A Flexible Packaging Path to a Circular Economy

Flexible Packaging Sustainability Roadmap

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Prepared for The Flexible Packaging Association
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About the Flexible Packaging Association

The Flexible Packaging Association is the voice of the U.S. manufacturers of flexible packaging and their suppliers. The association's mission is connecting, advancing, and leading the flexible packaging industry. Flexible packaging represents over $33 billion in annual sales in the U.S. and is the second largest and one of the fastest growing segments of the packaging industry. Flexible packaging is produced from paper, plastic, film, aluminum foil, or any combination of those materials, and includes bags, pouches, labels, liners, wraps, rollstock, and other flexible products.

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PTIS, LLC is a leading business and technology management company focused on Creating Value Through Packaging© and helping clients throughout the packaging value chain develop long term packaging strategies and programs. PTIS, recognized for foresight, thought leadership, and the success of their 20 year *Future of Packaging* program, helps companies achieve and incorporate these elements into their innovation programs, e-commerce, holistic productivity, sustainability, holistic design, and consumer/retail insights related to packaging. To learn more about PTIS, visit their website www.ptisglobal.com

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Chapter 1

Executive Summary

About this report

Packaging sustainability is at a tipping point with a renewed focus on collecting and recycling packaging materials to foster and build circular economy (CE) principles across the packaging value chain. With this focus, the Flexible Packaging Association (FPA) requested a report and roadmap to better understand sustainability/environmental implications with an end goal to develop sustainability/circular economy roadmaps to guide the FPA and its members over the next decade. This report, *The Path of Flexible Packaging to a Circular Economy,* provides information, knowledge, and insights related to flexible packaging and sustainability, circular economy, legislative trends, impacts to the industry along with key outcomes, and actions to enable the industry to align with CE principles where materials are collected, sorted, processed, and turned back into new products or packaging.

> "A circular economy is an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life." - Waste and Resources Action Programme - WRAP (UK)

The report provides a holistic system view of flexible packaging and sustainability while utilizing the latest insights and foresight to develop the roadmaps designed for FPA members, stakeholders, and the industry as a whole to advance sustainability and circular economy packaging efforts. This report has a North American focus, but it should be noted that low flexible packaging recycling rates are a global issue. There are additional efforts underway around the globe to address concerns, particularly in Europe through organizations such as Circular Economy for Flexible Packaging (CEFLEX) and the U.K. Plastics Pact.

Background

Sustainability is a focal point for most brand owners and increasingly more consumers, legislators, and NGOs. While the COVID-19 pandemic has put a focus on the sanitation and hygiene of products, it is expected that this will not diminish the desire for greater packaging recovery and may increase the desire for more sustainable solutions as the amount of packaging and plastic personal protective equipment (PPE) makes the use of plastics even more visible.

Plastic packaging production and use are expected to triple between 2015 and 2050, with flexible plastic packaging generally outpacing overall industry growth. This growth

is attributed to the numerous consumer and producer benefits that flexible packaging offers, including convenience, shelf impact, ability to withstand e-commerce distribution, and shelf life extension of many products. Additionally, flexible plastic packaging (FPP) is generally well aligned with a sustainable materials management (SMM) framework, which focuses on the efficient use of resources. Streamlined lifecycle assessments (LCAs) often find that flexible packaging has lower fossil fuel use, greenhouse gas emissions, water use, and amount of material discarded. However, awareness of plastics in global waterways and the environment has led more consumers and legislators to look for packaging to align with circular economy principles.

The flexible packaging industry is responding to this through the development of higher barrier mono-material based pouches which can be recycled, though infrastructure remains limited today.

Sustainability Drivers

There are several drivers that must be considered in the development of crucial sustainability actions. These include:

- NGOs and Associations
    - Perhaps the greatest influence today comes from the New Plastics Economy initiative championed by the Ellen MacArthur Foundation which calls for all packaging to be recyclable, compostable, or reusable and has over 450 brand owner, retailer, government, and packaging provider signatories
- Corporate
    - Brand perception, sustainability goals, investor expectations on Environmental Social Corporate Governance (ESG) which consider the sustainability and societal impact of an investment in a company or business
- Government/Legislative
    - Includes Extended Producer Responsibility (EPR), materials bans, single-use plastic bans, circular economy goals, and climate change impacts/ carbon taxes
- Societal
    - Public concern over marine debris, plastic in the environment, food waste, and an overall lack of plastic recycling

The Future of Flexible Packaging in 2030

Support for the roadmaps is centered on envisioning the future state of flexible packaging in 2030. This is based on understanding the current state of flexible packaging and where the industry would like to be in a decade. The future state is informed through secondary research (including numerous global reports and initiatives focused on flexible packaging), primary research with subject matter expert interviews, a survey

of FPA members, and interviews with over 50 members of the packaging value chain, including associations, brand owners, retailers, raw materials suppliers, and consultants.

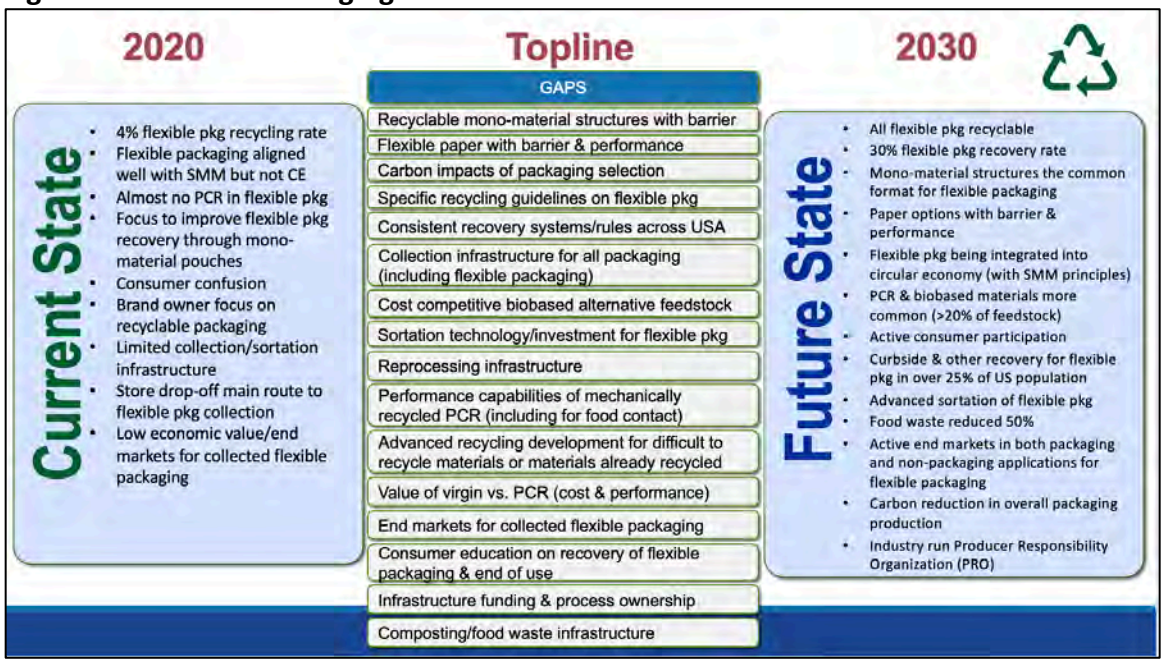
That information and knowledge formed the basis for the future state (see Figure 1-1 below), which then highlighted the major gaps that will need to be addressed for flexible packaging to reach the future state.

Major gaps (and challenges) include:

- Development of high barrier mono-material (or polyolefin-based) structures
- Lack of consistent recovery systems/rules across the country
- Lack of collection infrastructure for flexible packaging
- Limited value of flexible packaging that is collected today due to a lack of end market applications and demand
- Value of PCR vs. virgin material today in price and performance
- Need for infrastructure funding to support collection, sortation, reprocessing, and end markets
- Lack of "ownership" by any one entity for the recovery infrastructure, resulting in a lack of overall action
- Consumer education on the value of flexible packaging along with recycling options

The future state can be viewed as the "North Star" to help guide the industry toward the 2030 vision.

Figure 1-1. Flexible Packaging Current State to Future State Model



Solutions and the Roadmaps

The roadmaps help provide direction for FPA members and others in the packaging value chain. They are meant to help close the gaps and move the industry toward the future state with flexible packaging aligned to a circular economy framework. The roadmaps were also developed and built off other global roadmaps and plastic pacts, and while designed particularly for the U.S. market, are largely applicable globally.

Five specific roadmaps have identified key outcomes and key activities over the timeframes of 2025, 2030, and 2040 (further future focused) which are highlighted in depth in the report. The five roadmaps and examples of top considerations for 2030 include:

- Design
    - Design is the primary roadmap area where flexible packaging converters have direct control. The focus for 2030 is on recyclability, compostability (for certain foodservice applications), and developing structures and technology to aid in the sortation, such as the incorporation of digital watermarks. The initial focus is on polyethylene (PE) based structures, but longer term will include polypropylene (PP) and even paper-based substrates
- Collection
    - Identification of new programs such as curbside pickup, bulk flexible packaging collection (ex. master bag which holds other flexible packaging), and drop-off stations/depots in urban and rural areas to enhance convenience and expand the collection of flexible packaging
- Sortation
    - Infrastructure investment will be critical, including optical sorters, artificial intelligence, robotics as well as digital/chemical markers on flexible packaging to aid in efficiency and reducing contamination in bales
- Reprocessing
    - Development of additional cleaning infrastructure, along with mechanical recycling capabilities. Efficiencies in reprocessing will be aided through better sortation. By 2030, there will be commercialized examples of mid-sized scaling of advanced recycling which will allow flexible packaging back into new flexible packaging through virgin quality monomers
- End Markets
    - PCR requirements will be driven by brand owner goals (and likely some level of legislation) which will enhance end markets for flexible packaging by 2030. In the meantime, the industry will need to identify new end market applications (ex. construction products, non-food, industrial, etc.). Post-consumer recycled (PCR) focus will initially be driven by rigid applications before starting to reach higher levels for flexible plastic packaging (FPP) by 2030.

One critical area that did not have a specific roadmap but will have outsized influence is legislation and regulation. As of summer, 2020, there are currently eight states considering Extended Producer Responsibility (EPR) legislation for packaging, as well as one national bill. It is becoming increasingly likely that some form of a national funding mechanism, through EPR or other means, will be in place by 2030. EPR as a funding mechanism will likely start at the state level and could work toward a national framework over the decade. The challenges of collection, sortation, reprocessing, and end market value for all packaging — but flexible packaging in particular — show that significant infrastructure funding will be needed to eventually drive holistic system changes to capture a large portion of flexible packaging, enabling it to align with circular economy principles.

To help take ownership of the collection, sortation, and reprocessing system along with identification of leading investment opportunities, the development of an industry led Producer Responsibility Organization (PRO) will be critical to ensure that the revenue is put back into the packaging system to create a true circular packaging

How to Use This Report to Develop Your Flexible Packaging Roadmap

This report is meant to help guide FPA members, flexible packaging converters, and others in the packaging value chain align around necessary/important steps to help flexible packaging better align with circular economy (CE) principles. The report is divided in two main parts:

1.) The main body that shows the development and path of the roadmaps
2.) An appendix with additional insight, data, sustainability/circular economy focused organizations, and more detailed roadmaps

To take full advantage of this effort, FPA members are encouraged to:

- Review Chapters 2-4 to understand the background and sustainability drivers that are shaping the future
- Review Chapters 5-7 (Envisioning the Future, Risk Assessment, and Flexible Packaging Roadmaps) to gain a perspective of what 2030 will look like for flexible packaging, understand some of the risks that could accelerate, decelerate, or further challenge flexible packaging, and then understand implications from the roadmaps for their organization
- Companies may then develop their own 10-year strategy and roadmap for how they can play a role in delivering flexible packaging that aligns with the circular economy
- Chapter 14 provides additional strategic and tactical steps that organizations throughout the packaging value chain will need to take
- The design roadmap is one of the most important roadmap elements, as that portion is where FPA members can play the biggest role. However, it is important members review the other roadmaps to consider steps that will need to be taken in collection, sortation, reprocessing, and end market identification and development phases so they can take further actions to aid these areas
- Finally, be sure to consider collaborations, technologies, and other risks in developing an organizational roadmap and strategy

Remember, not every step in the roadmaps will be pertinent to your organization, and your group may not even agree with some of the steps but having a flexible packaging roadmap and strategy will help you plan for a future where more is expected of flexible packaging.

economy. While brand owners will likely form a PRO in response to EPR legislation to manage the process and fees of such a program, FPA members must be involved to ensure that new technology investments include consideration for flexible packaging recovery and not just a fee on the materials.

Without both the infrastructure investment and the PRO, it is unlikely that the flexible packaging industry will be able to meet the future state vision.

Summary

There are substantial challenges in driving flexible packaging toward a circular economy which will require significant investment and a shift toward system understanding and collaboration. The initial investment in collection, sortation, and reprocessing will likely be geared toward rigid packaging because of its greater ease of collection as well as stronger end markets. However, much of the infrastructure and technology investment needed to make rigid collection more efficient will also apply to flexible packaging. It is critical that the industry collaborate with others and ensure that the sustainability benefits already achieved through flexible packaging are further enhanced as it strives to embed itself into a circular economy framework. To meet future state goals, it is critical that flexible packaging converters, as well as other value chains, initiate actions now to meet mid and long-term objectives and circular economy goals.

List of Acronyms

CE	Circular Economy
EPR	Extended Producer Responsibility
FPP	Flexible Plastic Packaging
LCA	Lifecycle Assessment
NGO	Non-Government Organization
PCR	Post-Consumer Recycled
PE	Polyethylene
PP	Polypropylene
PPE	Personal Protective Equipment
PRO	Producer Responsibility Organization
SMM	Sustainable Materials Management

Chapter 2

Current State of Flexible Packaging

Background and Overview

Flexible packaging has and continues to grow in both the U.S. and globally due to the many benefits it affords from the ease of use, convenience, and shelf impact to low cost and positive lifecycle analysis attributes, which are identified below. Currently, flexible packaging is the fastest growing segment in the industry and is expected to grow from 1.34 trillion units to 1.8 trillion units in volume in 2023[1]. As flexible packaging growth continues, the industry will need to relook and take a more holistic approach to support the growth of this important packaging material option while considering end-of-use issues and the important focus that has been placed on eliminating packaging as waste.

Globally and locally, flexible packaging is looking to transform the packaging value chain to a more circular and waste-free value chain but there is much to be done. Flexible packaging development and growth came after the traditional municipal recovery facility (MRFs) installations were optimized for paper, metal, glass, and rigid plastics. Flexible packaging was not considered in the original designs of MRF layouts and construction collection and sortation systems. There are currently very few collection systems for flexible packaging except back-of-store post-industrial and front-of-store collection bins for grocery bags and all PE-based flexible packaging.

Currently destined to landfills due to lack of municipal recovery systems, the material value of flexible plastic packaging (FPP) is lost. As litter on roadways and in waterways, FPP is harmful to the environment, wildlife, and generates a public backlash. FPP can be a valuable asset in the evolving circular economy while equipping (empowering) brand owners with a solution to achieve their packaging goals (recyclable, reusable, or compostable) in addition to supporting global initiatives (reducing food waste, GHG emissions, and collection of packaging).

Current State for U.S. Flexible Packaging (Retail)

As can be seen in the following table (Figure 2-1), flexible packaging in the U.S. is an important and growing packaging substrate. It is used across all packaging sectors, but particularly in the food sector.

[1] https://www.euromonitor.com/global-flexible-packaging--state-of-play-and-sustainability/report

Figure 2-1. U.S. Total & Flexible Packaging (Retail Volume)

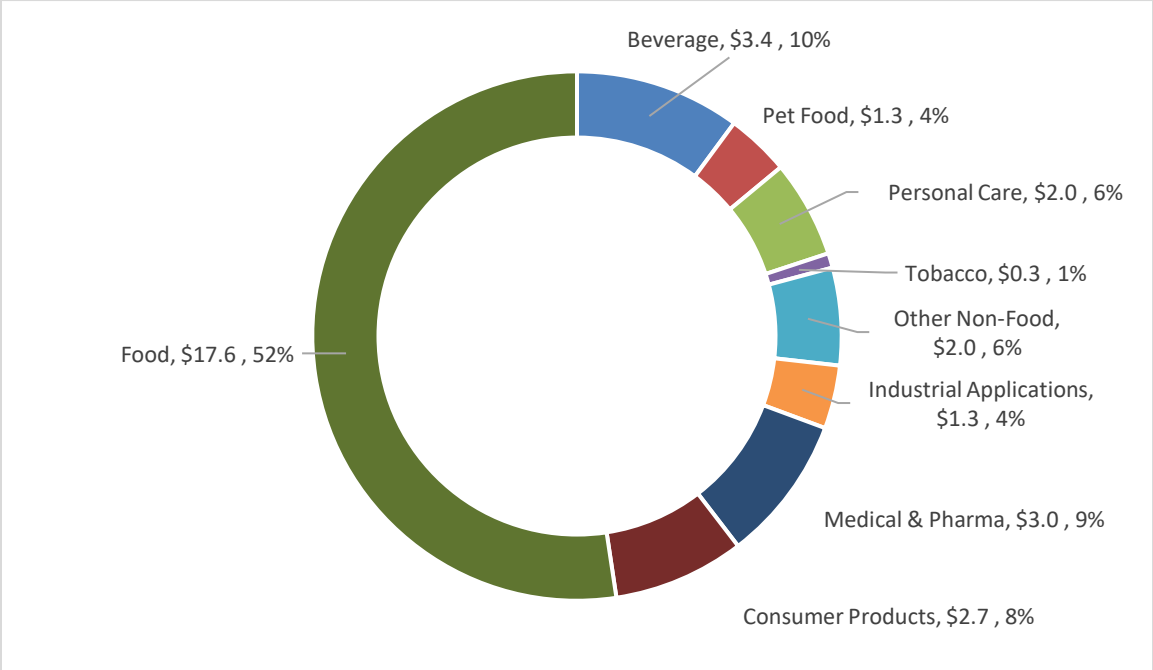
Package Type	2018 Package Volume (in Billions)	2018 % Total	2013-2018 CAGR	2018-2023 CAGR
Flexible packaging	124	27%	0.4%	1%
Total packaging	466	100%	1%	-1.3%

Source: FPA 2019 State of the Industry Report

U.S. Packaging End-Use Markets

Flexible packaging accounted for 41% of all packaging globally in 2019, according to Euromonitor. Food applications account for approximately half of all flexible packaging usage with the remainder identified in Figure 2-2 below.

Figure 2-2. U.S. Packaging End-Use Markets (sales in Billion USD)



Source: FPA 2020 State of the Industry Survey, preliminary data

Current Situation

It is important to consider flexible packaging's value, benefits, and concerns from a complete value chain perspective and take a systems approach to identify the best long-term solution(s) and move flexible packaging to a more desirable environmental state with significantly higher recycling rates.

The industry is already working toward becoming more circular. One example is an effort to move away from multilayer flexible packaging (MLP) and flexible plastic packaging (FPP) to mono-material barrier solutions that can be more easily recycled

through store drop-off collection bins. This has been a challenge for converters and raw material suppliers to provide the barrier, operational performance, and visual appeal. However, strong collaborations with these partners and brand owners have helped to bring these new technologies to fruition.

With the increased focus on sustainability and eliminating packaging as waste, the flexible packaging industry is facing a tipping point to be able to identify solutions to meet the Ellen MacArthur Foundation (EMF) and its New Plastics Economy (NPE) goals of all packaging being recyclable, reusable, or compostable by 2025/2030. Over 450 brand owners and other value chain contributors have subscribed to these ambitious goals. Another key tenet of the New Plastics Economy is the inclusion of PCR (22% by 2025)[2] in packaging to foster a circular economy. Many experts believe this goal is not realistic given the current availability of PCR content.

Rigid packaging recovery will be an important component to help fill short-term recycling and drive PCR utilization goals for brand owners. Flexible packaging will help support medium and longer-term goals as there is simply not nearly enough collection, sortation, and reprocessing infrastructure in place at this time for the material.

Flexible packaging is currently well-established for sustainable materials management (SMM) principles in that it uses resources very efficiently. PCR utilization provides significantly lower environmental impacts for GHG and water usage (40-90% lower) according to Franklin Associates. Figures 2-3 and 2-4 show the importance and value of flexible packaging from standpoint of greenhouse gas (GHG) emissions and water use.

Unfortunately, flexible packaging is not as well positioned for current CE initiatives. Brand owners, legislators, and consumers understand and are focused on recycling as the key means to move toward a CE for packaging. There are currently approximately 10,000 different recycling schemes in the U.S. and little established infrastructure to collect flexible packaging, other than store drop-off programs.

Examples of the sustainability benefits of flexible packaging are shown in Figures 2-3 and 2-4.[3]

[2] https://www.newplasticseconomy.org/assets/doc/Global-Commitment-2019-Progress-Report.pdf
[3] https://www.flexpack.org/sustainable-packaging#sts=A%20Holistic%20View%20of%20Flexible%20Packaging's%20Sustainability

Figure 2-3. Streamlined Life Cycle Assessment – Baby Food Comparison

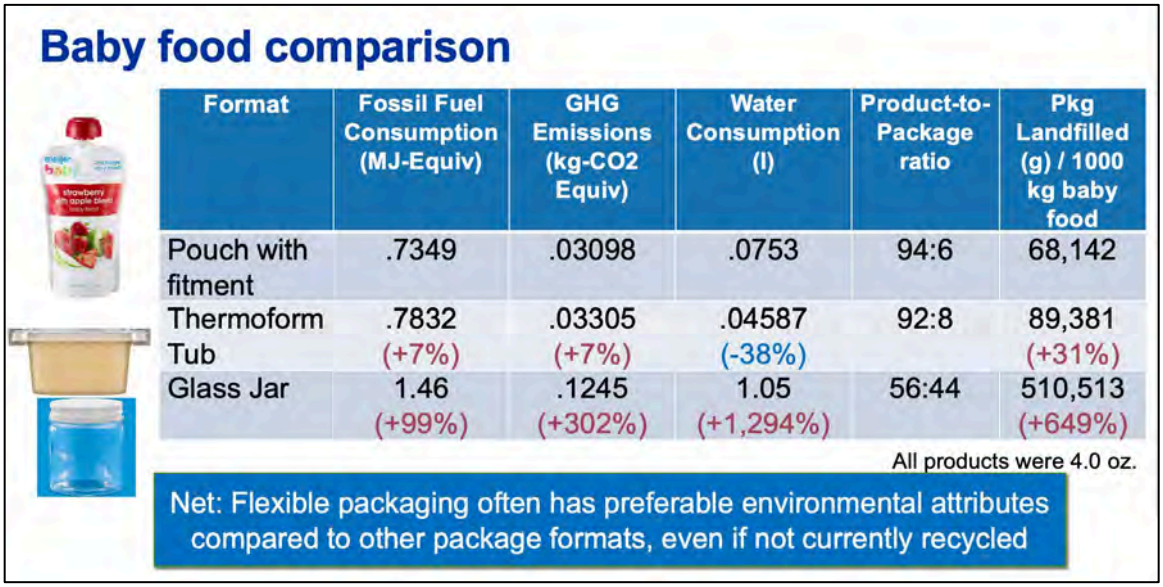
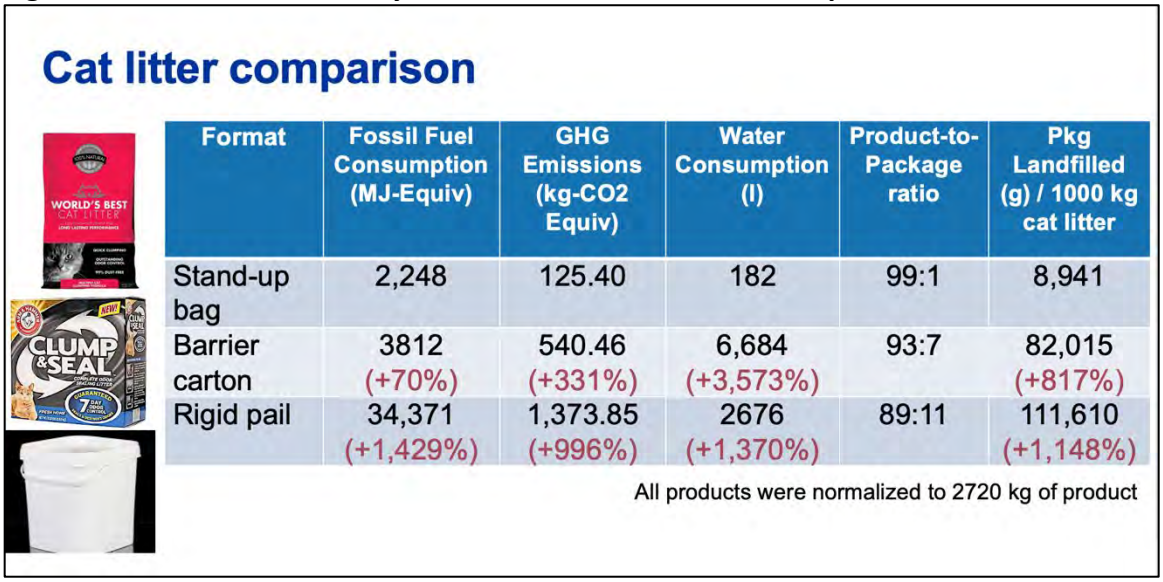


Figure 2-4. Streamlined Life Cycle Assessment – Cat Litter Comparison



Consumers are demanding improved sustainability actions, with millennials and Generation Z segments leading the charge. These consumers see recycling as the option of choice (FPA, 2019).

Post-Consumer Recycled (PCR) materials are targeted to be at 30% by 2030, with PCR content at a 6% level overall for rigid packaging within the current recycling structure. Consumers are also confused about what can and cannot be recycled and, as a result, many non-recyclable packages are put into recycle bins resulting in additional contamination and increased costs at the MRFs. One way to better communicate with consumers is to encourage companies to use the Sustainable Packaging Coalition (SPC) How2Recycle label on packages. The How2Recycle label explains if the package or components can be recycled or not. This can reduce confusion and improve MRF efficiencies.

The focus of most efforts to increase recycling rates is on rigid plastics and other materials. Composting and reuse applications are niche applications today and are part of the overall EMF charter to eliminate packaging as waste. Both compostable and bio-based resins will continue to grow in the future and offer positive contributions to CE efforts. By 2030, reusable and refillable packaging will play a much larger role. In the short term, flexible packaging will play a role as a refill vehicle for rigid applications (see photo to left). Over time, new applications of refilling and reusing flexible packaging through vending or standard fitment/ equipment refill systems will take hold such as the Algramo refill station (photo 2-2).

Photo 2-1. Method refill pouch

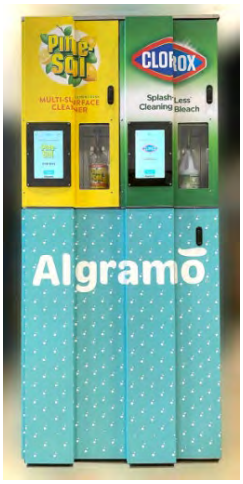
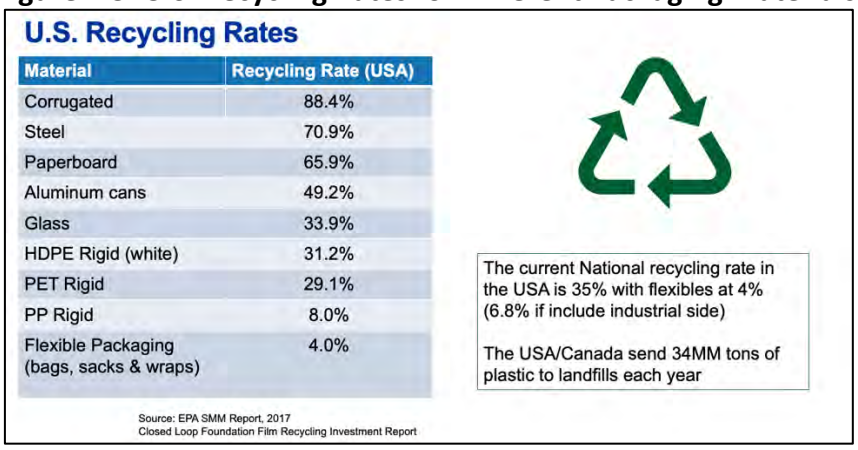


Photo 2-2. Algramo refill in New York City

A very important flexible plastics packaging recycling collection and sorting pilot project was completed in the fall of 2020 in Birdsboro, PA. Sponsored by industry Resource Recycling Systems (RRS) led a Materials Recovery for the Future (MRFF) pilot project to demonstrate the viability of collecting and sorting FPP. The results demonstrated that FPP can be effectively captured and sorted in a modified MRF with added blowers and optical sorting systems. This is exciting news and opens new collection and sorting opportunities for FPP given new investment in MRFs and improved collection infrastructure. This is another example of industrial collaborations investing dollars and resources to tackle and solve difficult problems.

Figure 2-5 shows the current recycling rates in the U.S. The materials currently collected and sorted at MRFs have much higher rates than flexible packaging. Additionally, recycling rates for some rigid plastics such as PET and HDPE bottles are around 30% but still offer significant upside to help provide PCR content to meet the 22% PCR content goal established by the Ellen MacArthur Foundation by 2025.

Figure 2-5. U.S. Recycling Rates for Different Packaging Materials



There tends to be a fair amount of confusion around the various recycling related terms like recycle, recycling, and recyclable. Just because something is recyclable does not mean it is recycled. For example, some new flexible mono-material PE pouches may be recyclable but if consumers do not have access to collection systems, they are not likely to be recycled. For purposes of this report, we will use recycling to refer to converting reprocessed flexible packaging into a new material, which may be new flexible packaging, rigid packaging, or as feedstock for another product.

Legislative Activity

Legislation as a key sustainability driver is likely to impact packaging dramatically over the next decade. There has been enhanced consumer awareness about plastic pollution and the low recycling rates of plastic packaging, which has also caught the attention of state and federal legislators. There are several federal acts moving through congress as of the summer of 2020 (see Figure 2-6). Some of the bills are focused on infrastructure funding for the collection and sortation of packaging, while others, like the Break Free from Plastic Pollution Act, would bring EPR to a national level in the U.S.

Figure 2-6. Summary of national legislation under consideration in U.S. Congress (summer 2020)

Additionally, there are many state-level initiatives under consideration as well. A sample of these include:

- 8 states (16 bills) exploring EPR,
- 19 states (47 bills) considering recycling-based legislation,
- 41 states (390 bills) looking at plastic specific initiatives.

California will have on its November 2022 ballot to place a $.01 fee[4] on plastic packaging to fund recycling and clean up waste.

For more discussion on legislation impacts for flexible packaging, see Chapter 12 in the appendix.

COVID-19 Impacts and Insights

As a result of the 2020 global pandemic, the world has changed dramatically and in many cases with vast implications for packaging. Reuse and refillable solutions largely stalled, although TerraCycle's LOOP program has expanded. Sustainability focus has remained, and the value chain recognized the strategic importance of continuing the CE journey. Below is a simple list of COVID-19 packaging related actions and insights:

- Packaging was considered an essential service, and COVID impacts will need to be understood and addressed going forward

[4] https://www.plasticsnews.com/news/california-plastics-vote-headed-2022-ballot?utm_source=pn-daily-report&utm_medium=email&utm_campaign=20200811&utm_content=article2-headline

- Currently, in the U.S., the FDA has said the COVID virus is not transmitted via packaging although some reports have indicated virus viability on packaging materials from one to three days
- There has been a significant increase in residential trash as a result of more stay at home dining – up 25%
- COVID has exposed vulnerability in the supply chain globally resulting in a variety of disruptions – including some stores stopping collection of store drop-off for grocery bags and flexible packaging
- An Ipsos COVID-19 survey of 1,016 American adults noted that 92% of respondents said recycling was now more or equally as important than before the pandemic for handling the increase in plastics and packaging
- Single-use plastics (SUP) legislative activities may be reconsidered as a result of COVID and may provide additional hygiene and safety elements for consumers
- There is a need to educate the public on the value of packaging and COVID implications
    - It appears that consumers have a heightened awareness of hygiene and safety and it is important to communicate the role packaging plays in this area
    - There is also a heightened awareness of concern around bulk/reusable packaging that needs more understanding and definition
    - This may be a good time to re-evaluate the importance and role for single-use packaging/plastics

Current State of Flexible Packaging Summary

Flexible packaging provides numerous positive consumer and operational benefits and is frequently utilized packaging material with growth expected to continue. Plastic packaging use is expected to triple by 2050 (2015 as a base year). As a result, there is a significant need and opportunity to increase the sustainability/CE focus on all materials, including flexible packaging, to create a world without packaging waste.

Much is needed to get to a new and better future state for flexible packaging. Some of the key needs and opportunities are noted below.

Key Insights and Opportunities

- There is a need and opportunity to create a collaborative role for Policy/Government to play in improving the recycling system in the U.S.
- New government policies to drive investment in improved recovery infrastructure through programs, including EPR, are gaining industry traction.
- It will be important to monitor and play a role in other collaborative efforts to meet the challenging and important circular economy goals for packaging. Leading collaborative efforts include CEFLEX, U.K. and the U.S. Plastics Pact, EMF/NPE, Consumer Brands Association/Recycling Leadership Council among others.

- As a result of COVID-19, packaging was deemed an essential service and there is a need to reconsider the value packaging affords to health and safety and to also better understand the need of single-use plastics[5].
- Sustainability with a CE focus is real and a top priority for the majority of the packaging value chain driving toward recyclability.
- Flexible packaging provides many benefits from cost/value to performance and reduced carbon footprints but has collection and sortation infrastructure needs.
- Suppliers and converters are commercializing new recyclable mono-material barrier materials to help support CE initiatives going forward.
- The new MRFF (Materials Recovery of the Future)[6] pilot in Pennsylvania met four of five goals showing that flexible packaging can be collected, sorted, and made into rFlex bales for a variety of end markets. There is a significant opportunity to continue investments in automating MRFs to provide sortation of FPP.
- Creating and implementing FPP roadmaps are critical to start now but improved rigid collection will be key to meeting brand owner PCR goals for 2025. Rigid packaging will be the driver for collection, sortation, and reprocessing investment as the weight and formats of rigid packaging are already implemented in most MRFs with end markets that are established.
- Continued focus on innovation and technology development such as advanced recycling, is an essential part of roadmap development and implementation for flexible formats.
- There has not been a clear plan for the future for flexible packaging to be able to deliver against the many requirements identified by EMF/NPE and brand owners. This report was developed to help provide direction to the many stakeholders and players that utilize flexible substrates.

[5] https://progressivegrocer.com/covid-19-highlights-need-effective-recycling
[6] https://www.materialsrecoveryforthefuture.com/wp-content/uploads/MRFF-Pilot-Report-2020-Final.pdf

List of Acronyms

APR	Association of Packaging Recyclers
CAGR	Compound Annual Growth Rate
CBA	Consumer Brands Association
CE	Circular Economy
EMF	Ellen MacArthur Foundation
EPR	Extended Producer Responsibility
EU	European Union
FPP	Flexible Plastic Packaging
GHG	Greenhouse gasses
MLP	Multi-layer packaging
MRF	Material Recovery Facility
MRFF	Materials Recovery for the Future
NPE	New Plastics Economy
PCR	Post-Consumer Recycled
PRO	Producer Responsibility Organization
RRS	Recycling Resource Systems
SPC	Sustainable Packaging Coalition

Chapter 3

Sustainability Drivers

Background

The definition of sustainability has been evolving over the last 30-plus years. In 1987, *The Brundtland Report* defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In 1994, the phrase "Triple Bottom Line" was coined, aimed at measuring a company's financial, social, and environmental performance over time.

In 2000, the UN Global Compact extended sustainability to all stakeholders in the value chain, targeting zero waste to landfill and incineration and 100% resource recovery with all products and materials recovered and recycled or reused at the end of use. The book "Cradle to Cradle," published in 2002 by McDonough and Braungart, introduced circular thinking to the value chain. In 2009, the EPA defined Sustainable Materials Management (SMM) as an approach to serving human needs by using/reusing resources productively and sustainably throughout their life cycles, generally minimizing the amount of materials involved and all associated environmental impacts.

The Ellen MacArthur Foundation, launched in 2010, introduced a circular economy framework, based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. More recent European initiatives within the flexible packaging industry include Circular Economy for Flexible Packaging (CEFLEX) – Designing for a Circular Economy Guidelines and the U.K. Plastics Pact, which contains a roadmap specific to flexible plastic packaging.

Introduction

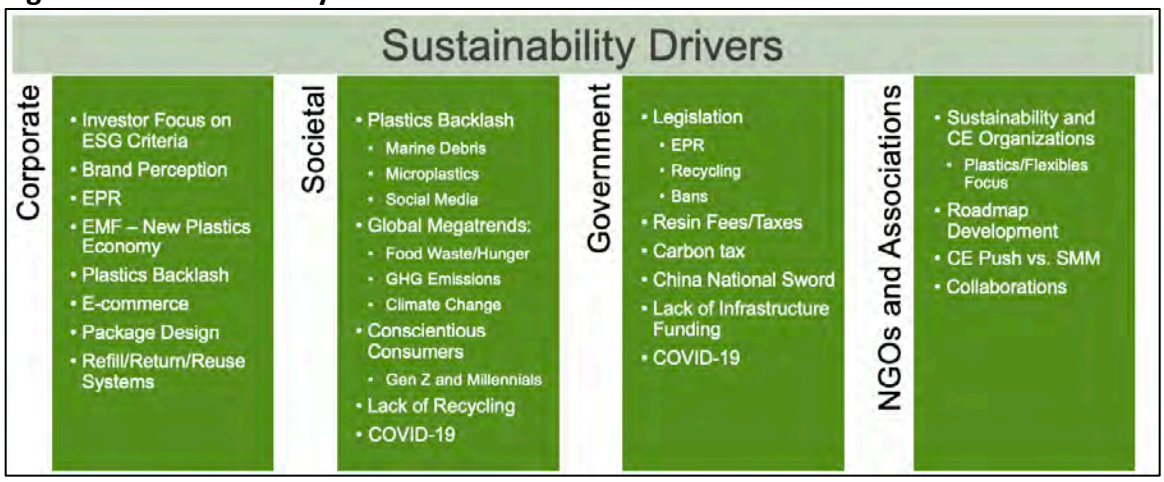
Flexible packaging offers sustainability benefits throughout the life cycle of the package, including material and resource efficiency, lightweight/source reduction, shelf life extension, reduced materials to landfills, and a high product-to-packaging ratio, among others. According to the World Economic Forum, global plastics production will triple by 2050 (from a baseline in 2015)[7], with flexible packaging keeping pace with that rate. There will continue to be tremendous pressure on plastics, and in particular, the flexible packaging industry, to develop and follow through on sustainability-focused initiatives.

This chapter will highlight the sustainability drivers and trends forcing significant changes in the flexible packaging value chain, broadly categorized as originating in the Corporate, Societal, Government, and NGO/Association sectors. The drivers listed in Figure 3-1 are not all-inclusive, and many interconnect, such as social media,

[7] http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

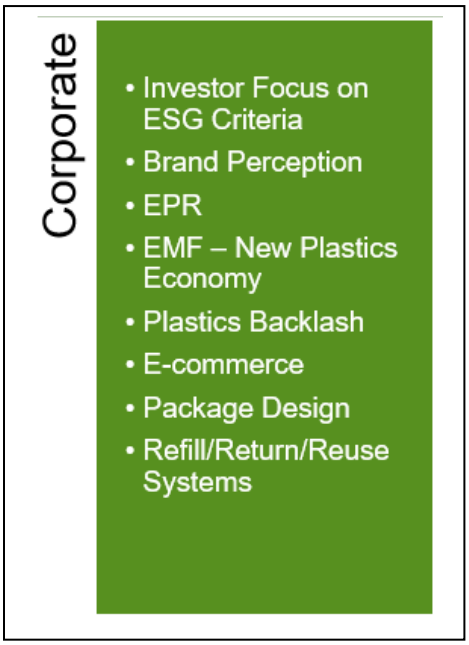
conscientious consumers, and plastic backlash. Several drivers, such as the Ellen MacArthur Foundation – New Plastics Economy (EMF-NPE) Global Commitment, COVID-19 pandemic, and e-commerce cut across multiple segments.

Figure 3-1. Sustainability Drivers



This chapter also includes insights from interviews and surveys with many FPA members and other players throughout the packaging value chain.

Corporate



Integrating sustainability into corporate strategy is essential as brand owners come under increasing pressure from consumer groups, activists, and elected officials to shift their models to incorporate more sustainable practices in all facets of their operations. Sustainability is now an integral part of the overall brand and image story for consumer brands, with packaging an extension of the brand's personality. Improving the environmental friendliness of product packaging is a way that brand owners are meeting sustainability goals.

Investor Focus on ESG Criteria

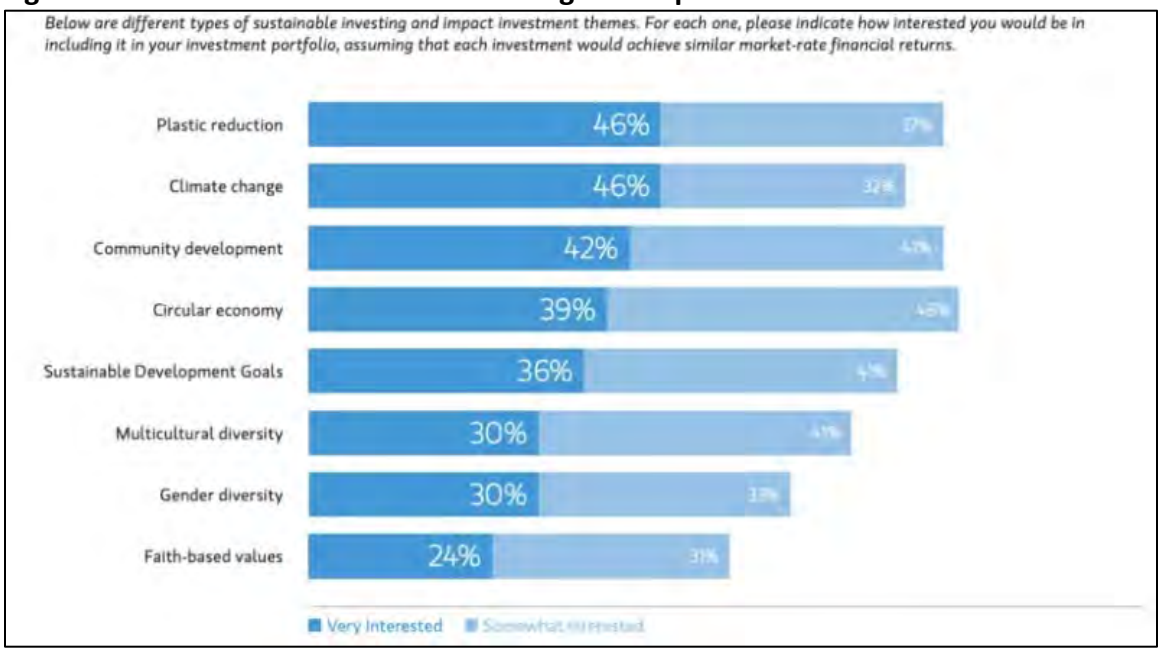
Environmental, social, and governance (ESG) criteria are a set of standards for a company's operations that socially conscious investors use to screen potential investments.

Morgan Stanley's Institute for Sustainable Investing has been polling investors since 2015 on their thoughts and attitudes around ESG. The results from the 2019 survey revealed that among individual investors, 85% are interested in sustainable investing, up

10 percentage points from 2017, while 95% of millennials are interested in sustainable investing, up 9 percentage points from 2017.[8]

The 2019 study also asked investors which areas of ESG they were most passionate about. Combining "somewhat interested" and "very interested" responses, a circular economy was the most popular investment theme. However, climate change and plastic reduction topped the list in the "very interested" counts. Of note, in 2018, the number of earnings calls that included mentions of "plastic waste" increased 340% year over year.

Figure 3-2. Interest in Sustainable Investing and Impact Investment Themes[9]



Matching this growth in interest, the amount of assets allocated towards sustainable investing has also grown. Many mutual funds, brokerage firms, and online advisors now offer products that employ ESG criteria. BlackRock, the world's largest money manager, is integrating ESG considerations into their investment processes firm-wide.

In the U.S., in 2009, $3 trillion was allocated to sustainable investments, and by 2018, this had quadrupled to $12 trillion. More than one out of every four dollars under professional management in the United States today is involved in sustainable

[8]https://www.morganstanley.com/pub/content/dam/msdotcom/infographics/sustainable-investing/Sustainable_Signals_Individual_Investor_White_Paper_Final.pdf
[9]Morgan Stanley Institute for Sustainable Investing (https://www.weforum.org/agenda/2020/01/the-business-case-for-investing-in-sustainable-plastics/

investing.[10] Globally, one in every three dollars is now focused on sustainable assets, topping $30 trillion — up 34% over the previous two years.[11]

Sustainable investing will continue to accelerate and attract more assets as investors increasingly recognize the value of ESG data, driving the full integration of sustainable investing among mainstream investors. Investor interests in sustainability require brand owners to develop solutions.

Brand Perception

Numerous consumer studies conducted in recent years focus on packaging sustainability, addressing awareness, responsibility, and purchase decisions. As part of our work, we reviewed many reports sponsored by participants throughout the value chain and others, including leading publications, investment firms, consultancies, and associations/NGOs. Selected findings, as they relate to brand perception, are described in the following paragraphs and other chapters in this report.

A large majority of consumers believe it is important for companies to design packages meant to be reused or recycled. Organic brands and foods with healthy ingredients should do a better job of using non-plastic packaging or packaging with recyclable materials. Consumers also expect brand owners to implement programs to improve the environment and hold them responsible for plastic food packaging recovery.

In response, brand owner efforts to promote sustainability focus on high recyclability and recycled content. Other commitments include eliminating packaging on some items and reducing packaging weight.

Packaging concerns include the impact on marine life, landfill usage, the difficulty of recycling and low recycling rates for flexible packaging, and the negative image around plastic. Single-use plastic is a growing issue, prompting even less engaged consumers to think more about limiting plastic use. More and more consumers are checking product packaging to ensure sustainability before purchase.

Surveyed consumers are open to changing their shopping habits to reduce their environmental impact. However, the true test of consumers' commitment to sustainability comes when asked if they would be willing to spend more for eco-friendly packaging. Across the food, beverage, personal care and beauty, and home care segments, an increasing number of U.S. consumers indicated they would pay more for sustainable packaging, with some willing to pay up to 10% or more.

Now and in the future, brand owners will need to be transparent in their approach to

[10] https://www.ussif.org/sribasics
[11] https://www.weforum.org/agenda/2020/01/the-business-case-for-investing-in-sustainable-plastics/

addressing sustainable packaging in response to growing consumer awareness and increasing regulatory requirements.

Extended Producer Responsibility (EPR)

For packaging, Extended Producer Responsibility (EPR) shifts the responsibility for end-of-use management from municipalities, upstream to producers. The goal is to create incentives for brand owners to incorporate sustainability considerations into the design of their packaging and is carried out through a fee structure based on material weight and difficulty to recycle. As a result, additional cost and environmental impacts are considerations when selecting the type of packaging for a particular product. Generally, brand owners will likely form a Producer Responsibility Organization (PRO) in response to EPR legislation to manage the process and fees of an EPR program. See Chapter 12, Packaging Sustainability Legislation and Related Initiatives for additional information about EPR.

Ellen MacArthur Foundation – New Plastics Economy Global Commitment

Led by the Ellen MacArthur Foundation, the New Plastics Economy initiative applies the principles of the circular economy and brings together key stakeholders to rethink and redesign the future of plastics. Launched in 2018, the NPE has over 450 signatories and includes companies representing 20% of all plastic packaging produced globally.

All consumer packaged goods (CPGs), retail, and packaging producing signatories — 123 in total — have now committed to making 100% of their plastic packaging reusable, recyclable, or compostable by 2025. CPGs and retailers have committed to an average of 22% recycled content in plastic packaging by 2025, roughly 10 times the estimated current global average.[12] Participants agree to report on progress annually and be reviewed every 18 months to ensure transparency and help drive momentum. An excerpt from the June 2019 Annual Report is shown in Figure 3-3.

[12] https://www.newplasticseconomy.org/assets/doc/GC-Report-June19-Summary.pdf

Figure 3-3. Synthesis of Progress Reported by the Top 10 FMCG Companies by Revenue

	PACKAGING DESIGN	RECYCLED CONTENT	STAGE OF ENGAGEMENT WITH REUSE	PLASTIC PACKAGING VOLUME
	%, by weight, of plastic packaging reusable, recyclable, or compostable (2018 / 2025 Target)	%, by weight, of post-consumer recycled content in plastic packaging (2018 / 2025 Target)	Stages: opportunity analysis / piloting / small part of portfolio / significant part of portfolio	Millions of metric tonnes per annum
1. Nestlé	65%	2% / 15%	Small part of portfolio	1.7
2. Procter & Gamble	NOT A GLOBAL COMMITMENT SIGNATORY			
3. PepsiCo	77%	3% / 25%	Small part of portfolio	2.3
4. AB InBev	NOT A GLOBAL COMMITMENT SIGNATORY			
5. Unilever	~50%*	<1% / 25%	Small part of portfolio	0.7
6. JBS	NOT A GLOBAL COMMITMENT SIGNATORY			
7. Tyson Foods	NOT A GLOBAL COMMITMENT SIGNATORY			
8. Mars, Incorporated	19%	0% / 30%	Small part of portfolio	0.2
9. The Coca-Cola Company	99%**	9% / N/A***	Significant part of portfolio	3.0
10. L'Oréal	N/A****	5% / 40%	Small part of portfolio	0.1

This first progress report sets a quantitative baseline against which to measure progress over the period to 2025 and lays out initial actions that signatories have taken to realize their commitments. In addition to driving brand owner goals, the Global Commitment is also propelling efforts by leading converters (Amcor, Berry, Sealed Air, for example) and retailers (Walmart, Target).

Plastics Backlash

Since the 1950s, plastics were hailed as the ultimate material of convenience, in addition to being light, malleable, and strong. However, in the past few years, plastic litter in the ocean (marine debris) has eclipsed other environmental concerns, primarily driven by the BBC show "Blue Planet II" and National Geographic's year-long "Planet or Plastic?" series. The spread of images from the Great Pacific Garbage Patch and sea turtles choking on plastic straws has also contributed to anti-plastic sentiments.

Almost half the 65,000 people in 24 countries surveyed by Kantar in September 2019 named consumer goods companies as the most responsible party for taking action on plastics, ahead of governments or retailers.[13] In response to pressure campaigns from consumer groups, activists, and elected officials, companies like Unilever, Coke, and Pepsi have shifted to different models, such as including minimum levels of PCR in their packaging.

E-commerce

The U.S. Environmental Protection Agency estimates that packaging constitutes one-third of all household waste and will continue to rise as e-commerce becomes a mainstay of the American shopping experience. Online spending represented 16% of total retail sales in 2019, and Amazon accounted for more than a third of all e-

[13] https://www.ft.com/content/27cf9734-faa7-11e9-98fd-4d6c20050229

commerce in the United States.[14] Amid the COVID-19 pandemic, Amazon and retailers like Walmart and Target have seen a spike in online sales as consumers have quarantined at home. The USPS, UPS, and FedEx delivered over 14 billion shipments in 2019. The widespread acceptance of online shopping for everything from discretionary items to everyday essentials is here, both for seasoned and "new to digital" consumers.

As many companies have not yet optimized packaging for e-commerce, overpacking is common when shipping products from a distribution center to a consumer. Because shipments are usually broken down into individual packages for delivery, this not only causes additional waste but also energy consumption and pollution due to the increasing complexity of this retail chain, which has four times as many touch-points as regular retail. Flexible packaging offers performance features such as waterproof and lightweight materials, better cube, and dimensional weight benefits which are all attractive to e-commerce providers.

Package Design

Design can have a significant impact on the amount of material used in packaging, how its strength is optimized to allow for safe transport from manufacturer to consumer, and how easily that packaging can be recycled.

More brands are moving toward sustainable packaging to meet consumer demand, stay ahead of regulations, and be environmentally conscious. Signatories to the EMF-NPE Global Commitment have set goals related to plastic packaging, including making it reusable, recyclable, or compostable and incorporating PCR content.

In the current state of flexible packaging, there are limited recyclable mono-material structures on the market. Continued development of mono-material pouches and identification of product lines suitable for transition to a mono-material PE format are paths forward for brand owners to meet sustainability goals, including GHG reduction.

Another route to sustainability is making plastic out of biologically derived materials such as corn, sugar cane, potato starch, or cellulose from seaweed or trees. Some brand owners, such as start-up brands, are willing to take more risks with their packaging and make going plastic-free part of the branding for differentiation.

Refill/Return/Reuse Systems

One solution to plastic and packaging reduction that is gaining some traction is the use of reusable, refillable containers. According to the EMF-NPE 2019 Global Commitment report, 50 brands and retailers will pilot or expand reuse and refill schemes. At least 10 signatories have committed to deliver reuse and refill trials through TerraCycle's Loop platform.[15]

[14] https://www.digitalcommerce360.com/article/us-ecommerce-sales/
[15] https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf

Loop offers products in reusable glass and steel containers delivered to and picked up directly from consumers' homes. Loop is currently available in the northeastern U.S. and Paris and is in the process of expanding across the U.S. and internationally (including Canada, the UK, Germany, and Japan). Loop has the backing of some leading brand owners as well as smaller companies and offers about 100 brands, including private label items.

Refill programs, using FPP as a refill for rigid applications in cleaning, personal care, and household applications are another way that brands can attain their sustainability goals. Refill subscription models, utilizing plastic pouches, such as Splosh, cut plastic waste by approximately 90%, and are returnable to the company for upcycling.[16]

Photo 3-1. Splosh handwash gel refill pouch with pre-existing dispenser

Much will depend on whether this new breed of refill and reuse products can appeal to shoppers who value low cost and convenience above all else.

Stakeholder Insights

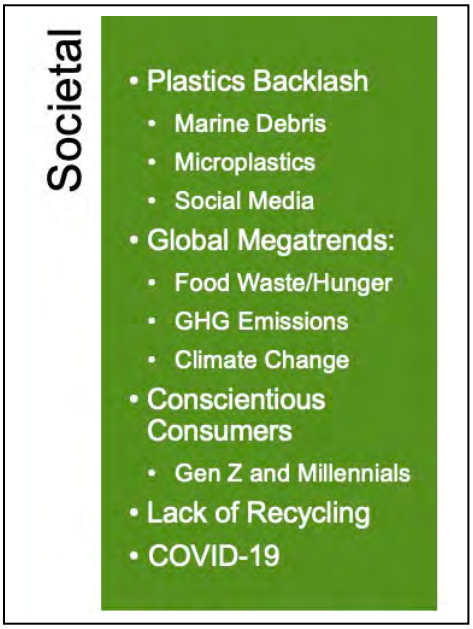
The PTIS and PMG teams engaged in over 50 interviews with stakeholders across the packaging value chain. We also completed an FPA member survey to gain insights on the role of flexible packaging and sustainability. Key takeaways from survey participants are below:

- Sustainability is a critical element of the business strategy and product development efforts of leading brands. It has become much more important and visible in the last few years. Ellen MacArthur Foundation (EMF) type solutions (recyclable, compostable, reusable, PCR content) figure most prominently in sustainability discussions.
- The most important initiatives to achieving sustainability goals are recyclability, meeting brand owner sustainability requirements, and (product) performance enhancements. These are rated as substantially more important than refill/reuse applications, compostability, and bio-based materials.

[16] https://www.plasticstoday.com/packaging/brand-hijacks-bottles-refilling-drastically-reduce-plastic-waste

- Negative issues include plastic and end-of-use dilemma – a lack of or insufficient recycling infrastructure and limited/weak market pull. Flexible packaging is seen as a hurdle to achieving (EMF-NPE) goals.
- There is a general acceptance of a federal government role in EPR or other approaches to driving common recycling goals and infrastructure funding.

Societal



Over the past few years, societal pressure around plastic waste has grown considerably, driven by the highly visible impact on marine environments and a broader awareness of sustainable lifestyles. Global issues such as climate change, food waste, and hunger are top of mind with the role of plastics intertwined. Today's consumers, led by millennials and Gen Z, are driving the demand for sustainability with some willing to look past potential savings to support environmentally conscious products and companies. As consumers navigate the COVID-19 pandemic, sustainability, safety, quality, and accessibility are key considerations. This section examines consumer profiles and global megatrends driving sustainability.

<u>The War on Plastics – Marine Debris, Microplastics, and Social Media</u>

Recent studies have found plastic pollution in the Arctic and the deepest parts of the ocean. Food containers and packaging together with plastic bags represent the largest component of marine debris.[17] Nine of the Ocean Conservancy's top 10 items retrieved from its annual beach cleanups are related to food and drink packaging. Of note, 10 river systems carry 90% of the plastic that ends up in the ocean - eight in Asia and two in Africa. With heavy coverage and reporting by the media, awareness of marine debris has led to public concern over plastics.

Microplastics are less than 5mm in size and are categorized as either primary or secondary microplastics. Primary microplastics are deliberately manufactured and include things like microbeads and the plastic production of pellets, also known as nurdles. Secondary microplastics result from the breakup of larger plastic items, like plastic bags and food packaging.[18] The presence of microplastics in oceans and waterways has received a great deal of scientific and media attention in recent years. In

[17] https://www.cleanwater.org/problem-marine-plastic-pollution
[18] https://ocean.org/wp-content/uploads/pac0978-ocean-litter-whitepaper-FINAL.pdf

the U.S., the only federal ban on plastics is the Microbead-free Waters Act of 2015, forbidding the use of microbeads in cosmetics.

Social media has decentralized the way information is spread and had a major impact on the way the public consumes news, opinion, and information. This has enabled NGOs and scientists to reach out directly to the public, without having to work through professional journalists. Campaigners seek to have their message go viral. Stories of giant seas of floating waste, a video of a plastic straw stuck up a turtle's nose, and the image of a plastic-filled albatross corpse are prime examples. Social media hashtags such as #saveouroceans, #zerowaste, #strawssuck, and #breakfreefromplastic have entered the mainstream lexicon over the last few years.

The proliferation of these efforts has made an impact. Brand owners ("citizen-scientists") are going on expeditions to see gyres first-hand. Grocery bag bans in certain cities and states are in place, as well as prohibitions on expanded polystyrene (EPS) foam containers and single-use plastics. At a global level, it has been a component of a recent G7[19] meeting and other country-specific legislation.

Global Megatrends – Food Waste, GHG Emissions, Climate Change, and Hunger

Consumers have a love-hate relationship with plastic food packaging. On the one hand, we have witnessed public concern about plastic pollution. On the other, we recognize the need to protect and preserve food and increase shelf life and plastic is often the most effective solution.

Thirty percent of the food produced worldwide is wasted every year, and in the U.S., it is higher, estimated at 40%.[20] Along with chronic poverty, conflict, and a lack of resources, food waste is one of the root causes of hunger worldwide. Plastic packaging can make a positive contribution to sustainability while fighting world hunger through shelf life extension and food waste reduction.

Food waste is also a major contributor to global greenhouse gases and methane gas at landfills. Packaging, in general, and flexible packaging, in particular, can help reduce food waste through methods such as portion control (to prevent overuse and waste) and extending food shelf life. For example, a cucumber wrapped in plastic can stay fresh for up to 14 days, while an unwrapped cucumber stays fresh for about five days.

In the developed world, more than 50% of food waste takes place in households, and nearly 20% is wasted during processing. Plastic packaging helps to reduce this high level of waste in both areas. For example, using a few grams of plastic for packaging has a worse environmental perception than a kilogram of destroyed tomatoes, although the

[19] https://www.ptonline.com/blog/post/g7-summit-leaders-agree-to-ocean-plastics-charter-
[20] https://yaleclimateconnections.org/2019/05/food-waste-has-crucial-climate-impacts/

latter, taking into account all processes in production and logistics, in most cases, has much higher GHG emissions and water use than the packaging material.

Conscientious Consumers

A major force driving the desire for more socially and environmentally conscious brands are consumers themselves—particularly younger generations now rising to prominence in the U.S. economy. Additional consumer insights are detailed in Chapter 4 - Value Chain.

Together, millennials (age 25-38) and Gen Z (age 18-24) make up around $350 billion of spending power in the U.S. These consumers have vocally expressed the desire to spend with brands and products that align with their values—chief among them environmental sustainability and climate change. As a result, customers have begun to favor—and sometimes outright demand—brands with a commitment to sustainability.[21]

As awareness of efforts to ban plastics grows — strongly correlated with heightened concern and individual action to reduce plastic use — retailers, brands, and restaurants are moving to reduce single-use plastics. This represents a strong signal that consumers will increasingly demand sustainable alternatives as awareness of waste grows.[22]

Lack of recycling

Most consumers continue to engage with sustainability primarily through their aspirations and good intentions. Even when consumers have convenient access to recycling, such as curbside service, they often fail to put recyclable plastic into the recycling bin. Consumers with access to curbside recycling (typically single stream) only place about 40% of recyclables into the recycling bin; the remaining 60% goes directly to landfill or is incinerated. The current rate of recycling for FPP is only 4%.

The majority of consumers would like to be more sustainable, especially regarding plastic and packaging waste. However, they cite confusion and apathy as primary reasons for poor recycling behavior. Confusion arises from a lack of consistency in recycling programs and the broad range of materials that consumers handle. Guidelines vary from municipality to municipality, and recyclability is typically not indicated on the packaging, although the How2Recycle label is making inroads. Estimates are 15-25% of what American consumers throw away in a single-stream recycling bin cannot be recycled. Surveys indicate over 50% of U.S. respondents separate waste at home, well below the European respondents' average of ~75%.[23]

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[21] https://www.53.com/content/fifth-third/en/commercial-banking/resource-center/acting-on-your-industry/how-to-manage-cost-of-sustainable-packaging.html

[22] https://sustainablebrands.com/read/waste-not/us-consumers-more-concerned-about-ocean-plastic-than-climate-change

[23] https://think.ing.com/uploads/reports/IIS_Circular_Economy_report_FINAL.PDF

In the U.S., approximately 30 million rural and 15 million suburban U.S. households lack curbside recycling—reflecting the distance between homes, the cost of using trucks to pick up recyclables, and the willingness of municipalities and private companies to invest in recycling programs.[24] Also, approximately 8 million multifamily residences lack curbside recycling because they fall under commercial rules, which makes them ineligible for municipal recycling services, with landlords as responsible for providing and paying for services. Additionally, some local governments are ending their curbside recycling programs, while many other municipalities have reduced the list of materials they will accept.

In-store drop off of flexible film (wraps, bags, flexible packaging) is an option through the Wrap Recycling Action Program (WRAP). WRAP campaigns help communities keep plastic film out of their municipal recycling facilities (MRFs) by establishing collection points at retailers, including mass merchant, grocery, and home improvement. The items shown in Figure 3-4 can be recycled along with back-of-house commercial film and retail/carry-out bags:

Figure 3-4. WRAP Program Accepted Items

As of 2019, WRAP had approximately 250 champions and partners in the U.S. However, with the onset of COVID-19, many stores initially responded by temporarily halting the collection of plastic bags and wraps, and individuals have quarantined at home or took limited excursions, decreasing supply.

COVID-19

The COVID-19 pandemic has given a new foothold to single-use plastics previously criticized for the waste they generate. Flexible packaging has benefitted because of increased concerns around hygiene and the protection it provides. Some bans on plastic shopping bags have been overturned or fees lifted because of initial concerns reusable alternatives could spread the virus. Meanwhile, the acceleration in e-commerce driven

[24] https://www.mckinsey.com/industries/chemicals/our-insights/accelerating-plastic-recovery-in-the-united-states

by lockdowns has buoyed sales of plastic envelopes and protective packaging, including shrink wrap, bubble wrap, and pillow packs. Many of these components are eligible for store drop-off recycling.

While COVID-19 has provided a new window of opportunity, plastics makers still expect pressure about waste to mount longer term, particularly due to the low recycling rates for plastics globally.

Stakeholder Insights

Consumer-related insights from throughout the value chain are detailed below:

- Curbside (or other) collection is seen as the only feasible way to collect post-consumer packaging to drive to high consumer participation rates for flexible packaging recycling; in-store collection requires too much effort and may disappear as stores start to implement plastic bag bans as part of their plastic reduction goals.
- Retailers are not necessarily major supporters of in-store drop-off or dealing with post-consumer packaging. Concerns include food residue, contamination, consumer knowledge, appearance, and pick-up frequency.
- Negative media attention has accelerated brand owners' focus on sustainability and aggressive goal-setting.
- Consumer education comes up consistently as many recognize a role for non-traditional players in the packaging value chain to drive the collection and inclusion of PCR.

Government

Governments can address sustainability concerns through policy development, regulation, facilitation, and internal sustainability management. However, the U.S. is one of the few industrialized countries without significant national recycling goals and laws, leaving policies in these areas to its states and cities. Not surprisingly, the European Union was the first with measures ranging from raising public awareness and making producers responsible for dealing with waste, to restricting the sale and use of single-use plastics.

Legislation

The U.S. has traditionally left much of recycling-based legislation to the state and local level, resulting in the enactment of plastic bag fees and bans, restrictions on plastic straws, and prohibition of EPS foam food containers. There are many state-level initiatives under consideration at the time of drafting this report (summer 2020), including exploration of EPR, recycling-based legislation, and plastic-specific bills.

Bills under consideration in Congress include a wide range of initiatives - from providing funds for investment into the recovery infrastructure (RECOVER Act), to grant programs for community and residential recycling programs (RECYCLE Act) to marine debris focused initiatives (Save Our Seas Act 2.0). Perhaps the widest-ranging bill is the Break Free from Plastic Pollution Act. It is the closest to a nationwide EPR system considered by Congress. These and other bills are detailed in Chapter 12.

Resin Fees, Plastics Taxes, and Carbon Taxes

Leading consumer brands have made major public commitments to use more PCR and make plastic a more circular material. The EMP-NPE Global Commitment estimates that PCR resin content of packaging was 4% in 2018 but needs to increase to 22% by 2025 to meet the goals for 400 companies and retailers in their program. In the U.S., there is currently more end-market demand for recycled polymers than there are recycled materials to meet that demand.

Virgin resin is currently less expensive than recycled resin, and a fee for virgin resin would put it on price parity with recycled resin, making it more cost-effective for use in packaging. Companies like Coca-Cola Co., PepsiCo Inc., Clorox Co., and others are endorsing such a fee in the U.S. to help level the playing field for recycled plastic and pay for improvements in the country's recycling system.[25] The proposal is part of a broader recycling policy platform put out by the Consumer Brands Association (CBA) that includes five other funding options.

A plastics packaging tax is another mechanism to support change. In the U.S., California will have a bill on its November 2022 ballot to place a $.01 fee[26] on plastic packaging to fund recycling and clean up waste. In early 2020, the U.K. announced that beginning in April 2022, they will introduce a new plastic packaging tax of £200 per tonne, applicable to all U.K.-manufactured plastic packaging with less than 30% recycled content as well as imported unfilled packaging. The move is designed to increase the use of recycled plastic in packaging by 40%.

The concept of a plastic tax is quite similar to a carbon tax. A carbon tax is paid during the upstream process, or when the fuel or gas is extracted from the Earth. Producers can then pass on the tax to the market by as much as they can. This, in turn, gives consumers a chance to reduce their carbon footprints. The U.S. doesn't currently implement a federal carbon tax, although it is a policy championed by most economists as an effective way to fight climate change.

China's National Sword Policy

[25] https://www.plasticsnews.com/news/consumer-goods-makers-propose-virgin-resin-fee-boost-recycling

In January 2018, global markets and commodity pricing of all scrap materials were severely disrupted by China's National Sword policy, which banned mixed plastics and other materials from entering the country due to high levels of contamination in imported scrap. Before the policy implementation, the U.S. exported over 30% of its scrap to China.

National Sword has contributed substantially to a 50% reduction in the revenues received from the sale of recyclables recovered through curbside recycling. In addition, it has resulted in increased processing costs and residue rates at material recovery facilities (MRFs).[27] On the flip side, it has also triggered efforts to build new domestic recycling infrastructure and find new technologies to reprocess plastic waste. Investments totaling $4.6 billion have been announced for both mechanical and advanced recycling in the U.S. in the last three years.[28]

Infrastructure Funding

Recycling decision-making is handled by 20,000 communities in the U.S., with each making their own choices about whether and what to recycle. It is also a service that competes and often loses to local funding needed for schools, policing, etc. With recycling systems under great financial pressure due to massive shifts in overseas markets and the COVID-19 pandemic stretching budgets even more, without federal monies, EPR and other funding mechanisms may become more relevant.

Extended producer responsibility (EPR) requires companies that make products to be responsible—financially or physically—for their management and disposal at the end of their use. Companies can do this through recycling or reusing products, buying them back, or they may hire a third party, usually a PRO, to deal with their waste management. EPR shifts the financial burden from local governments to manufacturers, which also motivates companies to design and produce more sustainable products. The EU has had an EPR program on packaging since 1994.

Other policies to benefit waste and recycling services include the following:

- Per Item Fee - A set fee per item sold, possibly focused on items that include non-recyclable or hard-to-recycle packaging, incurred either before or at retail point-of-sale
- Waste Generator Fee - All entities (companies, consumers, businesses, etc.) pay a set fee based on how much waste they send to landfill. The funds will pay for waste and recycling services
- Pay-as-you-throw (PAYT) - Residents pay a set fee for waste disposal (typically per bag of trash) and the funds will pay for waste and recycling services

[27] https://www.recyclingtoday.com/article/swana-arf-report-highlights-national-sword-impact-solutions/
[28] https://www.plasticsnews.com/news/consumer-goods-makers-propose-virgin-resin-fee-boost-recycling

There is one major federal infrastructure bill currently under consideration at the time of drafting this report - The Realizing the Economic Opportunities and Values of Expanding Recycling (RECOVER) Act. The bill (H.R. 5115), would allocate $500 million in matching federal funds for states, municipalities, and tribes. That money is intended to improve various aspects of collection and processing infrastructure, ranging from curbside equipment to drop-off sites and MRFs. RECOVER would also establish a recycling infrastructure program within the U.S. EPA.

Ultimately, government involvement at the state/national level will likely be essential in setting up an effective collection infrastructure, facilitating the establishment of related self-sustaining funding mechanisms, and providing an enabling regulatory and policy landscape.

Stakeholder Insights

Government-related insights from throughout the value chain are shared below:

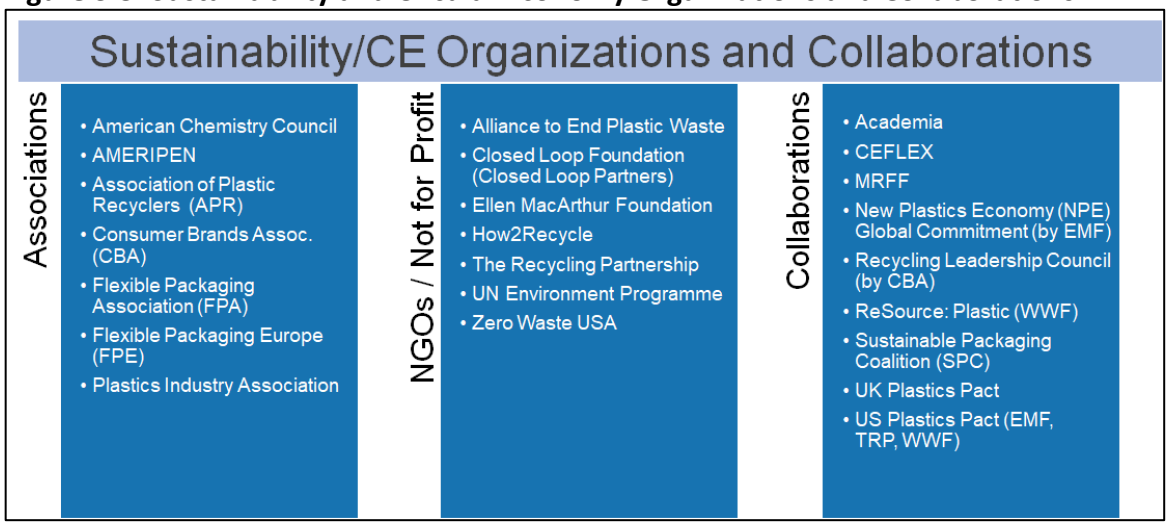
- EPR is recognized outside of the U.S. as a funding mechanism for recycling infrastructure. The concept of EPR is starting to gain more traction in the U.S. as a potential method for funding recovery infrastructure
- MRF profitability will be driven by strong demand for recycled packaging. There is no indication this will happen in the near future outside of government mandates

NGO/Associations

Sustainability is a critical element of business strategy and has become much more important and visible in the last few years. This can be attributed to a wide array of industry associations, NGOs, and collaborations pushing sustainability agendas, with an increased focus on plastic and packaging waste. Activist groups are using powerful imagery in social media campaigns to raise awareness too. Circular economy solutions, driven by Ellen MacArthur Foundation principles, are the most prominent and include packaging that is recyclable, compostable, reusable, and contains PCR content.

Figure 3-5 lists leading organizations with sustainability initiatives but is by no means a complete representation. Each of these groups and their related efforts are profiled in Chapter 11 while several are detailed in the following chart.

Figure 3-5. Sustainability and Circular Economy Organizations and Collaborations



Roadmaps: A Circular Economy Push vs. Sustainable Materials Management

Circular economy (CE) principles rose to prominence with the establishment of the Ellen MacArthur Foundation and subsequent New Plastics Economy Global Commitment. Roadmaps and guidelines for a more CE have become an increasingly important tool for the plastics industry around the world, especially in the EU. However, flexible packaging is currently well established for sustainable materials management (SMM) principles in that it uses resources very efficiently, but not as well-positioned around the CE model and recycling. Several initiatives addressing circularity, specifically for FPP, have recently been introduced including the roadmap presented in Chapter 7 of this report.

The U.S. Plastics Pact, a collaborative launched in August 2020 by more than 60 public and private stakeholders, is led by The Recycling Partnership (TRP) and the World Wildlife Fund (WWF) and is a part of the Ellen MacArthur Foundation's global Plastics Pact network. The pact calls for signatories to commit collectively to four targets by 2025:

- Fifty percent of plastic packaging either effectively recycled or composted.
- Thirty percent recycled content or responsibly sourced biobased content in plastic packaging.
- All plastic packaging is reusable, recyclable, or compostable.
- Development of a list of problematic plastic packaging to be eliminated by 2025.

CEFLEX is the collaborative initiative of a European consortium of companies and associations representing the entire value chain of flexible packaging It is working to make all flexible packaging in Europe circular by 2025. In June 2020, CEFLEX produced

'Designing for a Circular Economy[29],' a set of comprehensive guidelines to enable participants in the flexible packaging value chain to produce packaging that is easy to sort and recycle. Guidelines for the end of the cycle infrastructure are also included.

In 2020, The UK Plastics Pact developed a five-year strategy specifically for flexible packaging. Among the solutions proposed to increase the recycling rate for flexible packaging are:

- Designing packaging that can be recycled and sorted;
- Investing in sorting and reprocessing facilities; and
- Ensuring that recycled flexible packaging has strong end markets.

In the short term, the roadmap emphasizes capitalizing on the store collection points provided by supermarkets and other retailers. In the long term, curbside collections of flexible packaging must be implemented in all local authority areas. The UK is also introducing EPR schemes and a tax for firms that produce or import plastic packaging that does not have at least 30% recycled material. Their flexible packaging strategy aligns with the European CEFLEX program and it will be important to leverage best practices in Europe for end markets in the U.S.

The Consumer Brands Association (CBA) launched the Recycling Leadership Council in January 2020 to build the American Recycling Roadmap, a public policy framework to reimagine the U.S. recycling system. The council will host regional roundtables across the U.S., uniting stakeholders to discuss best practices in current industry action, technological innovation, and public-private partnerships, as well as to tackle the challenges faced by local recycling systems. The roundtable will help the council understand what is and is not working in different parts of the country and enable the group to pinpoint scalable themes and policy solutions.

Collaborations and Consortiums

Collaborations drive sustainability with the ability to develop multifaceted programs with investment money and resources from across the value chain. This is evidenced by the various initiatives of and endorsements by the Ellen MacArthur Foundation and activities of the American Chemistry Council (ACC).

The ACC has collaborated with Closed Loop Partners and supported organizations such as The Recycling Partnership, which works to systematically optimize and expand collection in large communities. It has also supported collection programs, including Materials Recovery for the Future (MRFF), the Wrap Recycling Action Program (WRAP), and Hefty® EnergyBag®. The ACC has also helped incubate multiple programs to

[29] https://guidelines.ceflex.eu

optimize the collection of post-use plastics to create dependable feedstocks, for both mechanical and advanced plastics recycling.

The Materials Recovery for the Future (MRFF) project, an ACC initiative, required collaboration between leading members of the flexible packaging value chain and proved that flexible packaging could be collected in single-stream recycling systems and sorted at an MRF with investment in optical sorters. MRFF partners touted the pilot project as successful for meeting four of the five performance goals and for having positive implications for the future. Going forward, numerous partners must collaborate on end-market development to boost demand and make the rFlex prospect viable in real-world conditions.

Closed Loop Partners (CLP) is an investment platform that invests in sustainable consumer goods, advanced recycling technologies, and the development of the circular economy. In July 2020, CLP launched a consortium with Walmart, Target, and CVS Health - the Beyond the Bag Initiative, a plan to reinvent single-use plastic bags. The program goal is identifying, testing, and implementing viable design solutions and models that more sustainably serve the purpose of the current retail bag.

Stakeholder Insights

Association and NGO-related insights from throughout the value chain are shared below:

- There is a latent need for coordinated direction moving forward. Too many organizations are pursuing similar goals with little or no coordination between them.
- EMF is viewed as the leading organization in pushing aggressive circular economy goals and thought leadership but will require significant funding increases to drive toward the goals. Many view the goals as unrealistic in today's political climate.
- Flexible packaging industry is behind NGOs in impacting public opinion. Converters want to do the right thing but seek direction on how to respond to emotion created by disturbing images.
- COVID fallout could include a re-invigorated NGO push against plastics.

Conclusion

While flexible packaging offers a number of sustainability benefits throughout the lifecycle of the package, FPP is expected to grow threefold by 2050 putting additional pressure on the industry. Sustainability is at a tipping point, driven by brand owner goals, societal awareness, pending legislation, and NGO pressure.

Brand owners are signatories to various initiatives (e.g., EMF-NPE, U.S. Plastics Pact), making commitments to act on packaging waste, in support of their overall brand and image story. Social media has heightened consumer knowledge and concern regarding plastics and end-of-use challenges with startling images and anti-plastic hashtags.

Millennials place a higher priority on sustainability, rewarding brands that offer sustainable packaging while also being socially conscious investors.

State and local governments have enacted single-use plastic bans but have not invested in recycling infrastructure. However, collaborations, like the MRFF project, proved that flexible packaging could be collected in single-stream recycling systems and sorted at an MRF with investment in optical sorters. Legislation, likely including EPR or other funding mechanisms, will play a critical role over the next decade.

NGOs and associations are exerting pressure with an increased focus on plastic and packaging waste and introducing CE initiatives with challenging goals. Collaboration will be the key to gaining momentum to enable all packaging, including flexible packaging to better align in a circular economy.

List of Acronyms

APR	Association of Plastics Recyclers
CBA	Consumer Brands Association
CE	Circular Economy
CEFLEX	Circular Economy for Flexible Packaging
CO_2	Carbon Dioxide
EPA	U.S. Environmental Protection Agency
EPR	Extended Producer Responsibility
FPP	Flexible Plastic Packaging
GHG	Greenhouse Gas Emissions
LCA	Life Cycle Assessment
MRF	Material Recovery Facility
MRFF	Materials Recovery for the Future
NGO	Non-Governmental Organization
PCR	Post-Consumer Recycled
PRO	Producer Responsibility Organization
RPET	recycled PET (polyethylene terephthalate)
SMM	Sustainable Materials Management
SPC	Sustainable Packaging Coalition
TBL	Triple Bottom Line
UN	United Nations
UPS	United Parcel Service
USPS	United States Postal Service
WRAP	Wrap Recycling Action Program

Chapter 4

Moving to a Circular Packaging Value Chain

Background and Overview

The packaging value chain is a very complex system that continues to evolve. Pre-2000 the value chain was really two chains. One was the supply side, which consists of raw material suppliers, converters, and associated entities that dealt with operations and manufacturing. Separately, the demand side was focused on delivering growth and sales and included consumer packaged goods companies/brand owners, retailers, consumers, and associated components focused on product delivery and sales. In 2002, the book "Cradle to Cradle" was published (McDonough and Braungart, 2002) and brought circular thinking to the value chain.

Companies and governments in Europe have been working on improving and optimizing the circular packaging value chain for the past two decades. This is largely driven by legislation and as a result, EU countries are ahead of most countries and offer a good place to look for best practices and new insights as we embark on the circular economy (CE) journey. This concept has evolved over the last 15 years in the U.S., and with the help of the drivers that were discussed in Chapter 3, leading companies on a new journey toward a circular packaging value chain. This goal of this new value chain will be designing to eliminate all packaging as waste and provide a new way of thinking that will be more thoughtful and purposeful to support a cleaner global environment in the future.

Circular Packaging Value Chain – Overview

Packaging, materials, and containers (both rigid and flexible) afford many benefits in bringing products to the market by providing healthy and safe products in an undamaged format at a cost that is supportive of the overall value to consumers and customers. An example of a simple circular packaging value chain is shown in Figure 4-1.

Figure 4-1. Circular Packaging Value Chain Model for Packaging

The packaging value chain is becoming more circular as companies increase their collaborative efforts and work more closely with a variety of NGOs focused on improving packaging circularity and eliminating packaging and plastics as waste. Some examples include The Ellen MacArthur Foundation (EMF), which is focused on eliminating packaging as waste as well as improving the circularity of plastics and eliminating problematic plastic packaging. Other organizations are also

focused on related efforts including Alliance to End Plastic Waste (AEPW), The Recycling Partnership (TRP), and The World Wildlife Fund (WWF) among many others. (See Chapter 11 – Sustainability/CE Organizations Activities and Collaboration for more information)

Circular Packaging Value Chain – Overall Interviews and Insights:

- For this report, more than 50 interviews were conducted with decision makers across the packaging value chain to better understand their thoughts on the importance of moving toward a circular packaging value chain for flexible packaging
- This primary research, along with many other inputs and resources, was used to help develop the various milestone future states (Chapter 5 – Envisioning the Future) and the circular flexible packaging roadmaps (Chapter 7 – Flexible Packaging Roadmaps) described in this report
- It was clear from all the respondents that driving to improve recycling is a key strategic objective for the participants and their organizations

Value Chain Roles in a Circular Economy

Raw Material Suppliers/Converters

Raw Material Suppliers (RMS) provide the many feedstocks and components so that the converters can convert these materials into a final package. Examples include plastic pellets, plastic film and paper, inks, coatings, and various additives to improve processing and packaging performance. This group plays a key role in PCR utilization, new technology development, and design.

Converters receive the RMS outputs and complete various processes to create an intermediate/final package. Examples include a variety of pouch formats with easy open/reclose features, fitments, cartons, cans, PET/HDPE bottles, printed films and wrappers, labels, shrink and stretch films, and more. Converters play a key role in package design and overall package carbon footprint.

Topline interview insights for RMS/converters include:

- High awareness among raw material providers of the need for sustainable packaging solutions
- Europe is considered a leading market for sustainable technologies given regulatory support and consumer pull. There is potential to identify best practices from Europe and apply to the U.S. market.
- EPR is viewed as a reasonable step towards the ultimate goal of zero waste, although there is some concern about how EPR fees would be calculated and influence brand owner selection of one material over another

- Potential for growth in paper as the new flexible material – with coatings and performance enhancements, while offering an opportunity to fit within existing recycling systems
- Flexible packaging in e-commerce may be a growth driver for converters – waterproof, lightweight, better cube, and dimensional weight benefits

Brand Owners/Foodservice

Brand Owners are often called consumer packaged goods (CPG) companies. They either manufacture and package their products or have them contract manufactured or contract packaged (CMCP). Examples include food and beverage companies, personal care, household, industrial goods, healthcare and beauty, pharmaceuticals, and more. The CPG sector is responsible for final package development and brand ownership.

Foodservice includes quick-serve and fast-casual restaurants as well as sit down restaurants and institutions. The sector may also include the growing meal kits area like Hello Fresh and Blue Apron. Food away from home approached 50% of total sales prior to the COVID pandemic. This sector specifies packaging for its products for dine-in and take-away and also plays an important role in reducing food waste.

Topline interview insights for brand owners/foodservice include:

- Sustainability is a critical element of business strategy. It has become much more important and visible in the last few years. EMF driven solutions (recyclable, compostable, reusable, PCR content) are the most prominent.
- Some negative perceptions include plastic and end-of-use dilemma – viewed as no recycling infrastructure and no market pull
- Flexible packaging can be seen as a hurdle to achieving EMF sustainability goals (all packaging recyclable) due to the current lack of recycling
- Virgin vs. PCR is a critical issue to future success
- There is some acceptance of a federal government role in EPR or other approaches to drive infrastructure funding
- For some applications, paper may be viewed as a sustainable solution since it can be recycled in existing systems; although paper may also be used in a laminated structure, which is not currently recyclable
- Curbside collection along with the expansion of collection in multi-family units is seen as the only feasible way to collect post-consumer and drive mass collection needed to boost flexible packaging recycling rates; in-store collection requires more consumer effort and could be eliminated by stores. Some have moved to reduce plastic grocery store bags

Contract Manufacturers/Contract Packagers

Contract manufacturers (CMCP) often include companies that provide both manufacturing and packaging capabilities or contract packaging where the products are provided to the company and the contract packager fills, seals, and packs the products for shipping. This segment is often referred to as CMCP.

- CMCP is growing at 11% annually and provides services to start-ups, small, medium, and large companies. Many multinational companies may use hundreds of CMCPs to manufacture and package a variety of goods.
- Retailers typically use CMCPs for the manufacture of their private label products
- CMCPs are generally an extension of the brand owners they provide services to and should challenge/question their customers going forward on the importance of packaging sustainability.

Retailers

Retailers and Omnichannel (the integration and orchestration of the many retail components used in the customer selling experience and may be in either through brick and mortar or online environment) provide a broad range of experiences and solutions for their customers and include many retail formats including convenience stores, gas stations, dollar stores, supermarkets, big box, and club stores. In addition, e-commerce, direct to consumer (DTC), and subscription services are included in the vast retail space.

Major retailers have defined sustainability goals as part of their overall programs and are also working on improving their Environment, Social, and Governance (ESG) efforts. Walmart has cut 230MM metric tons of GHG out of its supply chain in the last three years and is on track to meet its 2030 emission goals (Bloomberg, 2020). Additional packaging formats are used in this part of the value chain, including shipping and display formats, which are used to organize and provide greater customer shelf impact and convenience. Some retailers like Walmart and Target are setting sustainability goals for both their private label packaging, as well as incoming packaging from brand owners, to help simplify the many material offerings and support simpler recycling offerings. Since many retailers have their own private label products and act as a brand owner themselves, they need to follow and lead sustainable packaging practices. In addition, they play an important role in flexible packaging collection at both the front and back of the store.

Topline interview insights for this sector include (Retailer/Foodservice):

- There is some anti-plastic sentiment driven by consumer perception
- Flexible packaging offers great performance benefits but suffers from not having an end-of-use solution. Simpler structures, mono-materials could help meet goals
- Retailers recognize that some type of government intervention will likely be required to drive change and infrastructure investment
- Although paper is of interest, retailers have some concerns about performance capabilities
- Retailers are not positive about in-store drop-off or dealing with post-consumer packaging. Concerns include residual food, consumer understanding, contamination appearance, and pick up frequency.

- As a result of COVID-19, there was an initial concern about the collection of bottles and cans in bottle bill states, but states have since reinstated collection schemes

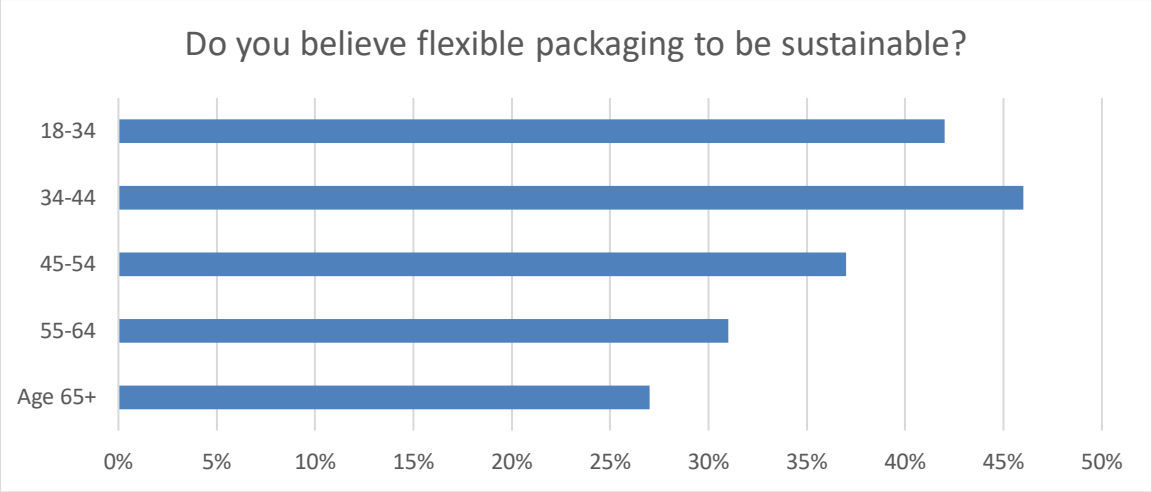
Circular Packaging Value Chain – Consumers

Consumers are the purchaser and generally the recipient of the various packaged goods from the retailer, manufacturer, and increasingly from e-commerce channels. Consumers are considering sustainability and packaging in their purchasing process and are more environmentally aware than they have been in the past. The following meta-analysis data support the increased awareness and interest in more sustainable packaging solutions.

Topline insights for this sector include (Consumer):

- Consumers believe manufacturers should design packages for recycling or reusability
- More consumers say they are willing to pay more for environmentally friendly packaging, though there may be some skepticism as consumer sentiment often does not align with actual purchase behavior
    - In one survey, nearly 80% of respondents said that sustainability was important and they would be willing to pay a premium for brands that are sustainable and environmentally responsible
- Millennials and Gen Z are driving the demand for more sustainable packaging and are looking for cause-based efforts to support as a part of the total value proposition
- Generally, consumers believe that e-commerce packaging is excessive and want to see less packaging in this channel
- Some consumers have a less positive view of plastics in general, especially single-use plastics, in comparison to other packaging materials. However, a 2019 study by the FPA (*FPA Flexible Packaging Consumer and Brand Owner Study*) showed that more younger consumers than older consumers generally felt flexible packaging is more sustainable. This was driven by their understanding of life cycle thinking and reducing overall product waste (see Figure 4-2).

Figure 4-2. Consumer perception about flexible packaging's sustainability



- Consumers are very concerned about the impact of plastics on marine life
- In one survey, more than 50% of respondents said they would like to reduce the amount of materials they throw away
- Note: The above data come from a meta-analysis of consumer information and insights from various sources with a focus on U.S. data for consumers

Circular Packaging Value Chain – NGOs and Associations

Non-Governmental Organizations (NGOs) identify macro concerns or problems and provide a pulse and platform for critical issues they believe need greater attention. Examples of NGOs, their activities, and goals are described in Chapter 11.

- The Ellen MacArthur Foundation and its work on The New Plastics Economy and the U.K. and U.S. Plastic Pacts are the driving forces for brand owners and many other parts of the value chain to focus on eliminating plastics and packaging as waste.
- Packaging trade associations are also focused on sustainability and are working with their memberships to communicate benefits and identify positive environmental efforts going forward. Examples include flexible and rigid packaging associations for corrugated, cartons, metal cans, glass, and flexible packaging formats.
- Other associations including the American Chemistry Council (ACC), Consumer Brands Association (CBA), Plastics Industry Association (PIA), Packaging Machinery Manufacturers Institute (PMMI), and more are playing an active role in this effort and some of their goals and actions are also included in scenario and future state development actions for the roadmap section of this report.

End-of-use management includes the collection, sortation, reprocessing, and end-market development. This very important set of efforts is paramount in the development of the roadmaps, which are detailed in Chapters 5 (Envisioning the Future) and 7 (Flexible Packaging Roadmaps).

Summary

The value chain is very complex and diverse, and all parts have efforts underway to enhance their sustainability profile. Much more still needs to be done to get all value chain players moving in the same direction. Continued collaboration and focused efforts supporting key initiatives that will enhance ESG and commitments to help support and drive infrastructure toward collection and sortation along with education will be critical to achieve EMF and various plastics pacts and related circular economy goals for packaging. By understanding the roles of each part of the value chain we hope the reader can better visualize how all components of the value chain are integrated and see how better collaboration and coordination will help achieve a truly circular packaging value chain.

List of Acronyms

CBA	Consumer Brands Association
CE	Circular Economy
CMCP	Contract Manufacturing Contract Packaging
EPR	Extended Producer Responsibility
ESG	Environment Social Governance
EU	European Union
FPP	Flexible Plastic Packaging
PCR	Post-Consumer Recycled
PRO	Producer Responsibility Organization
WRAP	Waste & Resources Action Programme

Chapter 5

Envisioning the Future

Background

This chapter will explore the rationale for developing flexible packaging roadmaps, as well as look at what the future of flexible packaging could entail, including the gaps that need to be addressed. There is a clear need across the packaging value chain to move to a system where flexible packaging is collected, sorted, valued, and integrated into the circular economy (CE). Along with this, there is a desire to drive more recycling of all packaging materials, especially flexible packaging which has one of the lowest rates for recycling in the U.S. today. Flexible packaging has a number of positive sustainability benefits, including efficient use of resources (very lightweight), food waste reduction, and generally lower carbon emissions than other forms of packaging. However, the low recycling rate needs to be addressed.

According to the World Economic Forum, global plastics production is expected to triple by 2050 (from a baseline in 2014)[30], with flexible packaging keeping pace with that rate. Thus, there will continue to be tremendous pressure on plastics, and in particular, the flexible packaging industry, to achieve significantly higher recycling rates in the future and to help address packaging that ends up in the environment.

There is no obvious silver bullet answer, but there is strong support to collect and recycle flexible packaging in the U.S. and globally, which will require significant collaboration efforts. This chapter presents a vision of a future that helps move flexible packaging toward circular economy principles.

Rationale for a Flexible Packaging Roadmap

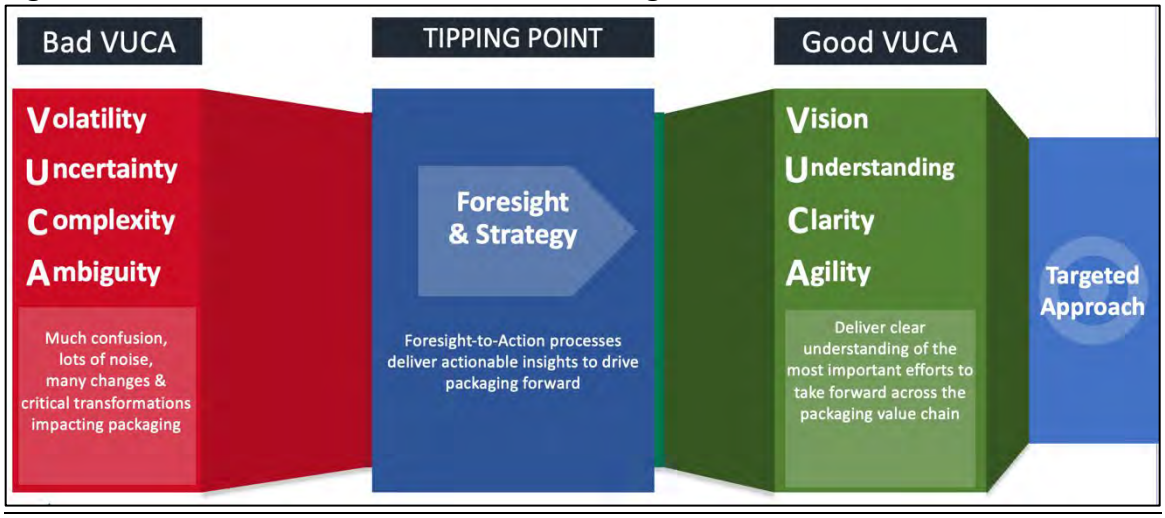
The following industry roadmap is meant to guide the flexible packaging value chain to more effectively navigate challenges and drive toward a future where flexible packaging fits within the principles of a circular economy (CE). As mentioned in Chapter 2, flexible packaging is currently well aligned with the principles of sustainable materials management (SMM) where resource efficiency and the use of fewer materials are important. The ultimate goal is to get flexible packaging to integrate both SMM and CE principles.

[30] http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

There is also a clear need to keep all packaging out of landfills and the environment. The value of packaging not recycled is estimated at US $80-120 billion,[31] and is lost to the economy annually, according to the Ellen MacArthur Foundation. While capturing all of these materials may not be realistic over the next decade, it does highlight that there is considerable value in materials that are currently not being collected.

With any roadmap, the goal is to bring a better vision of the direction for the industry. The authors use the model of going from *Bad VUCA* (Volatility | Uncertainly | Complexity) | Ambiguity) to *Good VUCA* (Vision | Understanding | Clarity | Agility) (see Figure 5-1). The team leveraged this model along with additional inputs, including interview insights from discussions with many FPA members and other players throughout the packaging value chain to focus on driving toward "Good VUCA" for the flexible packaging industry as it moves toward the future.

Figure 5-1. Current State to Future State for Design



Additionally, the team was also able to utilize a number of significant initiatives that are already underway globally within the flexible packaging industry. These include, but are not limited to:

- Circular Economy for Flexible Packaging (CEFLEX) – Designing for a Circular Economy Guidelines
- Ellen MacArthur Foundation – New Plastics Economy
- How2Recycle (SPC) and Association of Plastics Recyclers (APR) collaboration on flexible packaging guidance for recycling
- Materials Recovery for the Future (MRFF)
- UK Plastics Pact, including a specific roadmap for flexible packaging

[31] https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEC-Hybrid_English_22-11-17_Digital.pdf

Envisioning the Future State

To construct a path forward, models were developed for the current state (where flexible packaging is today) and future state (where the flexible packaging industry would ultimately like to be). The current state is set for 2020, while the future state is envisioned for 2030. The future state is considered the "North Star" to help guide where the industry needs to go to move toward circularity. The future state presented a "middle of the road" approach, trying to be aspirational but realistic due to the number of challenges that the industry will face in order to truly be embedded into a circular economy.

The current state to future state models is broken into six main areas that will be critical to ultimately getting to a stronger sustainability position for flexible packaging. Each of these areas must be addressed in order to move toward the ultimate vision of flexible packaging aligning with both SMM and CE principles. These areas include:

- Design
- Collection
- Sortation
- Reprocessing
- End Markets
- Policy/Legislation

When moving from the current state to the future state, there are major gaps that need to be addressed. The gaps are used to identify the specific actions in the roadmaps that members of the value chain need to be working on as the industry moves toward the future state. The flexible packaging industry is global in nature and numerous initiatives are being taken around the world to try and collect (and ultimately recycle) flexible packaging. What is apparent is that there is no one single solution that will solve the lack of recovery of flexible packaging. The challenges will be more difficult than other materials such as steel, aluminum, corrugated, and even rigid plastic face to increase recovery rates. It will take collaboration across a number of entities and industries, many of which may not have yet established such relationships. These will be instrumental in helping advance toward the future state.

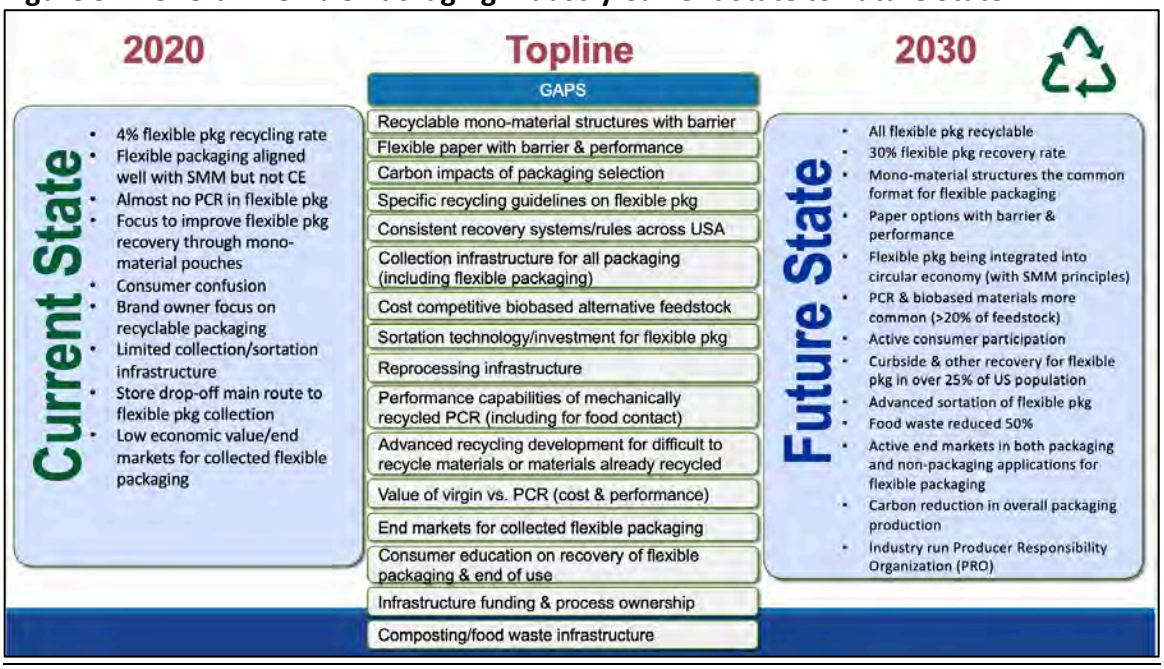
The following models identify a number of the major gaps that must be addressed. These models form the backbone of actions in the Flexible Packaging Roadmaps (Chapter 7).

Topline Current State Model

The current state to future state shown in Figure 5-2 provides a topline visual for the overall flexible packaging industry and the objectives the industry is looking to achieve by 2030. Currently, there is an overall recycling rate of about 4% (mostly grocery bags) for flexible packaging, largely collected at grocery store drop-off locations. Unfortunately, this material has low economic value today due to a lack of end markets for the material.

By 2030, the industry would like to address each of these critical areas identified in the model below. There are several critical gaps, shown in the middle of Figure 5-2, which must be addressed to reach the future state. Some of the gaps are areas within the direct control of flexible packaging converters and suppliers, such as the development of recyclable mono-material structures and the development of paper-based structures with barrier properties. However, most of the gaps, including consistent recovery systems rules or investment in sortation technology for flexible packaging are areas where the industry does not have direct control and will require significant collaboration with others to influence and drive systems to integrate flexible structures into a circular economy.

Figure 5-2. Overall Flexible Packaging Industry Current State to Future State



Design

FPA members and the global flexible packaging industry will be able to most directly influence the design area. This is mostly focused on materials and technologies that can drive to a better future state. Many brand owners, and some flexible packaging converters, have signed onto the Ellen MacArthur Foundation Global Commitment[32] to have all of their packaging be recyclable, reusable, or compostable by 2025. This will require significant innovation in the development of flexible packaging.

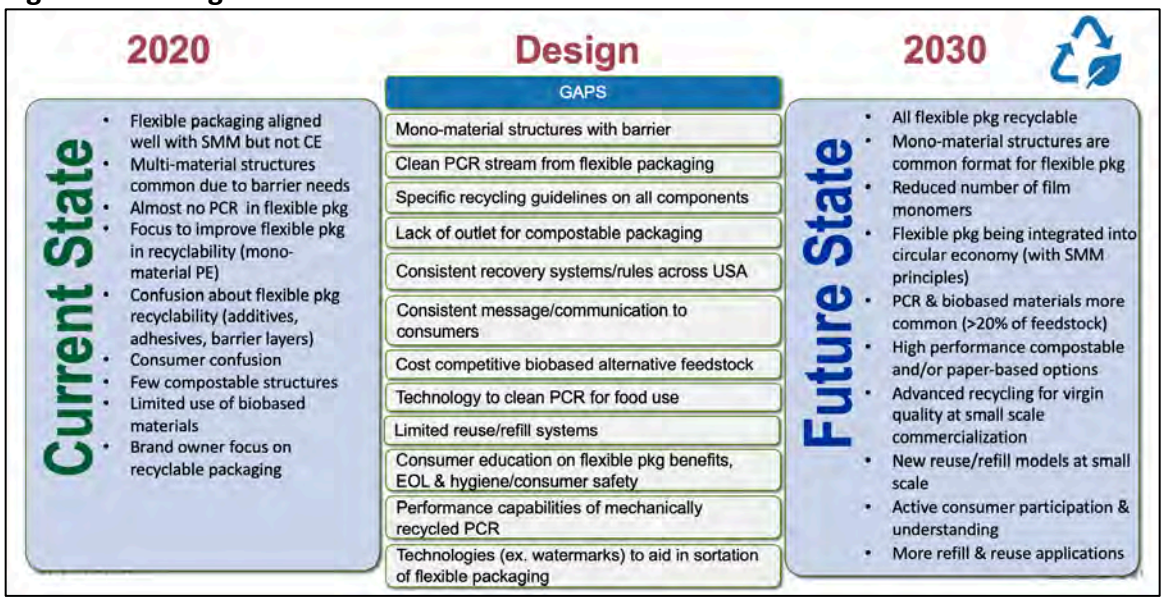
Important future state actions will include investment in the development of high barrier mono-material structures, inclusion of PCR and bio-based materials as feedstocks, more consistent consumer communication and understanding of flexible

[32]Ellen MacArthur Foundation Global Commitment - https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy/global-commitment

packaging recovery, and having new refill and reuse models in place. Additionally, flexible packaging converters in the future will need to have a wider portfolio of recyclable or compostable options, which could include paper-based structures. The gaps (see Figure 5-3) highlight the need to design for recyclability and aid in the collection and sortation processes through new technologies such as digital or chemical watermarks.

The model below (Figure 5-3) shows the current state, gaps, and future state for the design component.

Figure 5-3. Design Current State to Future State



Collection

Today, used flexible packaging is almost entirely collected via store drop-off programs, where consumers deposit grocery store bags or polyethylene (PE) based flexible packaging such as overwraps for beverages, paper towels, bread bags, or mono-material PE pouches into a bin at the front of participating stores. A challenge with this infrastructure is that it is administered by retailers, who may cut off collection at any time. Some retailers are looking to drive consumers toward reusable bags and will no longer be utilizing plastic grocery store bags. Bag drop off programs also require an additional step for consumers to take their bags back to retailers. As more consumers shop online, the number of trips to traditional retailers may be reduced. Regardless, the store drop-off programs will be critical to maintain in the short to mid-term until curbside and metro area pickup of flexible plastic packaging (FPP) is more common.

The future vision for flexible packaging collection is about making it more convenient for consumers. The Material Recovery for the Future (MRFF) project showed that flexible packaging can be collected curbside, with an investment in consumer curbside carts with lids so materials stay dry. While it is not yet known if flexible packaging will be

placed into carts loosely or bundled in a master bag (or another format), nearly all experts in the packaging value chain interviewed as part of this project believe that flexible packaging will need to be collected at curbside to achieve scale for collection and sortation. Another gap that must be addressed is the lack of consistency in materials and formats that are recovered based on geography and local MRF capability.

Additional critical gaps include driving collection in more places, particularly away from home, more multi-family dwellings, and dense urban locations. Finally, the collection of food waste and compostable materials will need to be increased dramatically in the years ahead. There is a current United Nations Sustainable Development Goal to reduce food waste 50% by 2030. Decomposing food waste is a major contributor to greenhouse gases[33]. The service needs to include both at home and foodservice collection, and could drive the use of compostable flexible packaging, in particular for foodservice, and contribute to lowering overall GHG emissions.

It is important to note that enhanced collection for all packaging materials will be critical by 2030. It is unlikely that flexible packaging will be the driver for improved collection in away from home and multi-unit housing, as rigid plastics and other materials are an easier step for service expansion and result in higher volumes for later reprocessing. However, it is essential that the flexible packaging industry be ready to engage and ensure it is included as the expansion of collection services emerges.

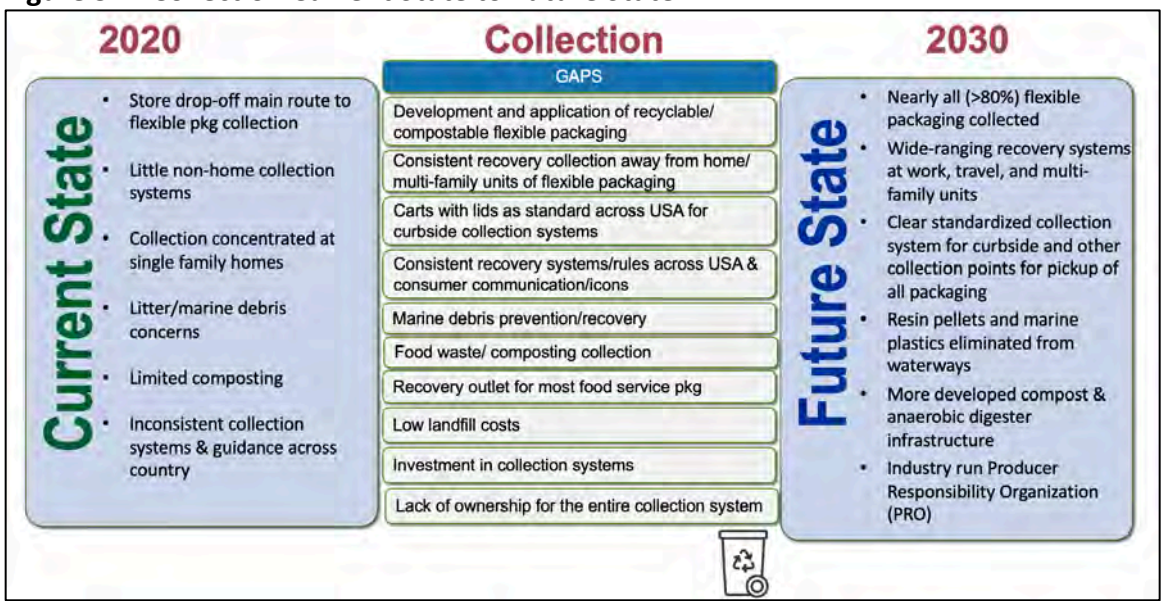
Finally, a potential component of the future state for collection, and many of the other focus areas including sortation, reprocessing, and end markets, is the formation of an industry-led Producer Responsibility Organization (PRO). A PRO is a collection of companies with joint responsibility and authorized/financed collectively or individually by producers (brand owners, private brand retailers). The purpose is to take responsibility for the collection, sortation, and ultimately finding end markets for packaging generated to ensure environmentally sound management. The PRO would play a key role in developing fees for different packaging materials based on several factors, including end-of-life options, and help manage the collection, sortation, reprocessing, and identification of end markets for packaging materials. The fees are then used for investing in the necessary technologies and infrastructure to process packaging materials, which ultimately help enable the circular economy for packaging.

A PRO is often formed after a country, state, province, or region implement Extended Producer Responsibility (EPR) laws requiring fees on materials to help fund recovery infrastructure. It is possible, however, for a PRO to form voluntarily in the absence of legislation, though far less likely. Regardless of legislation, the formation of an industry-led PRO plays a vital role in helping manage and take ownership of the entire packaging

[33]Food Waste - https://www.greenbiz.com/article/reducing-food-waste-could-dramatically-cut-ghg-emissions

recovery system. An example of a PRO would be Recycle BC[34] in British Columbia, Canada.

Figure 5-4. Collection Current State to Future State



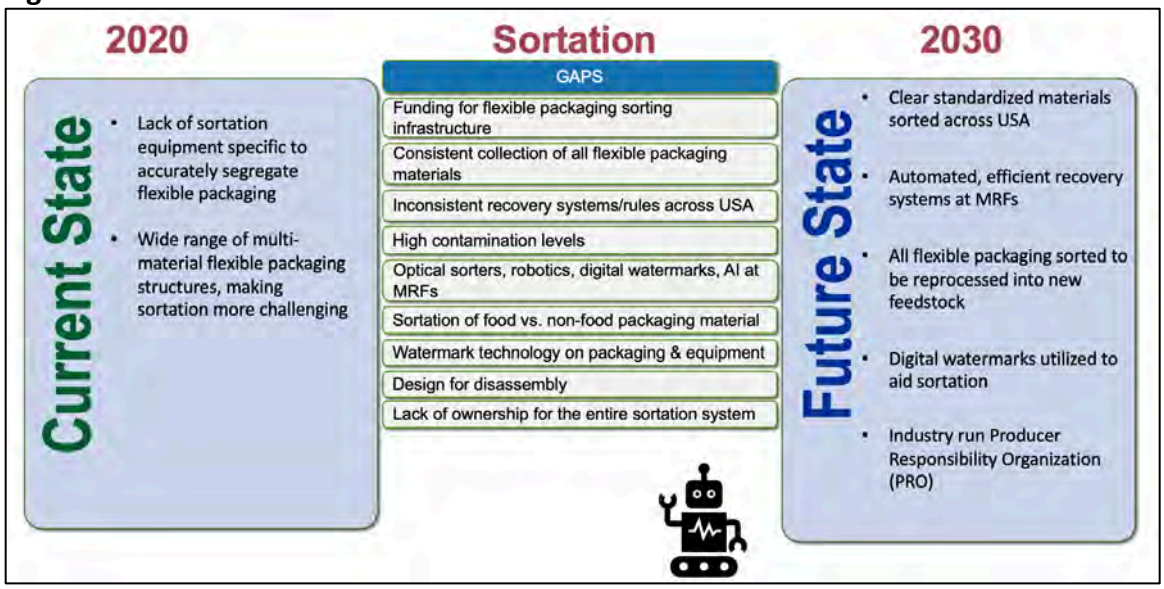
Sortation

After collection, materials are typically sorted into specific material streams (paper, corrugated, steel, aluminum, PET bottles, HDPE bottles, mixed plastics, etc.) at a Material Recovery Facility (MRF). Plastics can go through an additional sortation process at a Plastic Recovery Facility (PRF) where they are further segregated by type of plastic.

There are many significant gaps in sortation that need to be addressed to achieve a future state where flexible packaging is sorted for reprocessing. These gaps will require significant capital investment in optical sorting equipment, robotics, and the use of artificial intelligence (AI) at MRFs. The MRFF project highlighted that FPP sortation is possible through the use of multiple optical sorters, which will become more common in MRFs over time as a way to drive more efficient sortation and lead to higher quality bales. Additional technologies such as digital or chemical watermarks that can be printed or embedded into packaging, could work in tandem with optical sorters and robots to further enhance sortation quality.

[34]Recycle BC - https://recyclebc.ca/

Figure 5-5. Sortation Current State to Future State



Reprocessing

Reprocessing is the step where collected materials are taken from an MRF (typically in bales) and converted into a feedstock that can be sold for end markets and ultimately turned into new packaging, thereby enhancing circularity. Examples of reprocessing include mechanical recycling, as well as advanced recycling where the end product feedstock may be chemical monomers, polymers, syngas, fuels, or waxes. Reprocessing can also include steps to remove contamination from plastics bales or take steps to remove components such as ink that would lead to a more valuable end product.

Reprocessing includes applications where the collected packaging can be turned into a pellet or flake and used again in a plastic packaging application (ex. flakes from grocery bags turned into a new grocery bag). It may also include examples where a plastic component that cannot be used in the same application (such as a pouch holding chemicals), but could be used in other applications such as a rigid motor oil bottle or for durable goods like plastic railroad ties or parking lot bumpers, or even as a component to improve roads (see New Activities in Flexible Packaging chapter).

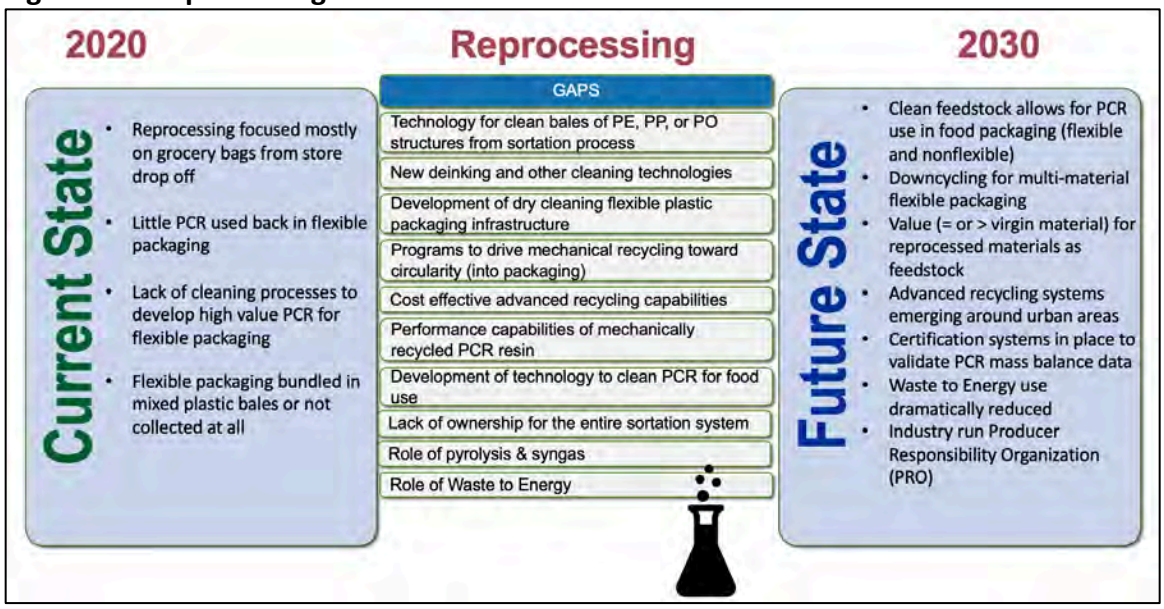
There are significant gaps in the reprocessing state for these materials such as the development of dry-cleaning infrastructure that was identified during the MRFF project. Additionally, investment in mechanical recycling for flexible packaging and advanced recycling technologies hold promise to take collected materials back to monomer or polymer levels where they can be used as a feedstock for new packaging (including flexible packaging) providing the same quality and cleanliness as virgin material.

Mechanical recycling will likely continue to be the dominant method for recycling flexible packaging in the next decade as advanced recycling processes tend to be more energy intensive. Advanced recycling, however, will play a critical role in further enabling a circular economy for flexible packaging, particularly for multi-material

structures such as medical packaging or where specific performance attributes are critical. This technology could also play a major role in reconstituting plastics back to the monomer level, particularly as polymer chains are broken down and have lower performance attributes from continuous mechanical recycling, which weaken the bonds. By 2030, there will be some emerging advanced recycling technologies starting to reach mid-sized or even large scale.

Similar to collection and sortation, a major investment into reprocessing infrastructure will be required.

Figure 5-6. Reprocessing Current State to Future State



End Markets

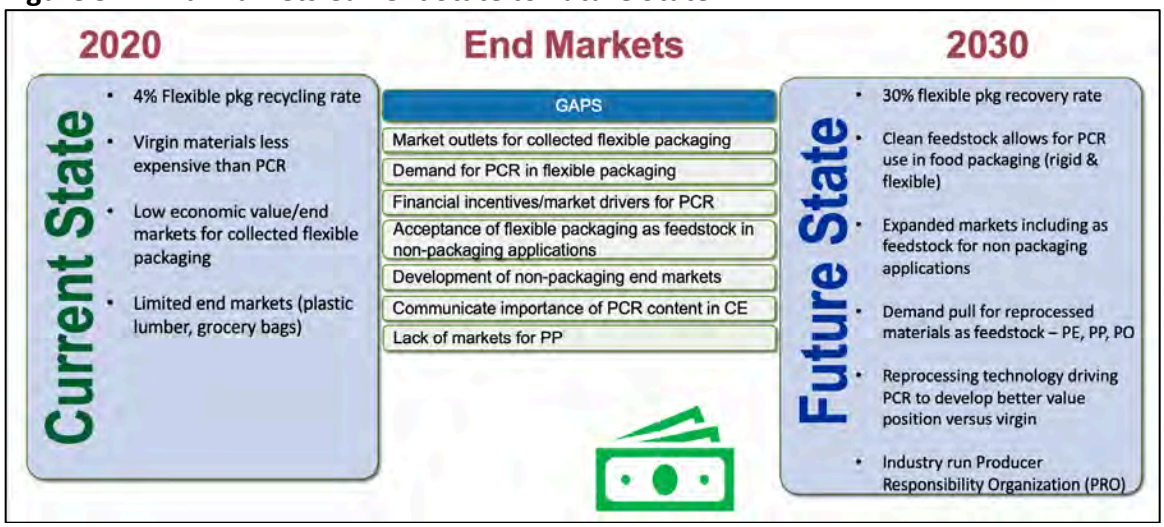
End Markets are where reprocessed materials are converted into valuable feedstocks that are turned into new products or packages that can then be used again in a new life, thereby creating circularity. Without the collected material being considered to be of value to someone else, there is no incentive for anyone in the packaging value chain to collect, sort, and reprocess waste materials.

In today's current state, flexible packaging has a very low recycling rate of about 4% and is viewed as a non-valuable for many end markets (especially non-PE structures). The reason for this is because the material cannot be easily used as a feedstock in new packaging or products. This is especially true for multi-material structures. Additionally, in 2020, the low price of virgin materials has made it very difficult for PCR material to compete as a viable feedstock as it is often more expensive, has lower consistency, and provides lower performance than virgin materials.

The key for new end markets will be to have a consistent, clean feedstock from the reprocessing step, along with demand pull from brand owners to drive investment.

Demand may also be created by legislation as is being done in parts of Europe with requirements for levels of PCR inclusion in packaging or taxes on virgin materials. At first, it may be that the best end markets for collected FPP are in non-flexible packaging applications such as rigid containers or even non-packaging applications. Over time, as cleaning technologies improve, PCR inclusion back into more flexible packaging will play a larger role.

Figure 5-7. End Markets Current State to Future State



Policy/Legislation

The final area of focus is around Policy and Legislation. This is clearly an area in which the flexible packaging industry does not have specific ownership but can have influence in helping to shape future output.

It is becoming more apparent in 2020, that government involvement, particularly at the federal level, will be an important driver in developing and funding collection and sortation infrastructure, and in influencing end markets. (See Chapter 12 – Packaging Sustainability Legislation for more specific examples of state, national, and global legislative actions impacting packaging)

Currently, there are several targeted bans at the local or state level on single-use plastics, particularly around foodservice use (straws, cutlery) and plastic grocery store bags. Additionally, many states are considering different Extended Producer Responsibility (EPR) regulations that would put the onus for funding recovery infrastructure on brand owners (including retailer private brands). While the U.S. has a goal to reduce food waste by 50% by 2030[35] (from 2015 levels), the initiatives are voluntary and generally not focused on overall greenhouse gas reductions that can be

[35] https://www.epa.gov/sustainable-management-food/united-states-2030-food-loss-and-waste-reduction-goal

enabled through packaging (extended shelf life of products) or the collection of food waste (and compostable packaging). Finally, many of the legislative considerations have been slowed in 2020 due to a focus on COVID-19 responses, but many are expected to return as consumers look for sustainability focused initiatives.

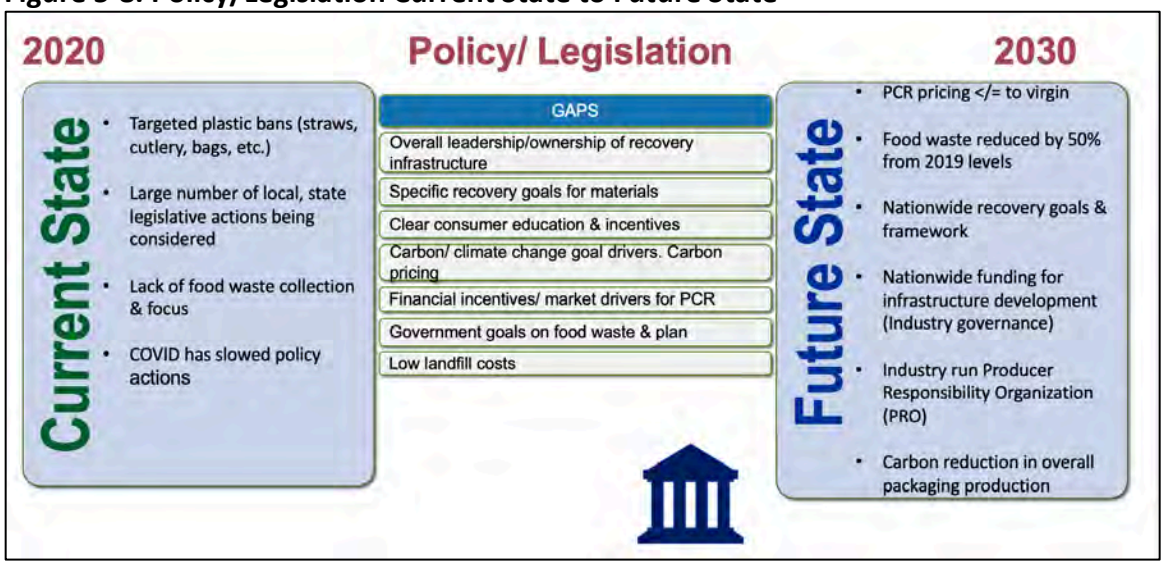
In the envisioned future state, it is thought that food waste will be reduced significantly from 2020 levels, and it is very likely that we will have a nationwide funding system (either through EPR or other laws), that will drive funding for recycling, composting, collection, sortation, and reprocessing infrastructure. Whether through pricing incentives/taxes or investment in new technology, pricing for PCR material will need to approach the price of virgin material, further helping end-market growth.

An important gap across the entire packaging value chain and collection process is a lack of ownership from any one entity to drive substantive change. Interviews with many members of the packaging value chain indicate that they believe government involvement could help incentivize and drive infrastructure investment necessary to achieve the future state in the collection, sortation, reprocessing, and end markets. This is where an industry led PRO could play a pivotal role in taking that ownership. Potential areas for government involvement could include:

- a push for nationwide EPR
- price/tax incentives for PCR material
- investment in recovery infrastructure
- setting nationwide recovery goal
- considering a carbon tax (potential for packaging to have a positive impact through food waste reduction)

Note that the packaging industry is already heavily influenced by legislation, often at the state or local level, through material bans or bag bans. A more proactive approach will be needed before 2030 to help drive toward a future state where investment is made in the critical infrastructure for flexible packaging.

Figure 5-8. Policy/Legislation Current State to Future State



Summary

The current state to future state models are meant to provide a realistic view of the challenges (gaps) ahead, to provide a vision to drive flexible packaging recycling higher and play an important role in a circular economy by 2030. The flexible packaging industry has the most direct control over the design phase but can help inform and work with leaders in the areas of collection, sortation, reprocessing, and end markets as all will be critical in reaching a state where flexible packaging is not only recyclable but actually recycled.

A key component is ownership of the entire process. The formation of an industry led Producer Responsibility Organization (PRO) will be critical to help identify lead technology and investment opportunities throughout the recovery process. The PRO would be focused on all packaging, not just flexible packaging. This organization would "own" the process for collecting, sorting, and reprocessing investment to drive recycling goals for all packaging materials. The investment dollars would come from either membership fees, or more likely, from government funding and fees from legislation such as EPR.

The challenges for integrating flexible packaging into the circular economy are extensive but can be done with pervasive collaboration and designing for recyclability. In short, it must be done, because consumers, governments NGO's and all parts of the value chain are demanding it be done.

List of Acronyms

APR	Association of Plastics Recyclers
Bad VUCA	Volatility | Uncertainly | Confusion | Ambiguity
CE	Circular Economy
CEFEX	Circular Economy for Flexible Packaging
EPR	Extended Producer Responsibility
FPP	Flexible Plastic Packaging
Good VUCA	Vision | Understanding | Clarity | Agility
MRF	Material Recovery Facility
MRFF	Materials Recovery for the Future
NGO	Non-Government Organization
PCR	Post-Consumer Recycled
PE	Polyethylene
PO	Polyolefin
PP	Polypropylene
PRO	Producer Responsibility Organization
SMM	Sustainable Materials Management

Chapter 6

Risk Assessment (Headwinds/Tailwinds)

Introduction

One of the challenges in preparing a roadmap is incorporating uncertainly into the document. Flexible packaging may be particularly challenging because very little of it is recycled currently. It has become something of a symbol for the improper disposal of used packaging. Although there are many very intriguing and attractive options, there is no single solution that has emerged to drive end of use.

In keeping with the metaphor of a roadmap, we originally titled this chapter "Speed Bumps." However, we felt that a more appropriate title would be "Headwinds and Tailwinds." A tailwind can increase an object's speed and significantly reduce the time required to reach the desired destination. A headwind, of course, can have the opposite effect. Unlike a speed bump, the issues and ideas that are presented here could very easily shift either way – accelerating the envisioned timeline or slowing down progress.

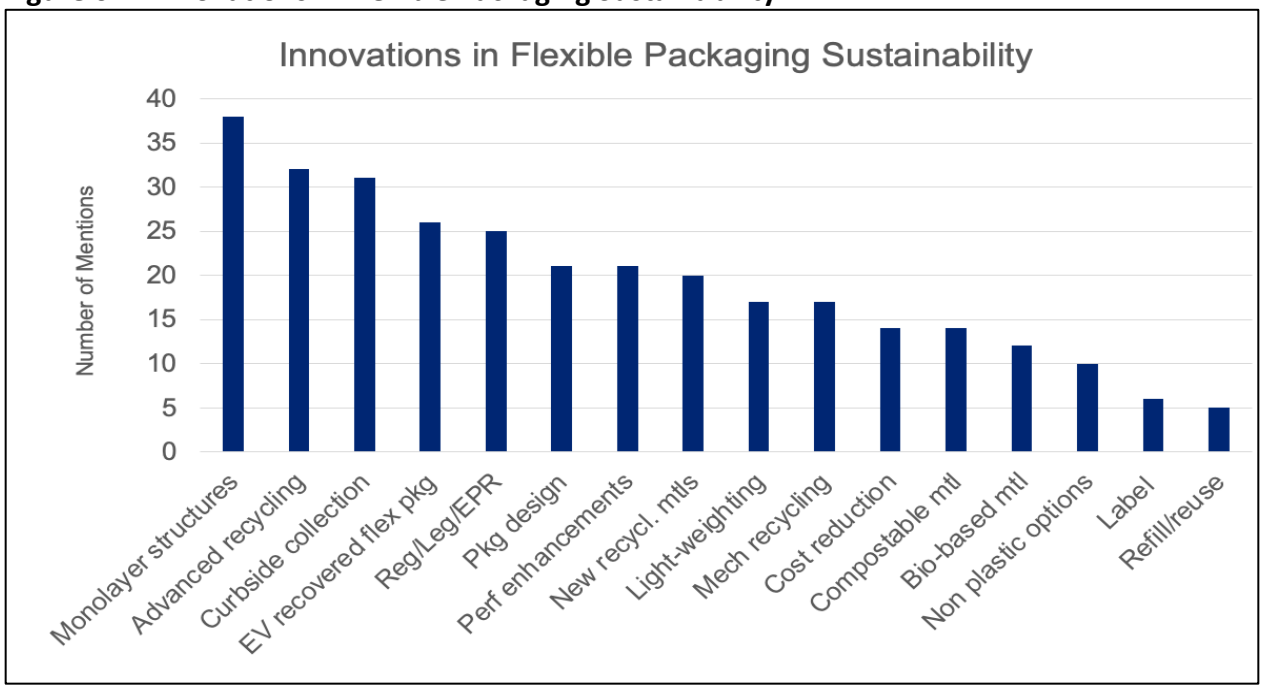
The summary descriptions of each headwind/tailwind are purposefully neutral. The table at the end of this chapter presents all issues from the perspective of a tailwind – a positive force that may or may not happen.

Background

In the late spring of 2020, PMG and PTIS surveyed the FPA membership. The purpose of the study was threefold: to take a pulse of the membership on key issues relating to sustainability, develop a deep understanding of member opinions and perceptions, and to test the alignment of perceptions and opinions internally and with the marketplace. The results were based on 61 completed surveys.

One of the questions asked was, "In what areas do you foresee the most important innovations in flexible packaging sustainability coming from over the next 3-5 years?" The results of this question are presented in the following chart in Figure 6-1:

Figure 6-1. Innovations in Flexible Packaging Sustainability



While the original point of the question was to identify areas of needed innovation, it also implies potential roadblocks or speed bumps – if these innovations do not happen, or do not happen quickly enough. For example, mono-material structures were most frequently identified as an area where innovation will occur in the next 3-5 years. If this happens, it will improve the opportunity to successfully recycle flexible packaging substantially. If it does not happen quickly enough, the industry will gravitate to other technologies such as advanced recycling or optical sorting as a way to reach recyclability goals.

Looking at the top five areas of innovation, it is interesting to note that only one is dealing with the physical package itself. Four of the five are issues related to recycling infrastructure or the regulations that will drive recycling behavior. Most of the package-related innovations are mentioned far less frequently – note the position of compostable, bio-based materials, or non-plastic options.

We would interpret this to mean that the short-term solutions needed to achieve sustainability will come more from infrastructure and process-related initiatives, while material changes and associated technology are areas with a longer-term payoff, other than the move toward mono-material structures. Consequently, we include these top five innovations in this chapter.

Current Status

The position of flexible packaging as a sustainable packaging alternative in mid-2020 is not particularly strong. The recycling rate of flexible packaging is probably around 4% (see Current State of Flexible Packaging chapter 2) and there is almost no PCR used in flexible packages. Further, there is substantial consumer confusion over what packages can be recycled and how they might or should be recycled – a situation that is made worse by the limited collection and sortation infrastructure for flexible packaging.

There are numerous questions. But there are also potential tailwinds. And that is the focus of this chapter. The specific tailwinds/headwinds that are considered include:

- Mass Balance – Will there be enough PCR to satisfy demand? Will there be enough demand to utilize the available PCR?
- Advanced Recycling – How quickly can advanced recycling spread to major U.S. cities or will NIMBY (Not In My Backyard) resistance win out?
- Bans, Legislation – What government regulatory action will be taken?
- Mono-material Structures – Can performance based mono-material structures be developed fast enough and at a cost-effective price point, with enough performance to allow substitution for multi-layer packaging?
- Carbon Footprint – How will climate change and associated actions impact flexible packaging?
- Curbside (and other) Collection – Can the U.S. build out a collection infrastructure sufficient for the envisioned growth in the availability of PCR from flexible packaging?
- Value of Recovered Packaging – What markets can be discovered or developed to provide pull-through demand for recovered flexible packaging?
- Microplastics – Can the U.S. successfully reduce and eventually halt the flow of waste into the world's oceans?
- Pandemic – Will the current COVID-19 pandemic or one that is yet to be encountered push converters and brand owners toward or away from flexible packaging?
- Social Media – Will Facebook posts tell the LCA story of flexible packaging or will an Instagram photo of ocean waste be widely shared and slow progress toward sustainability goals?

Mass Balance

The concept of mass balance is to measure the volume of used plastic (one side of the balance) and compare that to the amount consumed as mechanically or chemically recycled, reprocessed, reused, converted to energy, or landfilled (the other side of the balance). It can be used to understand available volumes of post-use products and to verify claims of recycled content.

The American Chemistry Council's Plastics Division recently announced a set of standards designed to help brands and others use more recycled content, and to

accurately communicate with consumers. The standards can also be used by resin manufacturers as traceability standards to increase confidence in recovery and advanced recycling technologies.

The ACC's Mass Balance Certification Principles consist of three core principles and eight enabling principles. The three core principles address chain of custody traceability, attribution of credit, and use of third-party audits.[36]

Closed Loop Partners Executive Director Allison Shapiro has observed that in North America, the supply of post-consumer plastic resin could only meet 6% of demand. If every company set a goal of 25% post-consumer content, it could not be met.[37]

Ben Jordan, Coca Cola's Senior Director of Environmental Policy, reinforced Ms. Shapiro's claim when he said, "You've got to have enough bottles to come back through the recycling infrastructure to create the supply in the first place. When we look globally around the world, our A-No. 1 priority is getting the collection rate on our packaging up."[38]

Michael Bermish, a senior consultant at chemicals and energy consulting firm Wood Mackenzie, also concurs with the shortfall in supply of recycled resin, saying that "our analysis is that the industry will fall far short of collecting enough bottles to meet their requirement."[39]

The pandemic is exacerbating what was already a tricky problem for beverage producers: getting enough clean, food-grade used plastic to make new bottles. Despite being easily recyclable, less than a third of PET bottles sold are collected for recycling in the U.S., and just 4% are used to make new drinks bottles, according to the Container Recycling Institute, a nonprofit. Other estimates are that 6% of all PET used for bottles makes it back to the market in the form of new bottles.[40]

More than 100 municipalities in the U.S. halted curbside recycling programs as the pandemic struck, while nine out of 10 states with deposit programs—where shoppers get cashback for returning containers—initially suspended requirements for retailers to participate.

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[36] https://plastics.americanchemistry.com/recycling-and-recovery/Mass-Balance-Certification-Principles-2020.pdf

[37] "https://www.greenbiz.com/article/will-recycled-plastics-survive-tanking-oil-prices

[38] ibid

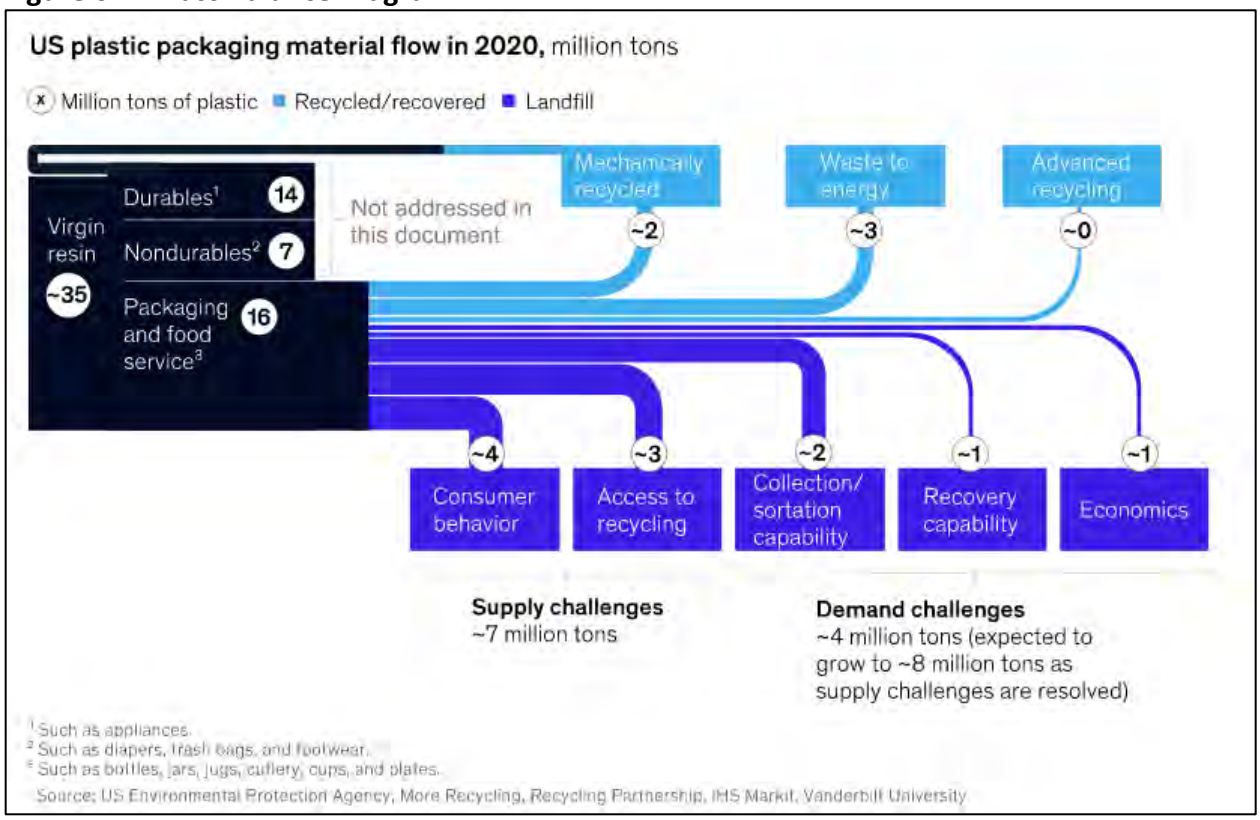
[39] https://www.wsj.com/articles/how-the-coronavirus-complicated-the-quest-for-a-greener-plastic-bottle-11593005945?mod=searchresults&page=1&pos=1

[40] https://thenextweb.com/syndication/2020/04/25/chemical-recycling-could-be-the-solution-to-plastic-pollution/

In response to the gap between the supply of recyclate and growing demand, the Consumer Brands Association has come out in support of a fee on virgin plastic. The fee would be used to finance recycling programs and make recycled material more cost-effective.

In a recent white paper, "Accelerating Plastic Recovery in the United States," McKinsey & Company presented a simple diagram illustrating the challenges of growing the volume of recycled or recovered plastic packaging waste.

Figure 6-2. Mass Balance Diagram



McKinsey identified five challenges that are currently restricting the rate of recycling. Consumer behavior includes failure to use available recycling mechanisms, confusion, and apathy. Forty five million households lack access to curbside recycling. Current collection and sortation technology is ineffective in dealing with approximately 30% of plastic packaging. Much of that is flexible packaging, which often ends up in paper bales or in residual waste which is landfilled. There are some advanced recovery technologies, including pyrolysis and dissolution, but all are operating at a limited scale in the U.S. Lastly, while some plastics – including PET, HDPE, and PP – have economic value, residual bales, which make up around 20% of MRF volume, have no value and are

landfilled. Advanced sorting technologies or secondary sorting can help to address this issue.[41]

McKinsey's analysis includes all plastic – packaging and others, and both flexible and rigid structures. However, the categories of landfilled and recovered/recycled in the diagram are the same for flexible packaging and the challenge is greater than illustrated, as only 9% of flexible packaging is currently not landfilled (post-industrial and post-consumer).

The bottom line is that there will almost certainly not be enough material available for PCR needs in 2025, and likely in 2030 as well. The tailwind that would change this likely scenario is a monumental push into collection, sortation, and reprocessing. However, the focus for PCR will be initially on rigid packaging applications as those are relatively easier and can have a larger and more visible impact. Usage of PCR in flexible packaging will go up but will initially be in non-food/beverage applications. While flexible packaging will inevitably play a larger role in the circular economy, if advanced recycling takes off faster than anticipated, it would be a boon for PCR content in flexible packaging. If not, it will be far more difficult to get PCR into flexible packaging for food applications.

Advanced Recycling

Advanced recycling breaks the plastic down to the molecular level, making available "platform molecules" that can then be used to make other materials such as pyrolysis oil or monomers. Plastics are largely very stable materials, so they generally need a good deal of energy to break them down, by using thermochemical processes, hydrolysis, or solvolysis.

In addition to these three processes, somewhat on the fringe of advanced recycling, are efforts to break down plastic molecules using naturally occurring micro-organisms that can digest plastic. There are up to 50 known "plastivore" micro-organisms that can digest plastic because they contain enzymes that help break down the molecular structure. But using these natural processes can be challenging because the biological organisms must be kept alive and doing so requires specific conditions such as temperature and pH levels. Also, they often take a long time to complete the process.[42] Despite these hurdles, this avenue of research continues and if successful, could radically alter the recycling path for flexible packaging.

BP developed a technology, with the tradename BP Infinia, that the company says will transform unrecyclable polyethylene terephthalate (PET) plastic waste into new, virgin-

[41] https://www.mckinsey.com/industries/chemicals/our-insights/accelerating-plastic-recovery-in-the-united-states

[42] https://thenextweb.com/syndication/2020/04/25/chemical-recycling-could-be-the-solution-to-plastic-pollution

quality feedstocks. BP is planning to build a U.S. $25-million pilot plant in Naperville, Illinois to prove the technology. The plant is targeted to be operational in late 2020. If successful, BP may then move on to full-scale commercialization.

There are at least two other companies that have announced comparable technologies. OMV, an Austrian oil and gas company, and Austrian Airlines partnered in 2019 to turn used plastic cups from the airline into synthetic crude that could be later processed into fuels or other plastic products. Dow Inc. announced in August 2019 that it is partnering with the Netherlands-based Fuenix Ecogy Group to turn recycled plastic waste into oil. Dow will use the feedstock, known as pyrolysis oil, to produce new polymers at its manufacturing site at Terneuzen, the Netherlands.[43]

Advanced recycling could complement mechanical recycling, especially for problem materials in physical recycling such as thin films and microplastics. The share of recycled material can also be allocated to specific products by a third-party auditor. Such products can be certified as containing PCR and are indistinguishable from products manufactured using virgin resin from fossil feedstock. They can be used in demanding applications including food packaging.[44]

Although many in the packaging industry see advanced recycling as "the" answer or a significant part of the overall solution to the challenges facing flexible packaging, the technology does face significant hurdles. First, it can take 15-17 years to move from concept to commercial stage production. Substantial investment will be required to make advanced recycling a viable, large-scale component of flexible packaging recycling before 2030. Secondly, as currently envisioned and operationalized, it is expensive – some of the cost is due to the high cost of sorting, separating, and cleaning recovered plastic.[45] Thirdly, the process requires plastic material that is of suitable quality, with low levels of contamination and at sufficient volume to meet demand. These are some of the same challenges facing the mechanical recycling infrastructure.[46]

As done currently, advanced recycling is carbon intensive and generally uses much more energy than mechanical recycling. Other headwinds include the relatively high cost and the carbon impact. By 2030, advanced recycling will likely be centralized systems located within an economic transport radius of major metro areas. If advanced recycling can accommodate difficult-to-recycle multi-material structures, and allow flexible packaging to more easily incorporate PCR, it could certainly be a tailwind for flexible

[43] https://thenextweb.com/syndication/2020/04/25/chemical-recycling-could-be-the-solution-to-plastic-pollution/
[44] https://www.basf.com/global/en/who-we-are/sustainability/we-drive-sustainable-solutions/circular-economy/mass-balance-approach/chemcycling.html
[45] https://resource-recycling.com/plastics/2020/02/26/the-big-issues-in-chemical-recycling-theyll-sound-familiar/
[46] https://www.greenbiz.com/article/5-things-you-need-know-about-chemical-recycling

packaging, providing a circular loop back into new packaging. It is likely that we will see only small to mid-scale implementations for FPP by 2030.

Bans, Legislation

Bans on plastic bags, straws, and foam containers have been debated for years. And the effectiveness of bans has been brought into question.[47] Three states – California, New York, and Hawaii – have statewide bans on plastic bags. (Technically, Hawaii does not, but all counties in the state have their own bans.) More recently, at least 13 states have enacted bans on bans, preventing local jurisdictions from enacting bans that effectively create a patchwork of regulations impacting certain types of plastic products.[48]

One of the challenges introduced by the recycling of plastics – and a key point raised by those favoring bans – is the cost of recycling. Not only is it difficult to recover and reprocess plastics, but it can also be expensive. EPR (extended producer responsibility) may be an answer.

EPR is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent waste at the source, promote product design for the environment, and support the achievement of public recycling and materials management goals.[49] It is a policy that is widely used in Europe, parts of Asia, and certain provinces in Canada.

Terri Goldberg, executive director for the Northeast Waste Management Officials' Association (NEWMOA), said: "Under this budget crisis, municipalities, in particular, will be looking for ways to make cuts, and EPR for packaging … is one way to shift some of their expenses for municipal recycling services while maintaining a high level of service." That interest from local governments could in turn push state legislatures to look more closely at EPR.[50]

In fact, some see the current environment as a catalyst that may shift slow-moving EPR legislation into high gear. "Disruptions like this allow us to step back and envision a new reality. [They] offer the opportunity to put a broken recycling system back together in a better way," said Scott Cassel, CEO and founder of the Product Stewardship Institute (PSI).

A bill making its way through the Maine (LD 2104) legislature in 2020 would require producers with more than $1 million in annual gross revenue to pay into a managed

[47] https://www.nationalgeographic.com/environment/2019/04/plastic-bag-bans-kenya-to-us-reduce-pollution/#close
[48] https://www.plasticsnews.com/article/20190503/NEWS/190509975/the-united-states-of-bans
[49] https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm
[50] https://www.wastedive.com/news/epr-coronavirus-covid-19-extended-producer-responsibility-maine-new-york-california/576612/

fund, with participating municipalities then eligible to be reimbursed for recycling and disposal costs. Since the Maine Legislature is adjourned at the time of this writing, the bill may have to be reintroduced in 2021.

Massachusetts has one bill in committee. New York had two bills introduced in 2020, but both are now in limbo. A major pair of California bills are on pause at the time of this report's writing, with one of the bill's sponsors quoted in the San Francisco Chronicle as saying it is unclear whether they will be a priority again this year.

The topic is far from settled. One of the main Democratic pieces of legislation around plastics, the Break Free from Plastic Pollution Act, includes an EPR system and bans 10 types of single-use plastic products.

Other legislation, like the plastics industry-supported RECOVER Act, advocate general federal tax dollars be used to finance better recycling. (See Chapter 12 for additional information on legislation)

Because of the challenges in creating national EPR legislation, some forecast that EPR will be enacted at the state level, gradually rolling out to multiple states and then, finally, to national legislation at some point in the far distant future. The speed of adoption will almost certainly impact the corresponding availability of funding and thus the rate of investment in the recycling infrastructure.

We are almost certain to see substantially more legislation coming in the next decade. If EPR happens state by state, it could be viewed as a headwind because of the complexity of different systems in place in each state. Bans on single-use packaging would also be a headwind, as those have not been thoroughly defined. A national EPR initiative could make it easier for overall consistency and lead to the development of an industry led Producer Responsibility Organization (PRO). This may be needed to get everyone involved in owning the entire collection – sortation – reprocessing – end market chain. If Democrats control multiple branches of government, the implementation of EPR could move much more quickly; the speed of adoption may be a headwind as some companies are not willing to move quickly for fear that brand owners will not pay. We could also see legislation on minimum PCR requirements, bans on materials, recycling targets. Based on perspective, EPR could be viewed as a headwind or a tailwind. For a tailwind, it would require industry to be involved in the development of EPR legislation and management through an industry-led PRO that ensures fees are used to fund recovery infrastructure, and not solely as a tax into a general fund. This certainly highlights the need for the industry to help shape relevant legislation.

Mono-material Structures

There are many barriers to effective recycling. In other sections of this report, we discuss issues such as consumer behavior that does not support recycling, under-developed recycling supply chains, inadequate technology at recycling facilities, and others. Many in the flexible packaging industry believe that mono-material can provide a large piece of the ultimate solution as these materials could be recycled as part of the store drop-off programs, where plastic polyethylene grocery bags are recycled. Developing mono-material structures with adequate barrier and performance properties is the challenge.

Several companies are making substantial strides towards commercially viable mono-material structures, with some already commercially available.

- In late 2019, Dow and Enka de Colombia, a producer of synthetic fibers and polymers announced a developmental partnership. The companies are focused on the use of recycled materials in the production of flexible packaging, and the incorporation of recycled resins into different structures. They noted that the use of mono-materials will likely involve compatibilizers and other resins, so that materials can be recycled together with polyethylene[51] .
- Mondi and Jindal films developed a mono-material PP with high barrier for Unilever Knorr dehydrated soups
- Dow and NOVA Chemicals have both introduced mechanically recyclable barrier and pouch packaging using single polymer material. Both of the structures are approved for How2Recycle store drop-off recycling programs developed through collaboration with the Sustainable Packaging Coalition.
- Dow's "RecycleReady" technology uses 100% INNATE™ single-site polyethylene pouch materials. The company claims the material is more puncture-resistant than PET/PE and the barrier can be incorporated with an EVOH layer.
- NOVA Chemicals is offering Surpass® Octene LLDPE resins with improved sealability. NOVA tests show a 50% increase in moisture and oxygen barrier compared with HDPE and higher stiffness.[52] NOVA highlights applications in protein packaging, dry goods, fresh foods, and others on their website.
- In the fourth quarter of 2019, German cleaning products company Werner & Mertz GmbH was recognized as a Diamond Award Finalist in the Packaging Innovation Awards for a single-layer PE pouch with detachable, decorative panels. Their packaging supplier, Mondi, developed the main pouch body with

[51] https://www.packworld.com/issues/sustainability/article/21112587/flexible-packaging-and-the-circular-economy

[52] https://etouches-appfiles.s3.amazonaws.com/html_file_uploads/614b88274d66930fa242c97b7df9065c_Cooperpresentation.pdf?response-content-disposition=inline%3Bfilename%3D%22Cooper%20presentation.pdf%22&response-content-type=application%2Fpdf&AWSAccessKeyId=AKIA3OQUANZMMJEUYZBJ&Expires=1593209119&Signature=678C3fT6fsyR8wcGVLxoLUMdig0%3D

detachable front and back panels devoid of a barrier. The package is made from Dow's Dowlex NG 5056 G low-density polyethylene resin. The outer film is printed backwards creating a damage-secure surface on the outside. It is welded onto the main body[53]

The pace of mono-material flexible packaging development seems to be increasing and will likely be the avenue for flexible packaging to hit the recyclable packaging targets of brand owners.

Mono-material development is critical to help drive collection sortation, reprocessing, and effective end markets. What may begin as PE based in U.S., could also see polyolefin-based materials with PP needed for more difficult applications like retort and microwavable. The industry will need to work with APR and other international organizations like CEFLEX to develop consistent international standards. Clear definitions and consistent understanding of what additives, adhesives, barriers, etc. are accepted will create a tailwind, and drive an ongoing focus on product development.

Carbon Footprint/Global Warming

According to the Center for International Environmental Law, in 2019, the production and incineration of plastic – packaging and other plastics – will add more than 850 million metric tons of greenhouse gases to the atmosphere—equal to the emissions from 189 five hundred-megawatt coal power plants.[54] Another estimate of the carbon impact of the plastic produced in 2015 using conventional fossil fuels is 1.8 gigatons of carbon dioxide equivalent (1,800 million metric tons). If a figure of 380 million tonnes is used for annual global plastic production, this implies that every kilogram of plastic produced adds between 2.2 and 4.7 kilograms of greenhouse gases.

There are several ways to reduce the carbon impact of plastics.

- Recycling all plastic waste would reduce carbon dioxide equivalent emissions 25% from current levels.
- Using renewable energy to produce plastic could cut greenhouse gas emissions by 50% in 2050, even if the plastics are made from petroleum.
- Reducing plastic demand could result in a dramatic cut in emissions, especially if combined with using renewable energy for production. However, the performance benefits of plastic packaging along with generally rising population and income will make sizeable reductions in demand unlikely – and would be replaced by other materials that likely have higher carbon emissions.

[53] https://www.packworld.com/home/article/15693431/dow-diamond-finalist-100-recyclable-pe-detergent-pouch-with-detachable-panels

[54] https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-Executive-Summary-2019.pdf

- GHG emissions could be reduced by 93% from 2050 levels by the combination of using only sugarcane-based plastics with 100% renewable energy, recycling all plastic waste, and reducing the growth in plastics demand[55]

These figures include all plastic – packaging and others, and all types of packaging. It is interesting to note, however, that flexible packaging has substantial environmental benefits that are not fully considered in this analysis. Flexible packaging is lightweight, uses less material, aligns with sustainable materials management (SMM) principles, and produces lower GHG emissions – even when compared to other plastic package formats.

A key question in the discussion of the carbon impact of plastic is the relative impact of substitute products. Eastern Research Group, an independent research company, recently conducted a study sponsored by the American Chemistry Council that compared a mix of different plastic packaging with substitutes such as paper. The study determined the quantity of raw materials required and the electricity, fuel, water, and other raw materials needed to make, distribute, and consume paper and plastic packaging. The research concluded that plastic used fewer resources.

Plastic alternatives also have the advantage of being lightweight. So, not only production costs but transportation and end-of-use material management are less costly.[56]

Despite the advantages plastic has over substitute products, the volume of plastics produced and the resulting volume of GHGs emitted, make plastic a highly visible contributor to the production of GHGs at the global level. And usage of plastics is expected to grow steadily through 2050, making the GHG numbers even larger. As a result, some industry watchers are calling for fees or penalties based on the carbon footprint of a plastic product, along with other products. Food waste legislation or carbon taxes could be a tailwind for flexible packaging as it may help reduce overall food waste. Life Cycle Analysis (LCA) tools that help calculate the impact of product and package together would help to confirm this opportunity. This tailwind movement could help drive a focus on flexible packaging and perhaps even compostable packaging.

"We need to use economic drivers with very well-designed extended producer responsibility that is anchored fundamentally in the value we place on carbon so there would be fees, what's called eco-modulation, where the fees adjust based on the performance of that product," Nina Bellucci Butler, CEO of More Recycling.[57] Such fees

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[55] https://anthropocenemagazine.org/2019/05/reducing-the-carbon-footprint-of-plastic-is-doable-but-not-easy/#:~:text=Recycling%20might%20be%20the%20most,business%2Das%2Dusual%20emissions.

[56] https://www.npr.org/2019/07/09/735848489/plastic-has-a-big-carbon-footprint-but-that-isnt-the-whole-story

[57] https://www.plasticsnews.com/news/senators-argue-plastic-bans-note-failure-recycling?utm_source=pn-recycling-report&utm_medium=email&utm_campaign=20200624&utm_content=article1-headline

could be a tailwind to flexible packaging sustainability. EPR programs also have lower fees for the use of PCR which would add to the tailwind.

The use of bio-based films and the reduction in flexible incineration will help to reduce the associated carbon emissions. Improving recycling rates and the use of PCR will also reduce the demand for virgin resin. But the likely reality is that mismanagement of plastic waste, especially in the developing world, will continue along with incineration.[58] Materials like Braskem's I'm Green™ polyethylene, plastic produced from sugarcane can help address this issue by capturing CO_2 from the atmosphere during production, helping to reduce GHG emissions.

Curbside (and other) Collection

The Recycling Partnership's capture data shows that the average household generates 75 pounds of film and flexible materials per year. This suggests a residential supply stream of 7.3 billion pounds per year of flexible materials, just in the U.S.

Curbside collection is the primary vehicle for collecting post-consumer packaging waste. However, the infrastructure is inadequate and suffers from several systemic problems. Of the approximately 35 million tons of waste plastic produced in the U.S. each year (see the section on Mass Balance above), only 32% is currently captured by the curbside recycling system. In addition to literal curbside collection, there are other vehicles for post-use collection including store drop-off, industry, and office.

China banned imports of improperly sorted plastic waste in 2018, as part of a domestic crackdown on pollution called the National Sword. The National Sword initiative resulted in massive amounts of poor-quality recyclables backing up at U.S. and European ports and warehouses. Municipalities were forced to institute hikes in trash-collection fees as prices for recyclables dropped well below what China was paying.

But China's decision was the catalyst to begin a change in the recycling industry. Steve Alexander, president of the Association of Plastic Recyclers observed that "China didn't break recycling; it has given us the opportunity to begin investing in the infrastructure we need in order to do it better." Or, as David Allaway, a senior policy analyst for Oregon's Department of Environmental Quality said, "China finally is doing the responsible thing, forcing the recycling industry to rebuild its ability to sort properly and to focus on quality as much as it previously focused on quantity."

The direction of the rebuild is being sorted out, however, many industry associations, NGOs, and others are beginning to coalesce around a path forward. The Recycling Partnership has published five perspectives on U.S. curbside recycling that imply needed actions.

[58] https://www.inverse.com/science/plastic-pollution-prediction-2040

Table 6-1. Top 5 Perspectives on U.S. Curbside Recycling[59]

1	Curbside recycling in the U.S. currently recovers only 32% of available recyclables in single-family homes, leaving an enormous and immediate opportunity.
2	Only half of Americans have automatic access to curbside recycling, some who have access do not participate, and not all who participate do so fully. Access must be increased and the public must improve participation and recycling behavior.
3	Many communities are paying more to send materials to a MRF than the landfill. Helping recycling programs improve will require providing substantial funding support and addressing inexpensive tipping fees that make disposal significantly cheaper than recycling.
4	Contamination remains a critical issue, but it can be substantially reduced through the implementation of proven techniques.
5	Strong, coordinated action is needed in package design, capital investments, scaled adoption of best management practices, policy interventions, and consumer engagement.

The Closed Loop Fund, a $100 million effort implemented by several large companies to boost recycling, is providing no-interest loans and investments to municipalities seeking to upgrade their facilities. So far, the fund has invested $43 million for upgrades in Colorado, Connecticut, Illinois, Minnesota, and Pennsylvania.[60]

Improving the collection infrastructure is absolutely critical to achieving virtually any long-term sustainability goal. It is something of a chicken-and-egg issue as the supply and demand must be kept close to a balance and the value of post-consumer waste must be sufficient to justify the investment. Otherwise, government subsidies in some form will be required to make up the difference between market rates and that required for the cost of capital rates of return.

Collection will likely be a headwind for the time being. The focus in the short to medium-term will be on collecting rigid packaging, as that drives volume (helping companies and municipalities meet sustainability goals) and has higher end market value. FPP would benefit by finding ways to be included in curbside pick-up, either loose (like in the MRFF project) or in a master bag like the Hefty® EnergyBag® program. In dense urban areas, collection could be through drop-off depots such as currently undertaken in parts of Europe and British Columbia. Curbside bins allow flexible structures to blow away or get wet and stick to paper products – leading to contamination (as identified in MRFF). So, cart systems will be essential to keep flexible packaging clean and dry.

Economic Value of Recovered Packaging

As the COVID-19 pandemic began to unfold and financial markets recognized the potential hit on economic activity, a shock of historic proportions hit on April 20, 2020, as the price of crude oil dropped below zero. As a result, the price of virgin plastic resin plummeted. High-density polyethylene (HDPE) dropped 42%, polypropylene dropped 43%, and PET dropped 14%, based on figures from RecyclingMarkets.net.

[59] https://recyclingpartnership.org/stateofcurbside/

[60] https://www.sierraclub.org/sierra/2019-4-july-august/feature/us-recycling-system-garbage

Simultaneously, many municipalities and states, recognizing the benefits and need for single-use plastics among health care workers and their citizenry, repealed or put on hold regulations banning single-use plastics. For example, California's plastic bag ban had required reusable bags to include 40% recycled material. When the state allowed disposable shopping bags for public health reasons, the impact was far-reaching, and perhaps a bit unexpected.

Because virgin resin prices had dropped precipitously, and recycled resin prices had become substantially more expensive than virgin, the moment single-use laws were put on hold most plastic bag manufacturers switched to virgin resin. This caused concern that previous commitments to recycled content made by brand owner companies and retailers would fade along with the prices of virgin resin.

Under the New Plastics Economy, packaged goods companies pledged to use an average of 22% recycled content in their packaging by 2025. However, some highly visible companies pledging have indicated their commitments are long-term. For example, Ben Jordan, Coca-Cola's Senior Director of Environmental Policy, has said that low virgin resin prices and the pandemic may create some unforeseen situations, but the long-term goals and direction remain unchanged.

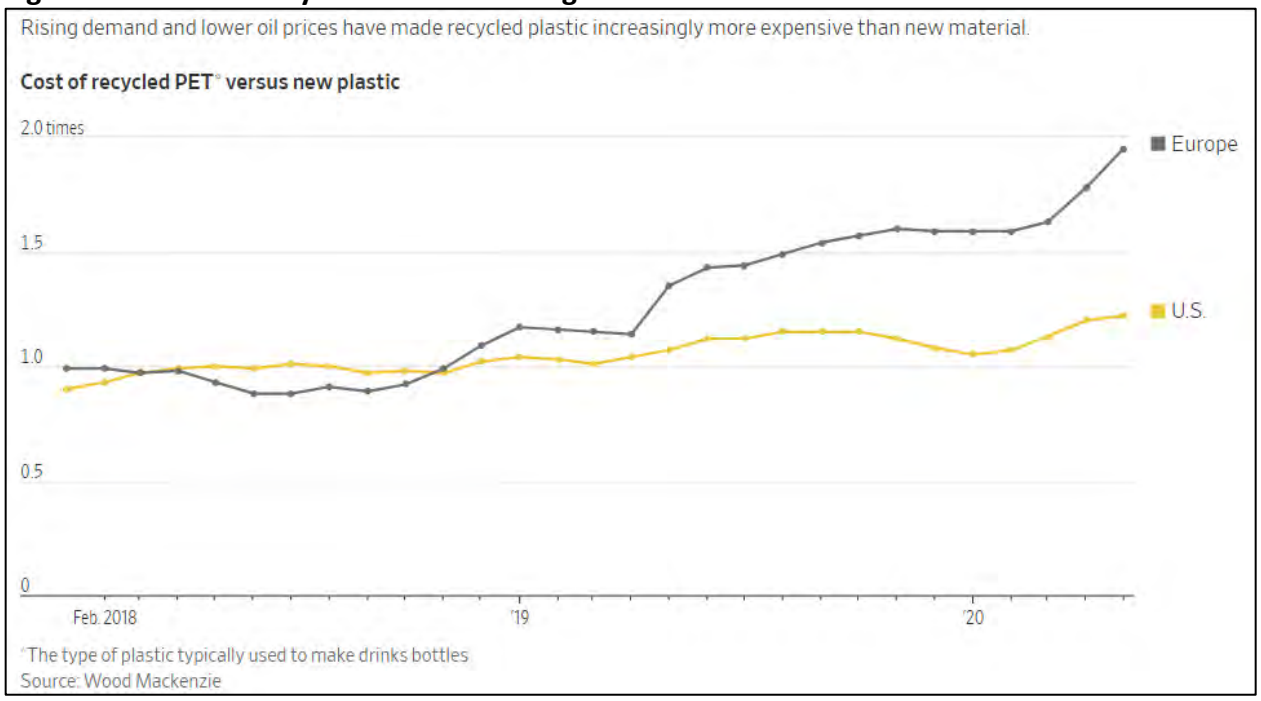
Coca-Cola has set goals of 100% recyclability of all its packaging by 2025, 50% recycled material in its packaging by 2030, and 100% of its packaging that enters the marketplace to reach a recycling system by 2030. The company launched "World Without Waste" in 2018 to drive circularity in all of its packaging, including PET bottles, glass, and aluminum.[61]

Despite these goals and statements that long-term objectives will be met, short-term goals are falling away. Coca-Cola missed a self-imposed May 2020 goal of using 50% recycled plastic in all its drinks bottles in the U.K., while Danone missed an April 2020 goal of using 100% recycled plastic for its Volvic bottles (sold in Germany). Danone missed similar targets in the U.K. and France. Both companies blamed COVID-19 for the delays.[62]

In Europe, the situation is more problematic, certainly with PET resin from a regulatory perspective. European Union rules mandate a 90% collection rate for plastic bottles by 2029 and 25% recycled content in plastic bottles by 2025. In addition to financial consequences for not meeting these mandates, bottled-water bans may also be put in effect.

[61] https://www.greenbiz.com/article/will-recycled-plastics-survive-tanking-oil-prices
[62] https://www.wsj.com/articles/how-the-coronavirus-complicated-the-quest-for-a-greener-plastic-bottle-11593005945?mod=searchresults&page=1&pos=1

Figure 6-3. Cost of Recycled PET versus Virgin



While the price of recycled PET has stayed on par with virgin PET in the U.S. – until the onset of COVID-19 – prices for recycled PET in Europe have been steadily increasing relative to virgin PET since late 2018, and now are approaching twice the price as of the summer of 2020.[63]

Ultimately, the market sets the price of any product or service – unless the government intervenes. And, in a free market, economics drive corporate decision making. So, some combination of consumer demand or brand owner push for PCR content, new technology making waste conversion to either feedstock or recycled resin much less costly, or increasing oil prices will be needed to drive long-term growth in PCR content.

For now, this looks to be a strong headwind. Flexible packaging is difficult to collect, and has little sorting, cleaning, and reprocessing today. Bales are difficult to clean so end markets are limited. A large infrastructure investment will be required and will likely be focused more on rigid packaging initially because of the economic value there. New markets for reprocessed flexible formats may initially be outside of packaging – such as plastic lumber, building materials, and perhaps other construction materials and roads. Over time, the available PCR product will get cleaner and can be included in rigid packaging, then eventually flexible packaging. Advanced recycling may be another source of a clean PCR stream with high economic value. In the interim, the industry will need good sortation, cleaning, and reprocessing through mechanical recycling. Package

[63] https://www.wsj.com/articles/how-the-coronavirus-complicated-the-quest-for-a-greener-plastic-bottle-11593005945?mod=searchresults&page=1&pos=1

design can also help move toward a solution through the use of digital watermarks like Digimarc that can help drive better sortation results.

Microplastics

Plastic debris less than five millimeters in length (about the size of a sesame seed) are called microplastics. On beaches, microplastics are visible as tiny multicolored plastic bits in sand. In the oceans, microplastics can be consumed by marine animals and have been detected in organisms from plankton to whales, in commercial seafood, and even in drinking water. According to the National Oceanic and Atmospheric Administration (NOAA), not much is known about the impact of microplastics because it's a relatively new area of study.

Eight million tons of plastics enter the oceans each year, but only 1% can be seen floating at the surface. Where the rest goes is not well understood.[64] Some of the microplastics pollution is from littering, but more is due to storms, water runoff, and winds that carry plastic into the oceans.

To better understand the size and scope of the microplastics issue, a research team from the Plymouth Marine Laboratory in the UK used nets with mesh sizes of 100 microns, 333 microns, and 500 microns to strain ocean water at two sites off the coasts of the U.S. and the UK. The research found that 2.5 times more particles were in the finest net than in the 333 micron net, and 10 times more than in the 500 micron net. The surface trawls off the coast of Plymouth in the UK and the coast of Maine in the U.S. showed similar results. The particles were largely fibers from textiles such as ropes, nets, and clothing. Extrapolating the findings from the water samples, researchers hypothesized that concentrations could exceed 3,700 particles per cubic meter.[65]

Not only are microplastics showing up in the ocean, more than 1,000 metric tons of microplastics fall on protected lands in the western region of the U.S. each year. The largest contribution of this pollution came from clothing.[66]

The Global Plastic Alliance (GPA) includes 75 organizations that in 2011 signed the Global Declaration. The declaration includes six statements that signatories agree to abide by: 1) to work in partnerships to prevent marine debris; 2) work with the scientific community; 3) promote science-based policies; 4) help spread eco-efficient practices; 5) enhance opportunities to recover plastics; and 6) prevent loss of resin pellets and products in transportation.

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[64] https://microplastics.whoi.edu/

[65] https://www.theguardian.com/environment/2020/may/22/microplastic-pollution-in-oceans-vastly-underestimated-study

[66] https://www.scientificamerican.com/article/thousands-of-tons-of-microplastics-are-falling-from-the-sky/

The GPA cites several studies on their web page that indicate that microplastics have no significant impact on human health nor influence the breeding/development of fish stocks.[67] However, the National Institutes of Health (NIH) states that "there is scientific uncertainty about the hazards of microplastic issues. There is concern that microplastics could have adverse health effects on humans as they move through the marine food web. Microplastics both absorb and give off chemicals and harmful pollutants. Plastic's ingredients or toxic chemicals absorbed by plastics may build up over time and stay in the environment. It is not known if humans can be exposed to these pollutants by eating contaminated seafood."[68]

The volume and visibility of the problem and the uncertainty surrounding its long-term impact on human health and the health of the earth's oceans make this a potentially volatile component of the overall packaging sustainability picture. The headwinds from microplastics are indirect – concern about FPP having low economic value and being more likely to become litter and be carried in the wind or find its way into waterways. This can become a tailwind only really if the industry finds ways to collect and use post-use FPP, particularly in developing markets which do not have a strong infrastructure for recycling or landfill. There is a strong need to find the answer(s) to reduce or eliminate waste here. The Alliance to End Plastic Waste (AEPW) and other groups are working on this, but a tremendous boost in infrastructure is needed.

Pandemic

As of the writing of this document, 6.5 million people have been diagnosed with the coronavirus in the United States and over 195,000 people have died. The number of cases and deaths is rising daily and there is growing concern that it is premature to identify the start of the second wave as the first wave is not yet over. Although the final chapter of the pandemic is far from being written, the impact on packaging and particularly flexible packaging is significant. As the pandemic continues to spread, several key areas have already and will be, impacted in important ways.

Bans on Single-Use Bags

Prior to the onset of the COVID-19 pandemic, there was a strong and growing movement against plastics in general, and specifically single-use plastics.[69] Environment and Public Works Committee Chairman John Barrasso, R-Wyo., noted that many states and cities have suspended single-use plastics bans or taxes as a result of the coronavirus pandemic. "COVID-19 has called into question taxes and bans on single-use plastics," he said. "The pandemic has reminded us of the critical role that single-use plastics play in

[67] https://www.marinelittersolutions.com/about-marine-litter/what-are-microplastics/
[68] https://toxtown.nlm.nih.gov/sources-of-exposure/microplastics
[69] https://www.flexpackmag.com/articles/90405-have-one-way-plastics-become-heroes-of-the-fight-against-covid-19?id=90405-have-one-way-plastics-become-heroes-of-the-fight-against-covid-19&oly_enc_id=7543D2843312B3B

protecting public health."[70] Many medicines, medical and surgical tools, and healthcare supplies are packaged in a single-use container. Almost all personal protective equipment (PPE) is also single-use. Its value in reducing the spread of disease is not questioned. However, many have taken some of the same arguments and applied them to single-use packaging outside of the medical or healthcare sectors. One application that has emerged as highly controversial is single-use shopping bags.

As the pandemic unfolded, many states reversed or put on hold bans on single-use shopping bags. Maine delayed the state's soon-to-be-implemented ban on single-use plastic bags. New Hampshire Gov. Chris Sununu prohibited shoppers from bringing reusable bags to stores in an effort to protect vulnerable workers. Massachusetts Gov. Charlie Baker made a similar move. Illinois shoppers were temporarily banned from bringing in their own reusable bags. Along with these moves, the Wall Street Journal editorial board voiced its support of reversing plastic-bag bans and related taxation.[71]

Some have criticized the bans noting that research indicates that the coronavirus was still viable hours after applied to plastic and stainless steel. The viability of the virus on cloth — like that used in many reusable grocery bags — was not studied. Massachusetts Bureau of Environmental Health Director Jana Ferguson has said the department has seen "no scientific information specific to bags and the ability of reusable bags to be a way to spread coronavirus."[72]

Shifts in Behavior

A recent McKinsey report noted that some categories of consumer spending increased during the pandemic while others declined. These shifts have an impact on the associated packaging. For example, consumer spending in the U.S. on groceries increased 14%. As a result, packaging such as flexible, rigid plastics, and corrugated grocery packaging also experienced increases. At-home entertainment increased 3%, resulting in increased demand for corrugated and protective packaging for the associated hardware and software.[73]

[70] https://www.plasticsnews.com/news/senators-argue-plastic-bans-note-failure-recycling?utm_source=pn-recycling-report&utm_medium=email&utm_campaign=20200624&utm_content=article1-headline

[72] https://www.marketwatch.com/story/politicians-ban-reusable-grocery-bags-for-spreading-coronavirus-whats-the-science-say-2020-03-31?mod=article_inlin

[73] https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Marketing%20and%20Sales/Our%20Insights/The%20great%20consumer%20shift/ten-charts-show-how-us-shopping-behavior-is-changing.pdf

From a longer-term perspective, McKinsey noted several packaging megatrends that they expected to show shifts due to the COVID-19 crisis. Sustainability requirements were expected to decrease slightly as efforts and attention shifted more to managing the immediate impact of the crisis, though many believe this is temporary. In fact, the rise in single-use plastic may put a stronger focus on recycling, particularly for single-use and lightweight packaging. E-commerce is expected to accelerate even faster. Increased price consciousness and hygiene/health focus were also seen as accelerating even more rapidly than pre-pandemic. Lastly, strong cost pressure and [74][75]

TerraCycle's "zero-waste" Loop service exemplifies the opportunity. Loop is a subscription service where many well-known brands have switched to reusable packaging that is returned, cleaned, and reused up to 100 times for each package.[76]

Photo 6-1. Examples of Loop reusable packaging

This optimism seems to be widely shared in the packaging industry. Survey results shared by the Sustainable Packaging Coalition (SPC) in a recent webinar show that 40% of respondents see increased relevancy and expectations for sustainable business due to COVID-19 and its effects. Thirty six percent see changing or additional expectations for sustainable business going forward, 21% see a negative impact on sustainable business and its role, and 2% see no impact.[77]

The potential rise of a future pandemic is unknown. However, if COVID-19 is a harbinger of future pandemics, the response will certainly impact consumer behavior, legislative and regulatory actions, and the timeline for achieving sustainability goals.

The pandemic has put safety at the forefront, ahead of sustainability initially. However, it will drive much more focus on sustainability very quickly as concern builds about what to do with all the PPE that has been used, largely FPP. This may lead to stronger legislation, which could be viewed as a headwind or tailwind depending on one's perspective.

Social Media

Social media is an online forum and vehicle to share ideas. Since it is largely unrestricted and unfiltered, it has been and continues to be a mix of truth, untruth, and half-truth.

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[75] https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Marketing%20and%20Sales/Our%20Insights/The%20great%20consumer%20shift/ten-charts-show-how-us-shopping-behavior-is-changing.pdf

[76]" https://www.greenbiz.com/article/will-recycled-plastics-survive-tanking-oil-prices

[77] SPC Webinar, 7/17/20, Contextual Trends in Sustainability, GlobeScan

Regardless, it has become a highly efficient means of spreading information. In the surveys of FPA members and stakeholders conducted by PTIS and PMG, there was a near universal perception that the flexible industry was well behind the not-for-profit community in controlling the dialog about plastic waste. One FMCG executive noted that "The NGOs got ahead of us – educated and impacted opinions more effectively and now everyone else is playing catch up." As another told us, "The CEOs of big companies are investing millions of dollars because they are afraid their business models are at risk if they don't evolve to meet the perceived challenge. Driven by not necessarily consumer expectations, but social media and concerns around environment and companies wanting to be seen as doing the right thing."

Some companies are strategically utilizing social media and leveraging the non-regulated environment. Brita launched a PR campaign in mid-2019 with the help of social media agency Social Chain. The #NoFilterNoFuture campaign was designed to encourage people to reduce the purchase and consumption of single-use plastic bottles by replacing them with Brita Filtering Water Bottles. The campaign includes content from 21 Instagram influencers and featured Photoshopped images of beaches and oceans filled with plastic garbage. The creative director was very open regarding the photo manipulation that was a key part of the campaign. "Many influencers have been called out for Photoshopping their post images to make themselves and their surroundings look more appealing. In this campaign, we aim to use photo editing for good."[78]

The speed and reach of social media can be stunning. For example, between February 1, 2018, and March 15, 2018, online conversation volume about plastic in the ocean increased by 637%. The primary contributor to this surge was the build-up and anticipation of a study published on nature.com on March 22, 2018, called "Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic."[79] The study found that the 620,000 square mile Great Pacific Garbage Patch was 16 times larger than originally projected. The story was picked up by major news outlets and then became the subject of blogs and tweets, causing a sustained spike in mentions that lasted for over a month.[80]

Other examples of viral social media images that have hurt the plastic industry include:

- A video of a sea turtle found entangled in a fishing net got over 22 million views
- A video of a sea turtle with a straw up one nostril was viewed over 39 million times
- David Attenborough's documentary series, Blue Planet II, was the most watched British television show of 2017. The first episode had more than 14 million

[78] https://www.prweek.com/article/1591999/influencer-campaign-depicts-shocking-future-plastic-pollution
[79] https://www.nature.com/articles/s41598-018-22939-w
[80] https://www.synthesio.com/blog/plastic-in-the-ocean-facts-social-listening/

viewers on the BBC. The seventh episode featured albatrosses that had ingested plastic pieces.

A study conducted by the Media Insight Project found that most people who use social media to get news do not have a lot of trust in the content. However, people who see a social media post from someone they trust evaluate the article more positively, are more likely to engage with it and to engage with the source that created the article. A trusted sharer affects reader opinions more than the reputation of the news source.[81]

In looking at the degree of influence of people voicing opinions about packaging waste, plastic usage, and sustainability, it is eye-opening to see the number of followers of some individuals. Actors and politicians, in particular, attract very large numbers of followers as shown in the table below.

Table 6-2. Influential Sustainability Social Media Sites[82]

Name	Purpose	FB Followers	Instagram	Twitter
Leonardo DiCaprio	Actor and environmentalist	18.1MM	44.5MM	19.3MM
Mark Ruffalo	Actor, climate change activist	6MM	17.9MM	6.6MM
Devendra Fadnavis	Indian politician – leader of the opposition	9.1MM	737,000	4.3MM
Dia Mirza	Indian model, actor, social worker	6.8MM	4.2MM	3.2MM
Jackson Harries	Artist, Activist	845.600	1.5MM	1.9MM
Sadiq Khan	Mayor of London	747,800	125,000	1MM
Zero Waste Home	Five Rs – refuse, reduce, reuse, recycle, rot	376,800	266,000	36,500
Suresh Prabhu	Commerce Minister, India	501,600	342,000	
Scott Parkin	Director, Rainforest Action Network	438,900	99,100	94,800
Trash is for Tossers	NYC zero waste blog	117,400	382,000	18,500
Zero-Waste Chef	Cooking with zero waste	32,000	170,000	
Michael Gove	British Conservative Party Politician	13,500		192,700
Going Zero Waste	Documenting personal health journey	47,600	157,000	4,600
Jess with Less	Minimalist site		108,000	
The Zero Waste Nerd	Traveling without waste	39,300	69,400	
Catherine McKenna	Canadian politician	31,500	20,700	139,200
Erik Solheim	Norwegian diplomat	8,300		114,900
Lewis Pugh	Swimmer and ocean advocate	36,800		52,600
Afroz Shah	Indian lawyer, environmental activist	23,200	24,200	51,600
ZeroWasteChica	Natural remedies, beauty recipes		26,800	
Helen Clark	Former PM of New Zealand		46,800	211,300
Shah A Farhad	Environmental and social activist	157,700		59,700
Daniel Schneider	Biologist, diver, activist		1,700	94,500
June Stoyer	Environmental Advocate		7,300	65,500
Paul Polman	Unilever CEO			64,100
Fabien Cousteau	Aquanaut, Environmental Advocate	20,600	15,100	50,000

Industry executives tend to think of social media as the unregulated realm of individual consumers, although it is equally accessible to all. Coordinated messaging from the

[81] https://www.americanpressinstitute.org/publications/reports/survey-research/trust-social-media/

[82] Facebook, Instagram, and Twitter accessed July 2020

flexible packaging industry on the positive aspects of flexible packaging – its favorable LCA numbers, the percentage of landfill space it occupies, and perhaps most importantly, the benefits that consumers enjoy because of flexible packaging – could be used to stem the tide of negative information and untruths about packaging that seems to dominate social media outlets.

It is certainly challenging to change consumer sentiment, but the packaging industry needs to provide good information on the benefits of flexible packaging, while working toward a circular economy. Investment in collection outlets/depots and sharing best practices are two ways to begin. How2Recycle and How2Compost may be used on more flexible packages to educate consumers on what can be recycled and what can be composted. It is also vital to the integrity of the industry that consumers understand that all compostable packaging may not actually be composted but may be best used currently in foodservice applications where there is greater control and used packages are less likely to contaminate the recycling stream.

Next Steps/Summary

Some of the issues and conditions that could create tailwinds allow some measure of control. Social media and legislation can be positively influenced. Other issues will require an investment of financial and intellectual capital. Advanced recycling, mono-material structures, and waste collection infrastructure need leadership and direction to guide industry and government investment. Other issues, such as mass balance, carbon emissions, the value of recovered packaging, and microplastics should be closely monitored and regularly evaluated to determine their direction and to develop an appropriate and current response. Lastly, there will be unknowns. Any roadmap only lists things that are known – roads, cities, points of interest. It is the unknowns that create not just unforeseen obstacles, but interesting challenges and unique opportunities. We may not experience another pandemic in our lifetimes, but we will undoubtedly experience many unexpected headwinds and tailwinds in the journey to a circular packaging economy. It is the attitude with which we face them that will reflect our character and determine our future.

Table 6-3. Summary of Headwinds/Tailwinds

Issue	Favorable Direction*	Horizon	Likelihood	Impact
Advanced Recycling	Investment/Public Support	Long-Term	Moderate	Moderate – High
Bans, Legislation	Controlled/Do not Occur	Ongoing	Moderate	Moderate
Carbon Emissions	LCA of Flexible Pkg Understood/Accepted	Ongoing	Moderate	High
Curbside (and other) Collection	Steady Gains	Immediate	High	High
Mass Balance	Moving to Equilibrium	Long-Term	Certain	High
Microplastics	Reduced Prevalence/ Widespread clean-up & capture	Immediate	High	Moderate – High
Mono-material Structures	Commercial	Long-Term	Moderate	Moderate
Pandemic	Does not Occur	Immediate	Low	Unknown
Social Media	Viral Image/Story	Ongoing	High	Varies
Value of Recovered Packaging	Demand for PCR Rises/Creates new markets	Immediate	High	High

NOTE: The table considers each headwind/tailwind from a positive (tailwind) perspective. As noted in the text, each issue could be a headwind or tailwind, depending on circumstances. The information, knowledge, and insights discussed in this chapter can be used in concert with the roadmaps to help adjust and strengthen roadmaps based on the various headwinds and tailwinds we will experience over the implementation phase.

Chapter 7

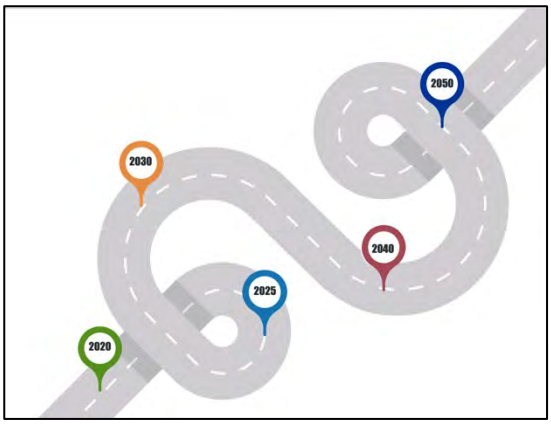
Flexible Packaging Roadmaps

Background and Overview

Based on the current state and future state (CS/FS) models discussed in Chapter 5, the following roadmaps were developed to provide more specific value chain actions that will need to be addressed as we work toward a circular economy (CE) for flexible packaging. The goal of the CS/FS models was to provide a vision or "North Star" for flexible packaging in 2030. While the current state and future state models were developed looking out to 2030, the roadmaps lookout to 2040 to provide a more comprehensive view of critical components that will be ongoing past 2030 to complete the transition toward a CE for flexible packaging.

How to use the roadmaps:

While not all actions in the roadmap will apply to every company, it is hoped that individual organizations will review the roadmaps to:



- Look for insights, direction, and priorities for your individual organization
- Identify collaborative relationships to help you achieve your goals (Also see Chapter 11 for sustainability-based organizations)
- Identify how to work with the FPA to influence future industry opportunities
- Identify technology and investment opportunities
- Understand how your organization plays a critical role in the system of driving flexible packaging to a circular economy
- Customize the roadmaps for your organization to set strategic goals for 2025 and 2030

To meet end goals will take a collaborative approach, driving toward the future state where all flexible packaging is collected and effectively recycled, reused, or composted.

Assumptions

When developing the roadmaps and baseline scenarios for the different timeframes, assumptions were developed for the time horizons (2020, 2025, 2030, and 2040). These scenario assumptions are outlined below:

- Generally middle of the road for the timelines and actions - not overly aggressive or conservative (See Chapter 6 Risk Assessment to better understand headwinds/tailwinds for roadmap timelines)

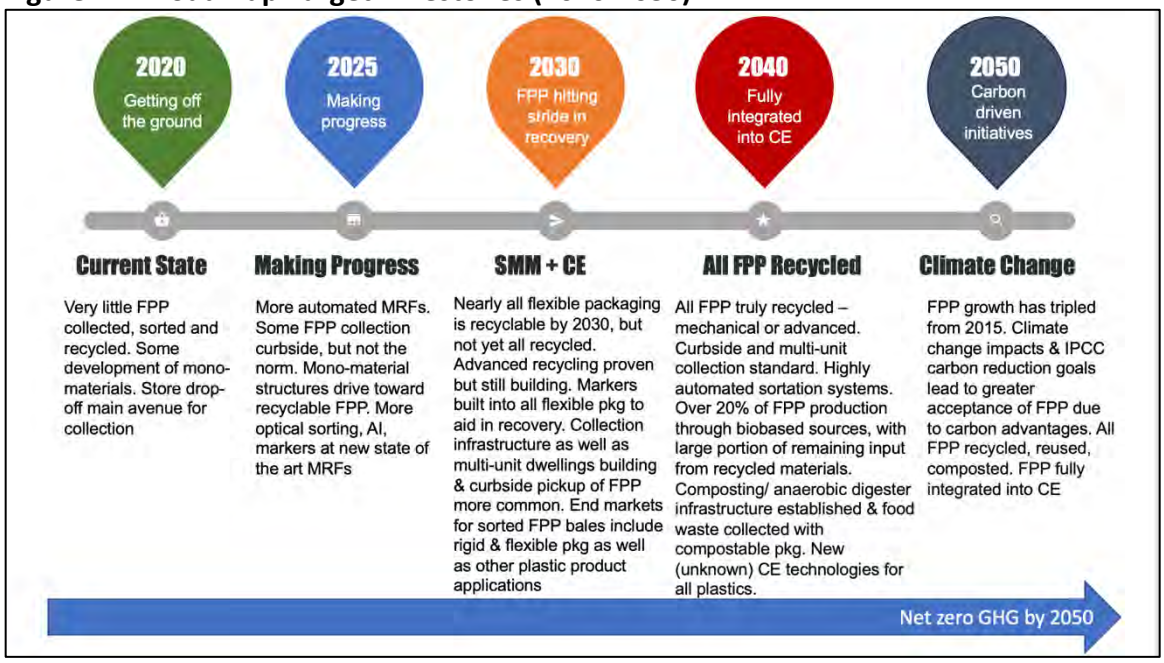
- Specific actions based on the baseline scenarios set for different time horizons
- Use the year as the point where there is increased activity taking place - leaders may move faster than the timeline, laggards more slowly
- Assumptions are based on knowledge from interviews, research links to other reports such as MRFF, CEFLEX, How2Recycle, etc.
- Over time, the industry will consolidate around global standards for recyclable flexible packaging (i.e., CEFLEX D4ACE Guidelines, APR Guidelines, SPC How2Recycle, FPA, etc.)
- EPR type legislation will be implemented in the U.S. at the state level by 2025 and national level by 2030 and will become a major source of infrastructure funding
- Rigid applications will dominate the use of PCR at least through 2030
- Growth of plastic packaging is expected to grow 3x between 2015-2050, necessitating the need for collection, sortation, etc.
- Waste to Energy is phased out/significantly reduced over time as countries look for plastics to be recovered and used in more circular/higher level applications
- The roadmaps are largely written from the perspective of a flexible packaging converter
- This roadmap is a 'living document' based on today's knowledge and should be updated and refreshed based on the latest knowledge, market trends, government structure, etc.

Baseline Scenarios:

The following baseline scenarios were set for 2020, 2025, 2030, and 2040. As the timelines get longer toward 2040, the specific actions are more difficult to determine, but the “North Star” for the Future State continues to be the guide to strive toward.

A topline overview of the vision that shows the progression for flexible packaging over the different time horizon 2020-2050 is shown in Figure 7-1.

Figure 7-1. Roadmap Target Milestones (2020-2050)



The following charts list the baseline assumptions for each year. These are the scenarios that were used to help develop the key outcomes and specific activities for each time horizon.

Figure 7-2. Baseline Scenario 2020 (Current)

- Flexible packaging recycling rate ~4%
- Store drop-off the only real option for flexible packaging recovery
- States and Federal Government looking at EPR and plastic focused legislation
- Targeted bans on some single use plastics (straws, cutlery, bags, etc.)
- Consumer confusion about what can be recycled
- Low oil prices making PCR more expensive than virgin
- COVID has put focus on safety now, but also drawn attention to plastic consumption
- Marine debris as a main driver of consumer focus on plastics
- Main end-market for collected flexible packaging is plastic lumber and grocery bags

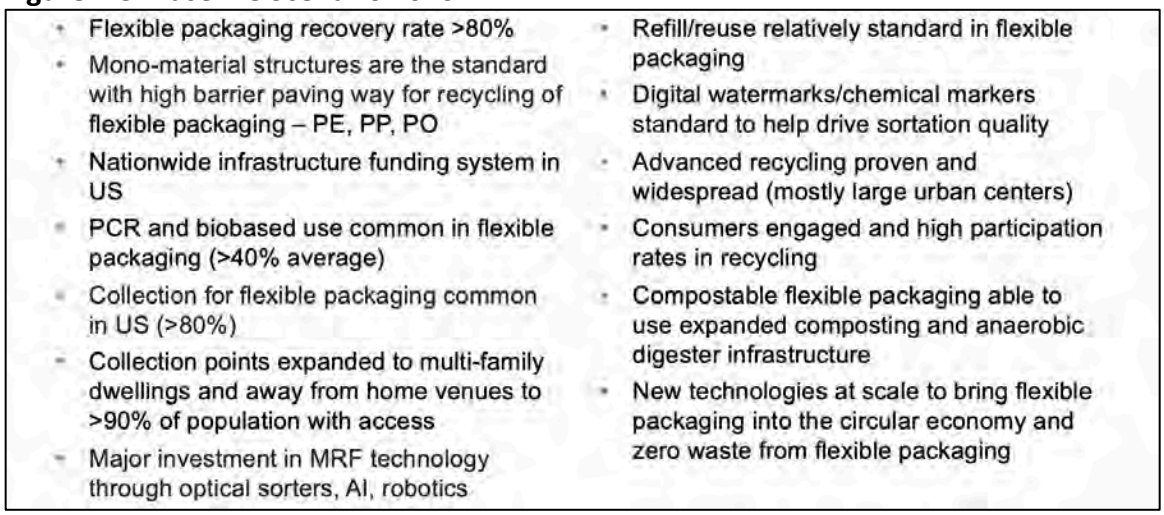
Figure 7-3. Baseline Scenario 2025

- Flexible packaging recovery rate ~10%
- Mono-material pouches much more common (about 50% of total production)
- More national funding on recovery infrastructure
- PCR use still a niche for flexible packaging
- Some curbside/metro collection for flexible packaging in about 5% of US
- Collection points expanded to multi-unit dwellings and away from home venues up to 15% of US population
- Digital watermarks/chemical markers (scaling up but not the standard) drive sortation & recovery streams
- Advanced recycling tested and in small scale production (not widespread)
- Refill/reuse growth - mostly rigid packaging
- Consumers more engaged and knowledgeable on recovery
- More consumer education through associations and government agencies
- 3-5 states have set up EPR programs
- More funding in those EPR states for recovery infrastructure – more optical sorters; other states fall behind in recovery rates
- More discussion on national EPR
- Food waste reduced by 20% - with packaging playing a major role
- More new technologies at pilot stage to increase flexible packaging collection and recovery

Figure 7-4. Baseline Scenario 2030

- Most flexible packaging collected
- Flexible packaging recycling rate ~30%
- Mono-material structures are standard with high barrier paving way for recycling of flexible packaging (PE, PP or PO blend)
- Biobased material use increasing, but still less than 10% of overall production
- PCR use more common in flexible packaging, getting toward 20% PCR in many structures
- Digital watermarks/chemical markers help drive sortation & recovery streams
- Curbside/metro/multi-unit dwellings collection for flexible packaging in about 25% of US
- Major investment in MRF technology through optical sorters, AI, robotics
- Refill/reuse moving into flexible packaging
- PP Advanced recycling proven, but not yet widespread (mostly near large urban centers)
- Developed end markets for collected FPP in both packaging & non-packaging applications
- Compostable flexible packaging but mainly for closed venues and food service applications
- Food waste reduced by 50% - with packaging playing a major role
- Nationwide infrastructure funding system in U.S.
- Consumers engaged and high participation rates in recycling

Figure 7-5. Baseline Scenario 2040



Roadmaps

The flexible packaging sustainability roadmaps are described on the following pages. Similar to the Current State and Future State models from Chapter 5, they are broken into the five main categories:

- Design
- Collection
- Sortation
- Reprocessing
- End Markets

The roadmaps include both Key Outcomes and Key Activities based on the scenarios previously discussed. The key outcomes (top of each roadmap graphic) are the specific outcomes or vision that will be achieved around the specific timeframe identified, while the key activities are the actions that will be critical to driving toward the identified outcomes. The roadmaps start with a Current State of 2020, and progress over time. Leading companies may move faster than the projected outcomes and activities, while some will lag- behind the timeline.

The roadmaps shown on the following pages are high-level roadmaps and are meant to provide general direction. In the Appendix, Chapter 14 (Detailed Flexible Packaging Roadmaps) includes more detailed components with granular level and tactical actions identified that companies, industry, and interested parties can use to advance flexible packaging toward a circular economy.

It is recommended that members of the packaging value chain review both the current state to future state models (Chapter 5), baseline scenarios, roadmaps (high level and detailed level – Chapter 14), and Risk Assessment (Chapter 6) to create and test product development, collaboration, and technology investment strategies.

How to Read the Roadmaps

The roadmaps on the following pages are set up so that a Key Outcome or Activity will follow across a particular row over time. They are meant to show the progression of that activity. For instance, in End Markets, a Key Outcome is for the flexible packaging recycling rate to move from 4% currently, to 10% in 2025, 30% in 2030, and nearly all flexible packaging recycled in 2040. Likewise, Key Activities will follow certain technologies across that time progression as well.

Design

Design is the area in which flexible packaging providers can have the most direct influence. Advancing flexible packaging sustainable/circular design over the next decade will require extensive collaboration between producer R&D teams and brand owner partnerships. Future design is also heavily influenced by the brand owner's desire to have all of their packaging be recyclable, reusable, or compostable in accordance with the Ellen MacArthur Foundation Global Commitment.

Currently, there are limited options for recyclable structures, and their performance (both barrier and operation speed) is a limiter for wider acceptance. Over time the Key Outcomes will include a wider range of mono-material and compostable structures and incorporation of increased levels of both bio-based materials and PCR for feedstock. By 2030, recyclable mono-material (or polyolefin based) structures should be the standard for flexible pouches.

This will require several key activities to occur over the next decade, and into 2040. Included here are continued development of mono-material structures with barrier, identification of key markets to move into mono-material by 2025, and new compostable or paper-based applications. Overall material simplification, where difficult to recycle materials and structures are phased out as technologies that bring enhanced barrier technologies will be critical to help make sortation and end markets more available. This process will need to start early to meet 2025 and 2030 brand owner recyclability goals.

Compostable packaging may be a niche today due in part to a lack of composting infrastructure and the availability of industrial and home compostable operations, but the inevitable focus on food waste and greenhouse gas emissions will lead to more opportunities in foodservice areas for composting over the next decade.

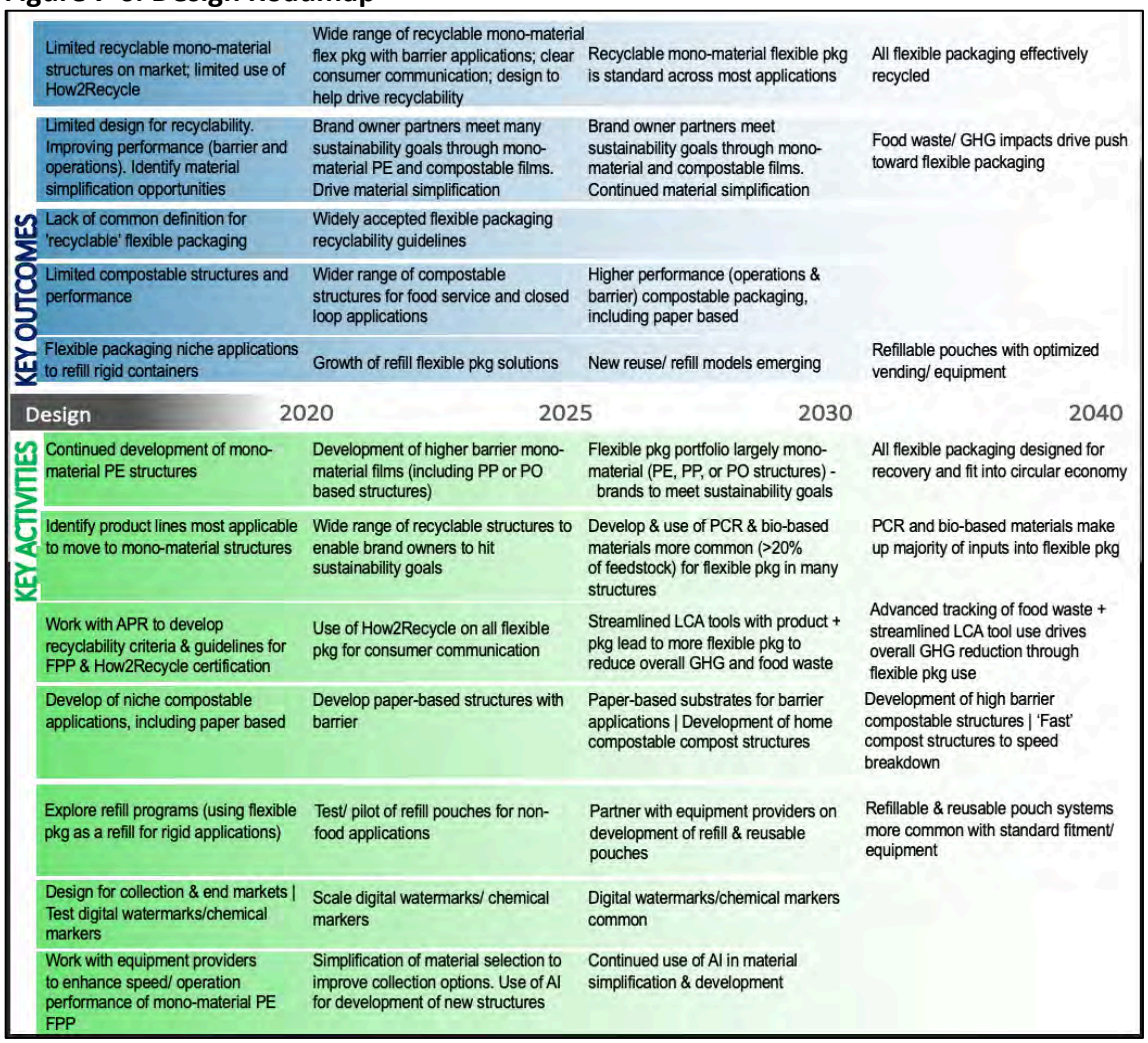
Additionally, there has been a tentative move by some brand owners to look at paper-based solutions instead of plastic substrates. This suggests there is a need for flexible packaging converters to explore paper-based solutions with safe barrier coatings as part of their portfolio.

Additional design elements, beyond structure that should be incorporated, include more consistent consumer communication, such as the use of the Sustainable Packaging Coalition's (SPC) How2Recycle icon, and technology-based solutions, including digital watermarks or chemical markers that can help packaging be accurately segregated at the sortation phase, leading to a higher value for collected packaging.

Over time, refill and reusable packages will also gain more traction and acceptance. Today there are some examples where a flexible pouch is used to refill a rigid container (ex. liquid soaps), but new technology will allow for the refill and reuse of flexible structures themselves by working with equipment suppliers in vending applications at various retail locations.

Figure 7-6 provides a high-level overview of the Key Outcomes and Key Activities for Design. See Chapter 14 for additional detailed Key Activities with more tactical and granular steps.

Figure 7-6. Design Roadmap



Collection

Today, flexible plastic packaging (FPP) is mostly collected at store drop-off locations typically found in the front of stores where consumers can bring plastic grocery bags as well other polyethylene (PE) based packaging overwrap for recycling. Flexible packaging is rarely collected at curbside in the U.S. In addition, the lack of consistent recycling rules for collection is a hindrance to broader consumer participation and will need to be more closely harmonized throughout the country.

Photo 7- 1. Drop off bins in Barcelona, Spain

In the longer term, it is expected that flexible packaging collection will need to be convenient to drive better consumer participation and recycling rates. This will include both curbside pickups, as well as collection from multi-unit dwellings and dense metropolitan areas where there has been little collection because of the lack of room and buildings that were not constructed to include space for recycling infrastructure. Rural areas also lack recycling collection today in many instances because of the lack of density for collection, making the collection more expensive. Solutions may include more drop-off depots like those used in Spain, where depots are set up conveniently in streets or by bus stops to foster recycling collection in both urban and rural settings.

Photo 7-2. Drop off station located near a bus stop in rural Spain

Another key component that will help drive collection is better harmonization of what is accepted for recycling across the country. Today, the U.S. has a wide range of rules for consumers about what is acceptable to place in a bin and what is considered contamination. The rules can also vary from town to town, based on the capabilities and technology at the Materials Recovery Facility (MRF) where collected materials are sent for sortation. A McKinsey article estimates there are 10,000 to 15,000 municipal recycling programs[83] with about 500 MRFs in the U.S., each with their own rules. Better

[83] https://www.mckinsey.com/industries/chemicals/our-insights/accelerating-plastic-recovery-in-the-united-states

harmonization of these rules will help drive packaging designers to focus on package designs that can be recycled, while also leading to lower consumer confusion, less contamination, and increased clean recycled content.

Collection of compostable food waste will also be critical as we go forward. Drawdown.org[84] estimated that reduced food waste is the top solution out of 100 opportunities to decrease GHG emissions. Overarching goals such as the reduction in greenhouse gases and food waste by national governments will only be accomplished through stronger composting collection systems. Compostable flexible packaging will be able to play a critical role over time, especially in foodservice and closed venues such as stadiums where incoming packaging can be more easily controlled and segregated at the restaurants or stadium venues. This will require a new design for compostable and paper-based structures, both requiring green chemistry for coatings to ensure acceptance at compost facilities. Additional work with organizations that certify compostable packaging may be needed for certification on home composting or structures that break down more quickly, more closely matching the composting time for food and yard waste at industrial composting facilities using windrows.

The Materials Recovery for the Future (MRFF)[85] project also highlighted the need for investment in carts with lids, rather than open bins to help facilitate flexible packaging collection. Bins that do not have a lid can result in flexible packaging being blown away by the wind, creating litter, or leading to flexible packaging sticking to paper products if it rains, further complicating the sortation process and driving up contamination levels. According to The Recycling Partnership, only about 44% of U.S. single-family homes with curbside recycling collection have carts with lids.[86]

There are vast challenges for the collection of flexible packaging that will only be solved with extensive collaboration. One way to drive collection may be through a packaging industry and brand owner led Producer Responsibility Organization (PRO), which was discussed in Chapter 5. A PRO is a collection of companies with joint responsibility and authorized/financed collectively or individually by producers (brand owners, private brand retailers), to take responsibility for the collection, sortation, and ultimately finding end markets for packaging generated to ensure environmentally sound management. While a PRO may form in response to the implementation of Extended Producer Responsibility (EPR) legislation, it may also be formed proactively to help address infrastructure challenges and drive ownership of the recovery process for packaging. The formation of such an organization would help identify areas where

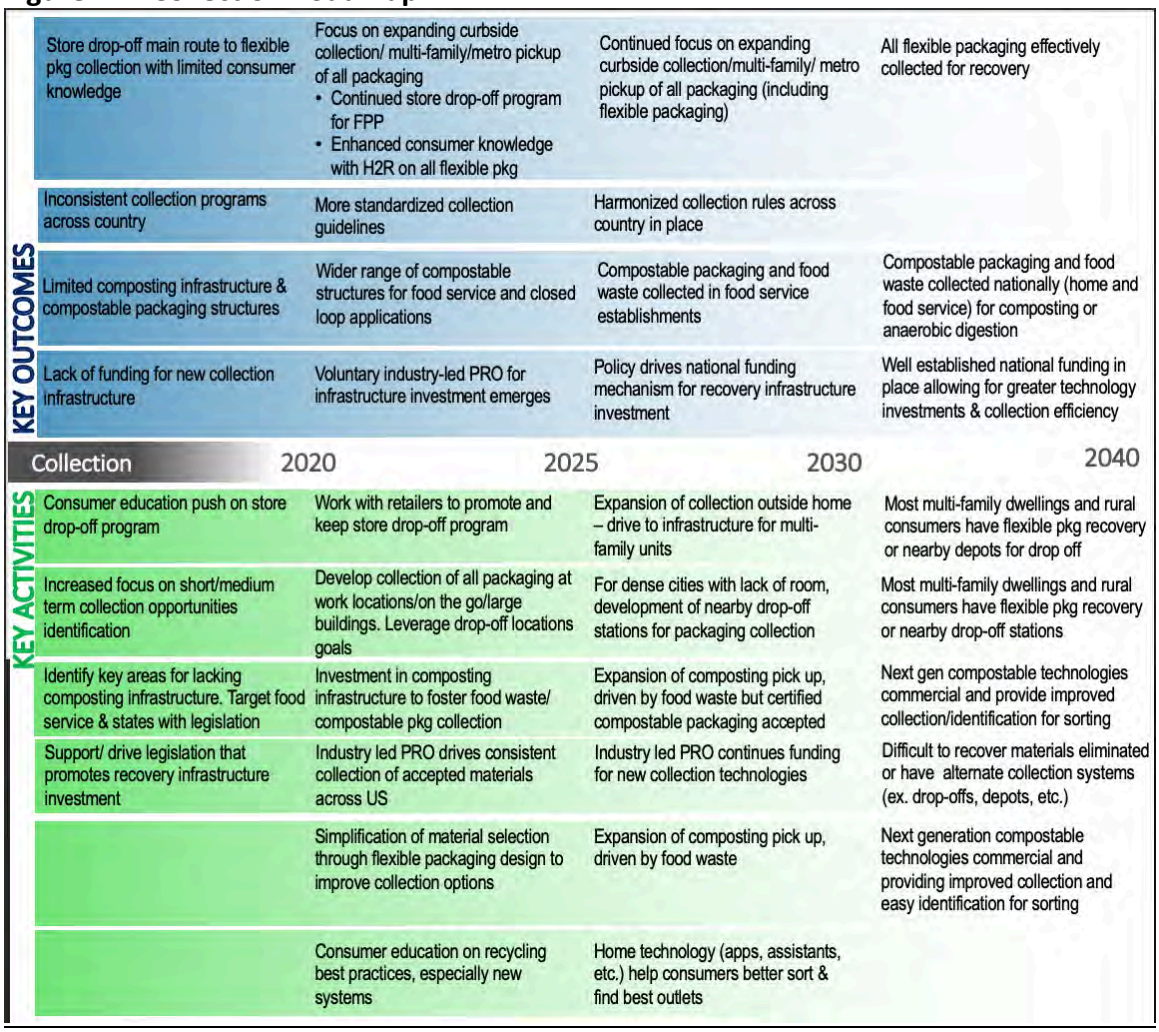
[84] https://drawdown.org/solutions/table-of-solutions

[85] https://www.materialsrecoveryforthefuture.com/wp-content/uploads/MRFF-Pilot-Report-2020-Final.pdf

[86] The Recycling Partnership. (2017). The 2016 State of Curbside Report. Retrieved from https://recyclingpartnership.org/wp-content/uploads/2018/05/state-of-recycling-report-Jan2017.pdf

investment in collection could be most effective and cost-efficient and play a critical role in the future for collection and sortation over the next decade.

Figure 7-7. Collection Roadmap



Sortation

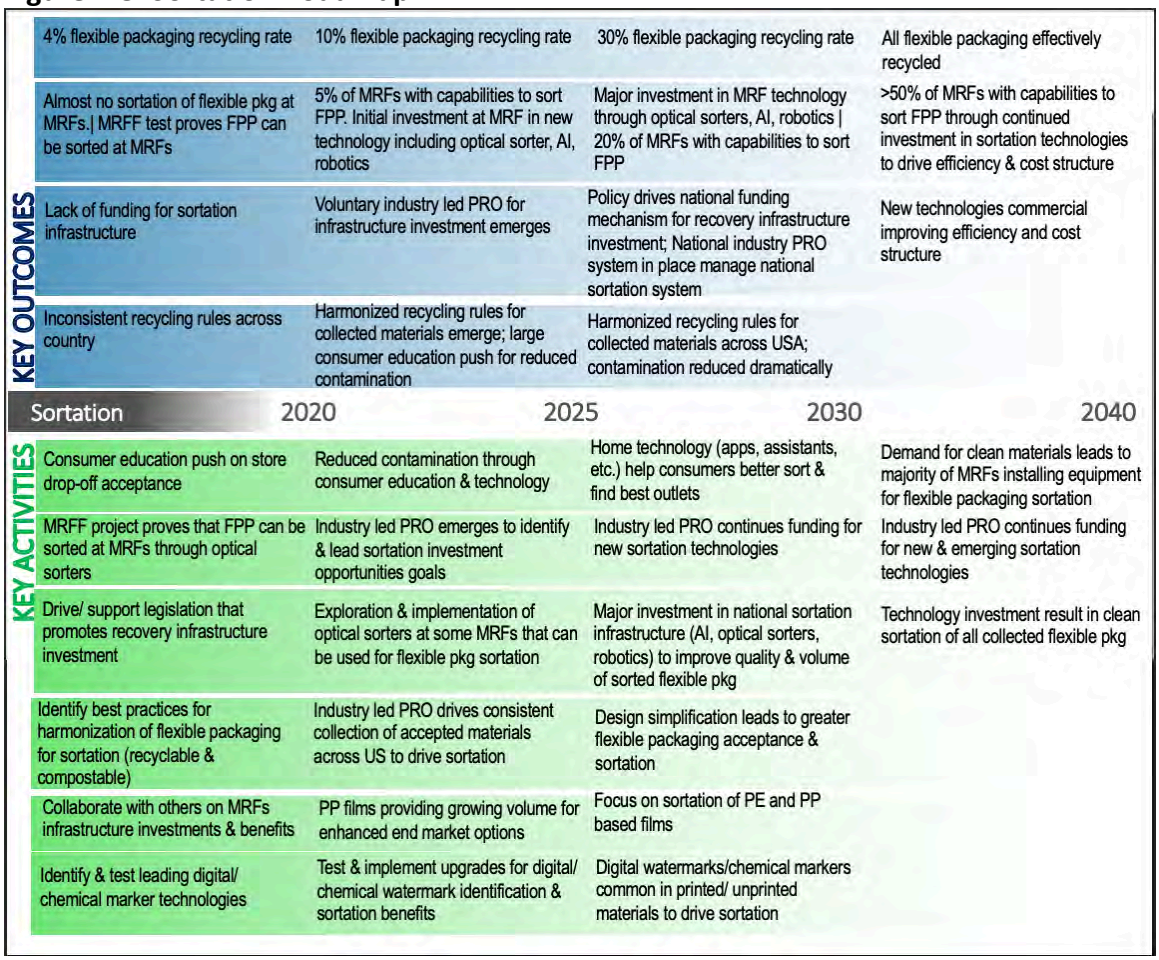
After collection, packaging materials are brought to a Material Recovery Facility (MRF) for sortation. This is an area where flexible packaging providers will have little direct influence but can design flexible packaging that can be effectively sorted. The future for effective and efficient sortation for flexible packaging will largely be driven by technology investment at MRFs including optical sorters, artificial intelligence linked to databases to identify and sort packages, and the use of digital or chemical markers which will also enable more accurate sortation. With the flexible packaging recycling rate at about 4% today, there will need to be large changes to drive to a recycling rate of 30% by 2030.

Like most other areas, the sortation area will require significant investment to address the current shortcomings. States and even national legislatures are looking at funding proposals for sortation, which may include EPR. Again, a PRO may be a critical

organization to help identify those technologies and locations for the investment to have the largest impact in driving recycling rates and ensure the packaging (and flexible packaging) industry has a strong voice in where expenditures are made.

Packaging converters will be able to play a role to foster efficient sortation through the use of polyolefin-based packages, both polyethylene and polypropylene based structures that are more likely to be sorted and have valued end markets. Additionally, fitments or other features in a package can be designed from the same polymer to enable sortation or designed for disassembly so fitments or attachments can be easily removed by the consumer, or through sortation technologies. Finally, the use of digital watermarks or chemical markers will further drive accurate sortation and can be incorporated during the design stage.

Figure 7-8. Sortation Roadmap



Reprocessing

Sorted packaging can be turned into a useful feedstock for a new product or package in the reprocessing stage. The future for flexible packaging will require a major investment in both mechanical, as well as advanced, recycling technologies.

A benefit that reprocessors will have in 2025 and beyond, is the significant pent up demand for recycled plastics for brand owners to use for new packaging. One estimate showed that the capacity of today's infrastructure will only be able to meet about 6% of the goals that brand owners have already committed to, necessitating the need for significant investment. Flexible packaging will likely not be the major driver for reprocessing investment (that will start through rigid plastic packaging) but it would be a beneficiary of enhanced technology and investment.

One of the major challenges today for flexible packaging that was highlighted in the MRFF report[87] was a lack of cleaning processes for flexible packaging. The report specifically called out a need for 'dry wash' capacity in the U.S. for flexible packaging. Additionally, the ability to recycle PP based films in the future will be needed, as well as scaling up capacity to process PE films. PP PCR can be used for valued added packaging in retort and microwave packaging applications.

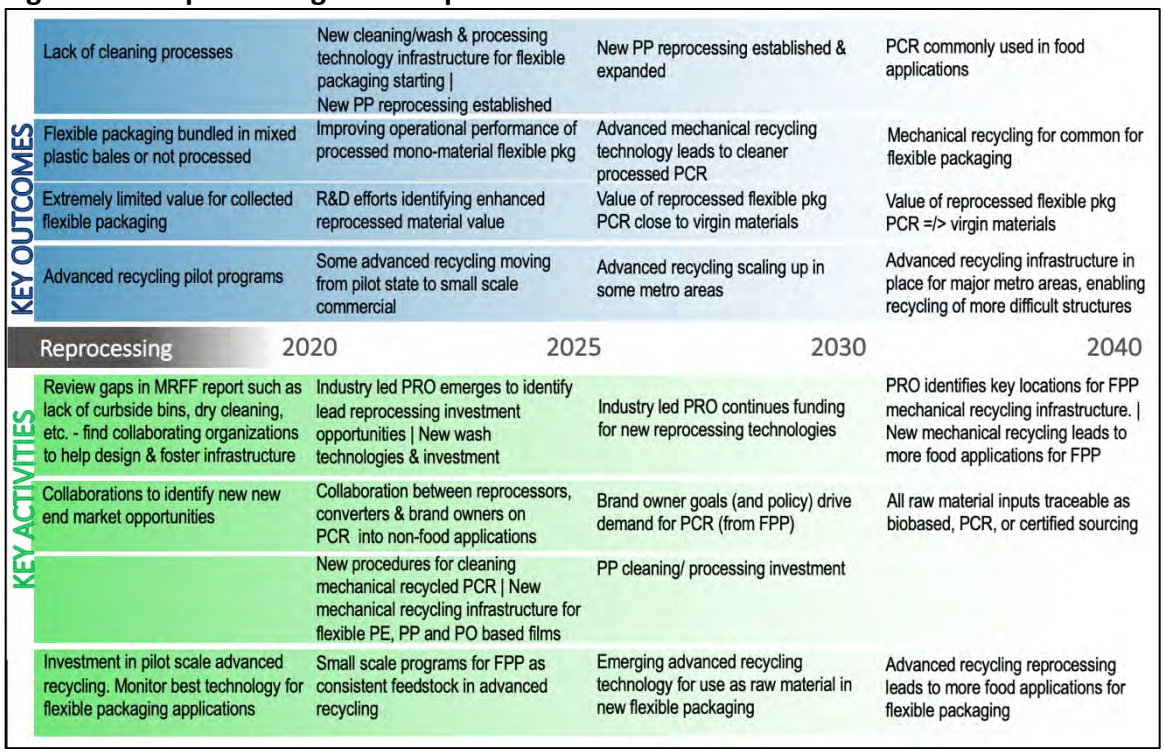
A challenge with a large percentage of flexible packaging is that the packages may hold sauces, gels, liquids, or even semi-moist products such as cheese that leave traces of product on the package after use, leading to contamination. New cleaning processes will be needed to find high-value end markets for these products. These may include new cleaning processes that take place before mechanical recycling or could include advanced recycling technologies. These technologies will offer the ability to take partially contaminated materials or flexible material that has been weakened over multiple rounds of mechanical recycling and create monomers and polymers with virgin-like quality, or other outputs including syngas, waxes, or transportation fuels. The combination of enhanced mechanical recycling, new cleaning processes, and advanced recycling will all play a major role in improving the recycling rate of flexible packaging. Advanced recycling will likely have some proven and commercial sites around major metropolitan areas by 2030, but likely will not be a major driver for recycling until the 2040 timeframe.

Again, flexible packaging converters will have limited direct influence on this area but will be critical to helping form collaborations and ensure quality feedstock can be used again in flexible packaging and other products to move toward a circular economy. Partnerships and testing of different feedstocks from these processes will play a pivotal role.

[87] https://www.materialsrecoveryforthefuture.com/wp-content/uploads/MRFF-Pilot-Report-2020-Final.pdf

Finally, the role of the industry led PRO will also be important in the identification of technology and investment in reprocessing.

Figure 7-9. Reprocessing Roadmap



End Markets

The final roadmap is for the development of end markets, a critical stage in the entire process. A major challenge for end markets in 2020 is that the price of recycled plastics, in general, is often higher than that of virgin resins. Recycled plastics have the additional challenges of having lower consistency (color, impurities) and lower overall performance from the mechanical recycling process. By 2030, the value for reprocessed FPP will need to be at or near the level of virgin materials. This may be accomplished through the earlier roadmap implementation of the collection, sortation, and reprocessing components becoming more effective and efficient through technology and infrastructure investment. Additionally, demand will be driven by brand owners looking to incorporate PCR back into their packaging and will help support the value and drive end markets.

Some countries, such as the United Kingdom[88] and Italy[89], are incorporating a tax on virgin resin as a way to incentivize the use of PCR and eliminate the price difference

[88] https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax/plastic-packaging-tax

[89] https://plasticsinpackaging.com/online/italy-postpones-plastics-tax-until-2021/

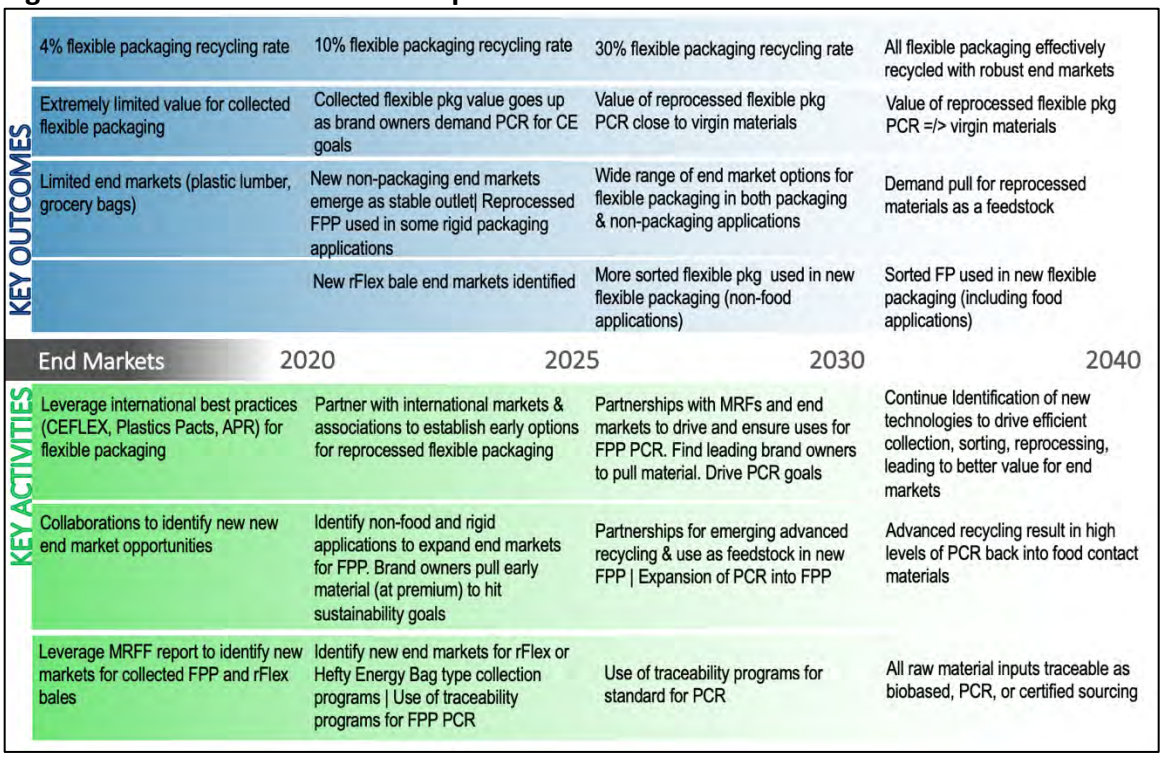
A key step will be taking flexible packaging that has been collected, sorted and reprocessed and finding new end markets for the collected materials. Today, little FPP is collected or sorted, and there has not been a major focus on finding new end markets. In 2025 and 2030, however, with more brand owners looking to incorporate PCR into their packaging, it will be critical to find outlets for collected PE, PP, polyolefins (PO), and even rFlex bales. Some of the initial end markets may be taking PP or PO bales and using the feedstock in rigid packaging applications. Some contaminated packaging may see a transition where they are used in unique applications such as roads[90] or other durable products where their use may help with properties of the road and lead to extended lifespan. Over time, as cleaning processes and advanced recycling become more sophisticated, there will be greater opportunities to turn recycled FPP back into new flexible packaging.

Another element that will grow in importance over time is the role of traceability and being able to ensure that PCR claims in packaging can be verified. Brand owners will be looking for this type of certification to protect against any greenwashing claims. Certification schemes are already underway for traceability from groups such as the Association of Plastic Recyclers[91] (APR) and through blockchain technologies (ex. BASF reciChain[92]).

In the end, flexible packaging converters will play a critical role in helping to identify end market opportunities and incorporating PCR back into flexible packaging, particularly for non-food applications. They will also need to be working with brand owners and testing new recycled feedstocks back into new packaging.

[90] https://www.foodprocessing.com.au/content/packaging-labelling-coding/article/soft-plastics-follow-the-red-recycled-road-1510745757
[91] https://www.environmentalleader.com/2020/04/plastic-pcr-certification-program/
[92] https://www.recyclingtoday.com/article/basf-recichain-project-british-columbia/

Figure 7-10. End Markets Roadmap



Summary

The roadmaps presented offer a guide to help companies, organizations, and interested parties a way to envision the systems approach that will be needed to help move flexible packaging toward a CE in the future. This is a daunting task for the flexible packaging industry to become integrated into a circular economy. It will take the investment of hundreds of millions of dollars into the recycling infrastructure. The Recycling Partnership estimated over $500 million[93] was needed by 2025 to transform the U.S. recycling system, and much of that investment was focused on further enhancing the collection of rigid packaging. The scale of investment and collaboration will be something that has not happened in the past. This collaboration will also require leadership and market incentives from governments, both at the state and national levels, along with new collaboration models like PROs to help coordinate investment and heighten the reality of the need and the sense of urgency.

Flexible plastic packaging today has a strong sustainability story, with its efficient use of resources and more limited lifecycle impacts, when viewed against other materials. However, there is a critical need to address the low recycling rates and design structures to meet brand owner goals of all of their packaging being recyclable, compostable, or reusable. The goal of these roadmaps is to provide a systems view and identify the

[93] https://recyclingpartnership.org/the-recycling-partnership-announces-first-ever-u-s-circular-economy-roadmap/

"North Star" to help the flexible packaging industry recognize the many critical steps and help launch key actions to strive and meet the key outcomes to play its part in a circular economy.

List of Acronyms

CE	Circular Economy
CS/FS	Current State and Future State
EPR	Extended Producer Responsibility
FPP	Flexible Plastic Packaging
MRF	Material Recovery Facility
MRFF	Materials Recovery for the Future
PCR	Post-Consumer Recycled
PE	Polyethylene
PO	Polyolefin
PP	Polypropylene
PRO	Producer Responsibility Organization
RFlex	Recycled Flexible Packaging bundles (may be PE, PO, PP, or mixed) (Specifically defined in the MRFF Research Report)

Chapter 8

Wrap-up and Summary

Sustainability continues to grow in importance and will be a major consideration for the entire packaging value chain over the next decade. Brand owners, consumers, legislators, NGOs, and retailers are all looking for packaging that aligns with circular economy (CE) principles and helps to meet their goals of all packaging being recyclable, reusable, or compostable by 2030, with some brands targeting 2025.

The crosshairs are on flexible packaging in particular as it does not currently align with the CE goals of brand owners. Significant challenges are ahead in design, collection, sortation, reprocessing, and end-market development. Further exacerbating the challenge is that 'design' is the primary component that flexible packaging converters have direct control over. This may include a move toward mono-material structures, compostable structures, as well as reusable pouches and technologies such as digital watermarks which may help in the sortation process. The other components are areas where flexible packaging can influence but will need collaboration and assistance to drive collection, sortation, and reprocessing.

To meet the challenges and implement the flexible packaging roadmaps will require significant funding and infrastructure development. Additionally, the upcoming decade is likely to see more focus on EPR and other legislative actions as COVID-19 has further strained municipal and state budgets, leaving local and state governments less willing or able to make large scale recycling infrastructure investments. As of 2020, there are currently eight states looking at EPR along with one national bill in the U.S. Senate.

This portends a future that will likely find a much more influential role from state and national governments over the next decade in shaping packaging recovery. The goal of these pieces of legislation will be to fund and develop infrastructure in an effort to drive more packaging to a circular economy.

Despite efforts for additional funding, it is generally thought that the initial focus will be driven by the collection of more rigid PET, HDPE, and eventually PP. These are materials that already have infrastructure, are more easily sorted at MRFs, and have more profitable end market opportunities. Much of the current MRF infrastructure was put in place over 30 years ago and needs to be updated for all materials to drive high recovery

rates. We also need to consider that plastic packaging use is expected to triple in volume by 2050 and it is imperative that the flexible packaging industry to be involved in these discussions as much of the technology needed to drive rigid packaging recovery and reprocessing can also be used for flexible packaging and lead to greater use of PCR in flexible packaging over time.

The flexible packaging future state and roadmaps were developed to provide a "North Star" for the flexible packaging industry – recognizing that the entire packaging value chain will need to work in concert going forward. Much like a bicycle chain, if any one link in the chain falls off — the collection of flexible materials, sortation technologies, reprocessing, or finding valuable end markets — the entire chain will cease moving forward and will prevent flexible packaging from integrating into a circular economy.

With flexible packaging currently having extremely limited collection (store drop-off programs) versus other materials, the challenge is more significant than other materials that have already established (though not at a high level) collection, sortation, and reprocessing systems. With no single entity providing ownership and leadership for the recovery value chain, flexible packaging may be more likely to encounter headwinds when looking for investment in recovery systems. This further drives rationale for the formation of an industry-led Producer Responsibility Organization (PRO) that manages the entire recovery chain.

It is important for all members of the FPA to review the Future State of 2030, Risk Assessment, as well as Roadmap chapters, in particular, to chart a course and develop internal roadmaps and strategy. Chapter 14 includes more specific actions and tactics that FPA members may find valuable.

To deliver a more circular future for flexible packaging, it will be critical to identify leading collaborative organizations to work with to help foster infrastructure and policies that will help lead to the Future State. Flexible packaging has a number of positive sustainability attributes and industry members should continue to merge the sustainable materials management principles it excels in (resource efficiency), with more circular economy-based principles to continue to be a favored packaging format for brand owners.

List of Acronyms

CE	Circular Economy
EPR	Extended Producer Responsibility
FPP	Flexible Plastic Packaging
NGO	Non-Government Organization
PCR	Post-Consumer Recycled
PRO	Producer Responsibility Organization
SMM	Sustainable Materials Management

APPENDIX

Appendix Chapters

Chapter 9

Market Research – Stakeholders, Members, Value Chain

Introduction

The voice of the customer is common terminology to describe the inclusion of the customers' perspective into strategic planning, product development, and other critical initiatives. In our task of developing roadmaps for flexible packaging sustainability, there are several customer groups whose voices need to be included in any serious discussion of the future of the industry.

One is the group of stakeholders who are closely associated with the future progress of the FPA. These people include the board of the Association who have demonstrated an interest and a passion for the future of flexible packaging in North America. The second group of customers are the members of the FPA. Members pay for a wide range of services that include thought leadership, market trends, legislative trends, and collaboration opportunities. Third, customers also include the larger universe of companies across the value chain that impact and are impacted by flexible packaging. The value chain includes resin manufacturers, packaging converters, brand owners, collection providers, recyclers, reprocessors, NGOS, other associations, and anyone who will help create the future state outlined in this document.

This chapter summarizes the results of interviews with stakeholders and the value chain, and a survey of FPA members. Representative slides are included in this chapter. The full PowerPoint report of each research initiative is available through the FPA.

Background

The three research initiatives were each conducted in the spring of 2020. Interviews with Stakeholders were conducted in March and April. Results of these discussions helped form the questions used in the survey of members, which was conducted in April and May. Interviews with companies across the value chain were completed in June and July.

All survey results were compiled and analyzed using appropriate tools. Interviews were examined for issues and themes that recurred across multiple individual interviews. Most of the analyses for interviews were qualitative in nature. Survey results were summarized numerically using averages and other quantitative tools to extract conclusions.

Stakeholder Interviews

Contact information for stakeholders was provided by the FPA. PTIS and PMG interviewed 13 individuals. Each interview lasted between 30 minutes and an hour and a half.

Specific questions are listed in the table below.

Table 9-1. Questions Used in Stakeholder Interviews

1	How do you define sustainability as it applies to flexible packaging?
2	How important is sustainability to your company?
3	How aggressively (on a 1-10 scale) would you say your organization is pursuing sustainable flexible packaging? Why did you give that number?
4	What are your organization's overall sustainability goals or objectives?
5	Will that goal(s) continue to provide strategic direction for the next 3-5 years? If not, how will it need to be modified and what would be the timing for the shift?
6	What is the biggest driver of sustainability? (e.g., government/regulations, consumer demand, brand image, company leadership, social or ethical concerns)
7	How will that change in the next 3-5 years?
8	What is the role of cost reduction in your sustainability efforts?
9	How important is sustainability for your customers (brand owners)? What are they telling you/ looking for when it comes to sustainability?
10	Advancing sustainability and the Circular Economy (CE) will require collaboration in the value chain. What do you see as the most important collaborations?
11	Which are you currently involved in?
12	Many brand owners are signing on to collaborations like the Ellen MacArthur Foundation (EMF) and the New Plastics Economy. What are your thoughts on where these initiatives are going?
13	What your role will be?
14	Is there an area of collaboration that is missing – entities that need to band together but are not doing so now?
15	Have you heard of the US Plastics Pact? Do you agree with its tenants – some/all? What are your thoughts on where it is going?
16	What are the biggest hurdles you are facing around implementing sustainability enhancements?
17	How do you get around these hurdles?
18	What will be 3 things that will have the biggest impact on flexible packaging sustainability – positive or negative?
19	Do you see anything coming out of other regions of the world (Europe, Asia, Latin America) that may be a leading indicator of where things will move in the future?
20	What technologies are you watching or testing that may have a significant impact on your sustainability efforts going forward?
21	How can the FPA be a resource to you and your company in reaching your sustainability goals or shaping public policy? Anything else the FPA can do to help?
22	What other comments or suggestions would you like to make?

Findings – Stakeholder Interviews

There is widespread recognition that there is not a single consistent or widely accepted definition of sustainability. However, the industry is moving toward a more holistic view that incorporates the circular economy. One respondent referred to this as "a more aspirational view." Others spoke of including an "end of life solution" and a definition that includes "the entire supply chain." Unequivocally, there is a desire for a definitional focus on a solution rather than just a description. And it is vital that "flexible packaging be positioned as the most resource-efficient package." Another respondent noted that "there will be confusion - and confusion does not bode well in the court of public opinion."

Sustainability has become more important for all stakeholder companies. It is a top management priority and a highly visible initiative. One participant said that "other things still matter, but sustainability is driving our dialogue." Many referenced "downstream pressure" coming from brand owners and, ultimately, consumers. However, smaller brand owners may not be pushing sustainability as hard as others, depending on their particular niche and other factors. And some sectors – for example, healthcare, are not as focused on sustainability for logistical or regulatory reasons.

Sustainability is being pursued aggressively. One respondent told of a high level team comprised of "our best product development people and pulled them out of the direct front line with customers. That we have taken these team members and focused them on sustainability shows how important it is and how aggressively (we are acting)." Sustainability is also becoming a more frequent strategic conversation. One respondent said that customers "don't like how plastics are vilified and want us to help them prove out why plastics are important."

Despite the high priority and visibility of sustainability, less than half of the companies represented in the stakeholder interviews have specific, measurable goals related to recycling, reuse, or recovery. Roughly half have more qualitative goals expressing desired directional change. For example, one said they "want to have a full sustainable packaging portfolio by end of the year. (But we) will not say all our packaging will be recyclable by XX time." Another simply said their goal is to "make sure we have products that meet what our customers are looking for." The underlying message is that sustainability goals are derived from package choice, which is driven by brand owners. And even though stakeholder survey results showed that less than half of companies have specific goals, many brand owners have signed on to Ellen MacArthur Foundation (EMF) and committed to having their packaging be reusable, recyclable, or compostable by 2025. Other brand owners have similar goals for 2030. This will be a challenge for flexible packaging – in particular multi-material FPP used for chips, confectionery, and other product categories.

Regardless of whether or not the goals are specific and measurable, we also wanted to understand the flexible packaging industry's strategic direction for sustainability for the next 3-5 years. We heard clearly that there is a latent need for coordinated direction. It is believed that some brand owners are making claims and signing up for goals that cannot be met, such as all their packaging being recyclable, or incorporating in a certain percentage of PCR, despite there not being enough infrastructure currently to support the high levels of PCR being requested. As one stakeholder put it, "we have the ability today to do it (meet our goals), but don't have the infrastructure or political will to do it." Further complicating the issue, converters are, of necessity, tied to brand owners. If brand owners change direction, converters will change with them. One respondent said that his company saw sustainability goals as "more like thematic areas – overarching. Many customers have goals on PCR, recyclability by 2025. We will continue to work toward those and modify them as our customers do." It is evident that advanced recycling[94] is perceived to be a necessary part of the recycling infrastructure for flexible packaging, allowing many goals to be met such as incorporating in higher levels of PCR into food and beverage packaging and allowing recovery of multi-material pouches, which is not possible through mechanical recycling.

Among many challenges that the flexible packaging industry faces is the generally negative public opinion of flexible packaging, and plastics in general. It is widely accepted that the industry is behind NGOs in impacting public opinion. "NGOs got ahead of us – educated and impacted opinions more effectively and now everyone else is playing catch up." Consequently, one of the biggest drivers of sustainability goes back to consumers – who are increasingly influenced by social media. "Social media is really driving now and influencing brand owners" one study participant noted. And the impact of social media is primarily negative. As another respondent observed, "society is looking more at flexible packaging as one of the waste streams that are not managed properly." Converters want to do the right thing, but seek direction on how to respond to emotion created by disturbing images of marine debris and plastic waste not being properly managed circulating across social media.

With the pandemic stretching on over 6 months (as of the writing of this report) and looking like it will be with us through most of 2021 (according to Bill Gates) what changes will we see over the next 3-5 years? The response to the pandemic has created a renewed sense of purpose, a focus on what matters most. One respondent in particular stated this very eloquently. "We have seen the emergence of purpose again. When it comes to getting your food from A to B, at some point you have to protect it. That is job one." COVID fall-out could also include a re-invigorated NGO push against plastics. "(We are) seeing more articles about the positive effect of lower fossil fuel use," noted one study participant. "COVID is putting single-use plastics in a different

[94]According to the American Chemistry Council, advanced recycling refers to several different processes that use existing and emerging technologies that return post-use plastics to their basic chemical building blocks for creating a versatile mix of new plastics, chemicals, fuels, and other products.

light. We will have some relief of pressure, but will be back in 6 months," another postulated. The most likely scenario foreseen by stakeholders will be little change as brands continue to look for cost-effective solutions.

Realistically, companies are driven by cost reduction/optimization and that will impact sustainability efforts. Study participants noted that established brands in particular are in a Catch-22 of having to make a change for consumers that will not pay. However, almost all believed that logical, cost-effective solutions will ultimately win out.

Sustainability is not only important to converters, but also to customers. More than one respondent observed that sustainability has become a standard part of Request for Proposals (RFPs). We have "seen sustainability move, in the larger customers, from a lower top 10 goal to a top 3," one executive said. And another observed that "sustainability has been elevated (in importance) across all customers." However, what that may look like is still open to debate. Most believed that sustainable solutions for flexible packaging will include mechanical recycling, in conjunction with advanced recycling and other options. As one person said, "we need to find solutions for wet, sticky, condiments and be able to recycle easily. We are going to need advanced recycling to get there."

Collaborations will also be required. The need for collaboration is recognized; and it will involve NGOs, converters, and others. As one participant summarized, "we have to work as an entity – industry and NGOs. Not just get rid of (flexible packaging) as a bad product. There is clearly a role for FPA – legislative aspects and public opinion." Consumers are also an important part of the collaboration – employees of CPGs and converters, and the general public.

The potential contribution from associations, NGOs, and industry groups is positive but often hampered by high cost and propensity to debate overtaking action. One executive stated quite bluntly of one major non-profit that "instead of setting a goal that is specific, attainable, measurable, and relevant and trackable, they have taken out the attainable and dropped in the aspirational and companies have signed on." The Ellen MacArthur Foundation (EMF) is a leading force among organizations seeking to establish collaboration. The EMF has driven the movement toward a New Plastics Economy[95] which calls for all packaging to be reusable, recyclable, or compostable by 2025, as well as the movement toward decoupling plastics production from fossil fuel based sources. Several stakeholders see their position as somewhat one-sided, driven by an aspirational NGO perspective but not rooted in actual infrastructure development.

In addition to EMF, the perception among stakeholders is that there are too many organizations pursuing similar goals and there is little or no coordination between them.

[95] https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy

Federal guidelines and perhaps oversight is necessary to achieve real change. As one noted, “there are too many organizations and we are spread too thin. This means less impact.”

One of the biggest hurdles faced in implementing sustainability enhancements is that flexible packaging works well and provides needed consumer performance. However, in its current form it is not aligned with circular economy principles that legislators, consumers, and NGOs envision. Many stakeholders see advanced recycling, EPR (if applied multi-laterally), and increased investment in infrastructure as part of the solutions. But targeted consumer research to understand perceptions and identify ways to communicate and effect needed changes in behavior will help to more precisely define the solutions.

Moving forward, the biggest impact on flexible packaging sustainability will come from a handful of directions. One is regulation/legislation at the federal level that will likely be a necessary element of an eventual solution to drive necessary infrastructure funding. Second is that the current recycling infrastructure will require substantial investment and must include viable, cost-effective options for flexible packaging. Third, a new or improved technology – either recycling or packaging – may drive the industry in a clear direction.

Some of the expected innovation or thought leadership may come out of other regions of the world. Europe is perceived as leading the way in recycling, product design, and producer responsibility. Advanced recycling is more accepted outside of the U.S. Several mentioned CEFLEX as an important initiative, even if they do not have European operations.

Lastly, the questions sought to understand how the FPA can be a resource in helping companies reach sustainability goals or in shaping public policy. The goal was to also understand what the FPA should be doing regarding sustainability. Stakeholders suggested that the FPA focus on positives – recognizing that the industry is hampered by a negative image with NGOs and consumers. LCA studies and consumer education are examples of facts that can shift the dialog in a more positive direction. The FPA was also encouraged to work constructively with regulators to develop understanding and sensible solutions. Grants for innovative programs may be part of this. Lastly, a roadmap for success in flexible packaging is needed which will require alignment with other industry organizations. This is an important strategy for the FPA long-term. As one executive stated, the FPA has a vital role in “defending the industry, being a strong voice for all substrates – paper and plastic.”

Member Survey

The purpose of the member survey was to develop and test alignment internally and with the marketplace, contrast results with stakeholder interviews, develop a deeper

understanding of member opinions and perceptions, and to take a pulse of membership. The final results are based on 61 completed surveys from 29 companies.

Table 9-2. Questions Used in Member Survey

1	To provide a rough idea of your geographic reach, what percentage of your sales comes from the U.S. market (if diversified company, please consider flexible packaging sales only)?
2	Does your company have specific goal(s) related to sustainability for flexible packaging?
3	(If you do have specific goals) What is the year in which you target to achieve that/those goal/goals?
4	(If you do have specific goals) What is the main focus of that/those goals? (check all that apply) – Picklist provided
5	What are the main reasons you do not have sustainability goals?
6	What are other areas of focus of that/those goals?
7	How has negative press about plastic packaging in general, or flexible packaging specifically, influenced your sustainability goals?
8	What job function within your company is the single most important force behind your sustainability efforts? (pick list provided)
9	What other job function within your company is the single most important force behind your sustainability efforts?
10	How important are each of the following initiatives to achieving your sustainability goals for flexible packaging? (1-5 rating from picklist)
11	From the list of initiatives above, which three are most important?
12	What other initiatives are important to achieving your sustainability goals for flexible packaging?
13	What are the biggest hurdles in implementing sustainability in your flexible packaging for the three most important initiatives identified in the previous question? (based on 3 selected from question 11)
14	What other hurdles are you experiencing now, or do you foresee?
15	Whom do you view as the leading companies in implementing sustainable flexible packaging? (can be any part of the value chain) What are these companies doing that makes them a leader in sustainable flexible packaging?
16	Advancing sustainability and the Circular Economy (CE) will require collaboration in the value chain. What collaborations or industry initiatives are you currently involved in?
17	Regardless of your involvement, which collaborations or industry initiatives do you think have the best opportunity to move the industry forward in a positive and constructive direction?
18	In what areas do you foresee the most important innovations in flexible packaging sustainability coming from over the next 3-5 years? (check all that apply) (pick list provided)
19	In what other areas do you foresee important innovations in flexible packaging sustainability coming from in the next 3-5 years?
20	Relative to (any component picked in Q19), who within the value chain will play the biggest role in driving innovation? (pick list provided)
21	In what areas or aspects of sustainability should the brand owner be placing the most emphasis? (check all that apply)
22	What other area or aspect of sustainability should the brand owner be placing the most emphasis?
23	What do you believe is the most important sustainability issue to brand owners currently?
24	What do you believe should be the most important sustainability issue to brand owners?
25	What is the most important role of the FPA in the push towards greater sustainability of flexible packaging? (check all that apply) (pick list provide
26	What other role of the FPA do you see in pushing towards greater sustainability of flexible packaging?

27	How strongly would you agree the FPA should develop a stance supporting national Extended Producer Responsibility (EPR) legislation that would focus on all packaging materials as a way to fund a recovery infrastructure? (rating from strongly agree to strongly disagree)
28	What do you see coming out of other regions of the world that may be a leading indicator of where things will move in the future in the U.S.?
29	What other comments or ideas would you like to share?

Findings – Member Survey

Eighty-five percent of survey participants stated that their companies have specific goals related to sustainability for flexible packaging. Goals focus on recyclable structures, recycled content, carbon impact (manufacturing & lifecycle). There is a lower focus on compostable or biobased materials and reuse. (See Figure 9.1)

Figure 9-1. Focus of Sustainability Goals

Results based on 61 responses from 29 companies

Companies that do not have sustainability goals cite the need to follow/respond to customer direction. “We do have manufacturing goals, but the question is about our products. Our customers determine the specifications for our products, so it would be overly aspirational for a packaging converter to set a goal that they specify the requirements of.” Others noted that they may not have goals currently, but that does not mean that sustainability is not important and visible in the company. “We do not have specific/measurable sustainability goals, but we are investing in several initiatives/projects to improve the sustainability of our operations, finished products, etc.”

Larger member companies are more focused on recyclable structures, recycled content, and lifecycle, while small and medium sized members show a bit more preference for compostable materials.

Most companies with sustainability goals have set 2025 as the target date for the achievement of goals. That date was noted by three times as many respondents as the next most frequently mentioned date, 2021.

Negative press about plastics in general or flexible packaging specifically has influenced sustainability goals in several ways. For some companies, it has increased the sense of urgency. As one noted, “we have been working and driving sustainability goals since 2016. The media and regulatory attention in 2019 have significantly accelerated the timing of our goals. In addition, the negative pressure has led to a significant shift in our resources to address the challenge and the opportunities.”

Another commented on the shift in emphasis based on consumer perception. “Negative press about plastic packaging has pushed us to focus more on recyclability than looking at the entire life-cycle impact of our products because it is difficult to convince consumers that sustainability is more than recycling. In general, the negative media attention has accelerated our focus on sustainability and influenced how aggressive our goals are.”

At least one company has responded by increasing its efforts in consumer education. “We've taken the feedback regarding plastic packaging and not only worked to advance our sustainability offerings, but we've also taken steps to work with customers on consumer education to demonstrate sustainable efforts throughout the supply chain.”

A number of respondents mentioned that negative press has led them to investigate new materials or consider modifying their product line. “The impact has mandated that we begin looking for alternatives with excellent barriers and shelf life.”

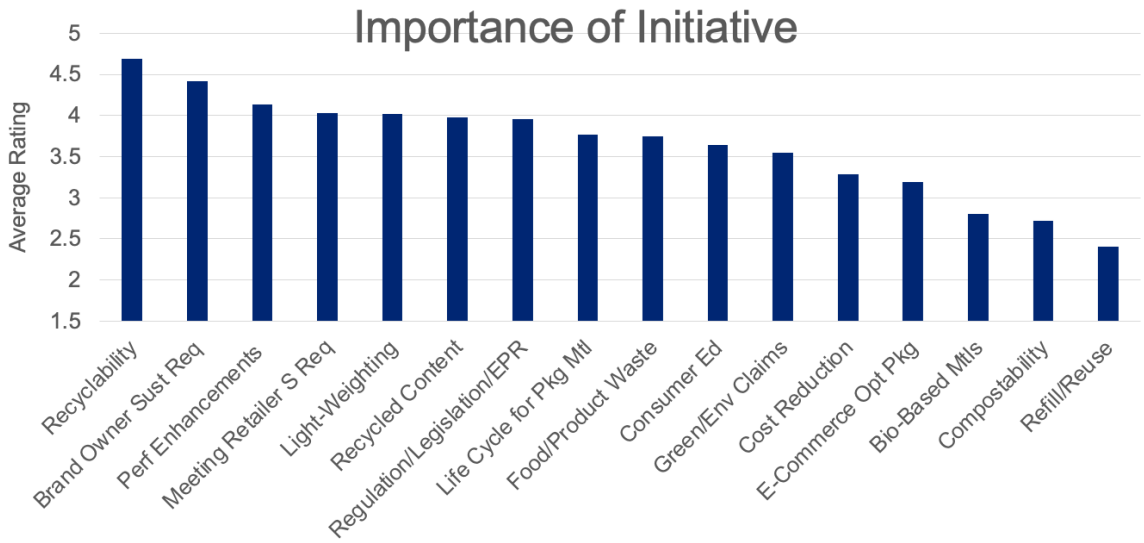
Sustainability is generally headed by VP or higher level positions. The most frequently mentioned position as being the force behind sustainability efforts is the CEO, followed by VP or Director of R&D and VP or Director of Sales and Marketing.

The most important initiatives (to achieving sustainability goals) are recyclability, meeting brand owner (BO) sustainability requirements, and (product) performance enhancements. These are rated as substantially more important than refill/reuse applications, compostability, and bio-based materials. (See Figure 9.2)

The most important initiatives are similar across larger and smaller member companies, with more nuances in the middle range where large companies focus more on food/ product waste while smaller companies are looking more at biobased and compostable materials.

Consumer education and EPR/Regulation also come up consistently as many recognize a role for non-traditional players in the packaging value chain to drive the collection and inclusion of PCR.

Figure 9-2. Importance of Initiatives to Achieving Sustainability Goals

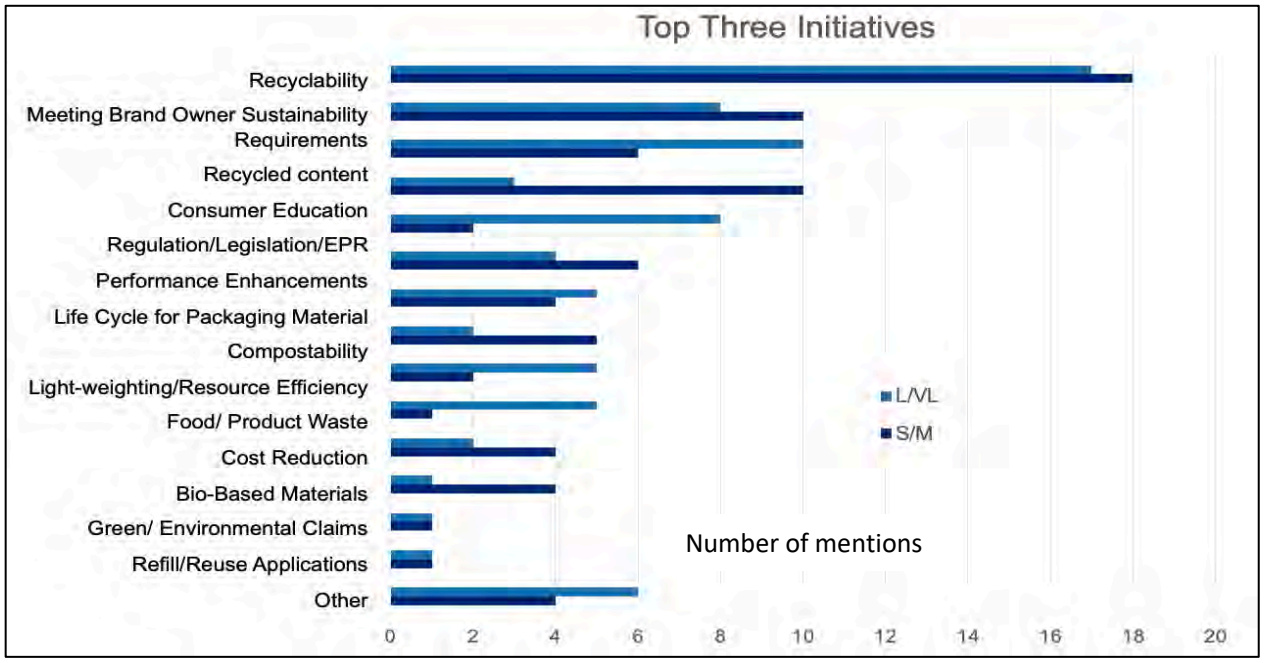


To clarify and confirm the most important initiative, we also asked what were the three most important initiatives from the long list presented. Recyclability was mentioned by 42 out of 61 respondents. Meeting brand owner sustainability requirements was listed among the top three initiatives by 22 respondents, and recycled content by 20 respondents. In contrast, meeting retailer sustainability requirements was mentioned by only 2 respondents, along with refill/reuse applications.

While recyclability almost runs away with being the most important initiative, consumer education, regulation/EPR come in the 4th and 5th slot – showing some recognition that non-traditional players in the packaging value chain have a large role to play in the future.

The initiatives noted as being among the top three varied by size of the company (See Figure 9.3)

Figure 9-3. Top Three Initiatives by Size of Company



Smaller and mid-size (S/M) companies (represented in Figure 9.3 by the lighter blue bar) were more likely than large and very large (L/VL) companies to include the following among their top three initiatives:

- Meeting brand owner sustainability requirements
- Consumer education
- Performance enhancement
- Compostability
- Cost reduction
- Bio-based material

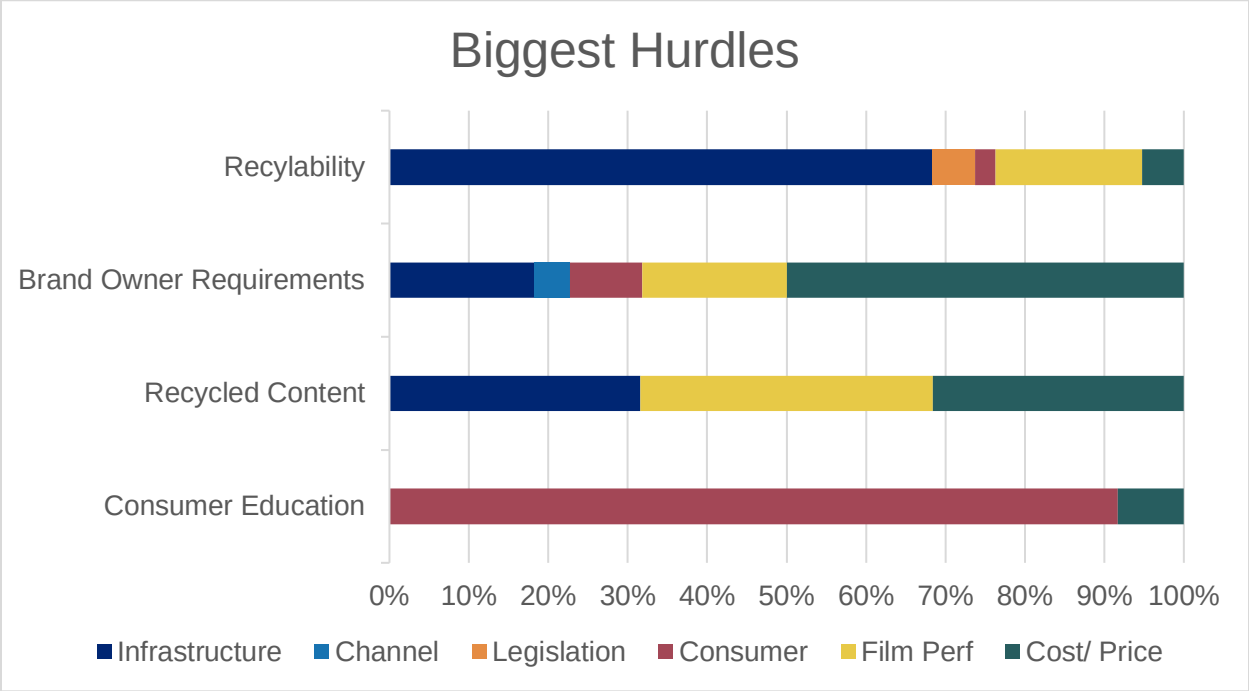
Large and very large companies were more likely to include the following among their top three initiatives:

- Recycled content
- Regulation/legislation/EPR
- Light-weighting/resource efficiency
- Food/product waste
- Life cycle for packaging materials

Respondents were asked what the biggest hurdles are in implementing sustainability for the three most important initiatives they chose. Looking at the most frequently identified important initiatives, infrastructure was the biggest hurdle identified by almost 70% of respondents choosing recyclability as an important initiative. Cost/price was identified by 50% of those choosing meeting brand owner requirements – confirming that brand owners are challenged on the price for sustainability options. For

those choosing recycled content, the hurdle was equally split between infrastructure, legislation, and cost/price.

Figure 9-4. Hurdles to Implementing Sustainability



Other hurdles identified by respondents included:

- Slow pace of change (overly conservative behavior, implementation of technology, legislation)
- Material cost (PCR, bio-based materials)
- Confusion over definitions (recyclability, sustainability, consumer understanding)

We asked respondents to identify companies that they saw as leading in the implementation of sustainable flexible packaging among converters, brand owners, material suppliers, and retailers. Companies mentioned most frequently were:

Raw Material Suppliers:

- Dow
- Borealis

Converters:

- Charter NEX
- Amcor
- Berry

Brand Owners:

- Nestle
- Coca-Cola
- Procter & Gamble

Retailers:

- Walmart
- Amazon/Whole Foods

Most responding companies are involved in several different collaborations, including associations, government, suppliers, customers, waste management, retailers, institutions, and peers. Specific organizations covered a wide range of issues, but those mentioned more frequently than others included: CEFLEX, SPC, AMERIPEN, ACC, Alliance to End Plastic Waste, and EMF. Moving forward – and regardless of collaborations currently supported, members want to see work in two key areas: consumer education and infrastructure.

The most important innovations that will drive flexible packaging sustainability are foreseen to come from many different areas over the next 3-5 years. Chief among them are:

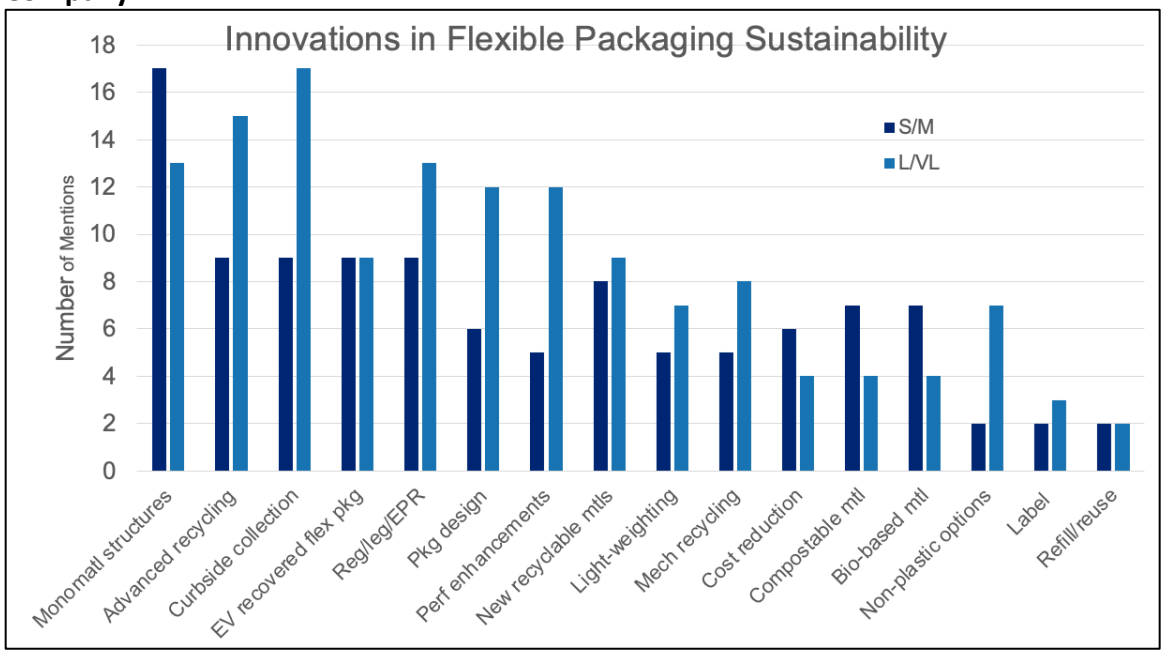
- Mono-material structures
- Advanced recycling
- Curbside (and other) collection

Somewhat surprising that the mechanical recycling or new recyclable materials are considerably further down the list. Respondents do not see technology developments in refill/reuse applications, label, or non-plastic options as being of high importance.

There are significant differences by the size of the company. (See Figure 9.5)

Large and very large companies are more likely to see curbside collection and advanced recycling as being higher in importance than small and medium sized companies. They are also more likely to see regulation/legislation/EPR, packaging design, and performance enhancement as being more important. Small and medium-sized companies are more likely to rate mono-material structures as an area for important innovations.

Figure 9-5. Important Innovations in Flexible Packaging Sustainability by Size of Company



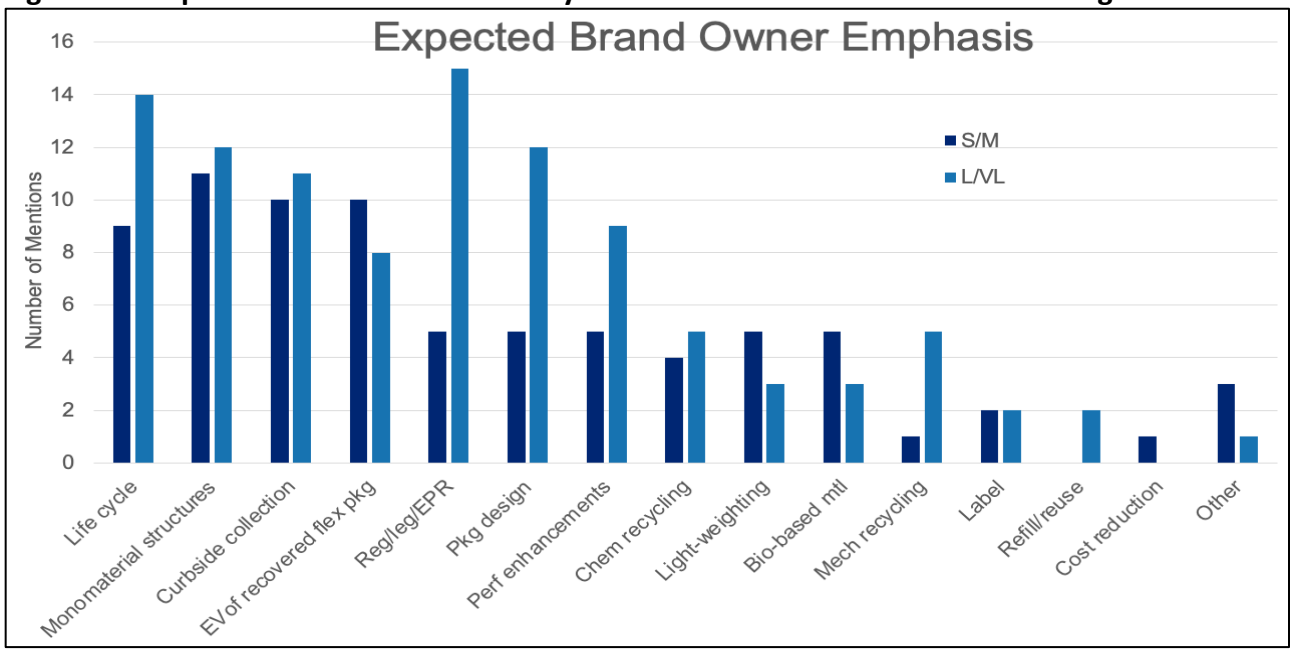
Respondents feel that brand owners should be placing the most emphasis on life cycle, mono-material structures, and curbside collection – more than label technology, refill/ reuse applications, and cost reduction. Results did vary by size of the company – large and very large companies were more likely to believe that brand owners should be placing more emphasis on life cycle, regulatory/legal/EPR, package design, and performance enhancements.

Brand owners focus on lifecycle components (carbon), mono-material structures, curbside collection, economic value of flexible packaging, regulations/EPR implication, and overall packaging design. Cost reduction is not a point of emphasis (but they do not want to pay more either!).

Larger members see EPR being driven more by brand owners than smaller members do.

Brand owners may see a larger government role as critical to helping fund infrastructure to achieve corporate recycling goals.

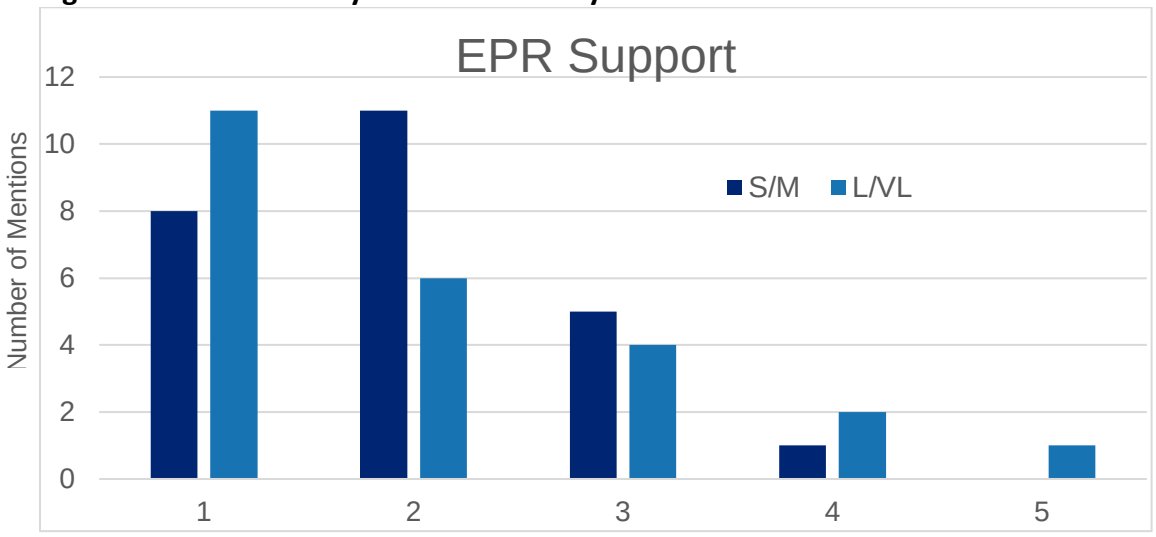
Figure 9-6. Expected Areas of Sustainability Where Brand Owners Should Be Placing



Emphasis

FPA members largely support some form of EPR (Extended Producer Responsibility). Forty-two of 61 respondents (69%) strongly agree/agree that EPR is an important way to fund recovery infrastructure (for all materials) while only 7 (11%) disagree. The key for the support is that infrastructure investment includes technology to drive recovery and not just be a fee on flexible packaging.

Figure 9-7. EPR as a Way to Fund Recovery Infrastructure



Value Chain Interviews

The PTIS and PMG teams engaged in several interviews with stakeholders across the packaging value chain to gain insights on the role of flexible packaging and

sustainability. Questions were tailored for each part of the value chain but with common themes. Interviews were completed with 52 individuals representing virtually all stages in the flexible packaging value chain.

Findings – Value Chain Interviews

Since each position in the value chain was asked a different set of questions, results are summarized by step or position.

Key take-aways from raw material and technology partners:

- There is a high awareness among raw material providers of the need for sustainable packaging solutions.
- PHA is a packaging material of interest and getting new investment in U.S.
- Digimarc technology (digital watermark aiding in waste sorting) has the potential to add substantial value to the sorting/recycling process.
- Europe is a more compelling environment for sustainable technologies given the regulatory support and consumer pull. There is also strong potential to identify best practices.
- EPR is viewed as a reasonable step towards the ultimate goal of zero waste and as a funding mechanism for the recovery infrastructure (recycling and composting).
- There is a high potential for growth in paper as the new flexible material – with coatings and performance enhancements. However, the life cycle trade-offs need to be clearly understood if using additional coatings or chemicals are used to achieve desired performance characteristics.

Key take-aways from brand owners:

- Sustainability is a critical element of the business strategy and product development efforts of leading brands. It has become much more important and visible in the last few years. Ellen MacArthur Foundation (EMF) driven solutions (recyclable, compostable, reusable, PCR content) figure most prominently in sustainability discussions.
- Negative issues include plastic and end-of-life dilemma – a lack of or insufficient recycling infrastructure and limited/weak market pull.
- Flexible packaging is seen as a hurdle to achieving sustainability goals – many of which are in line with EMF of all packaging being reusable, recyclable, or compostable.
- There is no clear commercialized technology (beyond movement toward all-PE based pouches) path to sustainable flexible packaging.
- The cost and availability of virgin versus PCR resin is a critical issue to success forward.
- There is a general acceptance of a federal government role in EPR or other approaches to driving common recycling goals and infrastructure funding.
- For some applications, paper may be a sustainable solution, and many foresee that paper will have significant opportunities going forward.

- Curbside (or other) collection is seen as the only feasible way to collect post-consumer waste to drive to high consumer participation rates for flexible packaging recycling; in-store collection is inconvenient to consumers, requires too much effort and may disappear along with the decline in brick-and-mortar stores.
- Flexible packaging in e-commerce may be a growth driver for converters. Performance features such as waterproof and lightweight materials, better transportation efficiency, and dimensional weight benefits are all attractive to e-commerce companies.
- There is an important and significant role for the FPA in uniting industry by providing feasible scenarios, encouraging appropriate legislation, and coordinating across industry groups.

Key take-aways from retailers and foodservice:

- Sustainability is important to retailers, but the current language does not convey the same sense of urgency as brand owners. Retailers are less likely than brand owners to have specific sustainability goals, though leaders like Walmart, Target, and Kroger are setting goals for their private label brands as well as brands they sell.
- At this stage of the value chain, there seems to be an anti-plastic sentiment, driven by consumer perception.
- Flexible packaging offers great performance benefits but suffers from not having an end-of-use solution. More simple structures, mono-materials, and advanced recycling have the strongest support for solution opportunities.
- Driving towards sustainable solutions will require a strong recycling infrastructure, standardized solutions across retailers, and a clear and consistent sustainability story.
- Currently, shared responsibility for progress in sustainability is leading to a lack of concrete action since no one has complete ownership.
- EPR is recognized outside of the U.S. as a driver of sustainable behavior. Retailers recognize that some type of government intervention will likely be required to drive change in U.S.
- Although paper is of interest as an alternative to flexible plastic, retailers have concerns about performance capabilities.
- Retailers are not positive on in-store drop-off or dealing with post-consumer packaging, especially flexible packaging. Concerns include residual food, consumer knowledge, appearance, and pick up frequency.
- The focus of the FPA should be on promoting infrastructure and technology as well as product innovation that drives sustainability.
-

Key take-aways from recovery companies:

- Sustainability is of very high importance to MRFs and other recovery companies.

- Recovery end markets include products made from recycled packaging (e.g., lumber), mechanical and advanced recycling, and other uses (e.g., as feedstock in cement kilns).
- The MRFs, converters, and brand owners all bear responsibility for improving packaging sustainability.
- The major limitations to recycling are the need for a greater push to change behavior – to the point of mandates – and outdated technology and lack of investment at MRFs.
- Reprocessors of flexible packaging profitability will be driven by strong demand for recycled flexible packaging. There is no indication this will happen in the near future without government mandates.
- From the perspective of recovery companies, brand owners own the packaging component and should take a more active role in the collection and fostering a circular economy through the use of PCR in new packaging.
- Optical sorters can play a key role in profitability.
- Demand for recovered flexible packaging needs to be created to drive economic value.

Key take-aways from associations and NGOs:

- From the perspective of NGOs, flexible packaging is an environmental challenge. As an executive at one NGO stated, "thin film packaging is very much vilified in NGO circles due to its environmental impact." This is driven by a lack of end of use collection/solutions rather than carbon impact.
- NGOs see flexible packaging as having essentially no value at end of life. To "zero wasters" the ideal sustainable solution is a reusable package.
- Mono-material is a short-term solution while advanced recycling will require substantial investment to be viable.
- EPR is a key mechanism to fund recycling infrastructure – especially as COVID has put municipalities at risk of defunding recycling programs. The industry will be asked to do more.
- There are substantial challenges with flexible packaging on the front end (they do not typically use PCR) and the back end (there is no serious outlet for collected materials). The result is that flexible packaging does not currently fit into a circular economy.
- In the eyes of NGOs, responsibility for creating a sustainable package alternative is shared across the value chain. A challenge currently is that no one entity owns the packaging value chain. In systems where EPR is implemented, Producer Responsibility Organizations (PROs) may play an important role in bridging this gap.
- NGOs see the need for cooperation dialog and are open to conversations with the FPA and other trade organizations.
- NGOs need to be better educated on the value of packaging in general and flexible packaging specifically – the industry is viewed as not having done a good job educating or bringing solutions.

Summary

The information from each of the three research projects summarized has been incorporated into the roadmaps included in this report. These can be found in Chapter 7.

Chapter 10

Non-flexible Packaging Material Understanding

The current focus on moving to a more sustainable circular economy (CE) for packaging and eliminating plastic and other packaging as waste is of critical importance to companies and organizations across the packaging value chain. Companies that provide materials, containers, and packaging components are working with their customers and other parts of the value chain as well as NGO's to help move toward a CE while offering a variety of solutions. To improve consumer sustainability/CE perceptions, some companies are trialing different materials, constructions, and formats to improve packaging sustainability and CE attributes. When considering packaging materials and sustainability, it is important to ensure communication aligns with the FTC Green Guides[96], which provide direction on sustainability claims.

Packaging, materials, and containers afford many benefits to bringing products to the market by providing healthy and safe products in an undamaged format at a cost that is supportive of the overall value to consumers and customers. All packaging materials and containers offer value and it is important for brand marketers and consumers to utilize a variety of packaging materials and options to deliver the best value based on consumer needs and usage occasion.

There are a variety of packaging materials and formats that can be used across products and categories. Components may be used in combination with flexible and non-flexible packaging solutions to provide a variety of product/package offerings, including bag-in-box cereal packaging, pouches, or sachets in cartons with or without overwraps, etc. The combination of different materials and formats leads to additional complexity in the overall sustainable packaging value chain. As a quick overview some formats are included in the following table.

[96] https://www.ftc.gov/system/files/documents/public_events/975753/ftc_-_environmental_claims_summary_of_the_green_guides.pdf

Table 10-1. Materials Comparison Overview

	Definition	Applications	Recycling rate	Comments/sustainability positioning
Composite Container	A composite container is a canister or a container made from more than one constituent material to enhance useful properties. Materials generally consist of kraft papers with metal or plastic ends	Snack canisters (Pringles), Paper bottles with plastic inner liners TetraPak for beverages	Generally, not broadly recycled	Provides convenience and lightweight. The predominant material may be recycled in some instances if it contains over 95% of a single material by weight. Work is underway to improve recycling solutions. Pringles is currently testing an all paper canister. TetraPak composite packages are shipped on a roll, so have a large inbound logistics GHG impact advantage over preformed containers.
Corrugated	Paper-based material consisting of fluted corrugated sheet and one or more flat linerboards used to make a container for shipping products (Wikipedia)	Shipping containers and displays that hold multiple product/package formats and often overwrapped with stretch film on pallets. E-commerce shipping	86.4%	Highest recycling rate and fits in most curbside systems Often contains 30% to 100% recycled fiber content. Used for protection and unitization. With the growth of e-commerce, corrugated boxes taking on more of a primary package role for the unboxing experience.
Glass	Container glass is made from silica, soda ash, and limestone, which is heated to very high temperatures in a kiln and then placed in specific molds to create containers (Wikipedia)	Bottles, jars, drinkware, and bowls	33.9%	Container glass is very strong, but brittle so is always coated to add additional protection. May include single-use or multiple use returnable offerings for beer and soft drinks . Glass tends to have a very high level of contamination in MRFs and recovery works best in dual-stream systems or where collected in deposit states. High GHG and water usage due to high energy requirements in the production of steel.
Metal Steel	Steel or tin cans are a container designed for shipping and distribution or storage of goods. The cans are coated on the inside to offer protection to the product and eliminate corrosion potential. Containers may be easy open or	Steel cans are a staple across a variety of product platforms, especially foods where the cans with a product are retorted/sterilized producing shelf stable products. Long shelf life applications	70.4%	Steel is readily recyclable and easily collected at MRF's due to their magnetic properties. Generally high GHG due to high energy requirements in the production of steel.

	require an opening device (Wikipedia)			
Aluminum	Containers made primarily of aluminum and coated and printed for decoration (Wikipedia)	Used primarily for beverages and other liquids	49.2%	Aluminum utilizes significant energy in mining and manufacture but is infinitely recyclable The most valuable material based on weight and high demand and strong end markets after sortation
Paper cartons	Paper cartons are made from paper fibers using a process that uses water and heat to make the end product called paperboard (Wikipedia)	Paperboard, especially cartons are used across wide product categories and sectors including crackers, cereals, and pasta	65.9%	Much of the paperboard cartons in use commercially may be up to 100% recycled materials. Additionally, a variety of products are packaged in a bag-in-box format where the outer package is paperboard and the inner package is a pouch that can be easily removed for recycling purposes.
Rigid plastics PET, HDPE, LDPE, PP, PS	Rigid plastics are plastics that do not conform easily when squeezed. They can be made from a variety of plastic materials and have a broad range of properties depending on usage requirements (Wikipedia)	Rigid plastics are used across a wide array of applications, including food, beverage, household, chemical, pharmaceutical. LDPE is used in a variety of squeezable applications and PS is used extensively in bakery packaging applications, etc. PET is widely used in soda bottles, while HDPE is common in milk jugs and laundry detergent	PET 29.1% HDPE 31.2% PP 4%	PET and HDPE bottles are the primary containers collected curbside. However, these numbers need to increase significantly to provide enough PCR for increased circularity. Other rigid plastics currently have very low recycling rates. PP collection efforts need to increase as this material provides enhanced thermal performance for higher heat processing and microwavability and is being used in more applications

Flexible packaging's method for collection today is mainly limited to store drop-off. Other materials such as bottles, cans, tubs, paper, and corrugated have curbside collection infrastructure (for single-family homes) allowing for easier collection. There is a clear and significant need to increase the collection and recycling of rigid plastics (bottles) and other materials such as PP to be able to meet future EMF/NPE and brand owner goals. Without a significantly increased collection of rigid plastic bottles, meeting EMF goals for PCR will be extremely difficult, if not impossible given current time frames.

Packaging Example Gallery

Photo 10- 2. Examples of composite packaging. Pringles testing new recyclable canister in UK (left) and TetraPak liquid cartons on the right

Photo 10-2. Corrugated boxes and rigid plastic containers

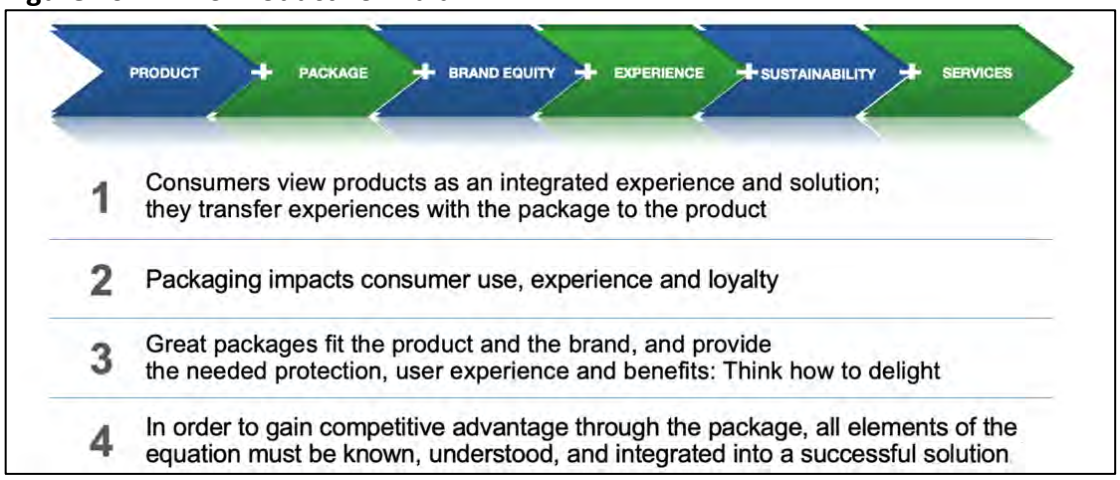
Photo 10-3. Steel cans (left) and aluminum can (right)

Photo 10-4. Paperboard carton (left) and glass bottles (right)

Summary and Looking Forward

Consumer and customer wants will always be critical and very important for brands and companies. Consumers and Brand Owners are strongly behind sustainability initiatives. In the 2018 BSR GlobeScan of Sustainable Business survey[97], consumers identified sustainability efforts as the second most important effort just behind corporate reputation. Going forward brand owners will need to increase their focus on identifying and providing packaging materials, formats, and containers that deliver against consumer needs and wants from a sustainability standpoint. As can be seen from the PTIS Product Formula (Figure 10-1) products need to provide many attributes to support the overall objective to support the many consumer wants.

Figure 10-1. PTIS Product Formula



[97] BSR. State of Sustainable Business, September 2018

The PTIS Product Formula describes the holistic nature of how packaging influences the overall product experience. When a consumer buys a product, they are buying a solution or experience and packaging plays a key role including package format. Additionally, the packaging role in brand equity and purpose is critical as well as the many attributes like convenience, safety, fun, and more. Importantly, sustainability and CE are also an important part of the overall product formula and will continue to play a more important of the overall product formula in the future.

Chapter 11

Sustainability/Circular Economy Organizations

Background

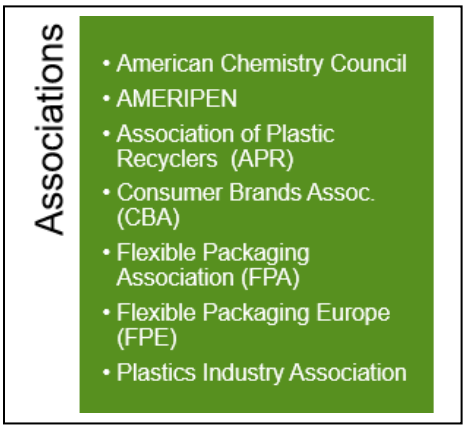
Over the next decade, attention will be focused on more sustainable packaging in the U.S. Solutions at scale will come from across the plastics value chain because no one company, industry sector, or individual alone can clear away the plastic waste already in our environment or curb the ever-increasing amount of new plastic waste that is generated daily. In the transition from the current state to the future state, associations, NGOs, and non-profits play a key role in advocating for change and facilitating collaborations.

Introduction

This chapter serves as a resource for learning about an organization and understanding how they fit in the packaging sustainability universe, including highlights of recent programs and activities. The groups, broadly categorized as Associations, NGOs/Not for Profits, and Collaborations, listed in Figure 11-1, are not all-inclusive, and many interconnect through their leadership in various initiatives. A prime example is the Ellen MacArthur Foundation, New Plastics Economy Global Commitment, U.S. Plastics Pact, and their signatories from the memberships of consumer brand associations.

Figure 11-1. Sustainability and Circular Economy Organizations and Collaborations

Associations



Associations, including the American Chemistry Council (ACC), Consumer Brands Association (CBA), and Plastics Industry Association (PLASTICS), are playing an active role in sustainability efforts. Some of their goals and activities are included in scenario and future state development actions for the roadmap section of this report. Packaging trade associations are also focused on sustainability - working with their membership to communicate the benefits and environmental footprint of various formats.

American Chemistry Council (ACC)

The American Chemistry Council has a sub-group called the Flexible Film Recycling Group (FFRG); its goal is to increase the collection and recycling of all flexible films significantly and to educate the public about the importance of recycling. The group tends to focus on the polyethylene (PE) film value chain and may not necessarily include a focus on multi-material films.

The group implemented the Wrap Recycling Action Program (WRAP) – creating an in-store drop-off option for flexible films (overwraps, grocery bags, bread bags, etc.). WRAP campaigns help communities keep plastic film out of their municipal recycling facilities (MRFs) by establishing collection points at retailers, including mass merchant, grocery, and home improvement stores. These PE bags are then combined with other PE film collected at the back of stores and sent to a reprocessing center to be recycled. The group has also developed the www.plasticfilmrecycling.org website to provide information to consumers and community leaders on how to advance flexible PE film recycling in their community. As of 2019, WRAP had approximately 250 champions and partners in the U.S. with over 18,000 collection points.[98] However, with the onset of COVID-19 in 2020, many stores temporarily halted the collection of plastic bags and wraps, as individuals quarantine at home or limit excursions, decreasing supply.

Another subgroup of the ACC is The Advanced Recycling Alliance for Plastics (ARAP) - formerly known as The Chemical Recycling Alliance. Members include innovative companies engaged in the business of developing and commercializing advanced recycling technologies, including plastic resin manufacturers, converters, and brands collaborating to develop advanced recycling solutions. Advanced plastics recycling and

[98] https://www.plasticfilmrecycling.org/

recovery technologies can create a wide range of products from post-use, recovered plastics, such as plastic and chemical feedstocks, transportation fuels, and crude oil, while complementing mechanical recycling. ARAP works closely with Closed Loop Partners, the Sustainable Packaging Coalition, The Recycling Partnership, and the Association of Plastic Recyclers.

The ACC's Plastics Division recently announced a set of standards designed to help brands and others use more recycled content, and to accurately communicate with consumers. The standards can also be used by resin manufacturers as traceability standards to increase confidence in recovery and advanced recycling technologies.

The ACC's Mass Balance Certification Principles consist of three core principles and eight enabling principles. The three core principles address chain of custody traceability, attribution of credit, and use of third-party audits.[99]

AMERIPEN

AMERIPEN represents the U.S. packaging value chain by providing public policymakers with fact-based, material-neutral, scientific information to advocate for a future where all production, distribution, and consumption are sustainable.

The association recently published "AMERIPEN Financing Principles and Objectives for Advancing Packaging Recycling in the US" – a framework for industry financing that proposes the development of a continuous-improvement fund financed and managed by the packaging industry. The fund could be developed at a national level but designed to support specific state and regional needs to drive recovery system changes. It would fund infrastructure upgrades and innovations to improve the quality of recyclables and advance the types of materials that can be processed cost-effectively. It would also help invest in innovations for end-market development and assist with educational efforts to reduce contamination and consumer confusion about recycling. While this could support some of the shortfalls in funding curbside community programs, its primary purpose would be to invest in mechanisms for change and not simply transfer costs from government to industry to run public solid waste services.

Association of Plastic Recyclers (APR)

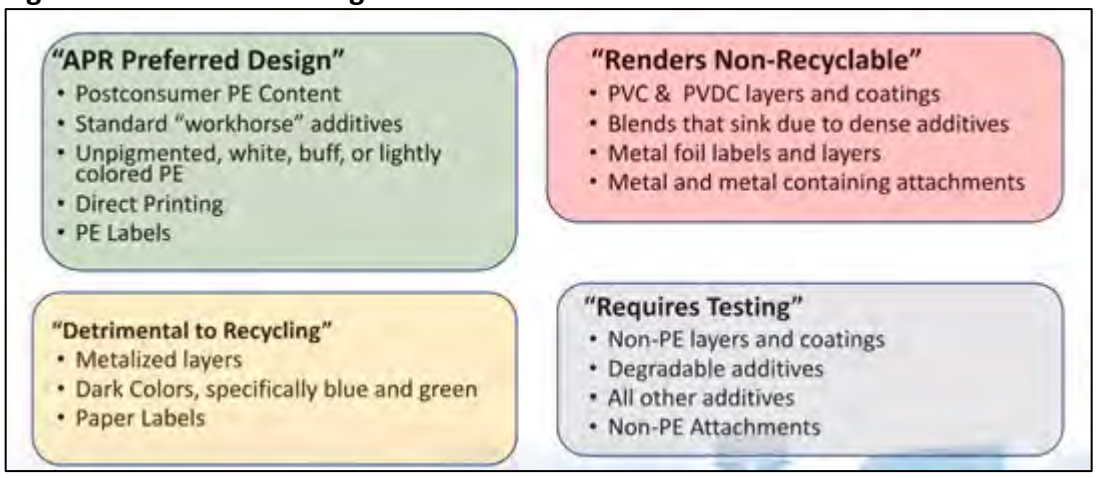
The Association of Plastic Recyclers (APR) is a trade association representing companies responsible for more than 90% of the post-consumer plastic processing capacity in North America. APR works to set standards and enhance the quality and quantity of recycled materials through technology, testing, design, and training.

The APR published the APR Design® Guide for Plastics Recyclability to help package design engineers at consumer brand companies and converters create packaging that is

[99] https://plastics.americanchemistry.com/recycling-and-recovery/Mass-Balance-Certification-Principles-2020.pdf

fully compatible with plastics recycling systems in North America. APR's film design for recycling work provides a voluntary process for multilayer package developers to market packages as recyclable through the current retail return system for PE film, especially when paired with the on-package How2Recycle label. An overview of the guide is shown below in Figure 11-2.

Figure 11-2. APR Film Design Guide



Note that the APR design for recycling process is entirely dependent on consumers being told whether they should recycle a particular film package or not. The program is expected to help with shifting to more recyclable bags, wraps, and pouches in the future.

Consumer Brands Association (CBA)

The Consumer Brands Association (CBA), formerly the Grocery Manufacturers Association, is a trade association of the food industry, representing the world's largest branded food, beverage, and consumer product companies. The CBA organized the Recycling Leadership Council, along with more than a dozen other business associations and environmental groups, in January 2020. Their collaborative efforts are discussed later in this chapter.

In May 2020, the CBA announced a new recycling platform, saying its members support "a national solution to fix the country's broken recycling system." Its three goals include harmonizing the more than 10,000 local recycling programs in the U.S., a long-term financing plan, and strong end markets to meet demand.[100] The six different funding mechanisms include virgin resin fees, packaging fees, waste generator fees, landfill tipping charges, per-bag fees for residential trash, and voluntary industry fees to support consumer education.

[100] https://www.plasticsnews.com/news/consumer-goods-makers-propose-virgin-resin-fee-boost-recycling

CBA argues a virgin plastics fee would make it more economically more attractive to use recycled content. The announcement comes as many of its member companies in the consumer goods industries have made commitments to use more recycled plastic in the U.S. but say they'll struggle to find enough material because of low recycling rates.

Flexible Packaging Association (FPA)

The Flexible Packaging Association (FPA) is the U.S. association of the manufacturers of flexible packaging; and material or equipment suppliers to the industry. The organization promotes the benefits, contributions, and advantages—including the sustainability—of the value added segment of the flexible packaging industry. It provides robust research for members on industry, legislation, and trends, as well as providing representation and advocacy for the flexible packaging industry before stakeholders including government, retailers, customers, and consumers.

The FPA has a range of sustainability resources for members and the public including streamlined lifecycle assessments and sustainability benefits of flexible packaging. The FPA is the sponsor of this report.

Flexible Packaging Europe (FPE)

Flexible Packaging Europe's (FPE) members include more than 80 small and medium-sized companies as well as the major European producers of flexible packaging for all materials. Six national flexible packaging associations are also members, ensuring consistency between national and European activities and lobbying.

In July 2020, members agreed on a Sustainability Vision. The goals are as follows:

- Designing flexible packaging for full effectiveness and minimum environmental footprint
- Circularity for flexible packaging
- Zero tolerance of leakage and littering into the environment
- Speeding up progress with cooperation.

FPE is a founding member of CEFLEX – the collaborative initiative of a European consortium of companies representing the entire value chain of flexible packaging – detailed later in this chapter.

Plastics Industry Association (PLASTICS)

The Plastics Industry Association (PLASTICS) is the only organization that supports the entire plastics supply chain and is considered the plastics industry's main U.S. lobbying group. During the COVID-19 pandemic, PLASTICS was quick to emphasize the need for single-use plastic products and plastic materials.

Programs include Operation Clean Sweep, the Zero Net Waste Program, and NEMO (New End Market Opportunities). Launched in 1991, Operation Clean Sweep (OCS) is an

international program designed to prevent resin pellets, flake, and powder loss and help keep this material out of the marine environment. PLASTICS is also a signatory to the "Declaration for Solutions on Marine Litter" and committed to working collectively with organizations around the globe to address the issue of marine debris. The PLASTICS Zero Net Waste (ZNW) program recognizes companies that take steps to drive toward zero net waste in manufacturing.

The NEMO for Film project was a formal demonstration (2017) aimed at better understanding different feed streams of PE films, improving the economics of recycling, and exploring new potential end markets in the U.S. Phase II demonstrated that recycled materials can be functionally used in structural applications, and proved to be a good, low-cost feedstock for advanced recycling technologies, like chemical recycling. When used in film applications, like shopping bags, the material proved functional, yet presented some aesthetic limitations - giving converters an opportunity to work with brands and help shift aesthetic requirements to accommodate a wider range of post-consumer recycled content (PCR).[101] In June 2020, a PLASTICS report announced that a new asphalt formulation using recycled polyethylene (rPE) film recovered from retail locations could achieve many of the same benefits of traditional polymer-modified asphalt formulations, including improved performance, decreased cost, and increased lifespan of asphalt.[102]

NGOs/Not for Profits

Non-Government Organizations (NGOs) identify macro concerns or problems and provide a pulse and platform for critical issues they believe need greater attention. The Ellen MacArthur Foundation and their work on The New Plastics Economy and the U.K. and U.S. Plastic Pacts are the driving forces for brand owners and many other parts of the value chain to focus on eliminating plastics and packaging as waste

Alliance to End Plastic Waste

The Alliance to End Plastic Waste, comprised of nearly fifty companies across the plastics value chain, includes many global chemical companies. Together, they have invested $1.5 billion towards solutions that will prevent the leakage as well as recover

[101] https://www.plasticsindustry.org/article/plastics-releases-report-recycled-materials-used-new-applications

[102] https://www.plasticsindustry.org/news/plastics-in-the-news

and create value from plastic waste. The majority of their projects are in Asia, Africa, and Latin America. The End Plastic Waste Innovation Platform, jointly organized by Plug and Play and the Alliance, focuses on supporting start-ups across the globe to innovate in the plastic waste management space.

Closed Loop Foundation/Closed Loop Partners

Closed Loop Partners (CLP) is an investment platform that invests in sustainable consumer goods, advanced recycling technologies, and the development of the circular economy. Responding to public opinion on environmental issues and climate change has significantly shifted corporate commitments around recycling and plastics reduction in recent years. Brand owners and corporate foundations pledged another $54 million to the Closed Loop Infrastructure Fund (CLIF) in June 2020, money that will go toward supporting recycling in the U.S. CLIF is the oldest of the multiple funding programs CLP manages. The CLIF extended investment indicates the pandemic has not slowed that momentum. It also has a leadership fund, beverage fund, fashion fund, venture fund, and the Center for the Circular Economy.

In July 2020, CLP launched a consortium with Walmart, Target, and CVS Health - the Beyond the Bag Initiative, a plan to reinvent single-use plastic bags. The goal is identifying, testing, and implementing viable design solutions and models that more sustainably serve the purpose of the current retail bag. CLP will also launch a Circular Accelerator, develop potential piloting opportunities, and aim to make infrastructure investments in support of the development of market-ready solutions.

The Closed Loop Foundation, the independent 501c3 affiliate of Closed Loop Partners, researches and supports business models that build markets and roadmaps to improve environmental outcomes through the circular economy. In 2017, the Foundation funded a national study to understand bottlenecks holding back recycling of post-consumer LDPE film and multi-laminate film packaging recycling and where investment is needed.

Ellen MacArthur Foundation (EMF)

The Ellen MacArthur Foundation (EMF) was launched in 2010 to accelerate the transition to a circular economy with three principals: design out waste and pollution; keep products and materials in use; regenerate natural systems. Plastics became the focus of the Foundation's first Systemic Initiative – the New Plastics Economy (NPE). The NPE brings together key stakeholders to re-think and re-design the future of plastics, starting with packaging. The EMF is a leading force among organizations seeking to establish collaboration.

How2Recycle

The How2Recycle program began in 2008 as a project of the Sustainable Packaging Coalition (SPC). The How2Recycle program contains a label graphic, which instructs consumers on which packaging components are recyclable. How2Recycle currently has

225 brand and retailer members and has issued more than 100,000 design recommendations to members to make their packaging more recyclable. [103]

The most popular design improvement recommendations issued for plastics include:

- Change to a film that qualifies for the Store Drop-Off label
- Change to mono-material from multi-material

Flexible packaging is by far the biggest and most challenging recyclability challenge facing brands. While some product categories can be changed to Store Drop-Off packaging today, others, such as those containing wet and sticky products or those requiring a high-performance barrier, require recycling system interventions. Interventions may include new or different collection mechanisms for reprocessing technologies like advanced recycling.

The How2Recycle label provides an excellent consumer interface and encourages design for recycling. Its drawback is that its use is voluntary, and as a result, not enough packages use it, especially if packages cannot be labeled with an unqualified "recyclable."[104]

Photo 11-1. How2Recycle label for a plastic pouch example

The Recycling Partnership (TRP)

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; and helped companies and communities invest more than $55 million in recycling infrastructure.

The organization debuted a three-pronged report in 2019, "The Bridge to Circularity," aimed at developing a more robust system to recycle packaging in the U.S. The non-profit will provide initial funding for the first initiative, "Pathway to Recyclability," focused on enhancing packaging design through new collaborations. The organization also calls for $250 million worth of investment aimed at "Unlocking Supply" for the growing number of manufacturers setting recycled content goals. Funding will be directed to collection and MRF infrastructure, consumer education, and unspecified "advocacy efforts." Finally, TRP calls for an additional $250 million to pursue a new

[103] https://how2recycle.info/news/2020/report-the-future-of-store-drop-off-recyclability
[104] https://www.closedlooppartners.com/wp-content/uploads/2020/02/FilmRecyclingInvestmentReport_Final.pdf

"Recycling 2.0" model. Funding will be directed to efforts around data systems, consumer participation, infrastructure, and research into new and emerging innovations.

In 2020, TRP, in conjunction with the EMF and World Wildlife Fund (WWF), organized the U.S. Plastics Pact discussed in the collaborations section of this chapter.

UN Environment Programme (UNEP)

The United Nations Environment Programme (UNEP) is the leading authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment. UNEP's work efforts fall into seven broad thematic areas: climate change, disasters and conflicts, ecosystem management, environmental governance, chemicals and waste, resource efficiency, and environment under review. The overarching commitment is to sustainability.

UNEP launched Clean Seas (#CleanSeas on social media) in February 2017, with the aim of engaging governments, the general public, and the private sector in the fight against marine plastic pollution. The New Plastics Economy Global Commitment is led by the Ellen MacArthur Foundation (EMF), in collaboration with UNEP. EMF leads the engagement with the private sector (the business signatories and endorsers), and UNEP leads the engagement with the governments. Other works include the 2018 publication "Single-Use Plastics – A Roadmap for Sustainability."

Zero Waste USA

Zero Waste USA is dedicated to promoting zero waste efforts nationally and internationally. The NGO promotes conserving resources and not burning or burying them. Founded in 1996 as GrassRoots Recycling Network, the name was changed to Zero Waste USA in 2014 and is an affiliate of the Zero Waste International Alliance – supporting communities in aspiring to zero waste. The organization is currently focused on training and certification of the next generation wanting to do zero waste work for communities or institutions – through forums, workshops, and online courses.

Collaborations

There are substantial challenges in driving flexible packaging toward a circular economy, which will require significant investment and a shift toward system understanding. Collaborations drive sustainability with the ability to develop multifaceted programs with investment money and resources from across the value chain. Within the last two years, several long-range recycling initiatives were introduced and successful pilot programs were conducted. Collaboration at multiple levels is a key theme throughout the roadmaps in this report. In the transition from the current state to the future state, many best practices will come from European initiatives, leading corporations, and non-profit organizations.

Academia

Higher education is in a unique position to affect change as the size and value of the global packaging industry are ever-expanding. Until Michigan State University (MSU) established its packaging program in 1952, there were no university-based packaging education programs in the world, and packaging is still a very new discipline.[105] Leading FMCGs are now attaching increased significance to packaging as a means to facilitate improved sustainability, as well as the rise of e-commerce and on-the-go convenience across industries and products. Collaboration occurs between academia, associations, and non-profits as well as with participants outside of the packaging value chain, such as financial institutions.

Through teaching, applied research, student-led initiatives, and campus management, the Ellen MacArthur Foundation (EMF) is working with leading universities and institutions worldwide to foster acceleration toward a CE. The EMF-NPE Global Commitment is supported by more than 50 academics, universities, and other educational or research organizations, including MIT Environmental Solutions Initiative, Michigan State University (MSU), and University College London.

The Sustainable Packaging Coalition (SPC) membership includes over 35 academic institutions, including Clemson University, MSU, University of Georgia, University of Wisconsin-Stout, and several international schools.

Leading brand owners, such as Unilever, are collaborating with academics, suppliers, start-ups, and other organizations to develop new technologies.

[105] https://www.packaginginsights.com/news/packaging-education-specialized-degrees-can-help-solve-sustainability-challenges-and-more-experts-say.html

Arizona State University, home to the first comprehensive School of Sustainability in the U.S., approaches Circular Economy through a three-pronged strategy: in education, in practice, and through RISN, a collaborative global network of public and private partners.

The Institute for Sustainability and Energy at Northwestern University (ISEN) is spearheading a new Program on Plastics, Ecosystems, and Public Health (PEPH). The ultimate goal is to establish a comprehensive scientific understanding of the uncertain environmental and human health impacts resulting from the unprecedented use and accumulation of plastics worldwide while accelerating the discovery of scalable solutions to mitigate such impacts.

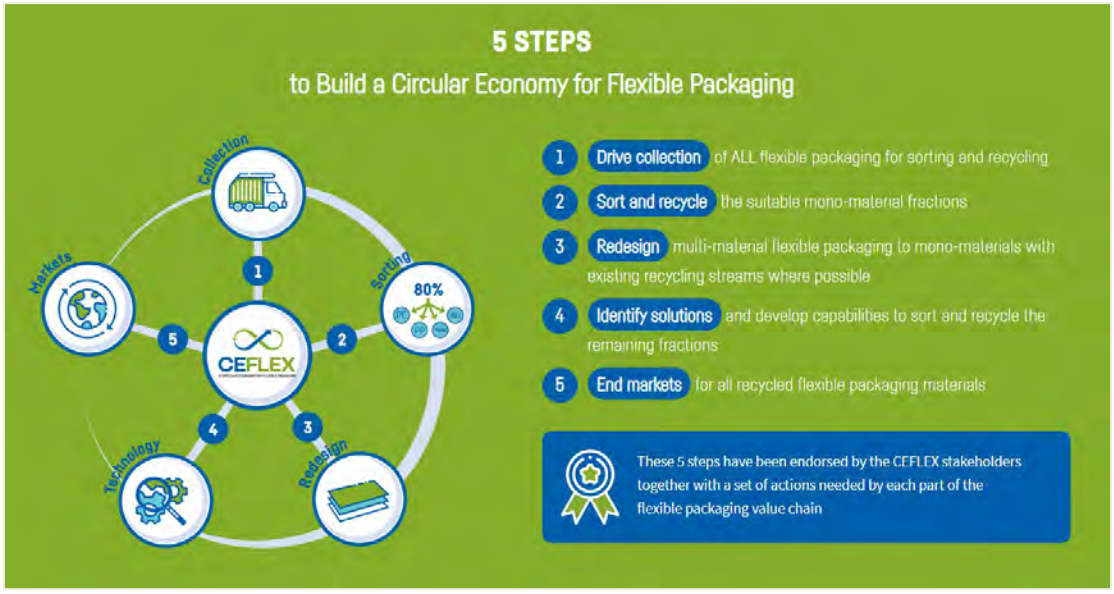
Non-traditional value chain participants, like Morgan Stanley, are working with academic institutions and non-profits to support research and thought leadership in order to better understand the challenges around and solutions to plastic waste. The global financial institution founded the Plastic Waste Reduction Fellowship with the University of Michigan School for Environment and Sustainability to explore how markets and investment can help reduce plastic waste and identify the drivers of plastics flows in the global economy. In partnership with Northwestern University's Kellogg School of Business, Morgan Stanley created a new plastic waste reduction award, the Kellogg-Morgan Stanley Sustainable Investing Challenge, specifically to catalyze innovative investment strategies around reducing plastic waste. They also partnered with the National Geographic Society and the University of Georgia College of Engineering on the Marine Debris Tracker – a mobile app that enables individuals to log plastic waste pollution along coastlines and in waterways. This is a first-of-its-kind open-data platform with over two million items tracked to-date, and the partnership is helping improve the understanding of the sources of plastic debris and pollution while also generating scientific findings.[106]

CEFLEX

CEFLEX is the collaborative initiative of a European consortium of companies and associations representing the entire value chain of flexible packaging, working to make all flexible packaging in Europe circular by 2025. In June 2020, CEFLEX produced 'Designing for a Circular Economy' (D4ACE), a set of comprehensive guidelines to enable everyone in the flexibles value chain to produce packaging that is easy to sort and recycle. Their five-step process is highlighted in Figure 11-3.

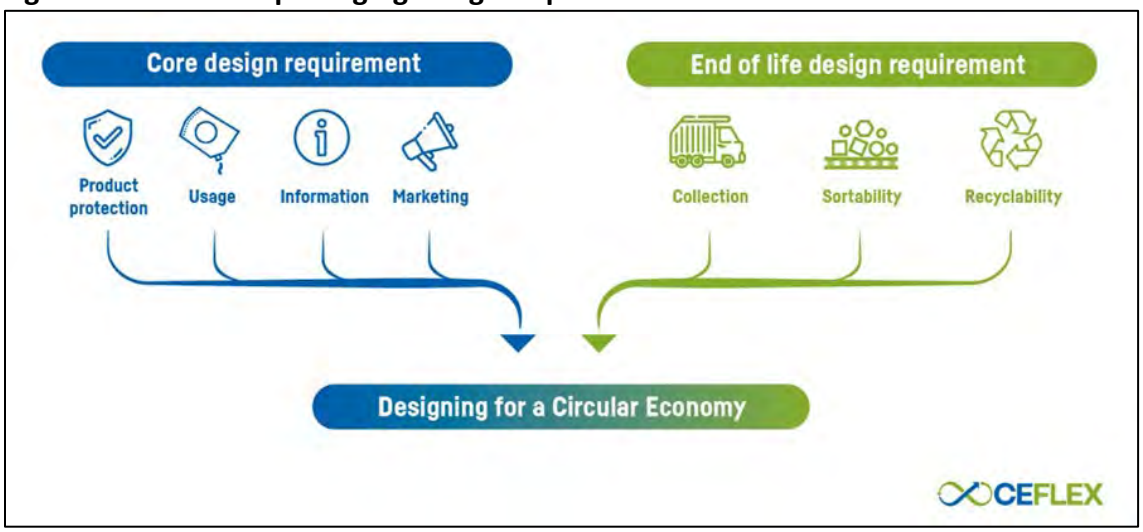
[106] https://www.weforum.org/agenda/2020/01/the-business-case-for-investing-in-sustainable-plastics/

Figure 11-3. CEFLEX – Five Steps to Build a Circular Economy for Flexible Packaging



Focused initially on polyolefin-based structures - PE, PP, and PO mixes - as these represent over 80% of consumer flexible packaging on the European market, the guidelines provide advice on the critical elements of flexible packaging, including the materials used, barrier layers, and coatings, size, shape, inks, and adhesives. The document will guide brands and retailers who play a key role in specifying consumer packaging to make informed design choices so that all flexible packaging is suitable for sorting and recycling but retains the functionality needed for its primary purpose, protecting the product.

Figure 11-4. Flexible packaging design requirements[107]



[107] https://guidelines.ceflex.eu/resources/

In most cases, CEFLEX says this will mean favoring mono-material over multi-material flexible packaging formats as these are the most efficient to sort and recycle. This preference for mono-material flexible packaging solutions brings with it a range of challenges to deliver similar functionality and the possibility to use existing packaging machinery.[108]

Materials Recovery for the Future (MRFF)

The Materials Recovery for the Future (MRFF) is a collaborative research project between leading members of the flexible packaging value chain created to research and pilot a scalable approach to recover the value from FPP (flexible plastic packaging) vs. landfilling.

Findings released in June 2020 include the following:

- With adequate optical sorting capacity and peripherals, FPP can be efficiently captured in a large single-stream MRF and processed into a commodity bale (rFlex) for reuse in a variety of markets while diverting plastic from landfills
- End market opportunities for rFlex include roofing materials (an immediate, high volume opportunity), pallets, and railroad ties
- Only a few North American reprocessors are interested in taking the rFlex bales, mainly because the bales contained both plastic and a certain amount of paper
- Assuming curbside flexible packaging recovery advances, bale specifications will need to be developed

The pilot hit the first four of five performance goals:

- Reduce the amount of FPP going into fiber products, even with increased FPP in feedstocks
- Minimize paper in the new rFlex product bale
- Reduce fiber Quality Control staff by 25%; reallocate that staff to other job functions in the MRF
- Integrate the FPP recovery system into TotalRecycle's existing MRF control system
- Capture at least 90% of FPP, which was determined from years of research prior to the pilot; hitting 74% (February 2020)

The pilot proved FPP can be sorted from single-stream curb side collection with the right equipment, which is deemed a success because the material causes problems at MRFs with traditional equipment. The other notable boon, in the opinion of multiple sources, is a cleaner fiber line.[109]

[108] https://packagingeurope.com/c/

[109] https://www.wastedive.com/news/flexible-packaging-separation-pilot-mrff-mascaro-rflex/582038/

New Plastics Economy Global Commitment (NPE)

The New Plastics Economy Global Commitment is led by the Ellen MacArthur Foundation, in collaboration with the UN Environment Programme. The EMF leads the engagement with the private sector (the business signatories and endorsers), and UNEP leads the engagement with governments.

The Global Commitment and its vision for a circular economy for plastic are supported by the WWF, and have been endorsed by the World Economic Forum, and The Consumer Goods Forum (a CEO-led organization representing some 450 retailers and manufacturers from 70 countries). There are more than 450 signatories including companies representing 20% of all plastic packaging produced globally, as well as governments, NGOs, universities, industry associations, investors, and other organizations. Amcor, Borealis, The Coca-Cola Company, Danone, L'Oréal, MARS, Nestlé, PepsiCo, Unilever, Veolia, and Walmart are the initiative's Core Partners. More recent signatories include Berry Global, Constantia Flexibles, Futamura Group, Mondelēz International, Inc., and TC Transcontinental.

Signatories commit to three actions to realize this vision.

- Eliminate all problematic and unnecessary plastic items
- Innovate to ensure that the plastics we do need are reusable, recyclable, or compostable
- Circulate all the plastic items we use to keep them in the economy and out of the environment

Sustainability is a critical element of brand owner business strategy and product development efforts and has become more important and visible in the last few years. EMF-type solutions are the most prominent, but some view as anti-plastic.

Recycling Leadership Council

The Consumer Brands Association (CBA) launched the Recycling Leadership Council in January 2020 to build the American Recycling Roadmap, a public policy framework to reimagine the U.S. recycling system.

The Council is comprised of stakeholders from consumer-facing industries, packaging companies, and the recycling ecosystem. The framework will seek consistency in the recycling system and guide advocacy at the federal, state, and local levels. Members include AMERIPEN, Closed Loop Partners, FPA, Ocean Conservancy, The Recycling Partnership, and other key industry associations.

The Council will host regional roundtables across the U.S., uniting stakeholders to discuss best practices in current industry actions, technological innovation, and public-private partnerships, as well as to tackle the challenges faced by local recycling systems. The roundtable will help the council understand what is and isn't working in different

parts of the country and enable the group to pinpoint scalable themes and policy solutions. Key findings from each roundtable will be summarized and shared publicly.

ReSource: Plastic

ReSource: Plastic, led by the World Wildlife Fund (WWF), is a first-of-its-kind effort to quantify corporate impact and track company actions and opportunities to reduce plastic waste. *Resource: Plastic* aims to enlist 100+ companies by 2030 in the effort to reach the ultimate goal of preventing at least 50 million metric tons of plastic waste from entering nature. WWF says that just 100 companies can prevent about 10 million metric tons of the world's plastic waste pollution. Principal Members are Keurig Dr. Pepper, McDonald's, Proctor & Gamble, Starbucks, and The Coca-Cola Company.

The inaugural report (June 2020) found these five companies collectively used 4.2 million metric tons of plastic in one year, of which only 8% was sourced from recycled material. The report findings were calculated using the ReSource Footprint Tracker, an innovative methodology designed to fill a critical measurement gap companies have needed to effectively advance plastic sustainability. Following the lifecycle of plastic, the Footprint Tracker measures how much and what kind of plastic is being used, and where they are likely ending up upon disposal.

The most recent members include Amcor, Colgate-Palmolive, and Kimberly-Clark. Thought partners are the Ellen MacArthur Foundation and the Ocean Conservancy.

Sustainable Packaging Coalition (SPC)

The Sustainable Packaging Coalition (SPC) is a membership-based collaborative led by the environmental non-profit GreenBlue. The Sustainable Packaging Coalition (SPC) is the leading voice on sustainable packaging, and its membership encompasses the entire supply chain. Members enjoy access to the Goals Database, a curated compendium of industry commitments aimed at improving packaging sustainability.

Recent projects include ASTRX and How2Recycle described below:

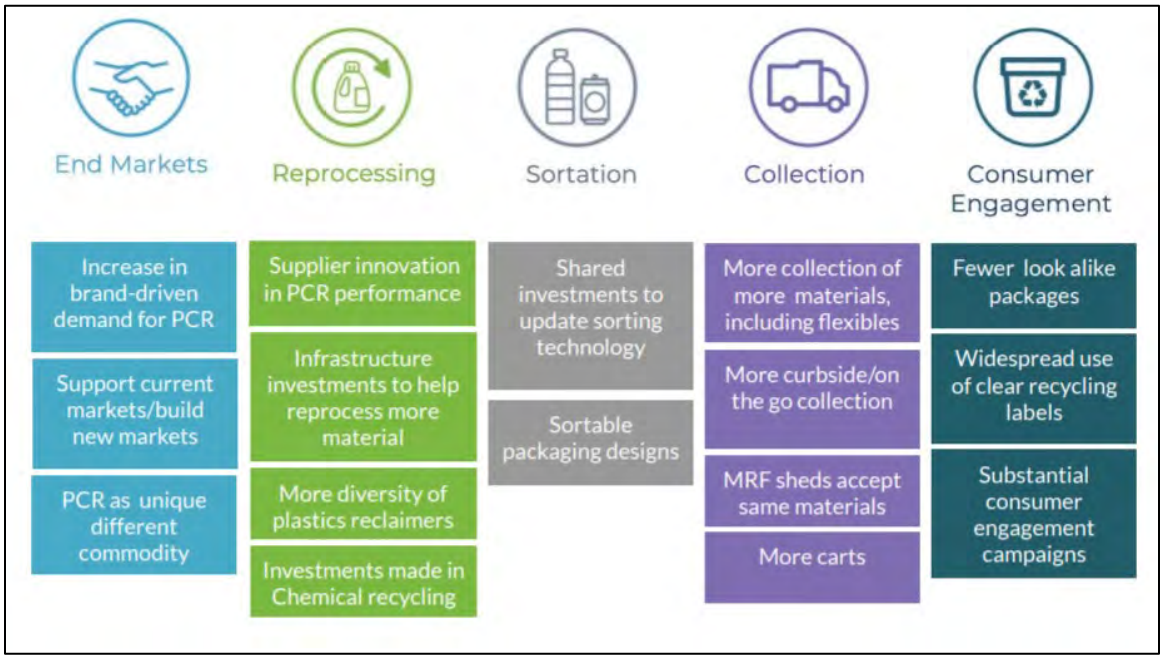
ASTRX (Applying Systems Thinking to Recycling), a joint project of The Sustainable Packaging Coalition® and The Recycling Partnership, released The ASTRX Review of Material Flow at MRFs and Reprocessors. The report investigates how plastic, paper, glass, aluminum, and steel packaging move through two critical pieces of the circular economy: material recovery facilities (MRFs) and reprocessors.

The How2Recycle® Label is the leading U.S.-based on-package recycling label. Launched in 2012, the program now consists of over 150 member companies that place the How2Recycle label on packaging to inform consumers how to recycle accurately and where to go if they need to find information specific to their municipality.

SPC ideas of what the future should look like and pathways to achieve those goals are listed below and in Figure 11.5:

- More collection systems are more available
- More material collected, less contamination
- Brands, retailers, packaging suppliers, governments, and consumers all step up their games
- MRFs are equipped with better technology
- Packaging behaves more consistently in recycling
- PCR isn't prohibitively expensive
- Market volatility is reduced

Figure 11-5. SPC's System of the Future Vision[110]



UK Plastics Pact

The UK Plastics Pact, led by WRAP (The Waste and Resources Action Program) and launched in 2018, is the first of the Ellen MacArthur Foundation's global Plastics Pact network. The UK Plastics Pact aims for a plastic packaging recycling rate of 70% and for all plastic packaging to be reusable, recyclable, or compostable by 2025.

In 2020, The UK Plastics Pact developed a 5-year strategy specifically for flexible packaging. Among the solutions proposed to increase the recycling rate for flexible structures are:

- designing packaging that can be recycled and sorted;

[110]SPC Virtual Event: What are the Solutions and What Does the System of the Future Look Like? (June 17, 2020)

- investing in sorting and reprocessing facilities; and
- ensuring that recycled flexible packaging has strong end markets

In the short term, the roadmap emphasizes capitalizing on the store collection points provided by supermarkets. The pact also calls for an average PCR content in PE and PP films of 10% by 2025. In the long term, curbside collections of flexible packaging must be implemented in all local authority areas.

U.S. Plastics Pact

The U.S. Plastics Pact is the latest in the Ellen MacArthur Foundation's global network of plastics pacts, which have so far launched in Chile, France, the Netherlands, Portugal, South Africa, and the UK, in addition to a wider European Plastics Pact. The Pact, launched in August 2020 by more than 60 public and private stakeholders, is being led by the Recycling Partnership with the support of WWF.

The Pact seeks to establish a near-term target for U.S. circular economy efforts to reduce the use of non-renewable virgin plastics through the following four targets for plastics packaging:

- Define a list of plastic packaging to be designated as problematic or unnecessary by 2021; take measures to eliminate them by 2025
- By 2025, all plastic packaging will be 100% reusable, recyclable, or compostable
- Undertake ambitious actions to effectively recycle or compost 50% of plastic packaging by 2025
- By 2025, the average recycled content or responsibly-sourced bio-based content in plastic packaging will be 30%

Commitments also include transparency and consistent reporting, with progress monitored through WWF's ReSource: Plastic Footprint Tracker and publication of an annual report. The next steps for the effort will include the creation of a roadmap, which will establish steps for achieving the targets outlined by the Pact.

Conclusion

Associations, NGOs, and collaborative schemes are integral to driving sustainability in the plastics and especially the flexible packaging industry. Opportunities include measuring trends, comparing flexibles to other formats, and evaluating new technologies. Organizations can also effect change by uniting the industry by providing feasible scenarios, encouraging appropriate legislation, and coordinating across industry groups. Key areas of focus include building infrastructure and promoting technology and product innovation that drives sustainability. Education on the value and benefits of flexible packaging – from the consumer to the MRFs – is also essential. It is an exciting time to be in the flexible packaging industry, and cooperation and open dialogue between these organizations and other stakeholders must continue.

List of Acronyms

ACC	American Chemistry Council
APR	Association of Plastics Recyclers
ARAP	Advanced Recycling Alliance for Plastics
ASTRX	Applying Systems Thinking to Recycling
CBA	Consumer Brands Association
CE	Circular Economy
CEFLEX	Circular Economy for Flexible Packaging
CLIF	Closed Loop Infrastructure Fund
CLP	Closed Loop Partners
D4ACE	Designing for a Circular Economy
EMF	Ellen MacArthur Foundation
EPR	Extended Producer Responsibility
FFRG	Flexible Film Recycling Group
FPA	Flexible Packaging Association
FPE	Flexible Packaging Europe
FPP	Flexible Plastic Packaging
ISEN	Institute for Sustainability and Energy at Northwestern University
LCA	Life Cycle Assessment
MRF	Material Recovery Facility
MRFF	Materials Recovery for the Future
MSU	Michigan State University
NAPRA	North American Plastic Recycling Alliance
NGO	Non-Government Organization
NPE	New Plastics Economy
OCS	Operation Clean Sweep
PCR	Post-Consumer Recycled
PE	Polyethylene
PEPH	Plastics, Ecosystems, and Public Health
PO	Polyolefin
PP	Polypropylene
PRO	Producer Responsibility Organization
rPE	recycled polyethylene
rPET	recycled PET (polyethylene terephthalate)
SPC	Sustainable Packaging Coalition
UN	United Nations
UNEP	UN Environment Programme
WRAP	Wrap Recycling Action Program
WRAP (UK)	Waste Resources Action Programme
WWF	World Wildlife Fund

Chapter 12

Packaging Sustainability Legislation and Related Initiatives

Background and Overview

Legislators around the globe have been taking a role in packaging regulations for the past thirty years but have become particularly active in the past five years, and will likely continue to be a major driver of future packaging direction. Legislation has the potential to shape recovery goals, fund/develop infrastructure, as well as implement bans on certain materials and play a role in developing market drivers for collected materials. Europe has tended to be a leading indicator of potential legislation in other parts of the world, with the U.S. typically moving more slowly than other countries toward environmentally-focused legislative goals.

The European Union (EU) set the stage with EPR in the 1990s and early part of the 2000s. In the U.S., action has primarily been through local governments leading with some state goals, but little action thus far at the national level. In the U.S., there is emerging recognition that the federal government may play a larger role in setting national objectives that bring all parties together.

This focus on legislation is driven by increased market forces, NGOs, as well as consumer pressures related to environmental concerns. There has also been a major focus on marine debris as consumers have become more aware of the issue.

This chapter[111] will cover some of the significant pieces of packaging-related environmental legislation and major voluntary initiatives and show potential pieces that could impact future legislation in the U.S. Please keep in mind that this chapter is not meant to be an all-encompassing legislative report as regulations are constantly evolving; some of the proposals may have passed or failed soon after the publication of this report. Instead, the chapter will touch on many of the key components of legislation and showcase examples from around the globe.

Major Legislation Initiatives

There are a few key elements of legislation that will be touched on in this chapter that appear to be the cornerstone of much of the packaging and sustainability legislative goals. Most of these initiatives have a goal to drive recycling rates of packaging materials, keep materials out of the natural

Major Legislative Initiative Buckets
Extended Producer Responsibility (EPR)
Material/Single-Use Plastics Bans
Marine Debris
Market Incentives/Recovery Infrastructure Funding

[111] Note: This section is current as of Sept. 1, 2020. Legislative agendas may change after report publication.

environment (water or land), and increasingly drive toward circularity where the collected packaging is recycled into another package or product.

Extended Producer Responsibility (EPR)

Perhaps no type of legislation has impacted the packaging industry more than Extended Producer Responsibility (EPR). The basic premise and goal of EPR is to shift the responsibility for end-of-life management of packaging upstream to producers rather than municipalities. The goal, through a fee structure based on material weight and difficulty to recycle, is to create incentives for brand owners to incorporate sustainability considerations into the design of their packaging.

This means that additional cost (and environmental impacts) needs to be considered when considering the type of packaging for a particular product. Generally, brand owners will form a Producer Responsible Organization (PRO) in response to EPR legislation to manage the process and fees of an EPR program.

One subject matter expert involved in EPR development, said "*EPR does not drive circular package design, it drives lightweighting… But it does fund recovery infrastructure."*

EPR has been a legislative framework that has grown significantly over the past two decades throughout Europe, South America, and is now law in many parts of Canada. Some U.S. states such as California, Vermont, and New York are all considering statewide EPR implementation.

To learn more about EPR and PROs, a report titled "*Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices and Performance*"[112] is available from the Product Stewardship Institute.

Material/Single-Use Plastics Bans

Another form of legislation becoming more common are bans of certain types of materials or single-use packaging. This can be seen through grocery bag bans in certain cities or states (including California), bans on expanded polystyrene (EPS) foam containers, and single-use plastics. Single-use plastics are not universally defined, but often include plastic shopping bags, straws, disposable cutlery, cotton swabs with plastic sticks, drink stirrers, and takeout food containers and cups made of EPS.

Marine Debris

Marine debris has grown in the public consciousness, driven largely by the BBC show "Blue Planet II" and National Geographic's June 2018 issue, titled "*Planet or Plastic?"*

[112] https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/packaging/2020.03.17_PSI_EPR_for_PPP.pdf

Both highlighted the impacts of plastic debris in waterways and their impact on wildlife and the environment. While over 90% of marine debris is believed to come from just ten rivers[113] located in Southeast Asia and Africa, the concern is global as the issue is exacerbated by developed countries shipping their waste and "recyclable" products to countries that do not have a robust recovery infrastructure, including landfills, leading to marine debris, and other environmental issues.

This concern has driven recent interest in finding far more domestic or regional outlets for collected materials and funding efforts to clean beaches as well as prevent marine debris. It has also led to a focus on legislative solutions and been a major component of some of the recent G7 meetings[114] and other country-specific pieces of legislation.

Additionally, in response, industry groups such as the Alliance to End Plastic Waste and Global Plastics Alliance have formed with initiatives focused on marine debris collection.

Market Incentives/Recovery Infrastructure Funding

While the implementation of EPR has been the largest source of funding for infrastructure development, there have been other initiatives by governments meant to fund recovery infrastructure. One example is a charge for plastic grocery bags, intended to drive down consumer use while also funding recovery of bags or cleanup of waterways.

Another example is a plastics waste levy of €800 per ton[115] on non-recycled plastic in the EU that comes into effect in January 2021. The goal of the fee is to provide additional funding for recovery, on top of EPR fees.

A final example is a fee on virgin plastic, meant to incentivize the use of Post-Consumer Recycled (PCR) materials in packaging. The UK[116] is proposing a tax if plastic packaging does not include 30% PCR, while Italy[117] is looking to implement a tax of €450/ton in 2021 on virgin plastic and Spain a similar fee on non-recyclable plastic packaging.

While there are many types of sustainability-related packaging legislation and regulation, these seem to form the largest drivers that have been emerging over the past few years.

[113] https://www.scientificamerican.com/article/stemming-the-plastic-tide-10-rivers-contribute-most-of-the-plastic-in-the-oceans/
[114] https://www.ptonline.com/blog/post/g7-summit-leaders-agree-to-ocean-plastics-charter-
[115] https://plasticsinpackaging.com/online/mixed-market-reaction-to-eu-plastics-charge/
[116] https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax/plastic-packaging-tax
[117] https://plasticsinpackaging.com/online/italy-postpones-plastics-tax-until-2021/

Regional Legislation

As noted earlier, there are many components of legislation that are taking place. Some regions like Europe tend to be an early indicator of legislation, while others like the U.S. tend to take more time. The following pages and figures highlight some of the major pieces of legislation across select regions and countries such as Europe, Canada, and the U.S. Again, this section is meant to be an overview rather than a comprehensive guide to ongoing legislation in each of these areas.

Europe

A key area that sets Europe apart from other regions is its comprehensive focus on sustainability. The EU has several overarching strategies that continue to trickle down toward packaging and have components specific to packaging.

For example, the goal of the EU Green Deal[118] is to drive the continent toward being carbon neutral by 2050. Tying into the Green Deal, but more with more specific sustainability objectives is the EU Circular Economy[119] (Figure 12-2) legislation with a focus on specific industries including plastics, food value chain, critical raw materials, and biomass and bio-based products.

Figure 12-1. Summary of key European legislation and government activity

[118] https://www.climatechangenews.com/2019/12/12/eu-releases-green-deal-key-points/
[119] https://ec.europa.eu/environment/circular-economy/

Figure 12-2. EU Circular Economy Plan overview

Drilling deeper into legislation specific to plastics are additional actions such as the EU Plastic Strategy, which says that all plastics must be recyclable by 2030. The EU Plastics Strategy[120] calls for all plastic packaging to be reusable or easily recycled by 2030. The 2025 goal is for a recycling rate of 55% for all plastic packaging in the EU.

The majority of countries in the EU also have some form of EPR to fund recovery infrastructure and drive recycling rates. Additionally, there have been both EU members and individual countries in Europe that are looking to implement additional fees on plastic packaging. These fees range from a proposed tax in the UK on packaging that does not contain at least 30% PCR, to taxes on non-recycled plastic packaging in Spain.

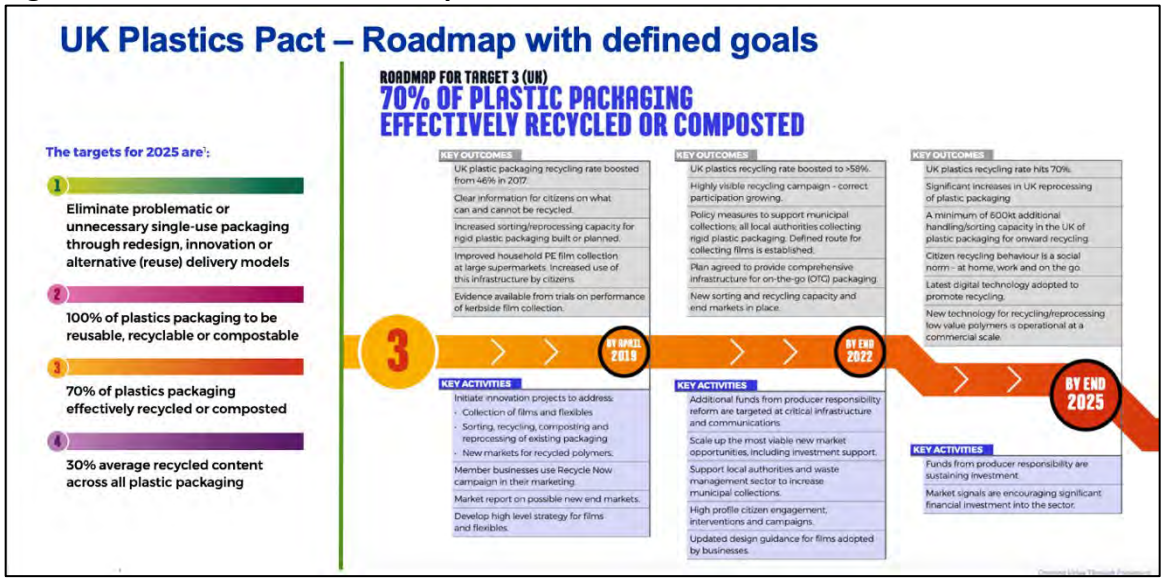
Figure 12-3. European legislation with fees on plastics

[120] https://ec.europa.eu/environment/circular-economy/pdf/plastics-strategy-brochure.pdf

Additionally, the EU is looking to implement a fee of €0.80 per kilogram of non-recycled plastic packaging. All of these fees are in addition to EPR specific fees for administering the collection, sortation, and reprocessing of packaging.

While not necessarily legislation, some European countries such as the UK, France, and the Netherlands have also set up voluntary "plastic pacts" with goals the industry has set to drive toward high collection rates. While these pacts are voluntary and not enforceable, some such as in the UK, were developed to head off legislation. The UK Plastics Pact[121] was developed with WRAP (Waste & Resources Action Programme) and sets several specific goals and actions over the next 5 years for the plastics packaging industry to meet. These goals are tied to the Ellen MacArthur Foundation's New Plastics Economy Initiative.

Figure 12-4. UK Plastic Pact example



The goal of all of this legislation is to continue to drive toward higher recycling rates, with a recycling target of 55% for all plastic packaging in the EU by 2025. The EU Plastic Strategy goal is to also increase plastics recycling capacity by a factor of four between 2015 to 2030.

In the end, Europe has a wide-ranging set of sustainability, legislative and industry-driven levers it uses to drive action on plastic packaging, through a number of taxes and fees.

[121] https://www.wrap.org.uk/content/what-uk-plastics-pact

Canada

The largest legislative impact in Canada is the establishment of EPR across a majority of provinces, including Ontario, Quebec, Manitoba, Saskatchewan, British Columbia – all with different levels of producer responsibility funding requirement. Currently, the system in British Columbia is the only fully–funded producer responsibility program, but both Ontario (by 2025) and Quebec are moving toward full producer responsibility. This means that the industry and its associated Producer Responsibility Organizations (PRO) will be responsible for the full cost to implement collection, sortation, and reprocessing.

Most Canadian EPR programs currently cover residential packaging only, but some provincial governments are considering including Industrial and Commercial materials in their recovery programs as well.

For the year 2018, Recycle BC (the PRO in British Columbia) reported a 78% recovery rate for all materials. This includes consumer access to recycling bins for 98% of the population. This rate is helped through the use of drop-off stations/depots, which play a significant role in driving consumer access and recovery rates.

In 2018, the province reported a flexible packaging recycling rate of 19%, with a target of 22% by 2022 and 25% by 2025. These significantly higher rates are again driven through the use of consumer sorting of flexible packaging at the drop-off centers and depots.

Figure 12-5. CCME Zero Plastic Waste Overview

To learn more about EPR legislation in Canada, please reference the report *Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices and Performance* from the Product Stewardship Institute.

The Canadian Council of Ministers of the Environment (CCME) also have launched a "Zero Plastic Waste Initiative,"[122] focused on the prevention of waste, collection and clean up, and value recovery from the materials that are collected. The program has two

[122] https://www.ccme.ca/en/current_priorities/waste/waste/zero-plastic-waste.html

separate phases, with Phase 1 focused on product design, single-use plastics, collection, markets, and recycling capacity. Phase 2 will focus on protecting waterways, lakes, and oceans.

Finally, the country is also moving forward with a single-use plastic ban. The final list of banned items was not available as of the writing of this report, but the ban will likely go into effect sometime in 2021.

United States

The final region evaluating this report was the United States. The U.S. has traditionally left much of recycling-based legislation to the state and local level. This has resulted in several local and statewide initiatives such as material bans (plastic grocery bags, straws, foam trays), beverage deposit systems, and PCR content requirements at the state or local level.

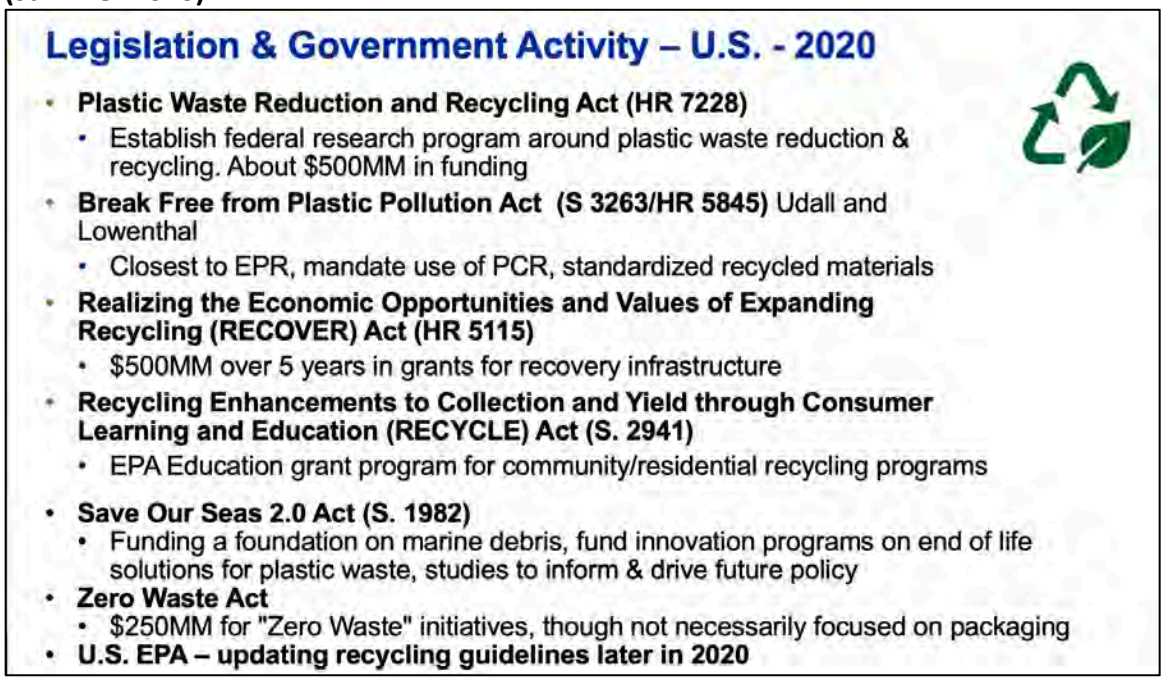
As of the development of this report (summer 2020), there are many state-level initiatives under consideration. A sample of these include:

- 8 states (16 bills) exploring EPR
- 19 states (47 bills) considering recycling-based legislation
- 41 states (390 bills) looking at plastic specific initiatives
- California will have on its November 2022 ballot a proposal for a $.01 fee[123] on plastic packaging to fund recycling and clean up waste. The bill targets single-use packaging and foodservice products. It would also require that all single-use plastic in the state be reusable, recyclable, or compostable by 2030

In the summer of 2020, several bills are being considered in the U.S. Congress (see Figure 12-6 for a summary). These bills include a wide range of initiatives from providing funds for investment into the recovery infrastructure (RECOVER Act), to grant programs for community and residential recycling programs (RECYCLE Act) to marine debris focused initiatives (Save Our Seas Act 2.0). Perhaps the widest-ranging bill would be the Break Free From Plastic Pollution Act, which is the closest to a nationwide EPR system that has been considered in Congress. The bill would require producers of packaging to be responsible for collection and investment in recovery infrastructure. It would also mandate the use of PCR in packaging, which could then stimulate end markets. The bill also would harmonize materials that are collected for recycling across the country and create a national bottle bill system with deposits on beverage containers.

[123] https://www.plasticsnews.com/news/california-plastics-vote-headed-2022-ballot?utm_source=pn-daily-report&utm_medium=email&utm_campaign=20200811&utm_content=article2-headline

Figure 12-6. Summary of national legislation under consideration in U.S. Congress (summer 2020)



While none of these bills comprehensively addresses all of the needs of the packaging and recycling industries, they do show a desire for legislators to address the low recycling rates in the U.S. at a national level and will likely lead to more significant implementation of sustainability and recycling-based legislation over the next decade.

Summary

Europe continues to maintain comprehensive framework legislation and recycling programs meant to drive toward lower carbon impacts across the EU, including through higher recycling rates and inclusion of PCR into new packaging. This is accomplished through the establishment of EPR programs, additional fees on non-recyclable plastic packaging as well as potential taxes on virgin feedstock for packages that do not meet a minimal PCR threshold. In some countries, the industry has collaborated and responded with voluntary goals such as the UK Plastics Pact - meant to provide a “north star” for all industry players to strive and meet goals on PCR, recycling rates, infrastructure investment, and consumer education.

Canada has continued its move toward EPR, with more provinces moving from partially industry-funded programs with costs shared with municipalities, to fully industry-funded programs. This move may continue in the future, particularly as municipalities and provinces come under financial strain.

The U.S. is starting to grapple with the likely need for national legislation to counter the inevitable action of EPR with several individual states considering their own programs. It

appears to be more of a question of 'when' than 'if' EPR emerges in the U.S. With eight states currently exploring EPR through bills, and another 41 states and 390 bills targeted specifically at plastics, it may be prudent for the packaging industry, including flexible packaging, to embrace and help frame any legislation focused on recycling infrastructure, up to, and including EPR.

The Consumer Brands Association (CBA), a large association that represents many of the food and beverage based brands, has been actively meeting with legislators in 2020 to help identify potential legislative frameworks[124] that may impact packaging. Some of the CBA proposals include:

Fee Generator	Description
Per Item Fee	A set fee per item sold, possibly focused on items that include non-recyclable or hard-to-recycle packaging, incurred either before or at retail point-of-sale.
Virgin resin fee	Virgin resin, which is used to make plastic, is currently less expensive than recycled resin. A fee for virgin resin would put it on price parity with recycled resin, making it more cost-effective for use in packaging.
Pay-As-You-Throw (PAYT)	Residents pay a set fee for waste disposal (typically per bag of trash) and the funds are used to pay for waste and recycling services.
Landfill Tipping Fee	An additional fee is levied on waste disposal in the landfill to strategically raise the price of landfilling to create price parity with recycling. This model only works in places where landfilling material is notably less expensive than recycling.
Waste Generator Fee	All entities (companies, consumers, businesses, etc.) pay a set fee based on how much waste they send to landfill. The funds are used to pay for waste and recycling services.
Check Off Program	Similar to USDA check-off programs, relevant private industries would voluntarily contribute a set amount of funds annually for consumer education.

With a combination of brand owners through the CBA and legislators discussing legislation focused on packaging, plastics, and recycling infrastructure, the next few years are likely to bring significant changes to the flexible packaging industry. The development of an industry-led PRO to help take ownership of the entire collection, sortation, and reprocessing process will be critical (and inevitable) if EPR emerges. Even without specific EPR legislation, industry development and backing of a PRO may be needed to help hit any specific recycling goals that legislators, as well as brand owners, demand. The fees levied through EPR and/or the PRO will then be used to fund critical infrastructure.

[124] https://consumerbrandsassociation.org/sustainability/recycling-policy-platform/

EPR will likely, at a minimum, be coming to 3-5 states within the next five years, and probably hit the national stage over the next decade as consumers, brands, NGOs, and legislators all demand higher recycling rates for packaging of all types.

List of Acronyms

CBA	Consumer Brands Association
CCME	Canadian Council of Ministers of the Environment
EPR	Extended Producer Responsibility
EU	European Union
FPP	Flexible Plastic Packaging
PCR	Post-Consumer Recycled
PRO	Producer Responsibility Organization
WRAP	Waste & Resources Action Programme

Chapter 13

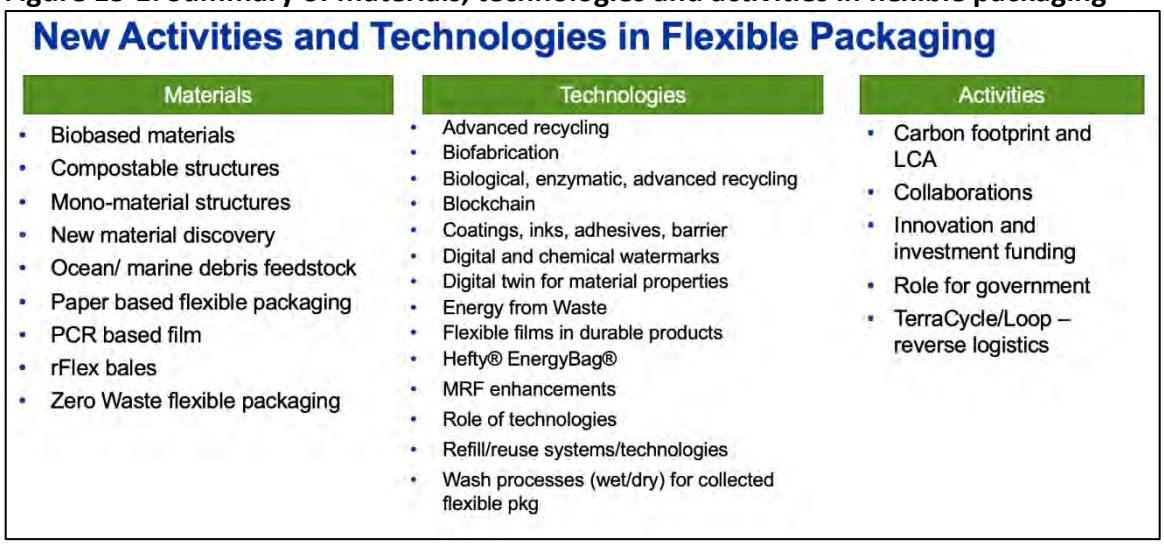
Recent Activities & Technologies in Flexible Packaging

Background

This chapter is broken into three distinct sections - materials, technologies, and activities. An overview of each of the sections and corresponding activities are provided throughout this chapter with additional references for readers looking to gain more information on specific materials and technologies. The chapter is meant to provide a view of a wide array of actions that are being undertaken in the flexible packaging industry to drive recycling opportunities.

Figure 13-1 provides an overview of several materials, technologies, and activities in flexible packaging that are currently underway or in development to improve flexible packaging recovery and enhanced sustainability attributes.

Figure 13-1. Summary of materials, technologies and activities in flexible packaging



Materials

This section focuses on a wide array of material-based solutions that are being used to help flexible packaging integrate better with circular economy principles.

Biobased materials

Biobased materials are where the feedstock used to produce flexible packaging comes from non-fossil fuel based renewable sources. Examples include corn (PLA), sugar cane (Braskem's I'm Green™ PE), starch, algae, cellulose, or other agricultural waste sources. The main driver behind using biobased materials is to uncouple the production of plastic from using traditional fossil fuel for their feedstock. This aligns with goals from the Ellen MacArthur Foundation. Biobased materials can be used in applications where flexible packaging is recyclable or compostable, as may be the case with structures using PLA, PHA, or cellulose. Braskem's I'm Green™ PE has been used in an entirely mono-material recyclable pouch.

It is important to note that any materials with a compostability claim should be certified through a third-party certification entity, such as the Biodegradable Products Institute (BPI), and meet the appropriate standards (ASTM D6400), and Federal Trade Commission Green Guides.

Compostable Structures

Compostability is one of the goals the EMF is promoting to limit plastic packaging as litter. Compostability requires a package to meet specific criteria set forth by international standards such as ASTM D6400 in North America and EN13432 in Europe, that require a package to be aerobically composted in industrial facilities. The specified target for compostable structures is to safely biodegrade in a set amount of time (less than 180 days). Testing for certification to make any claims should be completed by an accredited third-party lab, such as the Biodegradable Products Institute (BPI).

Compostable structures are often made from biobased materials such as starch, corn, micro-organisms (PHA), and cellulose as examples. Note that some biobased structures are also compostable, but not all. There are also non-biobased, but compostable materials such as BASF ecoflex®. Paper is another material that can be composted but must also consider the impact of coatings (PFAS, a moisture and grease barrier is no longer allowed to be added to structures looking for composting certification).

In North America, there is only a standard for industrial composting, which operates at a temperature of at least 55 degrees Celsius (131 degrees Fahrenheit). However, in Europe and Australia, there is also a home compostability standard for packaging that biodegrades at lower temperatures.

Compostable structures currently work best within closed loop environments such as stadiums or certain foodservice venues where all the packaging materials are

compostable. There may be significant long term opportunities for these structures in foodservice and food applications, particularly as the composting infrastructure is developed.

To learn more about compostability and claims, the Plastics Industry Trade Association (PLASTICS) has put out an *Industrial Compostability Claim Checklist*[125] document.

Mono-material Structures

Mono-material structures are a key driver in making flexible packaging recyclable, particularly in the short and mid-term. This is the primary method that flexible packaging converters are striving to meet brand owner commitments to have all of their packaging be recyclable. By making the pouches out of one material, primarily polyethylene (PE) today, pouches could be recycled through the store drop-off program which also collects PE based grocery bags. To achieve this, the incorporation of compatibilizers and other barrier technologies to provide the stiffness and barrier performance needed to replace many of the multi-material pouches are used.

There is a growing portfolio of mono-material pouches from a range of flexible packaging converters. Over time, look for barriers and performance properties to improve, and potentially include the use of other polyolefins such as PP.

New Material Discovery

Flexible packaging is always advancing and finding new materials, coatings, and compatibilizers. It is likely that work to advance new coatings that can provide high barriers to mono-material structures or even paper will advance over the next decade. There are currently multiple studies ongoing at universities to utilize artificial intelligence (AI) to find new material structures in a much faster time frame. Researchers at Northwestern University[126] used this technique to find metal-glass hybrid materials 200 times faster than would normally be accomplished. This is an area ripe for collaboration between leading edge researchers at universities and the packaging value chain.

Ocean/Marine Debris Feedstock

It is an unfortunate reality that there is a significant amount of plastic that leaches into the ocean and marine environments, usually in countries without adequate waste management infrastructure. Some companies have started collecting and processing the

[125] https://www.plasticsindustry.org/sites/default/files/Industrial%20Compostability%20Claims%20Checklist_0.pdf

[126] https://www.theverge.com/2018/4/25/17275270/artificial-intelligence-materials-science-computation

ocean plastics that have been collected to use in new packaging, largely rigid packaging today. Two examples are Head & Shoulder's Shampoo bottle in Europe as well as SC Johnson's Windex bottle in the U.S.

While the use of "ocean plastic" should never be considered a primary method to drive collection, it does help raise awareness for consumers of the issue as well as providing funding and incentive for organizations that collect marine debris.

Paper-Based Flexible Packaging

While most flexible packaging today consists of plastic materials, there is a push to look at paper-based structures that could be either recycled or composted in the existing infrastructure at their end-of-use. Traditionally, paper has been challenged to replace plastic structures because of a lack of moisture[127]oxygen barrier along with operational challenges in manufacturing facilities (paper does not have the tensile strength of plastic and will break much easier, resulting in significantly lower production output). Some brand owners such as Nestlé, however, are putting significant resources behind finding new coatings and technologies to enhance paper barrier properties. The confectionery giant has already launched a few paper-based packaging structures for candy bars[128] in Europe and Australia.

In the years ahead more brands will experiment with paper as an alternative to plastic packaging, if better barrier and production speeds can be achieved.

PCR Based Film

The inclusion of Post-Consumer Recycled (PCR) content is important over time as flexible packaging looks to move into a circular economy. Today, the use of PCR is fairly limited to a few applications, including a collaboration between Dow and Avangard Innovative[129] to collect and derive PCR feedstock for LLDPE and LDPE applications.

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[128]https://www.fooddive.com/news/nestle-develops-recyclable-paper-packaging-for-yes-snack-bars/558203/

[129]https://www.packworld.com/design/materials-containers/press-release/21110576/dow-avangard-to-supply-dow-with-pcr-pellets

While the use of reprocessed PCR film will likely initially be used in rigid packaging applications, look for additional use where flexible packaging is sorted and used back into flexible packaging in incremental steps in the coming years.

rFlex Bales

Though not a generally recognized industry term, rFlex bales consist of collected and sorted FPP. This bundle was developed during the pilot phase of the Materials Recovery for the Future (MRFF)[130] program led by Resource Recycling Systems (RRS) which set out to determine if flexible packaging could be collected and sorted through the use of optical sorters at a Materials Recovery Facility (MRF). The pilot did prove that FPP could be collected loose at curbside and sorted successfully, with the result being a bale of rFlex – sorted flexible packaging.

Although the program has only been piloted and tested at one MRF, it has proven that the same technology that is used for the sortation of rigid plastic packaging, could be used to sort FPP, with proper investments.

Zero Waste Flexible Packaging

Zero waste flexible packaging consists of materials that dissolve, without causing any adverse effects on the environment. An example would be the use of laundry detergent pods, which have a flexible film that contains the detergent. The pod is made of polyvinyl alcohol (PVOH) and is water-soluble, dissolving when the washing process starts. Other potential materials include PHA, thermoplastic starches, and fruit waste feedstock.

Another example is a seaweed based pouch. A company called Skipping Rocks Lab[131] produced 200,000 of the pouches (brand Oohu) that contained a sports drink and were distributed to runners in the 2019 London Marathon. Runners could either consume the entire pouch, or discard on the road, where it would safety break down in the rain.

While these applications are fairly specialized today, the use of these "zero waste" and safe materials may find additional applications as brand owners look for ways to eliminate litter and marine debris. These materials could be especially pertinent in emerging markets where the waste collection infrastructure does not currently exist.

[130] https://www.materialsrecoveryforthefuture.com/

[131] https://www.forbes.com/sites/trevornace/2019/04/29/london-marathon-runners-were-handed-seaweed-pouches-instead-of-plastic-bottles/#73cb0e242ba2

Technologies

This section will concentrate on non-material based technologies that are being used to enhance the sustainability profile of flexible packaging.

Advanced Recycling

Advanced recycling, also called chemical recycling, modifies either the formulation of the polymer material, or the structure of the polymer itself. Advanced recycling can result in a range of outputs, including chemical monomers, polymers, syngas, fuels, or waxes. Several advanced recycling processes can be grouped under advanced recycling, including (from Closed Loop Partners):

- Purification - a process that involves dissolving plastic in a solvent, then separating and purifying the mixture to extract additives and dyes to ultimately obtain a "purified" plastic. The purification process does not change the polymer on a molecular level.
- Decomposition - a process that involves breaking molecular bonds of the plastic to recover the simple molecules ("monomers") from which the plastic is made. Sometimes referred to as "depolymerization," the process can be biological, chemical, or thermal, and in some cases, a combination of two or three of these methods.
- Conversion - similar to decomposition in that the process involves breaking the molecular bonds of the plastic. A key difference is that the output products from conversion processes are often liquid or gaseous hydrocarbons similar to the products derived from petroleum refining.

Advanced recycling has several technological challenges as it scales toward commercialization, including that its processes tend to be more energy intensive. The technology, however, will play a critical role in further enabling a circular economy for flexible packaging, particularly for multi-material structures such as medical packaging or where specific performance attributes are critical. This technology could also play a major role in reconstituting plastics back to the monomer level, particularly as polymer chains are broken down and have lower performance attributes from continuous mechanical recycling, which weakens the bonds. By 2030, there will be advanced recycling technologies starting to reach a mid-sized scale and playing a larger role in FPP recovery.

A good resource to learn more about advanced recycling is the Closed Loop Partners *Accelerating Circular Supply Chain for Plastics*[132] report, which details 60 different advanced recycling technology providers.

[132] https://www.closedlooppartners.com/research/advancing-circular-systems-for-plastics/

Biofabrication

Biofabrication can be a complicated term with different meanings. In this context, we are using it in the sense of 'growing materials' from living organisms. Sources may include bacteria, fungi, yeast, and algae, which are all grown to create materials with specific properties, perhaps falling into the zero waste or compostable packaging category.

This is a relatively new area of science where we can expect to find new breakthroughs, which will take time to develop the technology and specific packaging applications on the market.

Biological, enzymatic, advanced recycling

Enzymatic recycling utilizes bacterial enzymes that break down plastics such as PET and reduce the plastic bottles to simple chemical entities that can be efficiently reprocessed into new, food-grade plastic. The French company, Carbios[133], has developed this process and claims that the new process can depolymerize *any* kind of PET – transparent, colored, opaque, amorphous as well as crystalline, fibers – into any kind of PET product. While the technology is still being developed, Carbios has developed partnerships with large brand owners and is looking to have a commercial scale facility available by 2025.

Breakthrough recycling processes such as these will be critical in the future to drive more efficient depolymerization of plastics and link to better circular economy integration.

Blockchain

Blockchain is a distributed ledger technology (DLT) that allows data to be stored globally on thousands of servers – while letting anyone on the network see everyone else's entries in near real-time. The technology will certainly be used in several financial, legal, and accounting transactions, but will have a role in packaging as companies such as BASF use blockchain technology as a way to track the traceability of recycled content throughout the packaging value chain. Systems like the BASF reciChain will be important to ensure transparency as brand owners and converters look to track the amount of PCR they are using in their packaging.

[133] https://www.forbes.com/sites/scottsnowden/2020/04/11/new-enzyme-breaks-down-plastic-in-hours/#76ac8f565e4e

Coatings, Inks, Adhesives, Barriers

The areas of coatings, inks, adhesives, and barriers fall into a catch-all of technologies that often make up a small percentage by weight of a flexible package but can play a critical role in how well a package performs overall, and certainly impact its environmental profile.

Coatings are an area that is expected to get a lot of attention in the upcoming decade. A primary area of research will be to improve barrier properties (oxygen and moisture) for mono-material flexible packaging so it can more closely resemble the attributes of multi-layer structures, but with enhanced recyclability. New coating technology will also be necessary to bring barrier and operational performance to paper-based or compostable flexible packaging. Other areas of research will include silicon-oxide, aluminum-oxide, EVOH as well as nanotechnology based options.

Adhesives working with water soluble layers that allow for materials or other attachments (such as fitments) to be separated during reprocessing will also need more research and development as packaging converters look to drive toward more recyclable structures. An example is W&H[134] which developed a film concept that allows the multilayer barrier film made from different types of plastic to be dissolved. The separation of the polymer layers is made possible by water-soluble layers within the structure. The result is pure plastics that can be regranulated and recycled individually as a product.

Digital & chemical watermarks

Digital and chemical watermarks are hidden markers that are applied to a material to help make packaging sortation more accurate at the MRFs. In the case of digital watermarks, a hidden code (similar to a QR code or UPC code) is applied to a package that is not typically visible to the human eye. This code can be placed over the entire package and allow scanners to more accurately determine into which bales the package should be sorted. The technology can also allow for much faster scanning at the retail level as well. Digimarc is a leader in this space and the use of digital watermarks was used in Project Holy Grail[135], a pilot utilizing markers at a MRF to drive more accurate sorting.

[134] http://packagingnewsletter.com/recyclable-high-barrier-film/?utm_source=newsletter&utm_medium=email&utm_campaign=w_h_brings_recyclable_high_barrier_film_suedpack_drives_advances_in_chemical_recycling&utm_term=2020-08-11

[135] https://www.newplasticseconomy.org/assets/doc/Holy-Grail.pdf

Chemical markers/tracers operate by applying a specific chemical to the resin or a label on a package. The MRF then uses UV light to highlight and determine what the material is for each package, and how to properly direct into the appropriate bale.

These technologies create the potential to drive better recycling for flexible packaging in the design stage by helping at the sortation stage.

Digital twins for material properties

Digital twins are based on a digital program that represents a virtual model of a real object or system. Digital twin[136] tools leverage components such as artificial intelligence, the Internet of Things, blockchain, data, virtual reality technologies, and collaborative platforms. This concept can be used to develop new materials that may lead to new coatings, adhesives, or packaging materials, which can lead to better recyclability or sustainability properties. Companies such as Math2Market's GeoDict digital twin software is an example where the technology is being used to unlock new materials properties without the trial and error methods used in laboratory settings.

Energy from Waste

Energy from Waste is a system that uses the heat from burned waste (including plastic packaging) to make steam for generating electricity or to heat buildings. Energy from Waste (EfW), also called Waste to Energy, is a primary method for solid waste management in Europe and parts of Asia. In 2018, 68 U.S. power plants generated about 14 billion kilowatt-hours of electricity from burning 29.5 million tons of combustible municipal solid waste[137]. EfW may continue to play a role in the short to mid-term as a method to provide electrical power, while also reducing the amount of material sent to landfills. Over longer periods of time, countries are expected to reduce reliance on EfW and utilize systems that promote the recycling of materials versus energy generation.

Flexible films in durable products

While flexible packaging does not currently have a wide range of end markets, there are a few applications where it is being used to create durable products that are meant for years of use. Perhaps the most widely used example is the use of PE-based grocery bags in "plastic lumber." The lumber is then used for durable structures such as weather resistant decking, park benches, and picnic tables.

Another area where collected plastic refuse is used, is as a substitute energy input for coal in the production of cement. A study[138] by the Norwegian University of Science and

[136] https://www.prescouter.com/2020/07/how-digital-twins-are-helping-repurpose-sustainability-values/

[137] https://www.eia.gov/energyexplained/biomass/waste-to-energy.php

[138] https://phys.org/news/2020-04-cement-factories-global-plastic-pollution.html

Technology has shown that this can reduce greenhouse gas emissions in the production of cement while preventing the material from leaching into the environment. This technique is gaining more traction in China and Europe.

Plastic waste is also being used as a binding substitute in the production of some roads. This has been done in parts of Asia and is being tested in Los Angeles[139] as well. Plastic incorporation into the recipe makes the road stronger, with one company estimating the roads can last eight to 13 times longer than a standard road.

Another application being tested at Queen's University in Belfast is the use of waste flexible packaging material in building materials, such as bricks[140] utilizing different percentages of plastic waste, which give the bricks new properties, while also utilizing the plastic into a durable application.

Other applications for recovered flexible packaging include use as a layer in plastic trash bags, and more recently in the production of roofing materials through part of the MRFF project.

The use of flexible packaging in durable applications may provide a short to mid-term option to collect FPP and use it as a feedstock by substituting for different materials and lowering their overall carbon impact or providing beneficial properties.

Hefty® EnergyBag®

The Hefty® EnergyBag® program is designed to complement current recycling efforts, and establishes a way to collect otherwise hard-to-recycle plastics, like candy wrappers and foam, at curbside and uses them as valued resources. The program has been implemented in a handful of communities in the U.S. and Canada. Consumers place fill special orange bags with difficult to recycle plastics, including multi-material flexible packaging such as chip bags that are not part of traditional curbside recycling programs. Once the Hefty® bag is filled, the orange bag is placed in the curbside recycling bin.

The EnergyBags® are then pre-sorted at an MRF, removed from the recycling line, and collected for transfer to another location for use as an energy source in cement kilns or converted to synthetic crude oil through pyrolysis.

[139] https://www.fastcompany.com/90420730/los-angeles-is-testing-plastic-asphalt-that-makes-it-possible-to-recycle-roads
[140] https://theconversation.com/plastics-could-help-build-a-sustainable-future-heres-how-133585

The idea of a separate bag used to mass collect (bundle) flexible packaging for pre-sort at an MRF, may be an alternative collection method to the loose collection of individual flexible packages that were used in the Materials Recovery for the Future project. This effort also provides additional collection of FPP and is considered as a short to medium component to reduce FPP waste.

MRF enhancements

Today's material recovery facilities (MRFs) use different screening and separating techniques to separate corrugated, paper, aluminum, steel, PET bottles, HDPE bottles, and other plastics. Manual labor is used to pull out contamination (often including flexible packaging that can wrap around equipment, leading to shutdowns) and can limit the speed of sortation. Several different technologies will be employed by MRFs in the upcoming decade to drive efficiency, sortation accuracy, and drive higher prices through better quality bales, with less contamination.

Examples of technology enhancements will include:

- Optical sorters – use high-speed cameras and infrared optics to identify materials, often using use jets of air to change the trajectory of materials toward the desired location. Optical sorters were critical in the sortation of flexible packaging in the MRFF project.
- Artificial intelligence (AI)/machine learning systems – learn new classes of materials, aid in sortation even without optical viewing.
- Databases – tied to robotics and AI – helps equipment identify certain materials or substrates based on an online database of SKUs tied to packaging type.
- Robotics – improve pick speed and accuracy, while decreasing human involvement in mundane or difficult work conditions. Can also help pick smaller, or difficult items such as coffee pods.
- Improved mechanical systems – reducing flexible packaging wrapping on equipment and rollers limiting production downtime.

Role of technologies (AI, VR, IOT, edge computing)

While not specific to packaging, in the future, flexible packaging converters and others in the value chain will all benefit through the use of artificial intelligence (AI), virtual reality (VR), the internet of things (IOT), and edge computing will certainly have implications that we can only infer today. They will speed the development of new materials (as researchers have shown) and help sort packages for recycling through AI, allow for new methods of testing and troubleshooting through VR, and link all items to the internet through tags or visual codes (even hidden visual codes). A recent article in *VentureBeat* highlighted how Amazon[141] used machine learning to save 915,000 tons of

[141] https://venturebeat.com/2020/09/14/how-amazon-is-using-machine-learning-to-eliminate-915000-tons-of-packaging/

packaging and switch from corrugated boxes to other formats, including mailers, for many products.

Refill/reuse systems/technologies

Refill and reuse systems are starting to gain additional traction and fit as one of the main pillars in the EMF New Plastics Economy. While refill and reuse systems are fairly niche applications today, systems such as Loop (see TerraCycle/Loop information in the Activities section) and Algramo in Chile, are starting to make inroads with reuse systems.

Today, flexible packaging is more often used as a refill component for items such as soap or detergent, into a rigid package. In the future, there may be some opportunities for flexible packaging to be used in refill applications where a standard fitment and vending system are used. This would likely be most applicable for household and personal care items that do not necessarily need to be cleaned for every reuse.

Wash processes (wet/dry) for collected flexible packaging

The MRFF project highlighted a gap in washing capacity for sorted FPP and rFlex bales. This wash step is an intermediate step after sortation but before reprocessing for materials that may not be a clean stream. It is believed increased capacity for wash processes and technologies will be an important role in finding high value end markets for rFlex or FPP bales to reduce contamination and improve quality so materials can be reprocessed into resin pellets.

Activities

The following section will touch on some of the key collaborative activities taking place to drive flexible packaging to play a stronger role in sustainability and circular economy principles. This list is far from exhaustive and meant to be representative.

Carbon Footprint and Life Cycle Assessment

Companies look to use LCA screening software that will allow them to make holistic decisions and tradeoffs using both LCA indicators and traditional package performance criteria (shelf life, damage rate, cube efficiency etc.). These streamlined LCA tools often show flexible packaging having several favorable environmental attributes to other package formats. (For a deeper dive into case studies of flexible packaging and

streamlined LCAs, see the FPA report, *A Holistic View on the Role of Flexible Packaging in a Sustainable World.*[142]*)*

The use of life cycle assessments can be an important tool to understand the environmental attributes of a range of package options. This is especially important in the design phase where the selection of material choices is made. Streamlined LCA tools (which are based on industry averages vs. individual company processes) such as EcoImpact-COMPASS™ from Trayak have made it much easier for brand owners, packaging converters, and package designers to understand the fossil fuel use, carbon emissions, water use along with other environmental indicators. These tools allow users to compare different packaging format impacts based on materials used, weight of materials, type of process, recycled content, etc. As leading companies such as Microsoft and Walmart start to track their overall environmental footprint, one of the key areas of focus will be on their packaging footprint.

LCA tools will continue to evolve to better incorporate in circular economy impacts such as calculating the impacts of reuse, circularity indicators, and even integrating product and packaging impacts that can better capture food waste prevention through the use of appropriate packaging.

Collaborations

There are several collaborations, including industry associations (such as the FPA), NGOs, and groups all fostering a goal to enhance the sustainability of packaging in general. The groups can have a wide array of goals and focal areas from the Alliance to End Plastic Waste (AEPW) which looks to invest in projects that drive plastics collection largely in southeast Asia, to regional efforts such as the U.S and U.K. Plastics Pacts, to global collaborations such as the Ellen MacArthur Foundation and the New Plastics Economy.

To learn about additional collaborations, please see Chapter 11 - Sustainability/CE Organizations, Activities, and Collaborations.

Innovation and investment funding

A number of organizations look to invest in specific technologies or innovation areas aligning around a specific goal. The organizations are often on the front end of packaging related issues and play an important role in bringing value chain members together to tackle issues that no one organization can properly handle. These groups also often partner with or invest in leading edge technology providers. Just a few examples of these groups impacting the flexible packaging industry include:

[142] https://www.flexpack.org/publication/RG93bmxvYWQ6Mzc=/download

- Alliance to End Plastic Waste – focused on rethink, recover, and recycle plastic waste to protect the natural resources and ecosystems, particularly in southeast Asia
- Closed Loop Fund - investment firm comprised of venture capital, growth equity, private equity, and project finance as well as an innovation center focused on building the circular economy
- M-Bold - a coalition of Minnesota's globally leading businesses, researchers, and other stakeholders working together to accelerate solutions to the most pressing challenges facing the food and agriculture sectors. One area the group is focused on is reducing packaging waste, with an initiative focused on the development of end-markets for products made from recycled resin using flexible plastic films, which are key to developing a more circular approach to the management of flexible films
- The Recycling Partnership – non-profit focused on increasing the collection and recycling of packaging. Also, one of the leaders of the U.S. Plastics Pact

Role for government

Government collaboration will likely play a much larger role in the upcoming decade as consumers, brand owners, NGOs, legislators, and the packaging value chain all look to drive recycling rates up and plastic in the environment down. While the goals for both government and packaging industry players may be the same, the path may be different. It will be imperative for the packaging industry to be proactive in working with local, state, and national governments to help frame collaborative legislation. One such example is the Consumer Brands Association (CBA), a leading industry association with a membership including major food, beverage, personal care, and household brands. The group has developed a Recycling Policy Platform[143], laying out a plan of proactive actions the industry and government could take and fund together to help all packaging reach higher recovery rates, which can be presented to members in the U.S. Congress.

This is just one example of industry working proactively with national legislators, supporting government initiatives as U.S. states and the national government looks to emulate some of the programs in Europe and Canada that have driven higher recovery rates.

See Chapter 12 – Packaging Sustainability Legislation and Related Initiatives for additional information on legislative activities in Europe, Canada, and the U.S.

[143] https://consumerbrandsassociation.org/sustainability/recycling-policy-platform/

TerraCycle/Loop – reverse logistics

TerraCycle is a group that has focused on collecting and reprocessing hard to recycled packaging over the past decade. Many of their programs are sponsored by brands, which have consumers mail packaging to them that is not typically collected (such as multi-material pouches) in curbside programs so the material can be cleaned and turned into new products such as tote bags and gardening supplies.

The company has also launched a new initiative called Loop[144], where products are sold in more durable reusable packaging. Many of these packs are made of robust rigid materials such as steel or aluminum canisters. These packs are then meant to be shipped back, cleaned, and refilled dozens of times. TerraCycle promotes the program as a return to the "milkman" days when milk was sold in glass bottles and returned multiple times.

Many leading brands and retailers have joined the Loop initiative model to test how this will work.

While flexible packaging is not used often with the Loop program, there may be future opportunities as common fitments and refill systems are developed.

Summary

The development of the three areas discussed in this chapter – materials, technologies, and activities - will all play an important role in supporting flexible packaging moving toward a circular economy. There will be leading areas that will have a larger impact than others but expect many of these to advance in the coming decade.

[144] https://loopstore.com

Chapter 14

Flexible Packaging Roadmaps

Background and Overview

The following tables are based on the higher level roadmaps which were highlighted and discussed in depth in Chapter 7. These roadmaps are more detailed and are meant to provide a more tactical view of specific key actions that can be used as a method to help a company, as well as the flexible packaging industry as a whole, move toward the desired key outcomes. There is a detailed roadmap for design, collection, sortation, reprocessing, and end markets.

The tables utilize the same key outcomes that were presented in Chapter 7, though some may have some additional key outcomes presented. There are additional key activities and strategies listed in the tables below that may also be undertaken.

To match the key outcomes (shown in blue) with the specific activities (shown in green), see the 2nd column from the left, which will have a number corresponding to each of the key outcomes. Moving down into the key activities area, there will also be a corresponding number to match the key outcome. Generally, there will be multiple rows of key activities per outcome. In most of the detailed roadmaps, there will be additional activities that may play an important role but are not tied to a specific key activity. In this case, the symbol in the 2nd column will be a '*.' These remain important areas of focus but may not easily fit within one of the broader outcome areas.

As mentioned in Chapter 7, these roadmaps are an important component and should be considered by individual companies to set their own strategy roadmap. Other steps to consider include:

- Look for insights, direction, and priorities for your individual organization
- Identify collaborative relationships to help you achieve your goals (Also see Chapter 11 for sustainability based organizations)
- Identify how to work with the FPA to influence future industry opportunities
- Identify technology and investment opportunities
- Understand how your organization plays a critical role in the system of driving flexible packaging to a circular economy
- Customize the roadmaps for your organization to set strategic goals for 2025 and 2030

Table 14-1. Design - Detailed Roadmap

		2020	2025	2030	2040
Key Outcomes	1	Limited recyclable mono-material structures on market; limited use of How2Recycle	Wide range of recyclable mono-material flexible pkg with barrier applications; clear consumer communication; design to help drive recyclability	Recyclable mono-material flexible pkg is standard across most flexible applications; All flexible packaging recyclable	All flexible packaging effectively recycled
	2	Limited design for recyclability. Improving performance (barrier and operations) of recyclable mono-material structures	Brand owner partners meet many sustainability goals through mono-material PE and compostable films. Drive material simplification	Brand owner partners meet sustainability goals through mono-material and compostable films - including GHG reduction. Continue material simplification	Food waste/GHG impacts drive to push toward flexible packaging
	3	Lack of common definition for 'recyclable' flexible pkg	Widely accepted guidelines on what is a recyclable flexible pkg (with APR)		
	4	Limited compostable structures and performance	A wider range of compostable structures for foodservice and closed loop applications (including paper-based)	High performance (operations & barrier) compostable packaging, including paper-based	
	5	Refill models with flexible packaging being used to refill rigid packaging grow	Growth of refill flexible packaging solutions	New reuse/refill models emerging	Refillable pouches with optimized vending/ equipment
	6	Limited PCR & biobased material availability	PCR and biobased incorporation happening at low levels	PCR & biobased materials more common (~20% of feedstock) for FPP in many structures	PCR and biobased materials make up a majority of feedstock in flexible pkg
		2020	**2025**	**2030**	**2040**
Key Activities	1	Continued development on mono-material PE pouches	Leaders testing & using digital watermarks to aid in sortation	Flexible packaging portfolio largely mono-material (PE, PP, or PO structures)	All flexible packaging designed for recovery and incorporation into the circular economy
		Continue & expand usage of How2Recycle burst on recyclable mono-material structures (and non-recyclable structures)	Use of How2Recycle label to communicate with consumers on nearly all flexible pkg	Use of digital watermarks/ chemical markers common in printed/ unprinted materials to drive collection	
		Streamlined LCA tool usage to	Design for disassembly to layers,		

		optimize the early design	fitments, etc. that can hinder recycling		
			Development of PP based mono-material structures & high barrier PE through coatings, nano, other barrier technologies	Continued development of PP based mono-material structures & high barrier PE through coatings, nano, other barrier technologies	
		Identify product lines most applicable to move to mono-material structures	Wide range of recyclable structures to enable brand owners to hit sustainability goals	Develop & use of PCR & bio-based materials more common (~20% of feedstock) for flexible pkg in many structures	PCR and bio-based materials make up the majority of inputs into flexible pkg
	2	Identify product lines that are most applicable to move to mono-material PE format	Continued development of higher barrier mono-material films. Expand into PP or PO based structures	Flexible packaging portfolio largely mono-material (PE, PP, or PO structures) further allowing brands to meet sustainability goals through flexible pkg	
		Work with equipment providers to enhance speed/ operation performance (largely retrofit & setting tweaks)	Continued partnerships with key equipment providers to continue performance benefits for new structures	Streamlined LCA tools with product + pkg lead to more flexible pkg to reduce overall GHG and food waste	Advanced tracking of food waste + streamlined LCA tool use drives more flexible pkg use and overall GHG reduction
		Continued work with coating providers, raw material producers, etc. on enhanced barrier properties (including paper & compostable structures)	Development on simplification for medical & pharmaceutical structure (aid in collection & sortation)	Continued simplification for medical & pharmaceutical structure (aid in collection & sortation)	
		Identify opportunities to increase flexible PP growth & opportunity for material simplification	Identify difficult to recycle structures and materials. Drive for overall material simplification	The continued push to eliminate difficult to recycle materials/overall simplification	
		Identify & test leading digital/ chemical marker technologies	Test & implement upgrades for digital/ chemical watermark identification & sortation benefits	Digital watermarks/ chemical markers common in printed/ unprinted materials to drive sortation	Identify & test leading digital/chemical marker technologies
		Explore new collaborative relationships to enhance and accelerate flexible pkg design through	Working group collaborations established and driving new investments and projects/programs forward		

		new market opportunities			
	3	FPA member alignment on what is a recyclable flexible package today	Work with APR on design guidelines related to inks, additives, tie layers, etc. that can make flexible pkg easier for mechanical recycling	Design for disassembly so non-recyclable components easily separated by consumers or through sortation processes	
		Work with APR to develop specific criteria & guidelines for recyclable flexible pkg & How2Recycle certification	Recyclable fitments and features that do not inhibit recyclability at sortation	Streamlined LCA tools with product + pkg lead to more FPP to reduce overall GHG and food waste	Advanced tracking of food waste + streamlined LCA tool use drives overall GHG reduction through flexible pkg use
		Explore PCR traceability programs	PCR traceability standards align	PCR program as standard	All PCR, biobased materials traced to a source
		Work with APR on design guidelines related to inks, additives, tie layers, etc. that can make flexible pkg easier for mechanical recycling	Harmonization of international definitions & standards (working with CEFLEX, Plastics Pacts, APR, etc.)		
			Use of How2Recycle on all FPP for consumer communication		
	4	Develop niche compostable applications, including paper-based	Development with paper and coating providers for enhanced performance and sustainability attributes	Paper-based substrates utilized for some low/medium barrier applications. Expansion of paper-based portfolio for flexible producers	
			Develop paper-based structures with barrier	Paper-based substrates for barrier applications | Development of home compostable compost structures	Development of high barrier compostable structures | 'Fast' compost structures to speed the breakdown
		Paper development with coating suppliers to provide barrier	A wider range of compostable structures - often targeted at foodservice/closed loop venues		Robust compostable structure portfolio for foodservice, baked good, short shelf life products (used in expanded compost or anaerobic digester infrastructure)
		Equipment partnerships to explore paper & compostable structure	Identify single-use plastic applications that may be vulnerable to legislation. Look for		

		performance enhancements	opportunities to modify (compostable, paper) if necessary		
		Explore the development of niche compostable applications (generally foodservice) with green coatings/barriers (non-PFAS)	Work with BPI on home compostable and faster industrial compostable standard in the USA (drive acceptance of compostable pkg)	Development of home compostable or "fast" compost structures that are accepted at composters	
		Explore new home compostable and/ or reduced time for compostable packaging that matches more closely composting infrastructure timing			
	5	Explore refill programs (using flexible pkg as a refill for rigid applications)	Testing/piloting of refillable pouches for certain applications (cleaning, personal care, household, etc.)	Continued development of refillable & reusable pouches with applications across multiple categories	Refillable & reusable pouch systems more common. Standard fitment/equipment systems across the industry to drive applications (ex. vending)
				Partnerships with equipment providers on the development of refillable & reusable pouches	Reuse of flexible pkg common
	*	Work with MRF providers to enhance collection opportunities	Strategic relationships with MRFs/ reprocessors to develop tight specification on PCR quality	Expansion of PCR usage - some usage in food (potential through advanced recycling partnership)	Advanced recycling monomers standard practice - strongly limits the need for virgin fossil-based inputs
			Utilize PCR in non-food applications (construction, trash bags, household, personal care, etc.)	PCR inclusion the standard for non-food applications - driving up overall PCR rate	
				Utilizing advanced recycled inputs for some applications (not standard yet)	
			More cost-effective & performance biobased feedstock tested. Still niche area for FPP	PCR & biobased materials more common (~20% of feedstock) for FPP in many structures	PCR and biobased materials make up the majority of inputs into flexible packaging
			Strategic relationships with MRFs/ reprocessors to		

			develop tight specification on PCR quality		
			Testing/launch of more biobased feedstocks		
		Explore PCR Traceability programs	PCR traceability standards align	PCR traceability/ certifications program as standard	All PCR, biobased materials traced to a source
			More cost-effective & performance biobased feedstock tested. Still niche area for flexible pkg		

Table 14-2. Collection - Detailed Roadmap

		2020	2025	2030	2040
Key Outcomes	1	Store drop-off main route to flexible pkg collection with limited consumer knowledge	Focus on expanding curbside collection/ multi-family/metro pickup of all packaging	Continued focus on expanding curbside collection/multi-family/ metro pickup of all packaging (including flexible packaging)	All flexible packaging effectively collected for recovery
			Continued store drop-off program, despite some bag bans	Utilization of new collection streams (MRFF, Hefty Bag, etc.)	
		Enhanced consumer knowledge with How2Recycle logo on all flexible packaging	Consumers reliable recycling flexible pkg at home and away from home	Recycling of flexible packaging standard for all consumers as collection commonplace across the USA	Enhanced consumer knowledge with How2Recycle logo on all flexible packaging
	2	Inconsistent collection programs across the country	Development of more standardized collection (materials, formats, etc.)	Harmonized collection rules across the country in place	
	3	Limited composting infrastructure & compostable packaging structures	A wider range of compostable structures for foodservice and closed loop applications (including paper-based). Helping reduce food waste	Compostable packaging and food waste collected in foodservice establishments	Compostable packaging and food waste collected nationally (home and foodservice) for composting or anaerobic digestion
	4	Lack of funding for new collection infrastructure	Voluntary industry led PRO for infrastructure investment emerges	Policy drives national funding mechanism for recovery infrastructure investment	Well established national funding in place allowing for greater technology investments & collection efficiency
		2020	**2025**	**2030**	**2040**
	1	Drive consumer knowledge about store drop-off and	Work with retailers to promote and keep store drop-off program	Expansion of collection outside the home – drive	Most multi-family dwellings and rural consumers have flexible

		items that can be collected through public relations campaigns. Partner with brands to get the message out	in place (require funding & education)	to infrastructure for multi-family units	pkg recovery or nearby depots for drop off
		Consumer education push on store drop-off program	Identify opportunities and developed collection of flexible packaging at work locations/on the go/ large buildings. Can be depot system or Hefty Energy bag type application	Continued push on alternate collection methods (including Hefty® EnergyBag® type of programs) that enable the curbside collection of flexible packaging, without significant MRF investment	Curbside pickup is common in the USA.
			Work with brand owners to continue to promote and drive the use of digital watermarks sortation and How2Recycle films for collection	For dense cities with lack of room, development of nearby drop off depots for packaging collection	
			Determine if store drop-off can be expanded working with municipalities for drop-off stations - particularly in more rural locations	Expansion of curbside carts (vs. bins) to enable flexible collection	
			Drop off depots and bins near waterways to reduce marine/ water debris		
			Consumer education on drop-off systems and best practices for all packaging, but include flexible pkg		
	2	Increased focus on short/medium term collection opportunities identification	Continued consumer education on store drop-off and other short/medium term program options	For dense cities with lack of room, development of nearby drop-off stations for packaging collection	Metro and office collection providing additional tonnage to support PCR needs
			Drive consistent collection of accepted materials across the USA		Most multi-family dwellings and rural consumers have flexible pkg recovery or nearby drop-off stations
			Identify the most problematic materials for collection & sortation. Limit acceptance & increase education for difficult to recover structures - or develop	Additional simplification of materials for increased collection efficiency	Difficult to recover materials eliminated or have developed alternate collection systems (ex. drop-offs, depots, etc.)

			alternate collection systems		
			Develop collection of all packaging at work locations/on the go/ large buildings. Leverage drop-off locations		
	3	Identify key areas lacking composting infrastructure. Target foodservice & states with legislation	Investment in composting infrastructure to foster food waste/ compostable pkg collection	Expansion of composting pick up, driven by food waste but certified compostable packaging accepted	Next-generation compostable technologies commercial and providing improved collection and easy identification for sorting
	4	Support/drive legislation that promotes recovery infrastructure investment	Industry led PRO starts to emerge & identify lead collection investment opportunities	Industry led PRO continues funding for new collection technologies	Industry led PRO continues funding for new & emerging collection technologies
		Review gaps in MRFF report such as lack of curbside bins, dry cleaning, etc. - find collaborating organizations to help design & foster infrastructure			
		Collaboration with other associations on continued methods to fund FPP recovery incentives at MRFs			

Table 14-3. Sortation - Detailed Roadmap

		2020	2025	2030	2040
Key Outcomes	1	4% flexible packaging recycling rate	10% flexible packaging recycling rate	30% flexible packaging recycling rate	All flexible packaging effectively recycled
	2	Almost no sortation of flexible pkg at MRFs.| MRFF test proves FPP can be sorted at MRFs	5% of MRFs with capabilities to sort flexible pkg. Initial investment at MRF in new technology including optical sorter, AI, robotics	Major investment in MRF technology through optical sorters, AI, robotics | 20% of MRFs with capabilities to sort flexible pkg	>50% of MRFs with capabilities to sort flexible pkg through continued investment in sortation technologies to drive efficiency & cost structure
	3	Lack of funding for sortation infrastructure	Voluntary industry led PRO for infrastructure investment emerges	Policy drives national funding mechanism for recovery infrastructure investment; National industry PRO system in place manage national sortation system	New technologies commercial improving efficiency and cost structure

	4	Almost no sortation of flexible pkg at MRFs	Some investment at MRF (<5%) in new technology including optical sorter, AI, robotics	Major investment in MRF technology through optical sorters, AI, robotics	
	5	Inconsistent recycling rules across the USA	Harmonized recycling rules for collected materials emerge; large consumer education push for reduced contamination	Harmonized recycling rules for collected materials across the USA; contamination reduced dramatically	
		2020	**2025**	**2030**	**2040**
Key Activities	1	Drive consumer knowledge about store drop-off and items that can be collected through a public relations campaign. Partner with brands to get the message out	Reduced contamination through consumer education & technology	Use of digital watermarks/ chemical markers common in printed/ unprinted materials to drive sortation	Technology investment (AI, optical sorters, robotics, watermarks) have resulted in clean sortation of all collected flexible pkg
		Consumer education push on store drop-off acceptance	Home technology (apps, assistants, etc.) help consumers better sort & find the best outlets	Clean sorted bales of PE, PP, PO, and remaining multi-material for reprocessing	Demand for clean materials leads to the majority of MRFs installing equipment for flexible pkg sortation
				Home technology (apps, assistants, etc.) help consumers better sort & find the best outlets	
	2	MRFF project proves that FPP can be sorted at MRFs through optical sorters	Exploration & implementation of optical sorters at some MRFs that can be used for flexible pkg sortation	Major investment in national sortation infrastructure (AI, optical sorters, robotics) to improve quality & volume of flexible pkg sorted	High levels of automated processing & technology investment at MRFs leads to economical sorting
		Leverage MRFF report and share more broadly with MRF	Development of other programs (e.g., Hefty® EnergyBag® type of sortation that allows consumers to include flexible curbside, but more easily sorted) without significant MRF investment	Industry led PRO continues funding for new sortation technologies	Demand for clean materials leads to the majority of MRFs installing equipment for flexible pkg sortation
	3	Drive/support legislation that promotes recovery infrastructure investment	Industry led PRO starts to emerge & identify lead sortation investment opportunities	Industry led PRO continues funding for new sortation technologies	Industry led PRO continues funding for new & emerging sortation technologies
			Legislation expanding sortation. EPR likely at the state level by	Major investment in national sortation infrastructure (AI, optical	Technology investment results in clean sortation

			2025. Ensure any system includes a plan for flexible pkg recovery	sorters, robotics) to improve quality & volume of sorted flexible pkg	of all collected flexible pkg
			Exploration & implementation of optical sorters at some MRFs that can be used for flexible pkg sortation		
	4	Explore with brand owners digital watermark/ chemical marker technologies that aid in sortation at MRF level	Major investment new technologies such as AI, robotics, digital watermarks, optical sorters	Drive sortation to high levels – food vs. non-food (through AI and digital watermarks)	
			Leaders testing & using digital watermarks to aid in sortation		
		Identify & test leading digital/ chemical marker technologies	Test & implement upgrades for digital/ chemical watermark identification & sortation benefits	Digital watermarks/ chemical markers common in printed/ unprinted materials to drive sortation	
	5	Collaborate with other like-minded associations/brand owners/corporations on lobbying for expansion of the MRFs infrastructure and benefits it brings	Work with brand owners to continue to promote and drive the use of digital watermarks sortation and How2Recycle films for collection	Reduced contamination through consumer education & technology	
			PP films providing growing volume for enhanced end-market options	Focus on the sortation of PE and PP based films	
	*	Explore PCR Traceability programs	PCR traceability standards align	PCR traceability/ certifications program as standard	All PCR, biobased materials traced to a source

Table 14-4. Reprocessing - Detailed Roadmap

		2020	2025	2030	2040
Key	1	Lack of cleaning processes	New cleaning/wash & processing technology infrastructure for flexible packaging starting |New PP reprocessing established	New PP reprocessing established & expanded	PCR commonly used in food applications

	2	Flexible pkg bundled in mixed plastic bales or not processed	Improving the operational performance of processed mono-material flexible pkg	Advanced mechanical recycling technology leads to cleaner processed PCR	Mechanical recycling for common for flexible pkg
	3	Flexible pkg bundled in mixed plastic bales or not processed	Improving the operational performance of processed mono-material flexible pkg	Advanced mechanical recycling technology leads to cleaner processed PCR	
	4	Extremely limited value for collected flexible pkg	R&D efforts identifying enhanced reprocessed material value	Value of reprocessed flexible pkg PCR close to virgin materials	Value of reprocessed flexible pkg PCR =/> virgin materials
	5	Advanced recycling pilot programs	Some advanced recycling moving from pilot state to small scale commercial	Advanced recycling scaling up in some metro areas	Advanced recycling infrastructure in place for major metro areas, enabling recycling of more difficult structures
	6				
		2020	**2025**	**2030**	**2040**
Key Activities	1	Review gaps in MRFF report such as lack of curbside bins, dry cleaning, etc. - find collaborating organizations to help design & foster infrastructure	Industry led PRO emerges to identify lead reprocessing investment opportunities | New wash technologies & investment	Industry led PRO continues funding for new reprocessing technologies	PRO identifies key locations for flexible pkg mechanical recycling infrastructure. | New mechanical recycling leads to more food applications for flexible pkg
	2	Collaborations to identify new end market opportunities	Collaboration between reprocessors, converters & brand owners on PCR into non-food applications	Brand owner goals (and policy) drive demand for PCR (from flexible pkg)	All raw material inputs traceable as biobased, PCR, or certified sourcing
			Next level equipment/ procedures to clean rFlex bales with less fiber (for MRFs that collect loose flexible packaging)	R&D programs to incorporate recycled flexible PP back into packaging applications (rigid)	
			New procedures for cleaning mechanical recycled PCR to allow for more applications	Collaboration between reprocessors, converters & brand owners on PCR into non-food applications	
			Collaboration between reprocessors, converters & brand owners on PCR into nonfood applications opportunities		
			New deinking technologies emerging to offer a		

			cleaner stream of materials		
	3	Identify leading reprocessing best practices	New procedures for cleaning mechanical recycled PCR | New mechanical recycling infrastructure for flexible PE, PP, and PO based films	Cleaner bales for reprocessors through use of digital watermarks/ chemical markers common in printed/ unprinted materials	
				rFlex bales cleaned and purer through technology and move toward mono-material structures, allowing for more application in PCR back into flexible packaging	
				PP cleaning/processing investment	
	4	Identify end markets today: grocery bags, plastic lumber, some plastic liners	Hefty® EnergyBag® type of program expansion - can be used in energy, road component, or eventually advanced recycling	Brand owner goals (and policy) drive demand for PCR - demand pull (reprocessors collaborate with converters and brand owners)	Brand owner requirements for high levels of PCR or biobased materials drive the use of both
			Brand owner demand for PCR leads to investment in cleaning technologies	Continued investment in new cleaning, de-inking, reprocessing technologies to meet demand	Advanced recycling drives new use - multi-material/medical films. High barrier, with virgin applications
	5	Investment in pilot-scale advanced recycling. Monitor best technology for flexible pkg applications	RMS, converters, brand owners, reprocessors collaborate to drive small scale investment with known demand for advanced recycling output	Emerging advanced recycling technology for use as raw material in new flexible packaging	Advanced recycling reprocessing leads to more food applications for flexible pkg
			Small scale programs for FPP as consistent feedstock in advanced recycling	Remaining multi-material packaging sorted as input for advanced recycling	Advanced recycling technology enables multi-material/medical films to be recycled back to the monomer level
	*	Explore PCR Traceability programs	PCR traceability standards align	PCR traceability/ certifications program as standard	All PCR, biobased materials traced to a source
			Industry led PRO starts to emerge & identify lead reprocessing investment opportunities	Industry led PRO continues funding for new reprocessing technologies	Industry led PRO continues funding for new & emerging reprocessing technologies

Table 14-5. End Markets - Detailed Roadmap

		2020	2025	2030	2040
Key Outcomes	1	4% flexible packaging recycling rate	10% flexible packaging recycling rate	30% flexible packaging recycling rate	All flexible packaging effectively recycled with robust end markets
	2	Extremely limited value for collected flexible pkg	Collected flexible pkg value goes up as brand owners demand PCR for CE goals	Value of reprocessed flexible pkg PCR close to virgin materials	Value of reprocessed flexible pkg PCR =/> virgin materials
	3	Flexible PP not collected	New PP and PO end markets identified	PP and PO become more widely used/new end markets in packaging	
	4	Limited end markets (plastic lumber, grocery bags)	New non-packaging end markets emerge as stable outlet | Reprocessed FPP used in some rigid packaging applications	Wide range of end-market options for flexible packaging in both packaging & non-packaging applications	Demand pull for reprocessed materials as a feedstock
	5		New rFlex bale end markets identified	More sorted FPP used in new flexible packaging (non-food applications)	Sorted FPP used in new flexible packaging (including food applications)
	6	PCR traceability programs emerging	PCR traceability standards align	PCR program as standard	All PCR, biobased materials traced to source
		2020	**2025**	**2030**	**2040**
Key Activities	1	Leverage international best practices (CEFLEX, Plastics Pacts, APR) for flexible pkg	Identify non-food applications (construction, trash bags, household, personal care, rigid packaging applications, etc.) to expand end markets | Partner with international markets & associations to establish early options for reprocessed flexible pkg	The continued growth of new technologies to support new end markets via new funding mechanisms	Continue Identification of new technologies to drive efficient collection, sorting, reprocessing, leading to better value for end markets
			Partner with international markets & associations to establish early options for reprocessed flexible pkg	Partnerships with MRFs and end markets to drive and ensure uses for flexible pkg PCR. Find leading brand owners to pull material. Drive PCR goals	

	2	MRFF project proves that FPP can be sorted at MRFs through optical sorters		Converters and raw material suppliers set up partnerships with MRFs and end markets that collect FPP to ensure a market for collected material	Advanced recycling technology enables multi-material/medical films to be recycled back to monomer level | Advanced recycling results in high levels of PCR back into food contact materials
		Flexible packaging converters, raw material suppliers, and end-market collaboration to identify new opportunities	Identify non-food and rigid applications to expand end markets for flexible pkg. Brand owners pull early material (at a premium) to hit sustainability goals	Partnerships for emerging advanced recycling & use as feedstock in new FPP | Expansion of PCR into flexible pkg	Continued flexible packaging growth contributing to reduced GHG emissions
	3	Start development of all flexible PP structures	PP stream being incorporated into food/non-food applications	PP providing a high-value PCR stream for various markets	
	4	Leverage MRFF report to identify new markets to collect FPP and rFlex bales	Identify new end markets for rFlex or Hefty® EnergyBag® type of collection programs | Use of traceability programs for flexible pkg PCR		
		End markets today: grocery bags, Trex lumber, plastic lumber	Hefty® EnergyBag® type of program expansion - particularly for multi-material applications - can be used in energy, roads (short/midterm), or eventually advanced recycling		
			Identify opportunities for flexible pkg in rigid and flexible packaging applications		
	5		An application where rFlex bales used as feedstock in pyrolysis	Partnerships for emerging advanced recycling & use as raw material in new flexible packaging	
				rFlex type bales cleaned and purer through technology and move toward mono-material structures, allowing for more application in PCR back into flexible packaging	

	6	Explore PCR traceability programs	PCR traceability standards start to gain traction	PCR traceability/ certifications program as standard	All raw material inputs traceable as biobased, PCR, or certified sourcing (similar to FSC for paper)
			Associations or industry led PRO to monitor mass balance to ensure enough PCR coming	Associations or industry led PRO to monitor mass balance – look for more PCR end markets	
	*				Increased growth of flexible pkg nationally and globally have helped reduce GHG and carbon levels across the packaging value chain

Chapter 15

Additional Sustainability Resources

This section provides links to several additional resources and reports that readers may find to be a valuable resource to gain additional in-depth knowledge on a particular topic.

Extended Producer Responsibility

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

Flexible Packaging Specific Reports

- ACC – Flexible Film Recycling Group - https://plastics.americanchemistry.com/Flexible-Film-Recycling-Group.aspx
- CEFLEX Designing for a Circular Economy - https://guidelines.ceflex.eu
- Flexible Packaging Europe – Sustainability Vision - https://www.flexpack-europe.org/files/FPE/sustainability/FPE-Sustainability_Vision_June2020.pdf
- FPA – *A Holistic View of the Role of Flexible Packaging in a Sustainable World* - https://www.flexpack.org/publication/RG93bmxvYWQ6Mzc=/download
- FPA – General Sustainability Resources - https://www.flexpack.org/resources/sustainability-resources
- FPA – *Sustainability and Life Cycle Impacts of Flexible Packaging in E-commerce* - https://www.flexpack.org/publication/RG93bmxvYWQ6MzQy/download
- Material Recovery for the Future, 2020 Research findings - https://www.materialsrecoveryforthefuture.com/research-results/2020-research-results/
- Pet Sustainability Consortium - Flex Forward program - https://petsustainability.org/new-flex-forward-pilot-program-aims-to-bring-groundbreaking-recycling-solutions-to-the-pet-industry/
- *Plastics Recyclers Europe: Flexible Film Market in Europe: State of Play* | 2020: https://743c8380-22c6-4457-9895-

11872f2a708a.filesusr.com/ugd/dda42a_ff8049bc82bd408faee0d2ba4a148693.pdf

- UK Plastics Pact – Flexible Packaging Roadmap - https://www.wrap.org.uk/sites/files/wrap/Creating_a_circular_economy_for_flexible_plastic_packaging_roadmap_2025.pdf
- WRAP – Wrap Recycling Action Program - https://www.plasticfilmrecycling.org/recycling-bags-and-wraps/wrap-consumer-content/

Plastic Pacts

- European Plastics Pact - https://europeanplasticspact.org
- UK Plastics Pact - https://www.wrap.org.uk/content/the-uk-plastics-pact
- UK Plastics Pact Roadmap - https://www.wrap.org.uk/sites/files/wrap/The-UK-Plastics-Pact-Roadmap-v3.pdf
- U.S. Plastics Pact - https://usplasticspact.org

Plastic Specific Reports/Roadmaps

- Ellen MacArthur Foundation New Plastics Economy - https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy
- Quantis – Plastic Leak Project Guidelines - https://quantis-intl.com/report/the-plastic-leak-project-guidelines/
- Pew Trust – *Breaking the Plastic Wave* - https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf
- PLASTICS: New End Markets Opportunities (NEMO) for film asphalt project reports - https://www.plasticsindustry.org/supply-chain/recycling-sustainability/new-end-market-opportunities-nemo/new-end-market-opportunities
- UNEP – *Single-use plastic: A roadmap for sustainability* - https://www.unenvironment.org/resources/report/single-use-plastics-roadmap-sustainability
- WWF - *No Plastic in Nature: A Practical Guide for Business Engagement* - https://c402277.ssl.cf1.rackcdn.com/publications/1208/files/original/WWF_McK_Plastic_Waste_FinalWeb2.pdf?1560193480
- WWF – *Transparent 2020 Report* - https://www.worldwildlife.org/publications/transparent-2020

Overall Sustainability Reports

- Drawdown.org – *Climate Change Solutions* - https://drawdown.org/solutions

- Ellen MacArthur Foundation - https://www.ellenmacarthurfoundation.org
- McKinsey & Company Insights: Paper, Forest Products, and Packaging - https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights
- PMMI: *Packaging Sustainability: A Changing Landscape* (Executive Summary) - https://www.pmmi.org/report/packaging-sustainability-changing-landscape

Recycling and Related Technologies

- *Accelerating Circular Supply Chain for Plastics*, Closed Loop Partners - https://www.closedlooppartners.com/wp-content/uploads/2020/01/CLP_Circular_Supply_Chains_for_Plastics.pdf
- APR Design Guide for Plastics Recyclability – PE Film - https://plasticsrecycling.org/images/pdf/design-guide/PE_Film_APR_Design_Guide.pdf
- AMERIPEN - *AMERIPEN Financing Principles and Objectives for Advancing Packaging Recycling in the US* - https://www.ameripen.org/page/publication-financing-2020
- Consumer Brands Association – Recycling Leadership Council - https://consumerbrandsassociation.org/sustainability/recycling-leadership-council/
- The Recycling Partnership – Bridge to Circularity - https://recyclingpartnership.org/circularity/
- The Recycling Partnership – *2020 State of Curbside Recycling* - https://recyclingpartnership.org/state-of-curbside-report-2020/
- Shelton Group – *Engaging Middle America in Recycling Solutions* - https://storage.googleapis.com/shelton-group/2020-Reports/Recycling_Pulse_Engaging_Middle_America%20_in_Recycling_Solutions.pdf
- Waste Management – *Report on Recycling, 2020* - https://sustainability.wm.com/downloads/WM_Report_on_Recycling.pdf

Chapter 16

Terminology & Definitions

Term	Definition
Advanced Recycling*	Advanced recycling of polymer waste is defined as any reprocessing technology that directly affects either the formulation of the polymeric material or the polymer itself and converts them into useful products like monomers, basic-chemicals, alternative fuels, and other value-add materials. Additional note from the Ellen MacArthur Foundation: chemical (advanced) recycling can be considered in-line with a circular economy if the technology is used to create feedstock, which 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) nor as part of a circular economy.
Barrier	A material that is designed to prevent or significantly reduce the penetration of water, oils, water vapor, or gases as desired. Barrier materials may serve to exclude or retain such elements without or within a package. Barriers often serve to extend the shelf life of food products.
Coating*	The application of a thin layer of a functional material onto a substrate.
Composability	A 90% breakdown of products by microbes into CO_2, water, and nutrients within a six-month timeframe and with no harmful residuals (EN 13432 or ASTM D6400). The package must meet standards to gain composability certification.
End Market	Refers to the final product after recovery. The product then goes back into consumer re-use.
Energy from Waste	The process of combusting/burning waste to generate electricity.
Extended Producer Responsibility (EPR)	Policy approach under which producers (brand owners) are given a significant responsibility–financial and/or physical–for the treatment or disposal of post-consumer products.
Flexible Packaging	Any package or any part of a package whose shape can be readily changed.
Flexible Packaging (CEFLEX)	Flexible packaging structures typically bend easily and can include bags, pouches, envelopes, sachets, removable lidding/liners, and wraps. Flexible packaging structures can be single or multi-layered, using a variety of materials including plastic film, paper, aluminum foil, or any combination of these. The construction may be plain, printed, coated, and/or laminated. Flexible packaging is most commonly used to protect fast-moving consumer goods products such as confectionery, snack foods, frozen foods, bakery, fresh produce, meat, dairy, pet food, processed foods, cosmetics, personal care, householder detergents, beverage bottle/can wrappings, pharmaceuticals, medical and other technical products.

Flexible Plastic Pkg (FPP)*	Within the context of this document, plastic-based flexible packaging is packaging that contains > 80% polymers. Within this context, the definition of mono-material and thresholds for polyolefin-based materials within these guidelines should be noted.
Lamination	A combination of two or more materials adhered together to create one structure. The lamination of multiple materials is intended to improve technical performance.
Material Recovery Facility (MRF)	Specialized facilities that receive, separate, and prepare recyclable materials. Upon sortation, these materials are sold and sent onwards to processing facilities.
Mechanical Recycling	Refers to operations that aim to recover plastics waste via mechanical processes (grinding, washing, separating, drying, re-granulating, and compounding). In mechanical recycling, polymers stay intact. Note: Paper and rigid plastics are also mechanically recycled.
Mono-material*	Contains predominantly one material type, either PE (LDPE, LLDPE, HDPE), PP, PET, aluminum, paper, or other. For plastics, this should be seen to mean >90% of one polymer type as this is the upper threshold when the other elements such as adhesives, additives, and inks are included. The exception is if one of the minor components, for example, paper, biodegradable plastics, etc., will disrupt the plastic mechanical recycling process. Bi-axially oriented and non-oriented forms of the same base polymer are considered to be mono-material as are PE and PP copolymers and homopolymers, as long as they have a neutral or positive effect on the recycled stream. This definition applies equally to paper and aluminum foil flexible packaging although the actual percentage may vary depending on the recycling process.
Multi-layer*	Contains more than one layer of material where a 'layer' is only considered if it is greater than 1 micron thick (where no material type is >90% of PE, PP, or PO (or >80% for aluminum)). The different layers in the structure can be 'joined' together through adhesive bonding or tie-layers via an extrusion, co-extrusion, or lamination process, or extrusion coating or extrusion lamination processes. The different layers can be copolymer blends and do not need to be a single material. There is a difference between layers and depositions. The addition of lacquers, adhesives, coatings and other material deposition processes including metallization where the layer of deposited material is in the order of 20

	nanometers to 10 microns does not change the definition of mono or multi-material. N*ote: not all multi-layer structures are multi-material structures and mono-materials can be multi-layered.*
Multi-material film	Films comprised of more than one layer of similar or different polymers. May also be referred to as multi-layered film, or depending on the process used to join layers–multi-laminate film.
Paper-based flexible pkg*	Within the context of this document, paper-based flexible packaging is flexible packaging that contains paper as a dominant material. Paper mills prefer to receive no plastic and paper laminations, or ones where the plastic is easily separated.
Polyethylene (PE)*	A polyolefin polymer based on ethylene. There are three main types used in film applications HDPE, LDPE, and LLDPE. It is valued for three main properties; toughness, heat-sealability, and barrier to water and water vapor. It has a low coefficient of friction and little, if any, moisture absorption. It is a very low-cost packaging resin and has low process energy costs as it has the lowest softening point of the packaging plastics. It is formed of long chains of C_2H_4 (ethylene) units. The molecules are long straggling chains with branches, tangled together in various ways to form the tough, transparent, heat-sealable material. The molecular structure of the types (HDPE, LDPE, LLDPE) of polyethylene vary.
Polyethylene terephthalate (PET)*	This is a high clarity film with a moderate gas barrier and tolerates fairly high temperatures (typically over 200°C), though these properties can all be improved by orientating, coating, or copolymerizing the film. It is often laminated with PE to give the seal properties needed for a film application or it can have a sealable coating applied to it. It is typically found as a 12 micron film and is valued for its good clarity, aroma barrier, and moderate moisture and oxygen barrier.
Polyolefin (PO)*	Group of polymer thermoplastics consisting of only PP and PE.
Polyolefin-based flexible packaging	In the context of this document, polyolefin-based flexible packaging is packaging made up of more than 90% polyolefin materials.
Polypropylene (PP)	A member of the polyolefin family of polymers, PP is a versatile material used for a wide range of applications and its polymer structure can be tailored to meet diverse requirements. It has a very low density, excellent chemical resistance, and good strength at a low cost. It is often used for applications such as microwave packs due to its high melt point and provides a good moisture barrier. It is often produced as a film in the biaxially orientated form known as OPP (or sometimes BOPP). Some non-orientated PP is used in packaging, primarily for twist-wrap. Orientation improves its low temperature durability making it ideal for freezer applications and grease barrier properties. It is an economical film used across a variety of food applications.
Post-Consumer Recycled (PCR)*	Waste material generated by households or by commercial, industrial, or 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.

Recyclable*	A pack can only be considered recyclable in a given country/market if there is a realistic chance (> 50%) it will be (i) collected; (ii) sorted into a material fraction that is sent to be recycled into a new material/product at scale and for which (iii) there are viable end-market applications. This includes when the recycled material is used in conjunction with virgin or recycled materials from other sources (i.e., it does not only need to be used at 100% inclusion). The key test of recyclability is whether the recycled materials will replace the need for new material from virgin or recycled sources.
Recycled Content*	Proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content.
Recycled Material*	Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or a component for incorporation into a product.
Reprocessing	Taking sorted plastics and turning them back into a viable feedstock, usually through either mechanical or advanced recycling.
Sorting*	Process of classification of the mixed plastic waste in multi-material collection schemes; it consists of separating plastics from non-plastic content as well as plastic itself into different colors/polymer categories.

*Denotes definitions taken from CELFEX Designing for a Circular Economy Technical Report

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