Advanced Recycling

Remaking Plastics to Meet Sustainability Goals

Plastic makers are embracing sustainable change and a new way to make plastics.

Advanced recycling creates new top-quality plastics out of used plastics, reducing our reliance on natural resources and allowing us to remake "hard-to-recycle" plastics.

Plastic makers are embracing sustainable change and a new way to make plastics. Major plastic companies are revising their business models and production processes to take advantage of advanced recycling technologies. We're committed to recovering and remaking plastics again and again.

Who benefits? Everyone. Consumers eager to support sustainability. Companies that want to make packaging and products out of recycled materials. And the environment by relying on used plastics instead of natural resources.

Impact: Game Changer

What's the upshot of advanced plastics recycling? Plastics that once ended up in landfills and incinerators now can be remade and stay in productive use. Films, foams, pouches, tubes, and more can be remade and remain in our economy and out of our environment.

With proper support, these technologies can scale, potentially doubling the plastics recycling rate in the U.S. and Canada, according to the Closed Loop Fund.

Advancing the Circular Economy

EPA: "A circular economy… recaptures 'waste' as a resource to manufacture new materials and products." For plastics, that means recovering and reusing plastics as a resource for new plastics. Reuse – don't discard.

To achieve this, America's recycling infrastructure needs a refresh. We're doing a decent job recycling boxes, bottles, and cans, but it has been difficult to recover all the new types of lightweight plastic packaging, such as plastic film and pouches.

Advanced recycling technologies can change that… and create a new life cycle for used plastics.

A decade ago, technology providers set out to convert hard-to-recycle used plastics into fuel. Technologies and the world have changed since then. Some companies still use these technologies to create fuel, but that is considered recovery, not recycling.

Today, these technologies focus on creating a circular economy in which used plastics are remade into new plastics that can be remade again and again. These technologies help create high-quality plastics that can even be used in medical, pharmaceutical, and food applications – virtually any plastic product or packaging.

Innovative Technologies

Advanced recycling is a broad umbrella term – also called chemical recycling or molecular recycling – that refers to several different technologies that purify or break down plastic waste into its constituent building blocks, which can then be used to create new plastic products.

Three Common Advanced Recycling Technologies

Pyrolysis	Gasification	Depolymerization
Used plastics are heated in the absence of oxygen until thermally decomposed, then condensed into valuable materials.	Used plastics are heated in an oxygen-controlled atmosphere and converted into syngas that is then converted into valuable materials.	Used plastics are broken into smaller molecules (such as monomers) that can be used to make multiple valuable products. Includes solvolysis, methanolysis, and glycolysis technologies.

Not Incineration

Incineration refers to destroying waste materials by burning. During advanced recycling technologies such as pyrolysis, thermal energy (heat) is used in the absence of oxygen, so there is no combustion. This means plastics are not burned during advanced recycling. Instead, plastics are broken down into their building blocks to form new feedstocks for plastics and chemicals, waxes and other products.

As a manufacturing process, there is a business incentive in advanced recycling to preserve every molecule to reuse.

Combustion Needs Oxygen

Combustion oxidizes organic molecules and creates carbon dioxide, leaving no viable product.

Pyrolysis = No Oxygen

Pyrolysis breaks polymers into molecules of significantly shorter chain length or monomers, which are the building blocks of plastics.

Comparable/Reduced Air Emissions

Like other manufacturing, advanced recycling facilities are subject to the Clean Air Act and state and local authorities. They also need to obtain operating permits and continue to monitor and report various air emissions as they operate.

A review of air emissions from advanced recycling facilities that use pyrolysis found emissions to be about equal to or lower than those from similar facilities such as food or auto making and institutions such as hospitals and colleges. No measurable lead or dioxin emissions were identified. Advanced recycling facilities that use pyrolysis can operate efficiently under existing air quality regulations designed to protect the air we breathe.

Air Emissions
Review of Average-sized Pyrolysis Facility Compared to Familiar Facilities
VOCs (volatile organic compounds) ≈ small food processing facility
Particulates ≈ small food processing facility
SO_2 (sulfur dioxide) ≈ small hospital
NOx (nitrogen oxide) ≈ large university
CO (carbon monoxide) ≈ large car making facility

Who's Using It?

Advanced recycling produces virgin-quality plastic that is safe for food, medical, and pharmaceutical packaging, so it can be used in virtually any application where plastic is being used.

Building on their history of using traditional "mechanically" recycled plastics, many global brands have incorporated advanced or chemically recycled plastic into their products. Examples:

Estee Lauder

Nalgene and CamelBak water bottles

Tupperware

Wendy's drink cups

Warby Parker eyeglass frames

Herbal Essences shampoo/ conditioner bottles

Mattel playsets

Ethicon medical device packaging

Clothing brands such as Patagonia and Zara

Advanced Recycling
One of Our 5 Actions for Sustainable Change

1. **REQUIRE PLASTIC PACKAGING IN U.S. TO BE MADE FROM 30% RECYCLED PLASTICS BY 2030.**
2. **MODERNIZE REGULATIONS TO HELP QUICKLY SCALE ADVANCED RECYCLING AND ACCELERATE A CIRCULAR ECONOMY FOR PLASTICS**
3. **DEVELOP NATIONAL RECYCLING STANDARDS FOR PLASTICS**
4. **STUDY THE IMPACT OF GREENHOUSE GAS EMISSIONS FROM ALL MATERIALS TO GUIDE INFORMED POLICY**
5. **ESTABLISH AN EXTENDED PRODUCER RESPONSIBILITY SYSTEM**

In addition to investing in advanced recycling, America's plastic makers are calling on Congress to help accelerate progress toward a circular economy for plastics. Among other provisions, our 5 Actions for Sustainable Change calls for creating a modern regulatory system that enables rapid scaling of advanced recycling while continuing to grow mechanical recycling.

The other Actions would require plastic packaging to contain up to 30% recycled plastics by 2030, create national standards for plastics recycling, use scientific studies to compare the environmental footprint of materials, and raise private funding to update our recycling systems. We're working on both sides of the aisle in the House and Senate on this plan to accelerate a circular economy for plastics.

States Are Leading the Way

States are not waiting for federal policy on Action #2. Half the country has passed laws to regulate advanced recycling facilities as manufacturing – not solid waste facilities, as some states still do. These modernized regulations can help quickly scale advanced recycling and accelerate a circular economy for plastics.

ADVANCED RECYCLING CAN CUT WASTE AND CREATE VALUE.

Companies striving to meet sustainability goals will have access to a greater amount and array of recycled plastics.

Communities around the globe will be able to create value out of used plastics rather than discarding them, as these technologies become widely distributed.

Plastics that once were landfilled or littered can instead be remade to boost local economies, create jobs, and improve sustainability.

Why Is It "Advanced"?

- Creates virgin-quality plastic for food, medical, and pharmaceutical packaging applications.
- Can recycle hard-to-recycle and mixed plastics.
- Limits our use of natural resources to create new plastic.
- Transitions plastic manufacturing from a linear model to a circular model.
- Helps recycle more of the 90% of plastics that aren't recycled today.