THE RECYCLING PARTNERSHIP

THE BRIDGE TO CIRCULARITY

PUTTING THE NEW PLASTICS ECONOMY INTO PRACTICE IN THE U.S.

Lead author:
Stephanie Kersten-Johnston

Other Recycling Partnership contributing authors and editors:
Dylan de Thomas, Sarah Dearman, Keefe Harrison, Katherine Huded, Jeff Meyers, Scott Mouw, Charlie Schwarze

External editors:
Ellen Martin, Laaren Brown

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ABOUT THE RECYCLING PARTNERSHIP

Less than half of the recyclables in U.S. homes get recycled. As the nation's leading recycling system change agent, The Recycling Partnership is on a mission to change this, by transforming recycling for good in states, cities, and towns all across the country in order to create a circular economy, stronger communities, and a healthier planet.

In five years, The Recycling Partnership has served more than 1,300 communities with best-in-class tools, resources, and technical support; placed nearly 600,000 recycling carts; reached 60 million households—nearly half of the U.S. population; and helped companies and communities invest more than USD $55 million in recycling infrastructure. In doing so, we have created meaningful social, environmental, and economic change, including diverting 230 million pounds of new recyclables, saving 465 million gallons of water, avoiding 250 thousand metric tons of greenhouse gas (GHG), and driving significant reductions in targeted contamination rates.

With the support of 45 (and counting) funding partners, our unique, public-private model proves that partnership powers progress. Eleven of our current funders are also signatories of the New Plastics Economy Global Commitment, collectively representing more than USD $880 billion in annual revenue.

By engaging the full recycling supply chain—from the corporations that manufacture products and packaging to local governments collecting recyclable materials from homes, to industry end markets, haulers, materials recovery facilities, and converters—The Recycling Partnership positively impacts recycling at every step in the process.

We help the nearly 50 percent of Americans who still need access to convenient recycling. We work with communities coast to coast to decrease waste and capture more quality tons of recyclables at the cart. We pursue policy options through our Circular Economy Accelerator. We find ways to create new end markets for recyclables. The Recycling Partnership is driving real recycling system change today, with a reach that extends beyond any other organization.

Fueling this system-wide change and a new circular economy is a commitment shared by The Recycling Partnership, its staff, its funding partners, and the communities it supports—to work together to find, try, and scale solutions. Our culture of innovative thinking asks how we can make the world better through partnership. After all, we're all in this bin together.

IN SUPPORT OF THE BRIDGE TO CIRCULARITY

Tackling the global plastic waste and pollution crisis requires concerted action at a global and local level. We are delighted to see The Recycling Partnership translate the ambitious targets of the New Plastics Economy Global Commitment into concrete and progressive actions to be taken in the United States, urging businesses and governments in the country to step up efforts towards transitioning to a circular economy for plastics. Stakeholders in the U.S., as well as around the world, must address plastic pollution at its source, by eliminating the plastics we don't need, innovating the plastics we do need, and circulating them safely in the economy to keep them out of the environment.

SANDER DEFRUYT, *Lead of the New Plastics Economy initiative, Ellen MacArthur*

PepsiCo's sustainable plastics vision is to create a world where plastics need never become waste, and stronger recycling systems will be key to making that vision a reality. Through partnership and a full systems approach, we can bring together each element of the circular economy and turn plastic waste into an economic and environmental opportunity. PepsiCo applauds our partners at The Recycling Partnership for producing a comprehensive and thorough assessment of the complex U.S. recycling system. This assessment identifies important solutions for raising recycling rates in the U.S., which will help PepsiCo to meet our common objectives with the Ellen MacArthur Foundation's Global Commitment.

TIM CAREY, *Vice President, Sustainability*

More than ever before, there is a need for collaborative action to address the recycling challenges at the local and national level and The Recycling Partnership's report helps provide the roadmap for partnership to accelerate progress toward a circular economy in the United States.

BRUCE KARAS, *Vice President Environment &*

Meeting brand commitments for recycled content relies on greater investment to scale the recycling system. The Bridge to Circularity outlines an action-oriented approach to advancing recycling and the circular economy investment in the United States. It comes at a time when there is momentum among stakeholders to make progress, and we hope this will help to drive collective action to tackle the critical waste issue. We commend The Recycling Partnership for developing this impactful report and look forward to working with them to drive action.

BRIDGET CROKE, *VP of External Affairs,*

This report shows what members of the Association of Plastic Recyclers have known for years—that brands and producers need to be more intentional about design, supply and end market demand. It connects the lofty and welcome goals put forward by those same brands and connects it to the reality of a disconnected, unregulated and unsupported supply chain for the materials that they will need to reach those goals. And we know that those goals will have to be met in partnership with APR members. We welcome this report and look forward to working with The Recycling Partnership, their funders, and beyond, to make sure the goods designed to grab the eye of the consumer at the shelf, can actually be recycled and end up back on that same shelf.

STEVE ALEXANDER, *President*

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EXECUTIVE SUMMARY

It's time to develop a circular economy for packaging in the U.S.

The global momentum around rethinking plastics is greater than ever,[1] and the Ellen MacArthur Foundation's (EMF) New Plastics Economy Global Commitment[2]—made by more than 400 organizations, including the world's largest consumer brands, and representing annual revenues in excess of USD $2 trillion—has created a new sense of urgency to address the limitations of the U.S. recycling system.

The New Plastics Economy Global Commitment is based on a common vision of a circular economy for plastics—an economy that includes eliminating problematic or unnecessary plastic packaging; moving from "single-use"[3] to reuse models where relevant; designing all packaging to be reusable, recyclable, or compostable; and increasing the use of post-consumer recycled content (PCR). As companies face greater scrutiny than ever before on their use of plastics packaging, and as public pressure grows for companies to be accountable to their ambitious commitments, their need for a high-functioning recycling infrastructure will only increase.

The current U.S. system is insufficient

Census data shows us that there are nearly 20,000 municipalities in the U.S., each one making its own decisions about if or how to recycle.[4] These loosely connected community recycling programs, run by local governments, cities, and counties, provide the only reverse logistics mechanisms available at scale for post-consumer packaging in the U.S. In practical terms, this positions the community-run recycling system in the U.S. as the circular economy's last line of defense for packaging waste.

"The reality of delivering on the Global Commitment targets in the U.S. will require massive national and industry-wide efforts to create a more circular economy for plastics, by harmonizing production, improving collection mechanisms, and creating more robust domestic end markets."

As the leading national nonprofit working towards a better U.S. recycling system, The Recycling Partnership has been consistently activating system change in communities over the past five years. However, the reality of delivering on the Global Commitment targets in the U.S. will require massive national and industry-wide efforts to create a more circular economy for plastics, by harmonizing production, improving collection mechanisms, and creating more robust domestic end markets.

1 Evidence presented in Ellen MacArthur Foundation, "New Plastics Economy: Catalysing Action," 2018, page 22.
2 Details can be found here: https://www.newplasticseconomy.org/projects/global-commitment
3 Defined by EMF to mean "designed to be used once,": https://www.newplasticseconomy.org/projects/global-commitment
4 U.S. Census Bureau data on incorporated places: https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html

At the same time, the burden of cheap waste disposal and the pricing disparity between virgin and PCR plastics emphasize the need for systemic solutions.

We can use the imminent plastics commitments to create the impetus for game-changing solutions, but we cannot stop there. The systemic issues are neither specific to plastics, nor will they be solved through plastic-only interventions. Addressing only short-term targets, or concentrating on plastics alone, will not create a viable platform for a truly circular economy. Nor will recycling alone ultimately suffice.

While the scale of plastic waste is undoubtedly alarming and unsustainable, unintended consequences may result from a short-term focus on a single material category. Instead, the momentum around plastics waste should provide an entry point to address the broader question of how to build a circular economy for all consumer packaging in the U.S.—one of the largest markets for plastics production and waste in the world.[5]

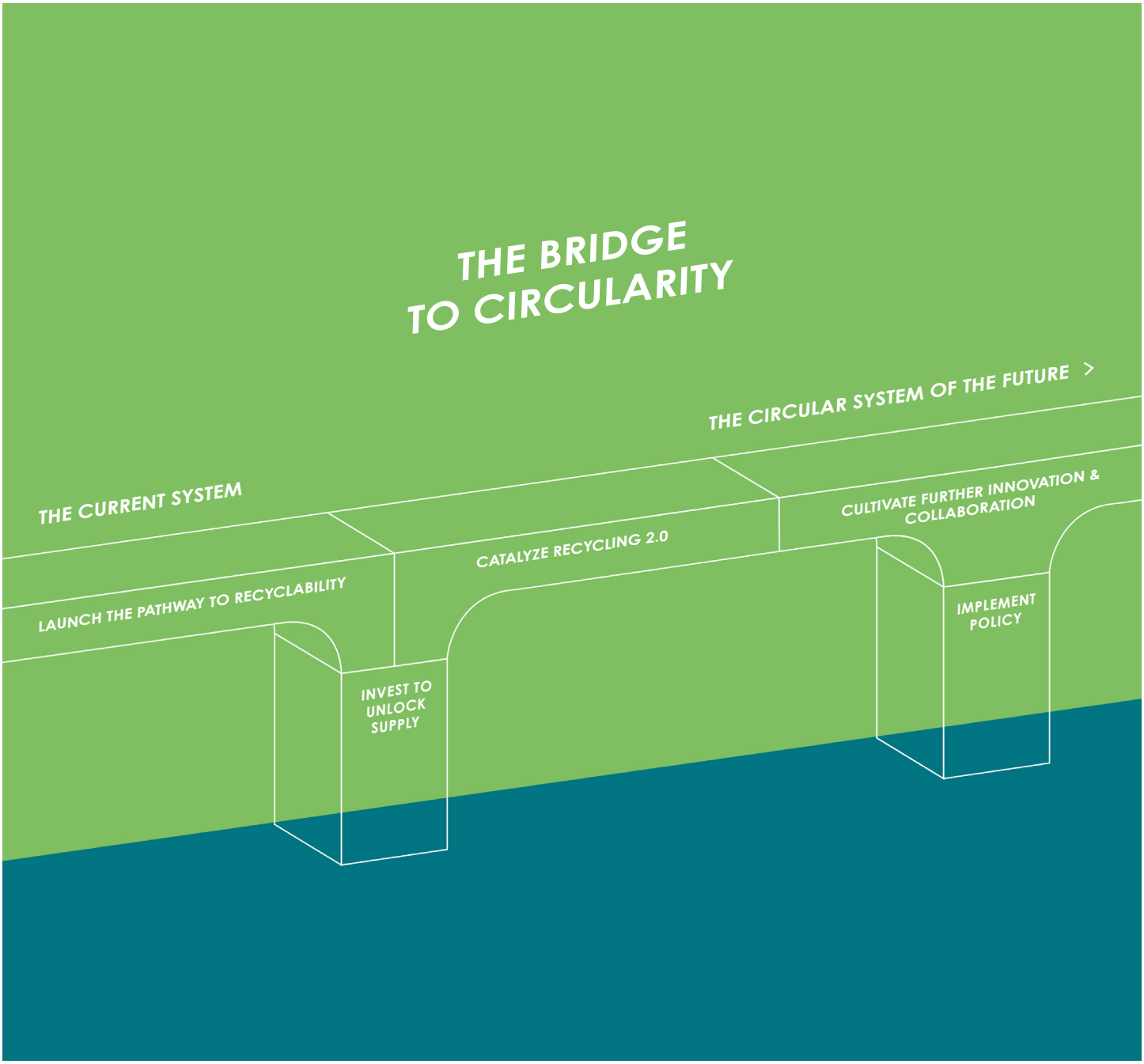
Three new initiatives will bridge the gap to circularity in the U.S.

There is no single solution for this immense systems challenge. However, to bridge the gap that exists between the current system and a circular one, The Recycling Partnership is calling for a concrete set of actions in the U.S., focused on "Recycling with Radically Improved Economics and Quality," a key pillar of the Ellen MacArthur Foundation's distinct strategies to drive the New Plastics Economy transition.[6] The launch of these initiatives corresponds to three major findings relating to achieving the Global Commitments in the U.S.[7]

"Addressing only short-term targets, or concentrating on plastics alone, will not create a viable platform for a truly circular economy."

Finding	**1** The speed of packaging innovation has outpaced the capabilities of recycling infrastructure.	**2** In its current form, the U.S. recycling system cannot deliver the supply of recycled materials demanded by the New Plastics Economy Global Commitment.	**3** Intractable underlying challenges necessitate a parallel exploration of how to build a sustainably funded and responsive future system.
Initiative	**Pathway to Recyclability**	**Unlocking Supply**	**Recycling 2.0 and Transformative Policy**

5 Waste data can be found here: https://ourworldindata.org/plastic-pollution
6 Ellen MacArthur Foundation, "The New Plastics Economy: Rethinking the Future of Plastics and Catalysing Action," December 2017, page 40: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEC-Hybrid_English_22-11-17_Digital.pdf
7 Ellen MacArthur Foundation, "New Plastics Economy: Catalysing Action," 2018, page 26.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IMPLEMENT POLICY
INVEST TO UNLOCK SUPPLY

INITIATIVE 1: **PATHWAY TO RECYCLABILITY**

Packaging industry signatories to the Global Commitment have set the target that 100 percent of their plastic packaging will be reusable, recyclable, or compostable by 2025. Viable chemical recycling, reuse, and composting options may emerge but will take much longer to scale than the 2025 timeframe allows. Meanwhile, a large number of the plastic packages produced today are currently not recyclable.

In the near term, packaging manufacturers and brands will be dependent on the effectiveness of existing mechanical recycling infrastructure to meet their Global Commitment targets. Despite some efforts to improve recyclability, challenges remain in the production of quality feedstock, the deployment of the latest technology, and fragmented system economics. Some brands have not prioritized recyclability as part of the packaging design process. In order to meet Global Commitment targets, brands need to align current packaging formats and pipeline packaging innovations with the realities of the current recycling system, while also investing to help that system evolve to support future packaging formats.

Pathway to Recyclability is a new initiative, led by The Recycling Partnership, that seeks to optimize the recyclability of current and pipeline packaging by investing time and resources to address specific areas of the system in the U.S. Building on valuable work done to date, this initiative will go further—driving bold action by connecting existing activities with structure, coordination, and oversight, in collaboration with Sustainable Packaging Coalition (SPC), the Association of Plastic Recyclers (APR), and others.

While the Global Commitment targets necessitate action on plastic packaging, Pathway to Recyclability aims to address the full spectrum of packaging materials in the U.S. It will focus on common materials and formats that are not yet widely accepted for recycling, as well as seeking to improve outcomes for materials and formats that are already widely recyclable, including, but not exclusive to, plastics. It will do this through two key actions:

1. Establishing the pathway

This workstream will build on and connect with existing tools to establish the industry-agreed roadmap in order to capture packaging that is not yet widely accepted for recycling.

2. Launching material and format collaboratives

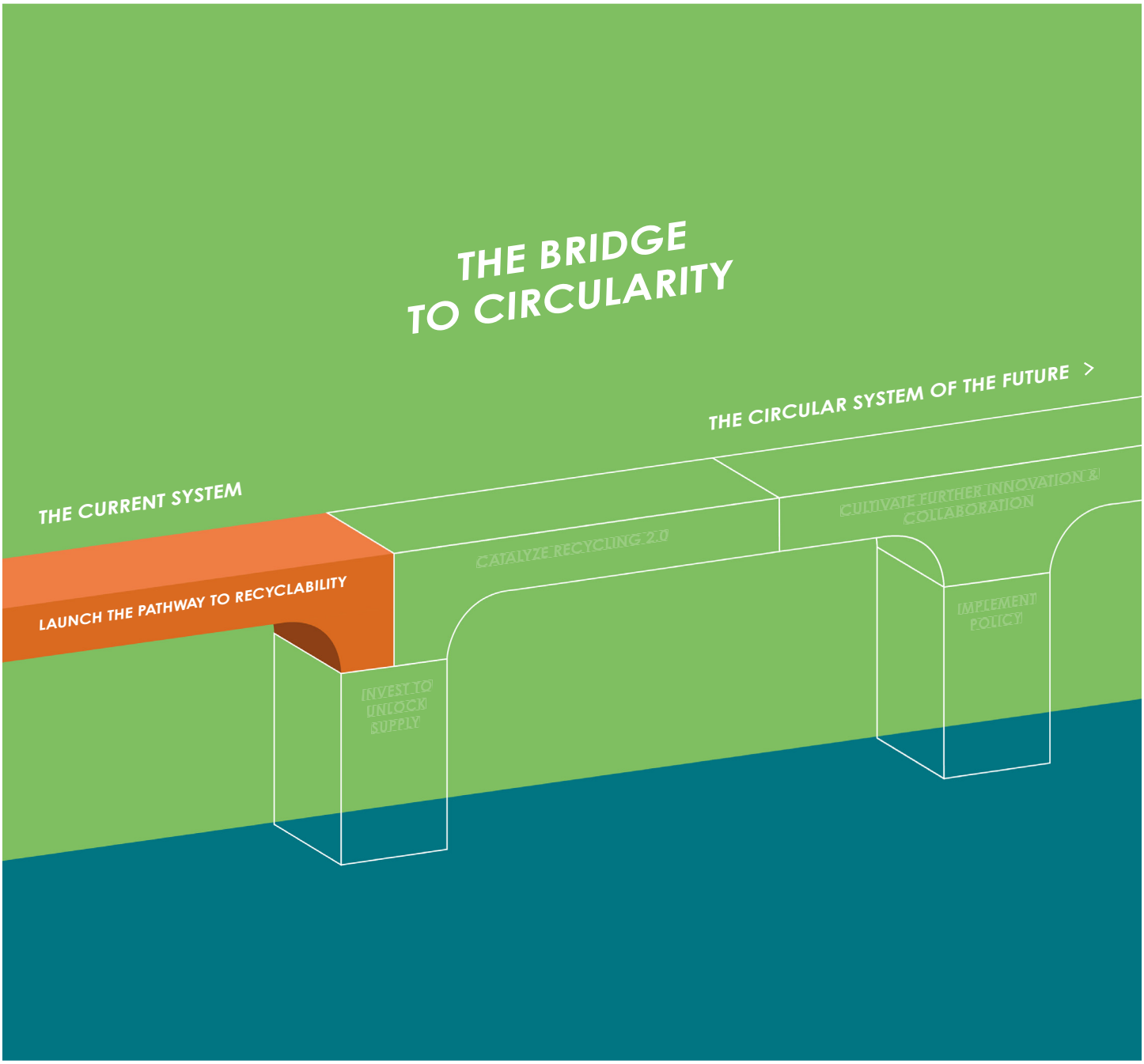
a. For packaging that is widely accepted for recycling but that can work together to improve capture—for example, metals, paper, glass.

b. For packaging that is not yet widely accepted for recycling—for example, film, small format packaging.

These voluntarily formed collaboratives of brands, suppliers, retailers, and recyclers will:

- Agree to specific principles of engagement that will depend on the packaging material or format.
- Address relevant gaps in their specific capture and recycling status.
- Co-invest in research to identify technology, innovation, and mechanisms to invigorate the packaging innovation pipeline in a more sustainable manner.

The Recycling Partnership will fund the initial collaborative convenings, with a view to agreeing on subsequent funding requirements on a per-material, per-format and per-category basis to achieve stated goals.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INITIATIVE 2: **UNLOCKING SUPPLY**

The New Plastics Economy Global Commitment has spurred significant projected demand for post-consumer recycled content (PCR) in plastics packaging. A Recycling Partnership analysis in this report, focusing on the prominent resin polyethylene terephthalate (PET), shows that there is an annual gap of more than 1 billion pounds between current U.S. supply and projected 2025 demand for recycled polyethylene terephthalate (RPET) for use in bottles. As a result, companies with significant dependence on U.S. RPET supply are destined to face challenges in meeting their recycled content targets unless strategic investments are made to address widespread national infrastructure gaps.

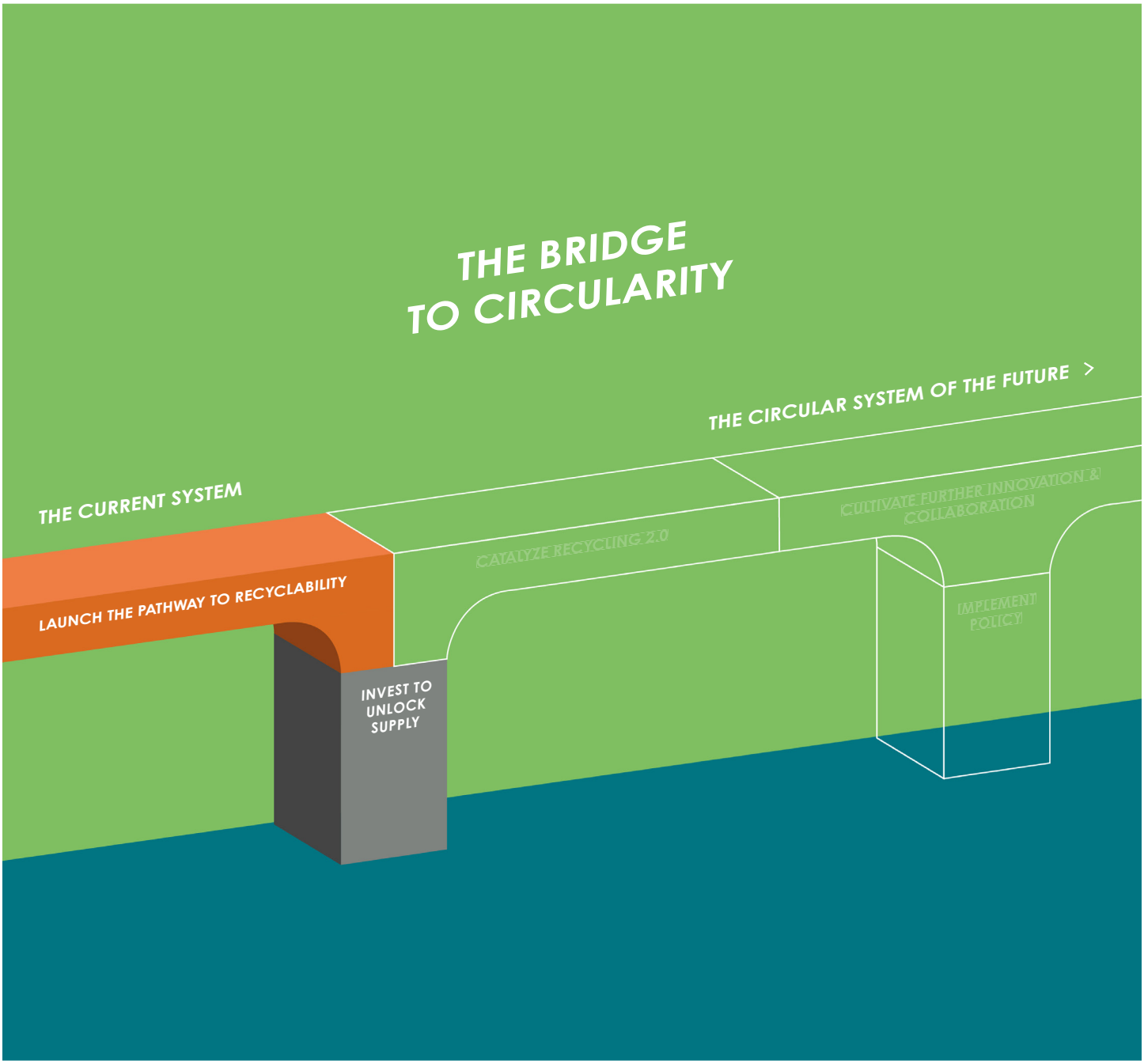
The U.S. recycling system is a complex, dynamic network. It is loosely connected yet highly interdependent, spread over varying jurisdictions subject to different rules and regulations, and serving diverse populations across a vast geography. Meanwhile, significant structural and economic issues constrain the supply system, severely limiting its elasticity. No material is immune to these challenges—metals, plastics, paper, and glass, broadly collected and processed as a co-mingled stream from homes across the U.S., all have the same enormous stake in the functionality of this system. While efforts to improve access, consumer participation, and system-wide infrastructure are underway, if brands are to achieve their goals, significantly more investment needs to be deployed in the near term in order to meet stated targets.

Investment is needed in a portfolio of interventions across the system in order to boost the available supply of post-consumer material. There is no silver bullet, and while the limelight may be on plastics in the short term, these interventions will help achieve a circular economy for the overall spectrum of packaging materials.

Unlocking Supply is an ambitious new Recycling Partnership initiative designed to begin bridging the gap in post-consumer supply by strengthening the existing recycling system for all materials. It calls for an initial investment of USD $250 million over five years, to be applied across the following areas:

- Critical equipment to expand and improve residential collection efforts for those lacking convenient access to recycling for all materials.
- Targeted projects to improve recycling behavior, including large-scale, sustained consumer education programs.
- Grants or low-cost capital to increase materials recovery facility (MRF) efficiency and the capture of critical plastics from the general material mix.
- Advocacy efforts to protect and expand mechanisms supporting the economics of recycling at the local and state levels.

"There is an annual gap of more than 1 billion pounds between current U.S. supply and projected 2025 demand for recycled PET for use in bottles."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INITIATIVE 3: **RECYCLING 2.0**

The Ellen MacArthur Foundation and its New Plastics Economy initiative are shining a spotlight on the inherent challenges of the current U.S. recycling system and, at the same time, presenting a critical opportunity for more than mere incremental improvements. While strengthening the current system will create the partial and necessary short-term foundations to begin addressing the urgent challenges highlighted by the Global Commitment, the current system is simply not sufficient to enable a transition to circularity in the U.S. The Bridge to Circularity requires bold and transformative action that will represent a true shift towards a circular economy for packaging in the U.S. The Recycling Partnership is launching the third initiative presented in this report, Recycling 2.0, as a means to embark on that path.

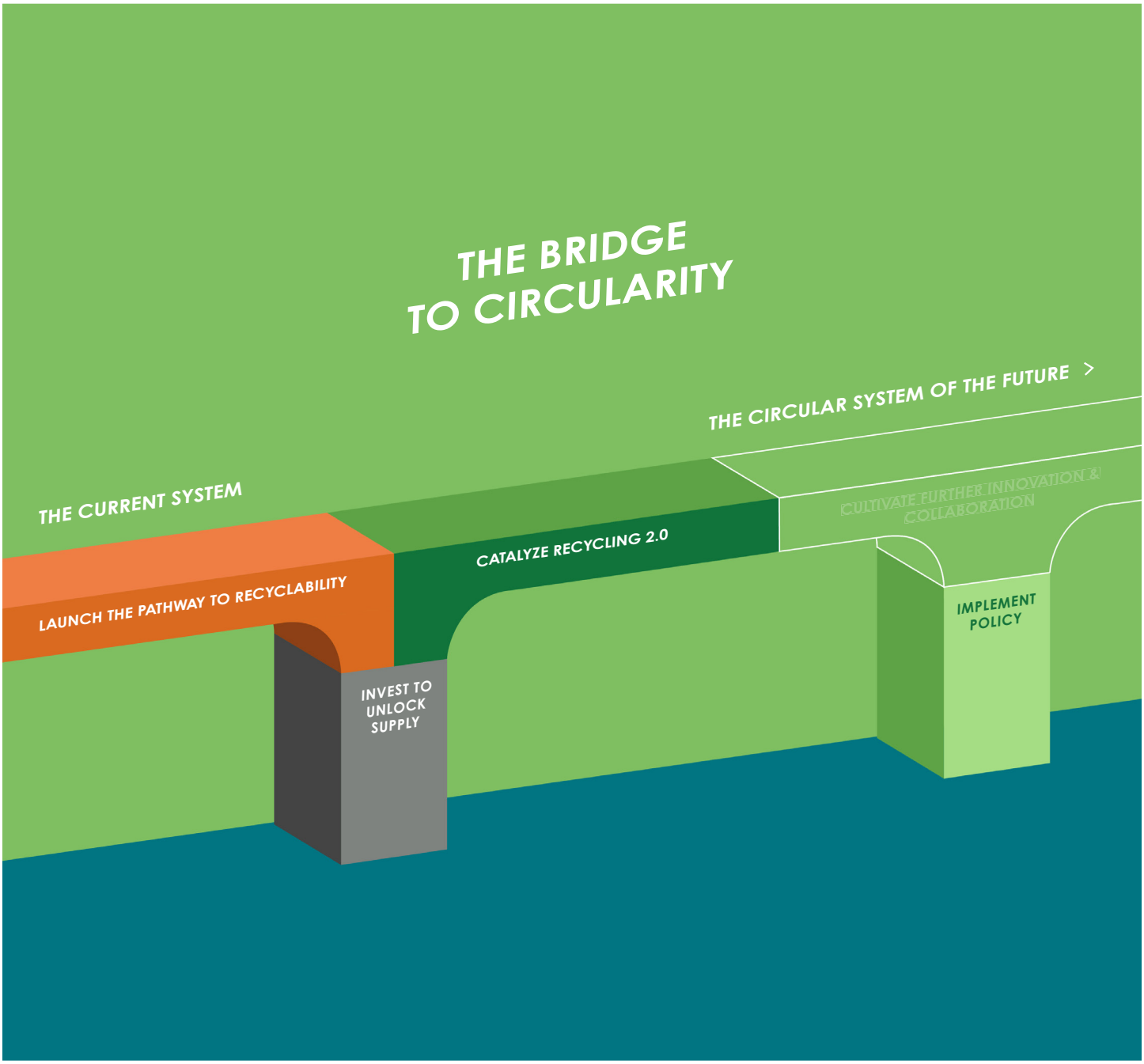
Transformative system change is needed for a truly circular economy. Current challenges come at significant cost to the system, to communities, and to the environment. Underlying all of these challenges are a lack of sustainable funding and a number of added economic constraints. While voluntary funding to date has been laudable, not all packaging industry stakeholders have stepped up, leaving a minority to carry the burden. Public resources at all levels are constrained by competing needs and policies. Analysis in this report shows that the funding currently available to support and grow the operational and capital needs for universal recycling is simply not enough. Exponential investment is needed to fundamentally improve how the system works. Therefore, while investment in the current recycling system is essential to shore up what is currently in place and prevent further systemic declines, a parallel exploration is needed, focusing on how to build a sustainably funded and responsive future system.

If there was an easy fix, it would already be implemented. The circular economy is complex, and the solution we must develop needs to recognize where the system lacks resiliency and look for ways to strengthen it. Recycling 2.0 is a new initiative, convened by The Recycling Partnership, to develop and build the future recycling system. It necessitates all stakeholders to come to the table to agree on sustainable solutions that will deliver a uniquely American approach.

Through public-private partnership that pulls from experience with other policies and systems, The Recycling Partnership will convene industry leaders to agree on transformative policy to catalyze this initiative and fund its scaled execution. In addition, Recycling 2.0 calls for an initial investment of USD $250 million to be applied via grants supporting national programs to include:

- Developing robust data systems.
- Delivering interventions to improve consumer participation.
- Deploying funding to fill gaps in existing technologies and solutions for collection, processing, and end market development.
- Implementing research and development for new and emerging innovations.

"The Bridge to Circularity requires bold and transformative action that will represent a true shift towards a circular economy for packaging in the U.S. The Recycling Partnership is launching the third initiative presented in this report, Recycling 2.0, as a means to embark on that path."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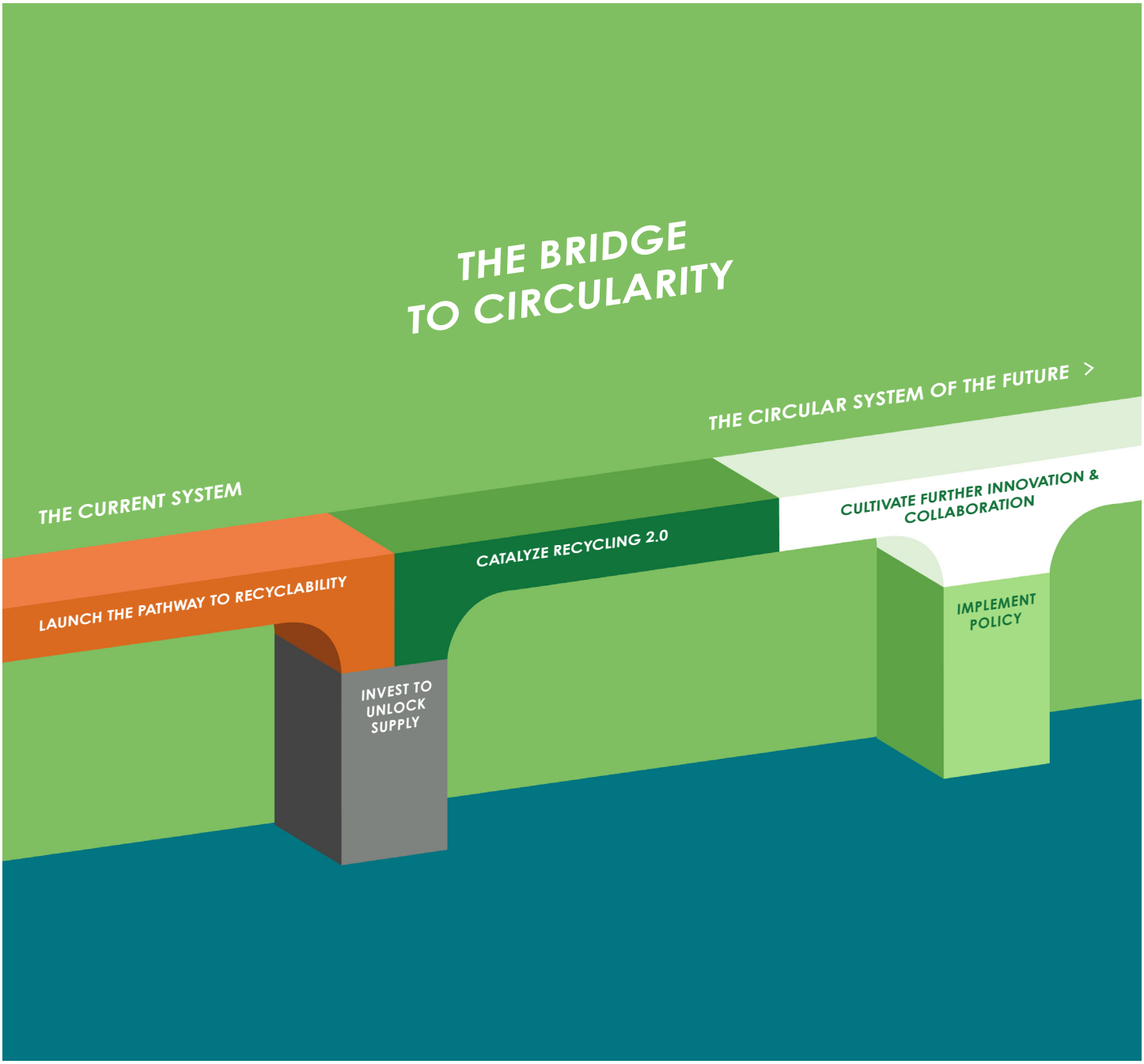
The Bridge to Circularity

Creating a circular economy for the U.S. does not stop at a single material. A circular economy for plastics will only ever be a partial solution, and the complex interplays and tradeoffs between commodities alone warrant looking past just plastics.

At the same time, effective recycling alone will not suffice: the Bridge to Circularity will depend upon other solutions and initiatives. Recycling 2.0 begins this effort, but The Recycling Partnership invites organizations working to implement reduction, reuse, composting, and other circular initiatives to connect and collaborate in the evolution of the full Bridge to Circularity.

This portfolio of initiatives presents a unique chance for the packaging industry to unite around a truly pioneering set of solutions, finally putting the future of the planet ahead of the complexities of the problem—and creating a truly circular economy for packaging in the U.S.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INTRODUCTION

The New Plastics Economy Global Commitment[8] demands a rapid pivot to action-based solutions. Amid the current global backlash against plastics, with many companies having now committed to ambitious goals, there is a need to move quickly toward solution implementation. Plastics packaging offers a range of environmental benefits, including material savings through increasing the shelf life of foods and reducing carbon emissions in production and transportation because of their light weight. However, most plastics are produced from non-renewable resources, and if not properly managed at the end of their useful life, can result in large-scale material loss to disposal, as well as environmental and human health threats, such as marine debris.

Since the release of its report "The New Plastics Economy: Rethinking the Future of Plastics" in 2016, the Ellen MacArthur Foundation (EMF) has taken a leading role in driving systemic change in the world of plastics packaging globally, through the lens of the circular economy. The latest landmark achievement for the organization comes in the form of its New Plastics Economy Global Commitment, launched in 2018, and to date encompassing more than 400 organizations globally—all now aligned on one common vision and a series of commitments to address plastic waste and pollution at the source.[9] According to the latest report (June 2019), business signatories to the Global Commitment account for more than 20 percent of global plastic packaging volumes, and collectively have revenues in excess of USD $2 trillion.[10] Of the eighteen major consumer packaged goods (CPG) companies, packaging producers, and retailer signatories, more than half are headquartered in the U.S.[11]

The Global Commitment (which is the same for packaged goods companies, retailers, hospitality, food service companies, and packaging producers, including own-branded products only for retailers) covers several areas. While these are all important to consider, this report focuses primarily on two specific commitments—that 100 percent of plastic packaging should be reusable, recyclable, or compostable by 2025, and that companies should set ambitious 2025 post-consumer recycled content targets across all plastic packaging used. In addition, the Bridge to Circularity recognizes the need to look to the long term and across the full landscape of packaging materials, and therefore calls for action across all areas that will further the achievement of a circular economy in the U.S.

The Global Commitment has established an ambitious and public platform to spur change, underpinned by clear accountability. In that sense, it is a force for good. By seeking to identify packaging types and formats whose harm outweighs their value, and setting clear baseline requirements around end-of-life outcomes for other plastics, while at the same time stimulating demand for recycled content, the Ellen MacArthur Foundation has set the stage for an altered global landscape for plastic packaging in the coming decade and beyond.

8 Details can be found here: https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy/global-commitment
9 Details of the EMF Global Commitment and Common Vision can be found in Appendix 1.
10 EMF Global Commitments, June 2019 Report, page 7: https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf
11 The Recycling Partnership Analysis of the Ellen MacArthur Foundation New Plastics Economy Global Commitment, June 2019, page 8.

However, without a roadmap to support constructive action on the part of signatories, there are also risks that come along with these commitments. The risks are in sharp focus in the U.S. in particular, which represents a USD $430 billion market for plastics (a sizable portion of which is for packaging)[12]—but one with recycling infrastructure that is already facing extreme pressures. For example, while demand for recycled content is critical to a growing marketplace for recycled resin, it does not guarantee that supply will respond. Significant constraints on that supply may severely limit signatories' ability to meet their targets, particularly for prominent recycled resins, such as recycled polyethylene terephthalate (RPET).

Furthermore, discarded plastic vastly outpaces current end-of-life processes, systems, and technology. In many cases, this means that plastic cascades toward other industry applications, or is disposed of. To meet a commitment that 100 percent of plastic packaging will be "reusable, recyclable, or compostable by 2025," significant pressure will be placed on signatories to improve packaging "recyclability" because of the potential limits to packaging reuse schemes, as well as a lack of industrial composting infrastructure at scale in the U.S. A failure to effectively address recyclability could exacerbate existing consumer confusion around what can be recycled, and worsen issues of value and quality in an already-stressed recycled materials marketplace.

"The scale of the collective commitments facilitated by the Ellen MacArthur Foundation, combined with the global focus on the issue of plastics, provides an unparalleled chance to transform the U.S. packaging landscape by creating a truly circular economy for packaging in the U.S."

Nonetheless, the scale of the collective commitments facilitated by the Ellen MacArthur Foundation, combined with the global focus on the issue of plastics, provides an unparalleled chance to transform the U.S. packaging landscape by creating a truly circular economy for packaging in the U.S. Since community recycling programs are currently the only scaled means of recapturing and processing post-consumer packaging material for use in secondary markets in the U.S., the recycling system will be the circular economy's highest priority for achieving the imminent targets.

This report speaks specifically to what might be needed to achieve some of the Global Commitment targets, but these initiatives are really only the beginning. While the focus of the Global Commitments is packaging,[13] and the majority of signatories are in industries such as consumer packaged goods (CPG) and retail (which is appropriate given that in the context of plastics use overall, packaging has by far the shortest lifespan[14]), it is important to recognize that packaging materials are by no means in isolation from other materials in the system. In fact, in many cases, products, packaging, and processes are all linked and ultimately need to be considered in a connected fashion throughout design and manufacturing. In addition, other materials (such as those more commonly associated with the textiles industry) can create both competition for feedstock and potential contamination.

However, if plastics packaging is used as an entry point to address key underlying systemic and behavioral challenges, this effort could act as the catalyst needed to not only shore up the circularity of the plastics packaging system, but also to help avoid similar problems in other material or product arenas.

12 Plastics Technology, "U.S. Plastics Industry Expands in 2017, Outpacing Manufacturing in General," 1/18/2019. https://www.ptonline.com/news/us-plastics-industry-expands-in-2017-outpacing-manufacturing-in-general
13 EMF follows ISO definitions. The ISO definition of packaging can be found in the Glossary for this report.
14 Roland Geyer, Jenna R. Jambeck, Kara Lavender, "Production, Use, and Fate of All Plastics Ever Made," Science Advances research, 2017, page 2 (product lifetime data).

FINDING 1

THE SPEED OF PACKAGING INNOVATION HAS OUTPACED THE CAPABILITIES OF RECYCLING INFRASTRUCTURE.

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THE SPEED OF PACKAGING INNOVATION HAS OUTPACED THE CAPABILITIES OF RECYCLING INFRASTRUCTURE.

Global Commitment: "100 percent of plastic packaging to be reusable, recyclable, or compostable by 2025."

This section of the report concludes that mechanical recycling of key post-consumer resins will continue to be the central solution focus in the near term for brands and packaging suppliers attempting to meet the target for "100 percent of plastic packaging to be reusable, recyclable, or compostable by 2025." Therefore, given the current state of packaging recyclability in the U.S., a significant amount of work needs to be done to improve the mechanical recyclability of current and pending packaging formats by 2025 in order to have a chance of meeting the target.

Based on Ellen MacArthur Foundation's definitions,[15] a growing volume of plastic packages produced in the U.S. are not yet recyclable. The urgency to achieve "recyclability" could lead to corners being cut around what counts as "recyclable," either deliberately, mistakenly, or semantically, given the complexity of the concept. In turn, this risks creating further confusion among consumers who are already puzzled by what is and what is not recyclable, potentially contributing to costly contamination in the recycling system.

Structure and oversight are needed for this drive towards recyclability to avoid unintended consequences that could impair rather than improve the system.

As the New Plastics Economy Global Commitment reinforces the need for recyclability proven to work in practice and at scale, achieving this target becomes increasingly dependent on the effectiveness of the recycling system. To meet their 2025 recyclability targets, brands, packaging suppliers, and retailers will need to become more familiar with the realities of the current system and to align current packaging formats and pipeline innovations with what can currently be processed mechanically. Looking beyond the scope of short-term targets, the future of recyclability will depend on substantial investment in innovation, to help generally non-recyclable packaging with other environmental benefits to also be collected and returned to the circular economy.

As outlined in initiatives such as Applying Systems Thinking to Recycling (ASTRX),[16] building recyclability for non-recyclable items is complex and multi-faceted. For example, design for recycling must be matched with end market development, support for collection and sortation of new and potentially challenging formats, and clear and effective consumer communication.

15 See Appendix 2 for details.
16 ASTRX is an initiative of The Recycling Partnership and the Sustainable Packaging Coalition, designed to map barriers and opportunities within the recycling landscape and identify tactics to advance the industry and deliver more high-quality recyclables to the supply chain: https://astrx.org/

KEY DEFINITIONS

The Ellen MacArthur Foundation has defined recyclability in the context of the New Plastics Economy Global Commitment to underpin its signatories' target to ensure that 100% of their plastics packaging is reusable, recyclable or compostable by 2025.[17] While it is important to read the definitions in full in order to understand their scope properly (see Appendix 2), some of the key elements of the definition are summarized as follows:

"RECYCLING" includes both mechanical and chemical recycling processes, but—in line with ISO definitions—it explicitly excludes technologies that do not reprocess materials back into materials but instead into fuels or energy.

"TECHNICAL RECYCLABILITY" is not enough: the successful post-consumer collection, sorting, and recycling of a package should be proven work in practice and at scale. "In practice and at scale" means that there is an existing (collection, sorting, and recycling) system in place that actually recycles the packaging (it is not just a theoretical possibility) and that covers significant and relevant geographical areas as measured by population size. The suggested thresholds to prove it works "in practice and at scale" are: a 30 percent recycling rate achieved across multiple regions, collectively representing at least 400 million inhabitants.

The Ellen MacArthur Foundation acknowledges that its "recyclable" definition applies at a global level for global commitments: it is a characteristic of packaging and is not linked to any local context or specific geographical area. As such, this definition does not apply to claims linked to specific geographical areas (e.g. on-pack recycling labels, customer communications), as these should always take into account the local context and systems in place (in line with ISO 14021 and U.S. FTC), and be in line with the local regulations that apply to such claims.

The FTC Green Guides section on "Recyclable Claims" and APR's definition of recyclability (both included for reference in Appendices 3 and 4) provide important context for the U.S. market specifically.

17 Full definitions can be found in Appendix 2, and also here: https://www.newplasticseconomy.org/projects/global-commitment

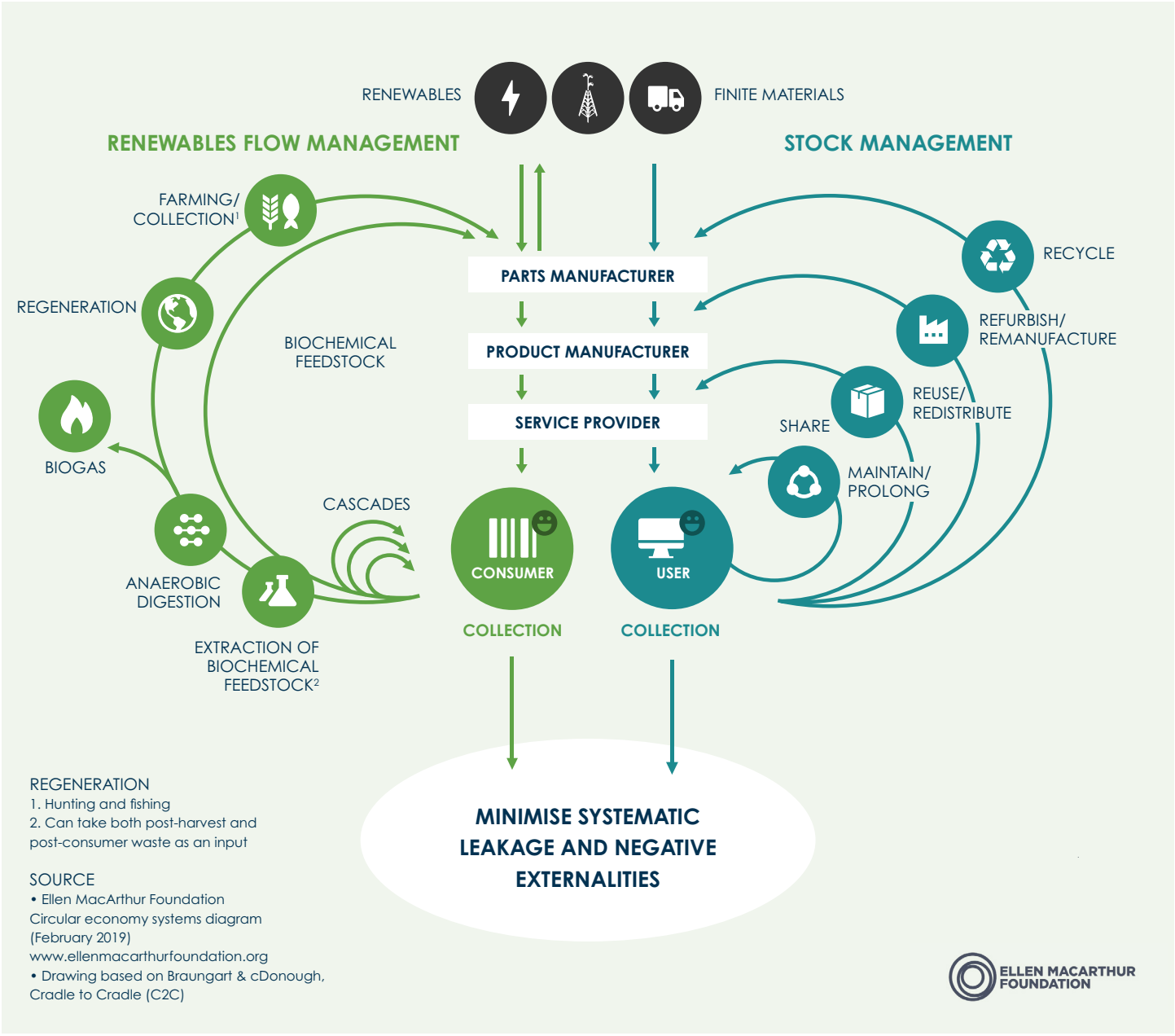


Figure 1: Adapted from Ellen MacArthur Foundation's butterfly diagram, which illustrates that reuse pathways have the potential to preserve more of the embedded energy and labor in materials. However, given the need to act quickly and at scale, mechanical recycling will become a major focus for achieving the targets.

The realities of packaging design and innovation

In practice, packaging design has tended to focus on cost, safety, quality, and consumer appeal, with convenience and marketing as key drivers. More recently, reducing weight has featured in packaging design specifications as a means to lower costs and emissions in particular. Packaging is therefore tending toward lightweight, cost-effective material compositions.

Packaging innovation and investment have vastly outpaced recycling innovation and investment. The pace of technological change and system investment in material collection and processing is orders of magnitude slower than the rapid innovation cycles of new packaging. This stress in the system is only getting worse, exacerbated by low recycling values that further disincentivize capital improvements. As a result, the current recycling system is built around legacy packaging. Given the range of packaging applications now in use, coupled with high dependence on consumer participation, the recycling system is increasingly challenged in its ability to manage post-consumer materials.

A good example of packaging innovation outpacing the capabilities of recycling infrastructure is the growth of sealable and closure packaging in the form of pouches. Pouch packaging is becoming increasingly popular as a flexible packaging option for such products as baby food, which might historically have been packaged in formats such as glass jars. According to a senior research analyst at Technavio, the advantages of this type of packaging are extensive: "The manufacturing of pouches is easy and less time-consuming when compared with other packaging materials. Additionally, the pouches can be printed with any color, logo, or design. This reduces the overall manufacturing cost as there is a decrease in the printing cost. Besides, printing on pouches is easier as they have a clear surface. This helps in creating brand awareness by promoting the product by providing clear information."[18] While there are also often other environmental benefits associated with lighter-weight packaging, pouch packaging overall is not yet recyclable, or recycled in practice at scale.[19]

Even when packaging sustainability goals are in place, a disconnect often still exists between sustainability functions and those in consumer insight, design, brand, and commercial functions, not to mention the fact that a challenging business case exists for choosing recyclable packaging options when the alternatives are so compelling for a range of reasons. However, if companies expect to meet their 2025 commitments, they need to design packaging formats and innovations with the realities of a 2025 recycling infrastructure in mind, while at the same time investing in technologies and innovations that can help the system adapt to needs beyond 2025.

The state of plastics recyclability in the U.S.

According to the U.S. Environmental Protection Agency (EPA), plastics containers and packaging have a 14.6 percent recycling rate[20]—a figure that is somewhat stagnant and significantly lags behind that of several other developed nations.[21] Recyclability may not always be the only or even the best lens through which to consider the overall impacts of packaging, and more work needs to be done to understand when, for example, emissions are a higher-order consideration. However, the key targets at hand focus on a specific goal of recyclability, meaning recyclability will likely affect how signatories

18 Technavio, Global Baby Food Packaging Market 2018-2022: Growth Analysis and Forecast. https://www.businesswire.com/news/home/20181002005849/en/Global-Baby-Food-Packaging-Market-2018-2022-Growth

19 Note that Dow has launched a pouch that is recyclable via store drop-off channels, Dow Recycle Ready Technology: http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_09d0/0901b803809d0bfe.pdf?filepath=packaging/pdfs/noreg/500-19801.pdf&fromPage=GetDoc

20 U.S. Environmental Protection Agency: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific-data

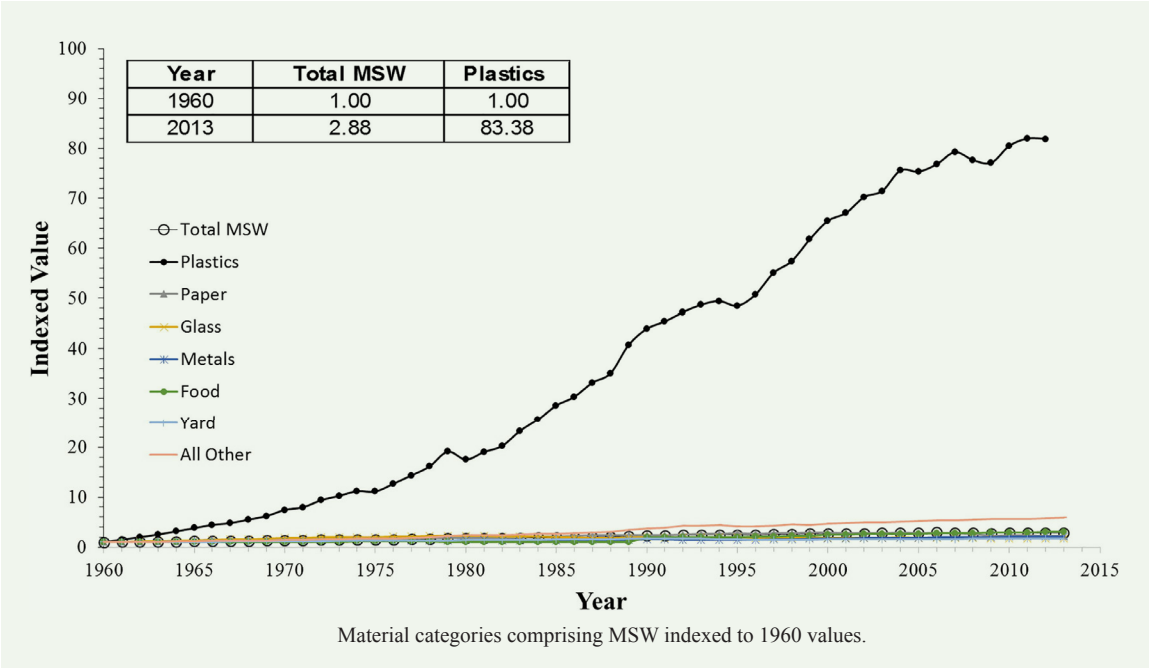
21 Accenture, FICCI Circular Economy Symposium Report: Making Plastics Circular, 2019, page 7.

invest to achieve the targets in the short term. It is against this backdrop that the need to create some structure around the ambition for "100 percent of plastic packaging to be reusable, recyclable, or compostable by 2025" comes into sharp focus. As PepsiCo vice president Chris Daly compellingly frames it, "Much modern packaging, because of its multi-component complexity or reduced recyclable value, is not recyclable municipally... The economic factors that have contributed to the success of the linear system are real and significant, but the waste stream that is emerging (and the speed, size, and variety of that stream) is an issue that needs a radical rethink."[22]

In the past thirty years, the nature of packaging materials in the U.S. waste stream as a whole has changed dramatically.[23] Some of the most notable evolutions have been:

- A significant reduction in the weight and volume of newspaper, and an increase in lower-grade "mixed waste paper," more commonly known as residential mixed paper (RMP) in the recycling industry.
- A large increase in the volume of corrugated containers (cardboard) driven in part by the rise of e-commerce.[24]
- Increasing volumes of plastics across the board, but in particular lightweight packaging formats, such as plastic bags and wraps, and multilayer flexible pouches.

Figure 2, from a 2018 issue of *Waste Management Journal*, puts the extent of the growth in plastics in particular into sharp focus. The chart shows that plastics has been by far the biggest growth area of the municipal solid waste (MSW) stream, by weight, since the 1960s.[25] The relative growth of plastics in the



Material categories comprising MSW indexed to 1960 values.

Figure 2: This chart from *Waste Management Journal* shows the relative growth of materials comprising municipal solid waste (MSW) between 1960 and 2013. The data is indexed to the 1960 MSW mix. While the article highlights the role that plastics have played in the decoupling of GDP growth and waste generation, it also serves to underscore the substantial growth of this material type.

22 Tom Szaky, The Future of Packaging. San Francisco: Barrett-Koehler Publishing, 2019, page 124.
23 Waste Management, "The Changing Waste Stream," November 2014, https://www.epa.gov/sites/production/files/2015-09/documents/changng_wste_stream.pdf
24 Smithers Pira, "Five Key Trends That Are Changing the Future of the Corrugated Packaging Market," January 2019: https://www.smithers.com/resources/2019/jan/trends-changing-the-corrugated-packaging-market
25 Reprinted from Waste Management Journal, Vol 77, Demetra A. Tsiamis, Melissa Torres, Marco J. Castaldi, "Role of plastics in decoupling municipal solid waste and economic growth in the U.S.", p147-155, (2018) with permission from Elsevier.

waste stream compared to other materials is clear, but the growth shown in the chart is even more significant given simultaneous moves to lightweight plastics. For example, a 2-liter PET bottle that weighed 2.4 ounces (68 grams) in 1980 now weighs as little as 1.5 ounces (42 grams), and the average weight of a single-serve 0.5-liter PET water bottle is now 0.35 ounces (9.9 grams), nearly half of what it weighed in 2000.[26] This means the relative volume of plastics has likely grown more than their weight. Given that recycling operations typically depend upon revenue by weight, lightweighting has also challenged the prevailing business model.[27]

Meanwhile, as Figure 3 (derived from EPA data) clearly shows, the recovery of plastics has not kept pace with their generation. A large volume of the remaining plastic is burned,[28] or lost to the system in landfill[29] or potentially marine leakage.[30]

Overall, these trends point to a clear overarching conclusion: plastics represent the biggest growth area in the packaging landscape, but an increasing volume of plastics in the waste stream is either not being recovered or is simply not currently recyclable. As an example, flexible packaging (comprising one of the largest and fastest-growing packaging segments)[32] is among the least recyclable, often due to multilayer applications that have chemically incompatible plastic layers that are very hard to separate.[33] This highlights the need to address not only the recyclability of what is already on the market, but also the nature of the packaging innovation pipeline and the creation of future-proof recycling systems.

U.S. PLASTICS GENERATION & RECOVERY

The amount of plastics generated and recovered in the U.S. by year, according to EPA figures

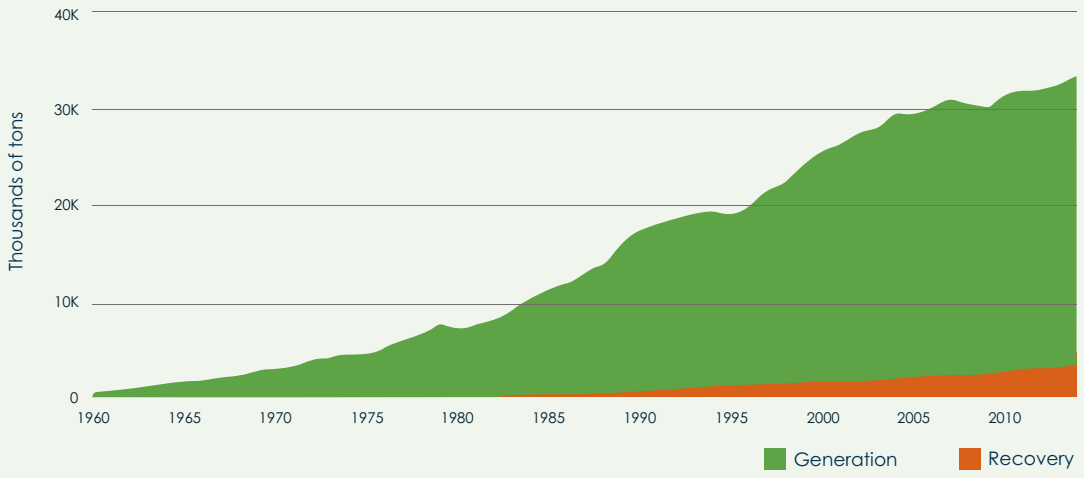


Figure 3: This chart, adapted from Waste 360 and based on EPA data, shows that the difference between U.S. plastics generation and recovery has increased over time since 1960.[31]

26 PET Resin Association. http://www.petresin.org/news_didyouknow.asp
27 Waste Management, 2016: http://mediaroom.wm.com/recycle-more-or-recycle-better/
28 U.S. EPA, Advancing Sustainable Materials Management Facts and Figures, 2015: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific-data
29 Ibid.
30 U.S. EPA: https://www.epa.gov/trash-free-waters/sources-aquatic-trash
31 Waste 360: https://www.waste360.com/waste-reduction/14-charts-epa-s-latest-msw-estimates
32 Flexible Packaging Association, State of the Industry, 2018: https://www.aimcal.org/uploads/4/6/6/9/46695933/trovillion_presentation.pdf
33 More information can be found in Closed Loop Partners report on Film and Flexibles, 2017: https://www.closedlooppartners.com/wp-content/uploads/2017/09/FilmRecyclingInvestmentReport_Final.pdf

Figure 4: Adapted from Flexible Packaging Association, State of the Industry, 2018.[34]

People are already confused about what is and is not "recyclable"

Even if people have access to a recycling solution, they will not participate unless they are aware and well informed about how to do so effectively. Research indicates that while consumers consider recycling to be important, they also find it confusing.[35] Coupled with recent negative press about the state of recycling, this confusion has contributed to widespread disillusionment among consumers about its efficacy, which unless addressed may serve to undermine efforts to improve its viability.

Consumer confusion about plastics recycling in particular is exacerbated by the Resin Identification Code (RIC) system, which is not directly indicative of recyclability.[36] The RIC system was devised in the 1980s in an effort to develop consistency in plastics manufacturing and recycled plastics reprocessing, and is now mandated in many states, including California.[37] While never intended as a consumer communication tool, the system uses arrow

34 Flexible Packaging Association, State of the Industry, 2018: https://www.aimcal.org/uploads/4/6/6/9/46695933/trovillion_presentation.pdf
35 Research commissioned by The Recycling Partnership in April 2019 showed that 87 percent of consumers feel that recycling is important, but 73 percent lack clarity on what is recyclable. Details can be found here: https://recyclingpartnership.org/download/29793/
36 See Appendix 6 for more details.
37 California Legislative Information here: http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PRC&division=12.7.&title=&part=&chapter=2.&article=

visuals that can often be misunderstood as meaning the package is "recyclable" when this is far from universally the case.[38]

Unclear and inconsistent consumer communication and labeling (exemplified by plastics, but not unique to plastics), along with the varying acceptance of materials in recycling programs across the U.S., has resulted in significant confusion about what can and cannot be recycled. Non-recyclable contaminant materials of any sort (not just plastics) entering the recycling system can have a detrimental impact on the economics of the system. Levels of "contamination" can be as high as 25 percent, meaning that approximately 1 in 4 items thrown into the recycling isn't recyclable (depending on the weight of items).[39]

This has become a major issue in many community recycling programs: in some cases, along with volatile global commodity markets, it has contributed to unsustainable increases in operational costs[40]—not least because a materials recovery facility typically pays not only to sort it, but then often to dispose of it. If more packaging formats emerge that consumers believe to be recyclable that cannot in fact be processed at recycling facilities, this problem will get progressively worse.

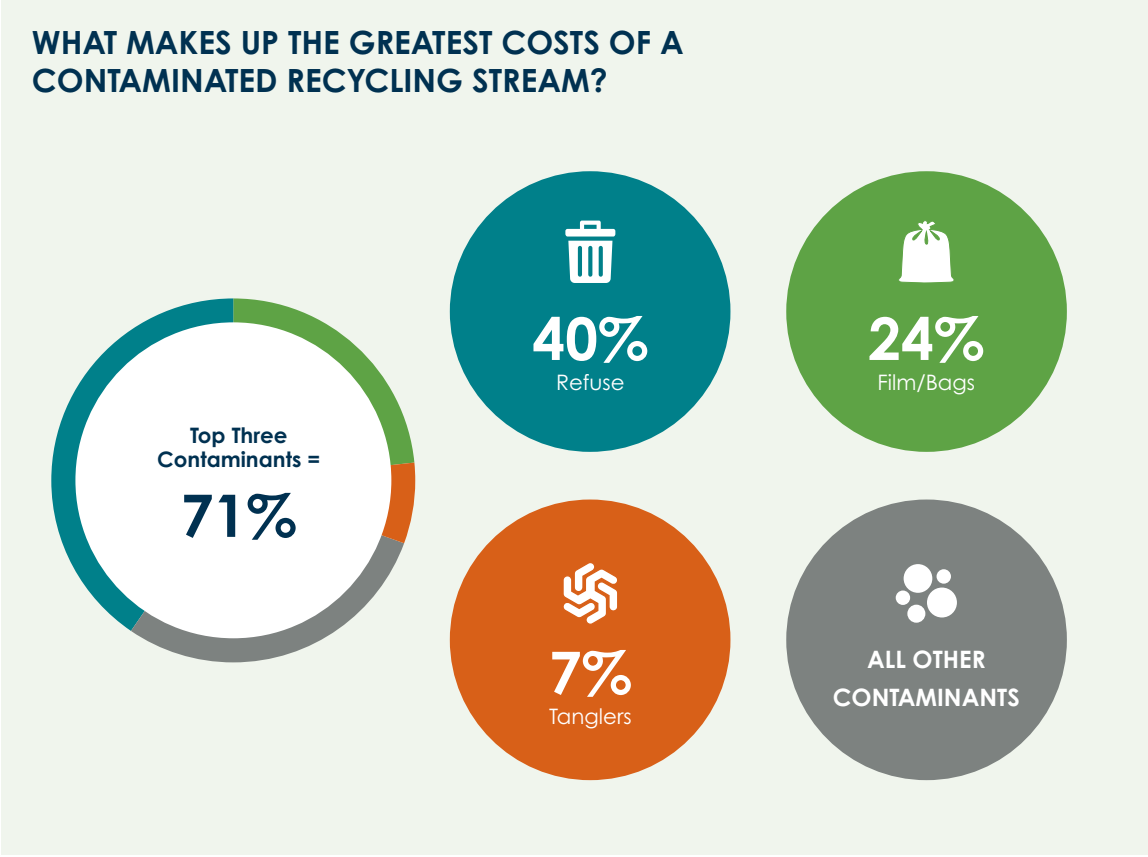


Figure 5: Key recycling stream contaminants and costs of contamination, based on Recycling Partnership research.[41]

38 This 2019 article from NPR features one of the most straightforward overviews of the state of plastics recyclability: https://apps.npr.org/plastics-recycling/

39 Josh Ocampo, Mic.com, "Americans Are Terrible at Recycling – This Is What Happens When You Put Something in the Wrong Bin," August 2018: https://www.mic.com/articles/190974/americans-are-terrible-at-recycling-this-is-what-happens-when-you-put-something-in-the-wrong-bin#.1wlEFdV1X

40 A recent example: Kelly Maile, "Surprise, Arizona, Suspends City's Recycling Program," Waste Today, August 2019: https://www.wastetodaymagazine.com/article/surprise-arizona-recyclables-to-landfill/

41 Data from The Recycling Partnership, "Costs of Contamination MRF Working Group Survey," 2017: https://recyclingpartnership.org/the-2017-costs-of-contamination-mrf-working-group-survey/

Mechanical recycling systems are a central focus for recyclability targets in the short term

The Global Commitment was created in the spirit of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. However, given the urgency of action demanded by the timelines and the scale of infrastructure required, the overarching commitment that 100 percent of plastic packaging will be "reusable, recyclable, or compostable by 2025" highlights that the efficacy of mechanical recycling systems will be key to achieving this goal, particularly in the U.S.

Chemical recycling technologies will take time to scale

For harder-to-recycle packaging types, such as multilayer flexible packaging, chemical recycling technologies have been highlighted as viable solutions for high-value recyclability. While the Ellen MacArthur Foundation's definition of recycling "includes both mechanical (maintaining polymer structure) and chemical (breaking down polymer structure into more basic building blocks, e.g., via chemical or enzymatic processes) recycling processes,"[42] mechanical recycling is the only recycling process currently available at scale.

A recent report from Closed Loop Partners highlights that, while there is potential to develop chemical recycling pathways for plastics in the U.S. market, this will require significant investment across the supply chain, developing both technology and collection mechanisms to support its growth. Of the 60 technology providers surveyed as part of the report, it has also taken, on average, 17 years to reach growth scale. Furthermore, the more mature companies are typically those that produce fuels from plastics waste—pathways that are excluded under the Global Commitment.[43] Those that produce polymers are at an earlier stage, on average.[44]

That said, investment timelines for chemical recycling are likely to compress in the wake of China's National Sword, and subject to a more nuanced understanding of their environmental impacts, chemical recycling technologies could provide a critical pathway to achieve recyclability in the longer term. This is particularly true for resins used heavily in food-contact packaging, and in situations where mechanical cycles may be more limited, like polypropylene. The fact that these solutions will not be a short-term fix for the timeframes stated simply underscores the need to keep a robust focus on improving mechanical pathways.

Reuse and refill options are also early in development

Global Commitment signatories agree that a shift from single-use to reuse business models will be an important part of the transition to a circular economy. Brands, retailers, and packaging producers in the Global Commitment have also committed to take action in this field. While this area has been underexplored over the past decades, more major brands and retailers are launching reuse models.[45] However, to date this remains a small part of the market and many efforts are in pilot stage.[46]

Scaling reuse and refill models will also be a nuanced exercise. First, reuse models will not necessarily be relevant for every application in every geography. Models will need to be considered on a case-by-case basis to decide which applications make sense in which regions, taking into account overall system benefits (emissions, waste, consumer convenience, and other considerations). Second, while some reuse models can be developed and scaled quickly, others

42 Direct extract from EMF definitions. See Appendix 2 for more detail.
43 Per EMF definitions. See Appendix 2 for more detail.
44 Closed Loop Partners, "Accelerating Circular Supply Chains for Plastics," April 2019, page 16: https://www.closedlooppartners.com/wp-content/uploads/2019/04/CLP_Circular_Supply_Chains_for_Plastics.pdf
45 Ellen MacArthur Foundation, Reuse—Rethinking Packaging, 2019, June 2019: https://www.ellenmacarthurfoundation.org/publications/reuse
46 EMF estimates reuse opportunities to be achievable for approximately 20 percent of plastic packaging. Reuse—Rethinking Packaging, 2019.

require significant investment in infrastructure, large-scale reverse logistics, or major shifts in consumer behavior.[47] While these models have the potential to deliver many benefits, in the 2025 timeframe for the targets, recycling will play a more significant role.

"Reusable packaging should be designed to be recyclable, as it will inevitably reach the maximum number of reuse cycles at some point, after which recycling ensures the material is kept in the economy."

Finally, reuse efforts will need to complement efforts on recycling; they will not replace them. As the Ellen MacArthur Foundation states, "Reusable packaging should be designed to be recyclable, as it will inevitably reach the maximum number of reuse cycles at some point, after which recycling ensures the material is kept in the economy."[48]

There are limits and unknowns surrounding compostable packaging

Another challenge facing companies aligned with this commitment is the lack of industrial composting infrastructure at scale in the U.S. According to EPA data, only 8.9 percent of municipal solid waste (MSW) is composted, compared with 25.8 percent that is recycled.[49] The vast majority of materials composted are also yard trimmings, food, and agricultural waste, as opposed to compostable packaging products. Only 185 full-scale composting facilities (as opposed to small community ones) are in operation in the U.S. and fewer than 60 of these have permits to enable compostable paper or plastics processing.[50] According to Mike Manna, founder and managing director of Organic Recycling Solutions, "With...industrial composting facilities [serving less than 5 percent of the U.S. population], it's safe to say that we're currently ill-equipped to compost meaningful volumes of food and yard waste, let alone biodegradable plastic."[51]

While developing compostable packaging materials may be beneficial to the manufacture of high-quality compost or for the environment in the longer term,[52] more needs to be done both to understand the broader impacts of compostable materials, and to control their end-of-life environments in the U.S. waste system in order to better judge any perceived benefits.[53] Included in these impacts is the distinct probability that compostable plastics will enter the recycling stream and harm that process. Robust product identification and consumer education will be necessary preventive measures.

The unknowns around composting are reflected in the specific commitments made by major U.S. brands, which largely reference, for example, "research" (Colgate) and "explorations" (Nestlé) of compostable packaging options.[54] Exploring this pathway is a worthwhile endeavor, but it will be challenging to achieve clarity and to scale the necessary infrastructure in time to meet the 2025 timeframe.

These factors combined will require major action by signatories of the New Plastics Economy Global Commitment with sizable U.S. packaging footprints to improve packaging recyclability as a means to achieve the stated target by 2025.

"With...industrial composting facilities [serving less than 5 percent of the U.S. population], it's safe to say that we're currently ill-equipped to compost meaningful volumes of food and yard waste, let alone biodegradable plastic." (Mike Manna, founder and managing director of Organic Recycling Solutions)

47 Adele Peters, "Will Compostable Packaging Ever Be Able to Solve Our Waste Problem?," Fast Company, March 2019: https://www.fastcompany.com/90393297/will-compostable-packaging-ever-be-able-to-solve-our-waste-problem
48 Direct extract from EMF definitions. More details can be found here: https://www.newplasticseconomy.org/projects/global-commitment
49 U.S. EPA, 2015 data: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials
50 Nora Goldstein, "Quantifying Existing Food Waste Composting Infrastructure in the U.S.," Biocycle, 2019, page 2: http://www.biocycle.net/pdf/2019/FoodWasteCompostInfra.pdf
51 Mike Manna, "The Myth of Biodegradability," from The Future of Packaging, page 111.
52 Adele Peters, "Will Compostable Packaging Ever Be Able to Solve Our Waste Problem?," Fast Company, March 2019: https://www.fastcompany.com/90393297/will-compostable-packaging-ever-be-able-to-solve-our-waste-problem
53 An example of the type of research needed, Oregon DEQ: https://www.oregon.gov/deq/FilterDocs/compostable.pdf
54 EMF Global Commitments, June 2019 report: https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf, p27, 35 and 39

Becoming "recyclable" and ultimately getting recycled

Tools and resources do exist to improve the communication about the recyclability of different types of packaging (including plastics) by improving awareness and education. However, they do not leverage one another as effectively as they could to support the full journey of brand packages when they enter the marketplace.

For example, the Association of Plastic Recyclers (APR) has developed comprehensive design guides for rigid plastics recycling, as well as detailed sorting potential protocols and training programs.[55] APR is a largely recycling industry-focused organization with deep technical expertise. However, it has lacked the funding and membership reach among corporations needed to fully universalize the uptake of this content, and provide the necessary widespread education in its implications. Similarly, the Sustainable Packaging Coalition (SPC) has introduced How2Recycle,[56] a clear and comprehensive labeling solution to help consumers better understand the recyclability of packaging. However, How2Recycle remains a voluntary communication mechanism that is not universally applied.

Figure 6: The Sustainable Packaging Coalition (SPC) has introduced How2Recycle, a voluntary labeling solution to help consumers better understand the recyclability of packaging, including specific information that refers to the package format and how to prepare it for recycling.

55 Association of Plastic Recyclers (APR): https://www.plasticsrecycling.org/apr-design-guide/apr-design-guide-home
56 https://www.how2recycle.info/

As outlined in the ASTRX Navigating the Recycling System tool, the system needs to work as a whole, with attention paid to each step of the recycling process, from end markets right back to consumer engagement and, therefore, packaging design.[57] Securing profitable and yet cost-effective end markets is an essential first step[58] and can in turn incentivize collection and sortation, as demonstrated by APR's Recycling Demand Champions Initiative.[59]

There are a number of packaging formats and materials for which robust end markets already exist. Packaging suppliers and brands have the option to design packaging for these end markets, knowing that they will benefit from economies of scale. For packaging formats where end markets are underdeveloped, such as for multilayer flexible packaging, suppliers and brands will need to be prepared to invest in developing them in order to achieve recyclability and access PCR.

To properly manage the complexities of multiple simultaneous attempts to transition non-recyclable packaging toward recyclability, coherent end-to-end guidance needs to be developed to create the opportunity for innovation within agreed guardrails. This will enable coordinated innovation in packaging and recycling markets without flooding the stressed recycling industry with new requirements and conflicting interests.

ELEMENTS OF THE SYSTEM REQUIRED TO WORK IN ORDER FOR RECYCLING TO BE SUCCESSFUL

Figure 7: ASTRX Map of the Recycling System showing the elements of the system required to work in order for recycling to be successful. A detailed worksheet is available for reference in Appendix 5.

57 Applying Systems Thinking to Recycling (ASTRX): https://astrx.org/resources/navigating-the-recycling-system-worksheet/ and https://astrx.org/resources/example-of-how-a-package-flows-through-the-recycling-system/. Summarized here: https://astrx.org/resources/navigating-the-recycling-system/

58 It is worth noting that while end markets alone will not suffice to ensure recyclability, in a situation where they are are naturally connected to the value of materials, virgin alternatives may limit the ability to accelerate end-market development.

59 Association of Plastic Recyclers (APR): https://plasticsrecycling.org/recycling-demand-champions

Pathway to Recyclability

A first step in ensuring that brands achieve the targets set under the Global Commitment is to build a Pathway to Recyclability. The Recycling Partnership will partner with organizations, including APR and SPC, on this U.S.-focused initiative, leveraging the work done to date to address specific areas of the recycling system. However, Pathway to Recyclability will go further—driving bold action by creating structure, coordination, and oversight, and resolving the interplay between existing activities and endeavors.

While the opportunity exists to address the recyclability of plastics through this new initiative, the full potential of the effort will only be realized when it unlocks the ability of the recycling system to respond effectively to current and future packaging formats, regardless of their material composition, with a view to creating a truly circular economy for packaging in the U.S.

The initiative will focus on common materials and formats that are not yet widely accepted for recycling, such as polyethylene film and high-density polyethyelene (HDPE) tubes, supporting the transition from technically recyclable to accepted in practice and at scale. However, it will also seek to improve the fate of materials and formats that are already widely recyclable (including, but not exclusive to, plastics), with a focus on more targeted systemic interventions, such as enhancing capture rates and further developing end markets. It will encompass two key components:

1. **Establishing the path**
   Focused on packaging that is not yet recyclable, and building from ASTRX tools, this work will encompass the development of a stage-gate process to establish a clear roadmap to capture packages for recycling. Key deliverables will include navigation tools and toolkits for MRFs and communities, supported by active stakeholder engagement and training.

2. **Launching material and format collaboratives**

   a. For packaging that is widely accepted for recycling but that can work together to improve capture—for example, metals, paper, glass.

   b. For packaging that is not yet widely accepted for recycling—for example, film and small format packaging.

   These voluntarily formed collaboratives of brands, suppliers, retailers, and recyclers will:

   - Agree to specific principles of engagement that will depend on the packaging material or format, but which may include standardizing recycling language and undertaking relevant organizational training on design guides, where these exist, or supporting the development of them where they do not.
   - Address relevant gaps in material or format specific status—for example, improving the effectiveness of collection mechanisms, exploring viable collection mechanisms where standard practice is lacking, activating and brokering potential end-market solutions to enable demand-pull where it is lacking, and identifying recyclability guardrails around key attributes, such as additives.
   - Co-invest in research to identify technology, innovation, and mechanisms to invigorate the packaging innovation pipeline in a more sustainable manner.

The Recycling Partnership will fund the initial collaborative convenings, with a view to agreeing on specific actions as outcomes of those meetings, along with the associated funding requirements—which will likely vary by material format and category—to achieve stated goals.

It is important to recognize that, regardless of research and investment, some packaging materials and formats may never meet the necessary criteria to be considered recyclable "in practice and at scale." In other words, an anticipated outcome of this initiative is to opt for either greater standardization or non-recyclability for certain packaging types, supported by appropriate labeling.

FINDING 2

IN ITS CURRENT FORM, THE U.S. RECYCLING SYSTEM CANNOT DELIVER THE SUPPLY OF RECYCLED MATERIALS DEMANDED BY THE NEW PLASTICS ECONOMY GLOBAL COMMITMENT.

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Global Commitment: "Set an ambitious 2025 post-consumer recycled content target across all plastic packaging used"

One of the core responsibilities of signatories to the New Plastics Economy Global Commitment is to "set an ambitious 2025 post-consumer recycled content target across all plastic packaging used." The commitments amount to "a [global] demand of 5.4 million [metric] tonnes of recycled plastic by 2025—the biggest-ever commitment to using recycled plastics for plastic packaging."[60] The commitments also represent approximately 20 percent of global packaging volumes, which will increase as more companies announce recycled content targets outside of, or as part of, the Global Commitment.

PCR targets have been set against a backdrop of limited data on the feasibility of developing supply to meet these goals. This section of the report uses polyethylene terephthalate (PET) generated in the U.S. to test how well the current recycling system can respond to the demand represented in the goals. While not necessarily a proxy for other resins, PET provides a good bellwether because it is a core packaging substrate for many Global Commitment signatories and it is already widely collected, with a relatively mature supporting infrastructure, including robust and growing reclamation capacity. Despite these advantages, the analysis in this section finds an enormous and challenging gap between the incremental demand for post-consumer recycled PET (RPET) and the available supply of this material in the U.S.

"Interventions to increase PET recycling can also be expected to significantly benefit other resins, as well as other materials."

60 EMF Global Commitments, June 2019 Report, page 11; conversion equal to nearly 6 million U.S. tons. https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf

Why is U.S. PET supply so important to achieving global recycled content goals?

The U.S. is a critical market in the effort to meet recycled content goals for a number of reasons:

- The massive overall scale of plastics generation and consumption.
- Correspondingly poor recovery performance, with PET recycling rates stuck near 30 percent or lower for more than a decade.
- A major market for a large number of key Global Commitment signatories.[61]

As signatories seek to meet their recycled content targets, strategic investments and careful navigation of the broader system economics need to take place on the supply side to unlock significant volumes of material. Used for beverage containers and many other food and household purposes, PET will likely be at the center of achieving the recycled content commitments of many Global Commitment signatories. PET also currently enjoys advantages on the PCR supply side over resins that are less widely collected today, and that suffer from lower capture rates. Interventions to increase PET recycling can also be expected to significantly benefit other resins, as well as other materials.

The goals

Many of the world's largest consumer packaged goods (CPG) companies, which sell billions of PET bottles each year, are among the signatories to the New Plastics Economy Global Commitment. They have made public commitments to increasing their usage of recycled PET (RPET) in their packaging. For example, Nestlé aims to have 35 percent recycled content in its PET water bottles by 2025,[62] PepsiCo plans to use 25 percent recycled plastic content by 2025,[63] and the Coca-Cola Company is targeting 50 percent recycled material in all packaging by 2030.[64] While the brands committed to the overall goals make up only 20 percent of packaging supply globally,[65] they also represent some of the largest consumer brands in the U.S. and are estimated by The Recycling Partnership to constitute between 60 and 80 percent of annual U.S. CPG usage of PET resin.

Considering that many major CPG brands are seeking to achieve as much as 25 percent recycled plastic in their products by 2025, and that many brands such as Poland Spring (Nestlé Waters) and Evian (Danone), have committed to (or already achieved) 100 percent recycled content, it is reasonable to assume that a minimum level of 25 percent RPET in bottles will become a CPG industry desired average by 2025.[66] Plastics Pact[67] commitments already made in specific markets such as the U.K., France, the Netherlands, and Chile support this baseline, particularly for global companies. The public commitments in the U.S by these highly visible, market-leading companies will likely be reinforced by the groundswell of consumer anti-plastic sentiment.

61 The Recycling Partnership Analysis. Ellen MacArthur Foundation New Plastics Economy Global Commitments, June 2019, page 8.
62 EMF Global Commitments, June 2019 Report, page 39: https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf
63 PR Newswire, September 2019: https://www.prnewswire.com/news-releases/pepsico-accelerates-plastic-waste-reduction-efforts-300917771.html
64 Ibid, page 45.
65 Ibid, page 10.
66 Legislative activity in states like California may also drive or reinforce the 25 percent standard.
67 The Global Commitment has prompted several national agreements to be put in place to support the achievement of goals. These are known as "plastics pacts."

"The Gap" for PET: Summary

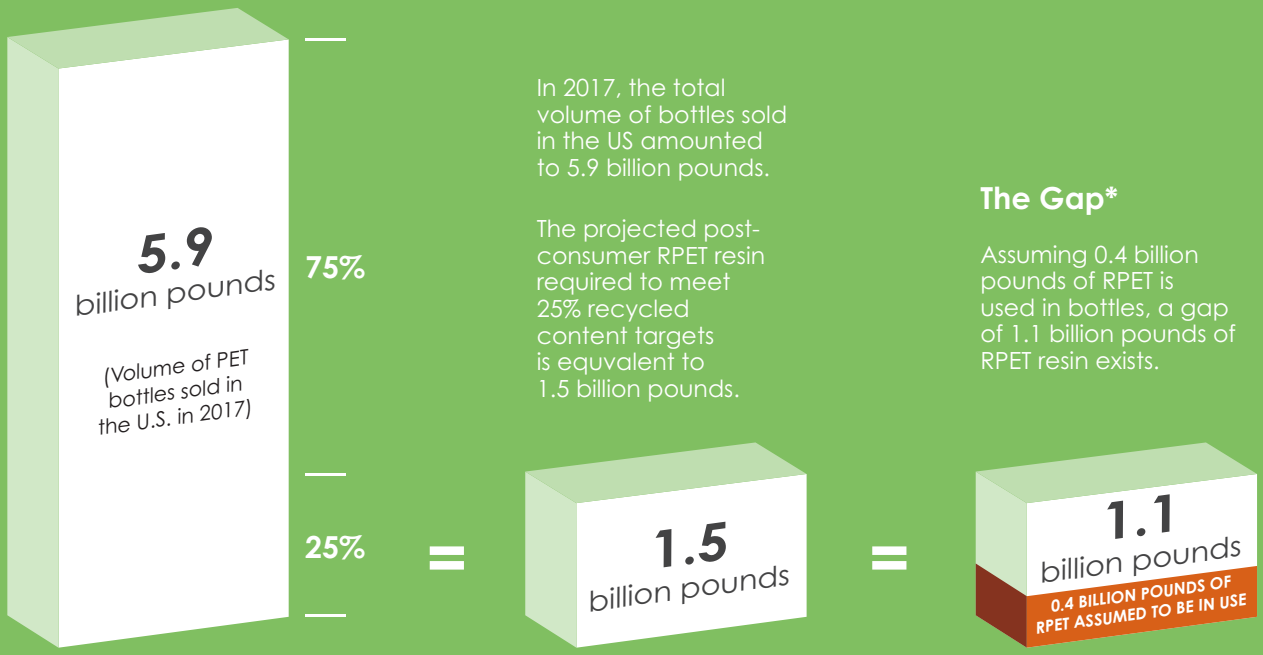
The National Association for PET Container Resources (NAPCOR) issues an annual report that provides a basis for analyzing the volume of recycled bottles needed to meet a 25 percent content target.[68] An estimate of this growth in demanded RPET volume can be tested against the 2017 figures in NAPCOR's most recent report. The NAPCOR data indicates that 5.9 billion pounds of PET bottles were produced in the U.S. in 2017.[69] Assuming flat production growth, a 25 percent content target on domestic sales of 5.9 billion pounds of PET bottles equates to a need for nearly 1.5 billion pounds of RPET resin. NAPCOR data indicates that the current amount of RPET used in PET bottles for 2017 was approximately 357 million pounds (or 0.4 billion pounds as a rounded volume) or around 6 percent. The remaining 94 percent of bottles, by weight, were comprised of virgin, petro-chemical-sourced PET resin.

If we assume a goal of 25 percent recycled content in PET in bottles, brands need an additional 1.1 billion pounds of RPET resin to be recycled and used in bottle-grade RPET—a three-times increase over the current amount available, and equivalent to a 19 percentage point growth in the overall U.S. PET recycling rate.[70] With yields averaging 67 percent in the U.S., this demand will require 1.6 billion pounds more recycled PET bottles in the domestic recycling stream each year, equivalent to a 27 percent point growth in the overall U.S. PET recycling rate. This additional supply would require every person in the U.S. to recycle 100 additional PET bottles each year.[71]

"If we assume a goal of 25 percent recycled content in PET in bottles, brands need an additional 1.1 billion pounds of RPET resin to be recycled and used in bottle-grade RPET—a three-times increase over the current amount available and equivalent to a 19 percentage point growth in the overall U.S. PET recycling rate."

Data		Volume (in pounds)
Supply	PET bottles sold in the U.S. in 2017	**5.9 billion**
Demand	Projected post-consumer RPET resin required to meet 25 percent recycled content targets	**1.5 billion**
	Post-consumer RPET used in bottles sold in the U.S. in 2017	**0.4 billion**
	The gap between current and 25 percent post-consumer resin use	**1.1 billion**
	PET bottles needed to deliver incremental demand for RPET resin	**1.6 billion**

68 NAPCOR Rate Report 2017: https://napcor.com/wp-content/uploads/2018/11/NAPCOR_2017RateReport_FINAL.pdf
69 For precise data and calculations please see Appendix 7. Our simplified projection assumes flat growth in PET bottles out to 2025 based on continued lightweighting of bottles and a continued increase in bottled water sales versus heavier weight carbonated soft drinks, per NAPCOR data.
70 A comparative analysis of other data sets conducted by The Recycling Partnership supports this conclusion. Further details can be found in Appendix 7.
71 Recycling Partnership calculation, assuming an industry average of twenty PET bottles per pound and a U.S. population of 3.27 million.



In 2017, the total volume of bottles sold in the US amounted to 5.9 billion pounds.

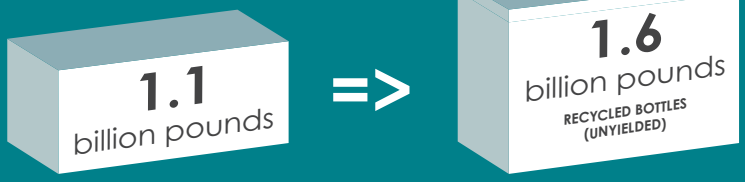
The projected post-consumer RPET resin required to meet 25% recycled content targets is equvalent to 1.5 billion pounds.

The Gap*

Assuming 0.4 billion pounds of RPET is used in bottles, a gap of 1.1 billion pounds of RPET resin exists.

*However, the average yield from recycled PET bottles to resin is only 67%.

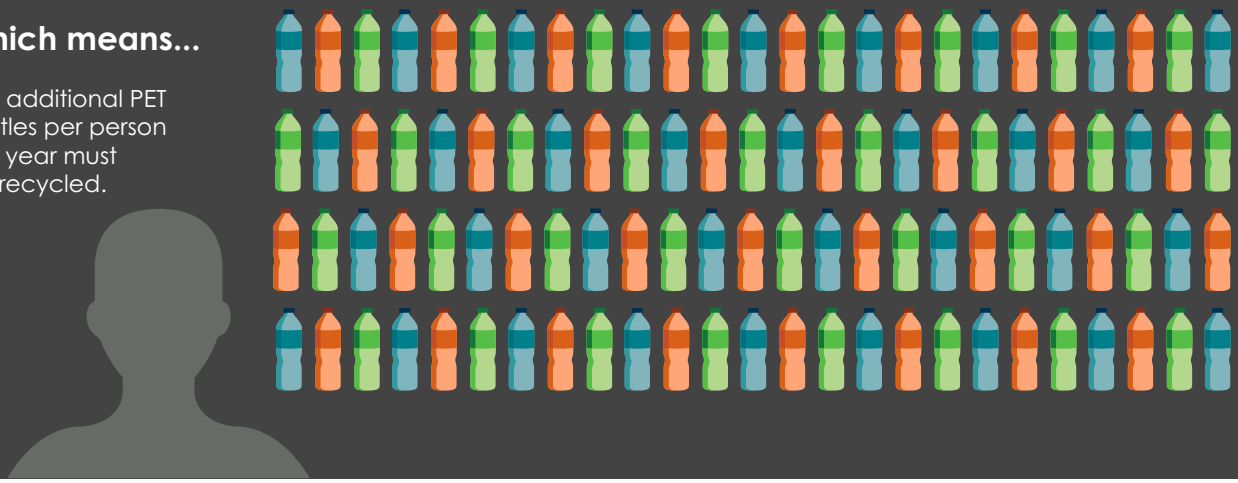
Which means, in order to meet 25% recycled content targets...



The projected post-consumer bottles required to meet 25% recycled content targets is actually 1.6 billion pounds.

Which means...

100 additional PET bottles per person per year must be recycled.



Competition for RPET

As documented in the NAPCOR report, use of RPET back into bottles competes with other end markets for recycled PET resin, in particular fiber (e.g., textiles and carpet) and sheet thermoform, which accounted for more than half of the demand for RPET in 2017. In fact, these are the fastest-growing combined segments of non-container use. The percentage of RPET that goes back into food-contact and non-food contact containers has actually declined over the past five years.[72]

There are indications that these non-bottle end markets enjoy structural cost advantages over bottle-grade RPET, which requires additional cost steps to decontaminate and produce. The risk for CPG brands is that, even if the supply of RPET overall increases, competing non-bottle end markets may capture more material, because the material can be more economically processed in those markets, without costly improvements in material quality. Price competition could become increasingly significant, especially if supply fails to grow or if RPET imports into the U.S. become constrained due to tariffs or new trade policies. Several apparel companies, such as H&M and Stella McCartney, have also signed on to the Global Commitment. Despite the limited manufacturing presence of these signatories in the U.S., their inclusion serves to underscore the trend toward increasing competition for recycled bottles.

If share-of-use remains the same across the board, to have met the goals in 2017, total PET pounds captured would have needed to be 5.3 billion pounds, equivalent to a total PET recycling rate of 90 percent.

Scenarios may develop that decrease the pressure to achieve this level of PET capture. For example:

- Recycled content users may choose (as some are already doing) to pay a price premium or to develop exclusive supply agreements that could give them priority access to PET bottles collected in the U.S.
- U.S. PET reclaimers could begin to import exponentially higher amounts of RPET from other countries. An unintended consequence of this move could be to shorten supply of RPET for use in those countries' domestic end markets.
- While unlikely, fiber uses could possibly plateau or decrease, allowing more material to be available for packaging content.

Regardless of the pathway that brands and their supply chains choose, the immense and fairly immediate demand created by the 25 percent goals will encounter a supply system that, in its current form, is fundamentally constrained and inelastic. The scale of the gap between current supply and projected demand for RPET by 2025 illustrates the urgency of working to increase the available supply of post-consumer resin (PCR) coming through the U.S. recycling system, while improving the quality of the material.

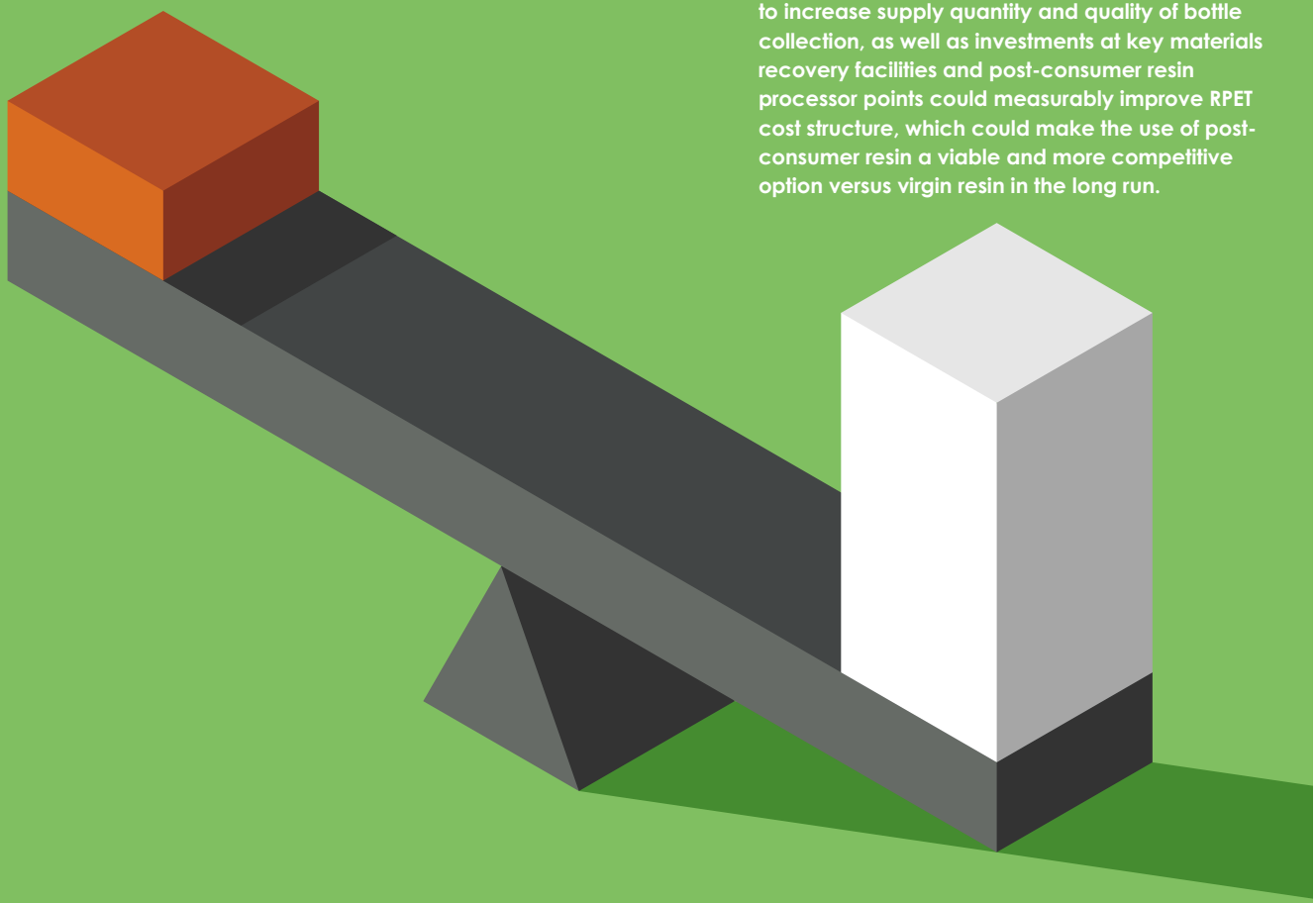
72 NAPCOR Rate Report 2017: https://napcor.com/wp-content/uploads/2018/11/NAPCOR_2017RateReport_FINAL.pdf

VIRGIN PET VS RPET

For large buyers of both virgin and post-consumer resin such as PET, the current infrastructure creates pricing disadvantages for RPET. Several key cost drivers have an effect on the economics of RPET and other post-consumer resins. In the case of RPET, for example, the following factors lead to higher RPET prices when compared to virgin PET:

- Supply chain fragmentation U.S. infrastructure for reclaiming and reprocessing post-consumer PET is fragmented, with each stop in the chain adding incremental margins onto real processing costs.
- Logistics inefficiencies Transport of bottles between different locations along the supply chain adds cost compared to a more streamlined virgin logistics infrastructure.
- Contamination Non-recyclable materials present in RPET bales will lead to yield loss and increase landfill costs at each step of the supply chain.
- Competition Bottle-grade RPET buyers normally require additional processing steps to convert recycled PET bottles to quality RPET flake that meets the standards of the Food and Drug Administration letter of non-objection (LNO).

Each of these factors inflates an already supply-disadvantaged RPET system in the U.S. today. A 2017 analysis by Closed Loop Partners and Resource Recycling Systems (RRS) showed that the cost of processing bottle-grade RPET in the existing U.S. infrastructure was slightly more than the price of virgin PET.[73] However, investments to increase supply quantity and quality of bottle collection, as well as investments at key materials recovery facilities and post-consumer resin processor points could measurably improve RPET cost structure, which could make the use of post-consumer resin a viable and more competitive option versus virgin resin in the long run.



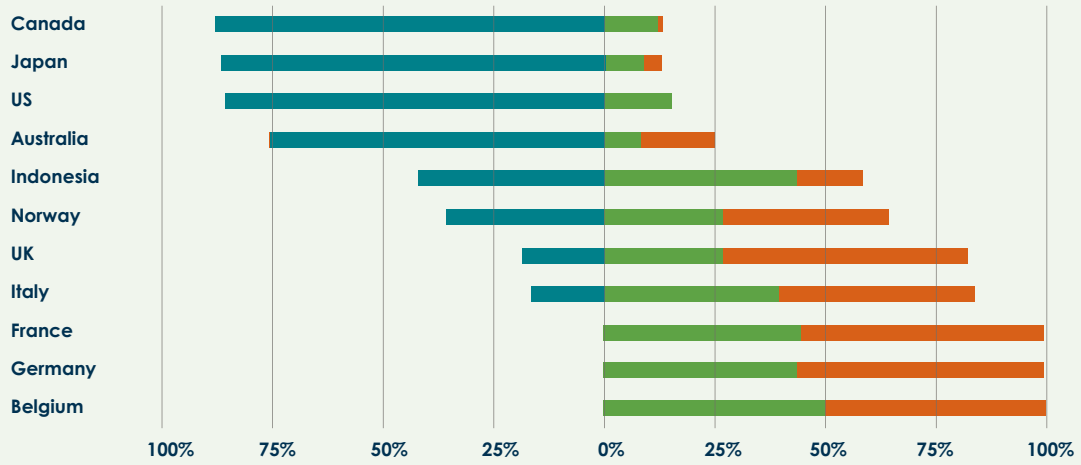
73 "Cleaning the RPET Stream," Closed Loop Partners, 2017, page 16: https://www.closedlooppartners.com/wp-content/uploads/2017/11/CLP-RPET-Study_Public-FINAL.pdf

Exploring RPET supply

With 1.7 billion pounds of PET captured in 2017,[74] more than 4 billion pounds of PET bottles were wasted to landfill, incineration, or pollution. If the current rates prevail through 2025, 21 billion pounds will be lost to disposal or litter in the next five years. At face value, this level of waste suggests plenty of opportunity to increase the available supply. However, the basic structure and value proposition in the current system of recycling in the U.S. will make it very challenging to capture more of that disposed PET.

The U.S. is almost unique in the scale of its potential supply of all recyclable materials, not just plastics. According to a recent report, while the U.S. represents just 4 percent of the world's population, it produces 12 percent of global municipal solid waste, including about 234 pounds (106.2 kilograms) of plastic waste per person per year.[75] These analyses also reinforce that recycling rates and performance lag significantly behind other developed countries. Other data sources reinforce this with a specific focus on plastic waste.

"With 1.7 billion pounds of PET captured in 2017, more than 4 billion pounds of PET bottles were wasted to landfill, incineration, or pollution."



Share of plastic waste that is:

- Not recovered (For ex. Ends up in landfill)
- Recycled (Fro ex. Materials reused)
- Otherwise recovered (For ex. Incinerated for energy)

Sources: Eurostat. GIZ, CCME, EPA, Yusuke Inoue, Accenture Research
Notes:
1. Data for EU countries may be subject to change in light of China's recent ban on waste import
2. Wherever data for plastic waste in general is not available, data for plastic packaging waste han been used

Figure 8: Varied approaches to plastic waste management across countries. Accenture, FICCI Circular Economy Symposium report, "Making Plastics Circular," 2019, page 7.

74 NAPCOR Rate Report 2017: https://napcor.com/wp-content/uploads/2018/11/NAPCOR_2017RateReport_FINAL.pdf
75 Verisk Maplecroft, "Waste Generation and Recycling Indices," June 2019, page 8.

The role of residential household collection

In the U.S., the responsibility for moving recyclable materials from disposal toward circularity belongs in large part to thousands of municipal and county recycling programs across the country. As an offshoot of their historical responsibility for collecting municipal solid waste, and instigated in part by sweeping state recycling laws established more than thirty years ago, local communities were given the task of building and operating recycling infrastructure. In short, cities and counties across the country are the primary decision-makers in the U.S. on what materials can (or should) be recycled. Beyond plastics, these community-based decisions affect paper, metals, and glass as well.

Local recycling programs have been designed to primarily serve single-family households, which are a rich source of potential PET supply.

"For brands and other Global Commitment signatories aiming for 25 percent PET content goals, U.S. household material is by far the richest source of potential feedstock."

The Recycling Partnership has conducted an analysis, based on waste composition and capture studies, to project household generation of PET bottles—which can in turn be compared to NAPCOR data to estimate the scale of the U.S. household supply. This analysis finds that residentially generated PET accounts for more than 75 percent of all generated PET bottles; in other words, three out of every four bottles that would be available for recycling are generated in the home—enough to bridge the estimated gap nearly three times over. For brands and other Global Commitment signatories aiming for 25 percent PET content goals, U.S. household material is by far the richest source of potential feedstock.

	Estimated annual pounds PET bottle generation per household	Adjusted for pure PET (deductions for cap and labels)*	Number of U.S. occupied homes	Total PET pounds	Percentage of bottles in U.S. (rounded)
Single-family homes	49.45	39.56	97,334,176	3,850,445,613	65%
Multifamily homes	37.09	29.67	21,008,278	623,300,339	10%
TOTALS (residential)			**118,342,454**	**4,473,745,952**	**75%**
Non-residential sources (by deduction)				1,456,254,048	25%
OVERALL TOTAL				**5,930,000,000**	**100%**

*20 percent reduction as estimated by Closed Loop Fund

Deposit States

A large fraction of currently recovered PET bottles occurs in 10 states with deposit programs, all covering a different range of kinds of PET bottles. Deposit state collection can achieve high capture rates of available bottles, ranging from 60 to 90 percent. However, there is a lack of industry alignment on deposit expansion among the Global Commitment signatories that are most aggressively seeking access to more material. In addition, expansions of current deposit laws have largely not succeeded and are counterbalanced by political action to eliminate such laws. Therefore, producing a supply adequate to meet the immediacy of the short-term goals necessitates focusing attention on residential sources in non-deposit states, where PET capture rates can be as low as 10 to 15 percent.[76]

Pathways to increasing residential PET collection

Dramatically increasing the level of residential PET collection in the U.S. will rest on three main strategies:

1. **Increasing access to recycling services to be on par or better than trash collection.**
2. **Ensuring the highest possible usage of those services (commonly called the "participation rate").**
3. **Encouraging consistently high recycling behavior, where recycling participants put all recyclable materials in recycling containers (referred to as the "capture rate").**

As stated above, the implementation of these strategies is largely in the hands of recycling programs operated by local governments. The constraints on these programs to address the challenges are discussed below, but it is important to consider first, on a general level, where the U.S. currently stands.

Curbside access is limited

In a groundbreaking 2016 study, the Sustainable Packaging Coalition estimated overall access to recycling, including curbside services.[77] The data indicated that only 59 percent of U.S. households enjoy this most convenient form of recycling access.

76 The State of Florida's 2017 Solid Waste Annual Report found the statewide plastic bottle recycling rate to be 10 percent: https://floridadep.gov/sites/default/files/2017_Toal_Tons_Collected%26Recycled_Glass_Aluminum%26Steel_Cans_Plastic_Bottles.pdf

77 Sustainable Packaging Coalition, "2015–16 Centralized Study on the Availability of Recycling," July 2016: https://sustainablepackaging.org/findings-released-spc-centralized-study-availability-recycling/

Type of Recycling Access	Percentage of U.S. Population
No recycling services available	6%
Access to drop-off only	21%
Curbside recycling automatically/universally provided	**53%**
Subscription-based curbside—assumed uptake	**6%**
Subscription-based curbside—no uptake of service	14%

Key gaps have a direct impact on PET supply:

- The 6 percent of households in the U.S. with no access to recycling represents a straight loss of as much as **280 million pounds of PET** each year.
- Subscription-based curbside service also contributes to PET loss. Because subscribing often requires the payment of a fee, the SPC report used industry standards to estimate that only 30 percent of households with available subscription programs actually sign up. The 70 percent that do not take up service could represent the annual loss of another **660 million pounds of PET** to disposal.
- Drop-off systems are challenged by issues of convenience and can suffer from low participation rates. Although difficult to quantify, the potential loss of PET from households with drop-off only access only could exceed one billion pounds. Moving some or all of these households to curbside service could dramatically improve PET capture.
- Due to negative market economics as well as unilateral actions by some key stakeholders, access overall may have declined since the SPC report, leaving more gaps in recycling in the U.S.

In all, lack of effective access to recycling services could amount to the **loss of 2 billion pounds of PET** per year, easily enough to close the 25 percent recycled content gap (if all collected pounds went to packaging uses).

The effects of participation

Once a household has access to recycling, its actual use of the recycling service and its recycling behavior become paramount, which is reflected in program participation rates. Reliable participation rates from U.S. curbside programs are scarce, but a general rule of thumb for a high-performing recycling program using carts is 80 percent. Although bin-based recycling programs can, in the right circumstances, achieve high participation, the vast majority are very old programs in which participation (including the availability of a bin) has severely eroded.

The 59 percent of U.S. households with access to curbside recycling amounts to a total count of around 69 million homes. Using the 80 percent participation estimate would mean that 13.8 million homes with access to curbside recycling are not using the service, with 55.2 million U.S. households acting as participants. Using the estimates of single-family household PET generation above, non-participation represents a loss of **546 million pounds of PET** each year. This amount could be even higher, considering that participation in collection programs that use bins rather than carts, constituting about 20 percent of curbside-served households, is often substantially lower than 80 percent.

The impact of capture behavior

The Recycling Partnership capture studies and analyses of similar studies shows that curbside recycling participants put an average of 54 percent of their PET in recycling containers (in other words, recycling participants dispose of more than two out of every five bottles they generate).

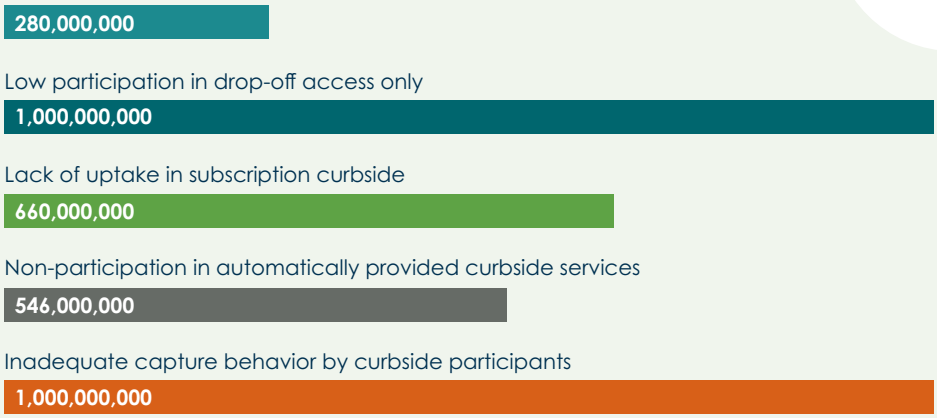
The net participating household figure of 55.2 million households, combined with a recycling participant capture rate of 54 percent, equates to a loss of **1 billion pounds of PET** each year.

The table below shows the estimated losses of PET due to the combined factors of access, participation, and capture behavior. This analysis in turn paints a picture of the potential points of intervention in the current system to improve PET recycling.

CAUSE OF PET LOSS

[Estimated Size of Annual Loss (in pounds)]

TOTAL
3,486,000,000



It should be recognized that this estimate is affected by deposit systems—for example, some of the potential loss of 1 billion pounds due to low drop-off participation may be partially captured in states where those drop-off households have deposit access. However, not all deposit programs cover all PET, and many of the fastest-growing areas of the country—including Texas, Florida, Arizona, Colorado, and Georgia—show significant room for improvement in PET capture while also not showing any significant movement to deposits. In those states, and others such as Ohio, Indiana, Pennsylvania, and Maryland, issues like access, participation, and capture behavior are the key to increased PET capture.

Constraints on local governments to deliver new supply

The central actors to take on these challenges of access, participation, and capture are the local government recycling programs operating at the heart of the current U.S. recycling system—as discussed above, they are the principal managers and arbiters of the U.S. curbside material supply system. However, these actors, as important as they are to the recycling economy, do not act in classical economic fashion. Their behaviors are largely unresponsive to demand, leading to a recycling supply system that, in its current form of financing and management, is fundamentally inelastic. As part of this, because of the effect of current market conditions on recycling processing costs, many local programs are financially disincentivized to collect additional recycling tonnage.

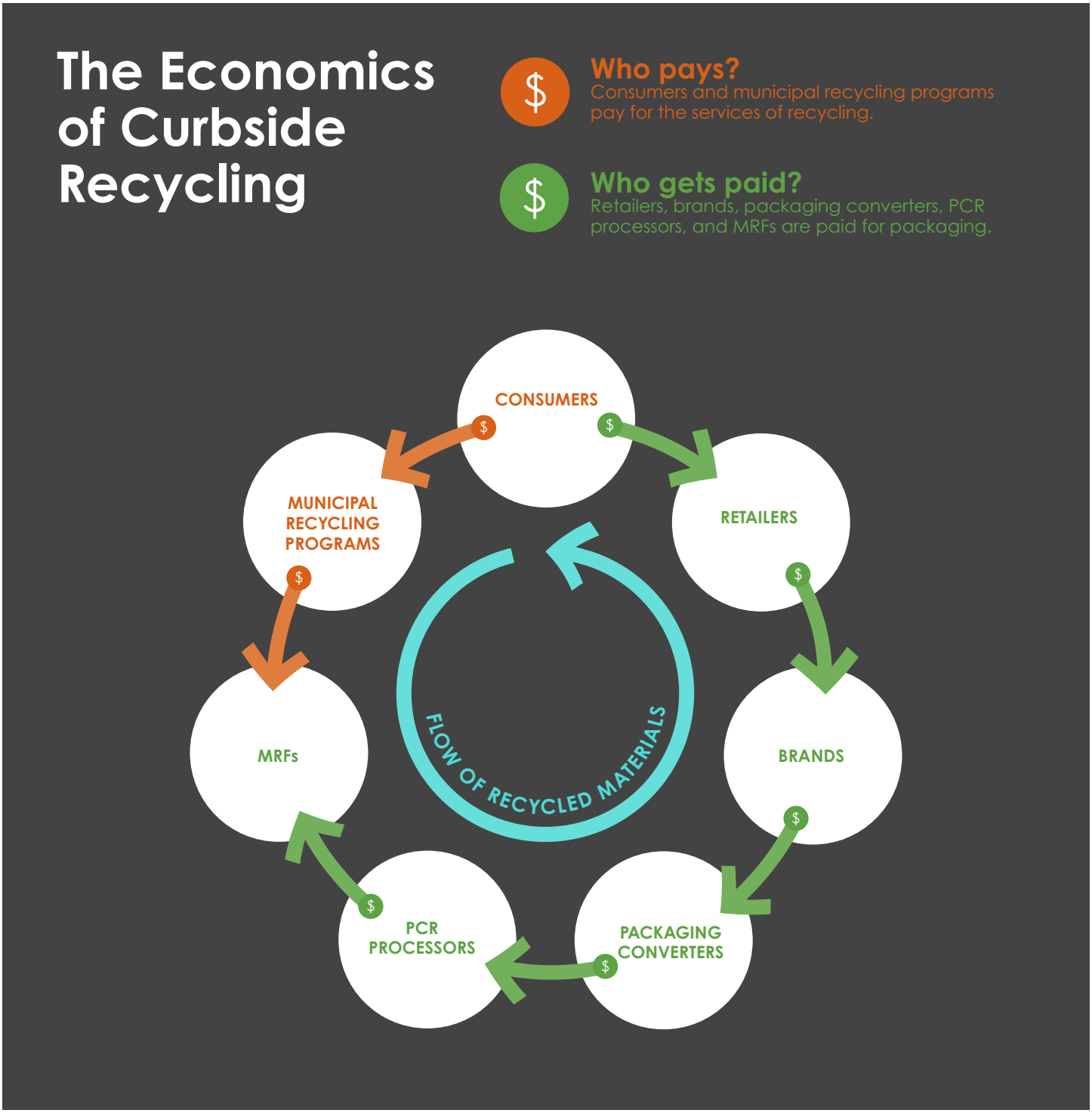
Structural and value proposition problems are at the foundation of these issues:

- Recycling is just one of the many services currently financed by local taxation, which is in turn continually under pressure to be kept as low as possible.
- Under many recycling contracts, local governments "lose money" on every ton they collect—material processing fees make the marginal cost of collecting another ton of co-mingled recyclables USD $50 or more.
- Access to internal capital to improve recycling competes with other demands for capital (for example, funds to build roads or schools).
- Access to external capital is limited and inadequate to the scaling of widespread system improvement.

These structural issues have been compounded by negative commodity pricing across the range of collected materials, especially in the wake of China's National Sword and related actions. The effects of market conditions have been felt in communities in every state of the country.[78]

The graphic on the next page demonstrates, in generalized form, the challenge of the value proposition for generating increased RPET supply in a system where co-mingled material supply is in the hands of local communities. At all points in the life cycle and value chain of PET resin, the supplier is paid, except for community recycling programs and by extension, the households they serve.

78 Waste Dive, "What Chinese Import Policies Mean for All 50 States," 2019: https://www.wastedive.com/news/what-chinese-import-policies-mean-for-all-50-states/510751/



In an economic system where the supply actors are, at best, not rewarded by commodity value, or, at worst, facing negative consequences of increasing supply, the prospects for these actors to react positively to massive increases in demand are dim. This is especially true in a system that has high fixed costs. Making the case for capital investments to boost system performance is challenged by the negative value proposition and competing demands for that capital. In turn, this is all constrained by pressures to keep the pool of capital—in the form of lesser taxation—as low as possible. Market conditions further reduce local motivation to increase supply.

Polypropylene

This analysis has focused on PET as an extremely important gauge for achieving the 2025 Global Commitment goals. In addition to being a good indicator of the scale of supply challenges, PET benefits from robust publicly available data on market uses and dynamics. However, additional resins will also be subject to recycled content goals: a good example is polypropylene, used in packaging formats such as yogurt cups.

Some might suggest that deposits are a superior system for sourcing an increased supply of PET. However, one of the risks of increasing the scope of deposit systems on materials such as PET bottles is that it would remove some of the more valuable materials in the curbside stream, worsening curbside economics.[79] Polypropylene (PP) is in packaging formats that to date have not been included in deposit systems. In that respect, such resins are even more reliant on a robust curbside recycling system that benefits from the inclusion of container plastics like PET for commodity marketing and household education. In other words, the recycling fate of both PET and PP are tied to very same factors of healthy recycling system development, as are other materials such as cardboard and aluminum.

PP has historically and largely been sorted in MRFs as part of a #3-7 resin bale—a commodity grade that mixes a range of resins as exclusive of PET and HDPE as possible, and that needs another separation step post-MRF sorting. This plastic grade relied on healthy export markets disrupted by China's scrap ban. As such, #3-7 plastics—or, in many cases, any plastic packaging that is not PET or high-density polyethylene (HDPE) bottles—have been the focus of elimination in some community programs and on some MRF sort lists. Despite having a very promising future as a valuable grade, this has reduced the amount of PCR PP available to put back into packaging, a situation exacerbated by a growing price disparity with virgin sources of the material.[80] In addition, because of PP's relatively lower volume in the stream of household materials entering MRFs, specific investments in sortation equipment for the material has been hard to justify.

Technical, market, and investment strategies all exist to address these challenges. A robust effort to take on the challenges is highly recommended to brands who use this resin and who will need increased supply to meet Global Commitment packaging content targets.

79 Based on a Recycling Partnership analysis of current blended values, if all PET was removed, MRF losses would increase by 25 percent, and this could impose another USD $16 per ton in processing charges on community recycling programs.

80 Jared Paben, "Exploring the Interplay of Virgin and Recycled Plastic Markets," https://resource-recycling.com/plastics/2019/04/03/exploring-the-interplay-of-virgin-and-recycled-plastic-markets/

Unlocking Supply

Strategic and expedient investment in the current U.S. recycling system can yield significant results in the near term. Based on the analysis above, if Global Commitment signatories plan to meet their recycled content targets, those companies will need to invest in:

- Critical equipment to expand and improve residential collection efforts for those lacking convenient access to recycling for all materials.
- Targeted projects to improve recycling behavior, including large-scale, sustained consumer education programs.
- Grants or low-cost capital to increase MRF efficiency and the capture of critical plastics from the general material mix.
- Advocacy efforts to protect and expand mechanisms supporting the economics of recycling at the local and state levels.

Unlocking Supply, a new Recycling Partnership initiative, calls for an initial investment of USD $250 million over five years in the U.S. to capture more recyclables, including more than 230 million pounds of post-consumer plastics. For PET, this investment crucially begins to unlock nearly 200 million pounds for brands, starting them on the path toward meeting their commitments by 2025.

Meanwhile, the investment could also yield an additional 90 million pounds of HDPE, and 60 million pounds of polypropylene.

The table below shows the modeled application of the Unlocking Supply initiative to key parts of the supply infrastructure, based on The Recycling Partnership's experience in communities around the country.

Because these interventions would be applied across a co-mingled collection infrastructure generally serving all commodities, they would also lead to increases in capture for PET, HDPE, and PP, as displayed in the table below, as well as other materials, as shown in the table opposite. This shows that, because of the nature of the U.S. recycling system, the pathway to circularity is closely linked for all materials.

Intervention	Households Reached (in millions)	Industry Investment (in USD millions)	New Pounds Collected (in millions of pounds)		
			PET	HDPE	PP
Conversion from bins to carts	4	$104	30	14.4	9.6
Optimization of recycling behavior	7	$28	26	5.4	3.6
New curbside access	3	$78	74	36	24
New multifamily recycling access	4	$40	74	30	18
TOTAL	**18 million households**	**USD $250 million**	**204 million pounds (102,000 tons)**	**85.8 million pounds (42,900 tons)**	**55.2 million pounds (27,600 tons)**

Intervention	New Pounds Collected (in millions of pounds)				
	Cardboard	Residential Mixed Paper	Glass	Aluminum	Steel
Conversion from bins to carts	72	192	96	7.2	9.6
Optimization of recycling behavior	63	168	84	6.3	8.4
New curbside access	180	480	240	18	24
New multifamily recycling access	180	480	240	18	24
TOTAL	**495 million pounds (247,500 tons)**	**1.32 billion pounds (660,000 tons)**	**660 million pounds (330,000 tons)**	**49.5 million pounds (24,750 tons)**	**66 million pounds (33,000 tons)**

Unlocking Supply requires an equal partnership between private sector funders and local government recycling programs for critical capital investments in recycling infrastructure. It will use the momentum of the Global Commitment to quickly and at scale apply grants to local recycling efforts in order to initiate new plastics supply, which will also increase the supply of other vital materials.

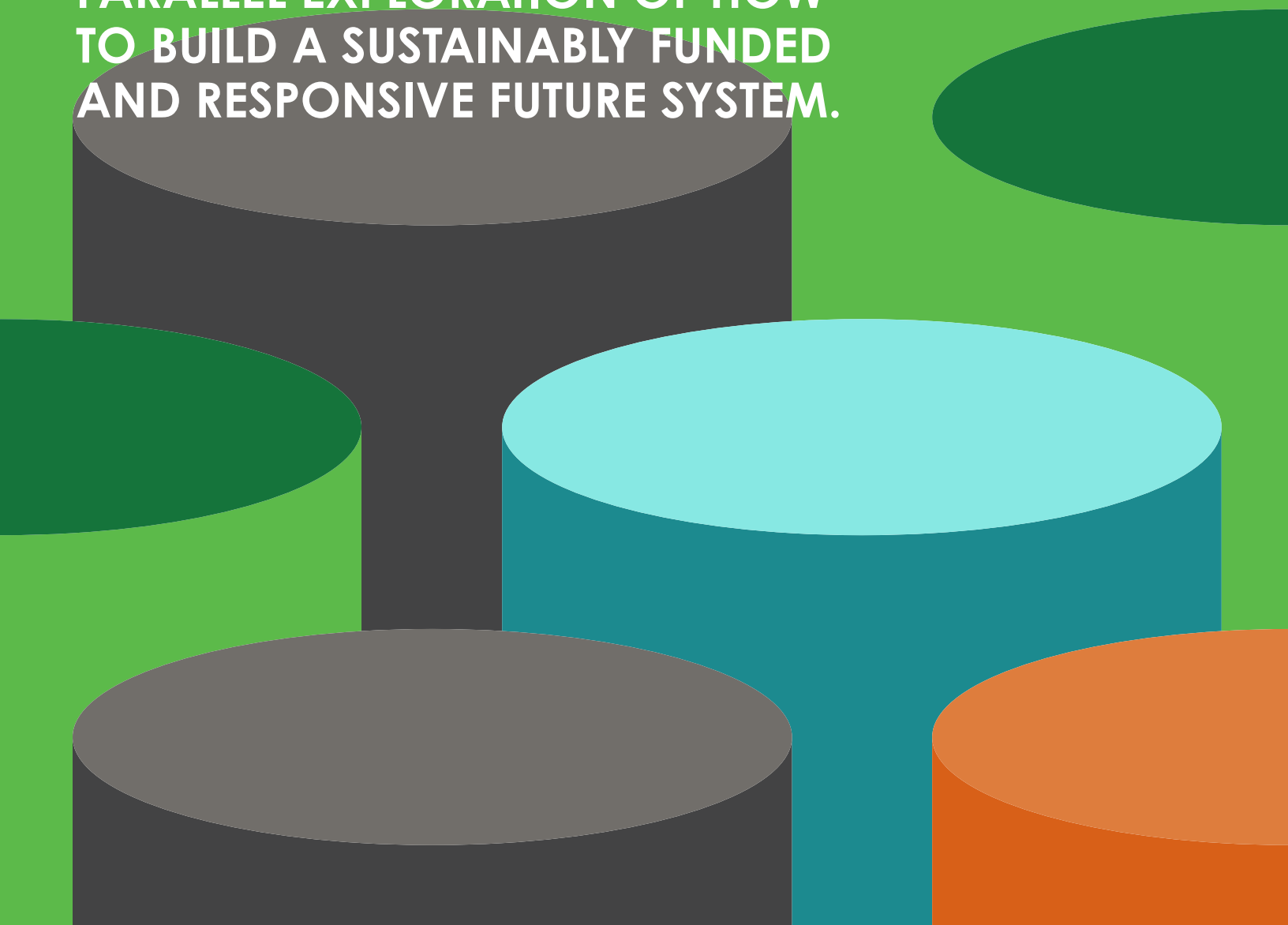
As noted above, the recycling system is one of high fixed costs where access to consequential capital is severely limited. However, applying an outside pool of capital, deployed at scale and as quickly as possible, will jump-start the development of new PET supply while also demonstrating solutions and approaches that could be widely applied in a recharged system. Leadership and support from the Global Commitment signatories is essential, as they pursue a core business strategy of supply development.

Sizable investment in the Unlocking Supply initiative provides a path towards closing the gap in the available supply of materials. However, the section on Finding 3 presents a broader vision that will benefit not just plastics but all commonly recovered recyclable materials, applying a system-wide view and a clear analysis of the fundamental changes needed to reach circularity across all packaging.

The EPA-supported Recycling Economic Information Project (REI) includes information about the number of recycling jobs and the wages and tax revenue they generate. The 2016 report shows that recycling and reuse of materials creates jobs, while also generating local and state tax revenues. In 2007, recycling and reuse activities in the U.S. accounted for 757,000 jobs, USD $36.6 billion in wages, and USD $6.7 billion in tax revenues. Further investment in the system can only serve to generate further economic value and impact.

FINDING 3

INTRACTABLE UNDERLYING CHALLENGES NECESSITATE A PARALLEL EXPLORATION OF HOW TO BUILD A SUSTAINABLY FUNDED AND RESPONSIVE FUTURE SYSTEM.



FINDING 3

INTRACTABLE UNDERLYING CHALLENGES NECESSITATE A PARALLEL EXPLORATION OF HOW TO BUILD A SUSTAINABLY FUNDED AND RESPONSIVE FUTURE SYSTEM.

Systemwide challenges

Recent U.S. exposure to recycled commodity market volatility, along with pressing concerns about the far-reaching environmental impacts of packaging materials like plastics, are highlighting the inherent challenges with the current U.S. recycling system. These circumstances present an opportunity for truly transformative change. The need to invest in the U.S. recycling system is more urgent than ever. For the benefit of all materials, we need to move past pilots, move past the storyline of being on a journey, and embrace fundamental change.

As discussed in Findings 1 and 2, extensive investment is needed across the existing system. This investment is needed not only to address economic constraints, but also to close gaps in research, technology, and data that have caused the system to fall far short of its potential. However, it is also evident that funding needs to be on a different scale altogether than what has been made available so far, and in a way that is more stable for the long term. In fact the business risk of not investing may loom larger, as consumer views of packaging and on issues of corporate responsibility continue to change. Given the scale of funding required, along with other economic pressures on the recycling system, this section of the report concludes that in parallel to investment in the current system, there needs to be a larger systemic fix explored at the national level in order to secure the future system: one that is sustainably funded and managed for the long term.

"The need to invest in the U.S. recycling system is more urgent than ever."

Today's funding model for recycling is unsustainable. However, there are structural fixes that can help to drive a more circular economy for packaging in the U.S. While arriving at solutions will not be easy, by convening a broad group of stakeholders, and learning from other markets and industries, structural fixes can be identified and applied. Government stakeholders, NGOs, brands,

packaging manufacturers, material suppliers, and recycling industries all need to come together to develop a shared vision for the future system. This presents an opportunity to arrive at an approach that is both particular to the U.S. market, and aspirational in its formulation, so that instead of lagging in its materials management practices, America can lead the way toward a circular economy for packaging—one in which "waste" is truly embraced as a domestic resource for the future.

Current funding levels and mechanisms are insufficient

As the analysis in Findings 1 and 2 underscores, the funding levels required to improve recycling rates and meet the emerging PCR material supply needs of the packaging industry are daunting. This does not account for the investment needed to ensure the system is successfully responsive to evolving materials, population demographics, and other influencing factors. Unlike recycling, most modern utilities, such as water, electricity, and natural gas, have already shifted to a model that covers their fixed, variable, and capital costs. The pricing model has created sustainable financing for these utilities, and residents enjoy universal access because of that. However, to date, the U.S. recycling system has been largely reliant on inconsistent local and state government taxes and fees, and voluntary contributions. This approach has left the system without sufficient resources to provide the level of access and infrastructure needed to be successful.

"Unlike recycling, most modern utilities, such as water, electricity, and natural gas, have already shifted to a model that covers their fixed, variable, and capital costs. The pricing model has created sustainable financing for these utilities, and residents enjoy universal access because of that."

Aside from some isolated examples, limited to a minority of states and materials, the U.S. recycling system is funded through state and local tax dollars. While considered to be a valuable public service by residents,[81] recycling is often in direct competition with fundamental public services such as education and policing—meaning its funding is constantly under downward pressure and subject to neglect. Therefore, recycling is a consistently underfinanced public service. Meanwhile, we are a long way from ensuring that all citizens have the ability to recycle as easily as they can throw something away.

Supplementary voluntary funding to support the U.S. recycling system has been made available by a small selection of packaging producers in recent years. For example, since 2015, The Recycling Partnership has used its public-private model, funded by 40+ members, to leverage more than USD $43 million in recycling infrastructure, in turn catalyzing USD $5 million in statewide investment.[82] Closed Loop Fund, an investment firm focused on building a circular economy, has more than USD $86 million in assets under management, and since 2015 has invested more than USD $50 million and leveraged over USD $210 million in co-investment for recycling infrastructure and innovation.[83] However, the system is not "fixed" and only a handful of producers have truly stepped up via these types of voluntary mechanisms, leaving the system wanting more, and a classic free-rider problem in clear view.

81 Research commissioned by The Recycling Partnership in April 2019 showed that 84 percent of consumers feel that recycling is a valuable public service. Details can be found here: https://recyclingpartnership.org/download/29793
82 The Recycling Partnership, Impact Report, June 2019: https://recyclingpartnership.org/impact-report-2019/
83 Closed Loop Partners, Impact Report, 2018: http://www.closedlooppartners.com/wp-content/uploads/2019/03/CLP-Impact-Report-2018-1.pdf

Added economic pressures

While funding may be a sizable challenge, it would be remiss for this analysis not to acknowledge that there are other factors that have a dramatic impact on the dynamics of the system. These include local and state policies and the interplay between the costs of virgin and recycled materials, as well as the costs of disposal.

Using the comparison of another essential service, trash collection and disposal, the average national landfill tipping fee of USD $55.11 per ton[84] has increased only USD $5.90 from the USD $49.21 average fees in place in 1995, nearly 25 years ago.[85] Although these prices reflect a change in the efficiency scale of landfills, they fail to represent the true externalities of this type of disposal. Landfills also carry well-known risks[86] and have detrimental impacts on communities and the environment.[87] At the same time, recycling is expected to be an effort that generates sufficient revenues to carry its own costs. Recent evidence has shown that recycling, when collection costs are included, will never be a self-funded effort that pays for itself in the long term,[88] and so a different, more sustainable funding solution is needed.

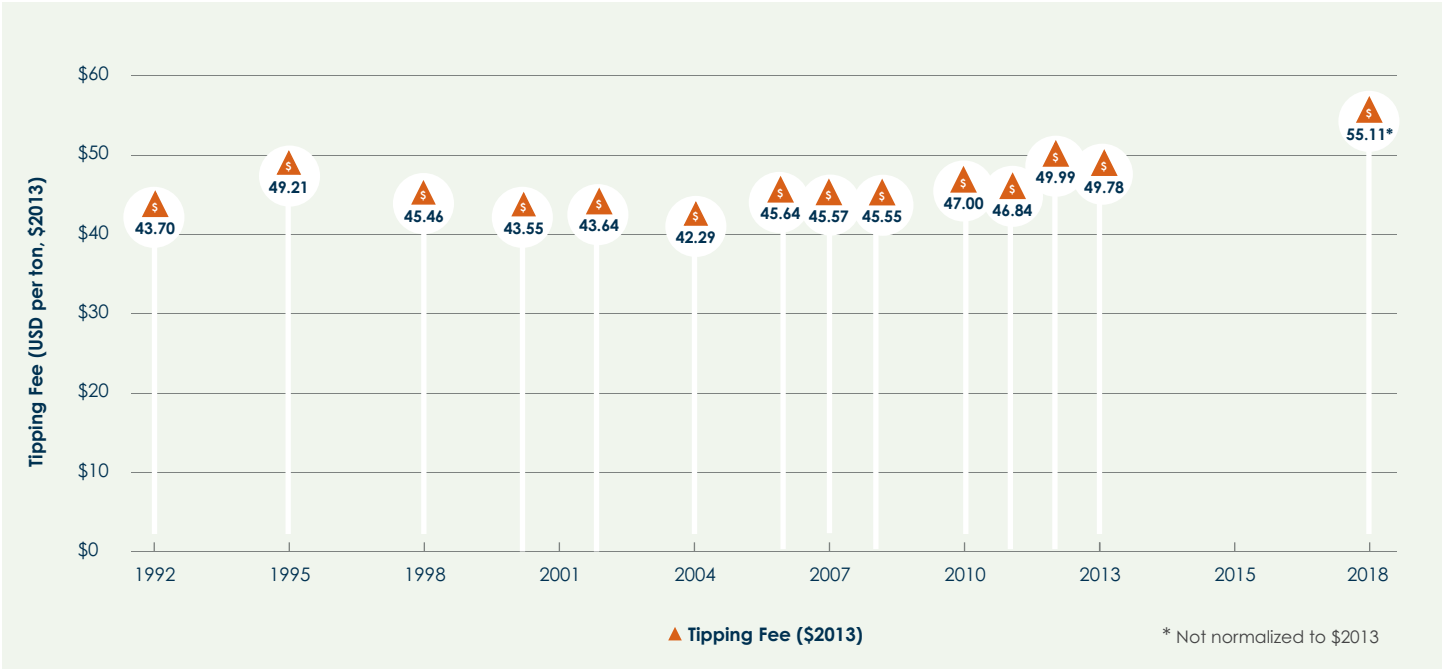


Figure 9: Adapted from "National Tipping Fees, 1982-2013 (EPA)" to include latest EREF data.This chart shows the limited increases in national landfill tipping fees over the last two decades.

In addition to the pressure on recycling created by cheap disposal, as prior sections have outlined, the price of recycled content is not only connected to the price of virgin materials; it also often suffers from a less favorable cost structure. In the case of RPET, for example, supply chain fragmentation, logistics inefficiencies, contamination, and competition add costs when compared with virgin resin.[89] While these dynamics persist, recycled content

84 Environmental Research and Education Foundation (EREF) "Analysis of MSW Landfill Tipping Fees: April 2018," page 1: https://erefdn.org/product/analysis-msw-landfill-tipping-fees-2/
85 U.S. EPA historic data: https://www.epa.gov/sites/production/files/2015-12/documents/historic_tipping_fees_and_commodity_values_02062015_508.pdf
86 One example of current risks associated with landfill is capacity, as detailed here: https://nrra.net/sweep/time-is-running-out-the-u-s-landfill-capacity-crisis/
87 A recent example: "Landfill Reaches Settlement with Ohio Attorney General," Waste Today, July 2019: https://www.wastetodaymagazine.com/article/sunny-farms-landfill-settles-with-ohio-epa/
88 Brian Clark Howard, "Five Myths About Recycling," Washington Post, April 2018: https://www.washingtonpost.com/outlook/five-myths/five-myths-about-recycling/2018/04/20/9971de66-43e6-11e8-8569-26fda6b404c7_story.html?noredirect=on
89 See Finding 2 of this report for more detailed information.

stands to be perpetually disadvantaged, which in turn has an impact on the prospects for sustainable improvements to the wider recycling system.

Policy reform for circularity

In light of limits facing alternative funding mechanisms, the best and arguably most equitable funding would come through the implementation of policy. The Ellen MacArthur Foundation's report suggests, "Such policy measures could include: recycling targets; levies and/or bans on landfilling and incineration; carbon or resource taxes; extended producer responsibility (EPR) schemes supporting after-use systems; deposit-for-recycling systems; and others. . . . In addition, regulatory policies could specifically support the adoption of good design practices through, for example, eco-design rules or more granular (adaptive) EPR schemes with contributions differentiated per packaging design criteria."[90]

While some may argue that policy interventions will disrupt the free market, that assumes that the recycling system represents a true free market. In reality, recycling already relies heavily on massive accumulation of local taxation and, as shown above, the central supply actors in the current system—local governments—do not behave like classic free market actors. It is perhaps no surprise, given the involvement of this disparate group of actors (who are focused on costs to residents and competing constituents' needs, and yet are influencing decisions about service level, container type, and amounts of education) that demand signals do not rapidly translate to new supply, as a free market would imply.

Policies to address the costs and environmental impacts associated with materials outside of packaging are not unheard of in the U.S. For example, extended producer responsibility (EPR) schemes exist for products such as paint, electronics, and carpet. In fact, there are more than 110 EPR laws currently in place for over 13 product categories in more than 30 states.[91] In the realm of packaging specifically, policy measures are increasingly common in other developed countries,[92] ten states source funding (sometimes used for recycling) through container deposit laws,[93] and multipronged proposed legislation targeting plastic pollution specifically has recently hit the national stage.[94]

Furthermore, in our nation's history, when there has been a big infrastructure need, we have implemented taxation. For example, prior to having sustainable funding, the U.S. had the roadway system that recycling has today—a patchwork that limited economic potential and efficiency. With infrastructure funding to build our nation's connected highways, we did more than just make it easier to travel; we catalyzed decades of economic growth that we are still reaping the benefits from. Funding came in part from gasoline taxes: the federal national average gasoline tax is 18.4 cents per gallon and states have their own taxes,[95] which could serve as an example for funding both national systems change and local infrastructure needs for recycling.

"There are some particularities to the U.S. market—including its sheer geographical scale, the large portion of the packaging production and consumption it represents, and its unique political and cultural composition—that necessitate thoughtful analysis of potential policy options to address the costs and environmental impacts of packaging."

90 Ellen MacArthur Foundation, "New Plastics Economy: Catalysing Action," 2018, page 40
91 Tom Szaky, The Future of Packaging, page 59.
92 For example, Ontario, Canada: https://www.wastetodaymagazine.com/article/ontario-adopts-epr/
93 Bottle Bill Resource Guide: http://www.bottlebill.org/index.php
94 U.S. Senate: https://www.tomudall.senate.gov/news/press-releases/udall-lowenthal-release-outline-of-legislation-to-tackle-plastic-waste-pollution-crisis
95 American Petroleum Institute, 2019: https://www.api.org/oil-and-natural-gas/consumer-information/motor-fuel-taxes

We need a new, and uniquely American, approach to the problem

This report is not intended to present an exhaustive analysis of potential policy options available, since many have already sought to fulfill this role.[96] Instead, it seeks to underscore the need for careful consideration and consultation around the approach chosen to support the U.S. recycling system. As the Ellen MacArthur Foundation rightly states, "All [these] policy measures come with advantages and disadvantages, which would need to be carefully examined in local context before implementation."[97] There are some particularities to the U.S. market—including its sheer geographical scale, the large portion of the packaging production and consumption it represents,[98] and its unique political and cultural composition—that necessitate thoughtful analysis of potential policy options to address the costs and environmental impacts of packaging.

Deposit laws will not solve for the whole system

While it is well understood that recycling rates for deposit containers are superior in locations where deposit laws exist, they also target some of the most valuable components of mixed material in the recycling system and are only a means to successfully recovering those specific materials. The goal should be to maximize the recovery of all materials of value in waste streams. Expanded deposits could have serious consequences for the primary means to achieve this goal—residential recycling programs.[99]

Meanwhile, as Finding 1 showed, packaging trends indicate substantial growth in materials that are not even considered in deposit programs, and investment in packaging innovation continues to identify new materials and formats. Given that any policy solution to address the needs of the system will take time to establish, the goal should ultimately be to invest that time in constructive solutions for the bigger picture: a comprehensive and responsive circular system that is resilient and can continually evolve to divert all materials from landfill.

EPR effects can be variable and limited

Equally, while producer-funded schemes for packaging stand to provide enough funding to transform the recycling system, as well as streamlining governance and decision-making, they currently take very different forms, and deliver very variable results.[100] There have been EPR packaging laws in place for up to thirty years in thirty-four European nations, five Canadian provinces, and eleven countries in Asia, South America, Africa, and Australia.[101] However, these have not, for example, protected many markets from the impacts of China's National Sword policies.

The power of incentives needs to be explored

Seeking funding for more effective recycling via policy also begs the need to explore other policy routes that could change the dynamics of the system. For example, cheap access to virgin materials and costs of disposal may persistently work against the efficacy of recycling unless addressed directly.[102] Tools such as eco-modulation, designed to increase

96 Such as this policy analysis report from the Carton Council, 2014: https://www.cartonopportunities.org/sites/default/files/files/Carton%20Council%20Recycling%20Policy%20Analysis%20Report%20%28distribution%20copy%29%20Updated%20Final-5-14r.pdf
97 Ellen MacArthur Foundation, "New Plastics Economy: Catalysing Action," 2018, page 40.
98 Supporting data available here: https://ourworldindata.org/plastic-pollution
99 Colin Staub, "Bottle Bill Expansion Draws Municipal Recycling Concerns," Resource Recycling, February 2019: https://resource-recycling.com/plastics/2019/02/13/bottle-bill-expansion-draws-municipal-recycling-concerns/
100 Neil Seldman, "EPR: The Good, the Bad and the Ugly," Waste Dive, March 2018: https://www.wastedive.com/news/epr-good-bad-ugly/519582/
101 Tom Szaky, The Future of Packaging, page 59.
102 Clare Goldsberry, "The Yin and Yang of Plastics Taxes," Plastics Today, August 2019: https://www.plasticstoday.com/packaging/yin-and-yang-plastics-taxes/209417850861405

the use of recycled content and reward recyclability, should be considered as a means to rebalance incentives.[103] Equally, efforts to increase landfill tipping fees to disincentivize disposal will undoubtedly have a positive impact on the recycling system, especially if funds are utilized to supplement community operational costs and make other necessary system improvements.

Any and all of these options will take time to realize, hence the need to continue investing in the current system as a parallel endeavor, as outlined in Finding 2. At the same time, this highlights the opportunity to address not just funding gaps, nor just plastics as a single material category, but to be considerate of how the future system could deliver a truly circular economy in practice.

Extensive investment in innovation is essential

While taxation has been employed as a tool to support infrastructure development in the history of the U.S., ingenuity and innovation have arguably played an equally important role in moving our nation beyond barriers to progress. Whether we consider breakthroughs in sanitation, medicine, or space travel, innovation and collaboration have been at the heart of this country's historic milestones. As the planet becomes increasingly overwhelmed by the packaging waste problem,[104] this is a moment when the U.S. can choose to lead, rather than lag.

"Whether we consider breakthroughs in sanitation, medicine, or space travel, innovation and collaboration have been at the heart of this country's historic milestones."

Innovation is needed across the board in recycling, not only to avoid potentially disastrous externalities such as marine debris, but also to prevent wasting critical resources by throwing huge volumes of packaging materials away at the end of their life. Consumer behavior needs to be better understood; innovative collection methods need to be trialed; new sortation techniques should be explored; and promising technological developments, such as chemical recycling, need to be tested and rapidly scaled as appropriate. Furthermore, better standardized data and measurement systems need to be developed to ensure that their insights can usefully inform continuous improvement.

In order to seize the opportunity to develop a unified and progressive response to the necessity for game-changing solutions, stakeholders need to agree on the parameters that will support the development of a U.S. national recycling system of the future. Collaboration will avoid disparate and uncoordinated efforts to implement a patchwork of solutions that may deliver only partial effects. Creating a future circular economy for the U.S. requires both a focus across material types and a system that does not stop at recycling. However, recycling will play a critical role in this system, and it needs a reset.

103 Examples can be found here: https://ieep.eu/publications/more-ambitious-extended-producer-responsibility-for-plastics-through-greater-eco-modulation-of-fees

104 United Nations Environment Programme, "Single-Use Plastics: A Roadmap for Sustainability," Executive Summary, 2018, page vi: http://wedocs.unep.org/bitstream/handle/20.500.11822/25496/singleUsePlastic_sustainability.pdf?isAllowed=y&sequence=1

Recycling 2.0

Recycling 2.0 is a new initiative, led by The Recycling Partnership, to develop and build the future recycling system. As detailed in this report, the success of the future system will depend on resolving sizable gaps in funding and prohibitive economic conditions. If these key disparities are not rectified, the journey to circularity will not be starting on a level playing field. Therefore, The Recycling Partnership will convene industry and government leaders to agree on the parameters for transformative policy in order to catalyze this initiative and fund its scaled execution.

Recycling 2.0 calls for an initial investment of USD $250 million over five years, in order to evolve the existing system from its legacy framework toward a world-class industry, supported by cutting-edge solutions. The investment will be applied as grants for national programs to include:

- Developing robust data systems—for example, the evolution of a comprehensive recyclability and accepted materials database to inform other interventions and introducing new and evolved measurement tools.
- Delivering interventions to improve consumer participation—for example, enhanced consumer engagement and messaging platforms around recycling.
- Deploying capital to fill gaps in existing technologies and solutions for:
    - **Collection**—for example, piloting apps for communities to track and report performance; expansion of multifamily collection methods; and testing of artificial intelligence in trucks and MRFs to monitor material and quality.
    - **Processing**—for example, new MRF grants, secondary MRF pilots to scale collection of #3-7 plastics and improve economics; installation of glass sortation equipment in strategic areas of the country to feed end markets; and eddy current improvements.
    - **End market development**—for example, end market pilots for glass; identifying new film and mixed plastics outlets.
- Implementing research and development for new and emerging innovations—for example, prototypes for tracking technology; robotics; technology in the home to curb contamination and boost capture; and chemical recycling feedstock tests.

Recycling 2.0 will rely on:

Collaboration—bringing industry and government leaders together to agree on the detailed parameters for the vision and roadmap.

Research—grounding efforts in a solid understanding of needs and evidence-based interventions.

Partnership—working with existing organizations with expertise in this area, such as Closed Loop Partners.

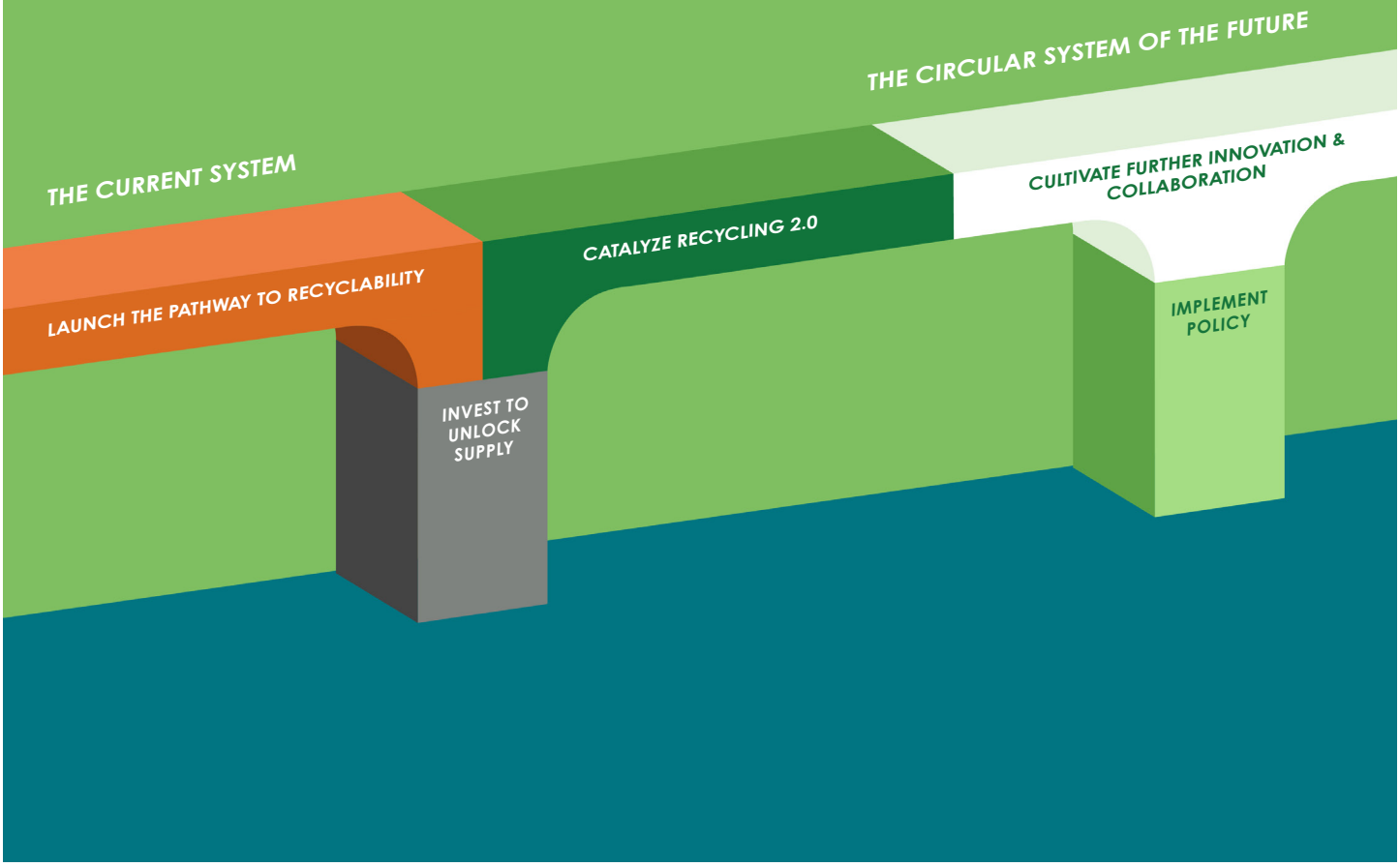
Execution—focusing on turning ideas into tangible action.

A full-system focus—rebalancing the discussion to encompass the full range of materials. While plastic may be a catalyst, it cannot be a distraction from the full potential of this endeavor. As packaging innovation continues to unfold, there is a need to rebalance and refocus the discussion by acknowledging that glass is heavy, bauxite extraction burdens aluminum, and fiber products (including mixed paper and cardboard) make up the majority of recyclables available from households.[105] In other words, no material is immune from impacts, and this needs to be a cross-material collaboration.

105 ASTRX Review of Material Flow at MRFs and Reprocessors, 2019, page 21: https://astrx.org/wp-content/uploads/2019/05/ASTRX-Review-of-Material-Flow-at-MRFs-and-Reprocessors-1.pdf

The Bridge to Circularity

Recycling 2.0 will begin to build an actionable roadmap toward a fully functioning circular system. However, a circular economy for packaging does not stop at recycling. The Bridge to Circularity will depend on effective recycling, but also on efforts to reduce our overall material consumption, capitalize on reuse opportunities, and scale up composting and other infrastructure to complete the bridge. Many stakeholders are working on these endeavors, and The Recycling Partnership invites them to connect and collaborate in the evolution of the Bridge to Circularity, working together to create holistic solutions in support of this transformational goal. This will enable the U.S. to look ahead to a future where today's waste is considered to be tomorrow's resources.



CONCLUSIONS & NEXT STEPS

This report was inspired by the Ellen MacArthur Foundation's (EMF) New Plastics Economy Global Commitment, through which hundreds of organizations have set targets relating to recyclability and recycled content. The report makes the case that the U.S. recycling system will be vital to the achievement of these global targets and serves to highlight how deficiencies in that system must and can be addressed. The report also underlines the need to employ a systems focus and cross-material approach, beyond just plastics, in order to better define "recyclable packaging" and to begin restructuring the U.S recycling system for the benefit of recycling all such packaging.

"The critical role this report plays, in contrast to prior and related analyses, is to outline specific measures that provide stakeholders with a means to move quickly from commitments and towards action."

The critical role this report plays, in contrast to prior and related analyses, is to outline specific measures that provide stakeholders with a means to move quickly from commitments and towards action. In summary, three key findings provide a platform for the launch of three new corresponding industry-wide initiatives.

1. The speed of packaging innovation has outpaced the capabilities of recycling infrastructure.

Summary:

Packaging materials and formats are evolving faster than the recycling system can manage. Stakeholders must work together to formalize an actionable pathway to recyclability in order to enable companies to reach their goals while improving the ability of the recycling system to capture the materials.

Next steps:

- Following the publication of this report, The Recycling Partnership will launch Pathway to Recyclability by developing a clear roadmap for how to move a package from technically recyclable to commonly accepted for recycling, and by launching collaborative groups for multiple materials and packaging formats in order to focus efforts on optimizing and improving the system.
- Stakeholder convenings will begin in early 2020 for a range of key materials and formats, seeking to agree to goals, principles, and parameters. This effort will build on the success of the Film and Flexibles Task Force, established in 2019, and will be a partnership-focused approach, leveraging the work done by the Association of Plastic Recyclers (APR), the Sustainable Packaging Coalition (SPC), and others in this space.
- The initial convenings will not represent an exhaustive list of collaboratives, and other materials and formats with an interest in partnering for solutions are invited to commit to driving action by joining this significant effort.

2. In its current form, the U.S. recycling system cannot deliver the supply of recycled materials demanded by the New Plastics Economy Global Commitment.

Summary:

For some materials, such as PET, demand for recycled content is outpacing the supply. The U.S. recycling system in its current form cannot deliver the supply of recycled materials needed to fulfill companies' goals. We must exponentially invest to improve collection, optimize participation, and improve processing efficiency, while also addressing longer-term structural issues in the U.S. system.

Next steps:

- Following the publication of this report, The Recycling Partnership will launch Unlocking Supply—an industry-wide, CEO-level fundraising effort specifically designed to unlock PCR supply through investment in residential recycling. The fundraising target to commence work towards the 2025 timeline is USD $250 million, with a goal of capturing more recyclables, including more than 230 million pounds of post-consumer plastics.
- The Recycling Partnership has identified target locations and projects that can put this capital to immediate use in communities across the U.S., for collection, education, and other interventions. The goal is to leverage grant dollars to deliver the pace and scale of change necessary.

3. Intractable underlying challenges necessitate a parallel exploration of how to build a sustainably funded and responsive future system.

Summary:

In order to meet the increasing demands placed upon it, the current system needs to be transformed into a sustainably funded, responsive, and truly circular system. Effective policy is critical to catalyzing this shift. In addition, work needs to be done in parallel in order to create an actionable roadmap to build the new system.

Next steps:

- Following the publication of this report, The Recycling Partnership will launch a transformative policy workstream to develop a policy proposal that seeks to achieve a sustainably funded and responsive recycling system for all materials. A specific proposal is anticipated in early 2020, and stakeholders will be invited to participate.
- Additionally, The Recycling Partnership will launch Recycling 2.0, an initiative calling for an investment of USD $250 million over five years to design and implement the future recycling system. Stakeholders will align on a vision, which will then inform an actionable roadmap to a fully functioning circular system for all materials. We invite all constructive stakeholders to join the effort.
- The Bridge to Circularity necessitates looking beyond recycling: The Recycling Partnership invites others to collaborate in the creation and evolution of initiatives that support a low-carbon economy by addressing reduction, re-use, composting and pathways to circularity.

It is time to transform the way we think about and manage waste in the U.S. Join us.

GLOSSARY

BAUXITE
A sedimentary rock with a relatively high aluminum content. It is the world's main source of aluminum.

CHEMICAL RECYCLING
Breaking down polymer structure into monomers and other basic chemical elements. This is an attractive option for plastic products that are difficult to recycle mechanically due to low quality, composite nature, or low economic value. The outputs can be used as virgin material alternatives in manufacturing new polymers.

CIRCULAR ECONOMY
The circular economy is an evolving framework towards an industrial system that is restorative and regenerative by design. It rests on three main principles: preserving and enhancing natural capital, optimizing resource yields, and fostering system effectiveness.

CONSUMER PACKAGED GOODS (CPG)
Industry term for merchandise that customers use up and replace on a frequent basis.

CONTAMINANT
Unwanted substance or material.

DEMAND-PULL
A term used to describe the rise of price levels because of an imbalance in aggregate supply and demand.

DISPOSABLES
Goods that are intended to be thrown away after their use.

ELLEN MACARTHUR FOUNDATION (EMF)
The Ellen MacArthur Foundation was launched in 2010 to accelerate the transition to a circular economy. Since its creation, the charity has emerged as a global thought leader, establishing the circular economy on the agenda of decision-makers across business, government, and academia. The Foundation's work spans across five areas: insight and analysis, business and government, education and training, systemic initiatives, and communication.

EXTENDED PRODUCER RESPONSIBILITY (EPR)
A strategy to impose accountability over the entire life cycle of products and packaging introduced to the market. This may take the form of legislation that mandates private sector roles, responsibilities, and outcomes for the funding and operating of systems designed to recover post-consumer packaging.

FIBER
In regard to this report, the term fiber refers to material made from recycled polyethylene terephthalate (RPET), the most common polyester resin, which is used in the production of high-strength textile fiber to manufacture clothes, reusable shopping bags, backpacks, and more.

FILM/BAGS
Plastic bags are made out of "film," or thin flexible sheets of plastic. Plastic film is typically defined as any plastic less than 10 millimeters thick. The majority of plastic films are made from polyethylene resin and are readily recyclable if the material is clean and dry.

FLEXIBLE PACKAGING
Packaging whose shape is likely to change after the contents are added or removed. This includes plastic bags and film such as bread bags, produce bags, paper towel and beverage overwraps, and also new packaging technologies such as pouches and multilayer films. Multilayer packaging may consist of multiple layers of the same polymer or incorporate different polymers or substances.

FTC GREEN GUIDES
Guidelines that the Federal Trade Commission has established to help marketers avoid making environmental marketing claims that are unfair or deceptive. The Green Guides were first issued in 1992 and were revised in 1996, 1998, and 2012.

INCINERATION
The destruction of something, especially waste material, by burning.

LANDFILL
A disposal site for the deposit of waste onto or into land under controlled or regulated conditions.

MATERIAL PROCESSING FEES
Costs incurred to process collected recyclables.

MECHANICAL RECYCLING
Recycling process by which the polymer structure of plastics is maintained.

MIXED WASTE PAPER also known as RESIDENTIAL MIXED PAPER
Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end usage as a consumer item, including old newspapers, old magazines, mailers and mailed advertisements, tabulating cards, and used cordage.

MRF (MATERIALS RECOVERY FACILITY)
A facility employing various manual and machine processes to sort recyclable materials, remove contamination, and process, usually by baling, for shipment and sale to various markets.

MUNICIPAL SOLID WASTE (MSW)
Residential and commercial non-hazardous waste generated by municipalities and commercial entities, not including medical or industrial or construction/demolition waste.

NEW PLASTICS ECONOMY GLOBAL COMMITMENT
A signed commitment uniting businesses, governments, and other organizations behind a common vision and targets to address plastic waste and pollution at its source. Signatories include companies representing 20 percent of all plastic packaging produced globally, as well as governments, NGOs, universities, industry associations, investors, and other organizations. The New Plastics Economy Global Commitment is led by the Ellen MacArthur Foundation, in collaboration with UN Environment.

PACKAGING
Any product to be used for the containment, protection, handling, delivery, storage, transport, and presentation of goods from raw materials to processed goods, from the producer to the user or consumer, including processor, assembler, or other intermediary.

POST-CONSUMER RECYCLED CONTENT (PCR)
For the purposes of this analysis, we are using the EMF definition. More details can be found here: https://www.newplasticseconomy.org/projects/global-commitment

RECOVERY (SYSTEM)
The successful diversion of recyclable materials out of landfill disposal to recycling collection and reuse systems. The European definition can include incineration with energy capture.

RECYCLABLE
Characteristic of a product, packaging, or associated component that can be diverted from the waste stream through available processes and programs and can be collected, processed, and returned to use in the form of raw materials or products.

RECYCLATE
Plastics material resulting from the recycling of plastics waste. The terms plastics secondary raw material, recycled plastics, and regenerate are used simultaneously.

Note: As soon as the used plastics material has been treated in such a way that it is ready to replace a virgin product, material, or substance in a production process, it loses its characteristics as waste.

RECYCLING
For the purposes of this analysis, we are using the EMF definition. See Appendix 2 for details.

RESIN
Substances which can be organic or inorganic in nature and widely used as raw materials in the manufacture of plastic products.

REVERSE LOGISTICS MECHANISMS
Systems for getting recyclables back to the manufacturer for reuse, remanufacture or recycling.

VIRGIN MATERIALS
Raw material that has never been processed into any form of end-use product.

Sources Used

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APPENDIX 1:

ELLEN MACARTHUR FOUNDATION GLOBAL COMMITMENT AND COMMON VISION

The New Plastics Economy Global Commitment

1. Endorse the Global Commitment's common vision (see below)

2. Make the following individual commitments (where 2025 refers to December 31, 2025)[106]:

    a. Take action to eliminate problematic or unnecessary plastic packaging by 2025

    b. Take action to move from single-use towards reuse models where relevant by 2025

    c. 100% of plastic packaging to be reusable, recyclable, or compostable by 2025

    d. Set an ambitious 2025 post-consumer recycled content target across all plastic packaging used

3. Commit to collaborate towards increasing reuse/recycling/composting rates for plastics

4. Report annually and publicly on progress towards meeting these commitments, as well as on annual volumes (metric tons) of plastics production/use (the latter is used for aggregation purposes only, but individual public disclosure is encouraged).

Common vision for a circular economy of plastics

Over 400+ signatories of the New Plastics Economy Global Commitment endorsed the vision of a circular economy for plastics, where plastics never become waste. They recognise this vision offers a root cause solution to plastic pollution with profound economic, environmental, and societal benefits.

For plastic packaging, specifically, they recognise a circular economy is defined by six characteristics:

1. **Elimination of problematic or unnecessary plastic packaging through redesign, innovation, and new delivery models is a priority**

    a. Plastics bring many benefits. At the same time, there are some problematic items on the market that need to be eliminated to achieve a circular economy, and, sometimes, plastic packaging can be avoided altogether while maintaining utility.

2. **Reuse models are applied where relevant, reducing the need for single-use packaging**

    a. While improving recycling is crucial, we cannot recycle our way out of the plastics issues we currently face.

    b. Wherever relevant, reuse business models should be explored as a preferred 'inner loop', reducing the need for single-use plastic packaging.

106 Definitions for the terms used by EMF can be found here: https://www.newplasticseconomy.org/projects/global-commitment

3. **All plastic packaging is 100% reusable, ecyclable, or compostable**

    a. This requires a combination of redesign and innovation in business models, materials, packaging design, and reprocessing technologies.

    b. Compostable plastic packaging is not a blanket solution, but rather one for specific, targeted applications.

4. **All plastic packaging is reused, recycled, or composted in practice**

    a. No plastics should end up in the environment. Landfill, incineration, and waste-to-energy are not part of the circular economy target state.

    b. Businesses producing and/or selling packaging have a responsibility beyond the design and use of their packaging, which includes contributing towards it being collected and reused, recycled, or composted in practice.

    c. Governments are essential in setting up effective collection infrastructure, facilitating the establishment of related self-sustaining funding mechanisms, and providing an enabling regulatory and policy landscape.

5. **The use of plastics is fully decoupled from the consumption of finite resources**

    a. This decoupling should happen first and foremost through reducing the use of virgin plastics (by way of dematerialisation, reuse, and recycling).

    b. Using recycled content is essential (where legally and technically possible) both to decouple from finite feedstocks and to stimulate demand for collection and recycling.

    c. Over time, remaining virgin inputs (if any) should switch to renewable feedstocks where proven to be environmentally beneficial and to come from responsibly managed sources.

    d. Over time, the production and recycling of plastics should be powered entirely by renewable energy.

6. **All plastic packaging is free of hazardous chemicals, and the health, safety, and rights of all people involved are respected**

    a. The use of hazardous chemicals in packaging and its manufacturing and recycling processes should be eliminated (if not done yet).

    b. It is essential to respect the health, safety, and rights of all people involved in all parts of the plastics system, and particularly to improve worker conditions in informal (waste picker) sectors.

They recognise this vision is the target state they seek over time, and acknowledge that realising it will require significant effort and investment. They also recognise the importance of taking a full life-cycle and systems perspective, aiming for better economic and environmental outcomes overall. Above all, they recognise the time to act is now.

APPENDIX 2:

ELLEN MACARTHUR FOUNDATION GLOBAL COMMITMENT DEFINITIONS

This is an extract from the Ellen MacArthur Foundation's New Plastics Economy initiative. Full details can be found here: https://www.newplasticseconomy.org/projects/global-commitment

Recycling

References to 'recycling' in this appendix always refer to 'material recycling'.

Definition: **Material recycling**

Reprocessing, by means of a manufacturing process, of a used packaging material into a product, a component incorporated into a product, or a secondary (recycled) raw material; excluding energy recovery and the use of the product as a fuel.

Source: ISO 18604:2013 - Packaging and the environment — Material recycling, modified (note to

Further explanatory notes

a. This includes both mechanical (maintaining polymer structure) and chemical (breaking down polymer structure into more basic building blocks, e.g. via chemical or enzymatic processes) recycling processes.

b. It explicitly excludes technologies that do not reprocess materials back into materials but instead into fuels or energy.

   Chemical recycling can be considered in line with a circular economy if the technology is used to create feedstock that is then used to produce new materials. However, if these same processes are used for plastics-to-energy or plastics-to-fuel applications, these activities cannot be considered as recycling (according to ISO definitions), nor as part of a circular economy. For a chemical recycling process, just like for the production of virgin plastics, no hazardous chemicals should be used that pose a significant risk to human health or the environment, applying the precautionary principle.

c. A high quality of recycling and of recycled materials is essential in a circular economy, where one aim is to keep materials at their highest utility at all times. This maximises the value retained in the economy, the range of possible applications for which the material can be used, and the number of possible future life-cycles. It therefore minimises material losses and the need for virgin material input.

- Maximising the quality and value of materials during recycling is made possible through a combination of packaging design and high-quality collection, sorting, cleaning, and recycling technologies and systems.

- On the design side, organisations such as APR, PRE, EPBP, RECOUP and others have design-for-recyclability guidelines for plastic packaging that, as well as recyclability, often indicate the quality of the recycled output (e.g. through traffic light systems or classifications such as 'preferred for recycling' versus 'detrimental for recycling').

2 Recyclable packaging

Recyclability is perhaps the most ambiguous term amongst all packaging circularity terminology. 'Recyclable' means different things to different people in different contexts.

In the context of the Global Commitment, where the term 'recyclable' is used for global commitments by businesses that put packaging on the market (e.g. packaging producers, fast-moving consumer goods companies, retailers, hospitality and food service companies), 'technically recyclable'[107] is clearly not enough: recycling does not just need to work in a lab. Instead it should be proven that packaging can be recycled in practice and at scale.

'At scale' means that the proof needs to be more than a lab test, a pilot, or a single small region. It means that recycling of a certain packaging type needs to be proven to work in practice in multiple regions, collectively representing a significant geographical area in terms of population size, ideally across different country and city archetypes. This to indicate that the recycling in practice is replicable, and that the design of the packaging is not the barrier to realise recycling in practice in other countries.

'In practice' means that within each of these regions, the recycling system (end-to-end system from consumer to recycled material) effectively recycles a significant share of all packaging of that type put on the market. In other words, in that area a significant recycling rate is achieved for that type of packaging.

Moving towards only using 'recyclable' packaging as described above is a necessary first step, but is one that should happen in conjunction with other efforts to ensure all packaging is actually recycled in practice in every market where it is used.

107 Technical recyclability considers the technical possibility to recycle a package, but does not take into account if the collection, sorting, and recycling of the package happens in practice, at scale, and with reasonable economics (e.g. it could work in a lab or in one (pilot) facility but not be economically viable to replicate at scale). Therefore, such a definition does not directly correlate to what is actually recycled in practice, and it would result in almost all packaging being considered 'recyclable'.

Definition: **Recyclable packaging**

A packaging (1) or packaging component (2,3) is recyclable if its successful post-consumer (4) collection, sorting, and recycling (5) is proven to work in practice and at scale.

Notes

1. In the context of a 2025 timeframe and the Global Commitment, a package can be considered recyclable if its main packaging components, together representing >95% of the entire packaging weight, are recyclable according to the above definition, and if the remaining minor components are compatible with the recycling process and do not hinder the recyclability of the main components.

   Otherwise, only the recyclable components of a package (or the recyclable parts of components - see footnote 3) can be counted towards achieving this commitment, and only when other components do not hinder or contaminate their recyclability.

   Examples:

   - If a bottle and its cap are recyclable, the packaging can be claimed to be recyclable if it has a label (<5% of total weight) that does not hinder the recyclability of the bottle and cap.
   - If that same bottle has a label that hinders or contaminates the recycling of the bottle and cap, the entire packaging is non-recyclable.
   - If a package has (a) certain component(s) that are not recyclable and that make up >5% of the total packaging weight (e.g. 12%) and that do not hinder or contaminate the recycling of the remaining recyclable components of the package, then only that recyclable part (e.g. 88%) can be counted towards this commitment.

   Longer-term, the aim should be for all packaging components (e.g. including labels) to be recyclable according to the above definition.

2. A packaging component is a part of packaging that can be separated by hand or by using simple physical means (ISO 18601), e.g. a cap, a lid and (non in-mould) labels.

3. A packaging component can only be considered recyclable if that entire component, excluding minor incidental constituents (6), is recyclable according to the definition above. If just one material of a multi-material component is recyclable, one can only claim recyclability of that material, not of the component as a whole (in line with US FTC Green Guides[108] and ISO 14021).

4. ISO 14021 defines post-consumer material as material generated by households or by commercial, industrial and institutional facilities in their role as end users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain. It excludes pre-consumer material (e.g. production scrap).

5. Packaging for which the only proven way of recycling is recycling into applications that do not allow any further use-cycles (e.g. plastics-to-roads) cannot be considered 'recyclable packaging'.

6. ISO 18601:2013: A packaging constituent is a part from which packaging or its components are made and which cannot be separated by hand or by using simple physical means (e.g. a layer of a multi-layered pack or an in-mould label).

108 US Federal Trade Commission (2012), Guides for the Use of Environmental Marketing Claims ("Green Guides"), Part 260.

Further explanatory notes

a. By being based on the principle that recycling needs to be proven to work in practice and at scale, the definition requires the entire system to be proven to work: material choices, packaging design, the manufacturing process, the most likely way of using, disposing and collecting the packaging, and the availability, compatibility, and performance of infrastructure for collection, sorting and recycling. It also implicitly requires the system to work technically, conveniently (if it works in practice and at scale, it must be convenient enough for actors in the system to participate) and economically (if it works in practice and at scale, it must be that the economics are reasonable and that there are end markets for the resulting material).

b. By being based on the principle that recycling needs to work in practice and at scale, the definition of recyclable packaging allows for innovation. A packaging item that is not currently recyclable could be so in future (e.g. by putting in place effective collection, sorting and recycling technologies at scale).

c. It is important to assess the recyclability of each package separately, taking into account its design, manufacturing processes and most likely way of using, disposing and collecting it, which all have a significant impact on the possibility and probability of the package being recycled in practice. For example:

   - Design: For example choices of materials, the shape and size of the packaging, additives and colourants, glues, inks, caps, labels.

   - Manufacturing process: For example, sometimes additives are added to facilitate the manufacturing process or residual amounts of catalysts or other products end up in the packaging during the manufacturing process.

   - Most likely way of using and disposing: One should assume the most likely way of using and disposing the packaging and not assume unlikely conditions. For example, in most countries one cannot assume that a significant share of households will disassemble packaging before disposing of it. Other questions to consider include: Would the package be disposed most often with or without the label or cap still attached? Would it most likely be disposed of empty and clean, or contaminated with product residues, glue or lid residues?

   - Most likely way of collecting: Is the pack most likely to end up in a collection system for business-to-business bulk materials or in that for household materials? A package could be recycled in practice and at scale in business-to-business but not in business-to-consumer applications (e.g. PE pallet wraps usually end up in different collection systems than PE wraps around consumer products).

d. While the definition does not specify where a package is recycled (i.e. allowing for the export and import of materials), businesses should ensure any exported packaging actually gets recycled before considering the recycling pathway to work in practice.

e. The available technical design-for-recycling guidelines by organisations such as APR, PRE, EPBP, RECOUP and others bring a more technical and in-depth analysis of design for recycling prerequisites. As such, these guidelines are complementary to the 'recyclable' definition of this appendix, and businesses are encouraged to refer to and apply these design-for-recyclability guidelines.

The suggested test and threshold to assess if the recyclability of a packaging design is proven 'in practice and at scale' is: **Does that packaging achieve a 30% post-consumer recycling rate in multiple regions,**[109] **collectively representing at least 400 million inhabitants?** A possible alternative, especially relevant for more local players, is to check if a 30% post-consumer recycling rate is achieved in all the markets where your packaging is sold. The above thresholds might be reviewed over time as more data becomes available.

These thresholds are not intended to be achieved today, but aim to define an ambitious yet realistic target to reach by 2025.

Note: The 'recyclable' definition above applies at a global level for global commitments: it is a characteristic of packaging and is not linked to any local context or specific geographical area. As such, this definition does not apply to claims linked to specific geographical areas (e.g. on-pack recycling labels, customer communications), as these should always take into account the local context and systems in place (in line with ISO 14021 and US FTC), and be in line with the local regulations that apply to such claims.

Finally, it is important to stress once more that, while the commitment to make all packaging recyclable by 2025, according to the definition above, is a necessary first step, it is not an end goal in itself. The target state to aim for is one in which all packaging is actually recycled in all markets where it is put on the market (ideally after several reuse cycles and not including some targeted applications where compostability might be the preferred solution).

3. Assessment methodology to apply the definition

A two-step process can be used to assess recyclability of a packaging (portfolio) in line with the above definition and thresholds.

Step 1: The first step makes an assessment at the level of 'packaging categories' and indicates for which of these packaging categories a 'system for recycling' exists in practice and at scale.

- **A 'system for recycling'** is an entire end-to-end system from consumer to recycled material, including collection, in some cases sorting, and reprocessing (which could include washing, drying, shredding, etc.) into recycled materials. This can be a formal or an informal system, as long as it works in practice and at scale.

- **Packaging categories** can be defined by combinations of materials, packaging formats and, where relevant, customer type (business-to-consumer or B2C versus business-to-business or B2B), and/or other criteria. The main rule of thumb is that packaging items that are not treated by the same 'system for recycling' or are treated as separate 'streams' of materials in certain 'systems for recycling' should be split into different categories. Examples include:

    - 'PET thermoforms' and 'PET bottles' are separate categories as these are often collected, sorted and/or recycled separately. As such 'PET packaging' by itself is too broad a category.

    - 'LDPE flexible packaging >A4 in B2C context' could be a category. This differentiates by size, because large and small films are often separated (with roughly A4 size used as the threshold in many regions), and by customer type because many more regions have 'systems for recycling' for these materials in place in a B2B context than in a B2C context.

109 Regions can be any geographic area (countries, states, provinces, ...), anywhere in the world

The aim of Step 1 is to produce a full list of packaging categories for the signatory's packaging portfolio that indicates which categories have a 'system for recycling' existing in practice and at scale. To assess if a 'system for recycling' exists in practice and at scale, it is recommended to assess if the packaging category achieves a 30% post-consumer recycling rate in multiple regions,[110] collectively representing at least 400 million inhabitants.

Step 2: If no 'system for recycling' exists in practice and at scale for a certain packaging category, packaging in that category does not meet the definition of 'recyclable packaging' in the context of the Global Commitment at that moment in time.

If a 'system for recycling' does exist in practice and at scale for a certain packaging category, it is important to move to step two, which looks deeper into the detailed design (size, colourants, additives, labels, caps/lids, glues, inks, etc.) of that specific packaging and its components in order to assess if the different packaging components actually fit that system. In other words, it assesses if the different packaging components,[111, 112] once they enter the system, will (most likely) successfully run through the 'system for recycling' and end up actually being recycled.

For example, the fact that a 'system for recycling' exists in practice and at scale for PET bottles does not imply that every single PET bottle can be considered recyclable: size, colourants, additives, labels, caps/lids, glues, inks, etc. could all hinder the recycling of a specific bottle.

This type of assessment in step two is widely known and applied. Various design-for-recycling guidelines, tools and/or testing methods are available from, for example The Association of Plastics Recyclers (APR), Plastic Recyclers Europe, European PET Bottle Platform and many more. If there are minor differences between the different guidelines, it is encouraged to use the geographically most relevant one or the strictest one.

This assessment is done at packaging component level and for the specific 'system for recycling' the packaging would end up in. For example, assuming a PET bottle and all its components end up in the 'system for recycling' for PET bottles, one should assess for each packaging component (e.g. bottle, cap, label) if they are (most likely) going to be recycled in practice through that system.

100% of the packaging weight can be considered recyclable if its main packaging components, together representing >95% of the entire packaging weight, are recyclable according to the above definition, and if the remaining minor components are compatible with the recycling process and do not hinder the recyclability of the main components. Otherwise, only the (weight of the) recyclable components of a package (or the recyclable parts of components) can be counted towards achieving the recyclability commitment, and only when other components do not hinder or contaminate their recyclability.

110 Regions can be any geographic area (countries, states, provinces, ...), anywhere in the world (independent of where your organisation is based).
111 A packaging component is a part of packaging that can be separated by hand or by using simple physical means (ISO 18601), e.g. a cap, a lid and (non in-mould) labels.
112 For packaging producers, it suffices to only assess the components they produce and sell. E.g. if your organisation produces bottles, and the caps and labels are selected and applied by your customers, you might not decide about the design of the other components. Your commitment on and assessment of recyclability is in that case limited to the bottle itself (i.e. your packaging portfolio).

APPENDIX 3:

FTC GREEN GUIDES DEFINITION OF "RECYCLABLE" CLAIMS

This is an extract. Full details can be found here: https://www.ftc.gov/sites/default/files/attachments/press-releases/ftc-issues-revised-green-guides/greenguides.pdf

Recyclable Claims

a. It is deceptive to misrepresent, directly or by implication, that a product or package is recyclable. A product or package should not be marketed as recyclable unless it can be collected, separated, or otherwise recovered from the waste stream through an established recycling program for reuse or use in manufacturing or assembling another item.

b. Marketers should clearly and prominently qualify recyclable claims to the extent necessary to avoid deception about the availability of recycling programs and collection sites to consumers.

    1. When recycling facilities are available to a substantial majority of consumers or communities where the item is sold, marketers can make unqualified recyclable claims. The term "substantial majority," as used in this context, means at least 60 percent.

    2. When recycling facilities are available to less than a substantial majority of consumers or communities where the item is sold, marketers should qualify all recyclable claims. Marketers may always qualify recyclable claims by stating the percentage of consumers or communities that have access to facilities that recycle the item. Alternatively, marketers may use qualifications that vary in strength depending on facility availability. The lower the level of access to an appropriate facility is, the more strongly the marketer should emphasize the limited availability of recycling for the product. For example, if recycling facilities are available to slightly less than a substantial majority of consumers or communities where the item is sold, a marketer may qualify a recyclable claim by stating: "This product [package] may not be recyclable in your area," or "Recycling facilities for this product [package] may not exist in your area." If recycling facilities are available only to a few consumers, marketers should use stronger clarifications. For example, a marketer in this situation may qualify its recyclable claim by stating: "This product [package] is recyclable only in the few communities that have appropriate recycling facilities."

c. Marketers can make unqualified recyclable claims for a product or package if the entire product or package, excluding minor incidental components, is recyclable. For items that are partially made of recyclable components, marketers should clearly and prominently qualify the recyclable claim to avoid deception about which portions are recyclable.

d. If any component significantly limits the ability to recycle the item, any recyclable claim would be deceptive. An item that is made from recyclable material, but, because of its shape, size, or some other attribute, is not accepted in recycling programs, should not be marketed as recyclable.

Example 1: A packaged product is labeled with an unqualified claim, "recyclable." It is unclear from the type of product and other context whether the claim refers to the product or its package. The unqualified claim likely conveys that both the product and its packaging, except for minor, incidental components, can be recycled. Unless the manufacturer has substantiation for both messages, it should clearly and prominently qualify the claim to indicate which portions are recyclable.

Example 2: A nationally marketed plastic yogurt container displays the Resin Identification Code (RIC) 6 (which consists of a design of arrows in a triangular shape containing a number in the center and an abbreviation identifying the component plastic resin) on the front label of the container, in close proximity to the product name and logo. This conspicuous use of the RIC constitutes a recyclable claim. Unless recycling facilities for this container are available to a substantial majority of consumers or communities, the manufacturer should qualify the claim to disclose the limited availability of recycling programs. If the manufacturer places the RIC, without more, in an inconspicuous location on the container (e.g., embedded in the bottom of the container), it would not constitute a recyclable claim.

Example 3: A container can be burned in incinerator facilities to produce heat and power. It cannot, however, be recycled into another product or package. Any claim that the container is recyclable would be deceptive.

Example 4: A paperboard package is marketed nationally and labeled either "Recyclable where facilities exist" or "Recyclable—Check to see if recycling facilities exist in your area." Recycling programs for these packages are available to some consumers, but not available to a substantial majority of consumers nationwide. Both claims are deceptive because they do not adequately disclose the limited availability of recycling programs. To avoid deception, the marketer should use a clearer qualification, such as one suggested in (b)(2).

Example 5: Foam polystyrene cups are advertised as "Recyclable in the few communities with facilities for foam polystyrene cups." A half-dozen major metropolitan areas have established collection sites for recycling those cups. The claim is not deceptive because it clearly discloses the limited availability of recycling programs.

Example 6: A package is labeled "Includes some recyclable material." The package is composed of four layers of different materials, bonded together. One of the layers is made from recyclable material, but the others are not. While programs for recycling the 25 percent of the package that consists of recyclable material are available to a substantial majority of consumers, only a few of those programs have the capability to separate the recyclable layer from the non-recyclable layers. The claim is deceptive for two reasons. First, it does not specify the portion of the product that is recyclable. Second, it does not disclose the limited availability of facilities that can process multilayer products or materials. An appropriately qualified claim would be "25 percent of the material in this package is recyclable in the few communities that can process multilayer products."

Example 7: A product container is labeled "recyclable." The marketer advertises and distributes the product only in Missouri. Collection sites for recycling the container are available to a substantial majority of Missouri residents but are not yet available nationally. Because programs are available to a substantial majority of consumers where the product is sold, the unqualified claim is not deceptive.

Example 8: A manufacturer of one-time use cameras, with dealers in a substantial majority of communities, operates a take-back program that collects those cameras through all of its dealers. The manufacturer reconditions the cameras for resale and labels them "Recyclable through our dealership network." This claim is not deceptive, even though the cameras are not recyclable through conventional curbside or drop-off recycling programs.

Example 9: A manufacturer advertises its toner cartridges for computer printers as "Recyclable. Contact your local dealer for details." Although all of the company's dealers recycle cartridges, the dealers are not located in a substantial majority of communities where cartridges are sold. Therefore, the claim is deceptive. The manufacturer should qualify its claim consistent with (b)(2).

Example 10: An aluminum can is labeled "Please Recycle." This statement likely conveys that the can is recyclable. If collection sites for recycling these cans are available to a substantial majority of consumers or communities, the marketer does not need to qualify the claim.

APPENDIX 4:

ASSOCIATION OF PLASTIC RECYCLERS (APR) DEFINITION OF RECYCLABLE

Full details can be found here: https://www.plasticsrecycling.org/images/pdf/design-guide/PET_APR_Design_Guide.pdf

An item is "recyclable per APR definition" when the following three conditions are met:

- At least 60% of consumers or communities have access to a collection system that accepts the item.
- The item is most likely sorted correctly into a market-ready bale of a particular plastic meeting industry standard specifications, through commonly used material recovery systems, including single-stream and dual stream MRFs, PRF's, systems that handle deposit system containers, grocery store rigid plastic and film collection systems.
- The item can be further processed through a typical recycling process cost effectively into a postconsumer plastic feedstock suitable for use in identifiable new products.

APPENDIX 5: ASTRX MATRIX

Navigating The Recycling System

For packaging to be recycled successfully, we must consider how it flows through each of the five elements of the recycling system: manufacturing, reprocessing, sorting, collecting and engaging consumers. To start thinking about the criteria that can help assess the recyclability of a product and its ability to create reliable and valuable manufacturing feedstock, use the table below. Think of this as a starting point for a conversation about the recyclability of a product. Start by considering the ultimate goal: that a recycled product finds an end market.
Please see the original matrix here: https://astrx.org/resources/navigating-the-recycling-system/

END MARKETS (Feedstock for Manufacturing)	REPROCESSING (Paper Mills, Plastic Reclaimers, etc.)	SORTATION (MRF – Materials Recovery Facility)	COLLECTION (Curbside and Drop-Off)	CONSUMER ENGAGEMENT (Feedstock for Manufacturing)
Supply/Demand Is there demand to use the recycled material in products?	**Supply/Demand** Is there demand for the reprocessed material?	**Supply/Demand** Do reprocessors want to buy the material?	**Supply/Demand**	**Supply/Demand**
Design Are brand companies creating a "Demand Pull" by using recycled materials?	**Design** Are there design flaws that prevent reprocessing and recoverability?	**Design** Are there design flaws that impact sortation? Does its form enable it to be properly and consistently sorted (size, flatness, 3D, labeling, etc.)?	**Design** Is there a defined common suite of outreach materials that includes this material?	**Design** Does it have a How2Recycle® label to describe recyclability and any actions consumers need to take to recycle it, such as removing components or returning to a store drop-off location?
Specifications Do the product specifications allow for the use of recycled content in it?	**Specifications** Can material be combined or is it compatible with other currently recycled material?	**Specifications** Do new bale specifications need to be developed? Do bale specs allow for inclusion of the material?	**Specifications**	**Specifications**
Contamination Are there contaminants in the material that hinder the end application?	**Contamination** Does the material cause harm or contamination to other materials?	**Contamination** Can the product damage the recovery of other materials? Are there contaminants (moisture, food, etc.) that impact sortation?	**Contamination** Does this material hurt the recyclability of other materials?	**Contamination** Do consumers know how to prepare their materials for recycling (no food residue)?
Infrastructure	**Infrastructure** Is a new investment required to reprocess the material? Are there markets in different geographic areas?	**Infrastructure** Is a new investment required to sort the material? Are there MRFs available that can sort and market the material?	**Infrastructure** Is an investment required to collect the material? Are there collection carts or bins? Vehicles? Drop-off locations?	**Infrastructure**
Education	**Education**	**Education** Do MRFs know that it is possible to sort the material? Are pick line workers trained to identify the material?	**Education** Do local governments know all the materials that their MRF will accept?	**Education** Do consumers know the material is accepted? Do they know how to recycle it (via curbside, or community or store drop-off)?
Profitability Does it have a positive profitability analysis?	**Profitability** Does it have a positive profitability analysis?	**Profitability** Is there adequate volume to justify recovery, particularly if it must be marketed independently? Does it have a positive profitability analysis?	**Profitability** Is there adequate volume being collected to support recycling?	**Profitability**

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APPENDIX 6:

Adapted from various sources including:

- https://sustainablepackaging.org/101-resin-identification-codes/
- "The Future of Packaging" by Tom Szaky
- https://www.calrecycle.ca.gov/plastics/resins

RESIN IDENTIFICATION CODE OVERVIEW

As shown, there is no universal rule around recyclability by resin type.

Update [October 23, 2019]: Please note the chasing arrow symbols have recently been updated to be equilateral triangles, but many molds and products are still reflecting the old design. More information on the latest standard practice can be found here: https://www.astm.org/Standards/D7611.htm

RESIN IDENTIFICATION CODE (RIC)	NAME	COMMON APPLICATIONS	"RECYCLABILITY"	OTHER CONSIDERATIONS
1 PETE	**Polyethylene terephthalate (PET)**	Soft drink and water bottles	Commonly recycled	Some applications can be problematic in the recycling system, e.g., colored PET. PET is a high-value commodity with many potential applications once recycled.
2 HDPE	**High-density polyethylene (HDPE)**	Bottles for milk, water, juice, cosmetics, shampoo, dish and laundry detergents, and household cleaners	Commonly recycled	Colored HDPE is less valuable than natural HDPE as a recycled commodity.
3 PVC	**Polyvinyl chloride (PVC)**	Rigid packaging applications include: Blister packs and clamshells Flexible packaging uses include: Bags for bedding and medical, shrink wrap, deli and meat wrap, and tamper resistance.	Not commonly recycled	Named as an uncommon and potentially problematic material in the Ellen MacArthur Foundation report. The chlorine and other chemicals in PVC create additional concerns when incinerated.
4 LDPE	**Low-density polyethylene (LDPE)**	Shopping bags, bags for dry cleaning, newspapers, bread, frozen foods, fresh produce, and household garbage Shrink wrap and stretch film Coatings for paper milk cartons and hot and cold beverage cups Container lids.	Not commonly recycled	LDPE bags and wraps are commonly a major source of contamination at Material Recovery Facilities (MRF). Currently, the preferred means to capture this material is to ask consumers to return to retail.
5 PP	**Polypropylene (PP)**	Containers for yogurt, margarine, takeout meals, and deli foods Medicine bottles Bottle caps and closures	Commonly recycled	PP is commonly combined into plastics 3-7 bales, which are accepted in the majority of recycling programs. However, PP is easily recyclable and would be more valuable if it could be collected or sorted alone, at scale.
6 PS	**Polystyrene (PS)**	Food service items, such as cups, plates, bowls, cutlery, hinged takeout containers (clamshells), meat and poultry trays, and rigid food containers (e.g., yogurt) These items may be made with foamed or non-foamed PS.	Not commonly recycled	Named as an uncommon and potentially problematic material in the Ellen MacArthur Foundation report. Some applications are now subject to bans in a number of places; for example, New York City has banned EPS.
7 OTHER	**Other plastics including acrylic, polycarbonate, polylactic fibers, nylon, fiberglass**	Water cooler bottles, flexible films, multi-material packaging	Not commonly recycled	Applications vary significantly.

APPENDIX 7:

DETAILED CALCULATION SUPPORTING THE FINDING 2 PET ANALYSIS

Calculating PET bottles sold and recycled in U.S. annually (2015–2018)

The Recycling Partnership conducted a comprehensive analysis to corroborate industry reports on the amount of PET bottles manufactured, sold, and collected for recycling in the U.S. market annually (see chart below). While we see slight variations in reporting by source and year, such analysis affirms that between 5.6 and 5.9 billion pounds of PET bottles are sold and/or discarded in the U.S. annually. These industry reports also indicate that between 1.73 and 1.79 billion pounds of PET bottles are collected for recycling annually. This presents a gap of 3.8 to 4.2 billion pounds of PET bottles not collected for recycling in the U.S. each year.

Since 2017, The Recycling Partnership has conducted or gathered a series of PET capture rate studies in more than twenty cities to analyze household level, bottom-up data on the collection of PET in residential recycling programs. The results of these studies show that approximately 49 pounds of PET bottles are available in single-family households annually. Assuming that multifamily households generate 75 percent of the volume of waste generated by single-family households, multifamily households are estimated to generate approximately 37 pounds of PET bottle waste per year. Using 2018 U.S. Census data for both single-family and multifamily households to calculate a nationwide estimate and adjusting for dirt, residuals, and non-PET fractions of the collected bottles,[113] the study confirms approximately 5.9 billion pounds of PET bottles are discarded annually in the U.S., with approximately 1.78 billion pounds being recycled, representing a 4.16 billion pound loss of PET annually.

While the industry estimates and Recycling Partnership data are comparable, discrepancies in the data show that, according to boots-on-the-ground recycling data, 35 million fewer pounds of RPET are being collected each year than the industry believes is the case.

After corroborating industry reports on PET bottles sold, The Recycling Partnership selected the National Association for PET Container Resources (NAPCOR) as the foundational source for this analysis. NAPCOR, in partnership with the Association of Plastic Recyclers (APR), has produced an annual report on Postconsumer PET Container Recycling

Comparative Industry Analysis, 2015–2018

	PET bottles sold U.S. (pounds)	PET bottles recycled U.S. (pounds)	Gap: PET sales vs. RPET collected (pounds)
Closed Loop Partners 2015	5,592,000,000	1,797,000,000	3,795,000,000
NAPCOR 2017	5,913,000,000	1,726,000,000	4,187,000,000
The Recycling Partnership 2018	5,931,420,501	1,779,426,150	4,151,994,351
INDUSTRY AVERAGE	**5,812,140,167**	**1,767,475,383**	**4,044,664,784**

113 Table H1. Households by Type and Tenure of Households for Selected Characteristics: 2018. U.S. Census Bureau. https://www.census.gov/data/tables/2018/demo/families/cps-2018.html

Activity for thirteen years utilizing top-down industry reported sales numbers. In addition to its long-standing reputation in the industry, the NAPCOR data represents the higher end of reported sales estimates and therefore a higher, more conservative estimate for achieving recycled PET supply. In contrast, The Recycling Partnership data utilizes capture rate studies of PET collected on the ground, representing bottom-up reporting and a lower potential for recycled PET supply. We opted to present the best case scenario utilizing the higher NAPCOR numbers.

Calculating the gap in RPET supply & demand by 2025 (considering the New Plastics Economy Global Commitment)

To account for the impact of Ellen MacArthur Foundation's New Plastic Economy Global Commitment made by major consumer packaged goods (CPG) brands on projected demand for RPET, we considered a number of scenarios. While the brands committed to these goals represent only 20 percent of packaging supply globally, they are some of the largest consumer brands in the U.S., and are estimated by The Recycling Partnership to represent between 60-80 percent of U.S. CPG users of PET.

Considering this, we factored three scenarios into our model (see chart below), with a 25 percent recycled content goal representing 100 percent, 80 percent and 60 percent of the CPG market demand in the U.S. These scenarios are based on the assumption that 25 percent is an average across brands that have made no commitments to recycled content and others, such as Poland Spring (Nestlé Waters) and Evian (Unilever), which have committed to (or already achieved) 100 percent recycled content. The Recycling Partnership believes the groundswell of anti-plastic consumer sentiment and the necessary preservation of brand reputation will lead to the 25 percent recycled content being a reasonable average across 100 percent of CPG in the U.S. by 2025.

When applied to domestic U.S. PET bottle manufacturing quantities by weight, 1.4 billion pounds of RPET would be required to meet the 25 percent goal across 100 percent of CPG brands at current production levels.

NAPCOR reports 357 million pounds of PET recyclate is present in the total 5.9 billion pounds of PET bottles sold annually. Thus, there stands a gap between current supply and 2025 demand of RPET for use in bottles of more than 1 billion pounds (1,121,250,000, to be exact).

It's important to note the difference between NAPCOR's reported 1.7 billion pounds of recycled PET bottles annually and the 357 million pounds (6%) that actually make it back into next generation PET bottle production. This demonstrates a loss of more than 1.3 billion pounds of PET bottles collected for recycling that either are cascaded into different end markets (effectively downcycled) or lost in sorting, cleaning and reprocessing.

RPET Gap Analysis 2019 (pounds)			
NAPCOR 2017—PET bottles sold U.S.	5,913,000,000		
Global Commitment as a Percentage of Market Demand	**100%**	**80%**	**60%**
Percentage Recycled Content in Total U.S. PET Demand	25%	20%	15%
2025 U.S. RPET Needed to Meet Goal	1,478,250,000	1,182,600,000	886,950,000
2017 U.S. RPET Supply—NAPCOR 2017	357,000,000	357,000,000	357,000,000
Gap in RPET Recovery Supply and RPET Demand 2025*	1,121,250,000	825,600,000	529,950,000
Percentage Point Increase (pounds of PET vs. Bottle Generation)	19.0%	14.0%	9.0%
Pounds Needed, Adjusted by Yield Rate of Bottles to PET	1,673,507,463	1,232,238,806	790,970,149
Percentage Point Increase (pounds of PET vs. Bottle Generation)	28.3%	20.8%	13.4%
2017 U.S. RPET Supply as Percentage of 2025 Demand	24%	30%	40%

*RPET Recovery Supply reflects post-consumer PET collected for recycling and does not include pounds lost in processing or sale to other end markets other than bottles.

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