

Design for **Recyclability**

DOW

®



Can we create a cleaner world?

Keeping plastic out of the environment is a great way to start. By repurposing. Reusing. Recycling. And, in the process, incorporating **design for recyclability**. Ensuring plastic retains its value and promotes a circular economy. With new products and emerging technologies, we're finding ways. Read on to learn about some possibilities – and why we hope you'll join us in this important effort.



Committed to sustainability

We believe plastic waste should never end up in the environment. We believe in plastic for a circular world – a world where the value of plastic is retained, and the environmental burdens are eliminated.

How to do that? Figure 1 illustrates our three-part strategy. Working together with other concerned businesses and organizations, we believe we can continue to provide all the positives of plastic, while ensuring that none of that plastic ends up in the environment or is lost to landfills.

What's needed for action?

Global desire for more sustainable packaging is steadily growing. Recently, more than 350 organizations have signed on to the Ellen MacArthur Foundation's *New Plastics Economy*, committing to making 100% of their plastic packaging

Figure 1: Sustainability Strategy



reusable, recyclable, or compostable by 2025. Additionally, consumer package goods (CPG) brand owners and retailers have committed to an average of 25% recycled content by 2025. We're already working on these initiatives and hope you'll join us.

Answering the call

Most companies are focusing sustainability initiatives on increasing recyclability of their packaging and incorporating more post-consumer resin (PCR) content in packaging. We're ready to help. We've concentrated on developing and aligning products and technologies to help customers design packaging with all aspects of recycling in mind. "From design to disposal" is the idea – but ideally, true disposal never happens!

Making recycling work

Strategies and good intentions aren't enough. Products and processes need to work in the real world. Recycling, reusing, repurposing... all must become popular and practical options across the value chain. Are you ready to move forward with us?

Design for recyclability

We offer a broad range of resins, adhesives, specialties, and coatings that can enable more plastic packaging to be recycled. They allow us to work with you to design for recyclability right from the start, choosing materials that work together to create packaging that satisfies needs throughout its lifecycle.

Mechanical recycling

We're investing in product and application development. Looking for new options to improve the quality of recycle from flexible packaging defined by:

- Economics and speed
 - Regional infrastructure for plastic recycling
 - New markets
 - Partnerships that enable better understandings of PCR processes
- They're out there. Aren't you curious to see what we can discover?

Innovation & new business development

Exploring and evaluating new technologies such as chemical recycling and bio-based materials is important. And the possibilities are exciting.



Products & technologies

Existing polymers. Developmental products. Flexible and rigid components.

There are many options for polyethylene (PE) products that promote package recycling and offer sustainable advantages. Start with the few listed below. Plus, Dow technologies already enable greater recycling and reuse capabilities. There are more to come. Let's talk.

RecycleReady Technology offers the packaging value chain a sustainable, recyclable packaging system – a way to create flexible packaging that can be easily recycled through existing PE film recycle streams, such as grocery store drop-off programs.

Innovative resins for oriented films (TF-BOPE and MDO films) are unique products based on Dow's proprietary Solution Process offering outstanding physical properties and narrow gauge variation such as:

- Excellent toughness and optical properties
- Enhanced low-temperature resistance
- High stiffness

OPULUX™ Optical Finishes deliver matte and high gloss finishes, the latter with **OPULUX™ HGT Optical Finishes**. Both maintain excellent image clarity, good color retention, and physical properties. They can be coated on PE films to improve heat resistance for all-PE pouch converting while providing excellent matte and gloss appearance for noticeable shelf appeal.

EVERCAP™ Innovative Closure Resins provide distinct capabilities that allow the development of truly custom closures with unsurpassed levels of key attributes including ESCR/toughness and lightweighting, organoleptics, processability, and barrier protection.

ELITE™ AT (Advanced Technology) Polyethylene Resins offer the flexibility to tailor molecular weight distribution, short-chain branching distribution, and long-chain branching to match specific end-use requirements.

Our robust high-performance sealant portfolio – **AFFINITY™ Polyolefin Plastomers** and **SURYLN™ Ionomers** – helps to achieve hermetic seals for fully recyclable structures.

Incorporation of **post-consumer resin** in infrastructure, durables and package structures is on the rise. We work side-by-side and continue to push the envelope to expand their use in new applications.

Materials science advancements for **downgauging and lightweighting** isn't a new idea. We've been creating resins that make downgauging and lightweighting practical for decades. And we're not slowing down. Because it's more important today than ever before.

A diverse portfolio of **recycle enhancers** enables compatibilization of PE with EVOH, PP, PET, and nylon:

- **ELVALOY™ Copolymer Alloys** offer decades of proven performance in demanding soft polyvinyl chloride (PVC) applications by acting as non-migrating polymeric plasticizers that enhance softness, pliability, and long-term service.
- **FUSABOND™ Functional Polymers** help to improve compound performance.
- **INTUNE™ Olefin Block Copolymers** create value for a diverse range of markets and applications by:
 - Making multi-layer structures stronger via improved adhesion between layers of polypropylene and PE or
 - Enhancing polyolefin blends with improved polymer dispersion and adhesion at the interfaces
- **RETAIN™ Polymer Modifier** enables successful recycling of film barrier streams containing ethylene vinyl alcohol (EVOH) and/or nylon (PA) into new high-quality films. This helps create opportunities to meet sustainability goals aimed at reaching zero waste-to-landfill objectives.
- **VERSIFY™ Plastomers & Elastomers** offer a combination of excellent optics, sealing, and hot tack performance, plus elasticity, flexibility, softness, and compatibility in blends for film, fiber, injection molding, extrusion coating, soft compound, and sealant applications.

Table 1: Current recycling enhancement offerings

Recycle stream	Recycle enhancing technologies
PE / PP	INTUNE™ Olefin Block Copolymers
PE / PA	FUSABOND™ M603 Functional Polymer
	FUSABOND™ E226 Functional Polymer
	RETAIN™ Polymer Modifier
PE / EVOH or PA / EVOH / PE	RETAIN™ Polymer Modifier
	FUSABOND™ M603 Functional Polymer
EVOH or PA	FUSABOND™ E226 Functional Polymer
PP / PA or PP / EVOH	FUSABOND™ P353 Functional Polymer
	RETAIN™ Polymer Modifier
Polyesters / PE	ELVALOY™ PTW Copolymer Alloy
	ELVALOY™ AC 3427 Acrylate Copolymer

Success stories

Changing minds and changing the world. That's a big challenge! Are we all up to it? We're seeing success through initiatives and partnerships around the world. Plastics are being diverted from landfills. The ocean is getting cleaned. A circular economy is growing. A few of the success stories are shared here. There are many others. And with your help, we can write a few more.

Keeping hard-to-recycle plastic out of the environment

Dow initiated the "EnergyBag" pilot program in 2014. Today, in partnership with Reynolds Consumer Products, owners of the Hefty brand, the Hefty® EnergyBag® recovery program has successfully expanded. This program collects hard-to-recycle plastics from consumers at their curbsides and converts them into valuable resources, including energy, fuels, and other feedstocks.



Enabling non-recyclable materials to be recycled

Reducing the amount of trash that is diverted to landfills is a huge undertaking. With RecycleReady Technology, everything from dishwasher pods to dry cereal packaging can be recycled when placed in store-drop-off containers where existing PE-film recycling streams exist.

RECYCLE READY
TECHNOLOGY
for store drop-off recycling





Paving a new way

Plastic roads

Building and improving roads and infrastructure is critical in emerging, developing, and even fully developed regions. Dow is working with partners around the globe to construct polymer-modified asphalt roads with post-consumer recycled plastic. And it's working. There's even potential to improve certain roads. We're reducing the greenhouse gas emissions associated with traditional processes, too. Most of all, these projects are demonstrating that it is possible to divert plastic waste toward this unique and useful application.



Creating building blocks from recycled plastic

The Green Schools initiative

The Green Schools initiative addresses two important global issues: plastic waste in the environment and insufficient numbers of K-12 school buildings. In collaboration with the start-up and technology owner, Conceptos Plasticos, Dow is helping to build structures using self-assembling bricks made out of recycled plastic. This innovative process tackles both of these problems, while helping create a more circular economy. It encourages an efficient waste recovery process to decrease plastic contamination and increases public understanding of the potential for re-using plastic to retain its value.



Pack Studios

The global developmental resources of Pack Studios can further your packaging sustainability ambitions. As we design for recyclability, it is made easier with industry-scale fabrication equipment, filling lines, and physical and analytical testing capabilities to innovate, prototype, test, and accelerate new products to market. Let's see how our diverse portfolio of resins can address your specific packaging needs.



Meeting application needs

What types of packaging do you need?
What kind of sustainability endeavors are you undertaking? We'd like to help. The products and technologies listed here are applicable to virtually any flexible packaging structure:

- Stand-up pouches
- Form-fill-seal
- Thermoformed
- Spouted pouches
- Large-volume packaging

Are there others? Want to develop the latest benefits together?

Looking toward tomorrow

We have innovative ideas. We know the best results come from partnering with others as passionate as we are about improving tomorrow. Let's figure out ways to optimize sustainability efforts.

Changing the conversation

In the industry, conclusions like this are often referred to as the "call to action" or CTA. It's the last effort to prompt a call to your sales rep or visit the website. This time, we think it has to be broader – and more urgent. It's vital that we move toward a cleaner world. The first step is to change the conversation on global waste. To focus on keeping plastic out of the environment. And, to find ways to make plastic packaging help rather than hinder. Our world cannot wait.

We've presented many ideas here. We can't do it alone. We'd love for you to join us and make great, smart, sustainable packaging together. But even if you don't, we hope you'll get involved with someone in some other way. We all need to act. Responsibly. Sustainably. And like our future depends on it. Because it does.



About Dow

The Dow Chemical Company (Dow) combines science and technology knowledge to develop premier materials science solutions that are essential to human progress. Dow has one of the strongest and broadest toolkits in the industry, with robust technology, asset integration, scale, and competitive capabilities that enable it to address complex global issues. Dow's market-driven, industry-leading portfolio of advanced materials, industrial intermediates, and plastics businesses deliver a broad range of differentiated technology-based products and solutions for customers in high-growth markets such as packaging, infrastructure, and consumer care. More information can be found at www.dow.com.

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