GREENPEACE

# CIRCULAR CLAIMS FALL FLAT AGAIN

## 2022 UPDATE


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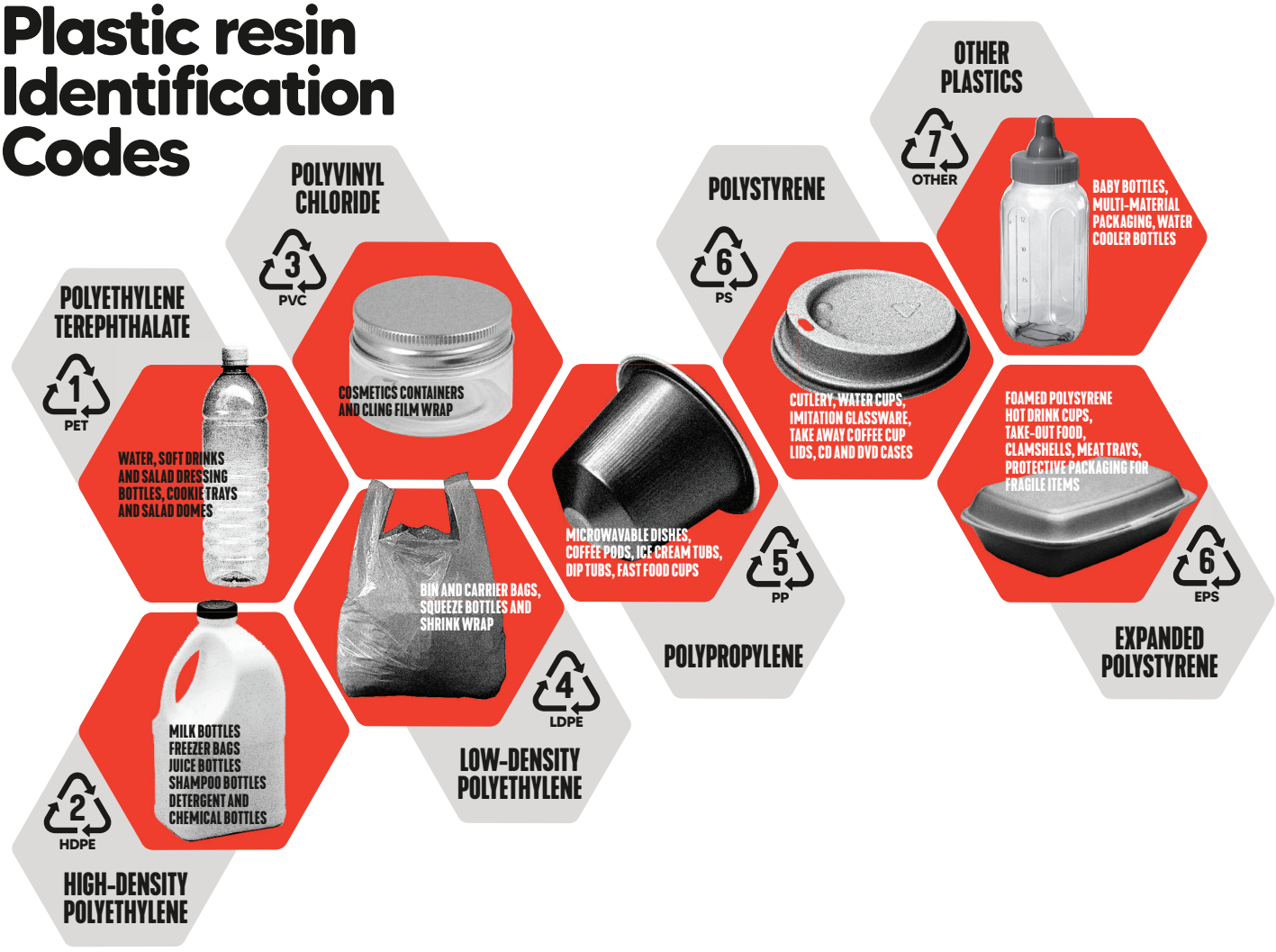
# Plastic resin Identification Codes




**NOTE: THE "CHASING ARROWS" LOGO IS MISLEADING FOR MOST TYPES OF PLASTIC, AS THEY ARE RARELY RECYCLABLE.**

# EXECUTIVE SUMMARY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A recent Organization for Economic Co-operation and Development (OECD) report projects that global plastic use and waste will nearly triple by 2060 with a meager increase in plastic recycling, resulting in a doubling of global plastic pollution.[2] The United States Department of Energy (U.S. DOE) estimated that the volume of plastic waste in the U.S. rose to 44 million metric tons in 2019,[3] which is about 295 lbs per person.[4]

The plastics and products industries have been promoting plastic recycling as the solution to plastic waste since the early 1990s.[5] Some 30 years later, the vast majority of U.S. plastic waste is still not recyclable. The U.S. plastic recycling rate was estimated to have declined to about 5–6% in 2021, down from a high of 9.5% in 2014 and 8.7% in 2018, when the U.S. exported millions of tons of plastic waste to China and counted it as recycled even though much of it was burned or dumped.[6]

In February 2020, Greenpeace USA published a comprehensive survey of plastic recycling in the U.S. titled "Circular Claims Fall Flat."[7] In that report we predicted that "the economic driver for collecting, sorting and reprocessing post-consumer plastic products is likely to worsen as expansion of plastic production lowers the cost of new resin."[8] That prediction has proven true as the U.S. plastic recycling rate has continued to decline.

Since 2020, an even greater barrier to plastic recycling than poor economics has come into focus through scientific research and testing: the toxicity of recycled plastic. According to a 2021 report published by the Canadian Government, toxicity risks in recycled plastic prohibit "the vast majority of plastic products and packaging produced" from being recycled into food-grade packaging.[9]

## 2022 UPDATE TO 2020 COMPREHENSIVE SURVEY

The 2020 survey examined plastic products accepted by the U.S.'s approximately 370 material recovery facilities (MRFs), and U.S. domestic plastic waste reprocessing capacity. The survey results revealed that only some types of PET#1 and HDPE#2 plastic bottles and jugs could be legitimately claimed as recyclable and led to the conclusion that most types of plastic packaging were economically impossible to recycle at the time and would remain so in the future.

This 2022 update of the survey shows little change: only PET#1 and HDPE#2 plastic bottles and jugs are widely accepted by the 375 MRFs in operation in the U.S. today. This finding is consistent with the 2021 California Statewide Recycling Commission's determination that only PET#1 and HDPE#2 bottles and jugs are recyclable in California.[10]

The 2022 update also confirmed a key finding of the 2020 report: acceptance of a plastic item by a MRF does not mean that the item will be recycled. As reported by the Wall Street Journal in August 2022, a California MRF admitted to accepting PP#5 tubs and disposing of them.[11] The City of Knoxville, Tennessee, also publicly states that it accepts plastics #3-7 at its recycling facility but disposes of them because "there is no end-market buyer."[12]

Moreover, the reprocessing capacity for the two widely accepted plastic items remains marginal, at 20.9% for PET#1 and 10.3% for HDPE#2 – well under the 30% threshold set by the Ellen MacArthur Foundation's New Plastics Economy (EMF NPE) initiative for determining whether a plastic product is recyclable.[13] In short, no type of plastic packaging in the U.S. meets the EMF NPE definition of "recyclable."

## FIVE REASONS WHY MECHANICAL AND CHEMICAL RECYCLING FAIL

Mechanical and chemical recycling of plastic waste has largely failed and will always fail because plastic waste is: (1) extremely difficult to collect, (2) virtually impossible to sort for recycling, (3) environmentally harmful to reprocess, (4) often made of and contaminated by toxic materials, and (5) not economical to recycle. Paper, cardboard, metal, and glass do not have these problems, which is why they are recycled at much higher rates.[14]

Due to toxicity risks, post-consumer recycled plastic from household waste is not being produced at commercial scale for food-grade uses globally or in the U.S., and likely never will be. While there is limited availability of food-grade PET#1 for beverage bottles only, there are growing toxicity concerns there, too.[15]

As described in a May 2022 OpEd in The Atlantic, "The problem lies not with the concept or process of recycling but with the plastic material itself – it is plastic recycling that does not work."[16] The high recycling rates of post-consumer paper, cardboard, and metals in the U.S. prove that recycling can be an effective way to reclaim valuable natural material resources. Plastic recycling in particular has failed because the thousands of types of synthetic plastic materials produced are fundamentally not recyclable.

## WE'RE AT A DECISION POINT ON SINGLE-USE PLASTICS AND PACKAGING

As scientific evidence of the harm caused by plastic waste and pollution and the toxic risks of recycled

plastic continue to mount, discussions about what to do regarding single-use plastics and plastic packaging are underway at the global level through the United Nations Environment Programme's (UNEP) plastics treaty,[17] in the U.S. Congress and city halls and state capitals across the country, and in corporate board rooms.

The failure of the concept of plastic recycling is finally becoming impossible for the companies and industry associations that promote it – and the non-governmental organizations (NGOs) that they fund for this purpose – to ignore. After three decades and billions of dollars of taxpayer spending, the excuse offered by the American Chemistry Council (ACC) that plastic recycling is still "in its infancy" can now be seen for the delaying tactic that it is.[18]

Corporate plastic pledge performance reporting does not reflect the failure of plastic recycling because it relies on the theoretical possibility of recycling a plastic item, rather than actual plastic waste processing rates. The reported shares of recyclable, reusable, or compostable plastic packaging used by EMF NPE and U.S. Plastics Pact member companies – 65.3% at the global level[19] and 37% in the U.S.[20] – can hardly be taken at face value when credible estimates show that only 9% of plastic was recycled globally in 2019[21] and only 5–6% of plastic waste was recycled in the U.S. in 2021.[22]

## WE ARE AT A DECISION POINT ON PLASTIC WASTE AND POLLUTION:

**Will we allow companies to continue to promote the failed, toxic plastic recycling myth or will we demand a pivotal change that dramatically reduces the production of single-use plastics? Instead of continuing on this false path, companies in the U.S. and around the world must urgently phase out single-use plastics by replacing their packaging with reuse and refill systems and offering packaging-free products.**

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# 1. 2022 UPDATE OF COMPREHENSIVE SURVEY

In February 2020, Greenpeace USA published a comprehensive survey of plastic recycling in the U.S. titled *"Circular Claims Fall Flat."*[23] The survey examined plastic products accepted by the U.S.'s approximately 370 material recovery facilities (MRFs) and U.S. domestic plastic reprocessing capacity to determine which plastic products meet the legal definition of "recyclable" in the U.S. In this 2022 update of that comprehensive survey, U.S. MRFs and plastic processing facilities were again assessed to determine which specific plastic products meet this legal definition, or the EMF NPE Global Commitment's definition of recyclable.

## 1.1 U.S. LEGAL DEFINITION OF RECYCLABLE

To legitimately claim a product as "recyclable," the U.S. Federal Trade Commission (FTC) requires that recycling facilities be available to a "substantial majority" of U.S. residents, defined to be at least 60%, and that the collected product be used in the manufacturing or assembly of a new item.[24] The FTC focuses on "established" and community-based recycling systems, rather than privately operated mail-back or retail store take-back programs, in determining recycling availability.[25]

But acceptance of a plastic item at a MRF alone does not provide a sufficient or "reasonable" assurance to a customer that it will be manufactured into another item. Sufficient market demand and domestic recycling/reprocessing capacity must exist for a plastic product to be considered "recyclable." Without market demand and domestic recycling/reprocessing capacity, the plastic material collected by the MRFs will not be bought by manufacturers and will not be recycled into another product. According to the FTC, "unqualified recyclable claims for categories of products that municipal recycling programs collect, but do not actually recycle, may be deceptive. To make a non-deceptive unqualified claim, a marketer should substantiate that a substantial majority of consumers or communities have access to facilities that will actually recycle, not accept and ultimately discard, the product. As part of this analysis, a marketer should not assume that consumers or communities have access to a particular recycling program merely because the program will accept a product."[26]

## 1.2 NEW PLASTICS ECONOMY DEFINITION OF RECYCLABLE

Figure 1 shows that the EMF NPE Global Commitment definition of "recyclable" requires an item to have a 30% recycling capacity in a region of 400 million people.[27] However, companies are not required to use that definition when self-reporting recyclability rates of their product portfolios.[28]

**FIGURE 1: EMF GLOBAL COMMITMENT DEFINITION OF RECYCLABLE[29]**

## HOW ARE RECYCLABILITY AND COMPOSTABILITY ASSESSED IN THE GLOBAL COMMITMENT?

**The definitions used by Global Commitment signatories to assess the proportion of recyclable or compostable packaging in their portfolios are more stringent than most other definitions.**

**The commitment to 100% reusable, recyclable, or compostable plastic packaging by 2025 is based on definitions that ask signatories to go beyond designing packaging for the technical possibility of recycling or composting, and requires that recycling or composting is proven to work 'in practice and at scale' for any given packaging design. The threshold to prove recycling or composting works 'in practice and at scale' is a 30% recycling/composting rate achieved across multiple regions, collectively representing at least 400 million inhabitants. To support reporting on recyclability, the Ellen MacArthur Foundation has for the last two years conducted a global survey of organisations with expertise on recycling rates with the aim of filling gaps in data required to provide evidence of where these thresholds are being met.**

## 1.3 2022 COMPREHENSIVE SURVEY RESULTS

The results of the 2020 survey indicated that only certain types of PET#1 and HDPE#2 plastic bottles and jugs met the legal definition of recyclable, and that most types of plastic packaging were economically impossible to recycle then and would remain so in the foreseeable future. This 2022 update shows little change: only PET#1 and HDPE#2 plastic bottles and jugs are widely accepted by MRFs, and U.S. reprocessing capacity for those items remains marginal at 20.9% for PET#1 and 10.3% for HDPE#2 – well below the 30% threshold set by the EMF NPE for determining whether a plastic product is recyclable in a region. In short, no type of plastic in the U.S. meets the EMF NPE definition of "recyclable." The results of this nationwide survey are consistent with the 2021 California Statewide Recycling Commission's determination that only PET#1 and HDPE#2 bottles and jugs are recyclable in California.[30]

The 2022 comprehensive survey assessed the following, across the U.S.:[31]

1. **Collection and sortation (MRF) facilities:** The contents of the publicly posted lists of specific types of plastic products accepted in the curbside recycling bins of the 375 operating U.S. residential MRFs were surveyed. (Details provided in Appendix A – 2022 Survey of U.S. Material Recovery Facilities.)

2. **Plastic waste reprocessing facilities:** The reprocessing capacity of the facilities that turn the collected/sorted material into plastic resin was assessed to determine the total U.S. processing capacity of specific types of post-consumer plastics. (Details provided in Appendix B – 2022 Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste.)

Table 1 summarizes the 2020 and 2022 survey results and provides an assessment of whether each product listed can legitimately be labeled as "recyclable" according to the requirements of the FTC Green Guides or the EMF NPE definition. The columns are described in detail in the footnotes to the table.

## TABLE 1: 2022 U.S. POPULATION'S ACCESS TO MUNICIPAL COLLECTION AND CAPACITY FOR RECYCLING INTO NEW PRODUCTS (UPDATED AUGUST 15, 2022)

| Plastic Item | (A) % of Total (375) U.S. Material Recycling Facilities That Accept the Item | (B) Access (%) of U.S. Population to Municipal Collection of the Item | (C) U.S. Reprocessing Capacity for Post-Consumer Plastic Type | (D) Can Product be Labeled as "Recyclable" per U.S. FTC Green Guides or EMF NPE Definition? |
|---|---|---|---|---|
| PET#1 Bottles and Jugs[A] | 2022: 100%<br>2020: 100% | 2022: 60% | Marginal<br>2022: 20.9%<br>2020: 22.5% | U.S. FTC: Yes<br>EMF NPE: No |
| HDPE#2 Bottles and Jugs[A] | 2022: 100%<br>2020: 100% | 2022: 60% | Marginal<br>2022: 10.3%<br>2020: 12% | U.S. FTC: Yes<br>EMF NPE: No |
| PP#5 Tubs and Containers | 2022: 52%<br>2020: 53% | 2022: 29% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| PP#5 or PS#6 Coffee Pods | 2022: 0%<br>2020: 0% | 2022: 0% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Plastic Clamshells | 2022: 11%<br>2020: 14% | 2022: 6% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Plastic Cups | 2022: 9%<br>2020: 11% | 2022: 5% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Plastic Trays | 2022: 5%<br>2020: 7% | 2022: 3% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Plastic Bags and Films[B] | 2022: 1%<br>2020: 4% | 2022: 0% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Expanded Polystyrene (EPS) Food Service | 2022: 1%<br>2020: 3% | 2022: 1% | Low/Insufficient<br><5% | U.S. FTC: No<br>EMF NPE: No |
| Plastic Lids and Caps (Loose) | 2022: 2%<br>2020: 3% | 2022: 1% | Low/Insufficient<br><5% | US FTC: No<br>EMF NPE: No |
| Plastic Plates | 2022: 2%<br>2020: 1% | 2020: 1% | Low/Insufficient<br><5% | US FTC: No<br>EMF NPE: No |
| Plastic Cutlery, Straws and Stirrers | 2022: 0%<br>2020: 1% | 2022: 0% | Low/Insufficient<br><5% | US FTC: No<br>EMF NPE: No |
| Plastic Food Wrappers and Pouches | 2022: 0%<br>2020: 0% | 2022: 0.0% | Low/Insufficient<br><5% | US FTC: No<br>EMF NPE: No |

**Column (A):** % of U.S. Material Recycling Facilities That Accept the Item: % determined from 2020 and 2022 U.S. MRF Surveys (details provided in Appendix A.1).
**Column (B):** Access (%) of U.S. Population to Municipal Collection of Item: According to The Recycling Partnership, about 56% of U.S. residents have access to established curbside recycling collection transported to MRFs and 4% have access to established drop-off systems.[32] The access for the total population was determined by adjusting for U.S. residents who have access to established municipal recycling collection systems (details provided in Appendix A.3).
**Column (C):** U.S. Reprocessing Capacity for Post-Consumer Plastic Type: Details provided in Appendix A.2.
**Column (D):** Can Product be Labeled as "Recyclable" per U.S. FTC Green Guides or EMF NPE Definition? Overall assessment of whether the specific product can legitimately be claimed or labeled as recyclable based on total population access (B) and the likelihood of collected materials being recycled into new products (C). The FTC Green Guides require that a significant (>60%) portion of the total U.S. population have access to established recycling programs to claim an item as recyclable, and the collected products must be manufactured into new items.[33]

[A] Bottles cannot have non-recyclable or non-sortable shrink sleeves.

[B] Plastic bags are accepted by municipal systems. This does not include plastic bags collected by drop-off at private retail operations because the FTC requirements are based on established municipal collection systems.


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The 2022 survey results are consistent with the findings of a May 2022 report by The Last Beach Cleanup and Beyond Plastics, which estimated a dismal recycling rate of 5–6% for post-consumer plastic waste in the U.S. in 2021.[34] They can be summarized as follows.

**PET#1 and HDPE#2 Bottles and Jugs**: The 2022 U.S. MRF Survey showed that these items are accepted by nearly 100% of MRFs. Based on up-to-date estimates by The Recycling Partnership (described in Appendix A.3), 60% of the total U.S. population has access to curbside and drop-off recycling service of some type. It is assumed that drop-off recycling centers also accept PET#1 and HDPE#2 bottles and jugs. Therefore, it is assumed that the 60% acceptance rate required by the FTC is met for these items.

**Polypropylene (PP#5) Tubs and Containers**: The 2022 U.S. MRF Survey showed that these items are accepted by 52% of U.S. MRFs. Based on up-to-date estimates of access to curbside and drop-off recycling, described in Appendix A.3, only 29% of the total U.S. population has access to collection of PP#5 tubs and containers.

As described by the *Wall Street Journal* in August 2022, it is critical to acknowledge that the acceptance of a PP#5 tub by a MRF is not proof that the PP#5 tub will actually be recycled into a new product.[35] When a MRF accepts it, PP#5 is typically collected as part of a mixed plastics #3-7 bale, which is not a "market-ready" bale as required by the Association of Plastic Recyclers (APR) in its definition of "recyclable" plastic.[36] The plastics industry acknowledges that individually most plastics #3-7 "are not available in the quantities necessary to justify investments in optical sorting and are difficult to sort manually due to a variety of resins used for a wide range of similar applications (i.e., creating 'look-a-like' materials and products). Therefore, most MRFs that accept PP#5 produce a mixed plastic, '#3-7' or 'pre-picked' bale that requires further sorting prior to recycling."[37] However, the economics of that sorting have proven to be insurmountable. The last remaining U.S. secondary plastic recycling facility that sorted mixed #3-7 plastics from MRFs, Titus Company in Los Angeles, closed operations in 2020.[38] As detailed in the 2020 "Circular Claims Fall Flat" report, it appears that MRFs are still accepting PP#5 tubs in curbside recycling bins and then disposing of them.[39] Examples include a California MRF that accepts PP#5 tubs and disposes of them[40] and the City of Knoxville, Tennessee, which publicly states that its recycling facility accepts plastics #3-7 but disposes of them because "there is no end-market buyer."[41]

Compounding the problem of recycling post-consumer PP#5 plastic items is that there are a limited number of plastic reprocessing facilities that will buy post-consumer PP#5 plastic. Analysis in Appendix A.2 shows that there is less than 2% U.S. domestic reprocessing capacity for PP#5 post-consumer waste. The facilities are primarily in the South and East U.S., with the largest U.S. processor of PP#5 located in Alabama; however, the polypropylene recycling capacity of that recycler is only 100 million lbs per year, which is less than 1% of the total U.S. PP#5 plastic waste produced.[42] The cost to transport PP#5 waste from


the West Coast is prohibitively high, which is a driving factor of lack of acceptance of PP#5 at California MRFs and thus to the 2021 California Statewide Recycling Commission's determination that PP#5 is not recyclable in the state.[43]

It is technically very difficult to safely recycle PP#5 waste into food-grade plastic due to toxicity and other barriers.[44] As plastic recycling expert Edward Kosior stated in October 2020, "While food-grade PP will claim to be recyclable, the fact is that to date there is no food-grade recycled PP available for re-use into new packaging – as a consequence, we still produce virgin PP for all food-grade requirements."[45] In 2022, the situation has not changed: food-grade PP#5 is not commercially produced from PP#5 post-consumer household plastic waste anywhere in the world.[46]

Indeed, the economics of collecting, sorting, and recycling post-consumer polypropylene products are becoming even more stressed and do not provide a sufficient driver for MRFs to invest in collection or separation of PP#5 post-consumer products from mixed plastics #3-7 bales. Recycled PP#5 competes with new PP#5, which is declining in cost, with the trend likely to continue thanks to 2 billion lbs of new PP#5 production starting in North America in 2022 and strong gasoline demand.[47] The feedstock for the production of PP#5 is a byproduct of gasoline refineries, and the cost of the new PP#5 is largely driven by U.S. demand for gasoline, which has increased in the economic recovery after the peak of the COVID-19 pandemic, causing propylene inventories to rise and prices to fall.[48]

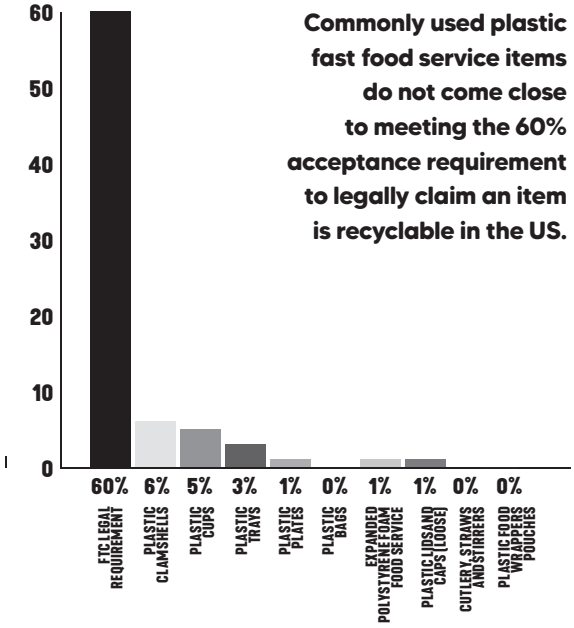
Chemical industry analysts Wood Mackenzie predict a downturn in the global polypropylene market with severe short-term overcapacity during the current investment cycle (2022 to 2026) as new additions in the market will far outpace demand growth.[49]

**Thermoforms (pods, clamshells, cups, trays, lids and caps, and other rigid, non-bottle packaging):** Thermoforms are heat-molded plastic packaging and products that may be made from plastics #1-7. They have very low acceptance rates by MRFs and very low to negligible recycling rates, according to the U.S. Environmental Protection Agency (EPA).[50] As stated by the president of the APR, MRFs have limited incentives to separate out thermoforms, which are viewed as "a relatively low-volume commodity that doesn't justify the sorting costs and bunker space."[51]

**Single-Use Plastic Food Service Items:** The 2022 U.S. MRF Survey confirmed the finding of the 2020 survey that no type of single-use plastic food service item (such as those used at fast food restaurants) can legally be claimed as recyclable in the U.S., as shown in Figure 2. As the "2021 Fast Food Plastic Survey" performed by The Last Beach Cleanup revealed, fast food companies serve many types of single-use plastics, including PET#1, HDPE#2, LDPE#4, PP#5, and PS#6 cups, lids, clamshells, trays, bags, and cutlery (see Figure 3). These items are negligibly accepted for collection by MRFs and not reprocessed in the U.S.[52]

**FIGURE 2: AVAILABILITY OF RECYCLING ACCEPTANCE OF SINGLE-USE PLASTIC FOOD SERVICE ITEMS IN THE U.S.**

## 2022 US POPULATION ACCESS TO RECYCLING FAST FOOD PACKAGING ITEMS




Commonly used plastic fast food service items do not come close to meeting the 60% acceptance requirement to legally claim an item is recyclable in the US.

**FIGURE 3: RANGE OF PET#1, HDPE#2, LDPE#4, PP#5, AND PS#6 CUPS, LIDS, CLAMSHELLS, TRAYS, BAGS, AND CUTLERY SERVED BY U.S. FAST FOOD COMPANIES**

# UNRECYCLABLE PLASTIC PACKAGING CLAIMED AS "RECYCLABLE" BY U.S. PLASTICS PACT

In the U.S. Plastics Pact's "2020 Baseline Report,"[53] numerous types of plastic packaging are claimed as "recyclable" that fail to meet either the U.S. FTC or EMF NPE Global Commitment definitions of "recyclable." These examples are highlighted in the U.S. Plastics Pact Case Studies and shown in Figure 4:

**#2: PE insulated box liners are not recyclable in the U.S.** Consumers have no access to established recycling systems that collect them, and there are no manufacturers known to be recycling the liners into new products. If consumers place items with PE liners in curbside recycling bins, the flat liners are most likely to contaminate paper or cardboard bales.

**#3: PE flexible film is not recyclable in the U.S**. Less than 1% of U.S. residents have access to established recycling systems that accept plastic films. According to a lawsuit contesting the sale of plastic bags in California, no evidence has been found of this type of post-consumer household plastic film being recycled into new products via store drop-off programs, either.[54]

**#4**: **Polyester flexible plastic is not recyclable in the U.S**. Consumers have no access to established recycling systems that accept plastic polyesters, and no evidence was found that this type of post-consumer household plastic waste is recycled into new products.

**FIGURE 4: U.S. PLASTICS PACT CASE STUDIES INCLUDING NON-RECYCLABLE PLASTIC PACKAGING EXAMPLES**

## U.S. PACT CASE STUDIES

1. To eliminate single-use packaging in **Walmart**'s InHome Grocery Delivery Program, **Returnity** custom designed a durable reusable bag and the collection and cleaning system that increased performance through tech integration and an enhanced customer experience.

2. To reduce packaging waste in meal kits, especially insulated box liners made of multi-laminated materials, **PAC Worldwide** designed PE insulated box liners that are fully recyclable.

3. **Amcor**'s AmPrima™ PE Plus solutions employ a variety of technologies, including proprietary techniques to deliver unmatched levels of stiffness, clarity, graphics performance, heat resistance, and run speeds in a recycle-ready PE-based solution for flexible firms.

4. **Evertis** partnered with a supplier to switch to ECOSEAL film, which replaced the PE layer with a specialty polyester that offers enhanced sealing capabilities, creating a monomaterial film that is 100% recyclable in the PET stream.

5. To make its toothpaste tubes accepted by current conventional recycling streams, **The Colgate-Palmolive Company** redesigned and chose HDPE, the "No. 2" plastic used to make milk jugs and other plastic bottles. Colgate-Palmolive also shared its recyclable tube design with the broader industry.

6. **The Clorox Company** worked with Algramo to minimize plastic waste while providing flagship Clorox products that are affordable, accessible and convenient. Algramo's refill system allows customers to purchase how much product they need, when they need it, based on what they can afford.

7. Since its launch in 1959, **The Coca-Cola Company**'s Sprite has always sported a signature green bottle. But in 2022, the entire Sprite PET portfolio will evolve from its iconic green color packaging to clear PET to optimize the package for recycling, and in turn, increase rPET supply.

8. **PakTech** chose 100% recycled and recyclable HDPE as the preferred material for its sustainable packaging handles. PakTech has also partnered with more than 500 businesses to establish dedicated recycling sites so the handles can be turned into park benches, planter pots and new PakTech products.

**Target 2**

**100% of plastic packaging will be reusable, recyclable, or compostable by 2025**

***Far more plastic waste is incinerated in the U.S. than is recycled, causing significant CO2 emissions.***

An aerial view of the Wheelabrator Incinerator located in the city of Baltimore, Maryland, USA.
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WHAT
CAN BE
HORSESHOE

# FIVE REASONS WHY PLASTIC RECYCLING FAILS

The plastics, packaging, and recycling industries have waged a decades-long misinformation campaign to perpetuate the myth that plastic is recyclable.[55] In its 2016 treatise on "Rethinking the Future of Plastics," the Ellen MacArthur Foundation acknowledges the many barriers to plastic recycling, but then quickly dismisses them with the proclamation that a global effort called the New Plastics Economy will succeed where "fragmented" and "small-scale" efforts have failed (see Figure 5).[56] This and subsequent EMF reports expand on the contrived premise of the circular economy of plastics and imagine benefits built on the fiction that plastic recycling will someday work, thanks to the implementation of a "global plastics protocol" and "large-scale, targeted 'moon shot' innovations."[57]

**FIGURE 5 – ELLEN MACARTHUR FOUNDATION PROCLAMATION THAT A GLOBAL NEW PLASTICS ECONOMY WILL OVERCOME DECADES OF PLASTIC RECYCLING FAILURE**

**Through overcoming these drawbacks, an opportunity beckons:** moving the plastics industry into a positive spiral of value capture, stronger economics, and better environmental outcomes. Actors across the plastic packaging value chain have proven time and again their capacity to innovate. Now, harnessing this capability to improve the circularity of plastic packaging – while continuing to expand its functionality and reduce its cost – could create a new engine to move towards a system that works: a New Plastics Economy.

U.S. households reportedly generated an estimated 51 million tons of plastic waste in 2021, 2.4 tons of which was recycled.[58] In an effort to boost demand for recycled plastic, the APR launched a Recycling Demand Champion Campaign in the U.S. in 2017;[59] it continues to tout the program as a success even though demand from participants dropped from 175 million lbs/year in 2020[60] to 138.7 million lbs/year in 2021[61] – an amount that represents only 0.14% of the total plastic waste generated in the U.S. that year. This is not the sort of "moon shot" needed to truly make a difference.

Even when faced with legal jeopardy, the petrochemical companies that make plastic continue to assert that plastic recycling will someday work. On April 28, 2022, California Attorney General Rob Bonta announced that a subpoena had been issued to ExxonMobil to determine whether the fossil fuel giant had lied to the public about both the negative effects of plastics and the success of plastic recycling.[62] The ACC,[63] the leading petrochemical business association and ExxonMobil[64] responded by promoting another old myth about plastic recycling, claiming that they are committed to "advanced recycling" technology that will work in the future.

However, the primary advanced recycling process, called "pyrolysis," actually incinerates plastic waste to fuel itself to high temperatures and recycles only a small portion of the waste.[65] In effect, the majority of the plastic waste involved in this process is burned. The document filed with the U.S. EPA by Brightmark Energy regarding its planned pyrolysis plant in Ashley, Indiana, for example, reportedly states that 70% of the feedstock would be combusted and 10% would be waste char, meaning that only 20% of the feedstock material would be reclaimed as pyrolysis oil (which still requires further refinement).[66]

Indeed, advanced recycling has long been recognized as a failure. Figure 6 shows a 1993 article from the *Lincoln Star Journal* where a plastic recycler states that the American Plastics Council is hindering true plastic recycling efforts by promoting pyrolysis, which is described as "a form of incineration, not recycling."[67]

**FIGURE 6: 1993 ARTICLE FROM THE LINCOLN STAR JOURNAL**

# Plastic manufacturers accused of not living up to recycling claim

GRAND ISLAND (AP) – Plastic manufacturers are not living up to their claim that they want to promote recycling of their product, according to an advocate of recycling.

Instead of promoting plastic recycling, manufacturers spend large sums to hinder recycling efforts, Marty Foran of PolyAnna Plastics in Milwaukee said Wednesday in the keynote address at the Nebraska State Recycling Association Convention.

As recently as six years ago, he said less than 1 percent of plastic was being recycled in the United States. He noted that 60 billion pounds of plastic are sold each year, with 59 billion pounds thrown away.

Forman said plastic recycling almost got started by accident when nine states approved container deposit laws that included provisions for deposits on plastic soft-drink bottles.

Forman said the American Plastic Council is spending more than $30 million this year but less than 1 percent is spent on recycling efforts.

However, $30 million will go to advertising that tells people to "take another look at plastic," he said.

One lobbying effort that hinders recycling encourages a process called Pyrolysis, which Forman described as a form of incineration, not recycling.

"Burning up resources is not recycling," he said.

Forman said there are some legitimate recycling efforts such as automated sorting of plastics. However, these early efforts have been abandoned in favor of Pyrolysis by the American Plastics Council, he said.

Forman said only soda bottles and milk jugs are being recycled to any significant extent. Almost all other plastic is discarded.

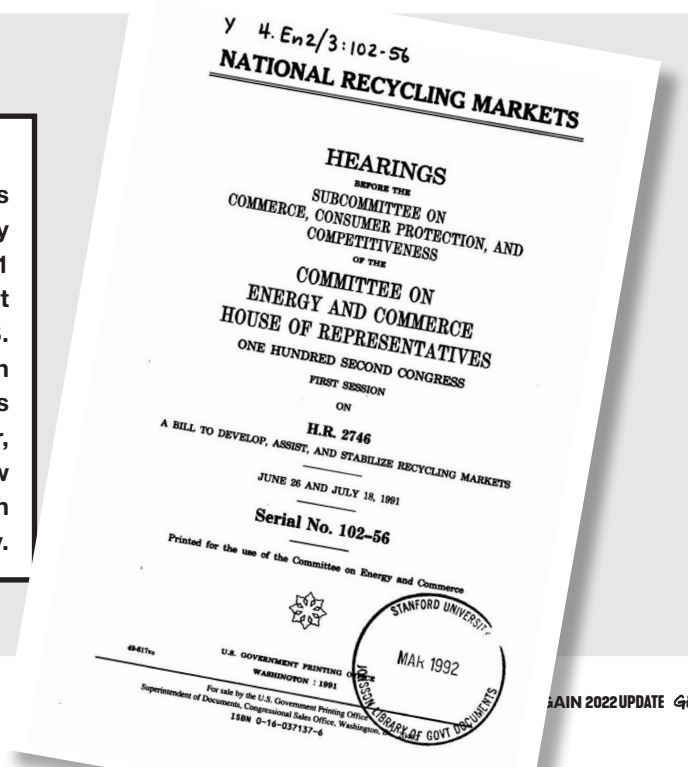
Plastics companies are now apparently recycling false promises made 30 years ago about the use of chemical recycling methods to recycle plastics.

For example, Figure 7 shows an excerpt of the 1991 congressional testimony by Eastman Chemical Company where it announced plans to "close the loop" by producing PET with recycled content for food packaging, including plastic soft drink bottles. The company stated that it would "use Eastman Kodak's existing methanolysis unit in Rochester, NY, to convert recycled PET into its raw materials. These will be blended with virgin feedstock at Carolina Eastman Company."[68] According to company officials, Eastman planned to produce about 50 million lbs of recycled plastic per year – enough to manufacture about 500 million soda bottles annually.[69]

Greenpeace USA and The Last Beach Clean Up were unable to find any evidence that a PET bottle recycling facility was ever operated at Eastman Kodak's Rochester, NY, facility, and the facility was fully shut down in 2012.[70]

**FIGURE 7: 1991 CONGRESSIONAL TESTIMONY BY EASTMAN CHEMICAL COMPANY**

**Eastman Chemical Company has announced plans to "close the loop" by producing PET with recycled content in 1991 for food packaging, including plastics soft drink bottles. With acceptance by the U.S. Food and Drug Administration expected in 1991, the company will use Eastman Kodak's existing methanolysis unit in Rochester, NY, to convert recycled PET into raw materials. These will be blended with virgin feedstock at Carolina Eastman Company.**



In 2019, Eastman again announced plans to build a PET#1 methanolysis plant.[71] As of July 2022 the plant was still under construction and had not yet started up or proven to be commercially viable.[72]

Mechanical recycling techniques have proven insufficient, failing to raise the percentage of plastic waste that is recycled in the U.S. over 10%[73] – so the plastics industry continues to try to fool the public and legislators with the promise of "moonshot" technologies that always seem to be 10 years away from commercial use.[74] A representative of Chevron Phillips Chemicals likened the commercialization of chemical recycling to "going to Mars."[75]

In reality, so-called advanced or chemical recycling is not technically, environmentally, or economically viable. It has failed and will continue to fail for the same down-to-earth, real-world reasons that mechanical recycling of plastics has failed. And, as described in reports by Greenpeace USA,[76] the Global Alliance for Incinerator Alternatives (GAIA),[77] and the Natural Resources Defense Council (NRDC),[78] toxic emissions from chemical recycling could cause new environmental and health harms.

Mechanical and chemical recycling of plastic waste has largely failed and will likely always fail because plastic waste is: (1) extremely difficult to collect, (2) virtually impossible to sort for recycling, (3) environmentally harmful to reprocess, (4) made of and contaminated by toxic materials, and (5) not economical to recycle. Paper, cardboard, metal, and glass largely do not have these problems, which is why they are actually recycled at high rates.[79]

These challenges are recognized by plastic producers. Amcor – one of the world's largest packaging companies, which produces packaging from a range of materials – has reportedly acknowledged that recycling of plastic packaging is extremely limited, whereas the big mainstream paper, metal, and glass suppliers are already using a larger percentage of recycled materials. Those industries typically also have roadmaps to meet zero-emissions goals by 2050, unlike the plastics industry, which Amcor describes as "the only industry that [still] has these little artisanal recyclers making the recycled content we're trying to find."[80]

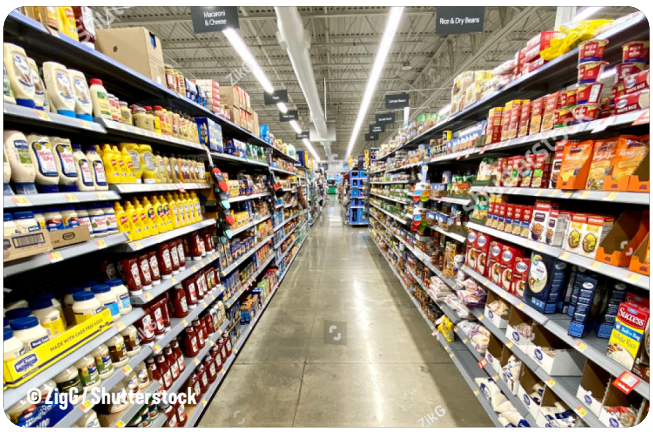
## REASON 1: PLASTIC WASTE IS EXTREMELY DIFFICULT TO COLLECT

Single-use plastics can be thought of as trillions of pieces of plastic confetti spewed from retail and fast food stores to over 330 million U.S. residents across more than 3 million square miles (not counting Alaska and Hawaii) each year. It's simply not possible to collect the vast quantity of small pieces of plastic sold to U.S. consumers annually.

The plastic, products, and recycling industries themselves admit that the collection of plastic waste from consumers is a major barrier to increasing plastic recycling rates. In response to a California lawsuit alleging that plastic bags are not recyclable because they are not collected and recycled,[81] the APR reportedly allowed that collection was a major barrier, stating: "Reusable plastic bags are recyclable. The issue is simply that they are difficult to channel back to recyclers."[82] The APR further blames lack of collection for the overall low plastic recycling rates in the U.S. (approximately 5% in 2021[83]), stating that recyclers "can only recycle what's made available to them"[84] and claiming that "The biggest issue is that our collection infrastructure is based on 1970s and 1980s technology. Our infrastructure is woefully lacking and woefully behind the packaging stream that we have today. Plastic recyclers operate at about 60% capacity today. We can recycle a lot more material. We can't get it. We can recycle anything if it's collected and sorted properly."[85] Under the guise of "infrastructure," the APR calls for more public investment in plastic collection – which actually means more trucks on U.S. highways, because actual physical conveyance infrastructure (pipelines and electrical wires) is not used to transport waste.[86]

Ironically, volunteer cleanup stunts, often funded by the plastics industry, also prove the impossibility of systematically collecting the trillions of pieces of plastic waste produced every year. Keep America Beautiful (KAB), a non-profit organization that is infamous for its greenwashing and advertisements from the 1970s,[87] is funded by plastics and fast food companies like Dow and McDonald's.[88] For decades, KAB led volunteer cleanups to collect plastic pollution. While KAB and sponsors celebrate collecting bags of plastic waste, the continual need for cleanups demonstrates that collection and recycling programs are not keeping plastic waste out of the environment. Tennessee's Chattanooga River, still filled with plastic pollution despite continual cleanups, is a stark reminder that volunteer cleanup efforts cannot keep up with the flow of new plastic waste into the environment.[89] In response to continuing low plastic recycling rates, The Recycling Partnership, which is funded by the plastics and products industries,[90] called for massive investment in its 2021 "Paying It Forward" report.[91] U.S. residents currently pay about $4.2 to $5.9 billion/year for the collection of recycling materials from curbside bins, with these services chiefly financed through local taxation.[92] On top of that, The Recycling Partnership called for a $17 billion investment over five years, with $1.2 billion provided each year for "education and outreach strategies to improve recycling behavior."[93] The $17 billion also includes a one-time investment of $4 billion to create a recycling system for unrecyclable plastic film waste.

***A representative of Chevron Phillips Chemicals likened the commercialization of chemical recycling to "going to Mars".***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While The Recycling Partnership claims that lack of curbside recycling bins and collection is the main reason for low recycling rates,[94] California's low plastic recycling rate suggests that isn't true. Curbside residential recycling has effectively been mandatory in California since 1989, when the California Integrated Waste Management Act (AB 939) made all California cities and counties implement solid waste diversion plans, which required curbside recycling collection to achieve.[95] Still, in 2021, the California Statewide Recycling Commission determined that only PET#1 and HDPE#2 bottles and jugs are recyclable in California.[96] **This suggests that lack of access to curbside recycling is not the main cause of low plastic recycling rates or limited acceptance of plastic items for recycling.**

## REASON 2: MIXED PLASTIC WASTE CANNOT BE RECYCLED TOGETHER

Spending billions of consumer and taxpayer dollars to increase collection could be a waste of money. Even if it were all collected, mixed plastic waste cannot be recycled together, and it would be functionally impossible to sort the trillions of pieces of consumer plastic waste produced each year into separate types to be reprocessed.

Plastics Recyclers Europe, an organization representing plastics recyclers, reportedly observed in June 2022 that "a lack of sorted plastics is undermining the businesses of European recyclate producers and the shortage is negatively impacting the operations of plastics recyclers across Europe."[97] Yet, as a representative of a major Californian recycling company was quoted as stating earlier in the year, "There's just so many types of plastic. We can't recycle them all. We can't manage them all. You can't recycle your way out of the larger plastic problem."[98]

There are thousands of different plastics, each with its own composition and characteristics.[99] Different plastics have different melting points, dyes, and colorants. Different types of chemical additives give plastics specific characteristics, such as flexibility or rigidity.[100] Polyethylene terephthalate (PET#1) bottles are made by blow-molding and cannot be recycled with PET#1 cups, trays, or clamshells, which are made by thermoforming and are a different PET#1 material.[101] Green PET#1 bottles cannot be recycled with clear PET#1 bottles.[102] To combat this issue, all beverage companies operating in Japan have voluntarily used only clear PET#1 since 1992,[103] and South Korea banned colored PET#1 in 2020.[104] Other types of plastics, including high-density polyethylene (HDPE#2), polyvinyl chloride (PVC#3), low-density polyethylene (LDPE#4), polypropylene (PP#5), and polystyrene (PS#6), all must be separated for recycling.[105]

Sorting plastics can also waste plastics. The Recycling Partnership admits that "in today's system, upwards of 15% of all the PET bottles that enter a MRF never come out the

other side," meaning that they are not properly sorted into PET bales but are disposed of in the MRF contamination stream.[106] Colored PET#1 bottles have negligible market demand and are a serious source of contamination in PET#1 bottle bales. Indeed, a 2019 study by the Plastic Recycling Corporation of California (PRCC) determined that colored PET#1 bottles cause valuable clear PET bottles to be inadvertently disposed of. The PRCC stated: "During the bale analysis, project leaders saw colored PET was one of the areas where a lot of clear PET loss was occurring. That's because colored PET makes up a high percentage of what's removed from the bales, so more clear PET escapes with colored PET than with other contaminants."[107]

Since 1994, when the U.S. DOE published its final report on waste plastic recycling, it's been known that no type of chemical recycling can successfully process mixed plastic waste from households.[108] The most common pyrolysis process requires a consistent amount of good quality feedstock (without any PET#1 or PVC#3) to function effectively,[109] but household plastic waste contains significant amounts of PET#1 bottles, clamshells, cups, and some PVC#3 packaging that looks just like PP#5 and HDPE#2 plastic.

Starting in 2018, the Renewlogy pyrolysis plant in Salt Lake City, Utah, was heavily promoted by Dow[110] and the ACC[111] as able to reprocess mixed plastic waste from Boise, Idaho, households through the Hefty EnergyBag program[112] and turn it into diesel fuel. But, as exposed in a 2021 Reuters investigation, the project was halted within a year due to contamination of the pyrolysis process.[113] Instead of being recycled, the mixed plastic waste collected by Boise is now burned in cement kilns, with significant carbon emissions.

Even though chemical recycling failed at the heavily touted Renewlogy plant, that failure has not stopped the plastics industry from continuing to make baseless and exaggerated claims, such as "Even mixed plastics and plastics with food residue can now be remade into new plastics approved for food, pharmaceutical, and medical use – through advanced recycling."[114]

Amcor, however, disagrees with the plastics industry's claim that mixed plastics can be chemically recycled, stating on its website that "There is often a misconception that with chemical recycling it will be possible to throw anything in and get virgin quality resin back. That may work in theory but it's unlikely in the real world."[115]

According to a 2022 report by the NRDC[116] and a recent statement by the ACC's VP of Plastics,[117] there are only a handful of chemical recycling facilities operating in the U.S. today. Greenpeace USA estimates the total capacity of the operating facilities to be about 121,600 tons/year – which is only 0.24% of the 51 million tons of plastic waste generated by U.S. households each year.[118] That's hardly the "massive wave of projects" claimed by the plastics industry.[119] Importantly, there's no proof that plastic waste from households is being reprocessed at these facilities. In fact, the Nexus pyrolysis plant in Georgia has admitted that it can't process much mixed household plastic waste and primarily uses "post-commercial and post-industrial" plastic film waste.[120] Recycling industrial and commercial plastic film, however, doesn't reduce the over 3.2 million trash trucks per year of U.S. consumer plastic waste going from fast food restaurants and households to landfills or incinerators, or ending up as plastic pollution.[121]

Fortunately, the Mayor of Macon, Georgia, did not automatically accept the claims made by Brightmark Energy when the company recently sought $500 million in public bonds to build a pyrolysis plant in Macon.[122] The city wisely required Brightmark to prove that its first plant, constructed in Ashley, Indiana,[123] was operating as promised. Since the Ashley plant had not started commercial operation, Brightmark Energy could not prove performance and the proposed Macon project was halted.[124]

## REASON 3: PLASTIC RECYCLING IS WASTEFUL, POLLUTING, AND A FIRE HAZARD

If all plastic waste is somehow collected and sorted, then the reprocessing of plastic waste itself makes plastic waste. In their announcement about construction of a new PET#1 bottle recycling facility in Mexico, Coca-Cola and ALPLA state that 30% of plastic PET#1 bottles received will be wasted.[125] This is consistent with the 2018 National Association for PET Container Resources (NAPCOR) report on PET#1 beverage bottle recycling, which stated that due to contamination and process losses about a third of the collected bottle material is disposed of.[126]

Microplastics are generated in mechanical recycling and are removed by washing operations. The microplastics are discharged to the environment via either untreated wastewater or wastewater treatment plant sludge streams.[127]

Recycling plastic has also been shown to be toxic to workers. Researchers at Leeds University in the United Kingdom performed a review of over 4,000 sources of information to evaluate the risks of (1) toxics in recycled plastics and (2) toxic exposure to workers and communities in plastic recycling operations.[128] Workers were found to be exposed to toxics in mechanical plastic recycling operations.

As reported by Canada's National Observer in 2021, "Most plastic products contain toxic chemicals added to give plastic desirable traits, like flexibility or non-stick properties. When they are broken down during recycling or incineration, these toxins – everything from endocrine disrupters to cancer-causing chemicals – can escape


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recycling facilities and landfills to contaminate people and the environment."[129]

Residents who live near U.S. plastic recycling facilities report plastic pollution spewing from the recycling plants and onto their property, including a resident of Lowell, Arkansas, who found pieces of plastic film and plastic dust covering her children's backyard playground equipment in May 2022.[130] As the KFSM news film report shows, a nearby plastic film recycling plant grinding plastic waste to be made into "green" decking was the cause of the plastic pollution.

Plastic is highly flammable, so plastic recycling can be dangerous to neighboring communities due to the risk of fires at the recycling facilities, which can release toxins into the air. For example, in August 2022, 39 neighbors of a plastic recycling facility in Dallas, Texas, filed a class action lawsuit against Poly America for toxic health impacts from a fire that burned for 23 hours in August 2020.[131] A map of the many fires at plastic recycling facilities in the U.S. and world is shown on The Last Beach Cleanup's website.[132]

## REASON 4: RECYCLED PLASTIC OFTEN HAS HUGE TOXICITY RISKS

Plastics are not inert like metal and glass. Plastic products themselves may contain toxic additives or absorb chemicals, and these products are generally collected in curbside bins that may be filled with problem materials like plastic containers used to store pesticides or motor oil.[133] According to a report published in late 2021 by the Canadian Government, toxicity risks in recycled plastic prohibit "the vast majority of plastic products and packaging produced" from being recycled into food-grade packaging.[134] This means that the billions of pounds per year of plastic used for food service packaging cannot be safely recycled back into food service packaging, leaving only two remaining options: downcycling the plastic waste into lower-value products or disposing of it via landfill or incineration.

## REASON 5: PLASTIC RECYCLING IS NOT ECONOMICAL

It has always been exorbitantly expensive to collect, sort, truck, and safely reprocess plastic waste. The significant jump in diesel prices in 2022 is making the cost of trucking plastic waste even greater; in May 2022 a Midwest recycler stated that trucking plastic waste to Canada was "two-to-three times more expensive than it was six months ago."[135] New plastic directly competes with recycled plastic, and it's far cheaper to produce[136] and of higher quality – and the petrochemical industry is rapidly expanding, which is lowering the cost of new plastic even further.

The basic economic premise of the "circular economy of plastics" is false. The Ellen McArthur Foundation claimed in 2016 that "After a short first-use cycle, 95% of plastic packaging material value, or USD 80–120 billion annually, is lost to the economy."[137] But they produced this estimation by simply multiplying the price of new plastic by the amount of plastic waste generated per year. This is like equating the value of old shoes to the cost of a new pair of shoes. In fact, mixed plastic waste has zero to negative value because there is a disposal cost to get rid of it.[138]

Since new plastic is cheaper and higher quality than recycled plastic, product companies will continue to buy new plastic instead. At the fifth session of the UN Environment Assembly in early 2022, Unilever admitted that it wouldn't increase its use of recycled plastic if the price was much higher than that of new plastic.[139]


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# 3. THE WORLD IS AT A DECISION POINT ON SINGLE-USE PLASTICS AND PACKAGING

As scientific evidence of the harm caused by plastic pollution and the toxic risks of recycled plastic continues to mount, discussions about what to do about single-use plastics are underway at the global level through UNEP plastics treaty,[140] in the U.S. Congress and city halls and state capitals across the country, as well as in corporate board rooms.

After more than 30 years, it is time to accept that plastic recycling is a failed concept. Unlike with paper or metals, there are two insurmountable barriers that prevent plastic recycling from ever working at scale: toxicity and economics. Plastic cannot be safely recycled from post-consumer household waste back into new food-grade plastic products. The flood of 400 million tons/year of cheap new plastic production[141] kills the business case for large-scale investment in plastic recycling. And the problem lies not with the concept or process of recycling but with the plastic material itself – it is plastic recycling that does not work.[142]

***Plastic waste bales at a warehouse in Australia. There are no buyers for the bales so the recycling company, SKM, declared bankruptcy.***

© Fairfax Media / Getty Images

Greenpeace believes that companies must take action now to eliminate single-use plastics and packaging and not rely on false solutions such as recycling (advanced, chemical, or otherwise), recycled content, and material substitution. Viable alternatives to single-use plastics and packaging, such as reuse and refill systems, exist and need to be rapidly scaled up and invested in by the world's biggest plastic polluters. These companies can no longer use recycling as a smokescreen to divert attention from the systemic changes that are needed.

## GREENPEACE IS CALLING ON COMPANIES TO TAKE THE FOLLOWING STEPS:

- **Urgently move to reuse systems and packaging-free approaches.** Set targets to have at least 50% reusable packaging by 2030. Note: Sectors for which a switch to reuse is comparatively easy – such as soft drinks, mineral water, alcoholic beverages, and coffee chains – should set more ambitious targets.
- **Commit to collaborating with others to standardize reusable packaging** and build shared reuse systems and infrastructure.
- **Phase out all single-use plastics (packaging and products),**[143] not just "virgin" or "new" plastic.
- **Be transparent.** Annually release verified data about your company's single-use packaging footprint, including single-use packaging reduction rates and reusable

packaging uptake. Disclose where plastic used originates and report on the full lifetime climate footprint of packaging production, use, and disposal.

- **Advocate for political action to drive industry-wide transformation.** Promote an ambitious global plastics treaty that addresses the entire life cycle of plastic products and emphasizes reduction. Support regional and national legislation that promotes the slow circular economy and extended producer responsibility, bans single-use plastics, and fast-tracks reuse, refill, and packaging-free systems.

# APPENDIX A. 2022 SURVEY OF PLASTIC WASTE COLLECTION/SORTATION AND REPROCESSING: TECHNICAL APPROACH AND DETAILED RESULTS

To meet the threshold for the "recyclable" label, the FTC Green Guides stipulate that at least 60% of the U.S. population must have access to an established recycling program that can collect or otherwise separate a product from the waste stream and reuse it in manufacturing or assembling another item.[144] In this comprehensive survey, the following were assessed:

1. **Collection and sortation (MRF) facilities:** The contents of the publicly posted lists of specific types of plastic products accepted in the curbside recycling bins of the 375 operating U.S. residential MRFs were surveyed. (Details provided in Appendix A.1 - Survey of U.S. Material Recovery Facilities.)

2. **Plastic reprocessing facilities:** The reprocessing capacity of the facilities that turn the collected/sorted material into plastic resin was assessed to determine the total U.S. processing capacity of specific types of post-consumer plastics. (Details provided in Appendix A.2 - Survey of U.S. Recycling/Reprocessing Capacity for Post-Consumer Plastic Waste.)
3. **Current U.S. access to established municipal collection and sortation systems**

# A.1 2022 SURVEY OF U.S. MATERIAL RECOVERY FACILITIES

## A.1.1 SURVEY METHODOLOGY AND PUBLIC TRANSPARENCY

The original comprehensive, objective survey of acceptance of plastic items at U.S. residential MRFs for curbside recycling has been continually updated since its creation in October 2019 and was reverified in August 2022. The survey was performed and verified by technically qualified volunteers of The Last Beach Cleanup:[145] two registered professional chemical engineers and a recycling industry expert. The technical experts involved have no financial conflicts of interest related to legitimate recyclable labels for plastic products that would influence the assessment or results. The acceptance information was found in the public domain and is publicly shared to promote transparency and establish a traceable account of facts related to "recyclable" claims and labels for plastic products. The details of the survey were captured in a spreadsheet that is publicly available on the Greenpeace USA website.
**Survey of Plastic Item Acceptance:** A "MRFshed" approach was employed to survey the acceptance of plastic items sent to recycling facilities by U.S. residents who have access to curbside recycling. A MRFshed is defined "as a group of communities that funnel material into the same materials recycling facility (MRF)."[146] Through web searches, each MRF was investigated for the public disclosure of items accepted for curbside recycling. About one-third of the MRFs provided information on acceptance of plastic items at the facility. When MRF acceptance information was not found, a search of websites of local cities or counties that direct recycling to a specific MRF was performed. If this secondary approach revealed no information about the MRF, recycling guidance provided by the MRF owner (e.g., Republic Services' Recycling Simplified[147] guidelines to customers) was captured. The acceptance guidance provided by MRFs and local municipal governments ranged from complicated "wizard" search tools to easily understandable text and photos. Where there was inconsistency between text and photo guidance, all items listed or shown were considered accepted. This approach was intentionally conservative to avoid bias.

**Use of the Survey:** The 2022 U.S. MRF Survey results may be quoted with attribution to Greenpeace USA and The Last Beach Cleanup. The information in the survey spreadsheet may be quoted with attribution to the original source of the information (provided by links in the spreadsheet). The spreadsheet itself is the intellectual property of The Last Beach Cleanup and may not be reproduced without express written consent.

**Survey Updates**: Submissions by MRFs and local governments are welcomed to update or correct the information found and presented. Links to publicly available information are required to revise the traceable account. Since external links may change at any time, we request notification of a broken link. Please send updates with links to lastbeachcleanup@gmail.com.

### A.1.2 2022 U.S. MRF SURVEY RESULTS

Table A-1 summarizes the findings about the acceptance of plastic items by municipal MRF collection systems and corresponding evidence of disposal or export of plastic waste by MRFs. MRFs that still accept non-bottle plastics may be disposing of or exporting the collected low-value mixed plastic waste.

**TABLE A-1: 2022 PLASTIC ITEMS: ACCEPTANCE FOR MUNICIPAL COLLECTION BY U.S. MRFS**

| Plastic Item | Acceptance at U.S. MRFs (375 Total) |
|---|---|
| PET#1 Bottles and Jugs | 375 (100%) |
| HDPE#2 Bottles and Jugs | 375 (100%) |
| PP#5 Tubs | 194 (52%) |
| Plastic Clamshells | 41 (11%) |
| Plastic Cups | 32 (9%) |
| Plastic Trays | 17 (5%) |
| Plastic Bags | 3 (1%) |
| Styrofoam Food Service | 4 (1%) |
| Plastic Lids and Caps (Loose) | 9 (2%) |
| Plastic Plates | 6 (2%) |
| Plastic Cutlery, Straws and Stirrers | 1 (0%) |
| Plastic Food Wrappers and Pouches | 0 (0%) |
| PP#5 or PS#6 Coffee Pods | 1 (0%) |

## A.2 SURVEY OF U.S. RECYCLING/ REPROCESSING CAPACITY FOR POST-CONSUMER PLASTIC WASTE

Material recycling/reprocessing facilities that process the collected/sorted material into plastic resin for use in manufacturing or assembling another item are required to be "established" by the FTC for an item to be labeled as recyclable.[148] Since export markets are closing and do not provide sufficient assurance of recycling, sufficient domestic recycling/reprocessing capacity must exist for the plastic material collected by the MRFs to be recycled. The plastic recycling industry publishes limited information on the capacity of U.S. plastic recyclers/ reprocessors for specific types of post-consumer plastic waste. Estimates of U.S. domestic post-consumer plastic recycling/reprocessing capacity are made to determine if sufficient capacity exists to assure customers that a plastic product has a sufficient likelihood of actually being recycled into a new product if it is accepted by a MRF. The estimates are summarized in Table A-2 and detailed in Sections A.2.1 - A.2.7.

**TABLE A-2: SUMMARY OF ESTIMATES OF CURRENT 2022 U.S. RECYCLING/ REPROCESSING CAPACITY FOR POST-CONSUMER PLASTIC WASTE**

| Plastic Type | Estimate of Current U.S. Recycling/ Reprocessing for Post-Consumer Plastic Waste |
|---|---|
| PET#1 | 20.9% |
| HDPE#2 | 10.3% |
| PVC#3 | Negligible |
| LDPE/LLDPE#4 | Less than 5% |
| PP#5 | Less than 2% |
| PS#6 | Less than 1% |
| Other #7 | Negligible |

### A.2.1 U.S. EPA 2018 PLASTIC RECYCLING RATES

Recycling rates for plastic items provide a basic indication of recycling capacity because production rates are a portion of production capacity. The most recent U.S. EPA recycling rates published are for the year 2018 and are shown in Appendix B and summarized in Table A-3.[149] The "recycled" material, totaling 3.09 million tons, includes a significant amount of exported material: in 2018, 943 million kg (1.04 million tons) of U.S. plastic waste was exported (not including to Canada).[150] If the exported plastic waste counted as "recycled" is deducted from the total, then only 2.05 million tons, or 5.7% of the total U.S. plastic waste generated, were recycled. The 2018 data for "Total Recycled %" therefore provides a high estimate of U.S. plastic waste reprocessing capacity, because exports are included. Note that the EPA's definition of "Containers and Packaging" does not include plastic food service items such as cups and plates.

**TABLE A-3: 2018 U.S. EPA FACTS AND FIGURES ABOUT MATERIALS, WASTE AND RECYCLING**

| USEPA 2018 Solid Waste Data | Total Post-Consumer Plastic Waste (Thousand Tons) | | | Total Plastics in Containers and Packaging (CcP) (Thousand Tons) | | |
|---|---|---|---|---|---|---|
| Resin type | Total Plastic Waste | Total Recycled | Total % Recycled | CcP Plastic Waste | CcP Recycled | CcP Recycled |
| #1 PET | 5,290 | 980 | 18.5% | 3,860 | 980 | 25.4% |
| #2 HDPE | 6,300 | 560 | 8.9% | 3,790 | 560 | 14.8% |
| #3 PVC | 840 | Negligible | 0% | 390 | Negligible | 0% |
| #4 LDPE/LLDPE | 8,590 | 370 | 4.3% | 3,730 | 370 | 9.9% |
| #5 PP | 8,150 | 50 | 0.6% | 1,830 | 50 | 2.7% |
| #6 PS | 2,260 | 20 | 0.9% | 550 | 20 | 3.6% |
| #7 PLA | 90 | Negligible | 0% | 20 | Negligible | 0% |
| Other resins | 4,160 | 1110 | 26.7% | 360 | Negligible | 0% |
| Total Plastics | 35,680 | 3,090 | 8.7% | 14,530 | 1,980 | 13.6% |

## A.2.2 2022 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYETHYLENE TEREPHTHALATE (PET) PLASTIC #1 WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer PET plastic waste is approximately 20.9% of the total post-consumer PET plastic waste generated. This estimate is supported by the 18.5% recycling rate reported by the U.S. EPA in 2018 and other evidence.

Evidence supporting this estimate:

1. According to the most recent data published by the APR, in 2020, the U.S. reclaimer capacity was nearly 2.4 billion lbs.[151] NAPCOR previously reported that at the end of 2017 there were 22 PET recycling/reprocessing plants operating in the U.S., with a total annual nameplate capacity of 2.3 billion lbs.[152] However, NAPCOR did not report the number of recyclers or capacity in its 2018 report.[153] Detailed NAPCOR reports are no longer free and accessible to the public for viewing, and the report's cost of $4,000 is prohibitive for access by non-industry stakeholders.[154]
2. As shown in Table A-3, the U.S. produced 5.29 million tons (10.6 billion lbs) of PET waste in 2018. Assuming a 4% annual growth factor through 2020,[155] the figure for 2020 can be estimated at approximately 11.5 billion lbs. The existing U.S. domestic capacity for recycling/reprocessing PET waste is therefore estimated to be about 20.9% (2.4 billion lbs of reprocessing capacity for 11.5 billion lbs of waste produced).

## A.2.3 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER HIGH-DENSITY POLYETHYLENE (HDPE) PLASTIC #2 WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer HDPE#2 plastic waste is approximately 10.3% of the total post-consumer HDPE#2 plastic waste generated. This estimate is supported by the 8.9% recycling rate reported by the U.S. EPA in 2018 (see Appendix B) and other evidence.

Evidence supporting this estimate:

1. The APR reports a total U.S. HDPE#2 post-consumer reclamation capacity of 1.3 billion lbs for 2019.[156]
2. As shown in Table A-3, the U.S. produced 6.3 million tons (12.6 billion lbs) of HDPE#2 waste in 2018. Therefore, existing U.S. domestic capacity for recycling/reprocessing HDPE#2 waste is estimated to be about 10.3%.

## A.2.4 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER HIGH POLYVINYL CHLORIDE (PVC) PLASTIC #3 WASTE

The U.S. EPA data in Table A-3 indicates that the current U.S. domestic reprocessing capacity for post-consumer PVC#3 plastic waste is negligible. When it is accepted by a MRF, PVC#3 is typically collected as part of a mixed plastics #3-7 bale. There is negligible demand for these bales across the country. [157] As detailed by numerous examples in Greenpeace's 2020 "Circular Claims Fall Flat" report, collected mixed plastics are often disposed of to landfills or destroyed by incineration.[158]

## A.2.5 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER LOW-DENSITY POLYETHYLENE (LDPE) PLASTIC #4 WASTE

The U.S. EPA data in Table A-3 indicates that the current U.S. domestic reprocessing capacity for post-consumer LDPE#4 plastic waste is less than 5%. When it is accepted by a MRF, LDPE#4 is typically collected as part of a mixed plastics #3-7 bale. There is negligible demand for these bales across the country, and the collected mixed plastics are often disposed of in landfills or destroyed by incineration.

## A.2.6 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYPROPYLENE #5 PLASTIC WASTE

Available data indicates that the current U.S. domestic reprocessing capacity for post-consumer PP#5 plastic waste is approximately 2-5%. This conservative estimate is supported by the low (0.6%) recycling rate reported by the U.S. EPA in 2018 (see Appendix B) and other evidence. When it is accepted by a MRF, PP#5 is typically collected as part of a mixed plastics #3-7 bale. There is negligible demand for these bales across the country, and the collected mixed plastics are often disposed of in landfills or destroyed by incineration.

Evidence supporting this estimate:

1. Polypropylene is reportedly "one of the least recycled post-consumer plastics, at a rate below 1 percent for post-consumer recovery."[159]
2. KW Plastics (Alabama) is reported to be the largest processor of U.S. post-consumer polypropylene plastic waste; however, it only has the capacity to process 100 million lbs/year of polypropylene waste.[160] As shown in Table A-3, the U.S. produced 8,150 million tons (16.3 billion lbs) of polypropylene waste in 2018. Therefore, KW Plastics has the capacity to process less than 1% of U.S. post-consumer polypropylene plastic waste.
3. Assuming that KW Plastics processes about one-half of post-consumer polypropylene plastic waste,[161] the total current U.S. capacity to recycle/reprocess polypropylene plastic waste is estimated to be less than 2%.

## A.2.7 U.S. DOMESTIC REPROCESSING CAPACITY FOR POST-CONSUMER POLYSTYRENE (PS) PLASTIC #6 WASTE

The U.S. EPA data in Table A-3 indicates that the current U.S. domestic reprocessing capacity for post-consumer PS #6 plastic waste is less than 1%. When it is accepted by a MRF, plastic #6 is typically collected as part of a mixed plastics #3-7 bale. There is negligible demand for these bales across the country, and the collected mixed plastics are often disposed of in landfills or destroyed by incineration.

## A.2.7 U.S. DOMESTIC REPROCESSING CAPACITY FOR PLASTIC #7 WASTE

Plastic #7 waste includes multiple types of plastics "other" than plastics #1-6, including bio-based plastics such as polylactic acid (PLA) plastic. The U.S. EPA data in Table A-3 indicates that the current U.S. domestic reprocessing capacity for "other" plastic waste is negligible. When it is accepted by a MRF, plastic #7 is typically collected as part of a mixed plastics #3-7 bale. There is negligible demand for these bales across the country, and the collected mixed plastics are often disposed of in landfills or destroyed by incineration.

# A.3 CURRENT U.S. ACCESS TO MUNICIPAL COLLECTION AND SORTATION

To legitimately claim a product as "recyclable," the FTC requires that recycling facilities be available to a "substantial majority" of U.S. residents, defined to be at least 60%. The FTC focuses on established recycling systems, rather than privately operated mail-back or retail store take-back programs, in determining recycling availability.[162]

In its 2021 "Paying It Forward" report, The Recycling Partnership estimated the access to various kinds of recycling for U.S. households:[163]

- Curbside recycling: 52%
- On-property multifamily recycling: 4%
- Offsite drop-off recycling with trash: 4%
- Percentage of households with no or non-equitable access to recycling: 40%

Table A-4 provides an updated estimation of U.S. residents' access to collection services for recycling in 2022, including a detailed analysis of acceptance of PP#5 tubs.

### TABLE A-4: ACCESS TO COLLECTION SERVICES FOR RECYCLING: 2022 UPDATED ESTIMATION

| U.S. Population's Access to Municipal Collection for Recycling | (A) Total U.S. Population 2020[166] | (B) 2022 PP#5 Tub Acceptance (Recycling Not Assured) | PP#5 Acceptance Basis | 2022 Total U.S. PP#5 Tub Acceptance (A x B) |
|---|---|---|---|---|
| Curbside Recycling | 52% | 52% | 2022 U.S. MRF Survey | 27% |
| On-Property Multifamily Recycling | 4% | 52% | Assume accepted items same as for Curbside Recycling | 2% |
| Offsite Drop-off Recycling with Trash | 4% | 0% | Drop-off centers typically accept only bottles and jugs; PP#5 assumed not collected | 0% |
| Percentage of Households with No or Non-Equitable Access to Recycling | 40% | 0% | No acceptance | 0% |
| | | | US Population Access to Collection for Recycling (Collected Material May Be Disposed of, Not Recycled) | 29% |

# APPENDIX B: U.S. EPA 2018 SUSTAINABLE MATERIALS MANAGEMENT REPORT – TABLE 8 FOR PLASTICS[164]

## TABLE 8. PLASTICS IN PRODUCTS IN MSW, 2018 (US EPA DATA) (IN THOUSANDS OF TONS AND PERCENT OF GENERATION BY RESIN)

| Product Category | Generation | Recycled* | | Combusted with energy Recovery | Landfilled |
|---|---|---|---|---|---|
| | (Thousand tons) | (Thousand tons) | (Percent of generation) | (Thousand tons) | (Thousand tons) |
| **Durable Goods** | | | | | |
| PET | 660 | | | | |
| HDPE | 1,590 | | | | |
| PVC | 180 | | | | |
| LDPE/LLDPE | 2,130 | | | | |
| PP | 4,590 | | | | |
| PS | 760 | | | | |
| Other resins | 3,780 | | | | |
| *Total Plastics in Durable Goods* | *13,690* | *930* | *6.80%* | *1,740* | *11,020* |
| **Nondurable Goods ◊** | | | | | |
| Plastic Plates and Cups § | | | | | |
| LDPE/LLDPE | 20 | | | | |
| PLA | 30 | | | | |
| PP | 160 | | | | |
| PS | 820 | | | | |
| *Subtotal Plastic Plates and Cups* | *1,030* | *Neg.* | *Neg.* | *200* | *830* |
| **Trash Bags** | | | | | |
| HDPE | 230 | | | | |
| LDPE/LLDPE | 1,000 | | | | |
| *Subtotal Trash Bags* | *1,230* | | | *240* | *990* |
| **All other nondurables**** | | | | | |
| PET | 770 | | | | |
| HDPE | 690 | | | | |
| PVC | 270 | | | | |
| LDPE/LLDPE | 1,710 | | | | |
| PLA | 40 | | | | |
| PP | 1,570 | | | | |
| PS | 130 | | | | |
| Other resins | 20 | | | | |
| *Subtotal All Other Nondurables* | *5,200* | *180* | *3.50%* | *980* | *4,040* |
| **Total Plastics in Nondurable Goods, by resin** | | | | | |
| PET | 770 | | | | |
| HDPE | 920 | | | | |
| PVC | 270 | | | | |
| LDPE/LLDPE | 2,730 | | | | |
| PLA | 70 | | | | |
| PP | 1,730 | | | | |
| PS | 950 | | | | |
| Other resins | 20 | | | | |
| *Total Plastics in Nondurable Goods* | *7,460* | *180* | *2.40%* | *1,420* | *5,860* |
| **Plastic Containers & Packaging** | | | | | |
| Bottles and Jars*** | | | | | |
| PET | 3,130 | 910 | 29.10% | 440 | 1,780 |
| Natural Bottles† | | | | | |
| HDPE | 750 | 220 | 29.30% | 100 | 430 |
| **Other plastic containers** | | | | | |
| HDPE | 1,600 | 290 | 18.10% | | |
| PVC | 20 | Neg. | | | |
| LDPE/LLDPE | 40 | Neg. | | | |

| | | | | | |
|---|---|---|---|---|---|
| PP | 250 | 20 | 8.00% | | |
| PS | 80 | Neg. | | | |
| *Subtotal Other Containers* | *1,990* | *310* | *15.60%* | *330* | *1,350* |
| **Bags, sacks and wraps** | | | | | |
| HDPE | 640 | 50 | 7.80% | | |
| PVC | 70 | | | | |
| LDPE/LLDPE | 2,780 | 370 | 13.30% | | |
| PP | 570 | | | | |
| PS | 140 | | | | |
| *Subtotal Bags, Sacks and Wraps* | *4,200* | *420* | *10.00%* | *740* | *3,040* |
| **Other Plastics Packaging¥** | | | | | |
| PET | 730 | 70 | 9.60% | | |
| HDPE | 800 | Neg. | | | |
| PVC | 300 | Neg. | | | |
| LDPE/LLDPE | 910 | Neg. | | | |
| PLA | 20 | Neg. | | | |
| PP | 1,010 | 30 | 3.00% | | |
| PS | 330 | 20 | 6.10% | | |
| Other resins | 360 | Neg. | | | |
| *Subtotal Other Packaging* | 4,460 | 120 | 2.70% | 850 | 3,490 |
| ***Total Plastics in Containers & Packaging, by resin*** | | | | | |
| PET | 3,860 | 980 | 25.40% | | |
| HDPE | 3,790 | 560 | 14.80% | | |
| PVC | 390 | Neg. | | | |
| LDPE/LLDPE | 3,730 | 370 | 9.90% | | |
| PLA | 20 | Neg. | | | |
| PP | 1,830 | 50 | 2.70% | | |
| PS | 550 | 20 | 3.60% | | |
| Other resins | 360 | Neg. | | | |
| *Total Plastics in Containers & Packaging* | 14,530 | 1,980 | 13.60% | 2,460 | 10,090 |
| | | | | | |
| **Total Plastics in MSW, by resin** | | | | | |
| PET | 5,290 | 980 | 18.50% | | |
| HDPE | 6,300 | 560 | 8.90% | | |
| PVC | 840 | Neg. | | | |
| LDPE/LLDPE | 8,590 | 370 | 4.30% | | |
| PLA | 90 | Neg. | | | |
| PP | 8,150 | 50 | 0.60% | | |
| PS | 2,260 | 20 | 0.90% | | |

* Mechanical and non-mechanical recycling.

◊ Nondurable goods other than containers and packaging.

§ Due to source data aggregation, PET cups are included in "Other Plastic Packaging".

** All other nondurables include plastics in disposable diapers, clothing, footwear, etc.

*** Injection stretch blow molded PET containers as identified in Report on Postconsumer PET Container Recycling Activity in 2017. National Association for PET Container Resources. Recycling includes caps, lids and other material collected with PET bottles and jars.

† White translucent homopolymer bottles as defined in the 2017 United States National Postconsumer Plastics Bottles Recycling Report. American Chemistry Council and the Association of Postconsumer Plastic Recyclers.

¥ Other plastic packaging includes coatings, closures, lids, caps, clamshells, egg cartons, produce baskets, trays, shapes, loose fill, etc.

PP and HDPE caps and lids recycled with PET bottles and jars are included in the recycling estimate for PET bottles and jars.

Other resins include commingled/undefined plastic packaging recycling.

Some detail of recycling by resin omitted due to lack of data.

Neg. = negligible, less than 5,000 tons

HDPE = High density polyethylene

PET = Polyethylene terephthalate

PS = Polystyrene

LDPE = Low density polyethylene

PP = Polypropylene

PVC = Polyvinyl chloride

LLDPE = Linear low density polyethylene

PLA = Polylactide

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# REFERENCES


**13WMAZ.com.** 2022. Macon mayor withdraws support for Brightmark Plastics recycling plant. January 10, 2022. Available at: https://www.13wmaz.com/article/news/local/macon-mayor-withdraws-support-for-brightmark-recycling-plant/93-6068ca18-a2a6-41ce-8c6e-64f6ddf0c1ad

**5Newsonline.com.** 2022. HEALTH: Residents of Lowell neighborhood report plastic particles in air, claiming nearby factory to blame. May 25, 2022. Available at: https://www.5newsonline.com/article/news/health/residents-lowell-neighborhood-report-plastic-particles-air-claiming-nearby-factory-blame/527-ccd3b469-3b82-4cfb-b959-9202bff040b6

**Ambrose,** J. 2019. War on plastic waste faces setback as cost of recycled material soars. The Guardian, October 13, 2019. Available at: https://www.theguardian.com/environment/2019/oct/13/war-on-plastic-waste-faces-setback-as-cost-of-recycled-material-soars

**Amcor.** 2021. The benefits and challenges of chemical recycling for flexible plastic packaging in Europe. September 20, 2021. Available at: https://www.amcor.com/insights/blogs/chemical-recycling-flexible-plastic-packaging

**American** Chemistry Council. 2017. Renewlogy joins plastics-to-fuel and petrochemistry alliance. October 3, 2017. Available at: https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2017/renewlogy-joins-plastics-to-fuel-and-petrochemistry-alliance

**American** Chemistry Council. 2022a. ACC's Baca to announce stepped-up awareness efforts on advanced recycling at World Petrochemical Conference. March 22, 2022. Available at: https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2022/acc-s-baca-to-announce-stepped-up-awareness-efforts-on-advanced-recycling-at-world-petrochemical-conference

**American** Chemistry Council. 2022b. ACC statement on California's Attorney General investigation. April 29, 2022. Available at: https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2022/acc-statement-on-california-s-attorney-general-investigation

**AP.** 2012. Kodak closing Rochester Unit; 80 jobs impacted. May 15, 2012. Available at: https://www.manufacturing.net/home/news/13209289/kodak-closing-rochester-unit-80-jobs-impacted

**AP** News. 1991. FDA approves Kodak plan to recycle plastic for food containers. August 22, 1991. Available at: https://apnews.com/article/f213b7b3c-5254e1842344222cd87a46e

**Association** of Plastic Recyclers. 2022. APR press release: North American plastic recycling volumes highlight need for immediate solutions. April 22, 2022. Available at: https://plasticsrecycling.org/news-and-media/north-american-plastic-recycling-volumes-highlight-need-for-immediate-solutions.

**Association** of Plastic Recyclers. 2019 U.S. post-consumer plastic recycling data dashboard (Online). Available at: https://circularityinaction.com/2019PlasticRecyclingData

**Association** of Plastic Recyclers. 2020 U.S. post-consumer plastic recycling data dashboard (Online). Available at: https://circularityinaction.com/2020PlasticRecyclingData

**Association** of Plastic Recyclers. Recyclable per APR definition (Online). Available at: https://plasticsrecycling.org/recycling-definitions

**Association** of Plastic Recyclers. Sort for value online calculator (Online). Available at: https://plasticsrecycling.org/sort-for-value-calculator

**Baca,** J. 2022. American Chemistry Council: "Advanced recycling is not waste incineration." Bioplastics Magazine, May 6, 2022. Available at: https://www.bioplasticsmagazine.com/en/news/meldungen/20220506-ACC.php

**Brock,** J., Volcovici, V., and Geddie, J. 2021. The recycling myth: Big oil's solution for plastic waste littered with failure. Reuters, July 29, 2021. Available at: https://www.reuters.com/investigates/special-report/environment-plastic-oil-recycling/

**Brown,** L. 2022. Grand Prairie residents claim "toxic fumes" from plastic manufacturer fire left them with health issues. FOX 4 News, August 4, 2022. Available at: https://www.fox4news.com/news/grand-prairie-residents-claim-toxic-fumes-from-plastic-manufacturer-fire-left-them-with-health-issues

**Business** Wire. 2022. Breakthrough in food-grade recycled polypropylene. April 21, 2022. Available at: https://www.businesswire.com/news/home/20220421005210/en/Breakthrough-in-Food-Grade-Recycled-Polypropylene

**California's** Statewide Commission on Recycling Markets and Curbside Recycling. 2021. Policy recommendations. June 25, 2021. Available at: https://www.calrecycle.ca.gov/markets/commission

**CalRecycle,** Enforcement (Online). Available at: https://calrecycle.ca.gov/lgcentral/enforcement/

**Chaudhuri,** S. 2022. Your "widely recyclable" plastic yogurt container is rarely recycled. Wall Street Journal, August 17, 2022. Available at: https://www.wsj.com/articles/your-yogurt-tub-says-widely-recyclablebut-is-it-being-recycled-11660729184

**Chitalia,** A., and McDermott, M. 2022. Overcapacity puts pressure on polypropylene markets. Wood Mackenzie, August 11, 2022. Available at: https://www.woodmac.com/news/opinion/overcapacity-puts-pressure-on-polypropylene-markets/

**City** of Knoxville. Recycling (Online). Available at: https://www.knoxvilletn.gov/cms/One.aspx?portalId=109562andpageId=200229

**ConwayArkansas.gov.** Sanitation > Educational resources (Online). Available at: https://conwayarkansas.gov/sanitation/educational-resources/

**Cook,** E., Velis, C., and Derks, M. 2020. Plastic waste reprocessing for circular economy: A systematic review of risks to occupational and public health from legacy substances and extrusion. December 2020. doi: 10.31224/osf.io/yxb5u

**Doherty,** J. 2019. Chemical recycling of plastics "10 years away." Letsrecycle.com, October 21, 2019. Available at: https://www.letsrecycle.com/news/chemical-recycling-of-plastics-10-years-away/

**Earth911.** 2020. Recycling plastic clamshells and bottles, the same but different. September 11, 2020. Available at: https://earth911.com/business-policy/recycling-plastic-clamshells/

**Ellen** MacArthur Foundation. 2016. The New Plastics Economy: Rethinking the future of plastics. Available at: https://emf.thirdlight.com/link/faarmdpz93ds-5vmvdf/@/preview/1?o

**Ellen** MacArthur Foundation. 2021a. Global Commitment 2021 reporting guidelines. Available at: https://emf.thirdlight.com/file/24/CKkdo5RCFUWx-VTCKYMBCv52kTH/2021%20Global%20Commitment%20Reporting%20guidelines%20for%20business%20signatories.pdf

**Ellen** MacArthur Foundation. 2021b. The Global Commitment 2021 progress report. Available at: https://emf.thirdlight.com/link/n1ipti7a089d-ekf9l1/@/preview/1?o

**Enck,** J., and Dell, J. 2022. Plastic recycling doesn't work and will never work. The Atlantic, May 30, 2022. Available at: https://www.theatlantic.com/ideas/archive/2022/05/single-use-plastic-chemical-recycling-disposal/661141/?utm_source=feed

**Esposito,** F. 2022a. As one resin sees prices dive, another material soars. Plastics News, July 7, 2022. Available at: https://www.plasticsnews.com/resin-pricing/one-resin-sees-prices-dive-another-material-soars

**Esposito,** F. 2022b. Polypropylene pricing on the move, more volatility likely. Plastics News, May 5, 2022. Available at: https://www.plasticsnews.com/resin-pricing/polypropylene-pricing-move-more-volatility-likely

**Fawcett-Atkinson,** M. 2021. Plastic recycling could be more dangerous than you think. Canada's National Observer, June 29, 2021. Available at: https://www.nationalobserver.com/2021/06/29/news/plastic-recycling-toxic-chemicals-more-dangerous-than-you-think

**Federal** Trade Commission. 2012a. Green guides, 16 CFR 260. Available at: https://www.ftc.gov/policy/federal-register-notices/guides-use-environmental-marketing-claims-green-guides

**Federal** Trade Commission. 2012b. Green guides: Statement of basis and purpose. Available at: https://www.ftc.gov/sites/default/files/attachments/press-releases/ftc-issues-revised-green-guides/greenguidesstatement.pdf

**Fortune** Business Insights. 2022. Plastic market size, share and COVID-19 impact analysis. May 2022. Available at: https://www.fortunebusinessinsights.com/plastics-market-102176

**Future** Market Insights. 2022. Plastic market share poised to grow US$ 885 billion by 2032. July 7, 2022. Available at: https://www.globenewswire.com/en/news-release/2022/07/07/2475587/0/en/Plastic-Market-Share-Poised-to-grow-US-885-Billion-by-2032-Future-Market-Insights-Inc.html

**GAIA.** Chemical recycling (Online). Available at: https://www.no-burn.org/chemical-recycling-resources/

**Gendell,** A. 2022. In my opinion: PET recycling lessons can transform industry. Resource Recycling, June 29, 2022. Available at: https://resource-recycling.com/plastics/2022/06/29/in-my-opinion-pet-recycling-lessons-can-transform-industry/

**Gerassimidou,** S., et al. 2022. Unpacking the complexity of the PET drink bottles value chain: A chemicals perspective. Journal of Hazardous Materials **430**. doi: 10.1016/j.jhazmat.2022.128410

**Goldsberry,** C. 2019. Is an age-old chemical process the solution to today's plastic waste problem? Plastics Today, July 31, 2019. Available at: https://www.plasticstoday.com/recycling/age-old-chemical-process-solution-todays-plastic-waste-problem

**Gonazalez,** G. 2019. APR: Chemical recycling is not "silver bullet" for plastics challenges. Waste Dive, October 16, 2019. Available at: https://www.wastedive.com/news/apr-chemical-recycling-plastic-sej/564995/

**Greenpeace.** 2020a. Analysis exposes plastic industry's "chemical recycling" fantasy. September 9, 2020. Available at: https://www.greenpeace.org/usa/news/analysis-exposes-plastic-industrys-chemical-recycling-fantasy/

**Greenpeace.** 2020b. Circular claims fall flat: Comprehensive U.S. survey of plastics recyclability. Available at: https://www.greenpeace.org/usa/research/report-circular-claims-fall-flat/

**Hamilton,** G. 2022. EPA: Regulate "chemical recycling" for what it is – Incineration. Break Free From Plastic, March 9, 2022. Available at: https://www.breakfreefromplastic.org/2022/03/09/epa-regulate-chemical-recycling-for-what-it-is-incineration/

**Heffernan,** M. 2022. Plastics recycling report draws mainstream notice. Resource Recycling, May 11, 2022. Available at: https://resource-recycling.com/plastics/2022/05/11/plastics-recycling-report-draws-mainstream-notice/

**Hefty.** Hefty EnergyBag program (Online). Available at: https://www.hefty.com/products/hefty-energybag

**Japan** Soft Drink AssociationPartnership for Circular Economy. 2021. Announcement to achieve 50% bottle-to-bottle recycling by 2030. Japan Partnership for Circular Economy, April 19, 2021. Available at: https://j4ce.env.go.jp/en/casestudy/085

**Keep** America Beautiful. Our partners (Online). Available at: https://kab.org/about/partners/

**Kominik,** S. 2022. Packaging suppliers face winding pathway on the road to sustainability. Plastics News, July 1, 2022. Available at: https://www.plasticsnews.com/news/packaging-suppliers-face-winding-pathway-road-sustainability

**Kosier,** E. 2020. Keeping polypropylene recyclable. FoodandDrink.com, October 2020. Available at: https://www.nextloopp.com/wp-content/uploads/2020/10/Nextek.pdf

**Krouse,** P. 2022. Recycling the once unrecyclable: A technology born in Akron is taking shape in rural Indiana. Cleveland.com, March 5, 2022. Available at: https://www.cleveland.com/news/2022/03/recycling-the-once-unrecyclable-a-technology-born-in-akron-is-taking-shape-in-rural-indiana.html

**Lam,** M. 2022. "You can't recycle your way out": California's plastic problem and what we can do about it. KQED, January 24, 2022. Available at: https://www.kqed.org/news/11901288/you-cant-recycle-your-way-out-californias-plastic-problem-and-what-to-do-about-it

**The** Last Beach Cleanup and Beyond Plastics. 2022. The real truth about the U.S. plastic recycling rate. May 4, 2022. Available at: https://www.lastbeachcleanup.org/_files/ugd/dba7d7_5ae55cdb66d241239e8ae-123c96ec9b8.pdf

**The** Last Beach Cleanup. 2021 fast food plastic survey (Online). Available at: https://www.lastbeachcleanup.org/fastfoodsurvey

**The** Last Beach Cleanup. Fires at plastic recycling facilities (Online). Available at: https://www.lastbeachcleanup.org/fires

**LeBlanc,** R. 2019. An overview of polypropylene recycling. LiveAbout.com, May 9, 2019. Available at: https://www.thebalancesmb.com/an-overview-of-polypropylene-recycling-2877863

**Lincoln** Star Journal. 1993. Plastics manufacturers accused of not living up to recycling claims. October 22, 1993. Available at: https://www.

newspapers.com/clip/104321171/lincoln-journal-star/

**Makower,** J. 2020. Inside Eastman's moonshot goal for endlessly circular plastics. GreenBiz, May 11, 2020. Available at: https://www.greenbiz.com/article/inside-eastmans-moonshot-goal-endlessly-circular-plastics

**McCormick,** E. 2020. America's "recycled" plastic waste is clogging landfills, survey finds. The Guardian, February 18, 2020. Available at: https://www.theguardian.com/us-news/2020/feb/18/americas-recycled-plastic-waste-is-clogging-landfills-survey-finds

**Millbrandt,** A., Coney, K., Badgett, A., and Beckham, G.T. 2022. Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling **183**. doi: 10.1016/j.resconrec.2022.106363

**NAPCOR** and Association of Plastic Recyclers, 2018. Report on postconsumer PET container recycling activity in 2017. November 15, 2018. Available at: https://napcor.com/wp-content/uploads/2018/11/NAPCOR_2017RateReport_FINAL_rev.pdf

**NAPCOR.** 2019. Postconsumer PET recycling activity in 2018. December 16, 2019. Available at: https://napcor.com/wp-content/uploads/2021/07/Postconsumer-PET-Recycling-Activity-in-2018.pdf

**NAPCOR.** PET recycling reports (Online). Available at: https://napcor.com/reports-resources/

**Neo,** P. 2020. No colour, no PVC: South Korea bans hard-to-recycle plastic materials for FandB packaging. Food Navigator Asia, July 21, 2020. Available at: https://www.foodnavigator-asia.com/Article/2020/01/31/No-colour-no-PVC-South-Korea-bans-hard-to-recycle-plastic-materials-for-F-B-packaging

**NRDC.** 2022. Recycling lies: "Chemical recycling" of plastic is just greenwashing incineration. Available at: https://www.nrdc.org/sites/default/files/chemical-recycling-greenwashing-incineration-ib.pdf

**OECD.** 2022. Global plastic waste set to almost triple by 2060, says OECD. June 3, 2022. Available at: https://www.oecd.org/environment/global-plastic-waste-set-to-almost-triple-by-2060.htm

**Paben,** J. 2022a. California lawsuits take aim at reusable, recycled-content bags. Resource Recycling, June 8, 2022. Available at: https://resource-recycling.com/plastics/2022/06/08/california-law-suits-take-aim-at-reusable-recycled-content-bags/

**Paben,** J. 2022b. How a chemical recycling firm handles EnergyBag plastics. Resource Recycling, February 2, 2022. Available at: https://resource-recycling.com/recycling/2021/02/02/how-a-chemical-recycling-firm-handles-energybag-plastics/

**Paben,** J. 2022c. Thermoform-to-thermoform bill draws mixed reactions. Plastics Recycling Update, September 8, 2022. Available at: https://resource-recycling.com/plastics/2022/09/08/thermoform-to-thermoform-bill-draws-mixed-reactions/

**Pace,** M. 2019. Chattanooga Creek still full of trash despite volunteer efforts; Cleanup taking place next weekend. Chattanooga Free Press, February 13, 2019. Available at: https://www.timesfreepress.com/news/local/story/2019/feb/13/chattanoogcreek-still-full-trash-despite-volu/488647/

**PBS** Frontline. 2020. Plastic wars. March 31, 2020. Available at: https://www.pbs.org/wgbh/frontline/film/plastic-wars/

**Plastics** Make It Possible. 2021. Types of plastic: How many kinds of plastics are there? January 18, 2021. Available at: https://www.plasticsmakeitpossible.com/about-plastics/types-of-plastics/professor-plastics-how-many-types-of-plastics-are-there/

**Plastics** Recycling Update. 2020. Slipping through the cracks. Resource Recycling, Winter 2020. Available at: https://resource-recycling.com/plastics/2020/05/19/slipping-through-the-cracks/amp/

**Platt,** D. 2022. Europe sees higher prices for recycled resins across the board. Plastics News, June 29, 2022. Available at: https://www.plasticsnews.com/news/europe-sees-higher-prices-recycled-resins-across-board

**The** Recycling Partnership. 2017. MRFshed report. Available at: http://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2017/08/TheRecyclingPartnership_MRFshedReport_7.3.17.pdf

**The** Recycling Partnership. 2020. 2020 state of curbside recycling report. Available at: https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2020/02/2020-State-of-Curbside-Recycling.pdf

**The** Recycling Partnership. 2021. Paying it forward: How investment in recycling will pay dividends. Available at: https://recyclingpartnership.org/paying-it-forward/

**The** Recycling Partnership. Funding partners (Online). Available at: https://recyclingpartnership.org/funding-partners/

**Recycling** Today. 2017. APR launches program to expand market demand for recycled resin. October 18, 2017. Available at: https://www.recyclingtoday.com/article/apr-recycling-demand-champion-program/

**Republic** Services. Recycling simplified (Online). Available at: https://recycling-simplified.com/

**Rosengren,** C. 2020. Secondary MRF operator conducting Northeast plastics study following California facility closure. Waste Dive, November 12, 2020. Available at: https://www.wastedive.com/news/titus-secondary-mrf-plastic-american-chemistry-council/588828/

**Route** Ready. 2019. What you should know about the 4 major types of garbage trucks. October 10, 2019. Available at: https://routereadytrucks.com/blogs/know-4-major-types-garbage-trucks/

**Sanchez,** R. 2021. Keep America Beautiful ran a master class in corporate greenwashing. The Dieline, April 22, 2021. Available at: https://thedieline.com/blog/2021/4/22/keep-america-beautiful-ran-a-master-class-in-corporate-greenwashing

**Smalley,** M. 2022. Alpla, Coca-Cola FEMSA invest $60M in Mexican PET recycling plant. Recycling Today, January 31, 2022. Available at: https://www.recyclingtoday.com/article/alpla-coca-cola-femsa-invest-pet-recycling-mexico-plant/

**State** of California Department of Justice. 2022. Attorney General Bonta announces investigation into fossil fuel and petrochemical industries for role in causing global plastics pollution crisis. April 28, 2022. Available at: https://oag.ca.gov/news/press-releases/attorney-general-bonta-announces-investigation-fossil-fuel-and-petrochemical

**Staub,** C. 2021. KW Plastics adds dedicated polypropylene wash line. Resource Recycling, December 1, 2021. Available at: https://resource-recycling.com/plastics/2021/12/01/kw-plastics-adds-dedicated-polypropylene-wash-line

**Stina.** 2021. Assessing the state of food grade recycled resin in Canada and the United States. Available at: http://www.plasticsmarkets.org/jsfcode/upload/wd_492/20211201120602_9_jsfwd_492_q2_1.pdf

**Superior** Court of the State of California, County of Los Angeles. 2022. The Last Beach Cleanup vs. Gelson's Markets, case no. 22STCV18216. Lawsuit filed June 3, 2022. Available at: https://www.lastbeachcleanup.org/_files/ugd/dba7d7_a0cab1ed86e34e62a44d64402fa9ba18.pdf

**Suzuki,** G., et al. 2022. Mechanical recycling of plastic waste as a point source of microplastic pollution. Environmental Pollution **303**, June 15, 2022. doi: 10.1016/j.envpol.2022.119114

**Sweet,** C. 2018. How Dow Chemical and Boise are taking aim at plastics. GreenBiz, April 23, 2018. Available at: https://www.greenbiz.com/article/how-dow-chemical-and-boise-are-taking-aim-plastics

**Titus** MRF Services. 2019. Pacific Northwest secondary sorting demonstration project. Available at: https://www.plasticsindustry.org/sites/default/files/FINAL%20Report_Pacific%20Northwest%20Secondary%20Sorting%20Demonstration%20Project.pdf

**Toloken,** S. 2022. 175 countries commit to creating plastics pollution treaty. Plastics News, March 2, 2022. Available at: https://www.plasticsnews.com/news/plastics-pollution-treaty-negotiations-get-green-light

**Toto,** D. 2019. Eastman seeks to commercialize its methanolysis recycling technology. Recycling Today, March 5, 2019. Available at: https://www.recyclingtoday.com/article/eastman-to-commercialize-polyester-recycling-technology/

**Toto,** D. 2021. APR Recycling Demand Champions campaign generates 175 million pounds of PCR demand in its third year. Recycling Today, February 23, 2021. Available at: https://www.recyclingtoday.com/article/apr-demand-champions-increase-pcr-consumption-year-three/

**Toto,** D. 2022a. APR reports Demand Champions' impact. Recycling Today, June 23, 2022. Available at: https://www.recyclingtoday.com/article/apr-demand-champions-impact-2021/

**Toto,** D. 2022b. Eastman considers locations for second US methanolysis site. Recycling Today, July 1, 2022. Available at: https://www.recyclingtoday.com/article/eastman-considers-texas-locations-methanolysis-recycling-process-pet/

**Toto,** D. 2022c. PET supply tight, prices rising. Recycling Today, May 19, 2022. Available at: https://www.recyclingtoday.com/article/low-collection-rates-hamper-rpet-supply/

**Toto,** D. 2022d. Polypropylene rebounds. Recycling Today, April 22, 2022. Available at: https://www.recyclingtoday.com/article/polyolefin-scrap-demand-rebounds/

**UN** News. 2022. Nations sign up to end global scourge of plastic pollution. March 2, 2022. Available at: https://news.un.org/en/story/2022/03/1113142

**U.S.** Census Bureau. 2019. 2019 U.S. population estimates continue to show the nation's growth Is slowing. December 30, 2019. Available at: https://www.census.gov/newsroom/press-releases/2019/popest-nation.html

**U.S.** Census Bureau. USA Trade Online (Online). Available at: https://usatrade.census.gov/

**U.S.** Congress, House Committee on Energy and Commerce. 1991. National recycling markets: Hearings before the Subcommittee on Commerce, Consumer Protection, and Competitiveness. June 26 and July 18, 1991. Available at: https://www.google.com/books/edition/National_Recycling_Markets/j_4sa83MEYcC?hl=enandgbpv=0

**U.S.** DOE. 1994. A research needs assessment for waste plastics recycling: Volume II, project report. Available at: https://digital.library.unt.edu/ark:/67531/metadc671615/?q=1994%20A%20research%20needs%20assessment%20for%20waste%20plastics%20recycling

**U.S.** EPA. Facts and figures about materials, waste and recycling (Online). Available at: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling

**U.S.** Plastics Pact. 2022. 2020 baseline report. Available at: https://usplasticspact.org/wp-content/uploads/dlm_uploads/2022/03/U.S.-Plastics-Pact-Baseline-Report.pdf

**Volcovici,** V. 2022. Brightmark, Georgia county cancel $680 mln plastic-to-fuel project. Reuters, April 12, 2022. Available at: https://www.reuters.com/world/us/brightmark-georgia-county-cancel-680-mln-plastic-to-fuel-project-2022-04-11/

**Wagner,** R. 2018. In my opinion: Plastics-to-fuel is launchpad for innovation. Plastics Recycling Update, February 21, 2018. Available at: https://resource-recycling.com/plastics/2018/02/20/opinion-plastics-fuel-launchpad-innovation/

**Waste360.** Why is plastic recycling so difficult? (Online). Available at: https://www.waste360.com/recycling/why-plastic-recycling-so-difficult

**Westervelt,** A. 2022. Exxon doubles down on "advanced recycling" claims that yield few results. The Guardian, May 11, 2022. Available at: https://www.theguardian.com/environment/2022/may/11/exxon-advanced-recycling-plastic-pollution-investigation

**Wolman,** J. 2022. The chemical exec pushing advanced plastics recycling. Politico, July 13, 2022. Available at: https://www.politico.com/newsletters/the-long-game/2022/07/13/the-chemical-exec-pushing-advanced-plastics-recycling-00045400

**World** Economic Forum. 2022. Top 25 recycling facts and statistics for 2022. June 22, 2022. Available at: https://www.weforum.org/agenda/2022/06/recycling-global-statistics-facts-plastic-paper/

# ENDNOTES


1 ConwayArkansas.gov, "Sanitation > Educational resources"
2 OECD, 2022
3 Milbrandt et al., 2022
4 The U.S. Census Bureau reported a population of 328 million people in 2019 (see U.S. Census Bureau, 2019).
5 PBS Frontline, 2020
6 The Last Beach Cleanup and Beyond Plastics, 2022, pp. 2–3
7 Greenpeace, 2020b
8 Greenpeace, 2020b, p. 14
9 Stina, 2021, p. 4
10 California's Statewide Commission on Recycling Markets and Curbside Recycling, 2021, p. 94
11 Chaudhuri, 2022
12 City of Knoxville, "Recycling"
13 This is the target threshold "across multiple regions, collectively representing at least 400 million inhabitants"; see Ellen MacArthur Foundation, 2021b, p. 25.
14 Enck and Dell, 2022
15 Gerassimidou et al., 2022
16 Enck and Dell, 2022
17 UN News, 2022
18 Wolman, 2022
19 Ellen MacArthur Foundation, 2021b, p. 8.
20 U.S. Plastics Pact, 2022, p. 18
21 OECD, 2022
22 The Last Beach Cleanup and Beyond Plastics, 2022, p. 2
23 Greenpeace, 2020b
24 Federal Trade Commission, 2012a, p. 62129
25 Federal Trade Commission, 2012a, pp. 62129–62130
26 Federal Trade Commission, 2012b, pp. 174–175
27 Ellen MacArthur Foundation, 2021b, p. 25
28 Ellen MacArthur Foundation, 2021a, pp. 78–79
29 Ellen MacArthur Foundation, 2021b, p. 25
30 California's Statewide Commission on Recycling Markets and Curbside Recycling, 2021, p. 94
31 The survey is kept continually updated and was reverified in August 2022.
32 The Recycling Partnership, 2021
33 Federal Trade Commission, 2012a, p. 62129
34 The Last Beach Cleanup and Beyond Plastics, 2022, p. 2
35 Chaudhuri, 2022
36 Association of Plastic Recyclers, "Recyclable per APR definition"
37 Titus MRF Services, 2019, p. 5
38 Rosengren, 2020
39 Greenpeace, 2020b, pp. 10–11
40 Chaudhuri, 2022
41 City of Knoxville, "Recycling"
42 Toto, 2022d
43 California's Statewide Commission on Recycling Markets and Curbside Recycling, 2021, p. 94
44 Stina, 2021
45 Kosier, 2020
46 Business Wire, 2022
47 Esposito, 2022b
48 Esposito, 2022a
49 Chitalia and McDermott, 2022
50 U.S. EPA, "Facts and figures about materials, waste and recycling"
51 Paben, 2022c
52 The Last Beach Cleanup, "2021 fast food plastic survey"
53 U.S. Plastics Pact, 2022
54 Superior Court of the State of California, County of Los Angeles, 2022
55 PBS Frontline, 2020
56 Ellen MacArthur Foundation, 2016
57 Ellen MacArthur Foundation, 2016, p. 39
58 The Last Beach Cleanup and Beyond Plastics, 2022, p. 7
59 Recycling Today, 2017
60 Toto, 2021
61 Toto, 2022a
62 State of California Department of Justice, 2022
63 American Chemistry Council, 2022b
64 Westervelt, 2022
65 Westervelt, 2022
66 Hamilton, 2022
67 Lincoln Star Journal, 1993
68 U.S. Congress, House Committee on Energy and Commerce, 1991, p. 229
69 AP News, 1991
70 AP, 2012
71 Toto, 2019
72 Toto, 2022b
73 The Last Beach Cleanup and Beyond Plastics, 2022, p. 2
74 Makower, 2020; Doherty, 2019
75 Wagner, 2018
76 Greenpeace, 2020a
77 GAIA, "Chemical recycling"
78 NRDC, 2022
79 Enck and Dell, 2022
80 Kominik, 2022
81 Superior Court of the State of California, County of Los Angeles, 2022
82 Paben, 2022a
83 The Last Beach Cleanup and Beyond Plastics, 2022, p. 7
84 Heffernan, 2022
85 Gonazalez, 2019
86 Heffernan, 2022
87 Sanchez, 2021
88 Keep America Beautiful, "Our partners"
89 Pace, 2019
90 The Recycling Partnership, "Funding partners"
91 Association of Plastic Recyclers, 2022; The Recycling Partnership, 2021
92 The Recycling Partnership, 2020, p. 14
93 The Recycling Partnership, 2021, p. 5
94 The Recycling Partnership, 2021, pp. 12–13
95 CalRecycle, "Enforcement"
96 California's Statewide Commission on Recycling Markets and Curbside Recycling, 2021, p. 94

97 Platt, 2022
98 Lam, 2022
99 Plastics Make It Possible, 2021
100 Waste360, "Why is plastic recycling so difficult?"
101 Earth911, 2020
102 Enck and Dell, 2022
103 Japan Soft Drink AssociationPartnership for Circular Economy, 2021
104 Neo, 2020
105 Enck and Dell, 2022
106 Gendell, 2022
107 Plastics Recycling Update, 2020
108 U.S. DOE, 1994
109 Goldsberry, 2019
110 Sweet, 2018
111 American Chemistry Council, 2017
112 Hefty, "Hefty EnergyBag program"
113 Brock et al., 2021
114 American Chemistry Council, 2022a
115 Amcor, 2021
116 NRDC, 2022
117 Baca, 2022
118 The Last Beach Cleanup and Beyond Plastics, 2022, p. 7
119 Baca, 2022
120 Paben, 2022b
121 Estimation basis: 48.6 million tons/year of plastic waste not recycled per The Last Beach Cleanup and Beyond Plastics, 2022, p. 7; capacity of side-loader residential trash truck ~15 tons per Route Ready, 2019.
122 13WMAZ.com, 2022
123 Krouse, 2022
124 Volcovici, 2022
125 Smalley, 2022
126 NAPCOR, 2019
127 Suzuki et al., 2022
128 Cook et al., 2020
129 Fawcett-Atkinson, 2021
130 5Newsonline.com, 2022
131 Brown, 2022
132 The Last Beach Cleanup, "Fires at plastic recycling facilities"
133 Stina, 2021, p. 22
134 Stina, 2021, p. 9
135 Toto, 2022c
136 Ambrose, 2019
137 Ellen MacArthur Foundation, 2016, p. 15
138 McCormick, 2020
139 Toloken, 2022
140 UN News, 2022
141 World Economic Forum, 2022
142 Enck and Dell, 2022
143 Excluding essential single-use plastic medical equipment such as plastic syringes and tubing.
144 Federal Trade Commission, 2012a, p. 62129
145 The Last Beach Cleanup is a non-profit 501c3 organization whose mission is to reduce plastic pollution.
146 The Recycling Partnership, 2017, p. 4
147 Republic Services, "Recycling simplified"
148 Federal Trade Commission, 2012a, p. 62129
149 U.S. EPA, "Facts and figures about materials, waste and recycling"
150 U.S. Census Bureau, "USA Trade Online"
151 Association of Plastic Recyclers, "2020 U.S. post-consumer plastic recycling data dashboard"
152 NAPCOR and Association of Plastic Recyclers, 2018
153 NAPCOR, 2019
154 NAPCOR, "PET recycling reports"
155 Estimate based on compound annual growth rate projections for the plastics market; e.g. Future Market Insights, 2022, and Fortune Business Insights, 2022.
156 Association of Plastic Recyclers, "2019 U.S. post-consumer plastic recycling data dashboard"
157 Association of Plastic Recyclers, "Sort for value online calculator"
158 Greenpeace, 2020b
159 LeBlanc, 2019
160 Staub, 2021
161 Based on a review of the Plastics News Recyclers rankings, available to subscribers at https://www.plasticsnews.com/businessdata/439/Plastics%20Recyclers/Brokers.
162 Federal Trade Commission, 2012a, pp. 62129–62130
163 The Recycling Partnership, 2021
164 U.S. EPA, "Facts and figures about materials, waste and recycling"
165 U.S. EPA, "Facts and figures about materials, waste and recycling" (Table 8, included in Appendix B)
166 The Recycling Partnership, 2021

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