environmental investigation agency

Convention on Plastic Pollution

Essential Elements: Virgin Plastic Production and Consumption

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Background

"A problem well put is half solved" – John Dewey

Virgin plastic production and consumption are increasingly recognised as having reached unsustainable levels.[1]

Countries are inundated by an acute overabundance of inexpensive virgin plastic, undermining secondary markets for recycled material and investments in collection and recycling infrastructure.[2] This has been partly driven by the oil and gas industry turning to plastics to hedge against the possibility that a serious climate change response will reduce demand for their products.[3]

According to the International Energy Agency (IEA), the petrochemicals used to produce virgin plastic polymers and other products account for eight per cent and 14 per cent of total primary demand for gas and oil, respectively, and will soon become the world's biggest driver of oil demand, ahead of trucks, aviation and shipping.[4]

As a result, inexpensive virgin plastic is used freely and inefficiently whle creating unfavorable economics for most recycling, leading to a stark discrepancy between how much plastic is produced and how much is recycled. As of 2015, of all plastic waste ever produced, only nine per cent has been recycled; 12 per cent was incinerated and a further 79 per cent ended up in landfills or the natural environment.[5]

Policymakers increasingly draw the connection between eliminating plastic pollution and promoting a circular economy for plastics.[6] The two are inextricably linked. Following a review of 18 international and 36 regional instruments undertaken by the United Nations Environment Programme (UN Environment), there is growing consensus on the need for a new global agreement that addresses the fragmented landscape of plastics governance across its lifecycle, including upstream at the level of plastic production,[7] to facilitate the dual objectives of reduction and circularity. Yet current trends in virgin plastic production and consumption are forecast to overwhelm all efforts on waste management, widening the discrepancy even further. Based on 2016 baselines, annual virgin plastic production is set to double by 2040,[8] increasing to 2,000 million tonnes per year by 2050.[9]

For these reasons, the idea of achieving sustainable production and consumption of virgin plastic polymers has gained traction. Indeed, the United Nations Environment Assembly (UNEA), in UNEA Resolution 5/14, specifically directs the intergovernmental negotiating committee (INC) to take "a comprehensive approach that addresses the full lifecycle of plastic" and develop provisions to "promote sustainable production and consumption of plastics."[10]

Because virgin plastic polymers are both a product and pollutant with few companies dominating production, a situation similar to ozone-depleting substances (ODS), there are clear learnings for the global community in the approach taken by the Montreal Protocol on Substances that Deplete the Ozone Layer, widely considered to be the most successful multilateral environmental agreement.

This paper reviews how controls in the Montreal Protocol could be adapted to virgin plastic polymers and, in so doing, provides an upstream global regulatory framework for addressing plastic pollution at the stage of the lifecycle of plastic when plastic comes into existence as a material.

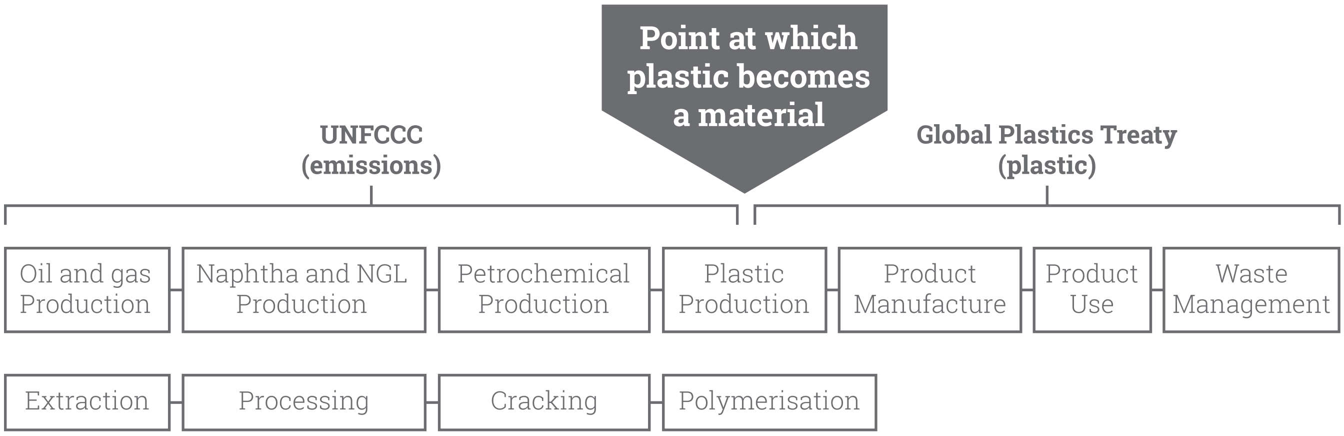
Conceptualising the lifecycle of plastic – how to define its stages?

Plastic comes into existence as a material upon polymerisation, yet the lifecycle begins earlier, the extraction and processing of raw materials, mostly oil and gas, and petrochemical production for use to make plastics.

Polymerisation is the natural starting point for any new global agreement on plastic pollution – the beginning of the lifecycle of plastic in solid form, as it were – but negotiators should also consider potential measures at the sourcing phase, including how this relates to the competencies of existing instruments and how such measures can support the over-arching objectives of the agreement. Plastic comes into existence as a material upon polymerisation. For this reason, in the context of the global plastics treaty, polymerisation is an important stage for conceptualising the lifecycle of plastic to design interventions across the full lifecycle. In essence, with it we can divide the full lifecycle of plastic into five main stages:[11,12]

(i) **Raw materials (sourcing)**, namely oil and gas extraction and processing for petrochemical production, which comprise 90 per cent of the greenhouse gas emissions associated with plastics, the stage to apply control measures to reduce climate footprint and health impacts to local communities;[13]
(ii) **Virgin polymer production and consumption (upstream)**, when plastic first comes into existence as a material through polmerisation, the stage to apply control measures to phase out problematic and hazardous polymers and additives and oterwise estabilsh limits on other polymers at achieve sustainable levels;
(iii) **Product design and use (midstream)**, when plastic products are manufactured and put into use, the stage to apply control measurs such as general and product-specific eco-design criteria and systemic approaches to promote reuse;
(iv) **Waste management and treatment (downstream)**, plastic waste that has been collected, the stage to apply control measures to ensure the environmentally sound management of waste in line with resource efficiency and the waste hierarchy with strict limitations on thermal treatment and other technologies; and
(v) **Plastic in the environment (leakage)**, namely terrestrial, freshwater and marine plastic pollution, the stage to apply control measures to remediate existing plastic pollution to reduce impacts on local communities, biodiversity hotspots, fisheries, tourism and navigational safety.

Such a conceptualisation has the benefit of ensuring the lifecycle of plastic at least encompasses when plastic comes into existence as a material upon polymerisation – virgin plastic production – coinciding with when plastic also first enters the environment as a pollutant in the form of spilled pellets. But it also implicates sourcing, which would align with the objectives of the UN Framework Convention on Climate Change and its Paris Agreement.[14]



Benefits of controlling virgin plastic production and consumption

Upstream measures that control the production and consumption of virgin plastic polymers have independent value but also support midstream and downstream measures by:

(i) ensuring the efficient use of virgin plastic polymers, eliminating inefficiencies in the system;
(ii) incentivising the replacement of single-use products and packaging in favor of reusable alternatives and innovative delivery systems;
(iii) promoting secondary markets while improving the economics of investments in separate collection and recycling.

For these reasons, the global plastic treaty should tackle unsustainable virgin plastic production and consumption head on with a start-and-strengthen mechanism for adjusting control measures over time via decisions of the Conference of the Parties (COP) – without the need for additional amendment or ratification, which can take years and be fought with political complexity. This is the approach taken in the Montreal Protocol for the production and consumption of virgin ozone-depleting substances as well as the Stockholm Convention and the International Convention for the Prevention of Pollution from Ships (MARPOL). At the inception of the Montreal Protocol, there were still many uncertainties and unknowns, requiring policymakers to make do with the information that was available. Although there are far fewer uncertainties and unknowns in the context of plastic pollution, some still remain and enduring success is likely to be achieved through the gradual strengthening of controls over time as new information becomes available.

Some definitions

"Virgin plastic polymers" means newly manufactured resin produced from petrochemical or biomass feedstock used as the raw material for the manufacture of plastic products and which has never been used or processed before.

"Recycled plastic polymers" means plastic polymers manufactured from scrap or waste plastic, often in the form of flakes, which can then be reprocessed into plastic products.

"Production" means the amount of virgin plastic polymers produced.

"Consumption" means production plus imports minus exports of virgin plastic polymers.

Main features

- **Controlled substances**. Parties define the substances to be controlled. In the context of plastic, these substances are polymers. Plastic polymers come in two types: thermoset, which cannot be remelted and remolded (~10 per cent), and thermoplastic, which can be melted and remolded (~90 per cent). Within thermoplastics, industry further classifies them into three main categories: (i) standard, used in common applications (~90 per cent of total market share); (ii) engineering, which possess improved mechanical or thermal properties (~10 per cent of total market share); and (iii) high-performance, used for exceptional end-use applications and niche products (less than one per cent of total market share).[15] Parties should therefore clearly set out the polymers to be controlled under the new agreement in an annex, which thereafter constitutes the "controlled substances" subject to all other measures. Updates to the annex to account for new polymers should be made possible via decisions by the Parties.

Virgin plastic polymers

(% of total market share by weight in 2019)

- **Polyethylene** (low density) (LDPE) = 17.4%
- **Polyethylene** (high density) (HDPE) = 12.4%
- **Polypropylene** (PP) = 19.4%
- **Polyvinyl Chloride** (PVC) = 10%
- **Polyethylene Terephthalate** (PET) = 7.9%
- **Polystyrene** (PS, EPS) =6.2%
- **Polyurethane** (PUR) = 7.9%
- **Other Thermoset Polymers** = 7.5%
- **Other Thermoplastic Polymers** = 11.3%

- **Reporting**. Article 7 of the Montreal Protocol requires all Parties to provide statistical data about ozone-depleting substances (ODS) to the Ozone Secretariat every year. The Ozone Secretariat uses the data to calculate annual ODS production and consumption for each Party. In the context of plastic, reporting obligations should also allow for the determination of annual production and consumption of virgin plastic polymers as well as use. Production refers to the amount of virgin plastic a country produces. Consumption refers to the amount of virgin plastic a country consumes, which is calculated as production plus imports minus exports. Use refers to the sector the polymers are used in, such as packaging, agriculture and fisheries, building and construction, automotive, electrical and electronic, household, leisure and sports plus others, including medical and laboratory. To this end, four key data points should therefore form the basis of reporting obligations for virgin plastic by polymer type: (i) production; (ii) imports; (iii) exports; and (iv) use. Fortunately, reporting is greatly facilitated by the relatively few virgin polymer producers, approximately 300 worldwide, about 100 of which account for 90 per cent of all single-use plastics.[16] The Parties should work to ensure a harmonised approach toward reporting, premised on the publication of guidelines and, in the case of developing countries and economies in transition, technical and financial assistance.

- **Licensing systems**. Licensing systems are regulatory schemes whereby a license is granted by authorities for a company to produce, export or import controlled substances, supported by a ban on unlicensed production, exports and imports. Many multilateral environmental agreements require licensing systems, including the Montreal Protocol and Basel Convention on the Transboundary Movements of Hazardous Wastes and Their Disposal. The objectives of the licensing system are to: (i) assist the collection of information; (ii) facilitate notification and cross-checking of reported information; (iii) prevent illegal production and trade.

- **Baselines**. Parties thereafter establish baselines for virgin plastic production and consumption, by polymer, based on average production and consumption by weight over a multi-year period (to compensate for annual fluctuations). The selection of the multi-year period that constitutes the baseline has important implications for virgin plastic production. For example, an historical baseline, such as 2019-21, would discourage expansion of virgin plastic production, serving as a soft freeze until additional controls can be adopted. The other option is a prospective baseline, for example 2025-27, which would encourage expansion of virgin plastic production up to and through the baseline years.

- **Freeze and phase-down**. Parties adopt restrictions on annual production and consumption of controlled substances. This would likely entail a cap on production and consumption ("freeze") at a certain level, such as 100 per cent of an established baseline, followed by a series of reduction steps ("phase-down") to lower levels of production and consumption over time. The freeze could be agreed first with the phase-down negotiated later, thus allowing for further assessment and development of alternatives and innovative delivery systems. [Note: Under a phase-down, a tail exists extending out indefinitely at the agreed-upon levels of sustainable production and consumption of virgin plastic polymers]. Consideration could thus be given to different schedules for different categories or types of virgin plastic polymers, as did the Montreal Protocol by targeting five specific chlorofluorocarbons (CFCs) and halons before other ozone-depleting substances. For example, virgin plastic polymers used in standard applications that tend to end up as pollution but with greatest recycling potential could be targeted first, with virgin plastic polymers used in engineering and high-performance applications accounted for in the tail of allowable production and consumption. Another example is to target for immediate freeze and phase-out certain problematic and hazardous virgin plastic polymers that are difficult to recycle, have high concentrations of toxic chemicals and for which alternatives are readily available, such as polyvinyl chloride (PVC), polystyrene (PS), polyurethane (PUR) and polycarbonate (PC), which collectively comprise 30 per cent of total market share.[17]

- **Exemptions**. The Montreal Protocol has several categories of exemptions, including global exemptions for certain laboratory or analytical uses as well as critical-use or essential-use exemptions, which authorise a specific country to use a specific amount of a controlled substance for a specific time. Such an approach could be considered here to allow for continued use, for example the medical or automotive sector.

- **Adjustments**. Any agreement should allow for controls to be adjusted and strengthened over time. At the inception of the Montreal Protocol, 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 agreement from trading in controlled substances with countries not party to the agreement in order to maximise participation and facilitate compliance.

- **Chemical restrictions**. Measures should also be adopted on quality standards for virgin plastic polymers to eliminate harmful chemicals used in their production, such as endocrine disruptors and carcinogens, as well as to align with eco-design criteria. Furthermore, there needs to be full transparency and public disclosure of the chemical additives and residual chemicals present in plastic polymers. The report *Considerations and Criteria for Sustainable Plastics from a Chemicals Perspective*, prepared for the Organisation for Economic Co-operation and Development (OECD), identified the creation of a system for passing this information along the supply chain as priority actions.[18] This would facilitate international trade and help to enable a non-toxic circular economy for plastics.

The overarching objective should be establish a set of control measures to achieve sustainable production and consumption of virgin plastic polymers in line with the dual objectives of reducing plastic pollution and promoting a safe circular economy for plastics. Such decisions would be informed by thorough assessment by scientific and technical bodies, balancing environmental objectives and feasibility with societal and economic needs.

Conclusion

UNEA Resolution 5/14 specifically calls for a "comprehensive approach addressing the full lifecycle of plastic" with provisions to promote "sustainable production and consumption of plastics."

As virgin plastic production and consumption is widely understood to have reached unsustainable levels, there are clear lessons from the approach adopted by the Montreal Protocol. Indeed, control measures at the upstream stage of the lifecycle of plastic are a necessary precursor to achieving sustainable production and consumption of virgin plastic polymers, facilitating economic circularity and enabling the reduction and elimination of plastic pollution. While critical, midstream and downstream measures will be inadequate if instituted alone, meaning upstream controls must be part of a holistic package of policies to address the plastic pollution crisis. As sustainable producion and consumption is a key part of the 2030 Agenda for Sustainable Development (SDG 12), it is a necessary lens through which to view approaches for tackling plastic pollution.

For more information

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References

1. Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., & Palardy, J. E. Evaluating scenarios toward zero plastic pollution. Science. 2020. 369(6510), 1455-1461. Available here. also: Simon, N., Raubenheimer, K., Urho, N., Unger, S., Azoulay, D., Farrelly, T., & Weiand, L. A binding global agreement to address the life cycle of plastics. Science. 2021. 373(6550), 43-47. Available here.

2. Bauer, F., Holmberg, K., Nilsson, L. J., Palm, E., & Stripple, J. (2020). Strategising Plastic Governance: Policy Brief. Available here.

3. International Energy Agency (2018). The Future of Petrochemicals: Towards More Sustainable Plastics and Fertilizers. Available here.

4. International Energy Agency (2018). The Future of Petrochemicals: Towards More Sustainable Plastics and Fertilizers. Pages 11 and 27. Available here.

5. G, Roland, J. R. Jambeck, and K. L. Law. Production, use, and fate of all plastics ever made. Science advances. 2017. Available here.

6. European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and social Committee and the Committee of Regions: A Strategy for Plastics in a Circular Economy (Brussels, 16 January 2018). Available here.

7. Simon, N., Raubenheimer, K., Urho, N., Unger, S., Azoulay, D., Farrelly, T., & Weiand, L. A binding global agreement to address the life cycle of plastics. Science. 2021. 373(6550), 43-47. Available here.

8. Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., & Palardy, J. E. Evaluating scenarios toward zero plastic pollution. Science. 2020. 369(6510), 1455-1461. Available here.

9. UNEP (2016). Global Chemicals Outlook II, p. 57. Available here.

10. United Nations Environment Assembly (2022). Resolution 5/14 End Plastic Pollution: Towards an International Legally Binding Instrument. Operative Paragraph (OP) 3(b). Available here.

11. Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., & Palardy, J. E. Evaluating scenarios toward zero plastic pollution. Science. 2020. 369(6510), 1455-1461. Available here.

12. De Silva, L., Doremus, J., & Taylor, R. (2021). The Plastic Economy. Environmental Defense Fund Economics Discussion Paper Series, EDF EDP. Available here.

13. Nature Climate Change (2019). Strategies to Reduce the Global Carbon Footprint of Plastics. Available here. Nature (2021). Growing Environmental Footprint of Plastics Driven by Coal Combustion. Available here.

14. Nature Climate Change (2019). Strategies to Reduce the Global Carbon Footprint of Plastics. Available here. Nature (2021). Growing Environmental Footprint of Plastics Driven by Coal Combustion. Available here.

15. PlasticsEurope (2016). PowerPoint Presentation: The Plastic Industry (Berlin, 20 August 2016). Available here.

16. Charles D., Kimman L., Saran N. (2021). The Plastic Waste Makers Index. Minderoo Foundation. Available here.

17. Rochman, C., Browne, M.A. (2013). Classify Plastic Waste as Hazardous (Nature, Volume 494, 14 February 2013). Available here.

18. Organization for Economic Cooperation and Development (OECD), Considerations and Criteria for Sustainable Plastics from a Chemicals Perspective Background Paper 1 (Copenhagen, 29-31 May 2018). Available here.

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