity Initiative, Systemiq has developed a methodology for assessing current earnings and a living income level for informal workers.[47] A just transition must also extend to vulnerable communities that face most harm from plastic pollution.
- **Remediation of legacy plastics:** Remediation of existing plastics in the environment is not quantitatively covered by the model and is instead addressed qualitatively.

- **GHG emissions and Paris Agreement alignment:** The scenarios modelled do not account for achieving net-zero GHG emissions or complete alignment with the Paris Agreement's objectives. While GHG emissions from different scenarios are estimated, the model does not incorporate broader strategies for reducing primary plastic production, decarbonising energy sources, altering feedstocks or capturing emissions at end of life.

Additionally, the model excludes global production caps, moratoriums or quotas due to the speculative nature of such measures. Many legal experts question the ability to implement these measures at a global level. The Global Full Lifecycle Scenario, however, does include strategies such as primary plastic reduction targets, which hint at the potential impact of production limitations without explicitly modelling these policies. Such restrictions, if any, are assumed to be implemented on a national level.

Despite these constraints, the model offers valuable insights into the magnitude of the plastic pollution challenge and the scale of action required to effectively address it. For a comprehensive understanding of the methodologies, the data and the full extent of limitations, readers are encouraged to consult the Technical Annex.

Box 5

No silver bullets – our approach to bio-based plastics, chemical recycling and substitutes

Bio-based, biodegradable and compostable plastics

While substitution with bio-based alternatives is relatively simple to achieve and might provide benefits in terms of GHG emissions, for example, if these products are non-compostable/biodegradable they are essentially identical to fossil fuel-derived polymers and thus present the same end-of-life challenges. Terms such as 'bio-based', 'biodegradable' and 'compostable' are inconsistently applied and lack universally adopted definitions. This can ultimately cause confusion regarding the correct end-of-life treatment by consumers. Similarly, the conditions under which full biodegradation is possible vary, and such products may generate microplastics and/or release chemical additives more rapidly than non-biodegradable plastics. Finally, correctly identifying and separating these plastics can be a challenge, which may hinder the recycling of conventional plastics. Bio-based alternatives also face potential competition with other uses of biomass, so scalable sustainable feedstock (eg, from agricultural waste) might be limited. If sourcing is unsustainable, this can result in increased pressure on land use, resulting in nature loss and heightened competition with food sources. [48]

In general, this analysis does not consider the substitution of existing substances with bio-based, biodegradable or compostable alternatives. Uncertainty remains as to the future role of these solutions and caution is required based on the available evidence.[49] There are a few specific exceptions for certain applications in agriculture, fisheries and aquaculture where plastics are likely to be left in the environment. In such cases, it is also imperative that their degradation is certified to occur under the conditions in which they will be used.

Chemical recycling

Chemical recycling encompasses a set of emerging technologies, with mainly pilot plants in operation and a growing number of larger-scale plants in the pipeline.[50] Its role in waste management is being promoted by certain segments of the industry and fiercely challenged by other stakeholders, including some environmental non-governmental organisations. This is reflected in multilateral processes. For example, in 2023, the Basel

Convention Technical Guidelines refrained from including chemical recycling as an environmentally sound waste management method while further research on its environmental impact is awaited.[51]

Chemical recycling technologies are still under development and have important drawbacks. One concern often raised is that the output of some of these technologies is not only plastic-to-plastic conversion, but also the production of fuel and chemicals from plastics (in this report, consistent with accepted definitions of 'recycling', only plastic-to-plastic yields are counted as 'chemical recycling'). Some chemical recycling technologies result in higher energy consumption and GHG emissions per tonne recycled relative to mechanical recycling. Chemical recycling technologies also require more investment,[52] which could create 'lock-in' effects as larger volumes of plastic waste must be fed into chemical recycling plants in order to ensure a return on investment.[53] This could present a risk of outcompeting mechanical recycling for feedstocks or disincentivising better solutions that may emerge in the future. There are also questions regarding the health impacts of emissions from chemical recycling processes on local communities if strict emission controls are not followed; and regarding the management of chemical additives (potential health concerns relating to mechanical recycling are noted in Box 4). On the other hand, mechanical recycling has technical limitations in terms of the feedstock it can process, the number of loops it can recycle and the quality of its output (which in many cases is inferior to primary plastic and is not usually certified as food grade, except for specific cases).[54, j] Product design changes could mitigate some of these limitations of mechanical recycling; but this is not always possible.

In this analysis, chemical recycling is applied sparingly to certain waste types where other reduction, substitution or recycling levers are not (yet) available and which would otherwise be landfilled, incinerated or mismanaged. However, due to associated risks and uncertainties, an alternative to the Global Full Lifecycle Scenario excluding chemical recycling was considered. Excluding chemical recycling results in limited increases in annual primary plastic production, GHG emissions and volumes landing in controlled disposal, as well as a minor decrease in recycling rates. This illustrates the marginal benefits that chemical recycling might have if applied to tackle the specified types of waste. However, forgoing these benefits may be worthwhile if the risks associated with chemical recycling are proven and cannot be mitigated through research and development and/or the use of different technologies.

Substitution

Substitution of plastic with alternative materials such as paper-fibre-based materials, metals or glass should be evaluated on a case-by-case basis, depending on the desired application and geography. Substitutes are typically more expensive than plastics and their carbon impact could be better or worse depending on the specific material and geography in question. Designing products for reuse is preferable to simple substitution with another single-use material; but where this is not possible, certain substitute materials may be effective for certain applications. As best practice, product LCAs should be conducted to measure the overall environmental, health and social impacts.

This analysis approaches substitution on a case-by-case basis for each sector or plastic application to avoid unintended consequences or regrettable substitutions (see the Technical Annex for detail).

j The search for end markets of mechanically produced recyclates was excluded from this analysis and it was assumed that all recyclates can be used in applications without market saturation.

Box 6

Lessons from the Montreal Protocol

The scale of the system change required to tackle plastic pollution is immense. One example of a multilateral environmental agreement that has brought about such a global system change is the Montreal Protocol (1987), which effectively phased out the production of ozone-depleting substances. Like the Global Full Lifecycle Scenario, the Montreal Protocol was a comprehensive framework for international coordination. The factors that were critical to the success of the Montreal Protocol included significant support from major manufacturers, the incorporation of effective trade mechanisms and the availability of effective alternatives that were reasonably affordable as well as profitable for producers. To ensure that the legally binding instrument can be as similarly effective as the Montreal Protocol in tackling plastic pollution, countries and various industry players should come together in a coordinated way to adopt new solutions and business models at scale across the full plastic lifecycle, so that the economic and environmental benefits outlined in this report can be realised.

FIGURE 16 **Emissions estimates for selected chlorofluorocarbons from 1978–2011**[55]

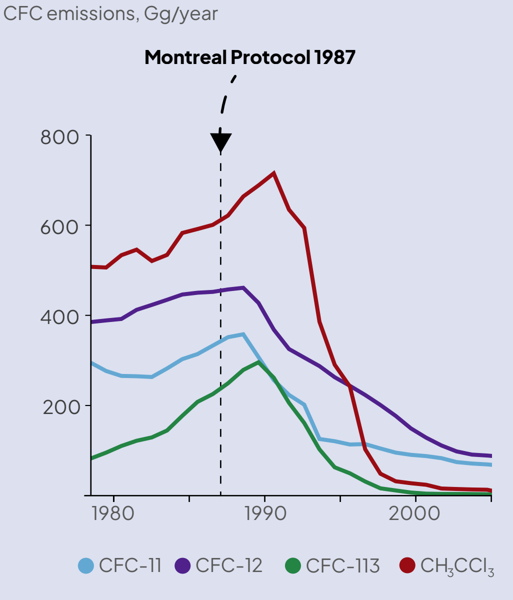
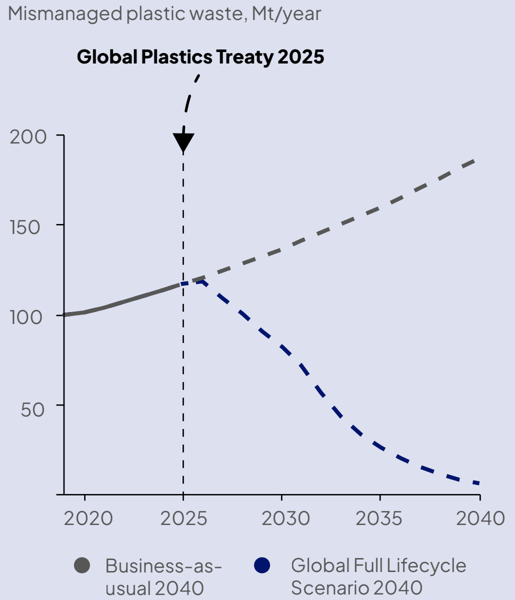


FIGURE 17 **Mismanaged plastic waste 2019–2040 under Business-as-Usual and the Global Full Lifecycle Scenario**



Conclusion

This report clearly demonstrates that the global mission to end plastic pollution demands a multifaceted approach. Comprehensive action across the entire plastic lifecycle, from production to disposal, is imperative. This strategy should be underpinned by robust, globally coordinated, legally binding measures. This dual approach is essential to make significant strides towards mitigating plastic waste and pollution on a global scale.

Focusing solely on downstream solutions, such as waste management, means that plastic volumes and the challenges of managing them will continue to increase. This limited scope is predicted to result in the persistent mismanagement of significant amounts of plastic waste and a failure to tackle pollution at its source.

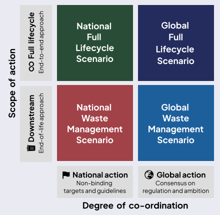
Similarly, relying on national action alone, without a framework for international coordination, will fall short of the global response required to address the transboundary nature of plastic pollution. National efforts, while crucial, can lead to fragmented policies and efforts, diminishing their potential collective impact. The likely result is a patchwork of initiatives that, while beneficial locally, will fail to deliver the systemic changes needed to combat plastic pollution effectively.

The consequences of failing to take coordinated action across the lifecycle are not just environmental but also encompass higher levels of spending, economic inefficiencies and missed opportunities for innovation and sustainable growth. The analysis highlights that there are significant public cost savings and economic opportunities, including for primary plastic producers and converters, to be realised from a treaty that puts in place a globally harmonized framework for action across the full lifecycle.

Only through a holistic and globally harmonized strategy can humanity meaningfully address plastic pollution

The findings of this report underscore the need to embrace a full lifecycle approach to plastic management, underpinned by global coordination and legal commitments. Only through such a holistic strategy can the world meet the ambitious goal set by UNEA Resolution 5/14 to end plastic pollution.

ANNEX A
Short definitions of scenarios



See page 9 for details on the approch to the frameworks for modelling the four alternative scenarios.

National Full Lifecycle Scenario

Purpose

While many countries recognise the need for solutions across the entire plastic lifecycle, some do not believe an agreement on binding rules or targets is desirable (restricting the flexibility to adopt a mix of solutions deemed locally appropriate) or practical (eg, for domestic or international political reasons).

Approach

This assumes the implementation of the same set of 15 policy interventions across the plastic lifecycle, with levels of policy ambition scaled down to 60% of the Global Full Lifecycle Scenario to reflect the risk that fewer countries will adopt these measures and some countries will have lower ambition levels. This is an estimate based on the experience of implementing the Paris Agreement (see Annex B), but it comes with significant uncertainty. The Scenario Explorer tool allows users to adjust this assumption on a regional level. In addition, the primary plastic fee was lowered to $50 per tonne (eg, a fee of $100 per tonne adopted by half of countries) to more accurately reflect the perspectives of member states.

National Waste Management Scenario

Purpose

While there is widespread support for improving waste management, some countries remain opposed to binding rules or targets. This would leave countries the flexibility to determine the mix and intensity of policies they wish to pursue.

Approach

This scenario assumes the implementation of the same policies outlined for the Global Waste Management scenario but at a lower level, due to fewer countries taking action and (some countries adopting less ambitious measures. To simplify, the level of ambition has been scaled down to 60% of the Global Full Lifecycle Scenario (see Annex B).

Global Full Lifecycle Scenario

Purpose

UNEA Resolution 5/14 champions the goal of 'ending plastic pollution'. With that goal in mind, this scenario was designed to assess the level of ambition required to minimise the negative impacts of mismanaged plastics (including microplastics) and plastic releases into the environment by 2040. We recognise that some member states define 'plastic pollution' to include all risks from plastics, not just mismanaged plastic waste. We have focused on mismanaged plastic waste as an important indicator that is more easily modelled, without ignoring other impacts such as GHG emissions, impacts on ecosystems, biodiversity, health and the just transition.

Approach

This assumes the implementation of 15 far-reaching policy interventions across the plastic lifecycle, adopted across all geographies, while taking account of diverse regional contexts and different starting points and needs. This does not suggest binding global rules in every policy area, but rather a consistent, harmonised approach, particularly in areas in which coordination is most critical (see Box 2). National action plans and the adoption of regionally appropriate approaches will still be important.

Global Waste Management Scenario

Purpose

Some countries consider mismanaged plastic waste to be the critical issue that the instrument should address. They point to the need to improve waste management infrastructure – particularly in regions where it is currently lacking – in order to minimise leakage of plastic into the environment. There is widespread support for improving such infrastructure, even among the countries that are advocating for action across the plastic lifecycle – so this scenario assumes a global consensus on action.

Approach

The central policy in this scenario is the introduction of national EPR schemes that increase investment in waste management infrastructure, complemented by targets and standards on collection and disposal, as well as the elimination of the plastic waste trade. While other policies could also improve waste management (eg, primary plastic fees which are invested in waste management infrastructure), we have only included policies that are widely endorsed by the countries advocating for this scenario.

ANNEX B
Estimating the policy impact of the scenarios

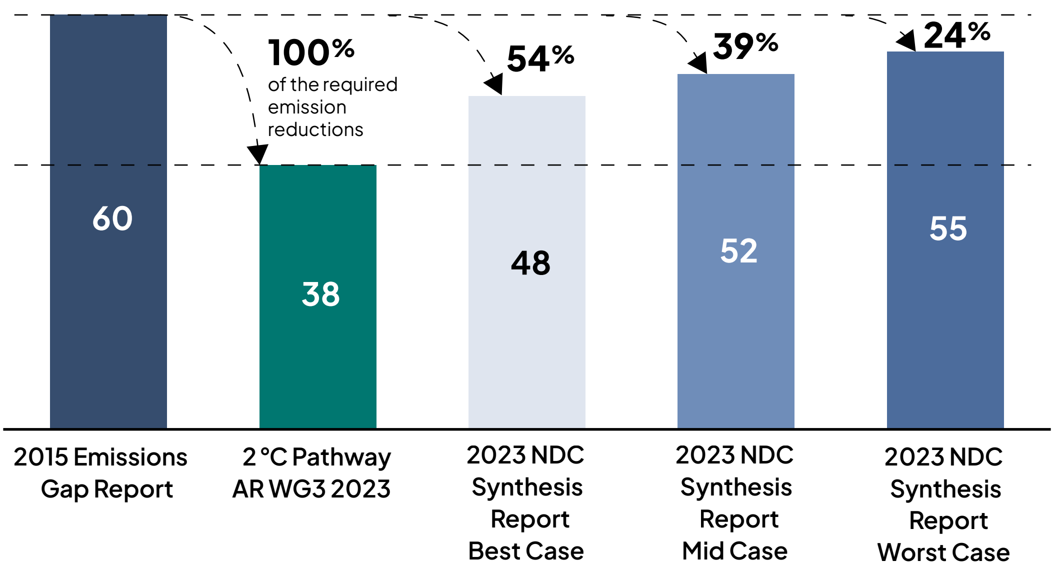
The Global Full Lifecycle Scenario was designed to minimise the negative impacts of mismanaged plastics (including microplastics) and plastic releases into the environment by 2040. It assumes adoption across all geographies, while taking account of diverse regional contexts and different starting points and needs. The potential impact of these policies in each sector and region were based on estimates of the maximum feasible impact from academic literature, existing policies and validation with experts (see the Technical Annex). The Global Waste Management Scenario assumes the global adoption of the same ambition level for relevant downstream policies.

To estimate the policy impact of the scenarios focused on nationally determined action, we look to the Paris Agreement's NDC process as a benchmark. The United Nations Framework Convention on Climate Change's 2023 NDC Synthesis Report[56] indicates a projected reduction in emissions to 48 $GtCO_2e$ by 2030 in the best-case scenario, marking a 20% decrease from the 60 $GtCO_2e$ initially forecasted when the Paris Agreement was signed in 2015. This would represent approximately 54% of the reduction needed to keep global warming likely below 2°C, which requires a drop to 38 $GtCO_2e$ by 2030. This would fall to 24% or 39% for the worst and mid-case scenarios respectively, accounting for the fact that the actual implementation and impact of national action may fall short of the stated ambition. The most optimistic projection implies that all conditional elements of the NDCs are implemented, which depends mostly on access to enhanced financial resources, technology transfer and technical cooperation, and capacity-building support; the availability of market-based mechanisms; and the absorptive capacity of forests and other ecosystems.

FIGURE 18 **Paris NDC process is expected to deliver between 24% and 54% of the required emission reductions to keep warming likely below 2°C[1] by 2030**

Estimates of 2030[2] emissions

$GtCO_2e$. All numbers are subject to rounding



1 Over 67% likelihood of keeping warming below 2°C.

2 Emissions to 2030 rather than 2050 were used as fewer than half of countries have submitted NDCs with details to 2050 or beyond. The pathway to 2030 is also critical as many emission reductions require investment and policy changes that have long lead-times (eg, infrastructure construction and lock-in effects).

Advocates of this approach argue that lessons from the Paris Agreement could be applied to the instrument to improve the effectiveness of the process – for example, by clearly defining substantive obligations that countries have to report on in national action plans.

The target of minimising plastic pollution by 2040 and the pathways implied under the Global Full Lifecycle Scenario do not yet have the same robustness as the scientifically determined and adopted target of limiting global warming set under the Paris Agreement. However, by using the Paris NDC process as a proxy, we estimate that the National Full Lifecycle Scenario and the National Waste Management Scenario – absent consensus on global rules – might at best achieve 60% of the impact per policy intervention compared to the Global Full Lifecycle Scenario. For example, under the National Full Lifecycle Scenario, the effectiveness of policies banning avoidable single-use plastics would be reduced to 60% of what could be achieved under the Global Full Lifecycle Scenario, taking into account regional and sectoral differences inherent in policy impact assumptions. This is an uncertain but critical assumption, which is why the Scenario Explorer tool allows users to adjust this assumption at a regional level.

There is one exception to the 60% effectiveness assumption for the nationally focused scenarios: following consultation with experts and review of country positions, the assumption for the adoption of national/regional fees on the primary production of polymers was reduced to more accurately reflect the perspectives of member states. The scenario assumes the adoption of a $50 per ton fee by 2040 globally – which in practice could mean that some countries adopt a lower or no fee, while others adopt a higher fee.

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Plastic Treaty Futures

Assessing alternative scenarios to end plastic pollution

'Plastic Treaty Futures' provides negotiators with a comprehensive analysis of distinct scenarios for the legally binding instrument on plastic pollution. Through detailed modelling, it illustrates the environmental and economic ramifications of varying levels of intervention and the stark contrast between action and inaction.

The findings reveal that comprehensive measures spanning the full plastic lifecycle, supported by international collaboration, are not only essential for significantly reducing mismanaged plastic waste and greenhouse gas emissions by 2040, but also economically advantageous. The report advocates for a balanced approach that addresses the need for both environmental stewardship and economic efficiency, aimed at lighting a path towards meeting the objective of ending plastic pollution set by UNEA Resolution 5/14 and ensuring a sustainable future.

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Report and analysis compiled by

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