environmental investigation agency

Ocean

Addressing the Issue Head-On

Measures on polymer production in the Global Plastics Treaty

April 2024

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ABOUT EIA

We investigate and campaign against environmental crime and abuse.

Our undercover investigations expose transnational wildlife crime, with a focus on elephants and tigers, and forest crimes such as illegal logging and deforestation for cash crops like palm oil. We work to safeguard global marine ecosystems by addressing the threats posed by plastic pollution, bycatch and commercial exploitation of whales, dolphins and porpoises. Finally, we reduce the impact of climate change by campaigning to eliminate powerful refrigerant greenhouse gases, exposing related illicit trade and improving energy efficiency in the cooling sector.

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Above: Oil refinery and petrochemical complex

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Executive summary

At issue in negotiations for an internationally legally binding instrument (ILBI) to end plastic pollution is how to reduce polymer production to sustainable levels.

The zero drafts made available for the third and fourth sessions of the intergovernmental negotiating committee (INC) set out potential approaches in the form of draft legal text for consideration. With this report, the Environmental Investigation Agency (EIA), using data made available by the Organisation for Economic Co-operation and Development (OECD) and Lawrence Berkeley National Laboratory (LBNL), aims to bring that draft legal text to life, highlighting common elements of any framework to address primary plastic polymers and modelling the implications of various approaches toward their elimination and limitation.

This report first provides background on primary plastic polymers before turning to the design of the tracking framework to monitor the evolution of polymer production over time. It then reviews the justification and need for setting a collective global ambition – a North Star – to support our shared objectives to transition to a circular economy for plastics while limiting warming to 1.5° Celsius (C). Finally, it models several scenarios of polymer production, relying on the measures under consideration at the INC, to reveal the implications on polymer production, waste generation and greenhouse gas (GHG) emissions. The results are astonishing.

The report finds that between freeze in overall production followed by the managed phase-down of polymer production, total plastics production could be reduced by up to 64 per cent against 2025 levels. Under such a scenario, between 2025-50, total GHG emissions could be reduced by 26-47 Gt CO_2e, reducing the contribution to the remaining carbon budget from 37 per cent to between 26-18 per cent. These scenarios would also reduce overall waste generation by 5.1-8.3 billion tonnes, avoiding as much as 7.1 billion tonnes of plastic waste being mismanaged, landfilled or incinerated and thereby helping to close the circularity gap.

The findings in this report underscore the essential role of measures on polymer production in the ILBI. In terms of reducing polymer production to sustainable levels, closing the circularity gap and limiting warming to 1.5°C, there is simply no substitute.

Above: Plastic waste dump site, Kenya

Background

Above: Plastic pollution, Manila, Philippines

Introduction

In March 2022, the United Nations Environment Assembly (UNEA) adopted the historic UNEA resolution 5/14 to develop an ILBI to end plastic pollution, based on a comprehensive approach that addresses the full lifecycle of plastics. An explicit aim of the resolution is to promote "sustainable production and consumption of plastics" in recognition that production has already exceeded what could be considered sustainable – for the environment and humanity.

The proliferation of plastics in society has grown exponentially in recent years. More than half of all plastics ever made have been produced since 2004, with single-use plastics accounting for 35-40 per cent of current production.[1] This mass production comes at a significant cost in terms of plastic waste management, borne by local municipalities, and an estimated 79 per cent of all plastic ever created is languishing in the open environment or landfills.[2] Plastic is simply too cheap and abundant, undermining the economics of separate collection and recycling. In this context, a circular economy for plastics remains an unachievable dream.

The production of plastics is also a significant driver of climate change. Plastics are the products of fossil fuels, and 99 per cent of the plastics ever made come from oil, gas or coal which have been processed and converted into petrochemicals and then, eventually, primary plastic polymers. In 2020, the total lifecycle emissions from plastics were estimated at 2.4 billion tonnes (Gt) of carbon dioxide equivalent (CO_2e).[3] In 2050, under conservative growth scenarios and assuming decarbonised power grids, the total lifecycle emissions are estimated to increase to 3.9 Gt CO_2e, constituting 19-23 per cent of the remaining global carbon budget to limit warming to 1.5°C under the Paris Agreement.[4] With 2023 the hottest year on record – and by a wide margin – it should be unacceptable to negotiate an ILBI that does not align with the Paris Agreement.

In light of this, widespread calls have come from governments, civil society, scientists and progressive industries for the ILBI to include a framework for reducing polymer production to sustainable levels. Polymer production is the salient issue that will define the ILBI to end plastic pollution.

Full lifecycle of plastics

Despite widespread support for measures addressing polymer production and intersessional work to advance those negotiations, a few delegations have blocked discussions, arguing that polymer production is not part of the lifecycle of plastic. This argument should be rejected. The minimum starting point for an ILBI, one that purportedly addresses the full lifecycle of plastic, would at the very least cover when plastic comes into existence as a material and commodity – i.e. upon polymerisation – which also coincides with when plastic first enters the environment as a pollutant in the form of pellets and powders.

In the zero drafts, measures to address polymer production can be placed into two categories. The first is a catch-all category of "primary plastic polymers," which are those produced and used in excess and for which limits on production are necessary to transition to a circular economy for plastics and promote resource efficiency. The second is a more specific category of "polymers of concern," which are those that, due to intrinsic hazard or inability to be recycled in an environmentally friendly manner, for example, should not be produced and used and are therefore for elimination. Taken together, these measures offer a framework for reducing polymer production to sustainable levels.

Types of plastics

Polymers can be classified in various ways based on properties or applications. A common distinction made is between thermoset and thermoplastics, which represent roughly 10 per cent and 90 per cent of plastics, respectively.[5] Thermosets are typically hard and rigid and their formation is an irreversible process and is therefore virtually impossible to recycle without losing properties of the original material. Thermoplastics are pliable or mouldable at elevated temperatures, solidify upon cooling and, depending on polymer type, can be recycled. Thermoplastics can be classified as follows:[6]

- **Standard.** Plastic polymers used in those applications where exceptional physical properties are not required, typically produced in large volumes – about 90 per cent of total demand[7]

- **Engineering.** Plastic polymers that have superior mechanical or thermal properties for low-volume applications, such as motorcycle helmets and car bumpers – about nine per cent of total demand[8]

- **Performance.** Plastic polymers that can withstand harsh conditions, such as corrosive environments, high temperature and pressure conditions – about one per cent of total demand.[9]

This briefing explores key issues that negotiators of the ILBI should consider when addressing polymer production. It first reviews the tracking framework and a collective global ambition before turning to an overview of different control measures and modelling their impact. It concludes with additional elements for consideration.

What is a polymer?

A **polymer** is a substance consisting of large molecules that are characterised by many repeating units, or monomers, bonded together. These molecules could consist of one or several different monomers.

Plastics are commonly defined by their material properties, namely a material consisting of polymers and additives that is then subsequently shaped or formed into products and includes fibres.

While all plastics are comprised of polymers, not all polymers are plastics. For example, starch is a naturally occurring polymer. Therefore, a plastic polymer may be considered as large molecules consisting of one or many repeating units that result in materials that may be shaped or formed into products.

A distinction may be made by the feedstock used to create the monomers that are polymerised to create plastic polymers. The feedstock may be derived from fossil fuels (*i.e.* oil, gas and coal) or from biological materials (*e.g.* corn, sugarcane and wheat). This distinction gives rise to the terms **'fossil-based'** and **'bio-based'** plastics. Despite their difference in feedstock, both are still considered plastic polymers.

Polymers may also be distinguished between primary and secondary plastic polymers. **Primary plastic polymers** are those plastic polymers manufactured from feedstock, both fossil-based and bio-based, that have never been used or processed before. **Secondary plastic polymers** are those plastic polymers made from plastic waste or recycled material.

For purposes of this report, primary plastic polymers are simply referred to as polymers for brevity.

Below: Polypropylene plastic pellets

Section I - Tracking Framework

Establishing a tracking framework to monitor the production of polymers is an essential element with independent value to the ILBI. Accurate information on polymer production allows the governing body to track progress toward its objectives, set priorities and perform periodic assessments.

A well-designed tracking framework for polymer production will perform the following key functions:

- **Objectives.** UNEA Resolution 5/14 mandates a "comprehensive approach that addresses the full lifecycle of plastic," including provisions to "promote sustainable production and consumption" and "periodically assess the effectiveness of the instrument in achieving its objectives," with the overarching objective being to "end plastic pollution."[10] Without a tracking framework on polymer production, the ILBI would be incapable of determining the achievement of its objectives

- **Assessments.** UNEA Resolution 5/14 mandates provisions "to periodically assess the progress of implementation of the instrument" and "to provide scientific and socioeconomic assessments related to plastic pollution."[11] It is unclear how such assessments would be undertaken without information on polymer production to understand, for example, the inputs of polymers into the economy and, if not collected, their release into the environment

- **Transparency.** Governments must currently rely on unsubstantiated information on polymer production volunteered by industry associations, such as Plastics Europe and the American Chemistry Council, or proprietary industry data that is expensive or incomplete.[12] Policymaking will require transparency across the plastics lifecycle, including on polymer production.

Implementing a tracking framework is a rather straight-forward exercise. This is due to the relatively few polymer producers in the world, an industry dominated by major companies.[13] For example, more than half of all single-use plastic waste can be traced to just 20 producers.[14]

Scope

The scope of the tracking framework should be broad enough to gather the necessary information. To this end, the tracking framework should cover all polymers, including thermoplastics and thermoset plastics, as well as polymers used in standard, engineering and performance applications, among others. This will allow the Parties to understand the trends in overall polymer production levels over time.

Starting point

The starting point – or baseline – is the reference point against which trends are measured. The key question for negotiators will be the year or years that represent the starting point for purposes of the ILBI. Starting points can be historic (previous point in time) or contemporary (at time of adoption).

Reporting

To ensure that the governing body is provided with regular information, it will be necessary for key data to be gathered and reported in a uniform manner. When choosing the data to report, negotiators should ensure that it is answers the right questions, namely:

- are we making progress towards achieving sustainable production and consumption?

- what impact are specific measures having on polymer production and consumption?

Following the approach in other instruments that have sought to monitor the production and consumption of substances, such as the Montreal Protocol, and adapting to the needs of the ILBI, reporting on polymer production should cover these key data points:

1. **Production =** quantities of polymers produced in the country

2. **Imports =** quantities of polymers imported into the country

3. **Exports =** quantities of polymers exported from the country

4. **Use =** use of polymers within a specific sector or application

Data would ideally be reported by countries on an annual basis for the previous calendar year. Reporting on production, imports and exports allows for the calculation of consumption through the formula: production plus imports minus exports equals consumption. Reporting on use allows for specific polymers to be associated with a specific sector or application thereby making the link between supply and demand, allowing policymakers to understand the implications of various demand-side measures.

Section II - Collective Global Ambition

Current levels of polymer production are unsustainable. The science is clear even if the petropolitics are muddy.

Several recent reports show that current levels undermine the transition to a circular economy for plastics and resource efficiency while conflicting with climate objectives.[15] For these reasons, the ILBI should include a collective global ambition to guide our activities to reduce polymer production to sustainable levels, providing a benchmark against which to measure our actions and define progress. Such a collective global ambition, such as 1.5°C under the Paris Agreement or 30 per cent by 2030 under the Kunming-Montreal Global Biodiversity Framework, would be the headline feature of the ILBI.

Various justifications for a collective global ambition exist, including:

- **Circular economy for plastics and resource efficiency.** Plastic waste currently has little value as a resource and plastic is readily used in excess and discarded without an afterthought. In significant part, this is because polymer production has been optimised, lowering bulk costs and undermining the market for secondary plastic polymers (recyclates). To achieve a circular economy for plastics and promote resource efficiency, the supply of polymers should match our ambitions on the demand side. Pew Charitable Trusts, in the report *Breaking the Plastic Wave: A Comprehensive Assessment of Pathways Towards Stopping Ocean Plastic Pollution*, estimates that, by implementing circular economy principles, polymer production could be reduced by 11 per cent by 2040.[16] The Nordic Council of Ministers estimates that, under a global rules scenario, polymer production could be reduced by up to 30 per cent by 2040.[17] The Organisation for Economic Co-Operation and Development (OECD) estimates that, under globally coordinated action, polymer consumption, and by extension production, by 31 per cent by 2040.[18] Such estimates, while indicative, are based on assumptions that only come to fruition with supply-side measures.

- **Alignment with 1.5°C.** The climate emergency poses an existential threat to humanity and much of biodiversity. Recent reports show that even current levels of polymer production are incompatible with our 1.5°C objective under the Paris Agreement. Plastics already contributes significantly to global emissions, emitting 2.4 Gt CO_2e per year, with the vast majority of emissions coming from the production phase.[19] This accounts for about 3.6 per cent of current global GHG emissions.[20] Current projections indicate that plastics production alone could consume 28-35 per cent of the remaining carbon budget to have a 67 per cent chance of keeping warming below 1.5°C. Even under a decarbonised scenario, this would be 24-29 per cent of the remaining carbon budget to keep warming below 1.5°C.[21] Reports have suggested that polymer production will need to reduce about 75 per cent from 2019 levels by 2050 to align with 1.5°C.[22] Following on a long list of the hottest months on record, and with 2023 now the hottest year ever recorded, it is incomprehensible to negotiate an ILBI that is incompatible with 1.5°C.

Moreover, reducing polymer production would help fulfil the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). Adopted by the UN General Assembly, the 17 SDGs and 169 targets serve as a "shared blueprint for peace and prosperity for people and the planet, now and into the future."[23]

But the latest SDG progress report paints an alarming picture – of the 140 targets that were evaluated, half of them show moderate or severe deviations from the desired trajectory. Further, more than 30 per cent of these targets have experienced no progress or regression below the 2015 baseline.[24] There is overwhelming evidence showing that plastic pollution impacts every single SDG, for example by exposing more than 200 million of the world's poorest people at risk of more severe and frequent flooding (Goal 1), polluting our lands and oceans (Goals 14 and 15), posing significant risks to human health across its lifecycle (Goal 3), exposing women to disproportionate levels of harmful chemicals (Goal 5) and, quite relevantly, being produced at unsustainable levels (Goal 12).[25] A collective global ambition on polymer production therefore also aligns with the Agenda 2030 for Sustainable Development.

So where do we go from here? It is said that we have to crawl before we walk and to walk before we run. Similarly, any collective global ambition on polymer production and consumption would necessarily have to start with a freeze as current levels are already deemed unsustainable. From there, negotiators should set out our direction of travel by identifying a collective global ambition to be achieved by a certain date.

Achieving the collective global ambition will necessarily require a comprehensive approach that addresses the full lifecycle of plastic, including both supply-side and demand-side measures, and will serve to set priorities and inspire national actions – similar to the collective global ambition of keeping global warming to within 1.5°C from pre-industrial levels, which underpins ambition under the Paris Agreement.

Section III - Control Measures

A collective global ambition to reduce polymer production to sustainable levels can only be met through a package of policies.

While demand-side measures form part of that package, supply-side measures do too and can be considered the great enablers of demand-side measures, creating the societal and economic conditions to transition towards a circular economy for plastics and promote resource efficiency – while providing certainty of result. In other words, supply-side measures are the invisible hand which allows the market to reach equilibrium, something that demand-side measures alone cannot achieve.

For these reasons, and in recognition of the interplay between demand-side and supply-side measures, the mandate to negotiators is clear: the ILBI is to be "based on a comprehensive approach that addresses the full lifecycle of plastic," which includes polymer production.

Several options for how to approach polymer production have been put forward in the zero drafts. Collectively, these offer a conceptual framework for how the ILBI could, and should, promote supply-side measures to achieve our collective global ambition, namely: elimination, limitation and observation.

Typology of control measures

The zero drafts identify three types of supply-side measures:

1. **Elimination.** For those polymers identified as "polymers of concern," the zero drafts propose to eliminate their production except as provided for in an annex

2. **Limitation.** For those polymers identified as "primary plastic polymers," the zero drafts propose to limit their production, through either globally agreed or nationally determined contributions or targets, expressed in percentage terms in relation to a baseline, as provided for in an annex

3. **Observation.** For those polymers not targeted for elimination or limitation, the zero drafts propose to otherwise track their production and report periodically to the governing body – a requirement applicable to polymers targeted for elimination and limitation as well.

While all plastic polymers should be within the scope of the ILBI and tracked, the initial coverage of the control measures is still unclear.

Eliminating production of polymers of concern

The zero drafts include provisions to eliminate – or phase-out – the production of certain polymers, namely those deemed "polymers of concern." This is in recognition that certain polymers pose unacceptable risk to human health and the environment.[26]

Examples of some qualifying features for polymers of concern could include:

- **Intrinsic hazard.** This includes polymers that use hazardous or toxic materials in their production, whose properties as a material pose an intrinsic hazard or who release of toxic or hazardous chemicals during use or at end-of-life

- **Risk of decomposition.** This includes polymers that quickly decompose into microplastics thereby quickly becoming vectors of chemical and biological contaminants

- **Environmentally unsound recycling.** This includes polymers that cannot be recycled in an environmentally sound manner due to chemical composition or other factors.

Experts have put forward several candidates for polymers of concern and have proposed indicative criteria to guide future listings in the annex. For illustrative purposes, relying on the considerations above, a potential initial list of polymers of concern could include:

- **Polystyrene.** Polystyrene (PS) has a highly toxic monomer, styrene, as well as being a significant contributor to pollution due to its light weight

- **Polycarbonate.** Polycarbonate (PC) is known to release Bisphenol A (BPA), an endocrine disruptor, harmful to health through different molecular mechanisms

- **Polyurethane.** Polyurethane (PU) uses toxic raw materials that are powerful irritants and releases volatile organic compounds

- **Polyvinyl chloride.** Polyvinyl chloride (PVC), during its production process, uses the potent carcinogen vinyl chloride and other highly toxic products and its chemical additives make it difficult to recycle safely, resulting in very low recycling rates.[27]

Under the ILBI, these polymers of concern – referred to as the "dirty quartet" – could be subject to elimination. Leaving any exceptions aside, taken together, estimates of total market share by weight of the dirty quartet range from 21-25 per cent.[28]

Limiting production of primary plastic polymers

After elimination, placing limits on the production of pollutants has proven to be the most effective measure to reduce their subsequent release into the environment – for obvious reasons. Here, whereby eliminating the production of polymers of concern reduces the complexity of the problem, limits on polymer production reduce the size of the problem. In this context, it also has the ability to turn a waste (plastic waste) into a resource (secondary plastic polymers), resulting in an economic win-win for polymer producers (produce less, earn more) and recyclers (collection more profitable).

Various considerations could inform which polymers would be subject to limitation, including:

- **Common-commodity polymers.** Polymers produced in high volumes, commonly used in short-lived plastic products and regularly discarded could be targeted. The OECD reported that common commodity polymers such as low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP) and polyethylene terephthalate (PET) make up 45 per cent of total plastic used and 51 per cent of plastic waste generated in 2019.[29]

- **Circularity potential of polymers.** To date, achieving environmentally sound and economically viable recycling of plastic waste has been challenging. The two main factors are: (i) the prevalence of cheap virgin primary plastic polymers that undermine investment in separate collection and recycling and the formation of secondary markets for secondary plastic polymers; and (ii) toxic chemicals used to produce primary plastic polymers and plastic products that undermine the circularity of secondary plastic polymers. While the latter must be addressed through measures on product design and elimination of chemicals, starting with 15 priority problematic groups of chemicals used in plastics, the former will require that limits be placed on the production – hence the supply – of polymers.[30] Currently, the most recycled polymers are PET, HDPE and PP, although nothing that approximates circularity at scale, and limits on those polymers and additional ones would help create the dynamics for circularity.

While upstream measures placing limits on polymer production create the enabling conditions for measures further down the lifecycle of plastic, such as midstream measures on product design and downstream measures on waste management, it is important to reaffirm that, to end plastic pollution, they form part of a package of policies to address the full lifecycle of plastic and work in tandem with the others.

National contributions or targets

How to set national contributions or targets represents a key area for deliberation and negotiation. Here, we outline three approaches for how national contributions or targets may be set in the ILBI to deliver on the collective global ambition:

- **Globally agreed.** The contribution each party makes to the collective global ambition is agreed globally and becomes a legally binding obligation. Whether these contributions are equally applied or differentiated is a matter for negotiation. A primary example is the Montreal Protocol whereby each party's schedule for phasing down the production of ozone-depleting substances (ODS) and hydrofluorocarbons (HFCs) are globally agreed and set out in the text.

- **Nationally determined.** Each party determines its contribution to the collective global ambition and serves as an aspirational obligation. This approach does not provide the same certainty of result as globally determined national contributions or targets. A primary example is the Paris Agreement whereby each party's nationally determined contribution (NDC) to the climate objective of limiting warming to 1.5°C is submitted and updated periodically.

- **Hybrid.** Other approaches are also available, including a hybrid of globally agreed and nationally determined. For example, Parties could initially submit nationally determined contributions or targets and subject them to a global stocktake that, if insufficient, triggers a process to adopt globally agreed contributions or targets. This is similar to the global stocktake in the Paris Agreement – but with an additional element to ensure the achievement of our objectives once it is shown that nationally determined actions and demand-side measures alone are sufficient.

Start and strengthen

Ending plastic pollution is a generational undertaking for which no silver bullet exists. For this reason, negotiators will need to take a 'start and strengthen' approach to eliminating polymers of concern and setting limits on certain polymers, whereby actions are taken in the context of what is reasonable now but progressively strengthened over time through formal processes as the need arises and conditions allow.

Below: Plastic pollution languishing in the open environent

Section IV - Modelling

To assess potential approaches towards addressing polymer production and their implications, EIA has modelled various scenarios. These highlight how a collective global ambition could be achieved through various supply-side measures to eliminate and limit polymer production for different types of polymers based on their characteristics and potential circularity.

Potential scenarios have been modelled using the best-available data of current primary plastic polymer production levels and growth scenarios. For business as usual, we have compared two scenarios for growth in plastics demand from 2019-50; (i) 2.5 per cent annual growth rate; and (ii) four per cent annual growth rate. In the scenarios where polymers are targeted for elimination, those polymers are: polystyrene (PS), polyurethane (PU) and polyvinyl chloride (PVC). In the scenarios where polymers are targeted for limitation, those polymers are: polyethylene (PE), polypropylene including polypropylene fibres (PP) and polyethylene terephthalate including polyester fibres (PET). The modelling assumes reductions are incremental year on year, providing a snapshot of the destination with progressive intermediate steps.

The modelled scenarios are illustrative of potential approaches to reduce polymer production to sustainable levels – the combination of policies available to policymakers to achieve this aim – and therefore meet a collective global ambition. In addition to a business-as-usual (BAU) scenario, the following scenarios are modelled: (i) freeze at 2025 levels of polymer production; (ii) freeze at 2025 levels of polymer production followed by elimination of certain polymers of concern; (iii) freeze at 2025 levels of polymer production followed by elimination of certain polymers of concern and limits on certain other polymers.

Assessments of these scenarios was achieved by tapering certain polymers to limit their production to 50, 40 and 25 per cent of their projected 2025 production levels, while other polymers are held stable or "frozen" at 2025 levels. Other polymers were "eliminated" by reducing their production to zero by 2050. Reductions were calculated at equal incremental reductions year-on-year so as not to prejudge negotiations on potential phase-down schedules and timelines.

The selection of 2025 as the starting point or baseline for the modelling is not intended to prejudge negotiations, but rather was selected to coincide with the year the ILBI is anticipated to be opened for signature. A historic baseline, such as 2020, could also be considered as each starting point raises unique considerations.

Analysis of GHG emissions

For each scenario, we have calculated the associated GHG emissions for each scenario using the data outlined in the Climate Impacts of Plastics Production report by LBNL. The LBNL data was used to calculate the total GHG emissions associated per million metric tonnes (Mt) of polymer produced. To calculate emissions, we calculated the total production by polymer type for each scenario between 2025-50 and multiplied this by the Mt carbon-dioxide equivalence (CO_2e) / Mt polymer.

The data set used for in this analysis has made the same assumptions on total polymer demand and recycling rates as the LBNL report for direct comparison.

End-of-life fate

In order to calculate the end-of-life fate of plastics in each scenario, OECD data was used to calculate the eventual fate of total plastic demand for each year from 2025-50 under a business-as-usual scenario. This was then applied to the total annual plastic demand in each scenario. This data is not disaggregated by polymer and calculated by the total volume of plastics.

Business-as-usual scenario

The business-as-usual (BAU) scenarios assume annual polymer production increases between 189-267 per cent. These projections estimate that total polymer production will increase to between 730-1,305 million metric tonnes (Mt) per year in 2050. In this scenario, from 2025-50, between 17.5-21.6 billion tonnes of plastics are produced globally, with every plastic polymer increasing in overall production. The total contribution to the remaining carbon budget in this period increases from 37 per cent (2.5 per cent annual growth rate) to 45 per cent.

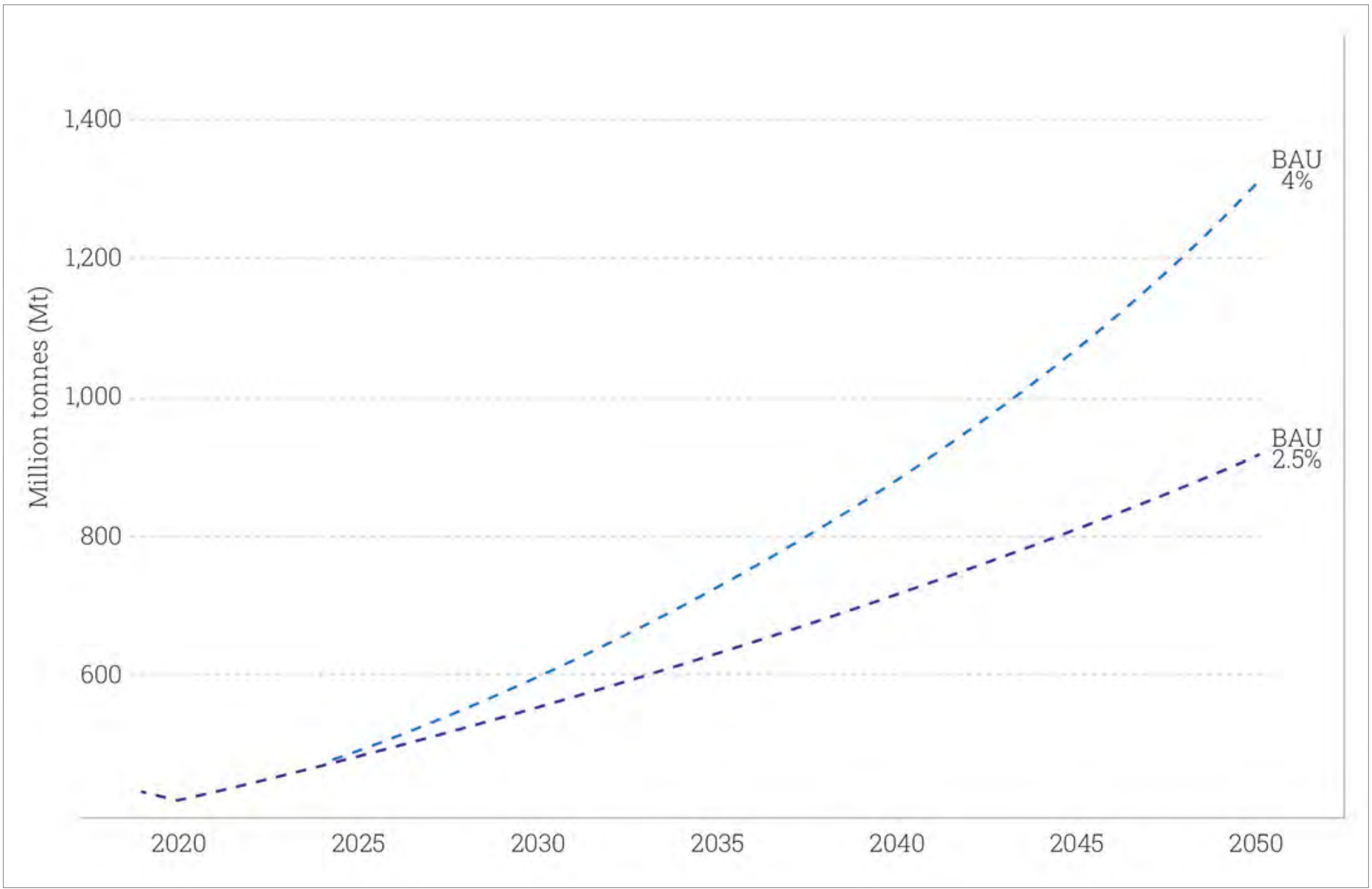


Figure 1: *Global plastic polymer production - business as usual scenarios*

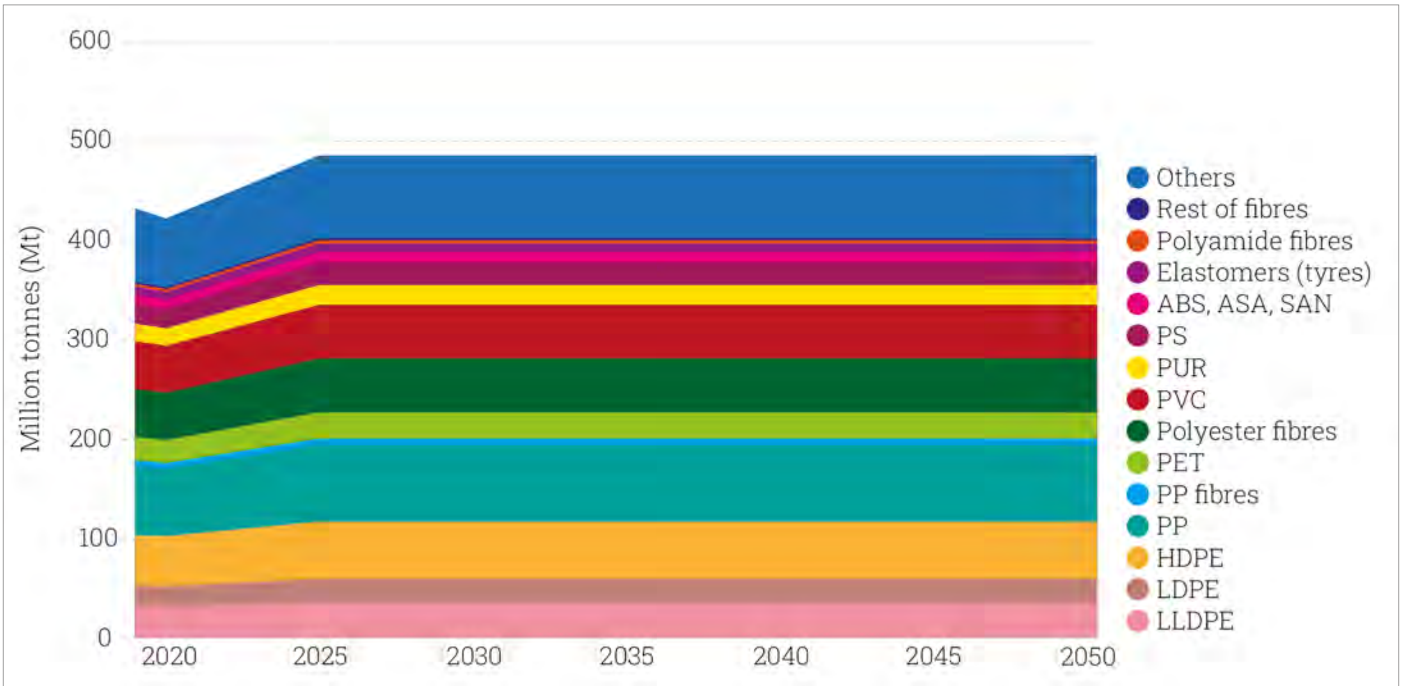
Freeze scenario

The freeze scenario assumes polymer production is frozen at 2025 levels, 483.36 Mt per year.

In the freeze scenario, between 2025-50, an additional 12.5 billion tonnes of plastics are produced globally. Compared to BAU, the freeze scenario avoids approximately 5.1 billion tonnes of plastic waste, of which 8.7 billion tonnes is projected to either be mismanaged, landfilled or incinerated.

This scenario also avoids 26 Gt CO_2e through 2050, with polymer production now constituting 26 per cent of the total remaining carbon budget with a 50 per cent chance of keeping warming below 1.5°C, which has been calculated as 250 Gt CO_2e as of January 2023.[31]

Figure 2: *Global plastic polymer production - freeze scenario*



Freeze plus elimination scenario

The freeze-elimination (F+E) scenario assumes polymer production is frozen at 2025 levels and the progressive elimination of three polymers of concern, namely polyvinyl chloride (PVC), polyurethane (PUR) and polystyrene (PS) by 2050, modelled as proportionate year-on-year reductions. The fourth polymer of concern identified as part of the dirty quartet, polycarbonate (PC), has not been modelled here due to lack of disaggregated production data.

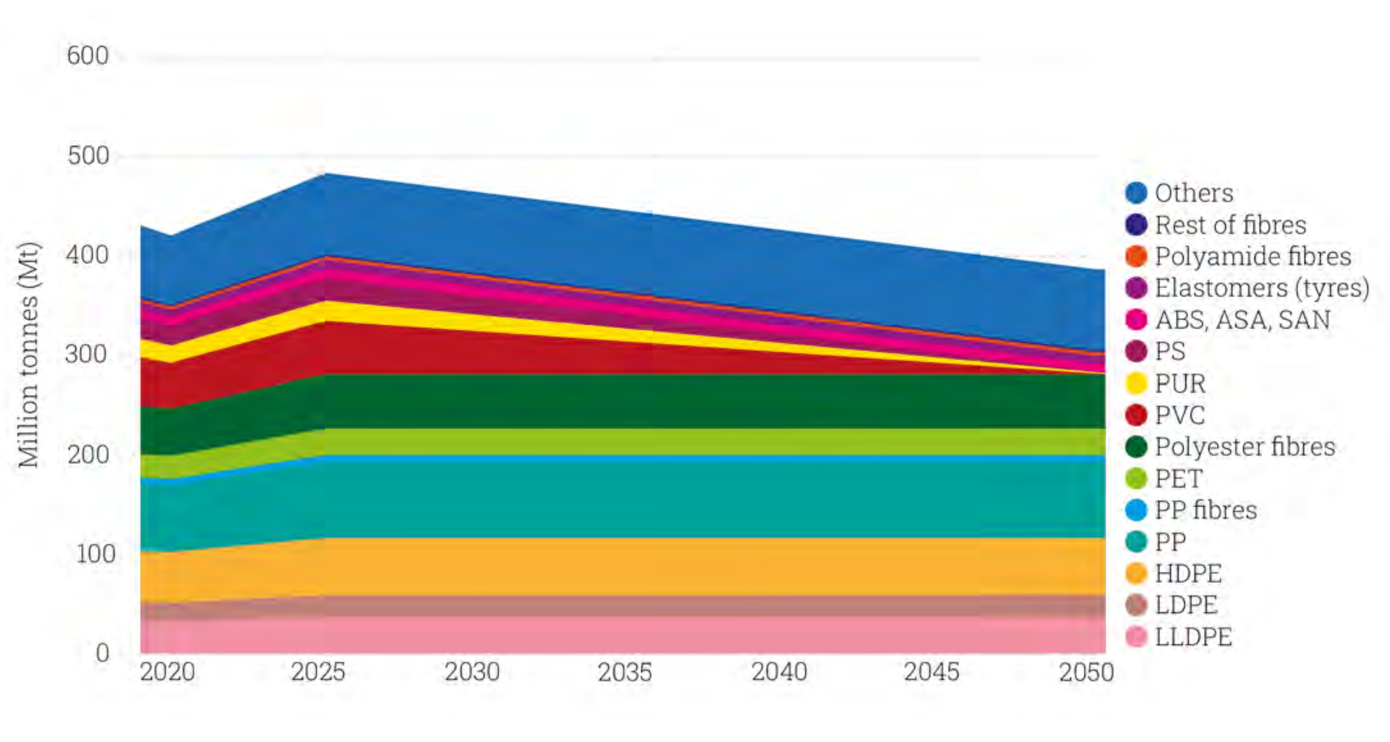
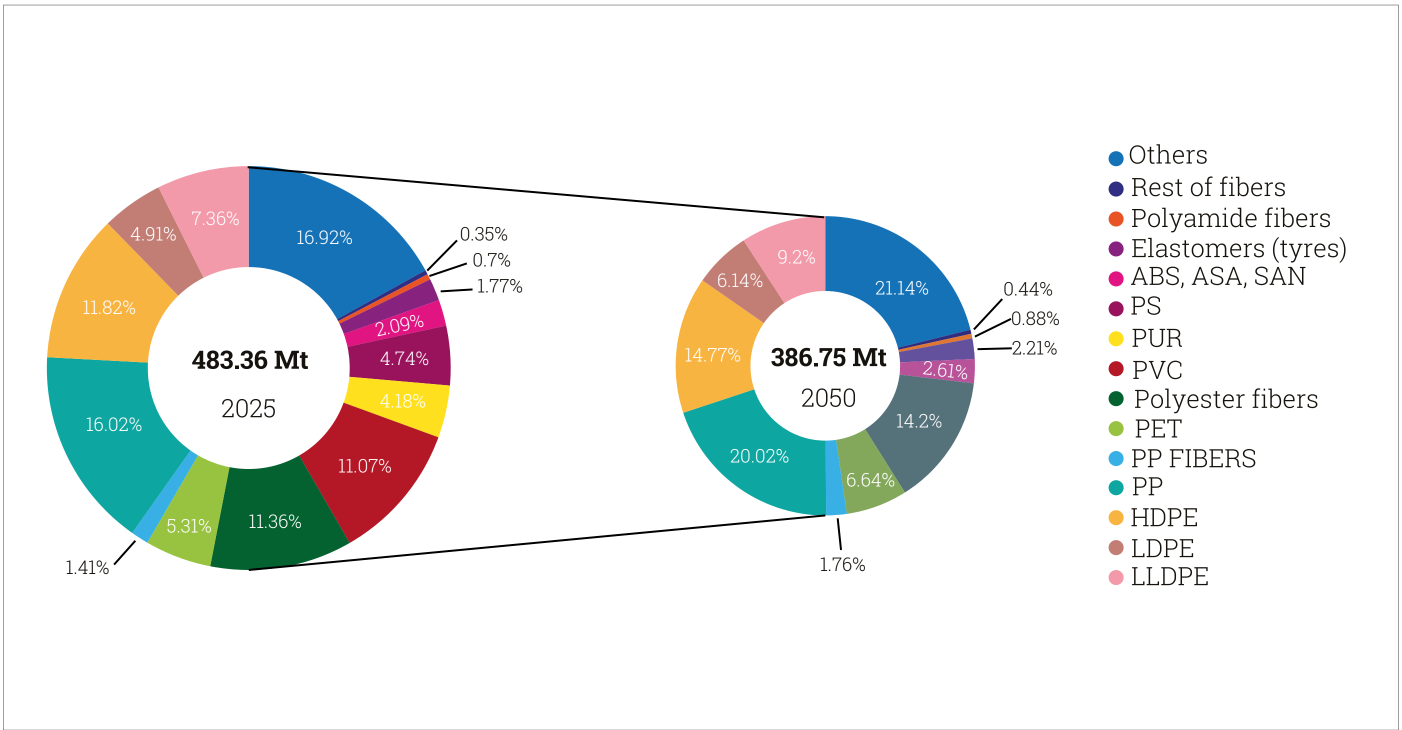


Figure 3: *Global plastic polymer production - freeze and elimination Scenario*

Figure 4: *Annual global plastic polymer production in 2025-50 – freeze and elimination scenario*



In this scenario, between 2025-50, 11.3 billion tonnes of plastics are produced globally. Compared to BAU, the F+E scenario avoids the need to manage approximately 6.1 billion tonnes of plastic waste, of which 5.2 billion tonnes is projected to either be mismanaged, landfilled or incinerated. This scenario also avoids 33.5 Gt CO_2e through 2050, with polymer production now constituting 23 per cent of the total remaining carbon budget with a 50 per cent chance of keeping warming below 1.5°C. Aggregate polymer production is 4 per cent lower than 2025 levels in 2030 and 20 per cent lower than 2025 levels in 2050.

Freeze plus elimination plus limits scenario

The freeze-elimination-limits (F+E+L) scenario assumes polymer production is frozen at 2025 levels and the progressive elimination of three polymers of concern, namely polyvinyl chloride (PVC), polyurethane (PUR) and polystyrene (PS), modelled as proportionate year-on-year reductions through 2050.

This scenario then further layers on limits on the production of four commodity plastics, namely high-density polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP) and polyethylene terephthalate (PET) as described below.

Low F+E+L scenario

In the low F+E+L scenario, the production of the four commodity polymers (HDPE, LDPE, PP, PET) is reduced by 50 per cent by 2050, modelled as incremental year-on-year reductions, in addition to the elimination of three polymer concerns (PVC, PUR, PS) and a freeze on the production of other polymers.

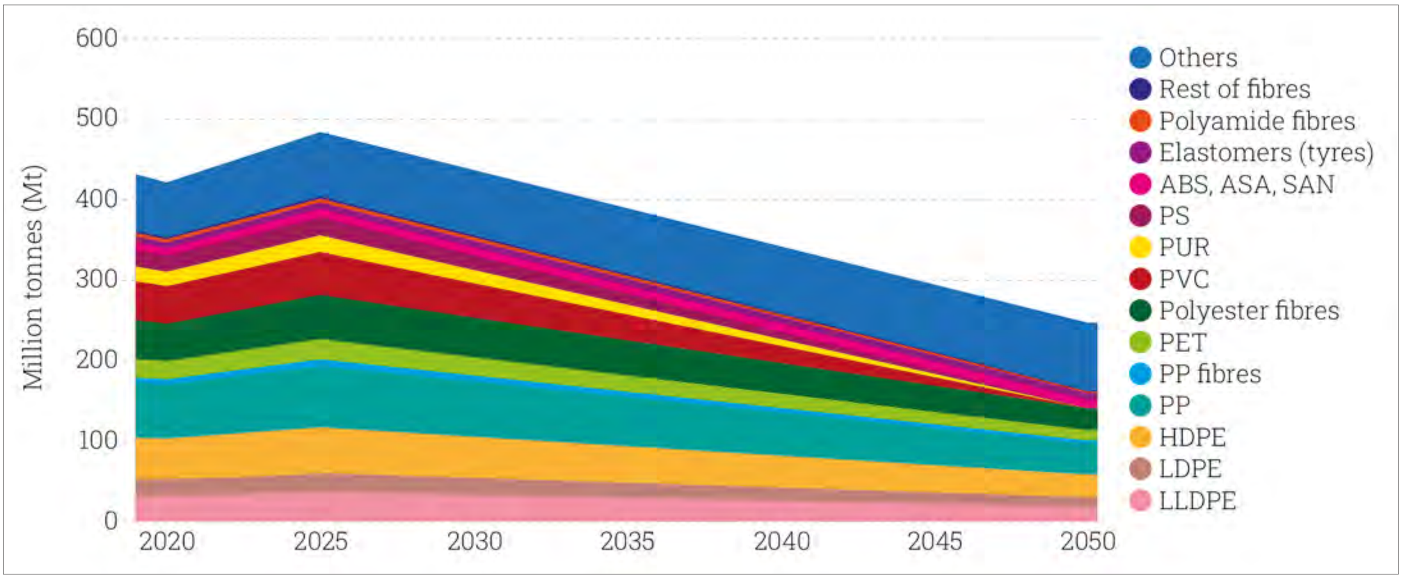
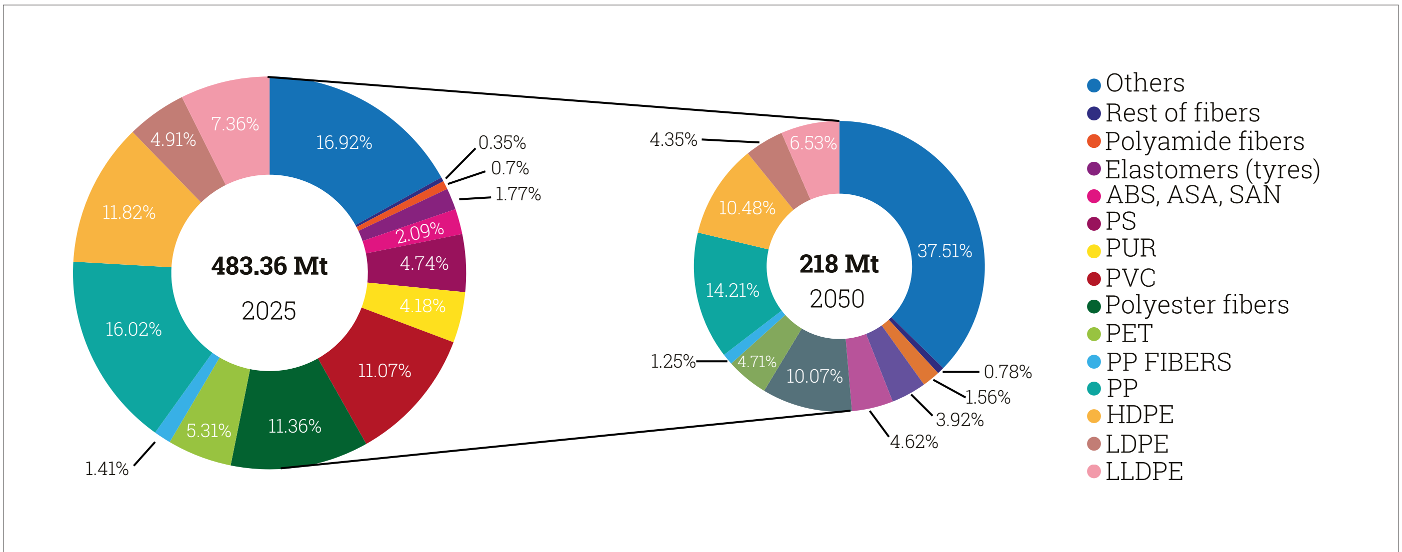


Figure 5: *Global plastic polymer production - freeze, elimination and limits scenario (low ambition)*

Figure 6: *Annual global plastic polymer production in 2025-50 - freeze, elimination and limits scenario (low ambition)*



In this scenario, between 2025-50, 9.4 billion tonnes of plastics are produced globally. Compared to BAU, this eliminates the need to manage approximately 7.6 billion tonnes of plastic waste, of which 6.5 billion tonnes is projected to either be mismanaged, landfilled or incinerated. This scenario also avoids 42.9 Gt CO_2e through 2050, with polymer production now constituting 20 per cent of the total remaining carbon budget with a 50 per cent chance of keeping warming below 1.5°C. Aggregate polymer production is around 10 per cent lower than 2025 levels in 2030 and 49 per cent lower than 2025 levels in 2050.

Mid F+E+L scenario

In the medium F+E+L scenario, the production of the four commodity polymers (HDPE, LDPE, PP, PET) is reduced by 60 per cent by 2050, modelled as proportionate year-on-year reductions, in addition to the elimination of three polymer concerns (PVC, PUR, PS) and a freeze on the production of other polymers.

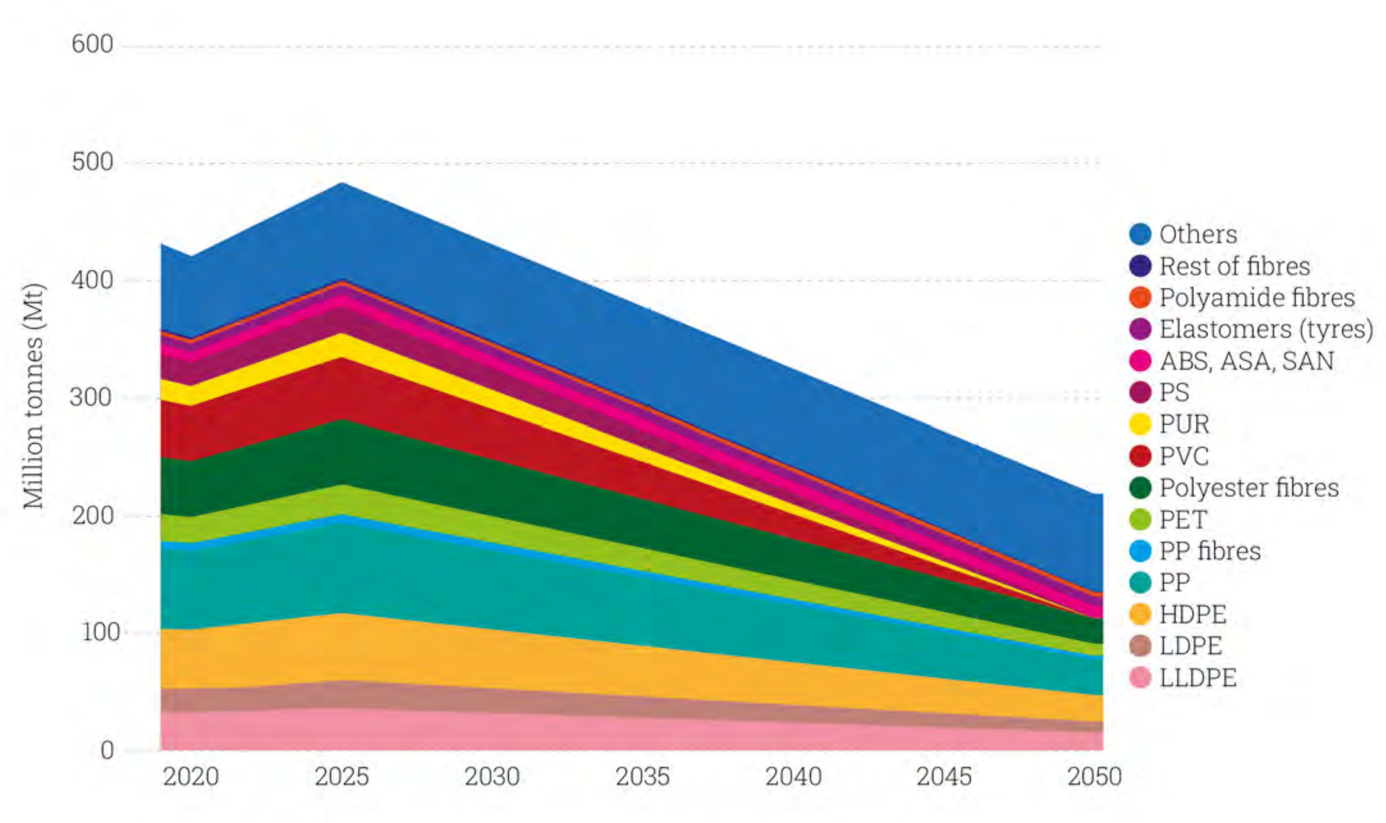
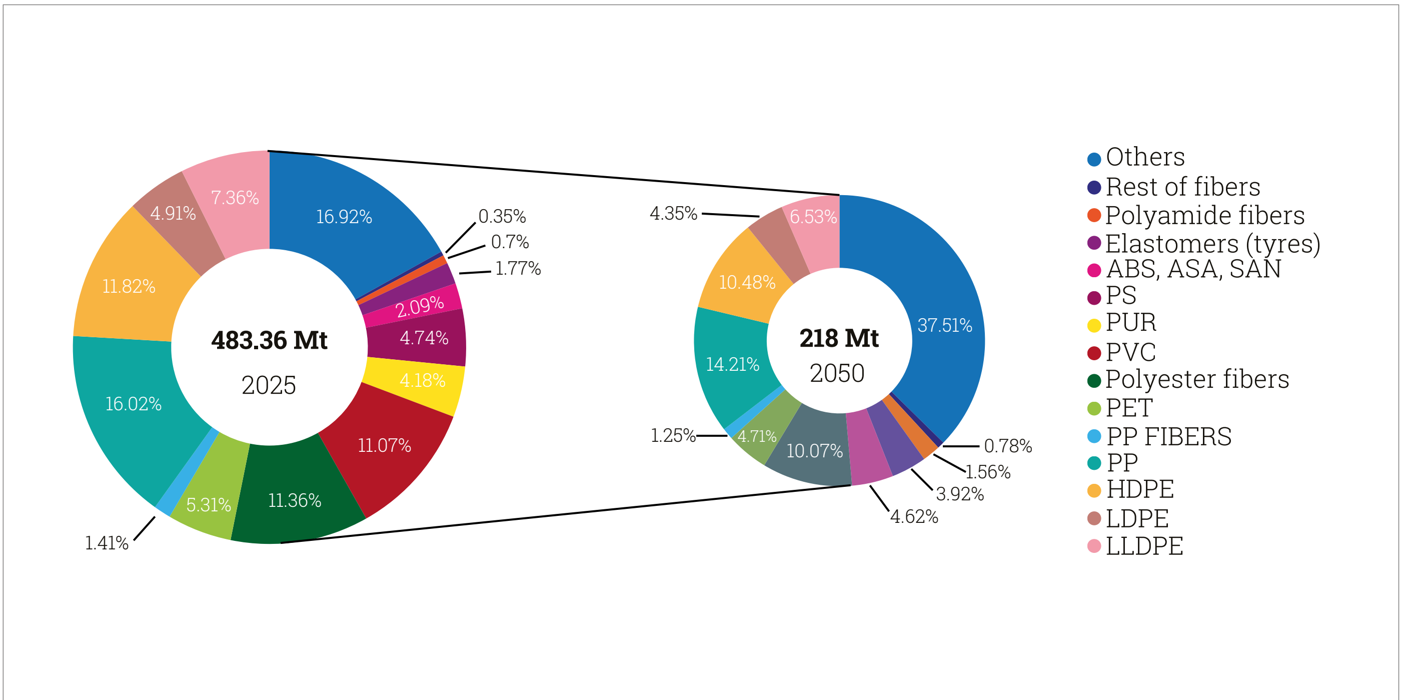


Figure 7: *Global plastic polymer production - freeze, elimination and limits scenario (medium ambition)*

Figure 8: *Annual global plastic polymer production in 2025-50 - freeze, elimination and limits scenario (mid ambition)*



In this scenario, between 2025-50, 9.1 billion tonnes of plastics are produced globally. Compared to BAU, this eliminates the need to manage approximately 7.9 billion tonnes of plastic waste, of which 6.7 billion tonnes is projected to be either mismanaged, landfilled or incinerated. This scenario also avoids 44.8 Gt CO_2e through 2050, with polymer production now constituting 19 per cent of the total remaining carbon budget with a 50 per cent chance of keeping warming below 1.5°C. Aggregate polymer production is 11 per cent lower than 2025 levels in 2030 and 55 per cent lower than 2025 levels in 2050.

High F+E+L scenario

In the medium F+E+L scenario, the production of the four commodity polymers (HDPE, LDPE, PP, PET) is reduced by 75 per cent by 2050, modelled as proportionate year-on-year reductions, in addition to the elimination of three polymer concerns (PVC, PUR, PS) and a freeze on the production of other polymers.

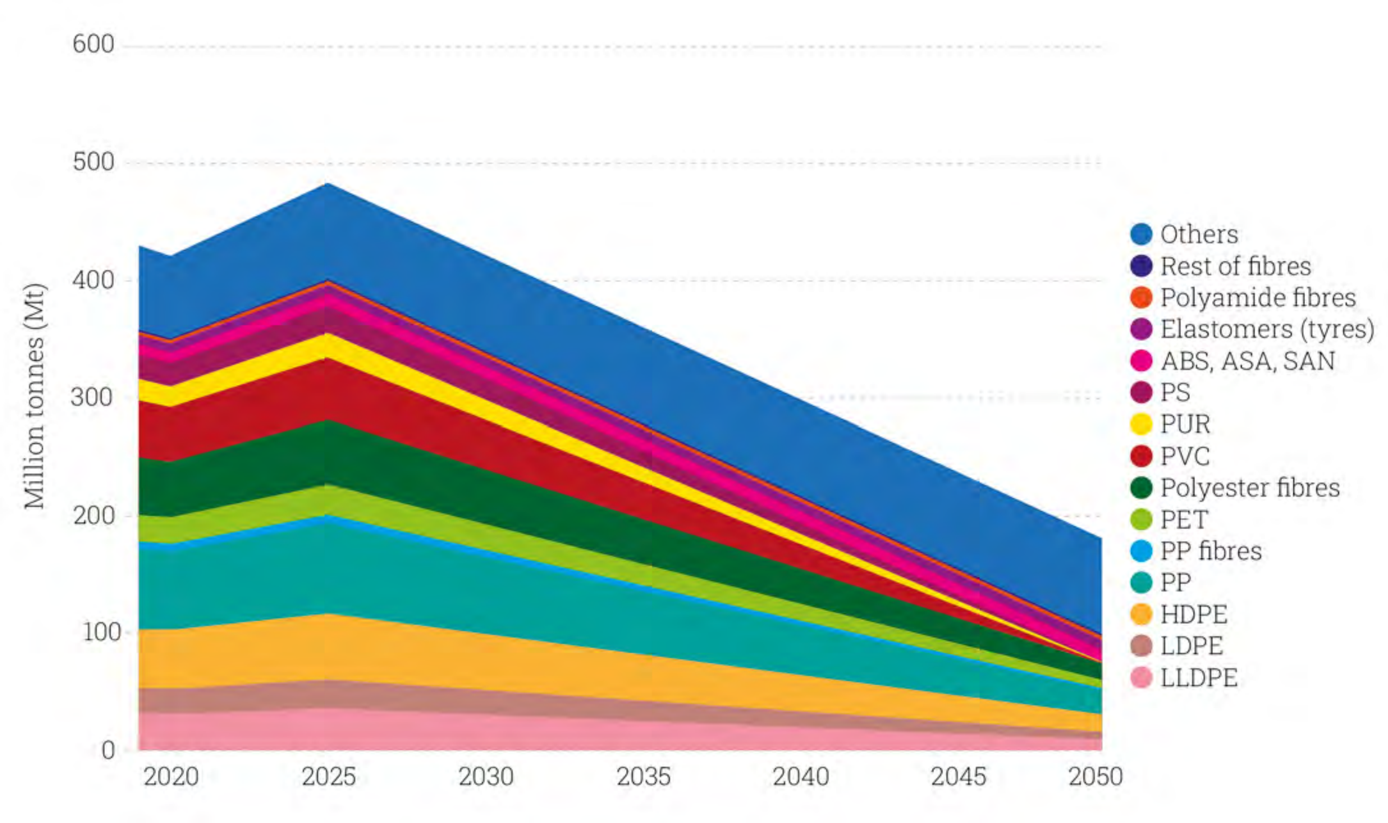
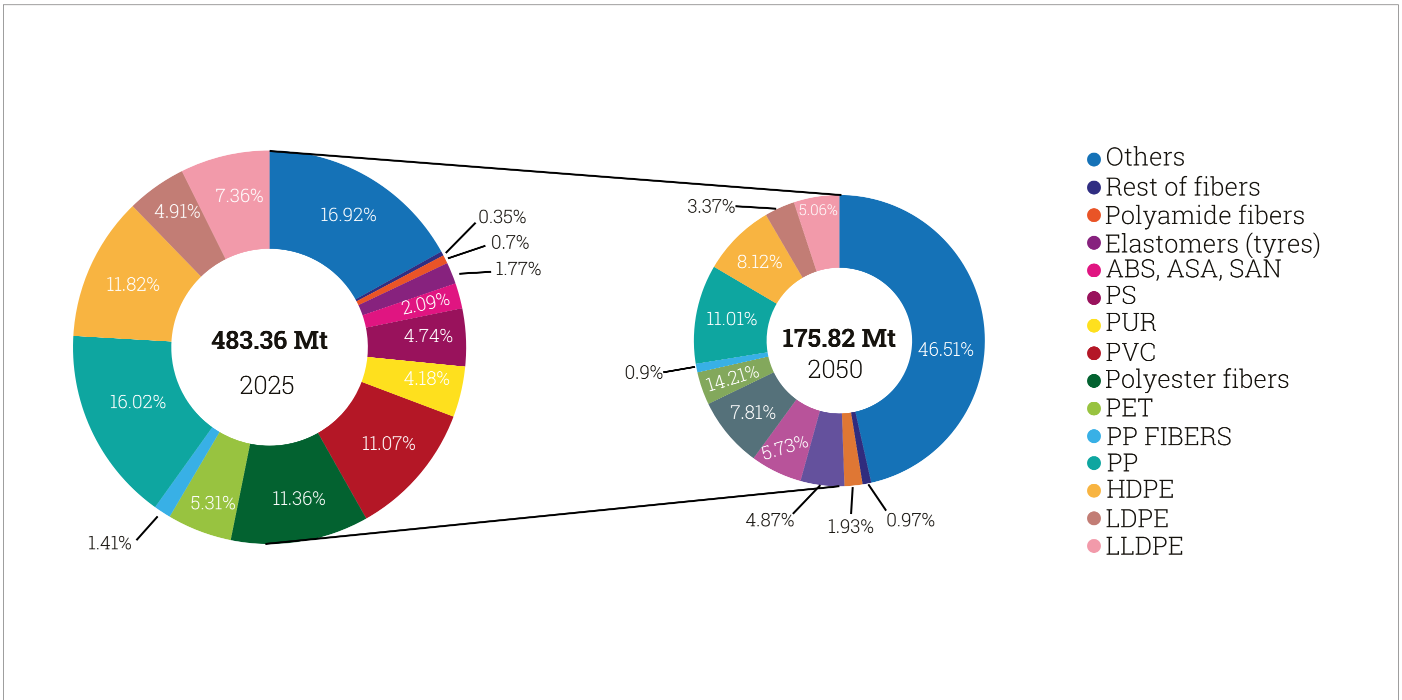


Figure 9: *Global plastic polymer production - freeze, elimination and limits scenario (high ambition)*

Figure 10: *Annual global plastic polymer production in 2025-50 - freeze, elimination and limits scenario (high ambition)*



In this scenario, between 2025-50, 8.5 billion tonnes of plastics are produced globally. Compared to BAU, this eliminates the need to manage approximately 8.3 billion tonnes of plastic waste, of which 7.1 billion tonnes is projected to either be mismanaged, landfilled and incinerated. This scenario also avoids 47.6 Gt CO_2e through 2050, with polymer production now constituting 18 per cent of the total remaining carbon budget with a 50 per cent chance of keeping warming below 1.5°C. Aggregate polymer production is 13 per cent lower than 2025 levels in 2030 and 64 per cent lower than 2025 levels in 2050.

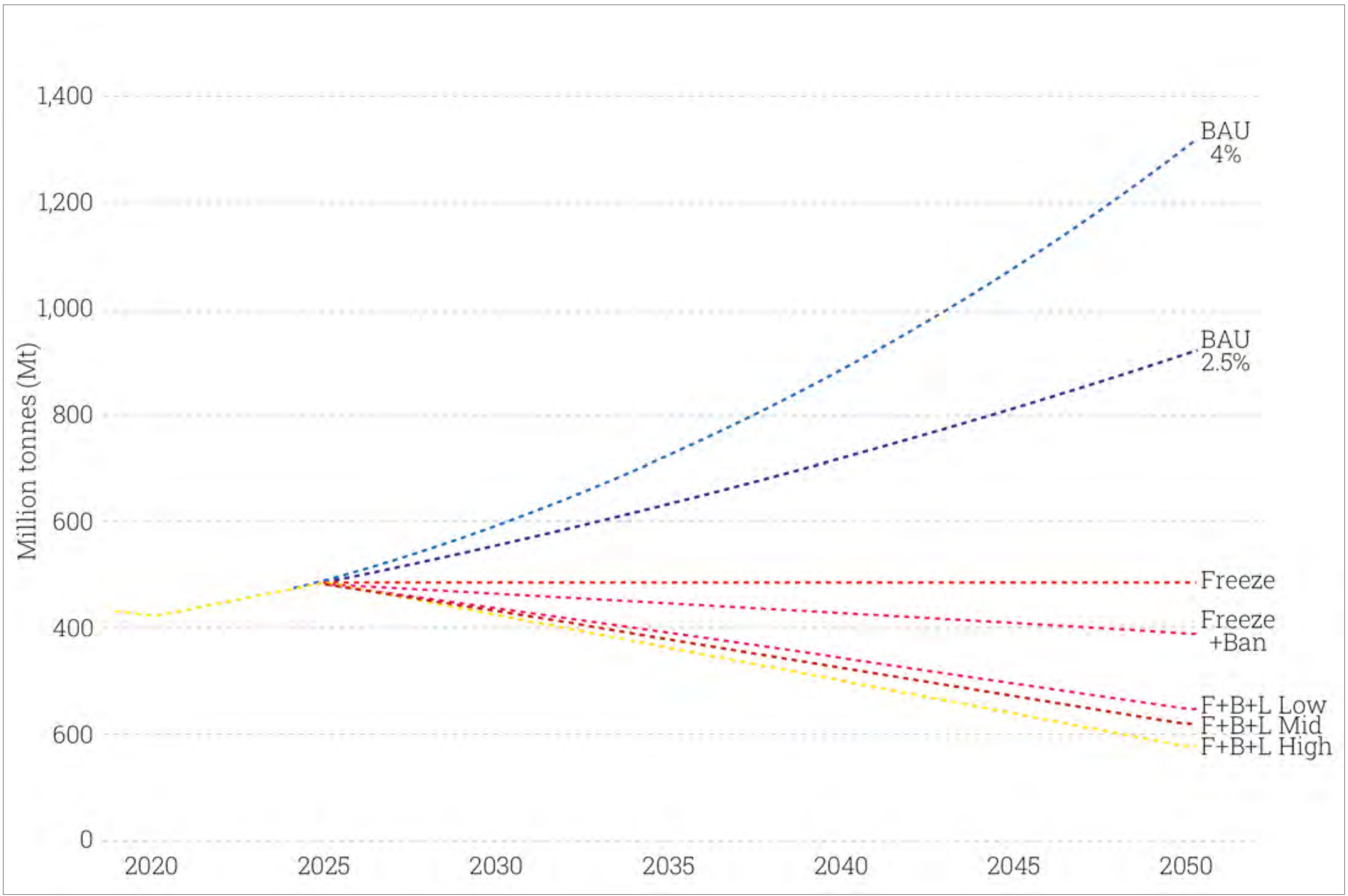
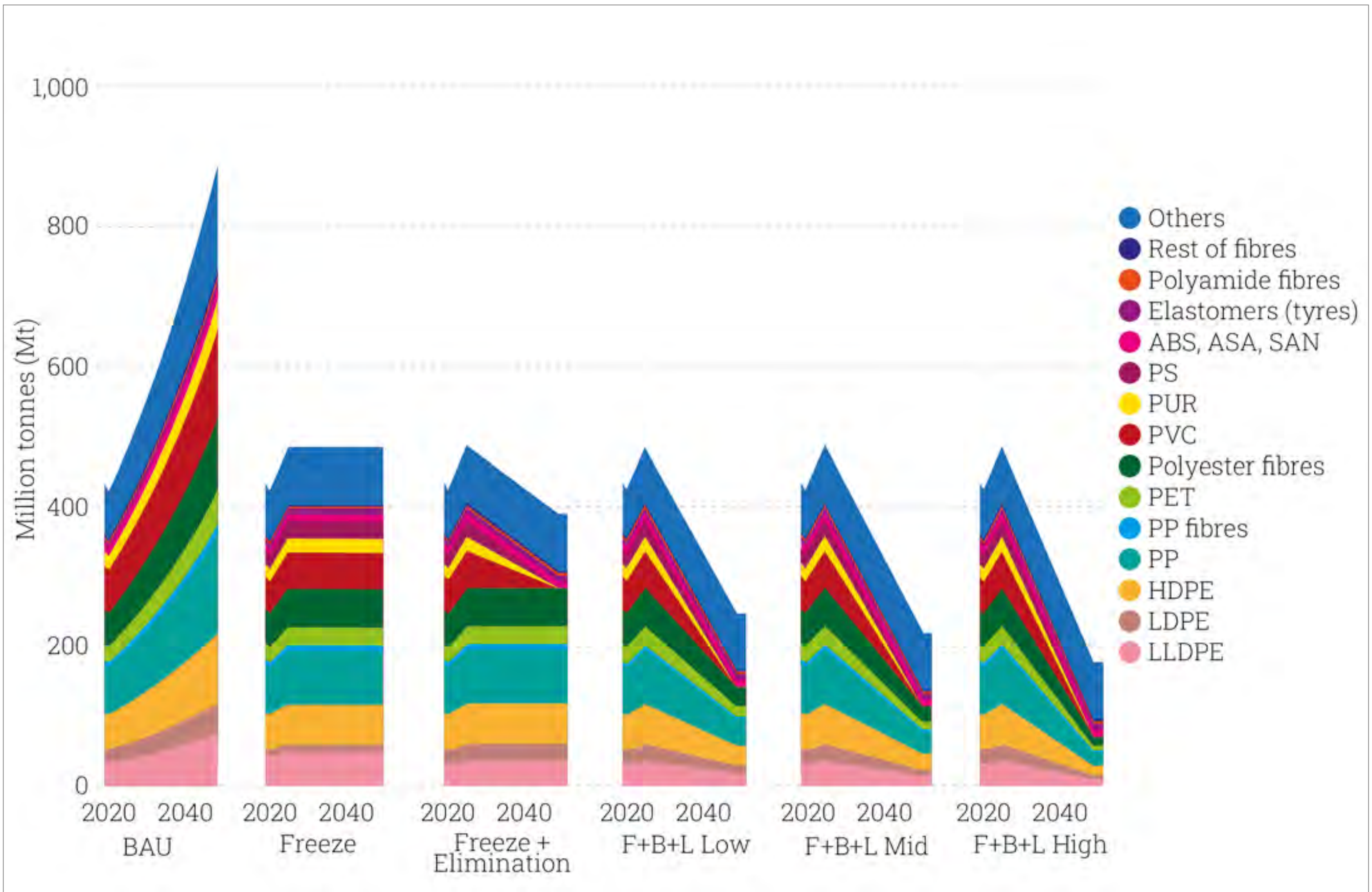


Figure 11: *Global plastic polymer production - comparison of scenarios*

Figure 12: *Global plastic production by polymer - comparison of scenarios*



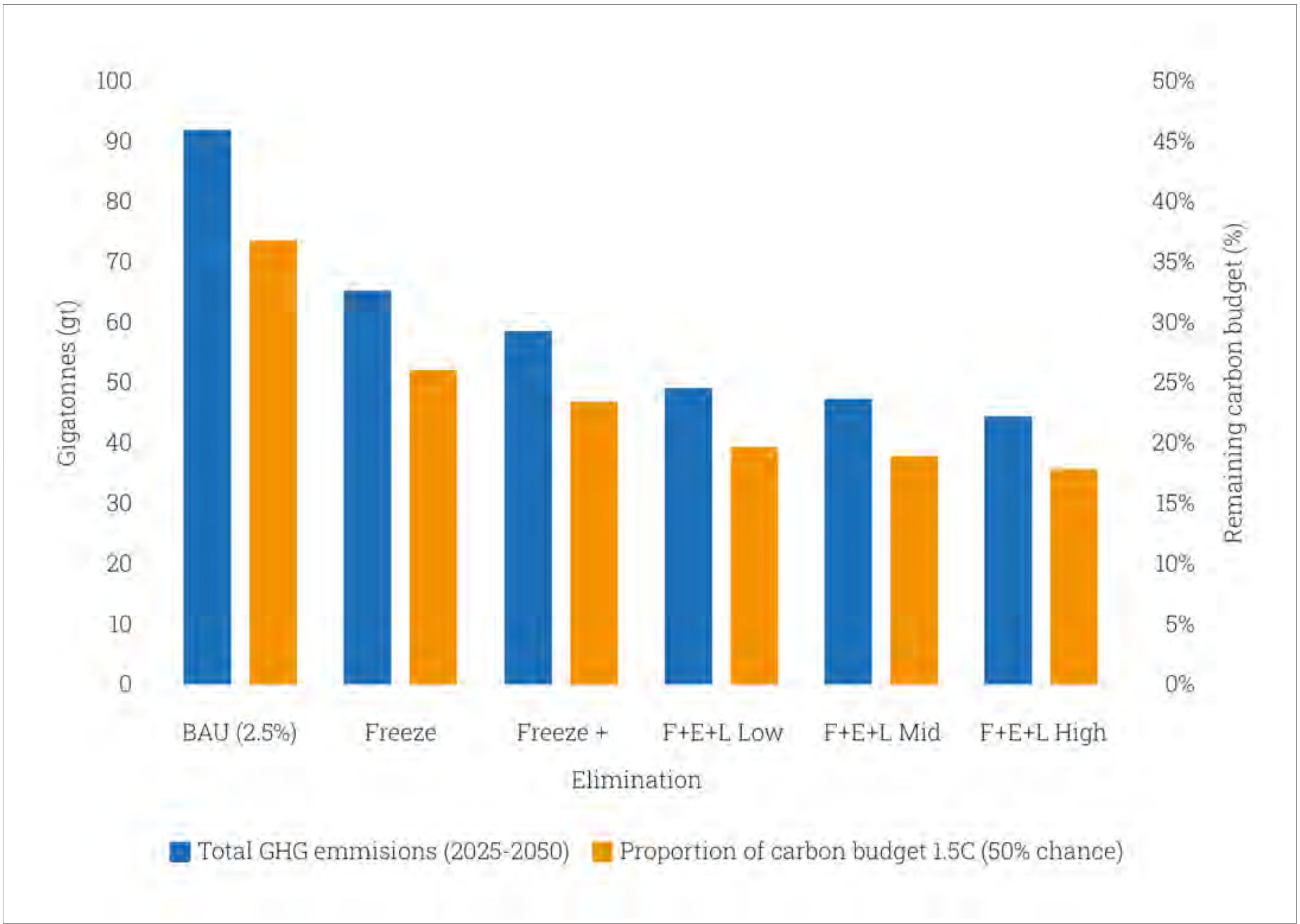
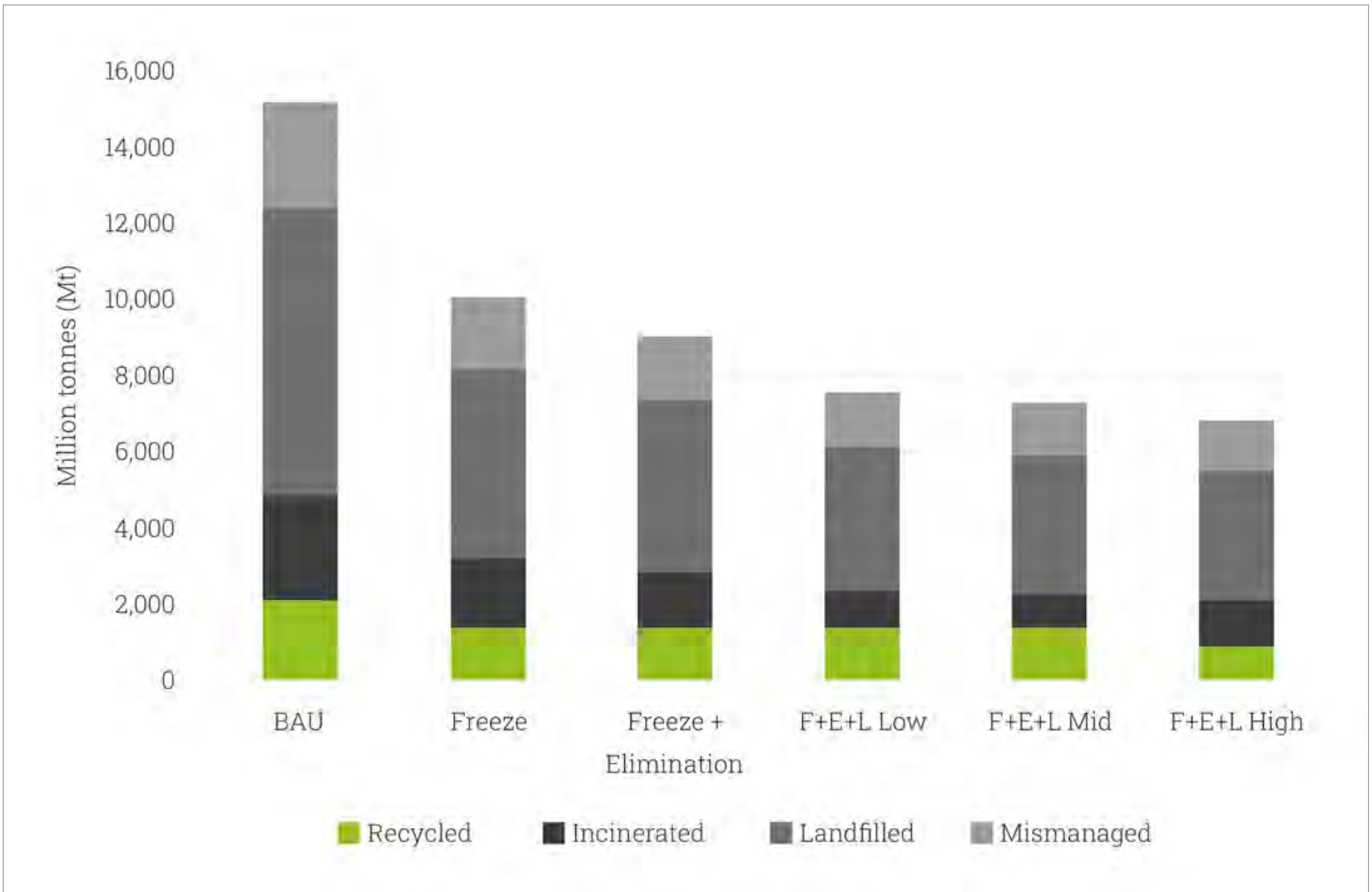


Figure 13: *Global plastic polymer production - comparison of scenarios*

Figure 14: *Global plastic production by polymer - comparison of scenarios*



Section V - Additional Elements

Additional elements in the design of a framework on polymer production should also be considered.

Exemptions

Negotiators will need to consider the types and procedure for exemptions. Types of exemptions could include certain laboratory or analytical uses as well as critical-use or essential-use exemptions upon request by the party. For those primary plastic polymers targeted for limitation, the need for exemptions should be low or non-existent, but for polymers of concern targeted for elimination there may be specific uses that are considered essential or require additional time in order to comply.

Adjustments

Allowing for controls to be adjusted and strengthened over time allows parties to continue to respond to increasing knowledge. At the inception of the Montreal Protocol, for example, there were still many uncertainties and policymakers had to make do with the information that was available. Although there are far fewer uncertainties in the context of plastics, many still remain and success is likely best realised through an adaptive science-policy interface that gradually strengthens controls as new information becomes

available. Moreover, as under the Montreal Protocol, an 'adjustment' of the phase-down schedule of any given controlled substance should be possible without the need for a formal amendment, which requires ratification.

Non-party trade provisions

Provisions on trade by parties with non-parties should prohibit or restrict countries party to the ILBI from trading with countries not party to the ILBI to maximise participation, facilitate compliance and uphold the objectives of the instrument.[32] It also ensures that countries that ratify are not disadvantaged.

Financial aspects

Limiting the supply of primary plastic polymers will influence the price of the material as the market adjusts its demand. However, any temporary price increase, which will inure to the benefit of polymer producers, does not mean there must be negative connotations for the consumer or economy at large. Much like price increases from demand-side measures, supply-side measures are a necessary step to shift the current paradigm and move away from a linear economy for plastics. This presents opportunities for investment in separate collection and sorting, recycling and reuse infrastructure and sustainable alternative materials or delivery systems, which will invigorate local and regional economies and create jobs. For these reasons, means of implementation is part of the discussion on polymer production. A key lesson from the Montreal Protocol is that financial support provided through a dedicated multilateral fund – there, the Multilateral Fund for the Implementation of the Montreal Protocol – covering enabling activities, incremental costs of compliance and clearinghouse functions can assist developing-country parties in the transition of their economies to more sustainable production and consumption patterns.

Section VI - Conclusion

It is clear that, if we are to truly end plastic pollution and live up to the ambition of Resolution 5/14, addressing the production of primary plastic polymers head-on will be necessary. It is now becoming increasingly clear that production controls are required to achieve the climate, circular economy and sustainable development targets that have already been agreed globally.

For negotiators to go about determining the control measures that would form part of this approach, discussions will need to centre around several key issues:

1. **determining our collective global ambition** to guide policymaking now and into the future

2. **assessing which polymers may be targeted for elimination** due to their intrinsic hazard, leakage into the environment and recyclability

3. **setting limits on polymers** that make up significant portion of market share and waste generation and require reduction to achieve the overall collective ambition

4. **the process for setting national targets,** be they globally agreed, nationally determined or by some other hybrid means.

This report has made a number of assumptions on the outcome of these discussions and modelled different scenarios which address the production of primary plastic polymers. From these modelled scenarios, it is shown that through targeting a few high-volume commodity plastics that contribute significantly to waste generation and pollution, significant reductions in production can be achieved.

These scenarios are not intended to be specific recommendations, rather illustrative of what may be achieved through said control measures. These scenarios suggest that the reductions that may be possible through both elimination and limitation would create the enabling environment for circular economy objectives that will require reduction of about 30 per cent of total production to require certainty of result.

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