

# Edison Explains



## Plastic recycling

**How are companies innovating plastic recycling in the face of the environmental movement?**



### How much plastic is recycled?

The EU puts global plastic production at 322 million tons (mt) for 2015, a 20-fold increase

from the 1960s, and is expected to double over the next 20 years. The EU is the second-largest global plastics producer, with a 20% market share compared to 26% for China. However, over the past few years Europe has held plastic production flat at c 60mt.

Europe is nevertheless a leader in plastic recycling and the EU recycled 41% of its 16.7mt of plastic packaging in 2016, [according to the European Association of Plastics and Recycling](#). The EU's overall plastic recycling rate is c 30%.

The US, by comparison, recycled 9.1% of its plastics in 2015, according to the EPA. However, [the recycling rate of the US is likely to fall](#) following China's National Sword policy and the restrictions it places on the import of waste.

### What is the legislative landscape of plastic recycling?

In recent years many developed countries have shipped their plastic abroad for recycling. However, China recently placed curbs (with effect from January 2018) on 24 grades of solid waste deemed low quality (including plastics). This policy change will restrict the amount of plastic that the US sends to China. Between 1988 and 2016 the US sent [26.7mt](#) of plastic to China.

The US recycling environment is not helped by a lack of federal oversight, a result of the [1965 Solid Waste Disposal Act's](#) refusal to mention recycling, leaving states to decide how much plastic is recycled in their constituencies has varied results.

The European Commission recently proposed new rules on waste management. It has set a target of reducing the amount of solid waste sent to landfill to 5% of total waste by 2030, reinforcing the need for plastic recycling.

More ambitiously, the EU recently set out a vision in its *Strategy for Plastics in a Circular Economy* that could result in a 50% recycling rate for plastics by 2030. This move would require a fourfold increase in recycling capacity by 2025, creating 200,000 new jobs.

### Why should we recycle plastics?

Although a significant share of plastic waste arising in the EU is sent abroad for recycling, where lower environmental standards commonly apply, 8mt of plastics are sent to landfill in Europe every year.

Most of these plastics are non-biodegradable, and will take up to 200–300 years to disappear. The plastics that do degrade can leech harmful chemicals into the ground, damaging local environments.

In addition, 9mt of plastic waste is dumped into seas and oceans every year. Here, exposure to salt and sun creates 'microplastics', which find their way into the ecosystem and the fish we eat.

The plastics that are not landfilled or recycled are incinerated. It is estimated that the production and incineration of plastic releases 400mt of CO<sub>2</sub> a year, according to the EU.

The plastics in landfill also contribute to greenhouse emissions, releasing methane as they degrade, or are broken down by CO<sub>2</sub>-generating bacteria.

### Which plastics are particularly harmful?

Not all plastics are equally harmful to the environment and some are easier to recycle than others.

One of the worst offenders, polyvinyl chloride (PVC), is used to make vinyl, among other things, including soft PVC used in construction. It can leech a variety of chemicals including carcinogens.

PVC ranks fourth in the [Toxic Substances and Disease Registry Substance Priority List](#), just below mercury. Because of its

#### Edison's insight:

"Current thermomechanical processes are limited by a number of factors, including the diminished quality of the recycled material and the sensitivity to contamination by other polymers and external impurities. These difficulties restrict the reuse of recycled plastics for their original purposes." Graeme Moyse, Industrial's director

weak safety profile, PVC is hard to recycle.

Polystyrene, for its part, can leach styrene and benzene, a toxin and carcinogen, when subjected to heat. It is also notoriously difficult to recycle.

Polyethylene terephthalate (PET) is one of the most commonly used polymers, and is used to produce bottles and packaging. When subjected to high temperatures, it can leach antimony, but it remains stable in cold climates. It is fortunately the most recycled plastic worldwide.

According to the PET Resin Association, the US recycles 31% of its PET. In the EU the rate is even higher at 52%.

On the safer side of the spectrum are high- and low-density polyethylene (HDPE and LDPE). LDPE is commonly used in shopping bags and thin film plastics, LDPE tends not to leach chemicals but is not biodegradable and not particularly easy to recycle. Another relatively safe plastic is polypropylene, which is commonly used in food containers due to its heat-resistant properties and is easily recyclable.

More recently, bioplastics made from renewable resources such as corn starch and cane sugar have entered the field. These plastics are fully biodegradable but not widely produced. Plastics Insight put the global production capacity of bioplastics at 2.05mt in 2017.

## How are companies innovating plastic recycling?

Carbios, [the French plastic recycling enzyme developer](#), has achieved enzymatic hydrolysis of PET plastics at 97% in only 16 hours. This biological process can recycle all kind of PET plastics back into virgin material and creates a circular production and disposal process. The company has teamed up with L'Oréal and is already scaling up the technology with TechnipFMC.

Elsewhere, Holland based-Ioniqa is building its first upcycling factory and developing a technology that can recycle PET back into virgin grade material. The company has partnered with Unilever and Indorama on its PET project.

Another project patronised by Unilever, the CreaSolv Process, is a new technology from the Fraunhofer Institute for Process Engineering and Packaging. The process hopes to recycle plastic multi-layer sachets used for small amounts of liquid or powder. These sachets, commonly produced for developing markets, have so far been an elusive target for recycling plants.

Loop Industries has teamed up with Evian in the development of its plastic recycling catalyst, which the company hopes will break down PET plastic without the need for heat or pressure.