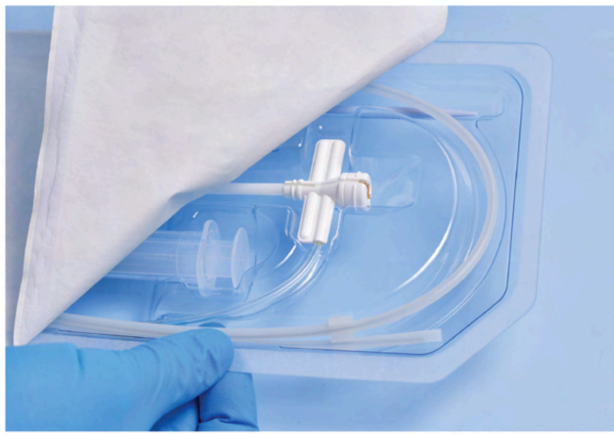
Thermoform Circularity Report

2025



PLASTIC iNGENUITY

PLASTIC iNGENUITY

Report Contents

Welcome

Letter from Dan Kuehn

President / CEO

As we turn the page after a long electoral year, much of the attention remains on Washington and the policy changes that might occur in the US Capital.
In Plastic Ingenuity's narrower niche of plastic thermoforming, this is no different. At PI, we remain focused on policy evolution and industry trends – many of which have the potential to reshape our industry and the industries of our customers. As you'll see, our team has put in the work to stay in front of these developments so that we can help our customers and partners understand what's changing, why it matters, and what steps can be taken to stay ahead. As you read, I hope you'll discover insights that can help drive your business forward and bring you closer to achieving your organizational goals.

Over the past year, our sustainability team has continued their efforts in supporting PI and our customers. These activities include:

- Conducting Sustainability Packaging Assessments and Sustainability-focused Voice of the Customer Interviews;
- Presenting Industry- and Customer-specific, bespoke sustainability Lunch-and-Learns along with speaking engagements at industry events;
- Developing different types and sources of sustainable materials such as PCR PP, novel oxygen barrier materials, and new fiber-based packaging technologies;
- Refining our approach to the accounting of carbon emissions and how information such as this gets reported back to industry partners and relevant management systems; and
- Releasing two new courses on Sustainable Packaging and Healthcare Packaging Sustainability (certificates available on-line for both courses).

We are proud of what the team has accomplished but there is still much to do – particularly since the prevailing narrative regarding some of our products is increasingly negative, while all the amazing things our products help us accomplish is too often overlooked. We need to work with all stake-holders to help improve our impact on the environment, and also tell the story of all the positive attributes of our products so that corporations and policy makers can make the best decision for the environment and end users. PI is committed to continuing initiatives in support of this outcome – and you'll learn more about these initiatives in these pages.

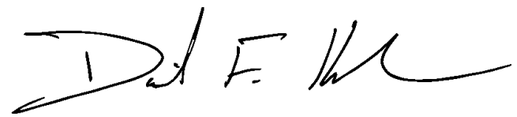
One important theme in this year's edition is the rise over the last two years in state-led initiatives to implement Extended Producer Responsibility (EPR) schemes. EPR policies typically place the responsibility for the lifecycle of packaging more squarely on the shoulders of producers and brand owners. This policy trend represents an evolution from voluntary sustainability commitments to a mandated approach requiring adaptation by all stakeholders in our value chain.

Here at PI, we support EPR programs that are well-constructed, material-agnostic, and reinvest directly into the recycling infrastructure in a way that will improve recycling rates for our products. A well-thought-out, industry-driven model with the right financial incentives can produce significant environmental benefits. However, not all EPR schemes are created equal. A poorly designed EPR scheme can lead to excessive costs, inefficiencies, and adverse environmental impacts. So, it is important industry leaders pay attention to the details of these EPR bills and provide guidance and leadership to policy makers to ensure we enact well-designed EPR schemes that positively impact innovation, accountability, investment and (most importantly) results.

We remain committed to making continued investments in these sustainability initiatives. We encourage anyone interested in learning more or getting more involved with PI in any of these efforts to connect with us.

For those of you that already work with us, thank you for your partnership and trust. We look forward to continuing our work together.

Sincerely,

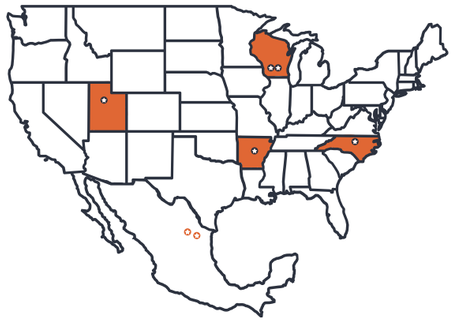


About Plastic Ingenuity

Tom Kuehn, Board Chair

Plastic Ingenuity is the largest custom thermoformer in North America. From concept to final product, we do everything in house. That means you have the assets you need to support your solution end-to-end without the hassle and downtime that comes with outsourcing these capabilities. Our team of experts will work with you to understand your goals, prototype your vision, and create a best-in-class package that's market-ready in no time.

We work in
7 Strategic Locations
Throughout The United States & Mexico



13.4% 5-Year CAGR

84 NPS
(top 10% in the industry)

900+ Employees

Cross Industry Experience,
Individualized Expertise

CONSUMER GOODS

HEALTHCARE

Vertically
Integrated Services

We build our own tools.

We extrude our own materials.

We build our own machines.

We provide rapid prototyping.

We offer automation consulting.

We provide a suite of sustainability services.

Our People

Joe Kuehn, Founder

From humble beginnings, our founder, Joe Kuehn, started PI with with just 5 employees in 1972. Since then, PI has grown into the largest custom thermoformer in the nation. In 2022, we celebrated our 50-year anniversary achieved through the resiliency, innovation and team expertise only earned by a lifetime of practice. In staying true to our mission statement, conservation has been a part of our work since day one. It wasn't always easy, but it was always better… together.

28 Years
average tenure of PI design engineers

18 Years
average tenure of PI quality assurance team

42% of Profits
bonused back to employees

#PIProud
Core Values

- **FRIENDLY & GENUINE**
- **RESOURCEFUL**
- **COLLABORATIVE**
- **TOTAL CUSTOMER FOCUS**
- **DEPENDABLE DOER**

"As someone who loves the outdoors, working for an organization that genuinely cares about lessening our environmental impact is something that's truly important to me. Seeing all the work our sustainability team does like encouraging our customers to increase their PCR content, teaching our engineers how to design for recyclability, and decreasing our carbon emissions have all made impactful improvements on our overall environmental impact. These things and more make PI a leader in sustainability and make me proud to work for a company that is bettering everyone's future."

Mia L.
Project Engineer
Cross Plains, WI

"Working at Plastic Ingenuity makes me proud because we don't just talk about sustainability, we act on it. We make decisions based on data and we're always transparent with our customers. While the plastic industry has its challenges, we're dedicated to improving circularity through better design, increasing recyclability, and reducing waste in our manufacturing. It feels great to be part of a company that's truly working to make a positive impact."

Greyson H.
Project Engineer
Cross Plains, WI

Top Work Places Two Years in a Row

In 2024, Plastic Ingenuity was recognized as a Top Workplace for the second consecutive year, earning both the Top Workplace USA and Madison Area Top Workplace awards! This achievement highlights the dedication, passion, and teamwork of our incredible employees and reflects the culture we've built together —one that values collaboration, innovation, and mutual success. At Plastic Ingenuity, fostering an environment where people thrive is at the core of what we do, and it's our team's unwavering commitment to excellence that drives our success. Thank you to every member of the PI Team for making this possible— here's to another year of accomplishments and growth!

TOP WORK PLACES 2023 WISCONSIN STATE JOURNAL MADISON.COM

TOP WORK PLACES 2024 WISCONSIN STATE JOURNAL MADISON.COM

PLASTIC INGENUITY

Community Impact

We are dedicated to giving back to the communities we serve through community events, mentorship moments, and peer-driven experiences. We believe what matters to our community, matters to us.

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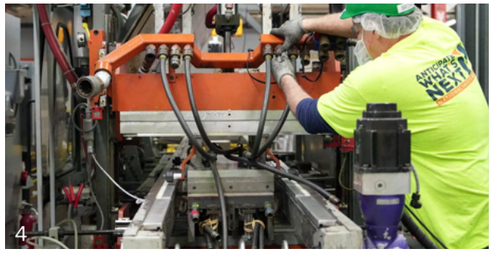

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7


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6

1. PI hosted Badgerland Girl Scout Council eager to explore the “Possibilities of Plastic”! These future scientists, engineers, and innovators got a behind-the-scenes tour of our plastic thermoforming plant to learn about manufacturing technology, sustainability, and the exciting careers that STEM offers.
2. The PI team celebrated Earth Day by picking up trash and planting wildflowers.
3. As a part of Future Quest, a partnership between Dane County School Consortium and Madison Metropolitan School District, PI helps to provide career awareness to middle school students in Dane County.
4. Our entire PI team, including this father-daughter duo, celebrates National Safety Month, ensuring we anticipate what's next.
5. PI wears Orange for Hunger Action Day, part of Second Harvest Foodbank of Southern Wisconsin's initiatives to raise awareness and take action against hunger.
6. Plastic Ingenuity's Manufacturing Day Event. PI hosts Middleton High School students, including tours and hands-on experiences showcasing the latest innovations in manufacturing, sustainability, and technology.
7. October is Breast Cancer Awareness Month and Plastic Ingenuity demonstrated its support by donning pink to honor the brave women and men who’ve faced this journey, and to remind each other that no one fights alone.
8. Plastic Ingenuity opened its doors to the community to witness our thermoforming operations and discover how we craft custom packaging solutions for the Food, Healthcare, and Consumer Goods industries.

WORLDSTAR WINNER 2025

2024 AmeriStar Winner

Award Winning Innovation

At Plastic Ingenuity, devising groundbreaking circularity innovations and services for our customers is embedded in our core values. Over the years, this commitment has yielded significant results. This year, Plastic Ingenuity and Beckman Coulter partnered to create packaging that would seamlessly integrate with the launch of a highly automated diagnostic machine while minimizing material usage and capitalizing on increased recycling opportunities.

Beckman Coulter began designing a custom thermoformed package to protect their newly developed consumables, including an extremely sensitive pipette tip requiring critical protection. They enlisted Plastic Ingenuity to help convert their initial design concept into a manufacturable solution. This took five years of extensive design engineering to achieve.

WHAT CAME NEXT

We discovered through substantial testing that the pipette tips were highly susceptible to damage, and any damage caused failures with the automated equipment. Even a slightly bent tip could shut down the machines for extended durations. This meant the lid and base tray needed to be as robust as possible yet remain a viable thermoformed PET part. The initial design featured straight sidewalls, which failed drop testing when the boxes were filled with product. Instead of simply adding material, Plastic Ingenuity focused on incorporating design features that would increase overall package strength.

THE RESULT

Plastic Ingenuity incorporated a cut-out feature to the package's base by adding a unique contour trim, allowing the lab techs to reach inside the package easily when loading the individual pipette trays. The final packaging achieved their primary goals of product protection, material minimization, and recycling improvements with improved tray handling—a win for both Plastic Ingenuity and Beckman Coulter.

PLASTIC INGENUITY
HEALTHCARE DIVISION

Endorsing the U.N. Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) provide a framework for organizations and governments to follow to ensure the development of new goods and services is as sustainable as possible. This is a holistic, people-centered approach with categories ranging from “no poverty” to “peace and justice.” Plastic Ingenuity is committed to aligning with the SDG framework. The following information details our alignment and progress to date.

End poverty in all its forms everywhere

We are committed to providing fair compensation for all of our team members and partners. In addition to competitive wages, team members share 42% of Plastic Ingenuity's profits through our discretionary profit-sharing program.

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

The custom thermoformed packaging we create plays a critical role in preserving and protecting food products. Effective packaging is essential to combat the issue of food waste, ensuring food reaches people safely and efficiently.

Ensure healthy lives and promote well-being for all at all ages

We are committed to providing a safe and secure work environment for our team members and visitors. Our goal is to have zero reportable injuries in the workplace. Additionally, we will continue to focus our engineering and capital resources to eliminate accidents and ensure well-being. We are committed to supporting the emotional and mental well-being of our team members with an Employee Assistance Program amongst other support mechanisms. In addition to internal measures, the products we make for the healthcare industry protect the medical devices and medicines trusted to save lives.

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

All team members are eligible to participate in our Educational Assistance Plan. The purpose of the Educational Assistance Plan is to help any team member who so desires to enhance his or her capabilities to the greatest extent possible within their career at Plastic Ingenuity.

Achieve gender equality and empower all women and girls

We remain committed toward equal opportunities for all genders. We will treat all people equally and nurture talent, regardless of gender. We support women's professional, academic, and general growth. We advocate for equality through community engagement.

Ensure availability and sustainable management of water and sanitation for all

We will be responsible stewards of the water we consume and discharge as part of our operations. We monitor our water consumption and strive for ways to reduce usage. As an example, we installed a closed-loop cooling system for our thermoforming machines to reduce water consumption by over 250,000 gallons per month.

Ensure access to affordable, reliable, sustainable and modern energy for all

We are committed to increasing the energy efficiency of our operations. Our energy intensity decreased by 22% over the last 6-year period from 2015 to 2021. In addition to efficiency, we will continue to generate renewable energy for our operations from on-site solar panels.

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

We provide team members with an environment to grow and feel pride in their work. We prioritize safe working conditions for all of our team members and partners. Our unique profit-sharing program creates a sense of ownership and fosters unparalleled teamwork. Unmatched employee tenure is a driver of our sustained growth. For example, the average tenure of PI design engineers is 28 years. We also provide a yearly cost of living adjustment to all team members, ensuring wages are modified to match the rising costs of living. Plastic Ingenuity participates in paid apprenticeship programs, featuring both youth apprentices and journeyworker apprentices.

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

We leverage our design and innovation expertise to create sustainable thermoformed packaging solutions. These innovations result in optimized material usage, reduced waste, and increased circularity. We invest in infrastructure improvements through our partnerships and associations, to recover more plastic waste so it can recirculate in our economy as recycled material.

Reduce inequality within and among countries

We are committed to a diverse and inclusive workplace, as we know that each of our team members helps to make us better. We welcome people from all backgrounds and walks of life. We are diligent in our effort to eliminate discrimination and harassment, ensuring the entire team completes necessary yearly training.

Make cities and human settlements inclusive, safe, resilient and sustainable

We are aligned with the shift to a circular economy, which will improve the sustainability of our communities. We abide by the Association of Plastic Recyclers Design Guide to create custom thermoformed packaging that is compatible with residential recycling systems. We collaborate with associations, like The Recycling Partnership, focused on increasing equitable access to recycling in our communities. We provide educational resources for customers through newsletters, video series, eBooks, and a yearly Thermoform Circularity Report, promoting the transition to a circular economy.

Ensure sustainable consumption and production patterns

We support the sustainable management of natural resources with pride. We seek to use more recycled content in our products to lessen our dependence on fossil fuel-derived materials. We design our packaging to be recycled so its valuable material can be recovered for reuse at the end-of-life. We leverage our design expertise to use the minimal amount of plastic while offering utmost product protection. We deploy lean manufacturing principles and continuous improvements to efficiently use the resources required in operations.

Take urgent action to combat climate change and its impacts

The phrase “we will be ever mindful of our natural environment” is embedded in Plastic Ingenuity’s mission statement. We quantify our Scope 1 and Scope 2 emissions, along with a detailed Scope 3 screening. This enables identification of opportunities to reduce our greenhouse gas intensity. We are evaluating ways to further bolster the use of renewable energy in our operations.

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Our Corporate HQ in Cross Plains, WI borders the Black Earth Creek, a world-class trout stream. To protect this ecosystem, we developed five rain gardens that reduce storm water run-off. We are members of Operation Clean Sweep, a stringent program designed to eliminate resin loss to the environment.

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

We are committed to natural environment preservation. We have reduced our landfill contributions by focusing on diverting our operational waste through recycling and reuse. Our ISO 14001 environmental management system ensures we are reducing the risk of polluting our natural environment from our operational activities.

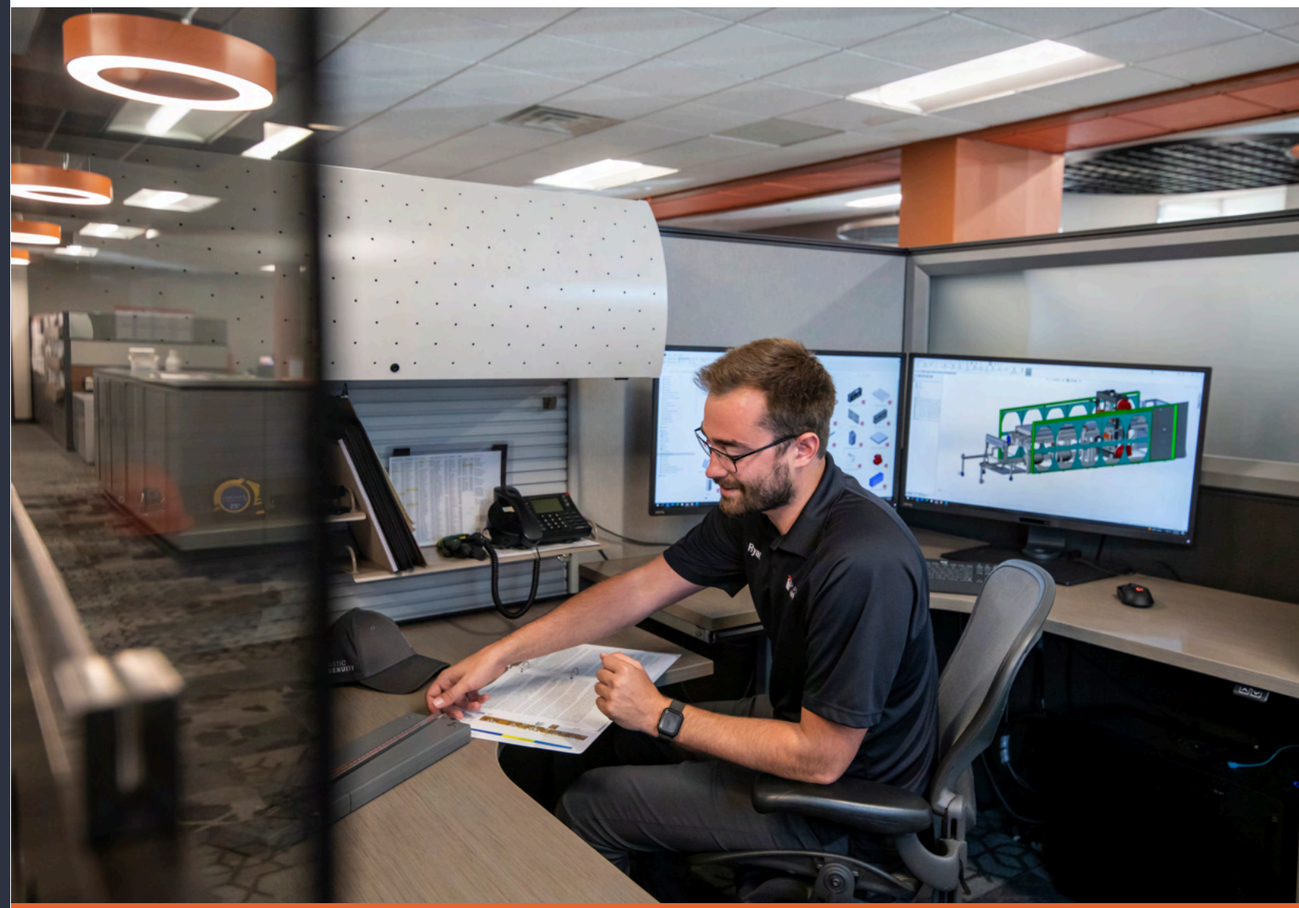
Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

We hold ourselves to the highest legal and ethical standards. We serve our internal and external stakeholders with honesty and integrity. We are dedicated to eradicating all forms of corruption within our company.

Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

We support a variety of collaborations and initiatives whose objectives are in line with the Sustainable Development Goals. In order to lessen our impact on the environment, enhance the circular economy, and encourage climate action, we collaborate with trade groups, NGOs, and other key stakeholders. Organizations and associations include PLASTICS (Plastics Industry Association), The Recycling Partnership, PP Recycling Coalition, Association of Plastics Recyclers, Sustainable Packaging Coalition, NAPCOR (National Association for PET Container Resources), Healthcare Plastics Recycling Council, and the Associated Recyclers of Wisconsin.

Capabilities



PLASTIC INGENUITY

Sustainable Product

Portfolio

Plastic Ingenuity has developed a portfolio of sustainable product solutions to enable brands, retailers, and healthcare manufacturers to meet their objectives.

Post-Consumer Recycled Materials

PCR is an ideal solution for packaging professionals seeking a solution to reduce virgin plastic usage, decrease carbon footprint, and increase their packaging circularity. We offer a portfolio of post-consumer recycled materials options for PET and PP packaging that have FDA No Objection Letter (NOL) status for use in food-grade applications. PCR derived from recovered thermoforms can be specified for enhanced circularity. Plastic Ingenuity offers PCR from mechanically recycled sources and advanced recycled sources using ISCC PLUS mass balance allocation. Third party certified PCR options are available for enhanced sourcing transparency.

OPS and PVC Elimination

Oriented Polystyrene (OPS) and Polyvinyl Chloride (PVC) have been identified as problematic plastics by the U.S. Plastics Pact and major retailers like Walmart and Target. Our PET thermoformed tray structures offer an alternative solution to PVC and OPS. This solution is ideal for packaging professionals seeking alternative material solutions to replace their OPS or PVC packaging. Cookie trays made from OPS and blister packs made from PVC are ideal candidates to transition to PET.

Bio-based Plastic Packaging

Bio-based plastic is an ideal solution for packaging professionals looking to reduce virgin plastic usage and the carbon footprint of their packaging. We offer bio-based PP thermoformed packaging using ISCC PLUS chain-of-custody certified bio feedstocks, such as used cooking oil. We also provide bio-based PLA for brands seeking an industrial biodegradable option.

Recyclable Colorants

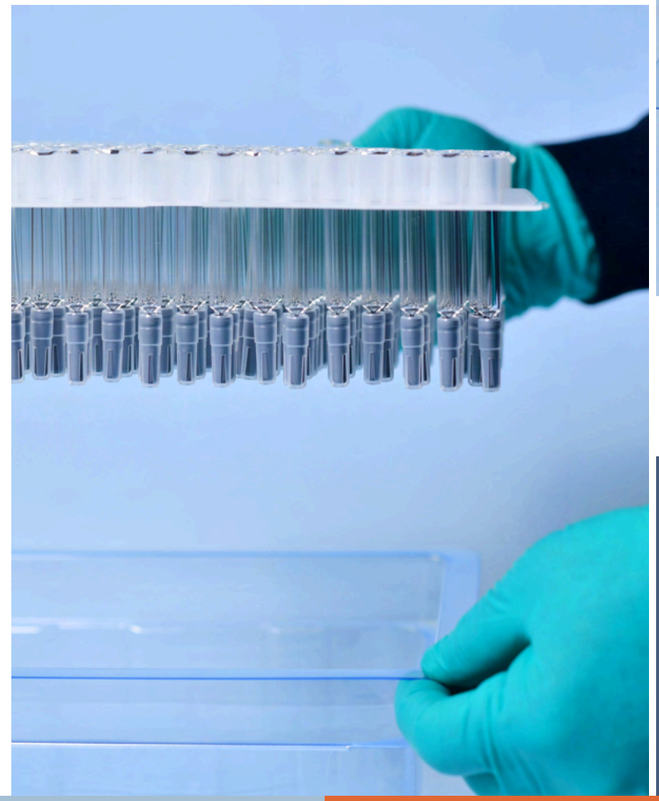
Colorants used in packaging can negatively impact a Material Recovery Facility's (MRF) ability to effectively sort items in their automated processes. We have developed thermoformed packaging with black colorants that are detectable by near-infrared (NIR) sorting technology. This solution is ideal for packaging professionals seeking to eliminate carbon black from their packaging portfolio.

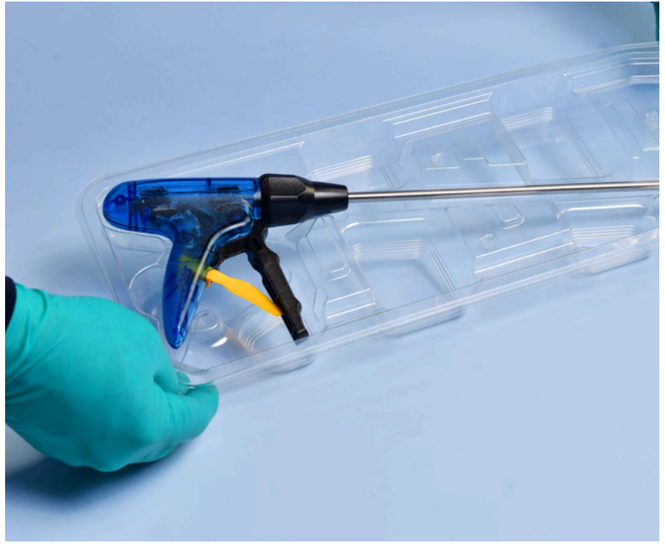
Recyclable Barrier Packaging

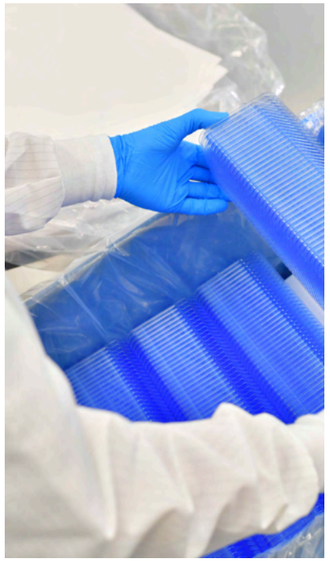
Oxygen and moisture barriers added to packaging are critical in preserving food products. However, these barriers can negatively affect the recyclability of the package. We have developed barrier packaging that is compatible with existing recycling streams without sacrificing preservation performance.

Ready-to-Use (RTU) Pharma Tub

RTU packaging is commonly used in the pharma industry to protect vials, syringes, and cartridges. Conventional RTU tubs made using an injection molding process result in material inefficiencies. We have developed a thermoformed RTU tub that provides the protective properties needed and conforms to the ISO 11040 standard, using up to 40% less plastic.







PuraForm™

PETG Alternatives

PETG is extensively used in medical device packaging to protect healthcare products during sterilization and distribution. However, PETG recycling options are limited. Our solution is compatible with the PET recycling stream but does not compromise sterility and protective performance.

Circular Materials for Healthcare Packaging

Due to regulatory requirements, the use of recycled content in healthcare packaging is constrained. Healthcare packaging engineers can enhance the circularity of their packaging by leveraging materials implemented via mass balance processes. We can provide Eastman's Renew™ and other circular materials by leveraging our ISCC PLUS certified mass balance system.

Sustainability Services

At Plastic Ingenuity, we collaborate with our customers to create packaging that promotes sustainable design and enhances circularity.

PLASTIC INGENUITY

Sustainable Packaging Assessment

Plastic Ingenuity's Sustainable Packaging Assessment (SPA) is the cornerstone of our sustainability services and is the most effective foundation for initiating meaningful progress. This process begins by identifying our customer's sustainability objectives and assessing current packaging systems. We provide a comprehensive roadmap with actionable steps tailored to help them achieve their goals. The SPA includes a detailed analysis of circular design and material options, evaluating the environmental impacts of each choice.

Our strength lies in seamlessly executing this plan and managing every aspect of the production process from design to delivery. In 2024, we created 20 Sustainable Packaging Assessments resulting in the following impacts when implemented:

74,999 Metric Tons of CO2e Avoided

8,786,236 Pounds of Virgin Plastic Eliminated

3,161,205 Pounds of PCR Increased

15,667,137 Pounds of Packaging Converted to Recyclable Materials

Source: Based on annual production volumes, CO2e data from Trayak EcoImpact and Plastic Ingenuity Custom Product Carbon Footprint Calculator

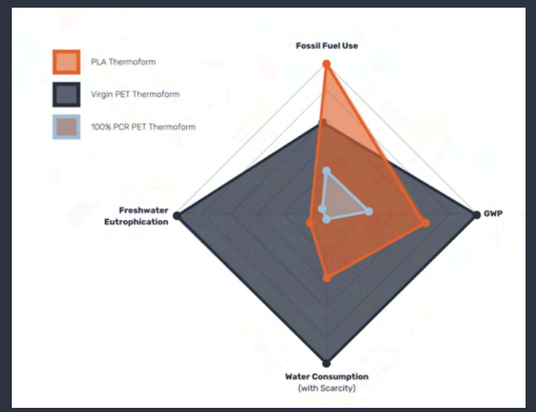
Step 1

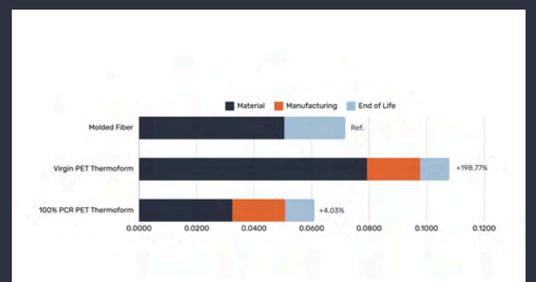
DEFINE YOUR SUSTAINABILITY GOALS

Whether you have established sustainability objectives or are just beginning your sustainability journey, we are here to help you define achievable targets.

Common goals may include:

- Material Reduction
- Maximize PCR Content
- Design for Recycling
- Minimize GHG Impact
- Eliminate Materials of Concern





Step 2

ASSESS YOUR CURRENT STATE

We evaluate design and material choices, analyzing their environmental impact to ensure optimal sustainability. With our deep expertise in design for recyclability, we have integrated these principles into every stage of our assessment process.

Life Cycle Assessment

With our LCA tools, we analyze the environmental impact of various design and material choices. By examining the entire life cycle of our customers' products, from raw material extraction to end-of-life, we help our customers make informed decisions that align with their sustainability goals.

We leverage the EcoImpact-COMPASS LCA Platform and our Plastic Ingenuity Custom Product Carbon Footprint Calculator to comprehensively analyze sustainability metrics such as our products' embodied carbon, water usage, fossil fuel usage, and energy consumption.

Design for Circularity Assessment

We thoroughly analyze the current package's design and material choices and compare them against the APR Design Guide, How2Recycle Framework, and other stakeholder-specific frameworks.

Step 3

CREATE A ROADMAP

We conduct a comprehensive gap analysis to identify discrepancies between a package's current state and our customer's desired sustainability goals. Then, we design a practical, actionable roadmap to bridge the gap, including clearly defined next steps and recommended timelines, providing a clear pathway for implementation.

Redesign Services

As a natural extension of our Sustainable Packaging Assessment, Plastic Ingenuity's ReDesign services empower customers to explore innovative packaging concepts, evaluate trade-offs, test novel materials, and more. Offered at little to no cost, these services have resulted in multiple award-winning sustainable packaging solutions.

Redesign for Recyclability

Designing recyclable thermoforms is complex, yet promoting circularity remains a core tenet of our ReDesign Services. Through our specialized design-for-recyclability consulting, we help customers create packaging that is not only functional but also recyclable in practice, allowing materials to re-enter the supply chain efficiently.

- Plastic Ingenuity engineers utilize the Association of Plastic Recyclers (APR) Design Guide on every design to develop packaging solutions optimized for real-world recyclability.
- Our team has experience navigating the Association of Plastic Recycler's Critical Guidance program to certify recyclability for complex material structures.

Redesign for Sustainability

We understand that sustainability means something different based on package and product needs, and we are dedicated to collaborating with our customers on their sustainability journeys. We work closely with our customers to identify innovative materials and design strategies that minimize virgin material usage through downgauging and incorporating recycled or bio-based materials. Our goal is to guide our customers through the complexities of sustainable packaging design and material choices, ensuring their products utilize materials efficiently and minimize environmental impacts.

PI SUSTAINABILITY SERVICES

Advisory Services

Environmental Regulation

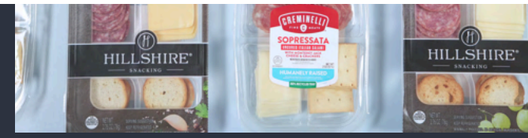
Plastic Ingenuity provides expert advisory services to help customers navigate environmental regulations, such as Extended Producer Responsibility (EPR) legislation. We guide compliance with recyclability mandates, source reduction goals, and LCA reporting while offering strategies to optimize packaging design. Our support ensures accurate data collection, reporting, and alignment with evolving regulations, empowering customers to meet standards and advance sustainability goals.

Takeback Program Design

With a stringent focus on circularity, we work with our partners to create customized solutions to divert waste from landfills. We tailor plans to take back materials by either integrating them back into the original product (closed-loop recycling) or using the material in other products (open-loop recycling). This program works by partnering with local recyclers to collect trays from end-user locations, clean and grind the material into flake, and send this material to Plastic Ingenuity for use in new trays. This streamlined approach diverts waste from landfill, reduces virgin plastic use, and strengthens the circularity of plastic products.

Mass Balance Certification

Our ISCC PLUS certification allows us to incorporate circular plastics from advanced recycling technologies and bio-based feedstocks into our products through a mass balance approach, which ensures credible and verifiable solutions. This certification provides guidance on allowable marketing claims to help maintain transparency and integrity throughout the value chain, ensuring a complete and unbroken chain of custody. Our team is here to support our customers throughout the ISCC certification and licensing process for incorporating circular materials.



Sustainable Systems

We aspire to ingrain sustainability into every aspect of our business and are systemizing our efforts to achieve this goal.

ISO 14001

Plastic Ingenuity's Cross Plains, WI, and Mazomanie, WI facilities maintain an ISO 14001-certified environmental management system, which is the backbone of our environmental sustainability program. The system governs how we manage environmental risks in our operations, ensures that we are proactively creating designs that minimize environmental impacts through the full life cycle of our products, and encourages the involvement of all team members to achieve our environmental goals.

ISCC PLUS

Our Cross Plains and Mazomanie facilities maintain an ISCC PLUS-certified chain of custody system. ISCC PLUS enables PI to use circular materials via mass balance allocation. These circular materials include plastics made from advanced recycled technologies or bio-based feedstocks.

Operation Clean Sweep

Plastic Ingenuity's pellet loss prevention system in our Mazomanie facility complies with the base requirements of the Operation Clean Sweep initiative, which aims to prevent plastic pellets, flakes, and powders from being released into waterways and oceans during manufacturing, transportation, or handling.

EcoVadis

EcoVadis is a global platform that provides sustainability ratings for businesses by assessing their environmental, social, and ethical performance across supply chains. Plastic Ingenuity leverages the EcoVadis system to monitor and improve our corporate social responsibility practices while promoting transparency and sustainability in our business operations.

CDP

CDP is a global non-profit organization that runs a disclosure system for companies, cities, and governments to report on their environmental impacts, particularly climate change, water security, and deforestation. CDP provides a platform for organizations to measure and manage their sustainability efforts, helping investors and stakeholders make informed decisions based on environmental performance data. Plastic Ingenuity used CDP's platform for the first time in 2024 with the intention of leveraging the learnings to fuel continuous improvement efforts.

Initiatives in Progress

Plastic Ingenuity's commitment to continuous improvement in sustainability enables us to adapt to evolving environmental challenges, reduce our environmental footprint, and meet stakeholder expectations.

ISO 50001

ISO 50001 is an international standard that provides a framework for organizations to establish, implement, and maintain an energy management system. Achieving ISO 50001 certification will enable Plastic Ingenuity to improve its energy performance, increase efficiency, and reduce greenhouse gas emission intensity through systematic energy management practices. We aim to have our Cross Plains, WI, and Mazomanie, WI, facilities conform with the standard by the end of 2025.

ISO 45001

ISO 45001 is an international standard that specifies requirements for an occupational health and safety (OH&S) management system. It helps organizations proactively improve workplace safety, reduce risks, and enhance employee well-being by providing a structured framework for identifying hazards, minimizing risks, and ensuring compliance with relevant legal requirements. We aim to have our Cross Plains and Mazomanie facilities certified to the standard in 2025.

Net Zero Waste Recognition

Net Zero Waste recognition is an acknowledgment awarded to organizations that successfully divert significant operational waste from landfills by prioritizing reuse, recycling, and recovery. This recognition highlights a company's commitment to reducing waste and achieving near-zero waste sent to landfills, aligning with sustainability and circular economy principles. We aim to have our Cross Plains and Mazomanie facilities net zero waste recognized in 2025.

Materiality Assessment

A materiality assessment is a systemic approach used by organizations to identify and prioritize the environmental, social, and governance issues that are most relevant to their business and stakeholders. It helps companies focus on areas that have the greatest impact on their operations and external perceptions, guiding sustainability strategies and reporting. The results of PI's most recent materiality assessment are shown below.

Impact on Business

- **IS** — Building resilient information systems

Equal

- **ED** — Eliminating discrimination
- **HQ** — Manufacturing high-quality & safe products
- **RT** — Recruiting and developing talent
- **CH** — Eliminate child or forced labor
- **IF** — Injury free workplace
- **LW** — Providing a living wage
- **SU** — Designing sustainable packaging
- **PI** — Ensuring growth of PI
- **ES** — Complying to stringent ethical standards
- **RM** — Using sustainable raw materials
- **RI** — Investing in plastic recycling infrastructure
- **BC** — Ensuring business continuity

Stakeholder Importance

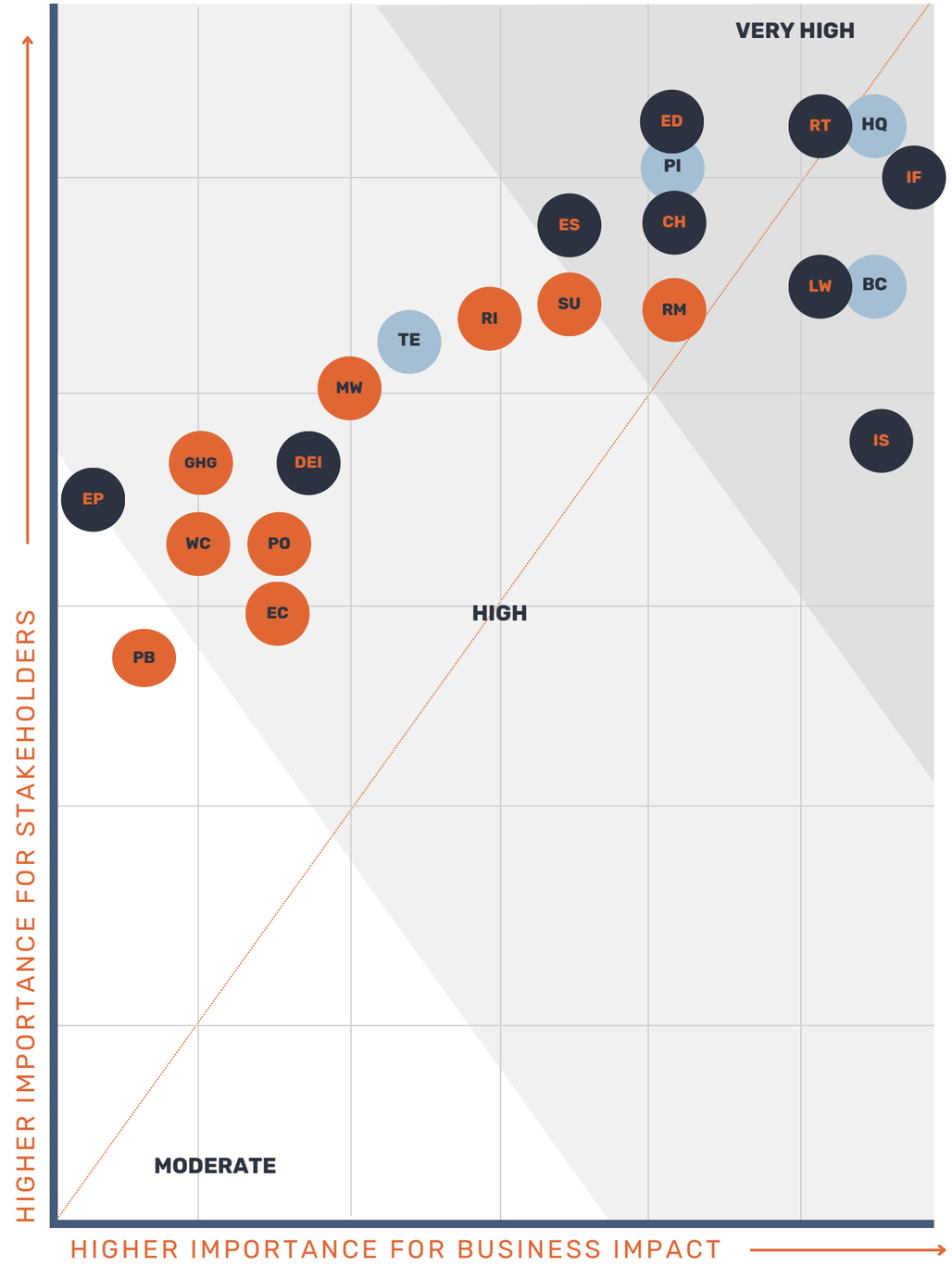
- **EP** — Promoting circular economy public policy
- **GHG** — Reducing greenhouse gas emissions from ops
- **WC** — Responsible water conservation
- **PB** — Protecting biodiversity
- **PO** — Sustainable procurement operations
- **MW** — Minimizing waste generated in operations
- **DEI** — Creating a diverse, equitable, and inclusive workplace
- **TE** — Transparent external communication
- **EC** — Reducing energy consumption

ENVIRONMENTAL

SOCIAL

ECONOMIC

MATERIALITY MATRIX: IMPACT ON BUSINESS VS. STAKEHOLDER IMPORTANCE



Stakeholder Study

OVERALL

PLASTIC INGENUITY

2024 Sustainability Stakeholder Study

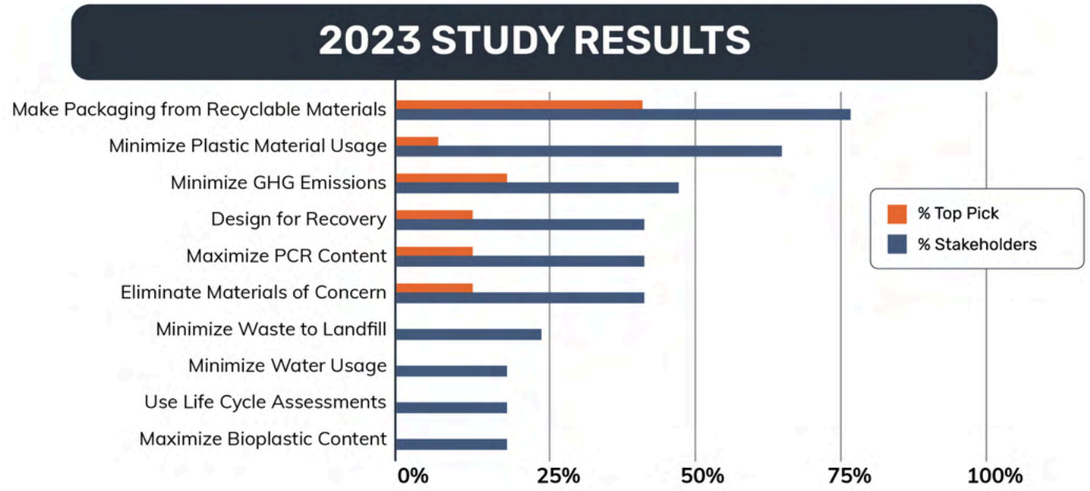
When Plastic Ingenuity formally established our sustainability organization in 2021, we set out to better understand the needs and motivations of key stakeholders advancing sustainable packaging. These insights shaped our sustainability strategies, leading to initiatives like adopting ISO 14001, creating our Sustainable Packaging Assessment service, and developing innovative sustainable products.

In the ensuing years, including 2024, we deepened this work by hosting live listening sessions with experts from CPGs, retail, and healthcare sectors. Participants, including packaging engineers, procurement specialists, and sustainability leaders, shared their goals, drivers, and strategies. These insights will continue to guide and strengthen our sustainability efforts.

2023 Recap: Key Findings

Before we dive into the 2024 study results, let's revisit the key findings from 2023. We asked stakeholders to describe their organization's packaging sustainability goals. The answers were dissected into individual goal statements, and high-priority goals were identified as "Top Picks." The following table and graph summarize the findings:

GOAL	% Stakeholders	% Top Pick
Make Packaging from Recyclable Materials	76	41
Minimize Plastic Material Usage	65	6
Minimize GHG Emissions	47	18
Design for Recovery	41	12
Maximize PCR Content	41	12
Eliminate Materials of Concern	41	12
Minimize Waste to Landfill	24	0
Minimize Water Usage	18	0
Use Life Cycle Assessments	18	0
Maximize Bioplastic Content	18	0



The top sustainability goal identified by stakeholders in 2023 was to "Make Packaging from Recyclable Materials." The results revealed a continued commitment to circularity. Goals related to utilizing recycled content, selecting packaging materials with robust recycling markets, minimizing packaging material usage, and designing for recycling remain prevalent. Organizations were focused on quantifying and working to minimize greenhouse gas emissions in their direct operations and supply chains.

2024 Study Results

Defining Sustainability

Each interview began by asking stakeholders to define sustainability, which varies widely based on personal values and experiences. As one stakeholder put it, "The definition of sustainability is open for interpretation."

Building upon our 2023 observation, the United Nations Sustainable Development Goals (SDGs)[1] are the predominant guiding principles high-ambition organizations leverage to define sustainability and align their goals. This framework highlights the need for businesses and institutions to assess their economic, social, and environmental impact. "Sustainability means future generations have the resources to meet their needs. We must keep our company economically successful while addressing the needs of customer requirements and other stakeholders in perpetuity," shared a sustainability professional.

Drivers of Change

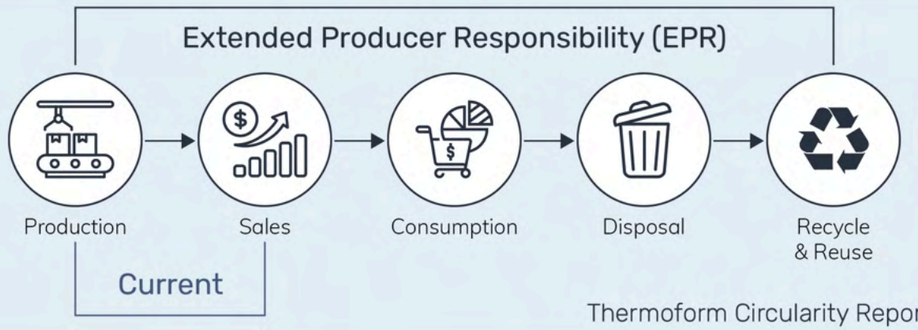
The drivers of change identified in 2024 align with our previous studies' results. These drivers include consumer preference for sustainable products, non-governmental organization (NGO) influence on corporate initiatives, retailer purchasing power, and legislation. The driver that rose to the top of the list in 2024 is Extended Producer Responsibility (EPR) legislation.

EPR policies make producers of products responsible for the entire life cycle of their goods, including disposal and recycling. EPR encourages producers to design and manage products in an environmentally responsible manner and to bear the costs associated with their end-of-life management. In 2024, Minnesota joined Maine, Oregon, Colorado, and California as states that have passed EPR legislation[2].

Stakeholders often identify the California EPR legislation (SB 54)[3] as the law with the most potential to disrupt the packaging industry. The statute requires all packaging in the state to reach a recycling rate of 65% by 2032, with incremental targets starting in 2028. The law sets a plastic packaging source-reduction requirement of 25% by 2032. If packaging categories fail to comply with these targets, producers who continue to use them could be subject to fines or outright bans. SB 54 authorizes civil penalties of up to $50,000 per day per violation and $18 million per year per violation. "Hopefully, the money goes back into recycling and not their general fund," candidly shared a procurement specialist. It should be noted, the legislation establishes two funds exclusively for the implementation and enforcement of the bill. The Producer Responsibility Organization (PRO) will deposit monies from the producers into these funds.

Given the potential fiscal impact, CPGs are dedicating resources to prepare their organizations for EPR compliance. The first step brands are taking toward compliance is gathering data from their packaging suppliers, such as weight and material specifications. They must report this information to the PRO assigned to manage the EPR systems in each state. One stakeholder lamented, "Just getting the weights of our packaging items is arduous given the number of suppliers we have and the diversity of packaging we use."

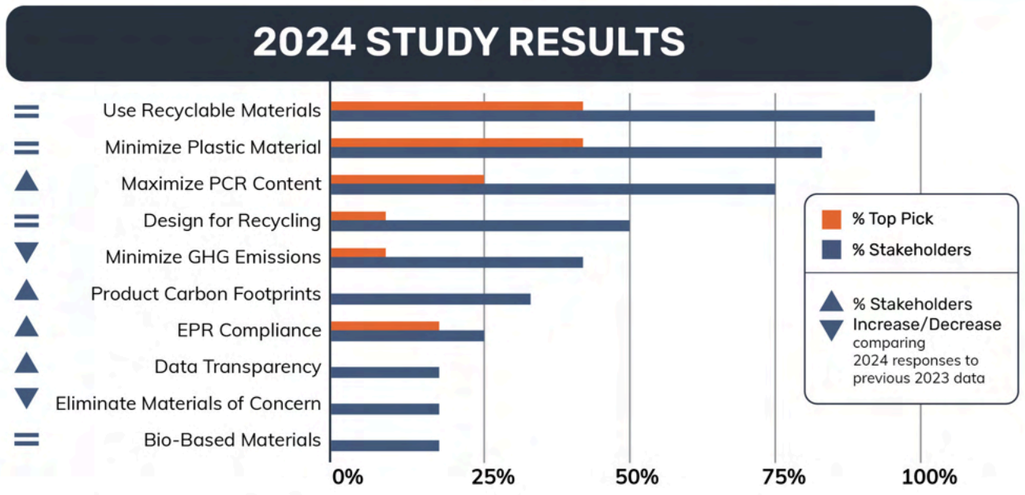
The most common sentiment shared by stakeholders is the difficulty of keeping track of the unprecedented level of legislation aimed at packaging. "We follow EPR as much as possible, but right now, we are taking a reactionary approach and just trying to stay afloat," said a packaging engineer. Many stakeholders expressed hope about the positive impact EPR will have on circularity, "EPR will have a major impact, and most of it will be positive."



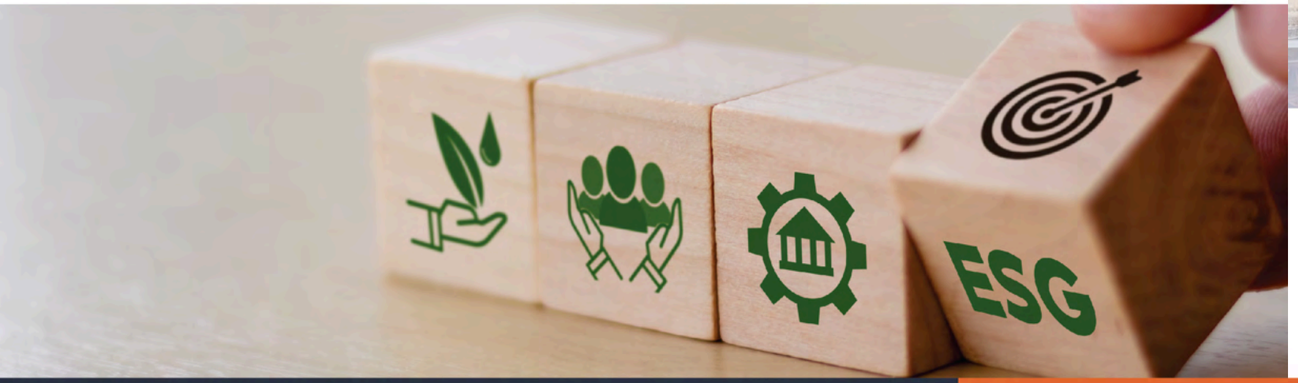
Sustainability Goal Analysis

We asked stakeholders to describe their organization's packaging sustainability goals. We dissected the answers into individual goal statements, and high-priority goals were identified as "Top Picks." The following table and graph summarize the findings:

GOAL	% Stakeholders	% Top Pick
Make Packaging from Recyclable Materials	92	42
Minimize Plastic Material Usage	83	42
Maximize PCR Content	75	25
Design for Recycling	50	8
Minimize GHG Emissions	42	8
Product Carbon Footprints	33	0
EPR Compliance	25	17
Data Transparency	17	0
Eliminate Materials of Concern	17	0
Bio-Based Materials	17	0



The results align well with the key tenets of EPR programs and NGO corporate commitment frameworks: recyclability, recycled content, and source reduction. The results are also similar to our previous studies, suggesting that sustainability goals remain consistent.



Make Packaging from Recyclable Materials

The top sustainability goal identified by stakeholders in 2024 was to "Make Packaging from Recyclable Materials," as 92% of organizations interviewed have a goal related to this aspect, including 42% that denote it as a top pick. This was the most identified goal in our 2023 study, as well.

Selecting the right materials is essential for developing recyclable packaging. PET and HDPE[4], two widely recycled plastics, dominate the recycling markets for rigid packaging formats. PP recycling has expanded rapidly in recent years, and stakeholders regard it as a desirable option. These materials align with well-established recycling systems and have strong end markets. Expanded Polystyrene (EPS) and Oriented Polystyrene (OPS) were two specific materials identified by stakeholders as in need of replacement. "EPS is a challenging material for us due to lack of recycling, but it is very lightweight and efficient," stated a packaging engineer.

Minimize Plastic Material Usage

The second most identified sustainability goal in 2024 was to "Minimize Plastic Material Usage," as 83% of organizations interviewed have a goal related to this aspect. It tied as a top pick, selected by 42% of organizations. This goal was the second most identified goal in our 2023 study, but fewer previously denoted it as a top pick.

The inclusion of source reduction targets in EPR legislation may account for the rising salience of this goal. Several stakeholders cited California's EPR law as a catalyst for their efforts around this goal. The law specifies source reduction requirements of 10% in 2027, escalating to 25% in 2032. The law caps the amount of source reduction achieved through PCR at 8% and sets targets for reusable/refillable systems[3]. "Achieving the source reduction requirement may be more difficult than hitting the recycling rate targets, and those are going to be extremely challenging," shared a stakeholder.

Insider Insight

"Achieving the source reduction requirement may be more difficult than hitting the recycling rate targets."

Maximize PCR Content

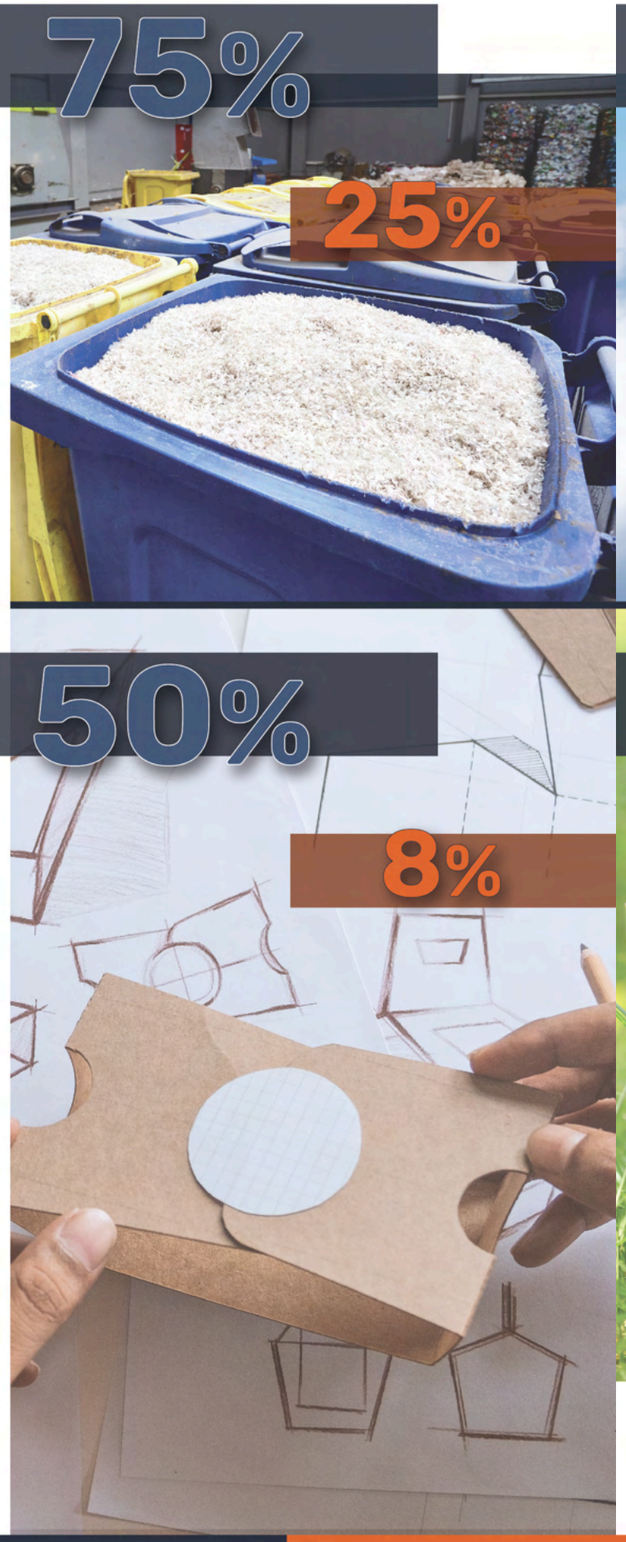
The third-highest sustainability goal identified by stakeholders in 2024 was to "Maximize PCR Content," as 75% of organizations interviewed have a goal related to this aspect, including 25% that denote it as a top pick. The goal was the fifth most identified in 2023, indicating an increase in priority.

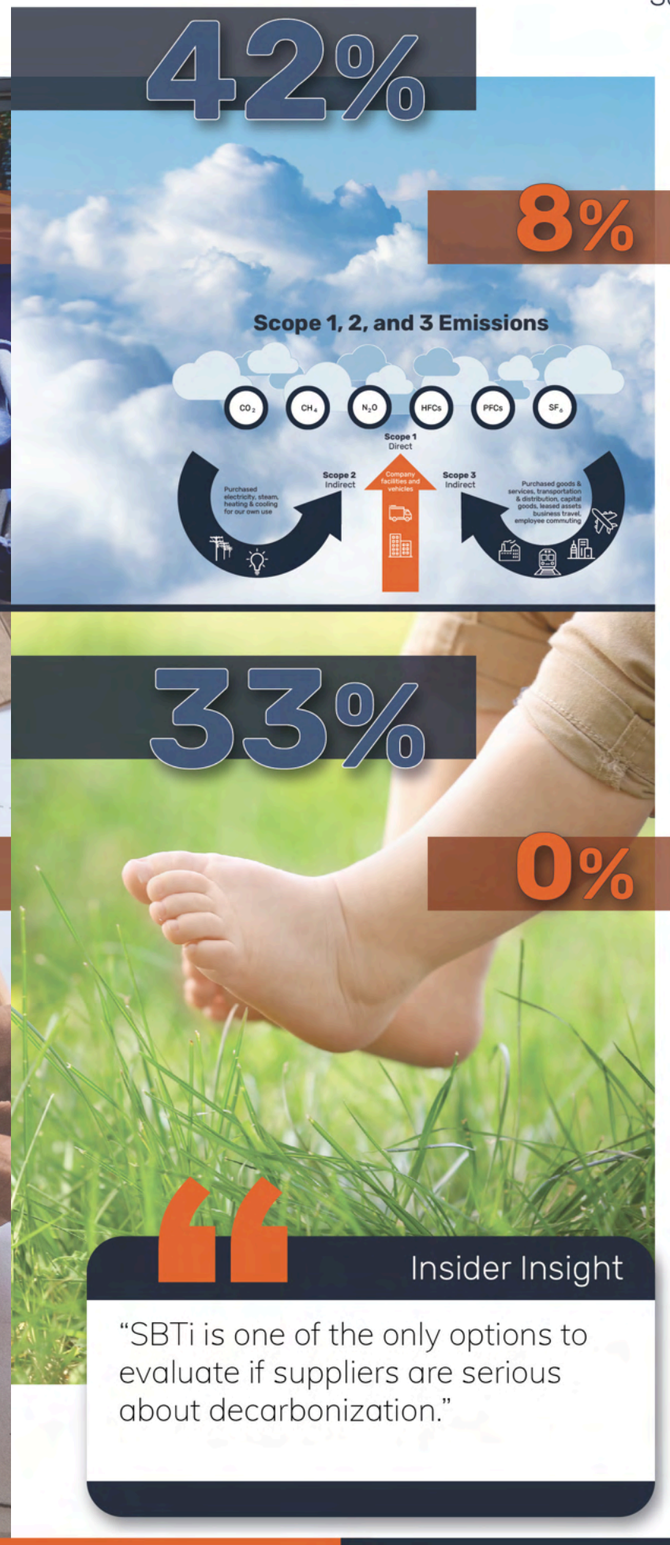
Stakeholders cited legislation and voluntary corporate commitments as drivers for this goal. New Jersey's minimum PCR[5] content law came into effect in 2024. The law calls for 10% PCR content in 2024, escalating to 50% by 2036. Canada will require 20% PCR in packaging starting in 2025, escalating to 50% by 2030[6]. Stakeholders expressed concern about the availability of PCR supply to meet escalating demand. Given stagnate domestic recycling rates, imports of recycled materials have increased to meet rising demand[7]. "We are concerned about the credibility of PCR coming from offshore," shared a sustainability specialist.

Design for Recycling

Half of the stakeholders listed "Design for Recycling" as a goal their company is working toward, and 8% listed this as a top pick. Choosing a highly recycled material is insufficient to ensure that a package design is optimized for recycling. Stakeholders recognize the importance of following design for recycling guidelines, such as the Association of Plastic Recyclers Design Guide[8].

Stakeholders frequently highlighted pressure-sensitive label selection as a major challenge in designing recyclable packaging. Traditionally, pressure-sensitive labels are made from paper-based materials with strong adhesives to ensure proper bonding. However, paper fibers and adhesives pose challenges for recyclers, often complicating reprocessing. Using non-preferred labels can render a package non-recyclable, but labels designed for recycling typically come at a higher cost. "EPR may change the economics if the fees are significant enough to justify using these labels," stated a stakeholder.





Minimize Greenhouse Gas Emissions

"Minimize GHG Emissions" was listed by 42% of stakeholders as a goal their company is working toward, and 8% listed this as a top pick. Of the organizations participating in our study, 58% have committed to the Science Based Target initiative (SBTi), which provides industries with a framework for decarbonization[9].

Most organizations classify packaging as a Scope 3 emission since it is typically a purchased good[10]. Although Scope 3 emissions often account for most of an organization's carbon inventory[11], Scope 1 and 2 emission reduction initiatives often take priority over Scope 3 since these emissions are within their direct control. However, Scope 3 emission reduction initiatives are becoming more prevalent. Several stakeholders identified SBTi as a factor in their supplier selection process, thus impacting their Scope 3 emissions. "SBTi is one of the only options to evaluate if suppliers are serious about decarbonization," stated a sustainability leader.

Product Carbon Footprints

One in three stakeholders listed quantifying "Product Carbon Footprints" as a goal their company is working toward, but none listed this as a top pick. Product Carbon Footprints (PCFs) are calculations of the amount of embodied greenhouse gas emissions in a product.

Organizations with mature carbon accounting processes are focusing on PCFs for packaging to improve the data quality of their Scope 3 emission inventory. Additionally, Oregon's EPR law mandates large producers to perform packaging PCFs every two years[12]. Others utilize PCFs to identify continuous improvement opportunities in their supply chain. "We dive into carbon footprint contributions at the packaging component level and engage with improvement opportunities based on the results," shared a sustainability professional.

Insider Insight

"SBTi is one of the only options to evaluate if suppliers are serious about decarbonization."

EPR Compliance

Quantifying "EPR Compliance" was listed by 25% of stakeholders as a goal their company is working toward, and 17% listed this as a top pick. The organizations citing this as a goal tend to have less mature sustainability goals and resources. This indicates that EPR will reach organizations in a way that other drivers cannot.

EPR compliance is a wide-ranging goal with many aspects, from recyclability to source reduction and carbon footprinting. Given the fiscal implications, organizations are attempting to prepare for EPR. "We are proactively eliminating problematic plastics like PVC (Polyvinyl Chloride)," stated a packaging engineer.

Data Transparency

A sustainability need listed by 17% of stakeholders was quantifying "Data Transparency." They cited this need is driven by the increased burden placed on organizations to report sustainability metrics. Stakeholders cited CDP[13], Corporate Sustainability Reporting Directive (CSRD)[14], and voluntary corporate reporting specifically as catalysts for data.

A common refrain heard from stakeholders was concern about acquiring the packaging component-level data necessary for EPR compliance. "Our packaging team is really struggling to figure out how we are going to meet reporting requirements," shared a packaging leader. A sustainability professional shared how providing data can enhance their organization's relationship with a supplier, "We want our suppliers to know that transparency with data builds trust."

Eliminate Materials of Concern

Another 17% of stakeholders listed "Eliminate Materials of Concern" as a goal their company is working toward, but none listed this as a top pick. Per- and Polyfluoroalkyl Substances (PFAS) were the most common materials of concern cited by stake-holders. "Maintaining product safety is our mandate," simply stated a packaging engineer.

PFAS are a group of synthetic chemicals known for their water-repellent, grease-resistant, and non-stick properties[15]. They are environmentally persistent, and studies have linked them to potential health risks. These chemicals are widely used across various consumer and industrial products. In packaging, PFAS serve as coatings on fiber-based materials to shield them from moisture and grease penetration.

Bio-Based Materials

Similarly, 17% of stakeholders listed using "Bio-Based Materials" as a goal their company is working toward, but none listed it as a top pick. "We are interested in bio-based plastics, but we are concerned about the practicality of composting packaging in mass quantities," stated a packaging leader.

Stakeholders see bio-based plastics as a solution to reduce reliance on virgin plastics made from fossil fuels. While bioplastics used in packaging have typically been viewed as biodegradable or industrially compostable, like PLA, there is growing awareness of traditional polymers such as PET and PP being produced from bio-based sources like used cooking oil and sugar cane[16]. Despite efforts to increase recycling and reuse, stakeholders acknowledge that virgin polymers will still be necessary to meet global demand.

Insider Insight

"We are proactively eliminating problematic plastics like PVC."

Source:

1 - United Nations, Sustainable Development Goals
2 - Sustainable Packaging Coalition, Guide to EPR Proposals
3 - CalRecycle, SB 54: Plastic Pollution Prevention and Packaging Producer Responsibility Act
4 - Stina, 2022 Plastic Recycling Data
5 - Waste Dive, New Jersey governor signs ambitious recycled content bill into law
6 - Environmental and Climate Change Canada (ECCC), Recycled content and labeling rules for plastics
7 - Plastic Ingenuity, PI Circular - Eleventh Edition
8 - The Association of Plastics Recyclers, Design® Guide for Plastics Recyclability
9 - Science Based Targets Initiative (SBTi), About Us
10 - Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Standard
11 - World Resources Institute (WRI), Scope 3 Reporting
12 - Printing United Alliance, Implementation of the Oregon Plastic Pollution and Recycling Mondernization Act
13 - CDP, CDP
14 - European Commission, Corporate sustainability reporting
15 - Food Safety Magazine, PFAS in Packaging: What the Food Industry Needs to Know
16 - Sustainable Packaging News, How Bioplastics Are Changing the Sustainability Landscape

Impacts of EPR Legislation on Thermoforms

EPR legislation has significant impacts on thermoformed packaging, driving advancements in sustainable practices. EPR policies hold producers accountable for the lifecycle of their products, promoting recyclable packaging designs, plastic source reduction, and increased post-consumer recycled (PCR) content. These policies encourage manufacturers to innovate, creating materials and packaging systems that are easier to recycle and integrate PCR. By incentivizing sustainable production, EPR supports a shift towards a circular economy, aiming to minimize waste and reduce reliance on virgin plastics, thus reshaping the future of thermoform packaging.

Key EPR Tenet	Description	Current State for Thermoforms	Pathway to Compliance
Recyclable Packaging	In California, all covered packaging must meet recyclability standards, or producers lose the ability to make recyclability claims by 2025. Stricter requirements are set for 2032; non-compliance by then could result in sales bans and civil penalties. California has ambitious recycling rate targets for covered materials: • 30% by 2028 • 40% by 2030 • 65% by 2032	Non-bottle PET and Polypropylene containers, like thermoforms, both have a national residential recycling rate of 8%. In California, non-bottle PET containers have a residential recycling rate of 14% and Polypropylene containers have a residential recycling rate of 13%. Residential recycling rate data is derived from The Recycling Partnership's 2024 State of Recycling Report.	Transition to recyclable materials. For example, shift from PVC or PS to PET. Follow design for recyclability guidelines such as the Association of Plastic Recycler's Design Guide or How2Recycle label framework. To aid in design for recycling mandates, Plastic Ingenuity evaluates every thermoform design for recyclability requirements.

Key EPR Tenet	Description	Current State for Thermoforms	Pathway to Compliance
Plastic Source Reduction	California mandates a reduction in plastic use by: • 10% by 2027 • 20% by 2030 • 25% by 2032 Only 8% of the source reduction can come from post-consumer recycled content. At least 10% of the source reduction must come by shifting to reuse or refill by 2032. These reduction targets aim to decrease unnecessary packaging and limit the use of virgin materials.	The baseline year for source reduction reporting is 2023. However, brands may receive credit for down-gauging efforts dating back to 2013 with proper evidence. Brands are gathering part weight data and legacy evidence of downgauging efforts.	Maximize post-consumer recycled materials when possible. Plastic Ingenuity offers PCR options for PET, PP, and HDPE. Identify down-gauging opportunities to reduce material usage. Document PCR and minimization efforts for reporting. Plastic Ingenuity's Sustainable Packaging Assessment provides impact data related to increases in PCR and down-gauging efforts.

Key EPR Tenet	Description	Current State for Thermoforms	Pathway to Compliance
PCR Usage	States and countries with active PCR mandates for non-bottle rigids are New Jersey, California, and Canada. New Jersey's minimum PCR content law came into effect in 2024: • 10% PCR content in 2024 • 50% PCR by 2036 California will begin requiring PCR in 2027: • 10% by 2027 • 20% by 2030 • 25% by 2032 Canada will begin requiring PCR starting in 2025: • 20% PCR starting in 2025 • Increases to 50% by 2030	Sources for PCR PET are readily available. Sources for PCR polypropylene are growing. However, there is concern from brands about the availability of PCR supply to meet escalating demand. Due to stagnant domestic recycling rates, imports of recycled materials have increased to meet rising demand, but concerns remain about the credibility of PCR coming from offshore sources.	Evaluate opportunities to maximize PCR wherever possible. Plastic Ingenuity provides a range of recycled material options for PET, HDPE, and polypropylene packaging. Our materials portfolio includes FDA No Objection Letter (NOL) status for food-grade applications, with sources from both mechanically and advanced recycled processes, supported by ISCC PLUS mass balance allocation. Third-party certifications for PCR materials are available to ensure credibility and transparency of recycled material sources.

Stakeholder Study
HEALTHCARE MARKET

PLASTIC INGENUITY

2024 Sustainability Stakeholder Study – Healthcare

A share of the stakeholders interviewed in 2024 work in the healthcare packaging sector. These organizations include medical device manufacturers (MDMs), pharmaceutical companies, biotech products, and life science applications.

Drivers of Change

The healthcare industry recognizes the interconnectedness of human well-being and the health of our planet[1]. "A healthy planet is needed for healthy people," stated a stakeholder. Recognizing the relationship between human and environmental health encourages sustainable practices within the healthcare industry, including waste reduction, energy efficiency, and the use of sustainable materials. Healthcare organizations prioritize preventing diseases linked to environmental factors, such as air and water pollution, by advancing solutions that promote clean air, safe drinking water, and climate resilience.

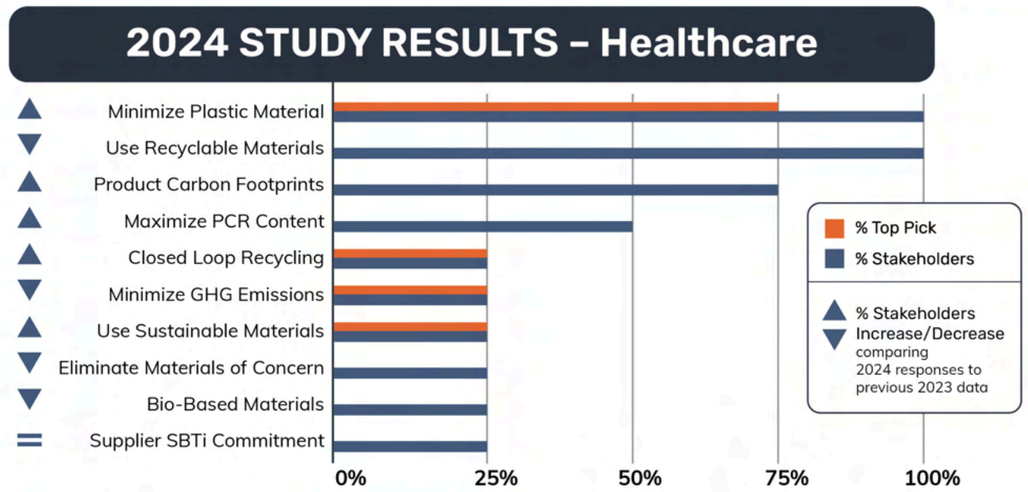
Cost savings associated with sustainability programs are a key driver. Healthcare facilities are adopting waste reduction and recycling programs to minimize disposal costs. The emergence of recycling in these settings is creating the need for recyclable packaging. From the MDM perspective, reducing packaging materials can lead to cost savings, especially in an industry where over-engineering packaging to eliminate risk is common practice.

Legislation plays a crucial role in driving change, with many stakeholders pointing to the European Packaging and Packaging Waste Regulation (PPWR)[2] as a key influence on their sustainability efforts. Set to be legally adopted by the end of 2024, the PPWR aims to minimize packaging waste and encourage a circular economy. Product-sensitive products like medical devices and pharmaceuticals are exempt for now from the PPWR recycling and PCR requirements for now, but secondary packaging items are not exempt. The clause will be reevaluated in 2035 to determine inclusion of contact sensitive packaging.

Sustainability Goal Analysis

Extracting the sustainability goals shared by healthcare organizations provides valuable insights, as indicated in the table and graph below:

GOAL	% Stakeholders	% Top Pick
Minimize Plastic Material Usage	100	75
Make Packaging from Recyclable Materials	100	0
Product Carbon Footprints	75	0
Maximize PCR Content	50	0
Closed Loop Recycling	25	25
Minimize GHG Emissions	25	25
Use Sustainable Materials	25	25
Eliminate Materials of Concern	25	0
Bio-Based Materials	25	0
Supplier SBTi Commitment	25	0



Minimize Plastic Material Usage

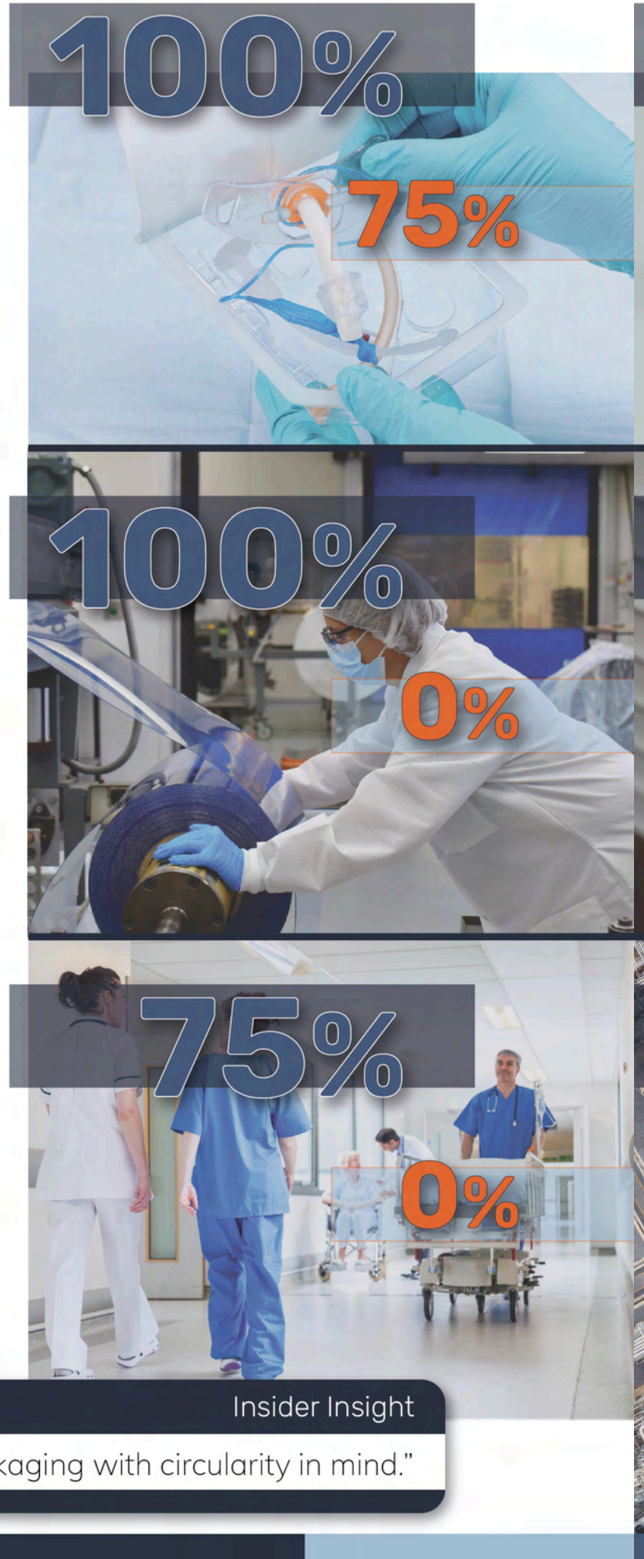
The top sustainable packaging goal identified in our study of healthcare organizations was to "Minimize Plastic Material Usage." All the organizations we interviewed cited this goal as an objective they are working toward, and 75% listed it as a top pick. Reducing material is not only beneficial for the environmental impact of packaging, but it also lowers packaging component costs. Consumer Product Groups (CPGs) have been reducing packaging weight for decades[3], but this concept is relatively new for healthcare organizations accustomed to over-designing packaging to eradicate risk. The confluence of sustainability benefits and cost-saving potential leads to this goal becoming a top priority in healthcare.
"We can create real value for the company through environmental sustainability," stated a packaging leader in the space.

Make Packaging from Recyclable Materials

All healthcare stakeholders listed "Make Packaging from Recyclable Materials" as a goal their company is working towards, though none listed it as a top pick. Although recycling in healthcare facilities is currently limited[4], stakeholders are projecting rapid growth and are adopting packaging design accordingly. A common area of interest is transitioning sterile barrier trays from PETG to APET. This transition benefits recycling and could result in cost savings for packaging components. "We are now designing our packaging with circularity in mind," shared a packaging engineer.

Product Carbon Footprints

Creating "Product Carbon Footprints" was a goal cited by 75% of the healthcare organizations we interviewed. None listed it as a top pick. Product Carbon Footprints (PCFs) quantify the embodied GHG emissions of an article[5]. They enable the creation of decarbonization plans at the packaging component level. "We want our suppliers to create PCFs and then come to us with improvement opportunities to decrease the carbon footprint," shared a sustainability leader.



Insider Insight

"We are now designing our packaging with circularity in mind."

Maximize PCR Content

Half of the healthcare stakeholders we interviewed cited "Maximize PCR Content" as a goal. None listed it as a top pick. Regulatory requirements, such as ISO 11607, limit the ability to use PCR materials in certain healthcare applications, like Sterile Barrier Systems (SBS)[6]. For these applications, healthcare companies are exploring adding PCR through certified mass balance systems, like ISCC PLUS[7]. Secondary and tertiary packaging may have more opportunities to use mechanically recycled PCR since the regulatory requirements are less stringent.
"Using recycled materials allows us to reduce our virgin material consumption and reduce our carbon footprint significantly," a stakeholder said.

Closed Loop Recycling

Of the healthcare stakeholders we interviewed, 25% cited "Closed Loop Recycling" as a sustainability goal they are working toward, and the same number listed it as a top pick. Commonly called a "take-back program," these recycling solutions support a circular economy by repurposing materials recovered from their packaging. They focus on applications that currently lack access to residential recycling path-ways, like trays for assembling medical devices[8].
"Establishing a take-back program allows us to reuse the materials in our work-in-process (WIP) trays," shared a packaging engineer. These programs often involve complex logistics, and stakeholders remain conscious of the potential for increased GHG emissions from additional transportation.

Minimize GHG Emissions

"Minimize GHG Emissions" was a sustainability goal being worked toward by 25% of the healthcare stakeholders we interviewed, and the same number listed it as a top pick. Given the notion that human health is directly related to climate health[9], health-care organizations are scrutinizing the impact of their products and packaging on the climate.
These organizations are making progress on their Scope 1 and 2 emissions and are starting to focus more resources on decarbonizing their supply chains.
"Decarbonization is a shared opportunity," stated a sustainability leader.

Use Sustainable Materials

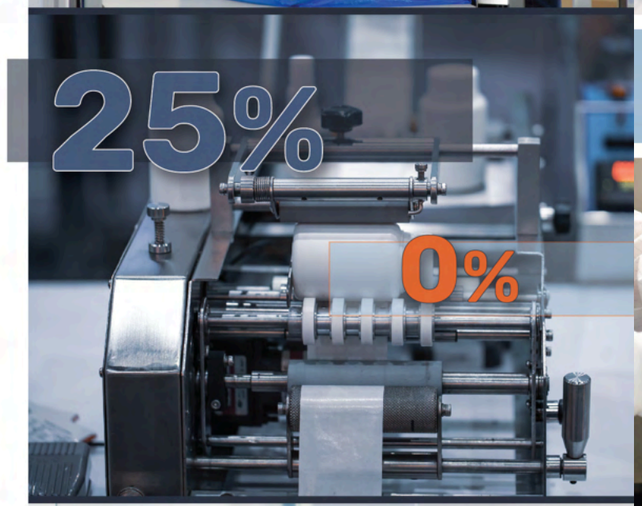
Similarly, 25% of the healthcare stakeholders we interviewed cited “Use Sustainable Materials” as a sustainability goal they are working toward, and the same number listed it as a top pick. “Sustainable materials” is a generic term with room for interpretation. Stakeholders citing this as a goal have less mature sustainability practices in place for packaging. When asked further about what makes a material sustainable, stakeholders cited bio-based, compostable, and recyclable materials as options but stated no preference. “If there is an innovative material, we want to know about it,” noted a packaging engineer.

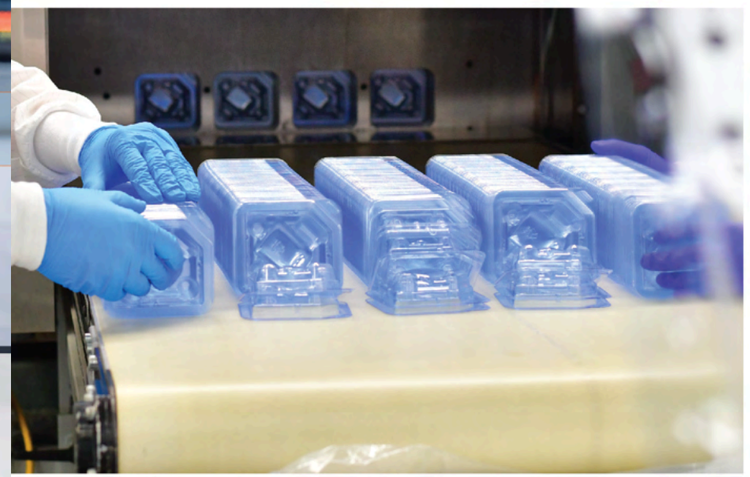
Eliminate Materials of Concern

Though none listed it as a top pick, 25% of the healthcare stakeholders we interviewed cited “Eliminate Materials of Concern” as a sustainability goal they are working toward. Healthcare companies are actively working to reduce the use of materials of concern in their packaging to ensure product safety. This includes phasing out materials like PVC, phthalates, PFAS, and certain heavy metals that may pose environmental or health risks[10]. Recycled materials, especially from mechanical recycling methods, receive increased scrutiny by healthcare companies, given the potential to add risk from a “materials of harm” perspective. “A quality issue could create significant damage, so we must be cautious,” shared a packaging leader.

Bio-Based Material

Using “Bio-Based Material” was cited by 25% of the healthcare stakeholders we interviewed as a sustainability goal they are working toward, though none listed it as a top pick. Conventional polymers, like PP and PE, made from renewable sources are the focus of stakeholders, rather than biodegradable options that are unlikely to provide the protective performance needed. “The bio-based options we have explored have not held up to sterilization,” noted a packaging engineer.





Supplier SBTi Commitment

Lastly, 25% of the healthcare stakeholders we interviewed cited “Supplier SBTi Commitment” as a sustainability goal they are working toward. None listed it as a top pick. Stakeholders stated that having suppliers commit to SBTi[11] is a way to catalyze the decarbonization of their supply chains. “65% of our suppliers by spend will be committed to SBTi by the end of 2025,” shared a sustainability leader.

Insider Insight

“If there is an innovative material, we want to know about it.”

Sources:

1 - McKinsey & Company, Sustainability and Health
2 - Smithers, A Framework for Understanding the Packaging & Packaging Waste Regulation (PPWR)
3 - McKinsey & Company, The drive toward sustainable packaging
4 - Healthcare Plastics Recycling Council (HPRC), Barriers to Recycling Healthcare Plastics at Hospitals
5 - EcoVadis, What is the Product Carbon Footprint?
6 - Healthcare Plastics Recycling Council (HPRC), Circularity for Healthcare Plastics
7 - Plastic Ingenuity, PI Circular - Seventh Edition
8 - Plastic Ingenuity, PI Circular - Third Edition
9 - National Academy of Medicine, Why Decarbonizing Matters for the U.S. Health Sector
10 - Health Care Without Harm, Priority chemicals of concern reference
11 - Science Based Targets Initiative (SBTi), About Us

Alliances

The shift to a circular economy for packaging demands intensive collaboration. No single company can tackle the complex challenges of system-wide transformation alone. That's why Plastic Ingenuity takes an active role and seeks leadership positions in all the associations we are involved with. By combining this collaborative effort with our extensive knowledge of sustainable thermoforming, we deliver significant value to our stakeholders. The only way forward is together.

We are proud to contribute to the following organizations:

The Association of Plastic Recyclers

APR promotes the development of the plastics recycling industry by providing leadership for long-term industry growth and vitality.

How2Recycle

How2Recycle is a standardized labeling system that provides clear recycling instructions for packaging to help consumers properly recycle materials. It aims to reduce confusion, increase recycling rates, and improve the quality of recycled materials.

HPRC
HEALTHCARE PLASTICS RECYCLING COUNCIL

HPRC is an industry consortium comprised of medical device manufacturers, material manufacturers, converters, waste collectors, recyclers, and hospitals. They focus on identifying barriers to plastics recycling and developing solutions along the entire value chain.

Executive Committee Member

Co-Leads of the Advanced Recycling Pilot and Plastic Sortation Projects

Institute of PACKAGING PROFESSIONALS

IoPP is dedicated to creating networking and educational opportunities to help packaging professionals succeed.

Member of the Sustainable Packaging Technical Committee

NAPCOR

NAPCOR provides a forum for its members to collaborate with peers on key projects and address significant issues affecting PET packaging throughout its lifecycle.

Board Member

Chair of the Thermoforming Committee

PLASTICS INDUSTRY ASSOCIATION

PLASTICS brings equipment makers, brand owners, processors, and material suppliers together to align their efforts to put recycling at the forefront of their businesses.

Recycling Committee Members

SUSTAINABLE PACKAGING COALITION*

SPC brings packaging sustainability stakeholders together to catalyze actionable improvements to packaging systems and lend an authoritative voice on issues related to packaging sustainability.

Design Collaborative Steering Committee Member

THE RECYCLING PARTNERSHIP

The Recycling Partnership is a nonprofit organization that leverages corporate partner funding to transform recycling for good in states, cities, and communities nationwide.

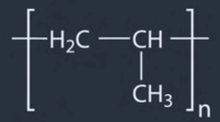
***Funding Member of the PP Recycling Coalition**

****Funding Member of the PET Recycling Coalition**

*The PP Recycling Coalition is focused on increasing access for people to recycle polypropylene through curbside recycling programs, ensuring more recycling processing facilities can sort the material successfully, and stimulating a robust end-market of high-quality recycled polypropylene for reuse in packaging.

**The PET Recycling Coalition is a robust group of stakeholders driving improvements that transform the PET plastic recycling landscape.

Spotlight: PP Recycling Coalition



An Initiative That's Making Progress

In 2020, The Recycling Partnership (TRP) launched the PP Recycling Coalition, an ambitious undertaking aimed at one of the most pressing challenges in modern recycling: increasing the recycling rates of polypropylene (PP) in the United States. Polypropylene, a highly versatile and widely used plastic, is a staple in packaging materials due to its lightweight, durable and adaptable properties. Despite these benefits, the recycling rate for PP remains low, presenting significant environmental and industry challenges.

The PP Recycling Coalition has set out to address these issues through a multi-faceted approach. Its efforts include advocating for advancements in recycling infrastructure, funding critical projects to improve sorting technologies and encouraging the use of post-consumer recycled (PCR) polypropylene in packaging. By fostering collaborations across industries and communities, the coalition is paving the way for a more sustainable future for PP materials.

Results by the Numbers[1]

(as of December 2024)

To date, 60 grants have resulted in $22 million to recycling facilities to support new and improved polypropylene sorting.

60

$22 MILLION

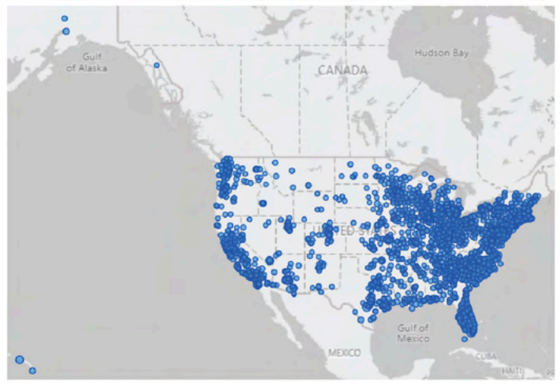
Since the Coalition's founding, new or improved access to polypropylene recycling has expanded to 48 million people.

48 MILLION

68 million new pounds of valuable polypropylene is recovered annually for processing in growing domestic markets.

68 MILLION lb

Map: Residential recycling access for polypropylene bottles, jugs, jars and tubs.



POLYPROPYLENE RECYCLING COALITION
AN INITIATIVE OF THE RECYCLING PARTNERSHIP

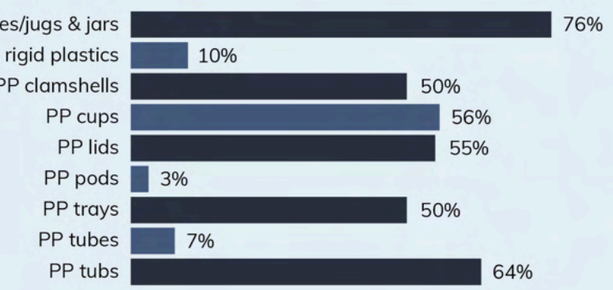
Plastic Ingenuity joined the PP Recycling Coalition in August 2021. Since then, we've been actively contributing resources and expertise to support the coalition's goals. We're inspired by the achievements so far and remain committed to fostering a robust recycling ecosystem for this essential polymer.

Please visit Polypropylene Recycling Coalition – The Recycling Partnership to learn more.

Understanding the Current Landscape

Polypropylene's lightweight, durable and versatile characteristics make it a popular choice for packaging applications across various industries. However, these same attributes pose unique challenges for recycling it. According to The Recycling Partnership, the residential recycling rate for rigid PP is just 8%. While commonly used formats like bottles, jars and jugs are more likely to be accepted in community recycling programs (76%), other formats – including pods, tubes and bulky rigid plastics – face significant barriers due to limited infrastructure and inconsistent local recycling guidelines.

Community Recycling Program Acceptance Data[2]
(as of September 16, 2024)



Why Certain Formats Lag Behind

Several factors contribute to the recycling challenges associated with specific PP formats. For example:

Addressing these barriers is critical to unlocking the full potential of polypropylene recycling.

Complex Shapes and Resin Variability

Items like trays and clamshells are often designed with intricate shapes and varying resin compositions, making them difficult to process with standard recycling technologies.

Contamination Issues

Food residue on PP containers further complicates recycling efforts, as it can lead to contamination that renders the material unsuitable for processing.

Infrastructure Gaps

Many materials recovery facilities (MRFs) lack the advanced sorting technologies required to efficiently separate polypropylene from other plastics in mixed recycling streams.

The Role of Community Recycling Programs

The variation in PP recycling acceptance across communities is influenced by several factors, including:

- Local recycling guidelines that dictate which materials are accepted.
- Differences in collection infrastructure and MRF capabilities.
- Individual participation rates that impact the overall effectiveness of recycling programs.

To address these disparities, the PP Recycling Coalition continues to advocate for standardized recycling guidelines and investments in infrastructure upgrades.

Food-Grade PCR Supply Challenges

Three primary factors limit the availability of food-grade PCR:[3]

RESIN UNSUITABILITY

Many PP packages are manufactured using resins that are not compliant with food-contact standards.

ADDITIVE ISSUES

A converter may incorporate additives that render the material incompatible with food-contact applications.

CONTAMINATION CONCERNS

Contaminants from the food product may infiltrate the packaging material.

Recyclers report that their ability to process more food-grade PCR is constrained by limited supply. They note that with a more consistent and reliable stream of high-quality recycled materials, they could significantly increase their capacity to meet growing demand.[3]

Drivers of Change

Legislative Initiatives

Legislation is playing a pivotal role in reshaping the recycling landscape. Extended Producer Responsibility (EPR) policies, enacted in five states so far, require manufacturers to take responsibility for the end-of-life management of their products. Additionally, laws mandating minimum PCR content in packaging are driving demand for food-grade recycled PP. These legislative measures are creating a larger market for recycled materials and incentivizing companies to prioritize sustainability.

Technological Innovations

Advancements in technology are essential for addressing the challenges of PP recycling. Key innovations include:

AI-Driven Sorting Systems:
MRFs are increasingly adopting artificial intelligence-based technologies to improve the identification and separation of polypropylene from mixed waste streams. These systems enhance efficiency and make the recovery of PP more economically viable.

Reclamation Advances:
Reclaimers are investing in sophisticated cleaning and extrusion systems to produce food-grade PCR PP. Although progress has been made, achieving consistent quality and addressing contamination remain significant hurdles.

Drivers of Change

Market Incentives and Brand Commitments

As more companies and brands commit to incorporating PCR content into their products, demand for recycled PP is growing. By integrating recycled content into packaging designs and increasing investment in recycling infrastructure, companies and brands are helping to create a viable market for PP thermoforms.

PI's Role in Advancing PP Recycling

As a leader in the industry, we are being proactive in advancing the recycling efforts of PP and have launched several key initiatives to support the recycling ecosystem:

1. **Enhancing Infrastructure:** Continuing our collaboration with The Recycling Partnership and supporting their efforts to expand consumer access to PP recycling and improve collection systems.
2. **Promoting PCR Integration:** Working with brands to incorporate recycled PP into their packaging and helping them navigate the trade-offs and compliance challenges associated with PCR materials.
3. **Sustainable Design Practices:** Advising brands on sustainable packaging designs that align with APR guidelines, ensuring compatibility with the recycling stream. Promoting the use of NIR-detectable colorants, which enhance sortation efficiency and reduce contamination from non-recyclable materials like carbon black.
4. **Investing in Food-Grade PCR:** Through pilot-scale tests, PI is working to qualify PCR PP for food-grade applications, paving the way for wider adoption in the food packaging sector.

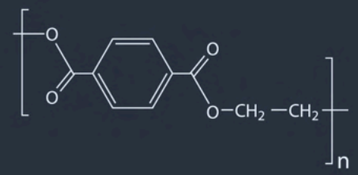
Conclusion

The progress made in PP recycling is a testament to the dedication of organizations like The Recycling Partnership and PI. While significant challenges remain, the combined efforts of industry leaders, technological innovators and legislative bodies are driving meaningful change. By addressing infrastructure gaps, improving access to recycling programs and fostering collaborations, the industry can unlock the full potential of polypropylene recycling. These efforts are critical not only for achieving sustainability goals but also for meeting the demands of an evolving regulatory landscape.

Sources:

1 - recyclingpartnership.org/polypropylene-coalition/
2 - recyclingpartnership.org
3 - "Assessing the state of food grade recycled resin in Canada and the United States," Stina Inc.

Spotlight: PET Recycling Coalition



A Partnership That's Seeing Results

In 2022, The Recycling Partnership (TRP) established the PET Recycling Coalition with the goal of advancing recycling practices for polyethylene terephthalate (PET) packaging. To support this mission, the coalition awards grants to material recovery facilities (MRFs) and PET reclaimers, enabling them to acquire critical equipment to enhance the efficiency of PET item recovery. By October 2023, a total of 11 grants had been distributed to recyclers across the country. These investments are set to significantly expand consumer access to PET recycling programs while increasing the availability of post-consumer recycled (PCR) PET in the marketplace.

Some of the Coalition's Impacts (since 2022)[1]

29M new pounds per year of recycled PET

20M pounds per year of increased capture at MRFs

8M pounds per year of increased capture at reclaimers

1.4M new households now have access to recycle non-bottle PET

54M new pounds of non-bottle reclamation capacity added each year

Stats & map from: recyclingpartnership.org
https://recyclingpartnership.org/wp-content/uploads/2024/08/TheRecyclingPartnership-PET-Coalition-Annual-Report-2024-FINAL.pdf

PET Recycling Coalition
THE RECYCLING PARTNERSHIP

Plastic Ingenuity became the first thermoforming company to contribute financial support to the PET Recycling Coalition in October 2022. Leveraging our distinct expertise and leadership in helping to achieve thermoform sustainability, PI aims to bolster the coalition's initiatives while driving mutual benefits for our own operations and customer base. Among the coalition's ambitious goals is restoring PET thermoforms to "widely recyclable" status on the How2Recycle platform.

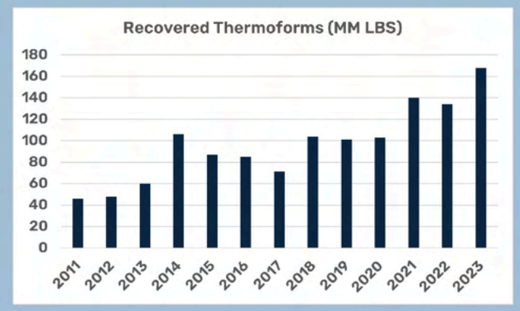
Please visit PET Recycling Coalition – The Recycling Partnership to learn more.

Understanding the Current Landscape

PET bottles have been classified as "widely recycled," with 89% of community recycling programs across the U.S. accepting those items. In contrast, the acceptance rate for PET thermoforms is just 54%.[2] Although PET thermoforms sit just below the "widely accepted" threshold of 60%, as do PET cups and lids, achieving that status is an attainable goal in the relatively short term.

Community Recycling Program Acceptance Data[2]
(as of September 16, 2024)

NAPCOR's 2023 PET Recycling Report revealed that the U.S. PET bottle recycling rate increased to 33%, up from 29% in 2022. This is the highest U.S. recycling rate since 1996 after the rate stagnated at or below 30% for 15 years. The amount of PET thermoforms recycled rose by 26% to 168 million pounds, an increase year-over-year of 34 million pounds. The average amount of PCR in bottles increased to 13.2% in 2023, nearly double the amount since 2017. The average amount of PCR used in PET thermoforms increased dramatically to 16.9% in 2023, up from 10.8% the previous year.[3]



Challenges in Recycling PET Thermoforms

The barriers to PET thermoform recycling stem from several interconnected issues that make their recovery more difficult than that of their bottle counterparts. These challenges include:

Contamination From Visually Similar Packaging

PET Thermoforms often get mixed with look-alike materials, such as PVC (polyvinyl chloride and OPS (oriented poly-styrene), which are non-recyclable and can severely contaminate recycling streams. When these materials are mistakenly included in PET recycling, they degrade the quality and usability of rPET, making it less valuable in the market.

Material Properties

Compared to PET bottles, thermoforms have a lower intrinsic viscosity (IV), which affects the properties of the recycled material. This lower IV limits the applications for which rPET from thermoforms can be used, often relegating it to lower-value products.

Labels and Glue

Adhesive labels on thermoforms create significant challenges during recycling, as they often leave behind residue that contami-nates the feedstock. There is little uniformity in the labels used, and recycling-unfriendly paper labels are in wide use.

Flake Geometry and Processing Issues

During shredding, PET thermoforms produce flatter flakes compared to the rounded flakes generated by bottles. This geometric difference reduces efficiency during the sorting and recycling process, making it harder to achieve high-quality outcomes.

Demand

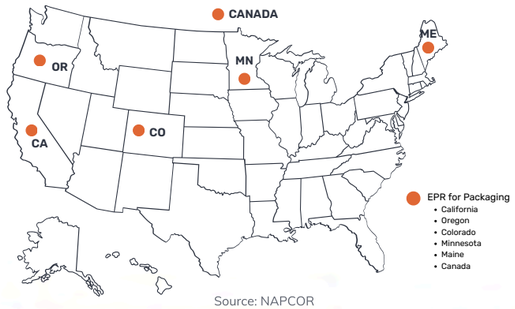
Brand PCR commitments don't typically specify PCR from thermoforms, so MRFs are not incentivized to sort them separately from bottles.

Drivers of Change

Legislative Action and Extended Producer Responsibility (EPR)

Governments are increasingly introducing policies to improve packaging recycling rates. For example, California's SB 54 legislation sets ambitious targets for PET recycling, requiring rates to reach 65% by 2032.[3] With PET recycling rates currently at just 12% in California, companies face mounting pressure to innovate or risk financial penalties and restricted market access. EPR programs incentivize brands and manufacturers to develop and invest in systems that will improve recycling rates, including thermoforms.

ACTIVE EPR FOR PACKAGING



Source: NAPCOR

Recycling Rates:

- 30% by Jan. 2028
- 40% by Jan. 2030
- 65% by Jan. 2032

Thermoform PET Recycling Example

Technological Innovations

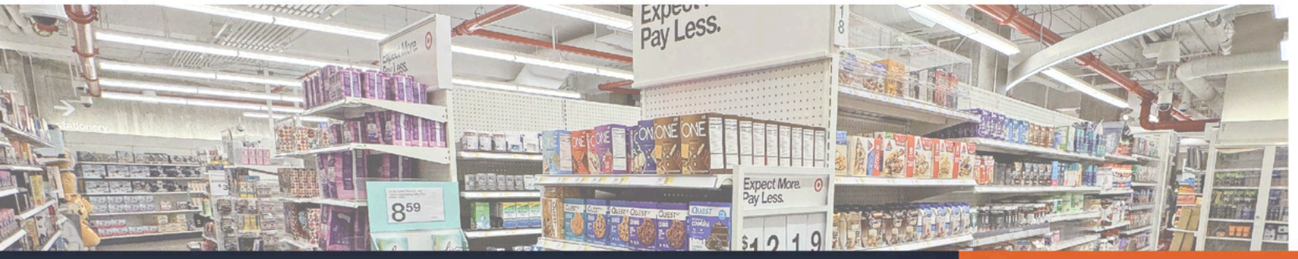
Advanced technologies are addressing critical inefficiencies in PET thermoform recycling:

AI and Optical Sorting:
Enhanced sorting technologies, such as AI-driven systems and optical sorters, are enabling MRFs to efficiently separate PET thermoforms from other materials, improving recovery rates and feedstock quality.

Reprocessing Upgrades:
Innovations like solid-state poly-condensation (SSP) improve the properties of rPET produced from thermoforms, expanding its usability in higher-value applications like bottles and food-grade packaging.

Corporate and Brand Commitments

Major retailers like Walmart and Target, along with numerous brands, are stepping up their efforts to incorporate rPET into their packaging. These commitments are driven by a combination of sustainability goals and compliance with emerging regulations.



PI's Role in Advancing PET Thermoform Recycling

PI is actively contributing to the improvement of PET thermoform recycling by combining advocacy, design innovation and cross-industry partnerships. Our company focuses on several key initiatives:

1 Improving Recycling Access and Infrastructure:
In collaboration with The Recycling Partnership's PET Recycling Coalition, PI is working to expand access to PET thermoform recycling through investments in infrastructure and consumer education. By narrowing the gap between bottles and thermoforms, these efforts aim to make recycling more accessible to households nationwide.

2 Fostering Industry Collaboration:
PI participates in initiatives like NAPCOR's Thermoform Committee, of which PI's own Daniel Kuehn, President & CEO, is the chair. The committee seeks to align industry standards, improve sorting practices and stimulate market demand for rPET-derived thermoforms. These collaborations demonstrate the importance of unified efforts in overcoming systemic barriers.

3 Designing for Recyclability:
By following APR guidelines, PI helps brands design PET thermoforms that are easier to recycle. This involves eliminating problematic materials, such as PVC and OPS, and incorporating features that enhance sortation and recovery.

4 Creating Markets for rPET:
PI is increasing the use of PCR content in our own products, helping to establish a stronger market for recycled PET. This approach not only supports the economic viability of thermoform recycling but also demonstrates leadership in promoting sustainable practices.

Case Studies: Real World Success

PI's initiatives have already produced measurable results, including the following examples:

WAHL CLIPPER PACKAGING

Plastic Ingenuity partnered with Wahl's packaging experts to explore alternatives to PVC. PI engineers carefully analyzed the performance needs of each tray and assessed materials for potential replacement.
PET emerged as the optimal choice due to its recyclability and compatible physical characteristics. Compared to the original PVC packaging, the PET version is more sustainable, retains equivalent durability and aligns with NGO and key retailer's objectives.

COOKIE & DESSERT TRAYS

At PI, we also excel in simplifying the shift of cookie and dessert trays from OPS to PET. Our expertise allows customers to adapt to the dynamic demands of sustainability initiatives without disrupting existing processes. Designed to meet specific requirements, our tailored thermoformed solutions are developed by our fully integrated in-house team for a seamless transition.

Conclusion

PET thermoforms present an enormous opportunity for improving recycling outcomes. While formidable challenges persist, progress is being made through the combined efforts of organizations like The Recycling Partnership, forward-thinking companies like PI, supportive legislative frameworks and innovative technological advancements. By addressing the systemic obstacles that currently limit thermoform recycling, the industry can reach its full potential, reduce plastic waste and build a more circular future.

Sources:

1 - The Recycling Partnership PET Coalition Annual Report 2024
2 - recyclingpartnership.org/recycling-data/
3 - NAPCOR

Spotlight: Healthcare Plastics Recycling Council

A Collaboration That's Minimizing Barriers

Founded in 2010, the Healthcare Plastics Recycling Council (HPRC) is a technical consortium of peers spanning the manufacturing, healthcare, and recycling industries. HPRC seeks to improve the recyclability of plastic products and packaging within healthcare settings across the United States and Europe. The council explores ways to enhance the economics, efficiency, quality, and quantity of healthcare plastics collected for recycling.

Key resources created by HPRC help support this mission across the entire value chain:

Hospicycle guides hospitals in implementing a plastics recycling program in patient care settings.

Design Guidance for Healthcare Plastics Recycling recommends preferred materials that improve recyclability without affecting product integrity or performance.

Guiding Principles for Advanced Recycling shares best practices based on HPRC's primary research and pilot projects.

HPRC
HEALTHCARE PLASTICS RECYCLING COUNCIL

Plastic Ingenuity became a HPRC member in October 2021, joined the Steering Committee in October 2022, and then the Executive Committee in January 2023 to help accelerate progress toward the council's mission.

Learn more by visiting the HPRC website.

Understanding the Current Landscape

Plastic is one of the few versatile materials that has been able to adapt along with the dynamic nature of the healthcare industry, delivering sterility, quality, durability, and – most significantly – patient and healthcare worker safety. Yet there are unintended environmental consequences of single-use plastics, namely the waste created. Most of the healthcare plastics produced globally are disposed of in landfills or by incineration, despite much of this material being uncontaminated and recyclable.

Up to 85% of healthcare plastic waste is non-infectious.[1]

U.S. healthcare facilities present a largely untapped waste stream. According to estimates, 1 million tons of clean, non-infectious healthcare plastics are generated each year.[1]

HEALTHCARE PLASTICS WASTE

Challenges to Overcome

Despite several barriers slowing healthcare plastics recycling, each challenge has a feasible solution, and there are favorable signs of progress.

CHALLENGES	POTENTIAL SOLUTIONS
Hospitals & Suppliers	
Multi-Materials	Mono-Materials
Identification of Plastic Type	Product and Packaging Labeling
	Education
Lack of Space	Procurement
	Engage with Recyclers Early
Legislation	
Extended Producer Resposibility and Compliance Complexity	Research and Evaluate Healthcare Waste Compared to Other Industries
Contaminated Products	
Waste Processors	
Lack of Waste Acceptance	Invest in Improved Sorting Technology and Capability

Hospitals & Suppliers

Many healthcare products and packaging are comprised of multiple materials and multi-layer structures that provide barrier properties. However, these complicated structures make it difficult for hospital staff to properly sort waste for recycling. Another difficulty is correctly identifying material types to determine the appropriate waste streams, resulting in inconsistent collections. Furthermore, most healthcare facilities lack adequate space for recycling infrastructure, from collection bins to plastic storage.

For healthcare plastics to be collected, sorted, and recycled, they must first be designed to be recycled. Key starting points include creating packages with mono materials or compatible plastic types in multi-layer structures and labeling to make material sorting easier. Training programs for all levels of healthcare staff, including procurement, can help emphasize the importance of plastics recycling when possible. Cooperation with waste processors gives hospitals the opportunity to gain off-site support with sorting and storage.

Challenges to Overcome

Legislation

Regulatory landscapes and infrastructure for recycling differ by geography, which often leads to a lack of clarity around compliance. Regulatory bodies and policymakers are encouraged to collaborate with the healthcare industry to help understand, evaluate, and improve recovery methods for healthcare plastics.

Waste Processors

Hospitals might struggle to find a waste processor willing to accept their relatively small quantities of plastic waste. Perceived safety risks can also be a barrier to recycling. Waste processors would do well to invest in improved sorting techniques compatible with healthcare plastic waste.

Drivers of Change

According to an opinion piece from the American Medical Association Journal of Ethics, "The healthcare industry faces a unique conundrum: the volume of waste it generates in caring for patients paradoxically damages the health of the populations it seeks to serve."3 Healthcare organizations are increasingly held accountable for their environmental impact, and that has driven some interesting initiatives toward improving the circularity of healthcare plastics.

Hospital Waste Reduction Commitments

Trailblazing healthcare systems are integrating environmental sustainability and social responsibility into their strategic priorities. "Such systems embody the medical ethical principle of beneficence [...] by not only avoiding harm but also actively promoting well-being by removing conditions that cause harm," as noted in the Journal of Ethics.[3]

Potential to Realize Cost Savings

Reducing waste and increasing recyclability of healthcare plastics are not only ethical, but also cost effective. For instance, hospitals submitting data to Practice Greenhealth's 2019 Environmental Excellence Awards saved an estimated $68 million on sustainability initiatives in 2018 "while reducing more than 309 million kBTUs of energy, diverting 146,750 tons of waste from the landfill, and avoiding 182,370 metric tons of carbon emissions through mitigation projects."[4]

Extended producer responsibility (EPR) policies have also shown cost-saving opportunities. EPR policies assign producers financial and operational responsibility for the end-of-life of products. In British Columbia, Canada, EPR policies could save $14 to $17 million Canadian dollars due to incentives to recover waste and maintain inputs at highest-value application for as long as possible.[4] In the U.S., EPR bills for packaging have passed in five states, and more have been introduced.

Drivers of Change

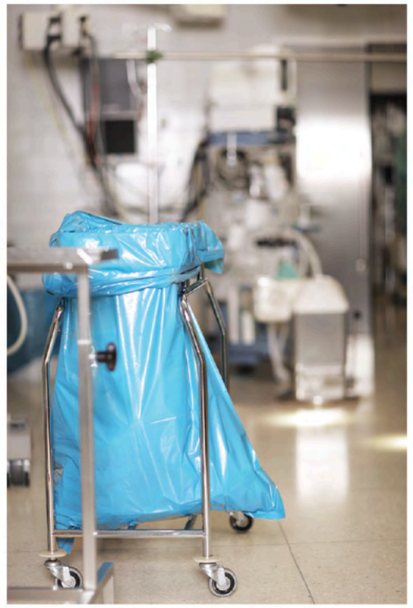
Influence of NGOs

Organizations such as Practice Greenhealth and Health Care Without Harm are committed to supporting waste reduction and sustainable waste management throughout the global healthcare sector. Practice Greenhealth has developed tools and resources to guide their member organizations to set baselines, identify goals and implement strategies like more efficient sorting, waste prevention, robust recycling, single-use device reprocessing, composting, and more.

Within the U.S. and Canada, Health Care Without Harm offers guidance to help healthcare organizations minimize the volume of waste generated, reduce the toxicity of waste by making smarter purchasing decisions upstream, and properly segregate and recycle waste. They also focus on other geographic regions and take a holistic approach at the global level.

Technological Innovations

Interest in healthcare plastics recycling remains high, particularly with evolving advanced recycling technologies and material enhancements.



Advanced Recycling

Advanced recycling encompasses processes that break down or remove the impurities in materials incompatible with or challenging for mechanical recycling. Purification, depolymerization and conversion processes reduce a polymer to a precursor and/or remove colorants and additives. Notably, polymers created from advanced recycling feedstocks have the same molecular composition as polymers made from virgin fossil feedstocks.

It's common practice to mix advanced recycled feedstock with virgin feedstock, additives and other materials to meet client specifications. By using a certified mass balance approach, such as ISCC PLUS, there is a chain-of-custody protocol to verify the amount of recycled material used at each step of the manufacturing process and ensure the recycled content is appropriately accounted for in the final product. Plastic Ingenuity is ISCC PLUS certified, which supports customers with traceability when implementing circular materials from advanced recycling technologies into their thermoform packaging.

Material Improvements

Another way to improve recyclability of healthcare plastics is to develop materials that are compatible with the existing recycling stream while maintaining the product's sterility and performance. The industry is moving away from polyethylene terephthalate glycol (PETG) to a healthcare-grade polyethylene terephthalate (PET) for packaging that will be accepted into the country's most widely recycled material stream.

PI's Role in Advancing HPRC Initiatives

Plastic Ingenuity guides medical device manufacturers in improving packaging sustainability. Additionally, we're pleased to propel HPRC efforts forward and support cross value chain collaboration.

Advanced Recycling Scale Up Pilot with Hospitals:
Plastic Ingenuity was the phase 3 co-lead for a project that collected a mixed stream of healthcare plastics from select hospitals and processed them using various advanced recycling technologies. By processing commercial-scale samples, HPRC sought to learn which materials are more or less favorable for different advanced recycling technologies.

1

Houston Regional Healthcare Plastics Recycling Pilot:
HPRC is collaborating with the Alliance to End Plastic Waste and the Houston Methodist hospital system to establish a region-wide recycling program for healthcare plastics. Plastic Ingenuity resources actively support this program, which aims to demonstrate an economically viable regional model that interested parties in other regions can adopt.

2

Sortation Technology Research:
Plastic Ingenuity co-led a recent HPRC project to complete a landscape assessment of innovative plastic sortation technologies that can be deployed to economically sort comingled healthcare plastic waste.

3

Conclusion

Healthcare plastics are a valuable feedstock from an underutilized waste stream. Alignment across the healthcare, manufacturing, and recycling industries is essential to achieving circularity. Thanks to strategic innovation and collaborative partnerships, progress continues to be made as we all work towards a more sustainable future.

Sources:

1 - Healthcare Plastics Recycling Council, Healthcare Plastics: Guidance for Recyclers, 2019
2 - Healthcare Plastics Recycling Council, Barriers to Recycling Healthcare Plastics, 2022
3 - Silva, G.S. and Thiel, C. American Medical Association Journal of Ethics. 2022;24(10):E934-943. doi: 10.1001/amajethics.2022.934.
4 - Jain, N. and LaBeaud, D. AMA J Ethics. 2022;24(10):E986-993. doi: 10.1001/amajethics.2022.986.

Good Information

PLASTIC INGENUITY

How to Create Sustainable Packaging

Packaging engineers face numerous challenges when creating new packaging for their products. Not only must the packaging protect the product in the most economical way, but it must also be sustainable. This article will dissect the definition of sustainability, highlight how to quantify sustainable packaging, discuss the sustainable attributes of common packaging materials, and explain how to combine all these elements to create a sustainable design.

Defining Sustainability

Our definitions of sustainability often mirror our values and life experiences. When engaging in sustainability conversations with peers, it becomes vital to align definitions. The United Nations (UN) definition of sustainability is a useful benchmark for reference, "Meeting the needs of the present without compromising the ability of future generations to meet their own needs."

The UN created the Sustainable Development Goals (SDGs) to provide a framework for organizations and governments to follow to ensure the sustainable development of new goods and services.

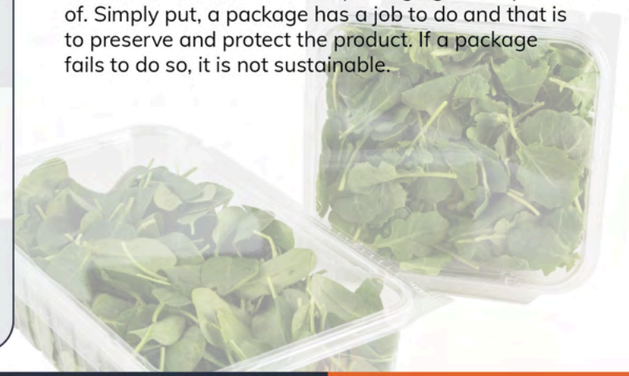
The framework emphasizes that businesses and institutions should consider their impact not only in terms of profits but also in terms of their effects on people and the planet:

Environmental:	Applies to preserving and protecting the natural environment for current and future generations.
Social:	Relates to the well-being and quality of life of individuals and communities. Social sustainability also promotes strong community connections and cultural diversity.
Economic:	Refers to the capacity of an economic system to maintain or improve the well-being of current and future generations.

These aspects demonstrate the multifaceted nature of sustainability—encompassing ecological, economic, social, and ethical considerations to ensure the long-term well-being of our planet and its inhabitants.

With this in mind, let's dive into the definition of sustainable packaging. Smithers defines sustainable packaging as "any form of packaging where a conscious, significant effort has been made to reduce the environmental impact of the package. This includes the ability of the packaging to increase shelf life, reduce spoilage, damage, breakage, and waste of the packaged products."

Notably, this definition describes what the package does in addition to what the packaging is comprised of. Simply put, a package has a job to do and that is to preserve and protect the product. If a package fails to do so, it is not sustainable.

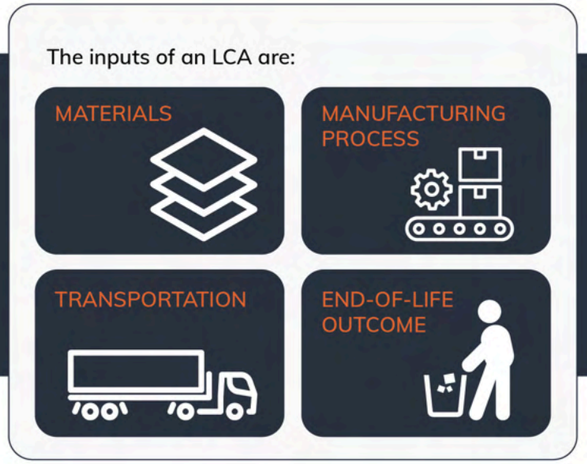


Back to the SDGs, packaging's role in benefiting society is often overlooked and underappreciated. Packaging is integral to preserving the food we grow and protecting the medical devices trusted to save lives.

To continue reaping the benefits of packaging, we must address some challenges. We must improve packaging's role in responsible resource consumption. This will require advancements in the pursuit of circularity, namely end-of-life management and using conscientious feedstocks to make our packaging.

Quantifying Sustainability

A life cycle assessment (LCA) is the systematic analysis of the potential environmental impacts of products or services throughout their entire life cycle. An LCA includes, but is not limited to, the environmental impacts associated with raw material extraction, manufacturing, assembly, transportation, distribution upstream and downstream, and end of life.



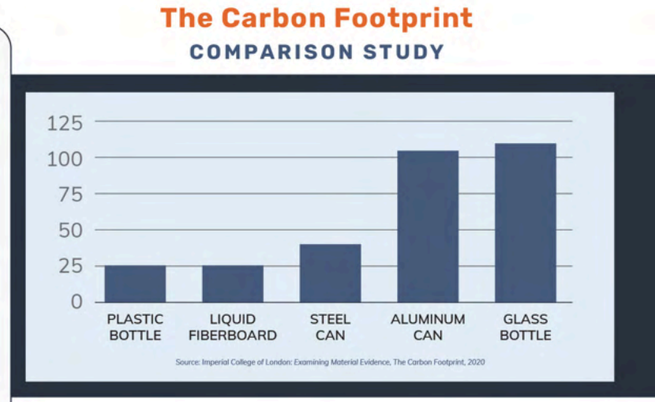
Once these metrics are entered as inputs to the LCA, the outputs are often global warming potential (GWP), fossil fuel usage, water consumption, freshwater eutrophication, cumulative energy demand, mineral resource usage, freshwater ecotoxicity, or human impact.

LCAs provide crucial insights by assessing factors such as resource consumption, energy use, emissions, and waste generation from raw material extraction to end-of-life disposal. These insights guide designers and manufacturers in making informed decisions to minimize environmental footprints and enhance resource efficiency. Ultimately, LCAs enable the development of reducing environmental burdens and advancing towards a more sustainable future for packaging.

Sustainable Material Selection

The first and often most consequential decision a packaging engineer must make is choosing a material substrate for their packaging. All materials have strengths and weaknesses. A sustainable packaging portfolio leverages the strengths of all material types, enabling them to work in concert.

Let's examine the environmental impact of common packaging material types by studying recently published LCAs. In 2020, the Imperial College of London published a study comparing the carbon footprint of 500ml beverage containers made from plastic, fiberboard, steel, aluminum, and glass. This study concluded that plastic and fiberboard had the lowest carbon footprint of the materials studied by a factor of 4x compared to aluminum and glass.



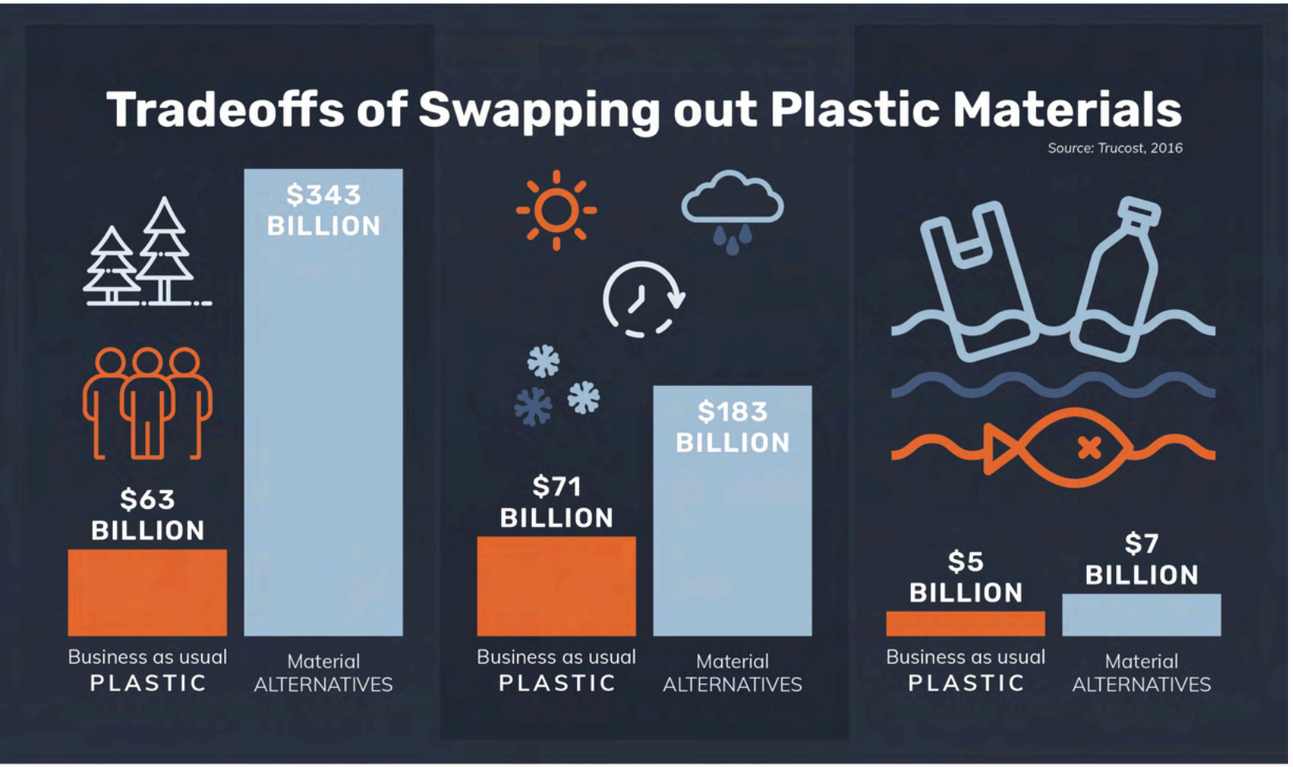
McKinsey published a study in 2022 that examined the climate impact of materials in six different packaging applications: grocery bags, wet pet food, soft drink containers, fresh-meat packaging, industrial drums, and soap containers. The study concluded that plastics have a lower greenhouse gas impact in 5 of the 6 applications studied. The industrial drum was the lone example of a material outperforming plastic in this study.

Comparison	Sector	Application	*Plastic vs*	*Next-best alternative*	% difference in total greenhouse gas contribution in United States, 2020
Plastics vs alternative materials	Packaging	Grocery bag	HDPE	Paper	80
		Wet pet food packaging	PET/PP	Aluminum or steel	70
		Soft drink container	PET	Aluminum	50
		Fresh-meat packaging	EPS/PVC	Paper	35
		Industrial drum	HDPE	Steel	-30
		Soap container	HDPE	Glass	15

Source: McKinsey – Climate Impact of Plastics

The final study to highlight is a publication from TruCost that compared the impact of plastic used in consumer products and packaging to their next-best alternatives across three aspects: damage to the health of humans and ecosystems, climate change, and damage to the oceans. The study found that plastic has a much lower impact on these aspects than alternatives. Substituting alternatives would lead to 5 ½ times more damage to the health of humans and ecosystems, 2 ½ times more impact on climate change, and 40% more impact on ocean damage.

Every material commonly used in packaging has pros and cons—no material is inherently good or bad. Materials need to be selected in concert to optimize sustainable packaging portfolios.



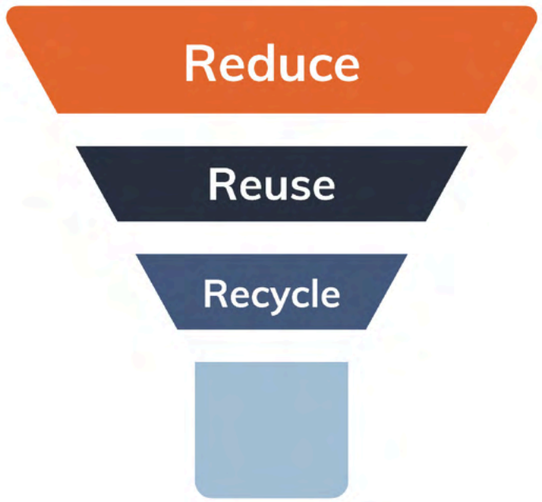
Designing Sustainable Packaging

According to the Sustainable Packaging Coalition (SPC), "Seventy percent of a product's overall impact is determined in the design phase." Adopting the waste hierarchy and circular economy principles in packaging design is crucial for sustainability. Let's examine how these principles can be applied to design sustainable packaging.

REDUCE

The top tier of the waste hierarchy is "reduce." Reduction is the most environmentally preferred strategy because it focuses on minimizing or eliminating waste at its source. Source reduction conserves resources, lowers energy consumption, and saves capital. One important note: It is crucial to not compromise product protection and preservation due to reduction strategies. A package that fails to protect the product is not sustainable.

The most effective way to assess if a package can be reduced is by challenge testing it to the point of failure. To achieve optimal package design, it's essential to minimize material usage while ensuring product protection. During the design process, each design element should be examined for potential reduction opportunities, including material choices, tolerances, and other features that could affect the environmental footprint. Similar challenge testing can be applied to secondary, tertiary, and distribution packaging to enhance pack-out efficiencies and pallet designs.



REUSE

The second tier of the waste hierarchy is "reuse." The SPC defines reuse as "Packaging that allows either the business or the consumer to put the same type of purchased product back into the original packaging, is designed to be returnable and/or refillable, and accomplishes a minimum number of reuses while by being part of a system that enables reuse."

It is important to note that reusable packaging can be very effective for certain product types, but it may not work for every product. There are many aspects to reusable packaging that need to be in place to make it work well. In a report from Smithers, they break down the critical success factors of reusable packaging into four key points. The reusable model must be:

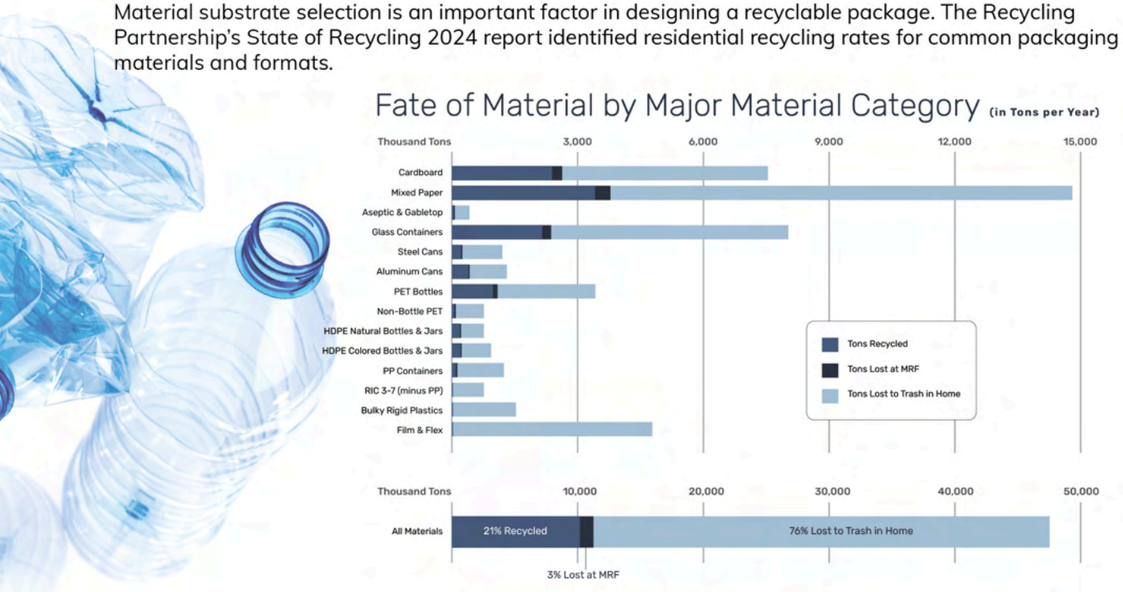
1. Optimizing convenience for the purchaser
2. Carefully balancing price & functionality
3. Creating consumer incentives
4. Linking seamlessly to integrated logistics & support tools

To ensure a reusable packaging model is designed sustainably, it is crucial to perform a life cycle assessment to determine if the reusable model will be more environmentally friendly than single-use packaging. The number of times a reusable package is returned is directly correlated to the environmental footprint of the packaging system. Based on SPC's position statement on reusable packaging, the return rate of the package should achieve 80%, if not 90%, to achieve environmental benefits. The lower the return rate of the package, the greater the environmental impact of the reusable package will be. Although it is not required to design a reusable package for recyclability, it is recommended because some consumers may not participate in the reuse model.

RECYCLE

The third and final tier of the waste hierarchy is "recycle." Brands' focus on recyclable packaging has grown as extended producer responsibility legislation becomes a reality, voluntary corporate recycling goals mature, and consumer preference for recyclable packaging strengthens. This has influenced suppliers, converters, and packaging manufacturers to integrate design for recyclability criteria into their development process.

Material substrate selection is an important factor in designing a recyclable package. The Recycling Partnership's State of Recycling 2024 report identified residential recycling rates for common packaging materials and formats.



Fate of Material by Major Material Category (in Tons per Year)

All material types have limited recovery due to constraints in recycling access and consumer participation. This chart highlights the highest rate of recycling per material type:

State of Recycling:
Highest Rates of Recycling by Material

Material	Tons Generated	Tons Recycled	Recycling Rate
Cardboard	7,509,483	2,371,572	32%
Glass Containers	8,000,677	2,152,303	27%
Aluminum Cans	1,308,956	393,488	30%
PET Bottles	3,412,310	971,215	28%
HDPE Natural Bottles	739,178	188,704	26%

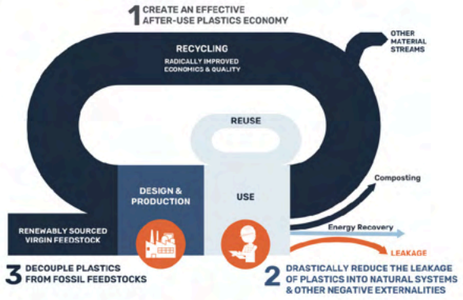
The Recycling Partnership's State of Recycling Report 2024

These rates max out around 30%, regardless of material type. This indicates the need to expand equitable residential recycling access and increase participation by building consumer trust.

Packaging engineers and manufacturers can do their part to improve recycling by leveraging industry guidelines for the type of packaging they produce. For plastic items, the Association of Plastic Recyclers (APR) Design Guideline bridges the gap between designers and recycling systems, ensuring products are genuinely recycling compatible. The guide helps package designers assess each aspect of a package design against industry-accepted criteria to ensure that it is truly compatible with recycling.

Circularity

Circularity builds upon the key tenets of the waste hierarchy. A circular economy is a model of production and consumption that reuses, refurbishes, and recycles existing materials and products as long as possible. This graphic from the Ellen MacArthur Foundation illustrates how shifting to a circular system is critical to optimizing resources and minimizing waste.



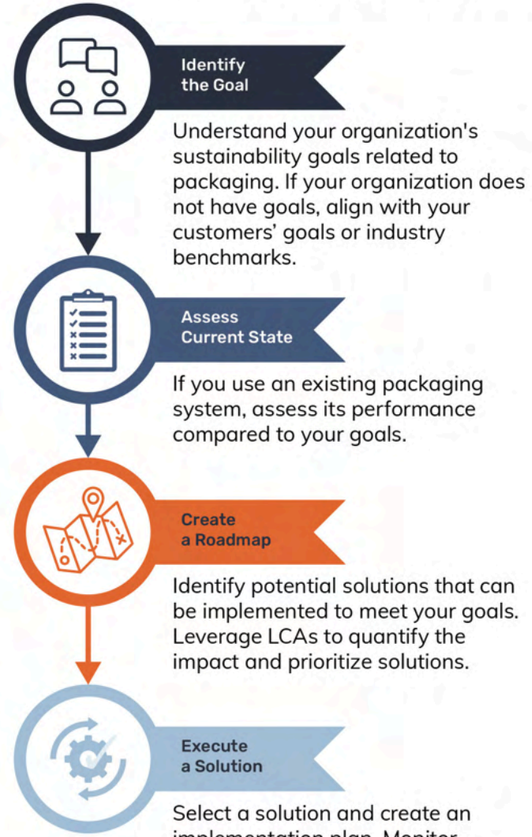
In addition to recycling and reuse, using post-consumer recycled (PCR) content instead of virgin materials is critical to advancing circularity. Introducing PCR into packaging keeps valuable material out of our landfills so it can recirculate in our economy. The demand for PCR fuels the economic incentives our recycling industry needs to continue operating.

Plastics made from renewable, bio-based feedstocks can provide a sustainable solution for virgin plastic, but they come with trade-offs. Bio-based materials have higher water usage across their lifecycle, given the water required to grow the feedstocks. The impact on global warming potential compared to fossil fuel sources is under debate. Growing and harvesting bio-based feedstocks requires equipment currently dependent on fossil fuels. However, these crops absorb carbon dioxide from the atmosphere as they grow. Another consideration is land use and its potential impact on the food supply chain and biodiversity.

Bio-based plastics that are recyclable at the end of life, like bio-based PET or PP, provide a clear pathway to circularity. Improvements to recycling are necessary to make this vision a reality. Compostable materials can also contribute to a more circular system, especially for packaging items contaminated by the product and unsuitable for recycling.

Roadmap to Sustainable Packaging

Creating sustainable packaging can be complicated, but the following process can simplify the endeavor:



Creating sustainable packaging is essential to minimize waste and conserve resources. Sustainable packaging promotes a circular economy, ensuring that materials are reused and recycled, supporting long-term ecological balance and thriving resources.

Sustainable Packaging Assessment CASE STUDY

PLA vs. PET Thermoforms

Overview

This case study assesses the sustainability attributes of PLA (polylactic acid) and PET (polyethylene terephthalate) thermoforms, focusing on material performance, life cycle assessment (LCA), and end-of-life outcomes.

Modeling Assumptions

EcoImpact-COMPASS LCA platform

24.8g

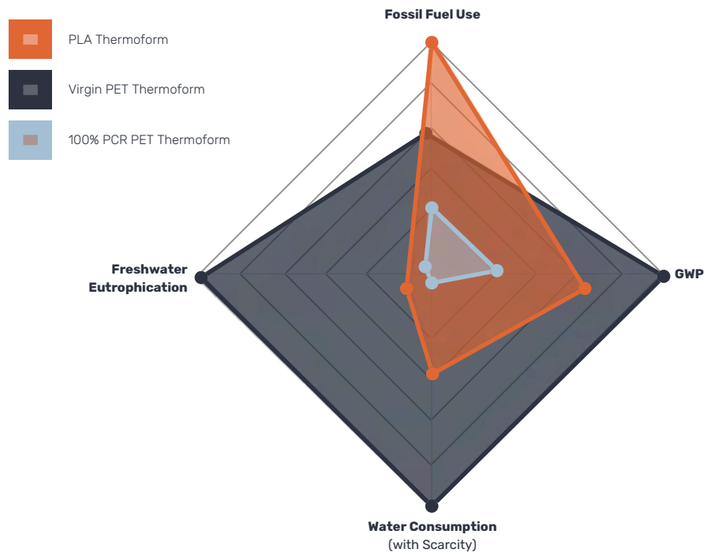
Part weight modeled at 24.8 grams for all material variables

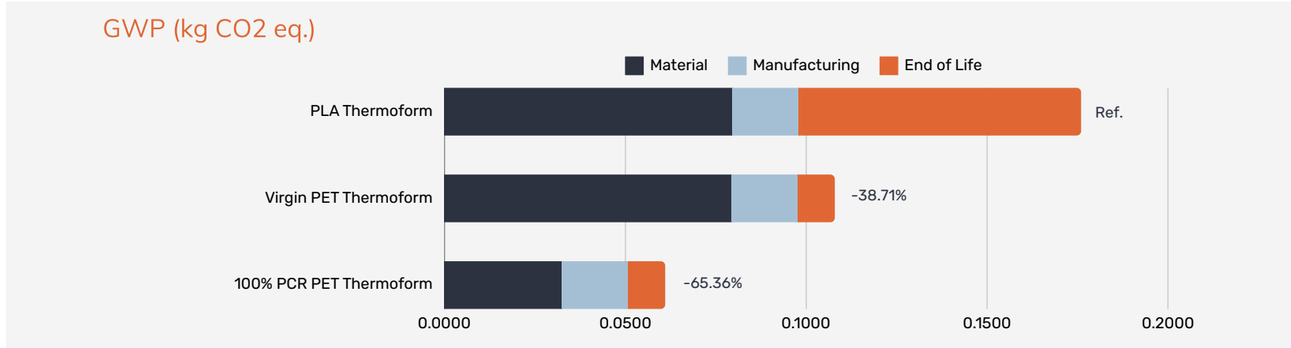
Does not include transportation impacts

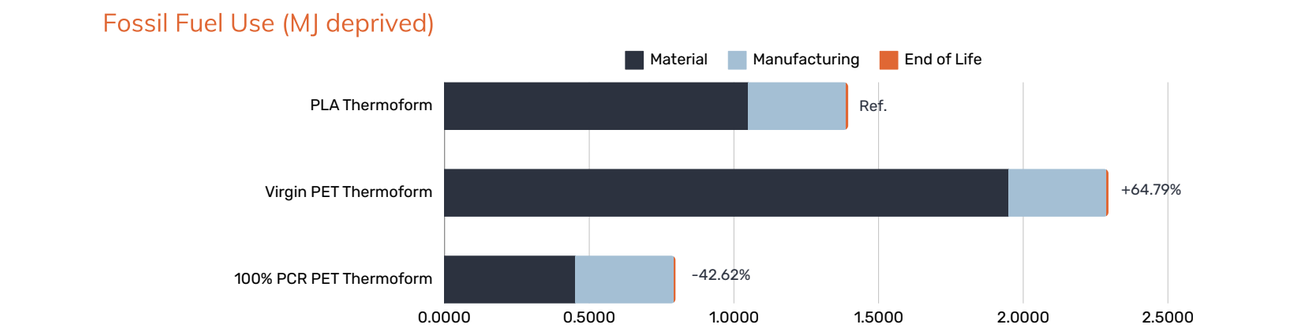
Life Cycle Assessment

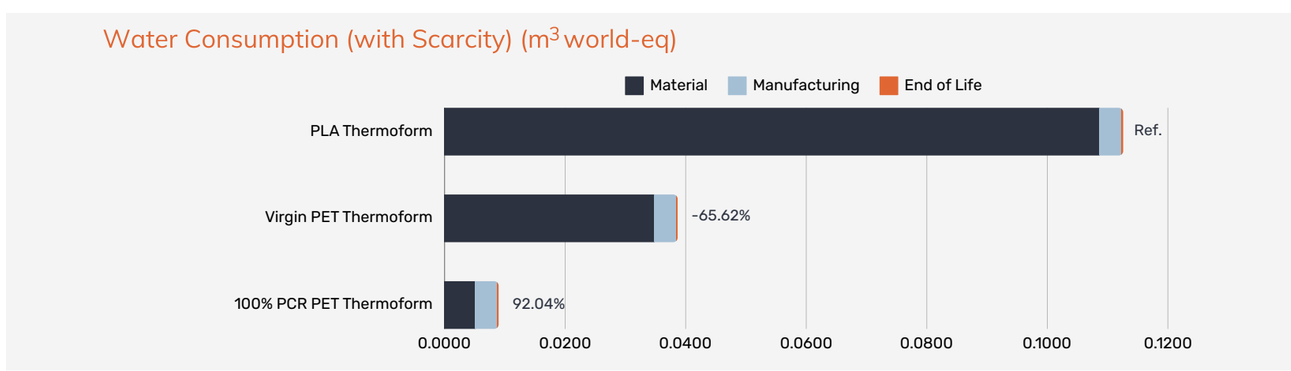
Key Takeaways:

- Virgin PET has a 38% lower carbon footprint than a PLA alternative.
- 100% PCR PET has a 65% lower carbon footprint than PLA.
- Although Fossil Fuel Usage is higher for Virgin PET than PLA, this can be easily reversed by incorporating recycled content.
- Water usage for PLA is 2.9 times higher than Virgin PET and 12.5 times higher than 100% PCR PET.









End of Life

PLA is designed to be compostable in industrial facilities, where it can biodegrade completely. However, this depends on the availability of such facilities, which are limited in many regions. If PLA ends up in a landfill, it can break down anaerobically, producing methane, a potent greenhouse gas. This outcome raises concerns about its overall environmental impact if composting facilities are inaccessible.

PET has a robust recycling infrastructure, making it one of the most recycled plastics globally. When recycled, it can be repurposed into new products, significantly reducing its environmental impact.

Conclusion

This assessment reveals that while PLA presents advantages in terms of reducing our dependence on fossil fuels, its end-of-life outcomes heavily depend on composting infrastructure. In contrast, PET, with its established recycling systems, offers better end-of-life management, despite its reliance on fossil fuels. The choice between PLA and PET thermoforms should consider specific application needs, environmental goals, and available recycling or composting options.

Sustainable Packaging Assessment
CASE STUDY

Molded Fiber vs. PET Thermoforms

Overview

This assessment compares a molded fiber tray and PET thermoforms with either virgin material or recycled content as sustainable packaging options, focusing on their environmental impacts through life cycle assessment (LCA) data and end-of-life outcomes.

Modeling Assumptions

EcoImpact-COMPASS LCA platform

MOLDED FIBER TRAY

- Material: Molded pulp typically made from recycled paperboard or newsprint
- Tray weight: 22.3 g
- Manufacturing process: material pulping through sulfite/kraft process and average molding

VIRGIN PET THERMOFORM

- Material: Virgin PET
- Tray weight: 24.8 g
- Manufacturing process: sheet extrusion and thermoforming

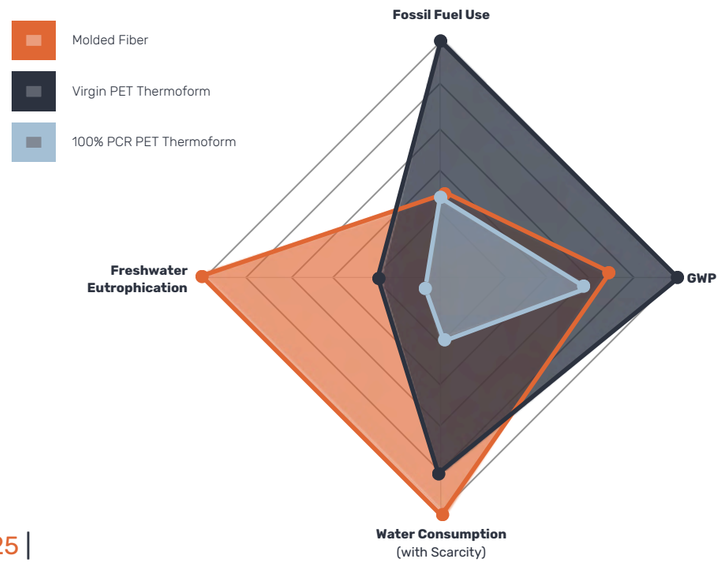
100% PCR PET THERMOFORM

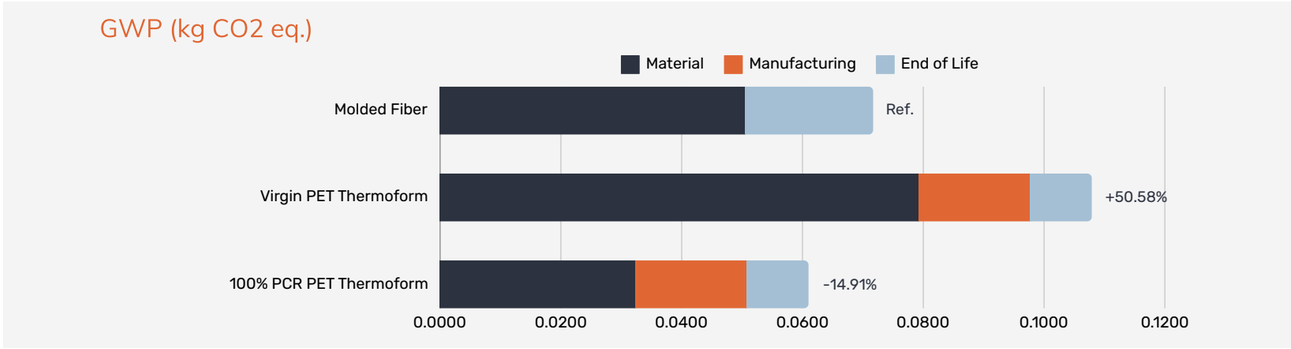
- Material: 100% Post Consumer Recycled (PCR) PET
- Tray weight: 24.8 g
- Manufacturing process: sheet extrusion and thermoforming

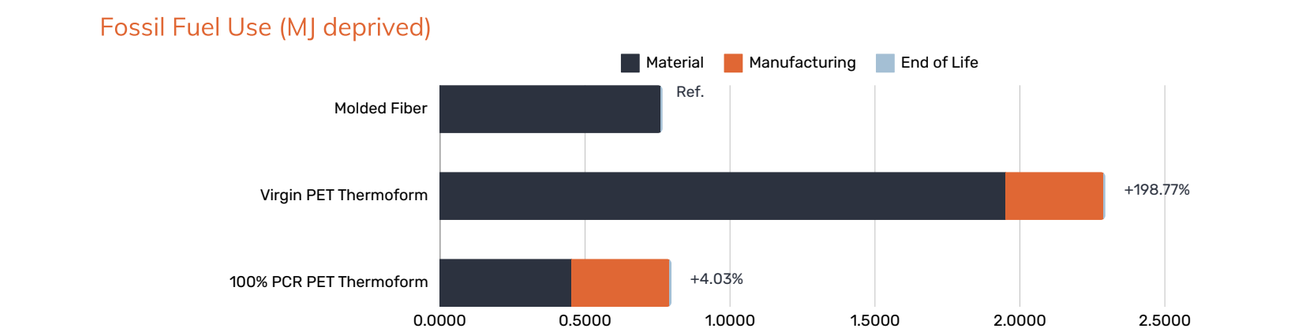
Life Cycle Assessment

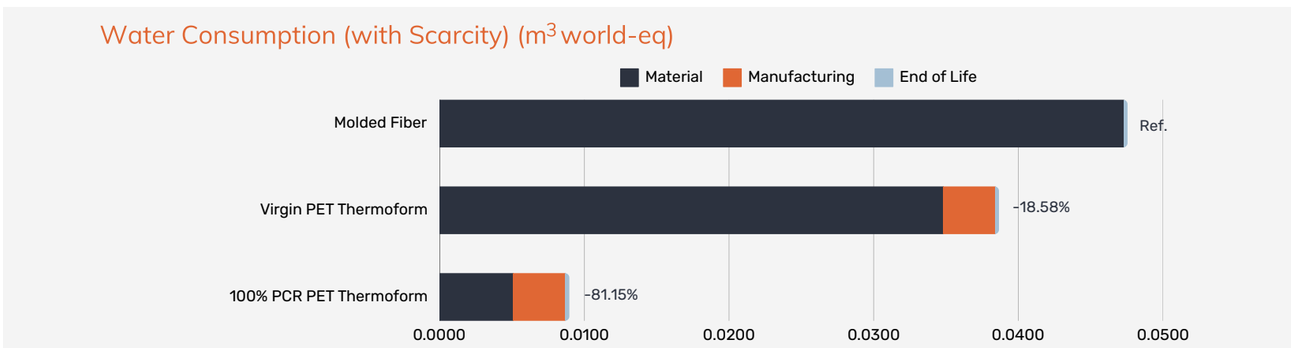
Key Takeaways:

- The 100% PCR PET thermoform reduces carbon emissions by 15% compared to the molded fiber alternative.
  - Minimizing material usage (down-gauging) and maximizing recycled content is critical to achieving the lowest carbon footprint possible.
- The water usage associated with molded fiber is 18% higher than a virgin PET thermoform and 81% higher than a 100% PCR PET thermoform.









End of Life

Molded Fiber packaging is classified as "widely recyclable" by How2Recycle. While fiber-based packaging is generally recyclable, factors such as coatings, laminates, inks, and adhesives can hinder the recycling process. In this scenario, the molded fiber option does not utilize coatings or laminations. The recycling rate for mixed paper packaging is 23% percent.[1]

PET Thermoforms: The recycling rate for not-bottle PET packaging is only 8%.[1] As manufacturers of PET thermoforms, following the guidelines set by the Association of Plastic Recycler's Design Guidance for PET packaging is crucial for setting thermoforms up for success with collection, sortation, and reprocessing.

Conclusion

Molded fiber presents strong sustainability potential through its renewable feedstock and end-of-life performance but faces challenges in water usage. PET thermoforms with recycled content excel in clarity, durability, and carbon footprint, but need improvement in collection and recycling. Minimizing material usage and maximizing recycled content is critical to maintaining a low environmental footprint for PET thermoforms.

1 - The Recycling Partnership, 2024 State of Residential Recycling Report

Two Courses, One Focus

Welcome to Good Information Courses by Plastic Ingenuity. These courses are designed to give a deeper understanding of thermoformed packaging.

Who is this course for?
Throughout this course, you will become familiar with the principles of thermoformed packaging. If you're a packaging engineer, procurement officer, buyer, sustainability manager or packaging development researchers, this detailed course will help you become familiar with thermoforming and how you can impact your sustainability efforts.

Course 1
Thermoform Circularity

The course will include an overview of the thermoforming process, types of polymers used in thermoformed products, mechanical recycling, advanced recycling, and finally, progress being made toward thermoform circularity.

Course 2
Sustainable Packaging

In our second edition of PI Courses, we will explore the evolving world of sustainable packaging and its impact on global sustainability goals. In Lesson 1, we begin by defining sustainability and discussing its significance, the United Nations' definitions, and the unique challenges and benefits of sustainable packaging. In Lesson 2, we discuss Life Cycle Assessments, leveraging industry insights to evaluate packaging's environmental footprint. In Lesson 3, we review sustainable materials, including types (fiber, metals, plastic), their feedstocks, formats, and performance trade-offs, concluding with an analysis of end-of-life options. Lesson 4 focuses on designing for sustainability. Highlighting strategies for reducing waste, selecting reusable and recyclable packaging, and understanding certifications. Circularity is discussed as an important but not sole aspect of sustainable design.

Getting Started
Visit www.PlasticIngenuity.com/courses to begin your free, pre-recorded, virtual course.

2025 Calendar of Events

MD&M West
February 4-6
Anaheim, California
February

Smither's Sustainability in Packaging
March 6-8
Chicago, Illinois
March

Plastics Recycling Conference
March 24-26
National Harbor, Maryland
March

SPC Impact
April 28 - May 1
Seattle, Washington
April - May

the[PACK]out
May 13-15
Coronado, California
May

PMMI Packaging Recycling Summit
June 25-26
Dallas, Texas
June

SPC Advance
September 29 - October 1
Boston, Massachusetts
September - October

Pack Expo
September 29 - October 1
Las Vegas, Nevada
September - October

Notable Leader in Sustainability

Every year, *Plastics News*, through a highly-selective process, handpicks a few leaders in the plastics industry paving the way in thought-leadership of plastic circularity. This year, our very own Corporate Sustainability Manager, Zach Muscato, has been awarded this recognition.

Article recap

Zach Muscato, now Corporate Sustainability Manager at Plastic Ingenuity (PI), began his career in plastics engineering with no formal background in sustainability. His transition into sustainability was driven by a desire to embed sustainable practices into the company's operations. Reflecting on his journey, Muscato stated, “I jumped at the opportunity to build this function out, but there was so much to learn—and I’m still learning every day.” He emphasized that embedding sustainability into processes has been key, with the most rewarding moments coming from company-wide collaboration to improve their practices.

Muscato, who has held engineering roles at Berry Global and Spartech Corp., joined PI in 2017. His role as sustainability manager focuses on helping brand owners meet their sustainability goals while collaborating across the industry to tackle challenges like reducing plastic waste and improving circularity. He believes in the essential role plastics play, but acknowledges the need for better waste management. “Too much plastic packaging goes to waste. We need to do a better job as an industry working with stakeholders to reduce waste and improve circularity,” he said.

Muscato is also heavily involved in industry groups like the Healthcare Plastics Recycling Council and the Sustainable Packaging Coalition. He views collaboration as the key to progress, stating, “Our goal is to change that, so we have recyclers and major device makers and packaging companies working together." Muscato’s leadership at PI reflects a commitment to advancing both corporate and industry-wide sustainability initiatives.

In Conclusion

Letter from Zach Muscato

Corporate Sustainability Manager

As we conclude this year’s report, we reflect on the strides Plastic Ingenuity has made toward a more sustainable future. We have achieved significant milestones on our path toward enhancing circularity, reducing our environmental impact, and creating long-term value for all stakeholders. This has been made possible by an unwavering commitment to collaboration, innovation, and environmental stewardship.

This report highlights our efforts across key areas, including circularity, waste reduction, carbon footprint minimization, and fostering a culture of sustainability within our workforce and community. From designing sustainable packaging solutions to collaborating with industry peers to solve complex challenges, our sustainability efforts align with our values and contribute to a more sustainable future.

Our proudest achievement is how we have systemized sustainability in Plastic Ingenuity, including ISO 14001 certification for our environmental management system and ISCC PLUS certification for our circular materials chain-of-custody system. Systemizing sustainability in an organization is essential to ensuring long-term sustainability. We will continue to systemize sustainability in the years to come through our pursuit of compliance to ISO systems pertaining to occupational health and safety and energy management. We will systemize our internal waste diversion efforts to achieve Net Zero Waste Recognition in our production facilities.

We recognize that the journey toward sustainability is enduring. We are committed to deepening our partnerships with stakeholders, expanding our sustainable packaging solutions, and setting ambitious plans to further our positive impact. Each year, our dedication grows stronger, driven by the belief that sustainability is not merely a responsibility but an opportunity to lead and inspire change in the industry.

Thank you for your continued support and trust in Plastic Ingenuity. Together, we can build a sustainable future that benefits not only our business but the planet and future generations.

Sincerely,

Zach Muscato

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Thermoform Circularity Report 2025

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