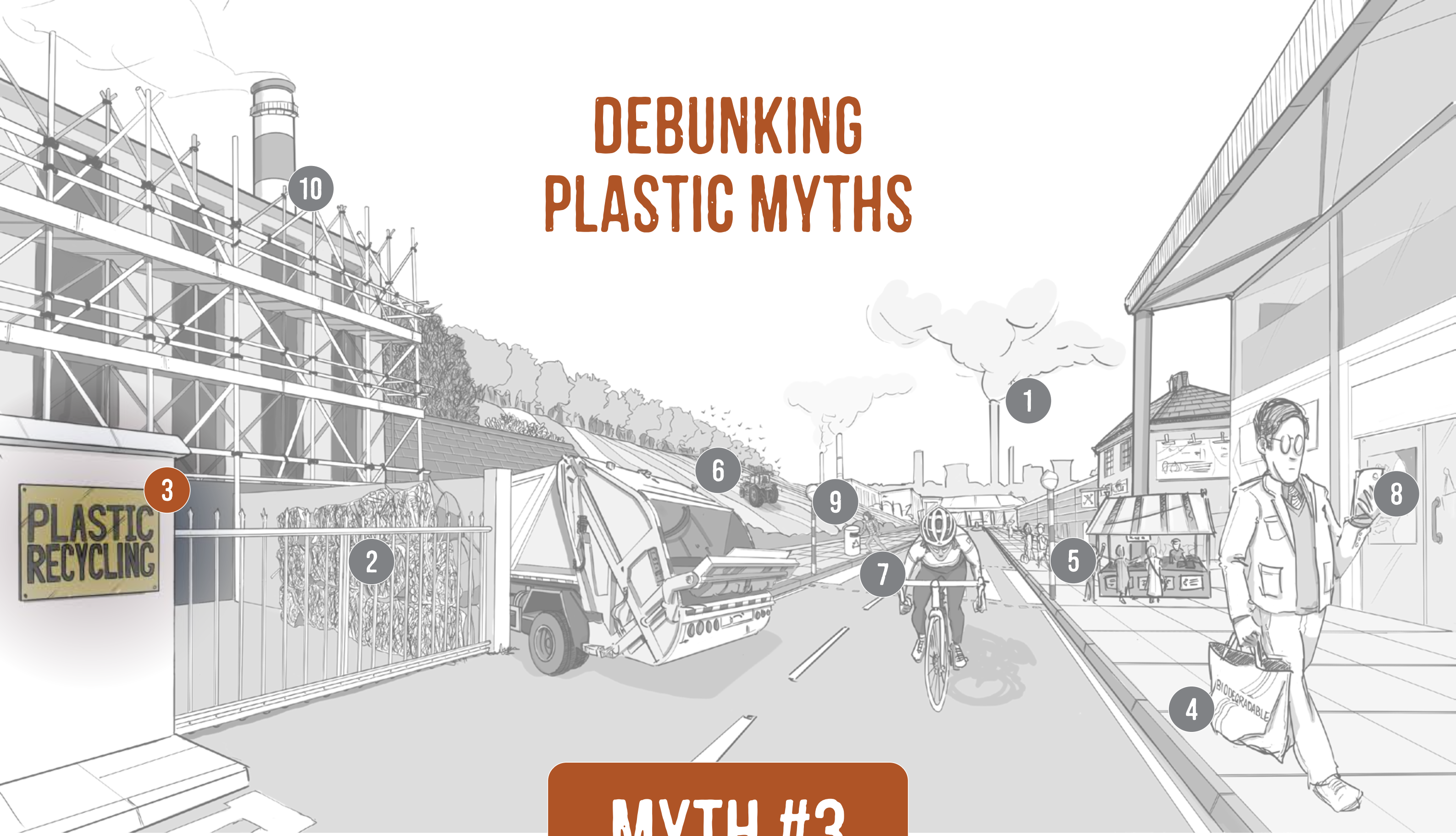
DEBUNKING PLASTIC MYTHS



MYTH #3

ALL PLASTIC CAN BE RECYCLED

Most plastics can be recycled, but whether they actually are or not depends on the cost of doing so. Non-homogenous material, costs for recycling, additives and contaminants are the main reasons why plastic waste currently generated cannot be recycled. No more than 10 per cent of the roughly 348 million tonnes of new plastic produced annually has been recycled to date (Geyer, 2020). Even one of the most widely recycled plastics (HDPE, PET) has a recycling rate of only 30 to 50 per cent of the waste generated. There are numerous reasons behind the low percentage of plastic recycling.

Non-homogeneous material

The non-homogeneous nature of plastic waste carries significant implications for the recycling process (Eriksen et al., 2018). Many products are made using more than one type of plastic, and the different materials may have different processing temperatures and melting points, making the process of separating the materials more difficult and expensive (Hahladakis & Iacovidou, 2018). Even products made of the same type of plastic produced with different methods can create chemical combinations that react differently when they are melted down for recycling (American Chemistry Council, 2021).

Multilayer or composite materials such as paper and plastics, metals and plastics, or plastics and glass fibre are hard to separate. Therefore reprocessing will only yield a low value composite. These problems are created by the design of packaging which selects materials for their barrier properties, strength, and storage stability to protect the product. The design is not made for recycling. In recent years the growth in plastic/paper laminates, such as "paper" cups, has been offered as a solution to plastics, but these products may also undermine the recycling process.

In reality, the preference for recycling will go to materials that give a return on the recycling efforts.

Small volumes of specific material will most likely skip the recycling process, but the material which is recycled degrades each reprocessing time. Therefore, perpetual mechanical recycling of separated materials will not be possible in perpetuity.

Additives and contamination

Most plastic products are made from a mixture of plastic polymers and additives that meet manufacturer requirements including but not limited to flame retardants and antistatic agents, antioxidants, colourants, fillers, and reinforcements. These additives represent an estimated 7 per cent of the mass of final plastics by volume (Geyer, 2020), and complicate the recycling of the waste. Although some additives can be removed by washing, many household items require additives that make separation during recycling difficult and that degrade the quality of the recycled plastics (Eriksen et al., 2018). The use of additives may interfere with the development of a circular plastic economy because the recycling costs are too high to justify the effort.

Food and beverage residues are also a common form of contamination in plastic waste. The plastic packaging inherent in the fast food and ready-made food culture generates an enormous amount of contaminated waste. The process of removing contaminated plastics requires special line or manual cleaning, and is particularly costly, but the failure to remove contamination renders the material worthless (Eriksen et al., 2018).

Plastic waste can also be contaminated with glues, inks, and paper labels. Inks that are used for printing information directly on packaging product will interfere with the recycling process and lower the quality of the recycled material (Mepex, 2017). The presence of even a small amount of paper or glue can ruin a batch as remolding from this material creates faults in the new products.

Black plastics are made with carbon black to absorb light, but the optical scanners used in processing plants cannot identify and sort black plastic, so it will either contaminate the batch of recycled material or will go to incineration or landfill (Osmanski, 2021; Adams, 2020; OECD, 2021). While industry is trying to find new detectable pigments, black plastic – which is present in about 15 per cent of our domestic products – is left out of processing (Turner, 2018; Adams, 2020).

Costs of recycling

Recycling is a costly task as it includes collection and reprocessing. Some materials elude the recycling technology used for sorting, and some have no standardized protocols. The result of these complications is that the collection and the reprocessing is too expensive for recycled material to sell at competitive market prices.

Promising recycling innovations such as advanced spectroscopy, machine learning, and artificial intelligence exist, but access to these technologies is unevenly distributed (Shiran & Kremer, 2021). Technical capacity such as sorting technology is limited, and the recycling systems are not robust enough to keep up with demand (Kirilyuk et al., 2020). Processing loss rates, which measure the percentage of the material lost in the recycling process, currently stand at about 35–55 per cent (Shiran & Kremer, 2021). In addition, plastic waste collection varies widely from place to place, and is sometimes limited to higher value items such as PET bottles.

Coding plastics for recycling

The American Society for Testing and Materials has developed a coding system to help consumers and recyclers sort products on the basis of the different polymer types used in making the products. The system identifies six basic types plus a catch-all category, 'other'.

Polyethylene terephthalate (PET, code 01) is one of the most widely available plastics, and is commonly used for plastic bottles and food packaging among other uses. High-density polyethylene (HDPE, 02) is used in plastic bottles, milk jugs, shampoo bottles, and other applications. Annual global production comes to 35 million tonnes for PET, and 57 million tonnes for HDPE. These are the most widely recycled plastics (Geyer, 2020). Blue Weave Consulting (2021) reports that, "According to the PET Resin Associa-tion, the PET recycling rate is 31 per cent in the United States and 52 per cent in Eu-rope." This relative success is attributable to homogeneous nature of the material with low contamination nature, and to the higher prices recycled PET and HDPE bring com-pared to other recycled plastics.

Polyvinyl chloride (PVC, 03) is used in pipes, fittings, wiring, cables, and other applications, but PVC has a high additive content and corresponding separation costs. The an-nual production is estimated at 39 million tonnes (Geyer, 2020), but very little of that is recycled. The main challenges lie in material collection, sorting, and the presence of some additives (Miliute-Plepiene et al., 2021; EURIC, 2020).

Low-density polyethylene (LDPE, 04) is used in food wrapping and garbage bin liners, with an annual production of 70 million tonnes. Polypropylene (PP, 05) is used in pack-aging, bottle lids, food tubs, furniture, and automobile parts, with an annual production of 75 million tonnes (Geyer, 2020). Both are recyclable but are often discarded by recy-cling centres. LDPE presents a risk of clogging the machinery and PP needs a slow recy-cling process that may add to increased costs, including maintenance.

Polystyrene (PS, 06), the material used to produce expanded polystyrene (EPS), has an annual production of 26 million tonnes (Geyer, 2020), but due to the limitations and expense of current recycling technologies, not much polystyrene gets recycled. In Eu-rope, United States, Japan, and some other countries, the EPS boxes used for protective and isothermal packaging are collected and recycled (Millicer et al., 2018; Thornberry et al., 2020; JEPSA Country Report, 2018).

All plastics that do not fall into the previous types are included in the "other" category (07), which covers a range of types and uses. Other plastics are manufactured in smaller, but still significant amounts compared to plastics in the first six categories, and production is expected to grow (Markets and Markets, 2021). The recycling protocols for plastics in this category are not standardized, and mechanical recycling technologies are limited. Treatment usually includes comminution techniques to reduce the size of the waste and/or thermal processing to break the waste down into materials and energy (Pickering, 2008), but most of these plastics are disposed in landfills (Rosa et al., 2018).

What can we do?

Achieving long-term solutions to the shortcomings of the current recycling systems will depend to a large extent on the development of viable markets for reprocessed plastic. Other actions include design innovations, incentives to invest in recycling capacity, and improvements in recycling technologies.

1. Develop recycling markets for all plastics

Modest markets already exist for some plastics, but others are struggling and need support. Improvements in processing technologies may lead to increases in recycled material, and that material needs a market. The development of markets for low-density polyethylene and polypropylene, for example, is a critical step toward increasing their recycling levels (Antonopoulos et al., 2021). From a wider perspective, markets for recycled material need to develop in step with design and processing improvements in order to establish and maintain a recycling system that supports circularity.

2. Design plastics for recycling

Under current designs, an estimated 30 per cent of plastic packaging will never be reused or recycled (MacArthur Foundation, 2016). The design changes that can improve this situation include: simplifying multilayer and composite materials and switching to mono-materials; removing dyes, plastic pigments, and other additives; eliminating the use of polymers that are difficult to recycle; and introducing alternative materials that do not harm human health or the environment (Shiran & Kremer, 2021; MacArthur Foundation, 2016). Life cycle assessments should guide the development of these design changes.

3. Improve recycling technologies

Improvements in sorting and recycling processes are necessary, as are investments in new plastic waste recycling technologies (The Nordic Region, 2014; Shiran & Kremer, 2021). Strategies for strengthening the sorting and mechanical recycling infrastructure could include incentives that promote the use of recycled material and disincentives that impede the use of virgin materials and the waste-to-energy incineration of plastic (Bening et al., 2021). As an important part of the overall improvement in recycling, collection systems need to keep pace with the requirements of the recycling technology.

4. Set targets for recycled content in new goods

The demand for recycled plastics needs to be stronger and to include a wider range of plastic grades (Shiran & Kremer, 2021). The European Recycling Industries Confederation calls for recycled content in products to boost the plastic recycling end market, and some countries have already set requirements for a certain percentage of recycled materials to be incorporated into products and packaging. The development and implementation of these measures should consider the challenges in terms of both quality and quantity that may exist in the present capacity of plastic recycling.

5. Increase plastic collection rates

The current plastic waste collection systems require innovative solutions that bring higher quality recyclables into the recycling market. One such collection programme at national scale – the Deposit and Refund Scheme – was originally designed for beverage containers but can be more widely applied. Consumers pay a deposit when they purchase a product, and get their deposit back when they return the recyclable material. Careful and thoughtful design and implementation has resulted in well-functioning deposit systems in many countries.

6. Adopt public policies on Extended Producer Responsibility and eco-modulation fees

Extended Producer Responsibility (EPR) is a strong policy tool that can help facilitate recycling and promote environmentally friendly product design (Pouikli, 2020; Walker et al., 2021). EPR is intended to hold manufacturers responsible for the post-consumer treatment or disposal of their products. In practice, EPR can result in design changes that enable the effective and efficient recycling of product waste. In some cases, pro-ducers pay a license fee for the management of their products' waste.

Eco-modulation fees in EPR schemes provide producers with an incentive for introducing upstream design changes aimed at reducing the environmental impacts of their products (Stewardship Institute, 2020). Europe has widely adopted eco-modulation fees for packaging in an effort to encourage manufacturers and retailers to use plastic packaging that can be recycled. Materials that are easy to recycle and have high market value, such as PET products, may have lower fees than materials that are difficult to recycle or have a lower market value such as LDPE products (Hogg et al., 2020). National guidelines for eco-modulation of fees for packaging and other plastic products will lead to the recovery of more and higher quality plastics.

References

Adams, R. (2020). Plastic pigment & masterbatch suppliers offer alternatives to carbon black in order to facilitate recycling. Focus On Pigments, 2020(4), 1–2. doi: 10.1016/j.fop.2020.04.001

American Chemistry Council, (2021). The Basics of Plastic Manufacturing, How Plastics Are Made. https://plastics.americanchemistry.com/How-Plastics-Are-Made/

Antonopoulos, I., Faraca, G., & Tonini, D. (2021). Recycling of post-consumer plastic packaging waste in the EU: Recovery rates, material flows, and barriers. Waste Management, 126, 694–705. doi: 10.1016/j.wasman.2021.04.002

Bening, C., Pruess, J., & Blum, N. (2021). Towards a circular plastics economy: Interacting barriers and contested solutions for flexible packaging recycling. Journal Of Cleaner Production, 302, 126966. doi: 10.1016/j.jclepro.2021.126966

Blue Weave Consulting. (2021). Global Plastic Recycling Market Witnessing an Upward Growth Trajectory—Projected to Reach USD 71.5 Billion by 2027 | BlueWeave. https://www.globenewswire.com/news-release/2021/12/15/2352933/0/en/Global-Plastic-Recycling-Market-Witnessing-an-Upward-Growth-Trajectory-Projected-to-Reach-USD-71-5-Billion-by-2027-BlueWeave.html

Delva, L., Deceur, C., Damme, V.N. & Ragaert K., (2019). Compatibilization of PET-PE blends for the recycling of multilayer packaging foils. https://biblio.ugent.be/publication/8526225/file/8614746.pdf

Eriksen, M.K. Pivnenko, K., Olsson, M.E. & Astrup, T.F. (2018). Contamination in plastic recycling: Influence of metals on the quality of reprocessed plastic, Waste Management, September 2018, 595–606. https://www.sciencedirect.com/science/article/abs/pii/S0956053X1830494X

European Commission. (2018). A European Strategy for Plastics in a Circular Economy.

EURIC. (2020). Plastic Recycling Factsheet. EuRIC AISBL. https://circulareconomy.europa.eu/platform/sites/default/files/euric_-_plastic_recycling_fact_sheet.pdf

Geyer, R., (2020). Production, Chapter 2 – Production, Use and Fate of Synthetic Polymers in Plastic Waste and Recycling. Letcher, T.M. (ed.). Cambridge, MA: Academic Press. pp. 13–22.

Hahladakis, J., & Iacovidou, E. (2018). Closing the loop on plastic packaging materials: What is quality and how does it affect their circularity?. Science Of The Total Environment, 630, 1394–1400. doi: 10.1016/j.scitotenv.2018.02.330

Hogg, D., Sherrington, C., Papineschi, J., Hilton, M., Massie, A., & Jones, P. (2020). Study to Support Preparation of the Commission's Guidance for Extended Producer Responsibility Schemes. Bristol: Eunomia. https://op.europa.eu/en/publication-detail/-/publication/08a892b7-9330-11ea-aac4-01aa75ed71a1/language-en

JESPA. (2018). JESPA Country Report 2018. https://epsrecycling.org/content/6-eps-recycling/jepsa-country-report-2018_nov-2019.pdf

Krauklis, E.A., Karl, C.W., Gagani I. A., & Jørgensen K.J. (2021). Composite Material Recycling Technology—State-of-the-Art and Sustainable Development for the 2020s. Journal of Composites Science. doi: doi.org/10.3390/jcs5010028

Kirilyuk, M., Mayer, M., Simon T. j., & Witte, C., (2020). The European recycling landscape – the quiet before the storm? McKinsey&Company. https://www.mckinsey.com/industries/chemicals/our-insights/the-european-recycling-landscape-the-quiet-before-the-storm

Markets and Markets. (2021). https://www.marketsandmarkets.com/Market-Reports/fluor-polymer-market-497.html?gclid=Cj0KCQiA-K2MBhC-ARIsAMtLKRuMsPBwAjUXhR0n1f7RUqyBSg2DC5iGNTbQ7rwmqmT6nsk2gRgGX3caAhb7EALw_wcB

Mepex Consult. (2017). Basic Facts Report on Design for Plastic Packaging Recycability. https://www.grontpunkt.no/media/2777/report-gpn-design-for-recycling-0704174.pdf

Miliute-Plepiene, J., Fråne, A., & Almasi, A. (2021). Overview of polyvinyl chloride (PVC) waste management practices in the Nordic countries. Cleaner Engineering And Tech-nology, 4, 100246. doi: 10.1016/j.clet.2021.100246

Millicer, H., Martin, R., O´Farrell, K., & Rako, D. (2018). The Recovery of Expanded Polysterene in Australia: Current Situation and Future Opportunities. Extract Report to Act Government – for Public Use. One Planet Consulting. https://www.helenmillicer.com/wp-content/uploads/2018/12/2017-18_EPS_PublicReport_OnePlanetConsulting.pdf

The MacArthur Foundation & New Plastics Economy. (2016). The New Plastic Economy: Rethinking the Future of Plastics and Catalysing Actions. https://ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics-and-catalysing

OECD. (2021). Case study on detergent bottles. An example of weighing sustainability criteria for rigid plastic non-food packaging Series on Risk Management No.63. OECD. Rhttps://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/CBC/MONO(2021)31&docLanguage=En

Osmanski, S. (2021). Why Isn't Black Plastic Recyclable? Here's What You Should Know. Green Matters. https://www.greenmatters.com/p/black-plastic-recyclable

Pickering, S. (2006). Recycling technologies for thermoset composite materials—current status. Composites Part A: Applied Science And Manufacturing, 37(8), 1206–1215. doi: 10.1016/j.compositesa.2005.05.030

Pouikli, K. (2020). Concretising the role of extended producer responsibility in European Union waste law and policy through the lens of the circular economy. ERA Forum, 20(4), 491–508. doi: 10.1007/s12027-020-00596-9

Rosa, An.D., Blanco, Ig., Diosdado R. Banatao D.R., Stefan J. Pastine St.J., Björklund An., & Cicala G. (2018). Innovative Chemical Process for Recycling Thermosets Cured with Recyclamines® by Converting Bio-Epoxy Composites in Reusable Thermoplastic—An LCA Study. https://pubmed.ncbi.nlm.nih.gov/29495571/

Stewardship Institute. (2020). Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance. https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/packaging/2020.03.17_PSI_EPR_for_PPP.pdf

Fråne, A., Stenmarck, Å., Gislason, S., Lyng, K., Løkke, S., Castell-Rüdenhausen, M., & Wahlström, M. (2014). Collection and recycling of plastic waste; Improvements in existing collection and recycling systems in the Nordic countries. TemaNord 2014:543. Nordisk Ministerråd. https://issuu.com/nordic_council_of_ministers/docs/tn2014543_web

Thomas, G.P. (2012). Recycling of Polyethylene Terephthalate (PET or PETE), AZO Cleantech. https://www.azocleantech.com/article.aspx?ArticleID=254

Thornberry, M. (2020). Expanding the Knowledge Base of Expanded and Extruded Polystyrene: A Report. REPAK. Maeve Thornberry&Associates. https://repak.ie/images/uploads/reports/Expanding_the_Knowledge_Base_of_Expanded_and_Extruded_Polystyrene.pdf

Turner, A. (2018). Black plastics: Linear and circular economies, hazardous additives and marine pollution. Environment International, 117, 308–318. doi: 10.1016/j.envint.2018.04.036

Shiran, Y., & Kremer, A. (2021). Achieving Circularity – A zero waste circular plastic economy in Norway. SYSTEMIQ. Handelens Miljøfond. https://www.systemiq.earth/wp-content/uploads/2021/06/AchievingCircularity-MainReport-June2021.pdf

UNEP. (2018). Africa Waste Management Outlook. UNEP. https://wedocs.unep.org/handle/20.500.11822/25514

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