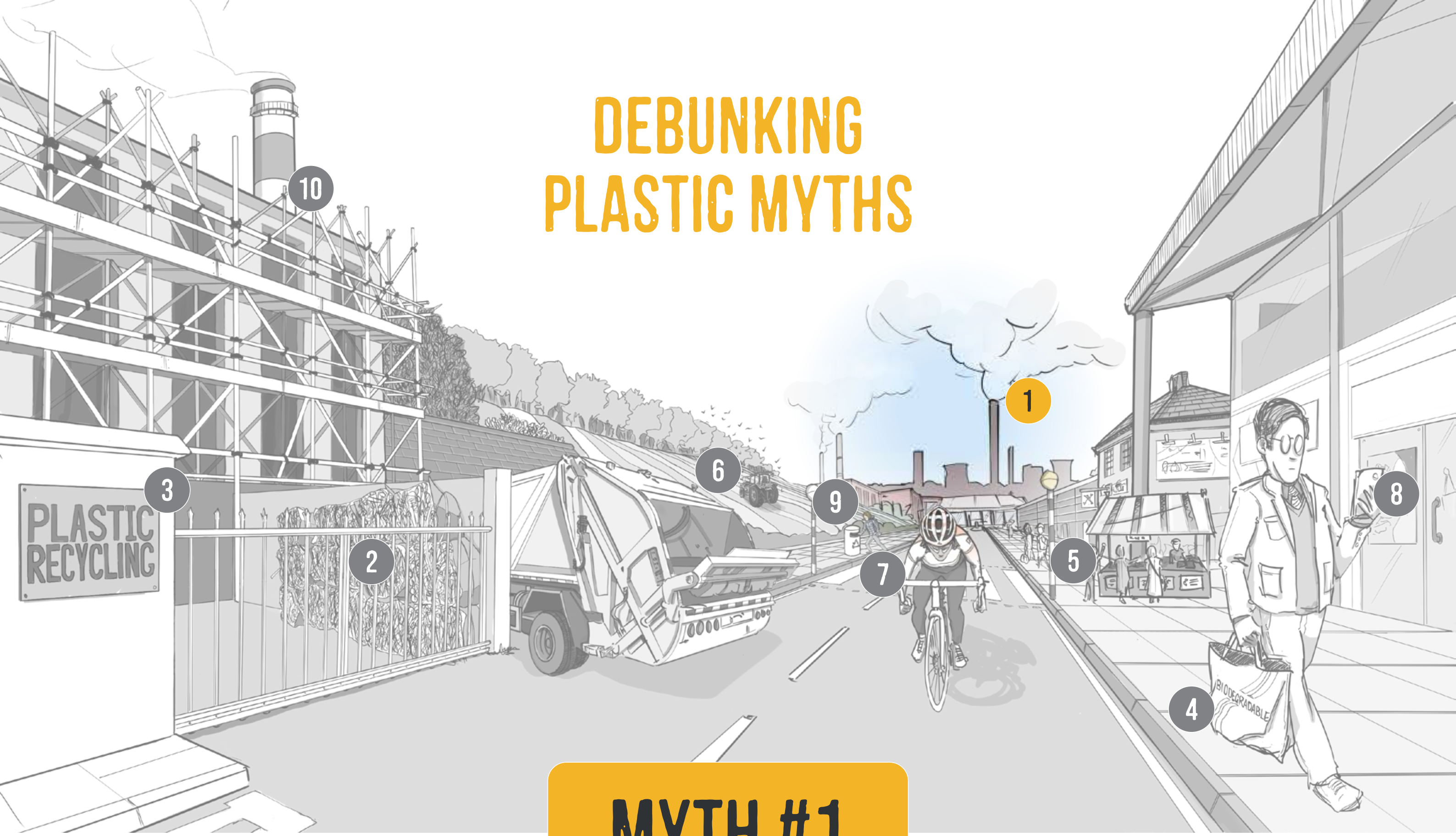
DEBUNKING PLASTIC MYTHS



MYTH #1

THE PRODUCTION OF PLASTICS IS INEXPENSIVE

The determination of the true costs of producing plastics is complicated by a web of subsidies; market forces; by market externalities* related to greenhouse gas emissions; and the disposal costs at end of product life. The hidden environmental costs of plastic are at least 10 times higher than the market price. While the prices paid in the production of plastics are low, the true costs are high and hidden from view.

Plastics are manufactured from natural materials, including crude oil, natural gas, coal, cellulose, salt, grains, corn, potatoes, palm and sugar beet (SAICM & UNEP, 2020). Globally, the low prices for oil and gas make these the most commonly exploited resources for the production of resins, which are further used to create plastic products (Mepex, 2017; Hopewell et al., 2009). Whether producers use oil or gas is contingent upon price and availability, since the process for producing plastic is similar for either feedstock (Hamilton et al., 2019).

In general, after oil or gas are extracted from the ground, they are transported to a refinery, where they are separated into component parts – ethane, propane, and hundreds of other petrochemical products – some of which are used for the production of plastics (Shaw & Sahni, 2014). These chemical components are sent to facilities where they are turned into olefins – the base for most plastics – the most common of which are ethylene and propylene (Kajaste & Oinas, 2021). Then comes the polymerization process, in which light olefin gases – monomers – are transformed into higher molecular weight hydrocarbons – polymers (Hamilton et al., 2019). The next step is compounding, where various blends of materials are melt-blended into thermal, physical, aesthetic, and electrical formulations and then pelletized, followed by a moulding process, which converts these pellets into finished or semi-finished plastic products (Baheti, 2021).

* Externalities refer to situations when the effect of production or consumption of goods and services imposes costs or benefits on others which are not reflected in the prices charged for the goods and services being provided (OECD, 1993)

Prices and costs

New virgin plastics are generally preferred to their metal, glass, and ceramic counterparts (dependent on the product) due to their lower market price, which is attributable to some extent to the large subsidies for the fossil fuel industry (Dalberg Advisors & WWF, 2021; IMF, 2021). Plastic manufacturers exploit economies of scale by purchasing long-term contracts for fixed amounts of fossil materials at a discount (Daniel, 2020). Such long-term contracts take advantage of market competition and developments in technology and production processes to decrease production costs and thereby reduce market prices. These market efficiencies together with the preference for the characteristics of plastic – weight, strength, and the ease with which it can be shaped and moulded – make plastic the solution of choice in many applications. Calculated market costs of plastic produced in 2019 was at least US $370 billion (Dalberg Advisors & WWF, 2021).

The market price of plastics is linked to current fossil fuel prices, which can be influenced by demand, commodity trading, global crises, natural disasters and by other market conditions that make the price of plastics subject to volatility. The supply and demand for virgin plastics, for example, may fluctuate based on the prices of substitutes and on grid energy and additive prices (OECD, 2018). Plant closures caused by crises or disasters can bring about temporary price surges because supplies are often bound to a few major petrochemical manufacturing plants globally (OpenLearn, 2021). Like other manufacturers, petrochemical manufacturing plants have been stricken by the COVID-19 pandemic. In fact, the post-pandemic economic recovery and energy crises has resulted in rising crude oil and natural gas prices (IEA, 2021; IEA, 2022).

In 2021, plastic substitutes became more expensive as several commodity prices increased, such as metal prices, which rose by 48 per cent (WB, 2021). Moreover, grid electricity prices affect the cost of virgin plastic production considerably, given that plastics are one of most energy-intensive materials to produce (OECD, 2018; Gutowski et al., 2013). According to the International Energy Agency (2021), power prices are already affecting operations of electricity-intensive industries. In addition, plastics with more additives – stabilizers, antioxidants, processing aids, lubricants, and pigments – are generally more expensive (OpenLearn, 2021), and a 2021 surge in additive prices of up to 10 per cent further increased the price of plastics (Sherman, 2021).

Market externalities – the hidden costs

The hidden costs associated with the environmental consequences of plastic production and the efforts required to alleviate those consequences add significantly to the true cost of plastic production. These hidden costs are not included in market prices. They are external to the traditional economic model, and are borne not by plastic producers, plastic product manufacturers or consumers, but by society at large in the form of compromised environmental quality and by the implementation of abatement measures and environmental policies (RDC, 2003). All of the extraction, transportation, and manufacturing processes involved in bringing a plastic product to the market result in externalities including natural resource depletion (Mudakkar et al., 2013) and greenhouse gas emissions (Astrup et al., 2009). The production phase accounts for the majority of the climate change impact linked to plastic product life cycles (OECD, 2018), but the mismanagement of plastic waste at the end of the product life cycle is another environmental burden.

The fossil fuels used for the production of plastics are non-renewable resources, and their use exacerbates resource depletion and environmental pollution in the long run (Ahamed et al., 2021). A 2009 report estimated that 8 per cent of global oil was being exploited for the production of plastics with half going to feedstock and half to fuel for the conversion process (Al-Salem et al., 2009). Ten years later, 10 per cent of global oil production was being devoted to plastic production (Jefferson, 2019). The World Economic Forum (2016) projected that if the current growth in plastics use continued as expected, the plastics sector would account for 20 per cent of total oil consumption by 2050.

The extraction, transportation, and processing of fossil fuel feedstocks for the production of plastics releases harmful emissions into the atmosphere. These include direct emissions, such as methane leakage and flaring, emissions from fuel combustion, energy expenditure related to drilling, emissions related to land disturbance resulting from deforestation for the construction of well pads and pipelines and finally, emissions resulting from polymer synthesis, resin plasticization, the creation of olefins, and other chemical refining processes (Hamilton et al., 2019; OECD, 2018).

The sociable lifetime cost of plastic produced in 2019 was calculated between US$2.7–4.8 trillion, and is expected to skyrocket to US$ 4.9–9.3 trillion in 2040 (Dalberg Advisors & WWF, 2021). Overall, the hidden environmental costs of plastic are at least 10 times higher than the market price for plastic (CIEL, 2019; Dalberg Advisors & WWF, 2021).

What can we do?

Businesses can adopt improved designs, more robust business models; governments can develop and adopt public policies on subsidies and procurement; extended producer responsibility; and can use taxes and regulations to provide incentives and disincentives to reduce production. Extended producer responsibility can compensate for some of the costs of negative externalities, but eventually the plastics market must become circular.

1. Consider the plastic life cycle

The plastic life cycle is rarely considered at a holistic level – production, consumption and waste management. Measures should be taken to develop supporting tools to map out and understand the real environmental, economic, social, and technical costs of plastic. Such tools can lead to best policy interventions and can monitor the progress of the measures over time. For instance, the plastic packaging sector can apply the Complex-Value Optimization for Resource Recovery tool, which helps local and national governments assess and monitor plastic packaging and waste management system (Iacovidou et al., 2020).

2. Adopt designs and business models that improve recycling and prolong useful life

The idea behind the design-for-recycling strategy – a key step in the shift to circularity in the plastics market – is to extend the useful life of plastic products as long as possible through redesign that enables better and easier recycling at the end of product life. The approach includes such changes as the removal of certain polymers and toxic additives from plastic production processes (SYSTEMIQ & Handelens Miljøfond, 2021) and the development of more durable, recyclable products with fewer environmental impacts (UNEP, 2017).

3. Realign subsidies to current conditions

Governments can end the fossil fuel subsidies that distort the market in favour of plastics. New environmental conditions call for new subsidy schemes, and the elimination of fossil fuel subsidies, which is long overdue. It is apparent that the barriers to removal of these subsidies are substantial – the political power of the industry, the fear of job losses, and the fear that higher energy prices might hinder growth or trigger inflation (Urpelainen & George, 2021). The removal of fossil fuel subsidies would, however, increase the price of virgin plastic by raising the price producers pay for fossil fuels, and would thus improve the competitive position of recycled plastic at least in terms of price. The provision of subsidies that promote the use of environmentally friendly alternatives to fossil fuels may be part of a government strategy to reduce greenhouse gas emissions (International Energy Agency, 2018).

4. Develop and adopt public policies that move towards a circular plastic economy

An active role for government is critical to the implementation of a circular economy, incentives and market-based instruments such as taxes are proven strategies (Cornago et al., 2021; Vora et al., 2021). Plastic taxes have the goal of nudging the market towards pro-environment behavior, and should target specific objectives (Walker et al., 2020). The Irish plastic bag levy, for example, met its objectives by decreasing plastic bag consumption by about 94 per cent during the first years of its implementation (Convery et al., 2007).

Dozens of countries have already instituted partial bans on single-use plastic items, such as cups, straws, and non-biodegradable plastic bags (UNEP, 2018). Of the 10 per cent of global oil production that was used for plastic production, 40 per cent was dedicated to making single use plastics (Jefferson, 2019). Governments at all levels, therefore, have significant opportunities to use environmental regulations to reduce the proliferation of single-use plastic items along with the associated greenhouse gas emissions and waste.

5. Implement Extended Producer Responsibility

Extended Producer Responsibility (EPR) is a policy option intended to hold manufacturers responsible for the post-consumer treatment or disposal of their products. In practice EPR, should result in design changes that reduce the impact of market externalities by lessening emissions in the production process or by enabling the product waste to be recycled effectively and efficiently. Some systems define specific recycling targets. EPR is normally based on a system whereby producers pay a fee for the management of their products' waste. Extended Producer Responsibility schemes are a step towards a circular economy for plastics.

Governments can also set an example and make a difference by their own actions by adopting green procurement policies that consider the life cycle impacts of the goods and services they buy. Procurement policies on waste, for example, can specify processes and packaging that encourage reuse and recycling or that generate less waste.

References

Ahamed, A., Vallam, P., Iyer, N. S., Veksha, A., Bobacka, J., & Lisak, G. (2021). Life cycle assessment of plastic grocery bags and their alternatives in cities with confined waste management structure: A Singapore case study. Journal of Cleaner Production, 278, 123956. doi: 10.1016/j.jclepro.2020.123956

Al-Salem, S.M., Lettieri, P., and Baeyens, J. (2009). Recycling and recovery routes of plastic solid waste (PSW): A review. Waste Manag. 2009, 29, 2625–2643. doi: 10.1016/j.wasman.2009.06.004

Astrup, T., Fruergaard, T., & Christensen, T. H. (2009). Recycling of plastic: accounting of greenhouse gases and global warming contributions. Waste management and research, 27(8), 763–772. doi: 10.1177/0734242X09345868

Baheti, P. (2021). How Is Plastic Made? A Simple Step-By-Step Explanation. https://www.bpf.co.uk/plastipedia/how-is-plastic-made.aspx

CIEL. (2019). Plastic & Health: The Hidden Costs of a Plastic Planet. https://www.ciel.org/plasticandhealth/

Convery, F., McDonnell, S., & Ferreira, S. (2007). The most popular tax in Europe? Lessons from the Irish plastic bags levy. Environmental and resource economics, 38(1), 1–11.

Cornago, E., Börkey, P., & Brown, A. (2021). "Preventing single-use plastic waste: Implications of different policy approaches", OECD Environment Working Papers, No. 182, OECD Publishing, Paris. doi: 10.1787/c62069e7-en

Dalberg Advisors & WWF. (2021). Plastics: The Costs to Society, The Environment and the Economy. https://mb.cision.com/Public/491/3410236/990cbb97a02e0eee.pdf

Daniel, J. (2020). Contracts to Burn: How Long-Term Fossil Fuel Contracts and Power Purchase Agreements Lock In Pollution. The Equation. https://blog.ucsusa.org/joseph-daniel/contracts-to-burn/?fbclid=IwAR3zbMGYW_2SZd5BL9q9He72kLEFJweBcCf-Z34HqMdnioP-5ggbQIy0ejM

Gutowski, T. G., Sahni, S., Allwood, J. M., Ashby, M. F., & Worrell, E. (2013). The energy required to produce materials: constraints on energy-intensity improvements, parameters of demand. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 371(1986), 20120003.

Hamilton, L. A., Feit, S., Muffett, C., Kelso, M., Rubright, S. M., Bernhardt, C., & Labbé-Bellas, R. (2019). Plastic and climate: the hidden costs of a plastic planet. Center for International Environmental Law (CIEL). https://www.ciel.org/plasticandclimate/

Hopewell, J., Dvorak, R., & Kosior, E. (2009). Plastics recycling: challenges and opportunities. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1526), 2115–2126. doi: 10.1098/rstb.2008.0311

Iacovidou, E., Ebner, N., Orsi, B., & Brown, A. (2020). Plastic packaging – How do we get to where we want to be? https://www.ezview.wa.gov/Portals/_1962/Documents/rdcab/Brunel%20Univ%20study.pdf

International Energy Agency (IEA). (2018). The Future of Petrochemicals. Towards more sustainable plastics and fertilizers. International Energy Agency.

International Energy Agency (IEA). (2021). Oil Market Reports. https://www.iea.org/reports/oil-market-report-october-2021

International Energy Agency (IEA). (2022). Oil Market Reports. https://www.iea.org/reports/oil-market-report-february-2022

International Monetary Fund (IMF). (2021). Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies. WP/21/236. International Monetary Fund.

Kajaste, R., & Oinas, P. (2021). Plastic value chain – Abatement of greenhouse gas emissions. AIMS Environmental Science, 8(4):371–392. doi: 10.3934/environsci.2021024

Mepex. (2017). Basic Facts Report on Design for Plastic Packaging Recyclability. Mepex Consult AS.

Mudakkar, S.R., Zaman, K., Khan, M.M., & Ahmad, M. (2013). Energy for Economic Growth, Industrialization, Environment and Natural Resources: Living with Just Enough. Renew. Sustain. Energy Rev. 2013, 25, 580–595. doi: 10.1016/j.rser.2013.05.024

OpenLearn. (2016). Introduction to polymers. The Open University. https://www.open.edu/openlearn/science-maths-technology/science/chemistry/introduction-polymers/altformat-printable

RDC. (2003). Evaluation of costs and benefits for the achievement of reuse and recycling targets for the different packaging materials in the frame of the packaging and packaging waste directive. 94/62/EC.RDC-Environment & Pira International. https://ec.europa.eu/environment/pdf/waste/studies/packaging/costsbenefits.pdf

SAICM & UNEP. (2020). Plastics and Chemicals of Concern In Consumer Products. http://www.saicm.org/Portals/12/Documents/Publications/SAICM_Policy_Brief_Plastics.pdf

Shaw, D. K., & Sahni, P. (2014). Plastic to oil. Journal of Mechanical and Civil Engineering, 46–48. https://www.researchgate.net/profile/Dipak-Shaw/publication/276205830_Plastic_to_oil/links/5552468608ae6fd2d81d4579/Plastic-to-oil.pdf

Sherman, L. M. (2021). BASF Increases Prices of Additives for Plastic Applications. Plastics Technology. https://www.ptonline.com/news/basf-increases-prices-of-additives-for-plastic-applications?fbclid=IwAR1LqmLAim83vAI5ucrzQeb9r1uiayth4cv7cLnF7RXHM65GHZgZQYplU8s

SYSTEMIQ & Handelens Miljøfond. (2021). Achieving Circularity. A Zero-Waste Circular Plastic Economy in Norway.

UNEP. (2017). Stockholm Convention on Persistent Organic Pollutants (POPs). The 16 New POPs. http://www.pops.int/TheConvention/ThePOPs/TheNewPOPs/tabid/2511/Default.aspx

UNEP. (2018). Single-use Plastics: A Roadmap for Sustainability (Rev. ed., pp. vi; 6). https://wedocs.unep.org/handle/20.500.11822/25496

Vora, N., Christensen, P. R., Demarteau, J., Baral, N. R., Keasling, J. D., Helms, B. A., & Scown, C. D. (2021). Leveling the cost and carbon footprint of circular polymers that are chemically recycled to monomer. Science advances, 7(15), eabf0187. doi: 10.1126/sciadv.abf0187

Walker, T., Gramlich, D., & Dumont-Bergeron, A. (2020). The case for a plastic tax: a review of its benefits and disadvantages within a circular economy. Sustainability.

World Bank Group (WB). (2021). Commodity Markets Outlook: Urbanization and Commodity Demand, October 2021. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO. https://openknowledge.worldbank.org/bitstream/handle/10986/36350/CMO-October-2021.pdf

World Economic Forum (WEF). (2016). The New Plastics Economy: Rethinking the Future of Plastics. World Economic Forum, Geneva, Switzerland. http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

OECD. (2002). Glossary of Statistical Terms. https://stats.oecd.org/glossary/detail.asp?ID=3215

Jefferson, M. (2019). Whither Plastics?—Petrochemicals, plastics and sustainability in a garbage-riddled world. Energy Res. Soc. Sci. 2019, 56, 101229

Urpelainen, J. & George, E. (2021). Reforming global fossil fuel subsidies: How the United States can restart international cooperation 14 July 2021. Brookings Institution. https://www.brookings.edu/research/reforming-global-fossil-fuel-subsidies-how-the-united-states-can-restart-international-cooperation/

Recommended citation: GRID-Arendal (2022, March 15). Plastic Myths – What can we do? Website. https://plasticsmyths.com/