



## TECH 2022S11: Advances in Mechanical Recycling of Plastics

Advances in Mechanical Recycling of Plastics is one in a series of reports published as part of NexantECA's 2022 Technoeconomics – Energy & Chemicals (TECH) program.

### Overview

Mechanical recycling is the most common method of recycling worldwide since it is very effective and environmentally friendly (when compared to virgin plastic production, landfilling, or incineration).

While applications have become more demanding, and more advanced recycling methods are needed, mechanical recycling will continue to be an important part of plastic recycling. Machine manufacturers continue to focus on decontamination technologies for food-contact plastics that enable the offering of bottle-to-bottle recycling processes. The expected contribution of mechanical recycling in the global waste management sector is expected to rise, which will help to reduce the amount of plastics that is landfilled.

This TECH report provides an updated overview of the technological, economic, and global outlook for mechanically recycled polyethylene terephthalate (PET), high density polyethylene (HDPE) and polypropylene (PP) produced from scrap bottles. The following issues are addressed in this report:

- What are the benefits and limitations of mechanical recycling?
- What are some of legislation and regulations that are being established by governments around the world that encourage recycling methods (including mechanical)?
- Who are the main machine manufacturers that offer mechanical bottle-to-bottle technologies?
- How do the economics of producing pellets from recycled flakes compare across different geographic regions?
- What are expected recycling rates for the various plastics studied in the report?

### Commercial Technologies

A superclean (physical) route can be used to recycle PET, HDPE, and PP in applications that come in direct contact with food. This route involves the use of mechanical and non-mechanical procedures to remove contaminants in scrap material.

To use rPET, rHPE, and rPP in food packaging applications, the recycling physical processes need to be

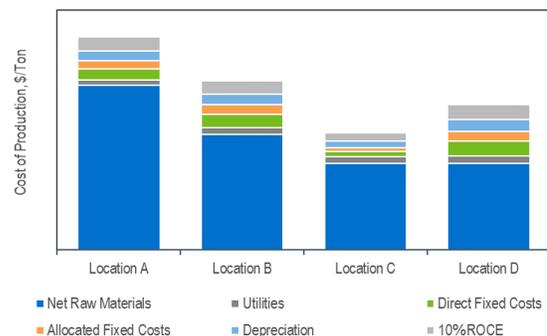
approved by the United States' FDA and the European Union's EFSA. Several processes have been granted approvals in recent years.

This report examines the main commercial processes for mechanically recycling polyethylene terephthalate, high density polyethylene, and polypropylene. Profiles of the main companies that offer mechanical recycling equipment for bottle-to-bottle processes are also included.

### Process Economics

Detailed cost estimates are presented to produce recycled flakes and corresponding pellets from scrap material, at China, Japan, USGC, and Western Europe locations. Estimates are developed for PET, HDPE, and PP on a full year 2021 price basis scenario. Sensitivity analyses on feed scrap pricing are also included.

#### Recycled PET Flakes Production Costs



### Commercial Overview

Global plastics recycling was disrupted in 2018 when China implemented a ban on waste plastics entering the country effective January 1, 2018. Prior to that, China had been importing more than half of the world's plastic waste.

In 2021, the world consumed an estimated 8.7 million tons of rPET, representing a recycling rate of 31 percent. At the same time, worldwide consumption rHDPE and rPP were estimated at 4.3 million tons and 3.8 million tons, respectively. The global recycling rate for rHDPE was about 8 percent while the global recycling rate for rPP was less than 5 percent during 2021.

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