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Technology and Costs

TECH 2023S11: Packaging Design for Recyclability and Cost

Packaging Design for Recyclability is one in a series of reports published as part of NexantECA's 2023 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The reality of nearly half of plastic products becoming waste after a single use urges the packaging sector to address climate change, mitigate plastic pollution, and minimize packaging waste. Although plastic's durability, lightweight nature, and versatility make it indispensable across sectors like consumer packaging and healthcare, its annual consumption presents a significant environmental challenge, with only 10 percent of global plastic waste being recycled. The packaging sector employs a diverse array of materials including plastics, metal, glass, and aluminum. While plastics typically demonstrate a lower Global Warming Potential relative to other materials, they present a pressing waste management challenge that stands as a paramount concern.

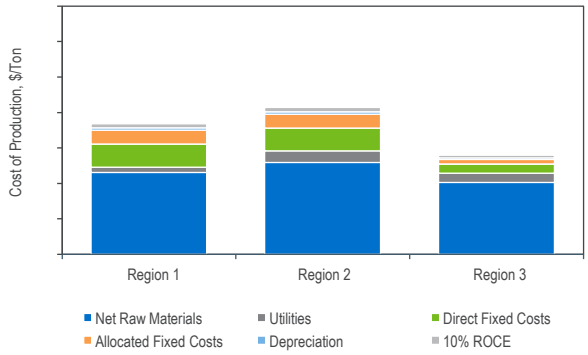
Commercial Technologies

The report's economic analysis on packaging design for recyclability delves into the mechanics and finances of blown film extrusion, cast film extrusion, bi-axially oriented film extrusion, and thermoforming across three key regions: the United States Gulf Coast (USGC), Western Europe, and China, referencing Q2 2023 pricing data. The global plastics packaging sector heavily relies on these processes due to the pervasive role the products play in countless consumer goods.

Process Economics

For example, Mono-layer Polyethylene Form-Fill-Seal Blown Film, a key material in global packaging particularly within the food and beverage sector, is favored for its lightweight and superior moisture-barrier properties. While it holds promise for recyclability, actual recycling rates diverge based on regional collection infrastructures and contamination hurdles. In terms of production cost efficiency, certain regions lead, impacted by environmental regulations, energy, raw material, and labor costs, all of which contribute to the broader economic and sustainability considerations in the packaging industry.

Cost of Production Summary for Mono-Layer Polyethylene -Form-Fill Seal Blown Film (Single Layer)
(Second Quarter 2023)



Carbon Intensity

The report explores the carbon intensity of blown film extrusion, cast film extrusion, bi-axially oriented film extrusion, and thermoforming in the United States, Western Europe, and China, highlighting the carbon intensity in tons of CO_2 equivalent per ton of produced material. The analysis centres around Scope 2 emissions, which are emissions from purchased electricity crucial for these technologies. The high electricity consumption, especially in heating and cooling operations, largely shape the carbon emission footprint in these processes.

Outlook

The report delves into the fundamentals of the recycling value chain for both mechanical and chemical recycling, analyzing recyclable contents beyond plastic as well, such as aluminium, corrugated cardboard, mixed paper, and glass. It explores various factors affecting the recyclability of plastic packaging, such as color, ease of separation, closures, dispensers, attachments, product composition including additives, and ease of emptying. The report examines the hurdles to achieving effective recyclable packaging, discussing technological limitations, regulatory factors, and material availability, and discusses the dynamics of policy, global harmonization, and Extended Producer Responsibility (EPR) schemes. The report also analyses various polymer types and their suitability for recycling.

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- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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