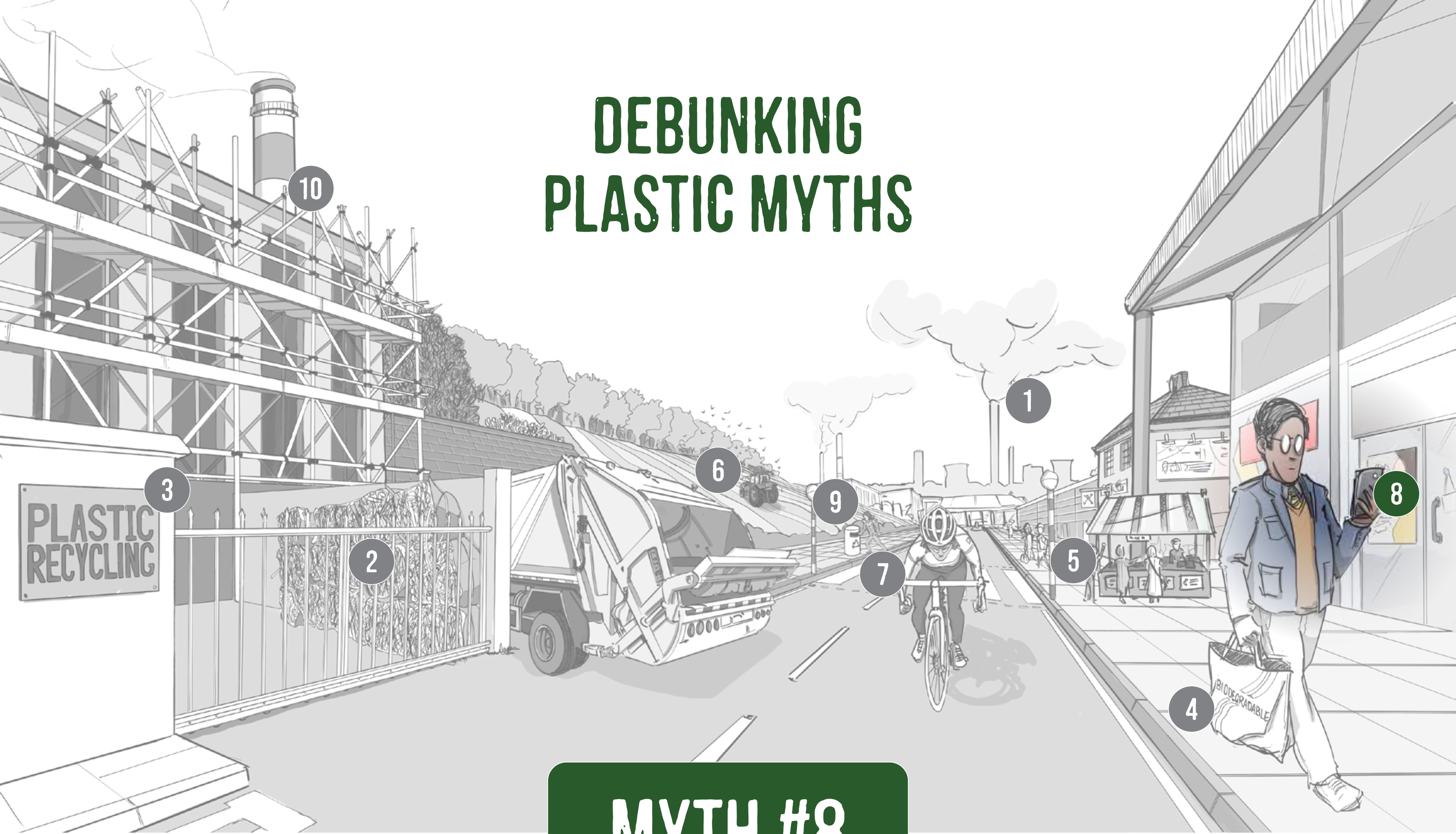
DEBUNKING PLASTIC MYTHS



MYTH #8

E-WASTE IS NOT A PART OF THE PLASTIC WASTE PROBLEM

The waste from electrical and electronic equipment at the global level ran to an estimated 53.6 million tonnes in 2019 and is projected to reach 74.7 million tonnes by 2030 (Baldé et al., 2017; Forti et al., 2020). The percentage of plastic in electrical and electronic equipment (and the resulting plastic waste) varies by the size of the equipment, but analysts generally agree that about 25 per cent of the waste from electrical and electronic equipment by weight, is plastic (Taurino et al., 2010; Ardolino et at., 2021). Thus, e-waste plays a significant part in the plastic waste challenges.

Continuous technological advancement has led to the proliferation of electrical and electronic equipment (EEE) ranging from large household appliances to smaller devices. Rapid technological obsolescence, limited repair options, and the availability of newer, more sophisticated replacements at accessible prices result in a substantial portion of these products becoming waste EEE, or WEEE (Ahiwar & Tripathi, 2021; Anandh et al, 2021). In smaller devices, the estimates of plastic content by weight run at almost 50 per cent (Martinho et al., 2012). For larger appliances, the estimates of plastic by weight converge at about 10 per cent (ibid).

Recycling WEEE

Only 17 per cent of the world's electrical and electronic equipment waste is documented as properly collected and recycled (Forti et al., 2020). This represents an increase over previous years, but the generation of e-waste is increasing at a faster rate than the rate of increase for recycling (ibid.). Collection and recycling rates differ from region to region – about 40 per cent is reported in Europe and less than 1 per cent in Africa (ibid.). The technology for recycling e-waste exists but it can be an expensive process, and the focus of e-waste recycling is mainly on precious metals.

The official recycling markets – those that operate under government regulations – have demonstrated economic viability (Cardamone et al., 2021). About half of the most common plastics are recycled and sent to plastic remanufacturing, and the rest are sent to energy recovery in Europe (Ardolino et al., 2021; Haarman et al., 2020). Recycling capacities that are insufficient to keep up with the waste generation may explain this situation (Cardamone et al., 2021).

The low official rates for collection and recycling are partially attributable to the exporting of e-waste from developed to developing countries where the e-waste management falls outside of official collection and reporting systems. This unregulated management of e-waste may include the burning of plastics in order to recover valuable metals, which may result in the release of persistent organic pollutants (Petrlik et al., 2021). Small household e-waste may also fall outside of recycling efforts as people dispose of this waste with other household waste sent to landfills.

WEEE composition

Electrical and electronic equipment contains a range of polymers and additives that can represent a significant portion of some products – 32 per cent (by weight) of an ordinary flat panel display for a laptop or a tablet, for example (Haarman et al., 2020). The current recycling options allow for the sorting and remanufacture of light polymers but the heavier polymers and blends – such as polycarbonate and acrylonitrile butadiene styrene (ABS) – remain challenging (Ardolino et al., 2021; Haarman et al., 2020; Cardamone et al., 2021).

The plastics used in EEE invariably include additives such as colourants, stabilizers or plasticizers, antistatic agents, flame retardants, pigments, fillers, catalysts, reinforcing glass, or carbon fibres, and may contain hazardous compounds (Buekens & Yang, 2014). The presence of these additives in the plastics in WEEE complicates the recycling process (PolyCE-Project, 2021) and unless the process can separate the material, the resulting recycled products could be of low quality (Schlummer & Mäeurer, 2006; Cardamone et al., 2021).

The additives used to darken plastics in cathode ray tube televisions and small electronic and electrical devices are common contaminants in WEEE (Grigorescu et al., 2019) and can hamper plastic identification and thus render the recycling process inefficient (Martinho et al., 2012). Of greater concern however, is the possible presence of high levels of brominated flame retardants (BFRs) and heavy metals which, when landfilled or improperly recycled, present serious risks to the environment and human health (Buekens & Yang, 2014; Hahladakis et al., 2018; Turner, 2018; Wang & Xu, 2014). The proportion of BFRs in the plastics in flat panel displays, for example, runs to 13 per cent (Haarman et al., 2020).

In spite of the prohibition on the production and use of several BFRs, a multitude of items in the end-of-life streams contain traces of these substances, some at levels exceeding the permitted limits (Taurino et al., 2010). A recent analysis finds that 22 per cent of the brominated diphenyl ether flame retardants in WEEE are likely to end up in recycled plastics because they are not properly separated out of WEEE plastic flows (Leslie et al., 2016). Shredded plastics sampled from recycling centres also showed concentrations of these substances (ibid.).

What can we do?

Solutions that meet the need for increased WEEE plastic recycling may come in several forms – increase official collection systems, design changes, improvements in recycling technology, better processing, and longer product life. A life cycle approach is implicit in all these solutions.

1. Design for recycling

More than 80 per cent of a product's environmental impact is determined at the design stage (Querol, 2021), so designers need to understand the implications of their choices of materials on recycling (Dalrymple et al., 2007). Design-for-recycling and other eco-design strategies allow the design of more environmentally friendly products by enabling better and easier recycling at the end of product life. Guidelines for these strategies as they apply to EEE include the minimization of additives, the avoidance of hazardous substances, and the use of common plastics (PolyCE-Project, 2021).

2. Develop improved recycling technologies

The capacity of recycling globally needs to keep pace with the increase in consumption of electrical and electronic equipment. Recycled polystyrene, which has a growing market of potentially high value, is widely used in electrical and electronic equipment but the recycling of polystyrene is expensive and a more economically viable technology may increase the amount that is recycled successfully. New recycling technologies that are capable of eliminating hazardous substances from WEEE plastics are appearing in the market, although most are still experimental (González et al., 2016; Schlummer et al., 2016; NONTOX Project, 2019; Wagner & Schlummer, 2020; Ardolino et al., 2021).

3. Improve the collection, sorting, and monitoring of e-waste

The serious threats to human health and the environment from e-waste call for urgent action to increase controlled e-waste management in all countries. The developing countries that accept exported e-waste from developed countries mainly target rare metals and have no facilities for the proper treatment of the e-waste.

Extended Producer Responsibility (EPR) is intended to hold manufacturers responsible for the post-consumer treatment or disposal of their products. In practice, a small fee at the production stage would subsidize the collection and recycling of WEEE with the intent of increasing the low recycling rates. EPR may also include traceability schemes that use smart labels, databases, or cloud-based services to improve monitoring and reporting (Baxter et al., 2015). Governments need to establish a clear legal framework with impl ementation and enforcement to ensure the success of EPR, which can also encourage design changes that enable the effective and efficient recycling of product waste.

The European Union has designated six categories of WEEE to help organize recycling streams and processes. The separate waste streams contain less diversity in material types, and processing is more straightforward (PolyCE-Project, 2021). The segregation of WEEE plastics into specific, clearly defined streams at the collection stage can increase WEEE plastic recycling levels (Dalrymple et al., 2007) and a sorting protocol for WEEE plastics like the EU sorting of WEEE could have similar benefits.

4. Extend the product life of electrical and electronic equipment

The rationale behind the planned obsolescence strategy is to design products with a pre-established, limited service life so that consumers replace the products more often. Several promising measures are in place but they do not explicitly prohibit planned obsolescence (Malinauskaite & Erdem, 2021). Stricter laws in the context of design-for-recycling and right to repair could compel businesses to build more durable EEE, which could easily be reused, remanufactured, or repaired. As a complementary measure, governments could offer tax relief and exemptions to businesses that sell repaired, reconditioned, refurbished, or remanufactured products (Gharfalkar et al., 2016).

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