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]

The result is a system where inexpensive virgin plastic is used freely and inefficiently, with 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. 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 start of the lifecycle of plastic – when plastic comes into existence as a material.

Defining the lifecycle – where should intervention begin?

In the context of the oil and gas industry, the lifecycle is typically divided into three stages based on functions and operations: upstream, midstream and downstream.

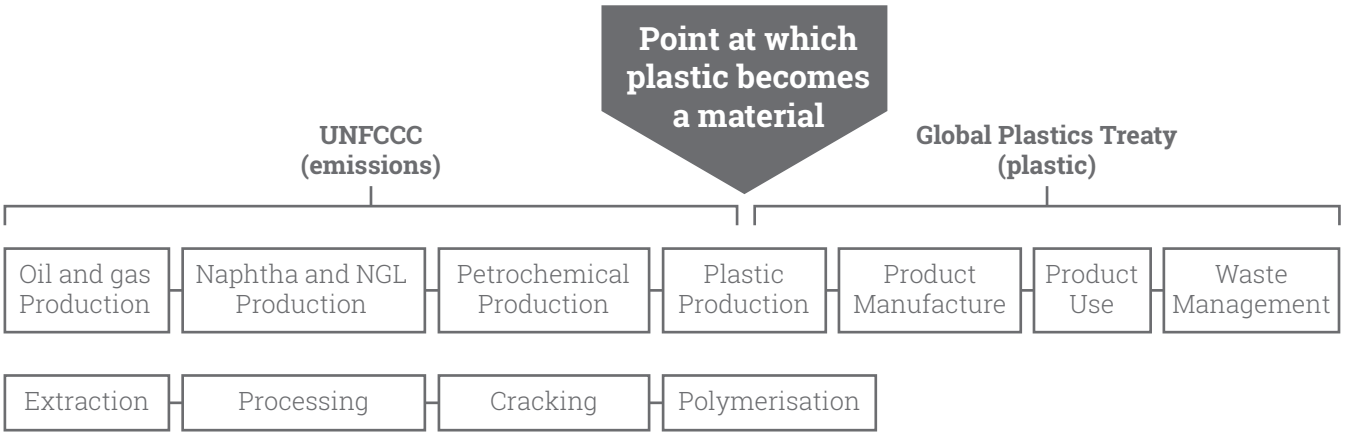
Upstream involves the extraction and gathering of fossil resources; midstream involves the processing of the fossil resources into various products, including naphtha and natural gas liquids such as ethane and propane, which are feedstocks to produce petrochemicals; and downstream includes refining and cracking into petrochemicals.[10] In this context, plastic does not yet exist.

Plastic comes into existence as a material upon polymerisation. For this reason, polymerisation is the natural starting point for any new global agreement on plastic pollution – the beginning of the lifecycle of plastic, as it were – with the lifecycle thereafter divided into three three stages:[11,12]

(i) upstream, *i.e.* production and consumption of virgin plastic polymers;
(ii) midstream, *i.e.* product design and use;
(iii) downstream, *i.e.* plastic waste management and treatment.

In the context of global policy action on plastics, UN Environment and many UN member states recognise the need for 'full lifecycle intervention.'[13] Such an approach has the benefit of defining the lifecycle of plastic as beginning when plastic comes into existence as a material upon polymerisation – the point of virgin plastic production – coinciding with when plastic first enters the environment as a pollutant in the form of spilled pellets, flakes and powders.

It also clearly delineates the scope of measures to be taken compared to the UN Framework Convention on Climate Change (UNFCCC), which addresses greenhouse gas emissions associated with the oil and gas industry and is better situated to address those negative externalities related to climate change:



Objectives

Preventing plastic pollution and promoting a safe circular economy for plastics will not be achieved with mid- and downstream measures alone. Upstream measures controlling the production and consumption of virgin plastic polymers are also needed, for independent reasons and to support mid- 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.

In the view of the authors, Parties should strongly consider tackling unsustainable virgin plastic production and consumption via a start-and-strengthen approach, consisting of two main elements: fact-finding and policymaking.

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.

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.

Main features

Element I – Fact-finding

- **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).[14] 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; (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.[15] 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.

In addition to forming the basis for fact-finding, reporting has independent value. Virgin plastic production is a key data point for understanding progress toward eliminating plastic pollution and promoting a safe circular economy for plastics.[16] In other words, scientists and policymakers are hamstrung in drawing conclusions on the evolution of plastic pollution in the environment and effectiveness of measures on waste management without knowing the quantities and types of virgin plastic being put into the global economy each year as an initial matter.

Element 2 – Policymaking

- **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-down certain problematic 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.

The objective of policymaking should be to establish a set of controls 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.

Additional features

- **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 design standards for common plastic products. 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.

Conclusion

As production and consumption of virgin plastic polymers have reached unsustainable levels, there are clear learnings in the approach adopted by the Montreal Protocol.

More than 150 countries countries now openly support the establishment of a new global agreement[19] and a majority of UN member states recognise the need for "full lifecycle intervention" when it comes to plastics, which must include controls on the production and consumption of virgin plastic polymers.[20]

In addition to reducing plastic pollution and promoting a safe circular economy for plastics, sustainable production and consumption of virgin plastic polymers will reduce biodiversity loss, help mitigate climate change, foster collaboration with virgin polymer producers, assist consumer goods companies and retailers and support municipalities and the waste industry.

For this reason, sustainable producion and consumption is a key part of the 2030 Agenda for Sustainable Development (SDG 12) and a necessary lens through which to view approaches for tackling plastic pollution.

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