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Plastics recycling: a path to sustainability

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The use of plastics is widely engrained in our everyday lives and provides us with immense convenience. They are used in our toothbrushes, single use Keurig pods, plastic wraps for food and its containers, bottles for water and laundry detergent, encasing our laptops and monitors, and countless other uses. Global plastic production and consumption continues to increase, and COVID-19's impact on hygiene, via single-use items and packaging for delivered goods, has accelerated that trend. However, we have all seen the images of plastic waste floating in the oceans and discarded bottles scattered along the roadside. In 2020, approximately 400 million tonnes of plastics were produced globally, and that figure is projected to reach over 1.1 billion tonnes by 2050 at current growth trends.[1] More sustainable and circular processes will be needed to achieve a balance between the use and benefits of plastics in our lives and its impact on the environment. First and foremost among these is a concept familiar to everyone – recycling.

Recycling

Various recycling programs have been around in the US for decades, and curbside pickup programs with dedicated recycling bins are increasingly found in many cities across the country. The US Environmental Protection Agency ("EPA") estimated that the US produced approximately 292.4 million tons of municipal solid waste ("MSW"), or almost 5 pounds of trash per person per day, in 2018 (see Figure 1).[2] The amount of recycled MSW amounted to approximately 69.1 million tons, or approximately 24% of total waste, of which 67% was categorized as paper and paperboard (see Figure 2).[3] Metals, such as appliances, steel, or aluminum/tin cans, comprised approximately 13% of the total recycled, while plastics represented a small share at approximately 4% of recycled MSW.

[1] Source: UN Environment Programme – Drowning in Plastics.

[2] Source: US Environmental Protection Agency – National Overview: Facts and Figures on Materials, Wastes and Recycling.

[3] Ibid.

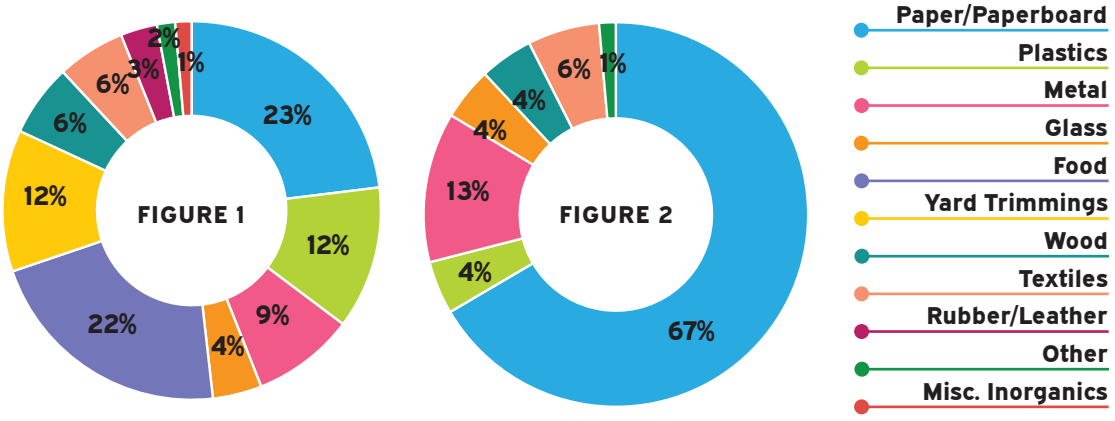

FIGURE 1
MSW Produced in the US

FIGURE 2
Recycled MSW in the US

Source: www.epa.gov
Note: Totals may not add to 100 due to rounding.

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Recycling rates, which are the percentage of recycled material relative to produced amounts, varied across products. For example, in 2018, lead-acid batteries boasted a 99% recycling rate, and paper and paperboard had a recycling rate of approximately 68%. While plastics comprise over 12% of the waste in the US, they have one of the lowest recycling rates at approximately 9%.[4]

[4] Source: EPA - https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials#R&Ctrends

Plastic types

There are different types of plastics used for different applications, and each has unique properties that need to be considered in the context of recycling. In 1988, Resin Identification Codes ("RIC") were introduced to help standardize the various types of resin materials used in different types of plastics for ease in the sorting and recycling process.

RIC	Resin Type	Common Products	2018 % of Plastics MSW Waste	Frequency of Recycling
1 PET	Polyethylene Terephthalate (PET)	water, soft drink bottles, polyester	15%	Common
2 HDPE	High-Density Polyethylene (HDPE)	shampoo, detergent, milk jugs	18%	Common
3 PVC	Polyvinyl Chloride (PVC)	piping, food tray, commercial cling film	2%	Uncommon
4 LDPE	Low-Density Polyethylene (LDPE)	plastic bags, food wrap, bubble wrap, dry cleaning bags	24%	Sometimes
5 PP	Polypropylene (PP)	food tubs, auto and industrial parts, car batteries	23%	Common/ Sometimes
6 PS	Polystyrene (PS)	foam cups, coolers, egg cartons, Styrofoam	6%	Uncommon
7 OTHER	Acrylic, Nylon, Polycarbonate	five-gallon water containers, CD/ DVDs, headlight lenses	12%	Uncommon

FIGURE 3
Major Types of Plastics

Source: EPA – Advancing Sustainable Materials Management: 2018 Tables and Figures.

As illustrated in Figure 3, some plastics are recycled more than others. For example, PET plastics, which are often used in single-use applications such as water and soft drink bottles, have some of the highest recycling rates. In 2020, PET recycling rates were approximately 27% in the US and 46% in Europe.[5] These higher recycling rates have reduced the amount of PET plastics from reaching landfills or incinerators. LDPE and PP RIC plastics represent a high percentage of MSW, as shown in Figure 3, but they have lower recycling rates. Clearly, there is an opportunity to make meaningful impacts on sustainability by increasing recycling rates in these categories. However, there are challenges in scaling and ramping up recycling of some plastics.

[5] Source: Barclays – Plastic Outlook for 2022.

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Recycling challenges

Collection and sorting – While recycling programs have increased meaningfully over the past decade, these programs are often lacking or non-existent in some communities. This is especially the case in rural areas and developing countries. It is estimated that approximately half of US residences have access to curbside recycling programs, and only 72% of those with access actually participate[6] in those programs. In the past, regulators and consumer brand companies have primarily focused on the recycling of PET plastics. As a result, much of the current plastic collection, sorting technology, and recycling capacity, has been oriented toward PET plastics. The recycling of other plastics remains constrained or is challenging to operate economically. For example, curbside programs do not accept LDPE plastics, making its collection less convenient and recycling less common. Some major retailers, such as Whole Foods, Target, and Walmart have drop-off areas that collect LDPE plastics. The LDPE-based plastics used for bubble packing, cling wrap, or plastic bags often get tangled in recycling machinery, potentially resulting in costly repairs, damage, and downtime of equipment.

[6] Source: The Recycling Partnership.

Contamination – Waste management companies often collect curbside recyclables in single stream programs where households place various products, such as paper, cardboard, glass, cans, and plastics, in a single recycling bin. However, there still is much confusion about what can and should be recycled, and the answer to those questions can vary across different cities. Collection facilities have different sorting and washing capabilities when processing recyclable materials. Generally, plastic recyclables that have not been rinsed can contaminate other items, most notably paper and cardboard, and the contamination can degrade the fibers and make them unrecyclable. Batches that are highly contaminated with either food or other materials tend to fetch lower prices in the recyclable markets or be rejected entirely by recycling facilities. In the past, much of the collected recyclable materials in the US were exported overseas to China and other Asian countries for processing and recycling. In 2018, China's National Sword program essentially banned imports of PET, PE, PVC, and other plastic recyclables by implementing contamination limits that were difficult, if not impossible, to meet. As a result, scrap plastic exports from the US have fallen dramatically, and the amount of plastics entering landfills has increased.

Robust recycled product markets – The market for recycled materials is small but growing. Plastics are most commonly made from feedstocks derived from oil (naphtha) and natural gas (ethane). As ESG considerations are becoming increasingly important for companies and consumers, there is a growing demand for recycled materials to become integrated back into the manufacturing processes of plastics. However, the availability of certain recycled feedstock materials[7] can be constrained in some markets, particularly for the less recycled plastic materials. Offtake agreements between the collectors, recycling facilities, and manufacturers need to be established to ensure there are adequate feedstocks. Ensuring purity and reduced contamination is also important during this process, particularly for food-grade recycled plastic materials. There is also the economic consideration of the cost of virgin materials versus the cost of recycled materials. When commodity prices are low, it is generally less economic to utilize recycled materials versus lower cost oil and natural gas feedstocks.

[7] Refers to raw materials that serve as a feedstock for the production of finished products.

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Policy and regulation

Governments are increasingly using policy and regulation to help create a more sustainable economy. For example, at the end of 2020, the EPA announced a national recycling goal of increasing the US recycling rate to 50% by 2030[8] (from a baseline of approximately 32% at the time of announcement). In 2021, the agency released the first part of its National Recycling Strategy[9] that provides a roadmap on how to transform the US recycling system beyond the "Reduce, Reuse, Recycle" slogan to a more circular economy.

A circular economy seeks to reduce materials usage, be less resource intensive, and recapture waste where it can serve as a feedstock to make new materials through recycling.

[8] Source: EPA - https://www.epa.gov/circulareconomy/us-national-recycling-goal

[9] Source: EPA - https://www.epa.gov/circulareconomy/national-recycling-strategy#strategy

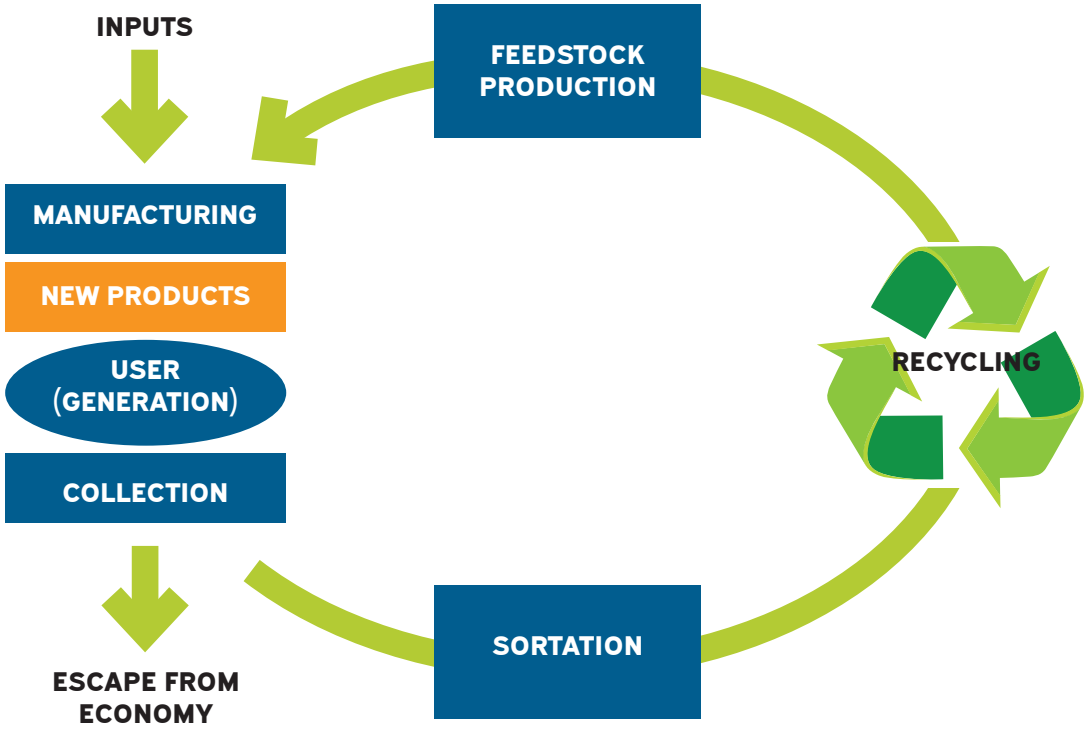

FIGURE 4
Circular material flow

Source: EPA - National Recycling Strategy.

The US can no longer rely primarily on exports to recycle domestically collected plastic materials. It needs to encourage full-cycle domestic recycling capabilities to help address its plastic waste. Doing so will require investments and innovation to develop and deploy more advanced machinery and processes to sort, cleanse, and purify recycled materials, in addition to developing more robust end markets for those recycled materials.[10]

Several countries in Europe have or are poised to introduce taxes on various RIC plastic packaging materials that do not utilize recycled materials. The effect of this tax will help reduce the pricing gap of recycled plastic feedstocks with virgin feedstocks, particularly during times when oil and natural gas prices are low. The US is also considering a similar tax on plastics without recycled materials.

[10] In 2021, Sheldon Whitehouse, Senator for Rhode Island, introduced the REDUCE act to impose a tax on virgin plastics for single use products. Source: https://www.whitehouse.senate.gov/news/release/whitehouse-unveils-reduce-act-to-tackle-plastic-pollution

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Recycling opportunity

Plastic recycling is poised for meaningful growth and expansion as plastic-consuming companies seek to become more sustainable and mitigate the impact of plastic taxes looming on the horizon in the US and Europe. Because feedstocks of plastics are primarily hydrocarbon-based, prolonging the useful life of plastic resins through recycling can meaningfully contribute to global efforts to decarbonize. As a result, companies, consumer, and investors are increasingly becoming interested in this space. Public and private companies are expanding their capabilities and capacities, and new companies are being formed. Private investment managers executing buyout, growth equity, venture capital, and credit strategies are becoming increasingly active in this space, via waste management collection and sorting, recycling process technologies, greenfield and brownfield project development, and project financing. Technologies are also being researched to recover energy from plastic waste that could be commercialized in the coming years as a sustainable source.

Summary

There is significant momentum and growth potential in the plastics recycling industry to help address environmental pollution and create a more sustainable and circular economy. Western countries have been leaders in plastics waste management, but additional actions may be necessary to increase recycling beyond its current levels, potentially including public education, incentives, and penalties. The EPA's National Recycling Strategy helps provide a framework to accomplish this, including improving the markets for recycled commodities, increasing collection and processing infrastructure, reducing contamination, and enhancing policies and programs to support circularity. This should lead to increased public and private investment within this sector, with the goal of generating attractive investment returns while also mitigating the global plastic waste problem. Expected investment returns from this sector are likely to span the risk and return spectrum, depending on the maturity of a technology or stage of development of a facility.

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