The Economics of Low-Carbon PE – Will Consumers pay for Sustainability?

Chemical Strategic Report Brochure

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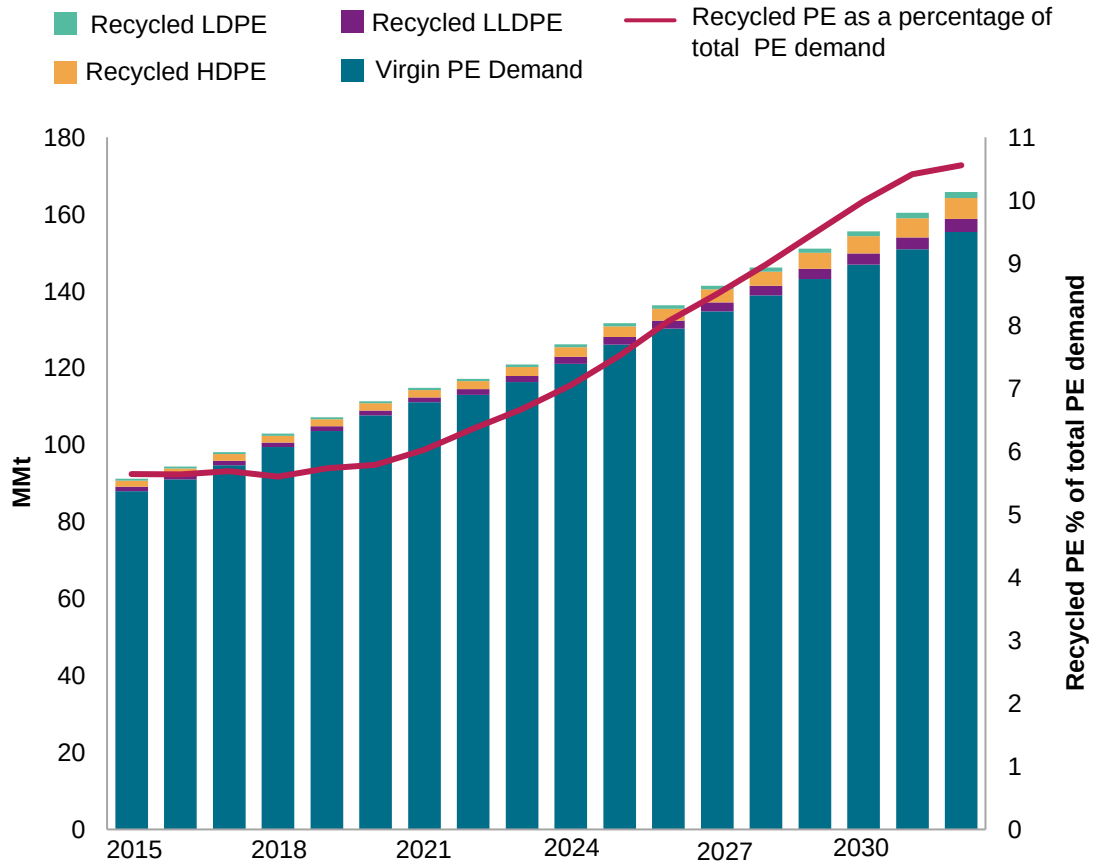
S&P Global
Commodity Insights

Polyethylene is one of the world's major thermoplastics

- Global commodity polymer consumption is expected to surpass 500 million metric tons before 2030.
- Polyethylene (PE) accounts for more than one third of global polymer consumption
- Relative to other global polymers, low cost, versatility, and weatherability are the major advantages for polyethylene.
- Recycled PE continues to grow, volumes becoming relevant, particularly in HDPE.

Global virgin and recycled PE demand estimates

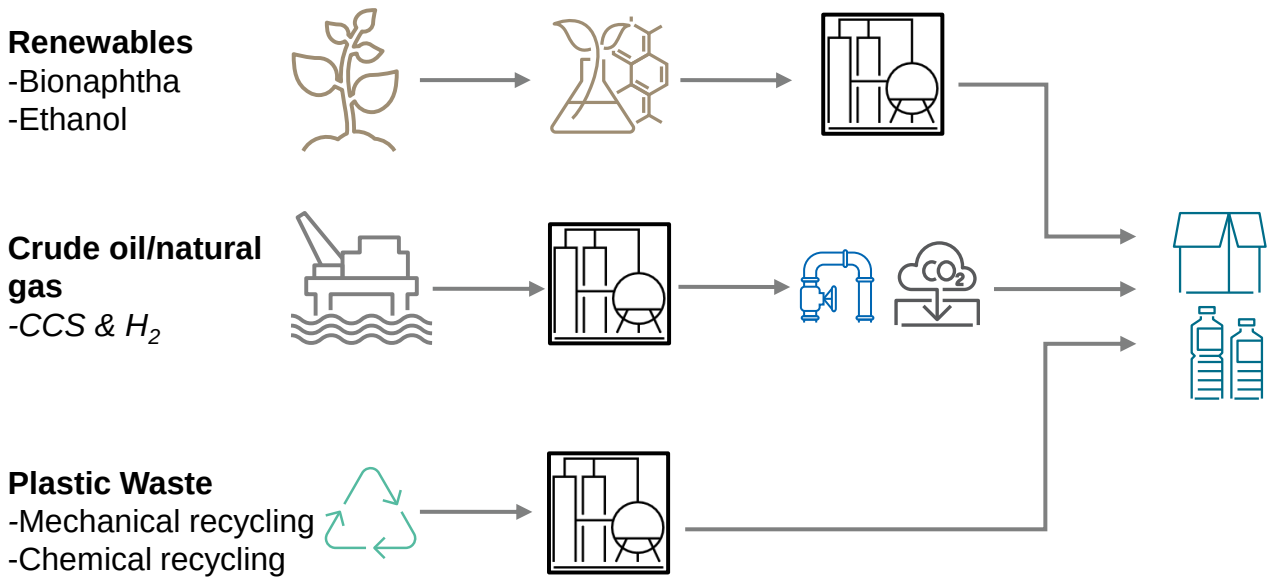


Data compiled March 2023.
Source: S&P Global Commodity Insights.

Pressure has picked up on the industry to mitigate the negative impact of plastic (including PE) consumption on the environment

- Problems of plastics waste, emissions and climate/environmental issues are likely to ~~get worse~~ worsen before policy and action begin to turn the tide. The trilemma of security, sustainability and affordability is at the forefront.
- Governments will play a larger role, including incentives and regulations such as the Inflation Reduction Act (IRA), carbon tax, extended producer responsibility (EPR) and bans on single-use plastics.
  - Conventional ethane crackers emit 0.85-1.2 metric tons of CO_2/metric ton ethylene. Strategies to trim carbon emissions include
    - electrification
    - sustainable fuels: biomethane or hydrogen
    - carbon capture utilization and storage (CCUS)
    - sustainable feedstocks: bioethanol or bionaphtha
    - production from plastic waste recycling

PE pathways covered in the report



Ethylene production is one of the largest CO_2 emitters in the chemicals industry

Source: S&P Global Commodity Insights.

Sustainability goals by brand owners, converters, and producers are currently driving efforts to produce low carbon polyethylene

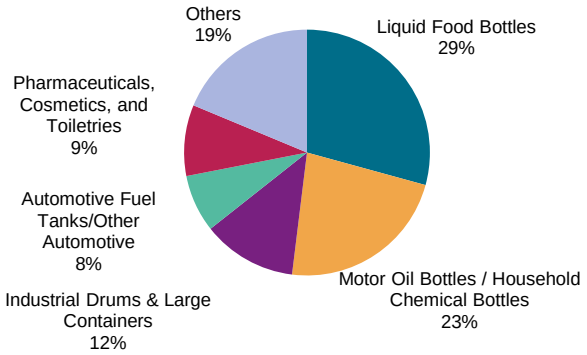
- Will feedstocks' supplies be limited in the future?
- What is the carbon intensity of these new technologies?
- What role will governments' incentives and regulations have in the economics?
- What premiums will be required?
  Who will pay?

	Brand owners	Polymer producers
	11 companies >10 MMt of plastic consumption	8 companies >50 MMt of commodity plastic capacity
Objective 1	**Increase recycled content** Current: ~ 1 metric ton 2025: >2 metric tons 2030: >4 metric tons	**Increase recycled/renewable plastic offering** Current: ~ 0.5 metric tons 2025: 2-3 metric tons 2030: > 12 metric tons
Objective 2	**Reduce virgin (fossil) plastic consumption** 2025: 15%-20% 2030: 35%-40%	**Reduce GHG emissions** Focus on scope 1 and 2 Occasionally, scope 3 reduction

Will consumers be willing to pay a price premium?

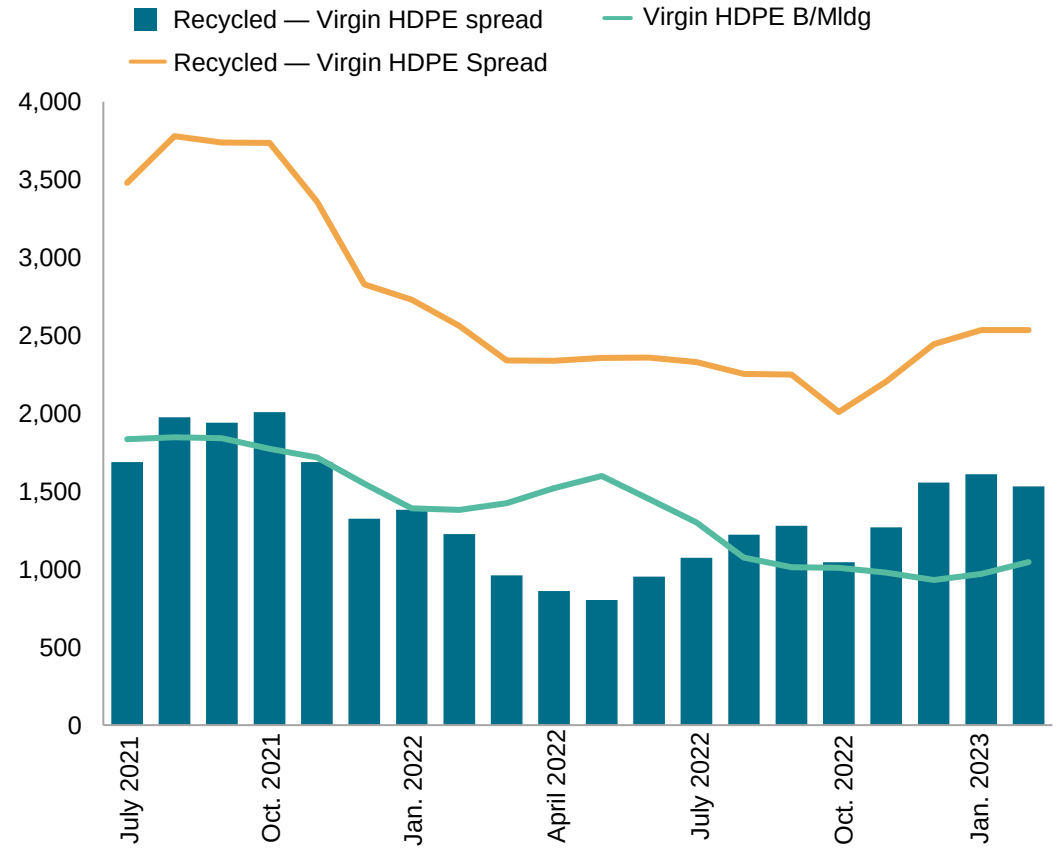
- Debate continues as to whether polyethylene markets would be able to absorb a price premium from new, higher cost production technologies and who should pay.
- For example, recycle HDPE (natural pellets) resin has been holding a substantial premium over virgin since before COVID-19.
  - Driving this premium is high demand due to brand owner sustainability targets and for compliance
  - Blow molding applications remain the largest end use segment for HDPE in North America, but the market is large and fragmented

North America Key HDPE Blow Molding Products, 2022



Source: American Chemistry Council (ACC)/PIPs

US virgin versus recycled HDPE prices ($/t)



Data compiled March 2023.
Source: S&P Global Commodity Insights.

This study analyzes different costs of producing low carbon PE, calculates the IRRs for each technology modeled, determines price premiums and willingness to pay them for low carbon PE across the entire value chain

Selected high-level tasks

1 Set baseline assumptions

- Focus on the United States, Canada and Brazil.
- Gather S&P Global 2050 long-term outlook for energy and feedstocks.
- Evaluate relevant regulations and incentives that can support incentives and encourage investments.
- Analyze converters, brand owners and producers' commitments.

2 Evaluate range of integrated costs at expected IRR assumptions

- Ethane-based HDPE
- Low-carbon HDPE
  - Ethane-based with hydrogen as cracking fuel and carbon capture sequestration
- Recycle HDPE via
  - mechanical
  - advanced (i.e., pyrolysis from mixed feed)
- Green HDPE via
  - bioethanol
  - bionaphtha

3 Fieldwork with industry participants

- Interviews with converters in North America.
  - Commitments to carbon neutrality or other sustainability goals
  - Willingness to pay a price premium for low-carbon PE
  - Factors that lead differentiation between green/recycle/low-carbon PE
  - Market segments most likely to sustain price premiums

4 Assess future low-carbon premiums

- Discussion of companies' sustainability goals.
- Assessment of price premium markets (recycle, green, others).
- Calculate the range of potential price premiums based on
  - costs and return on investment
  - market segmentation
- Forecast expected price premiums to range to 2050

5 Price premium implications

- Analyze how price premiums could be developed.
- Understand barriers and timing of adoption of price premiums.
- Determine drivers and constraints that impact potential price premiums.

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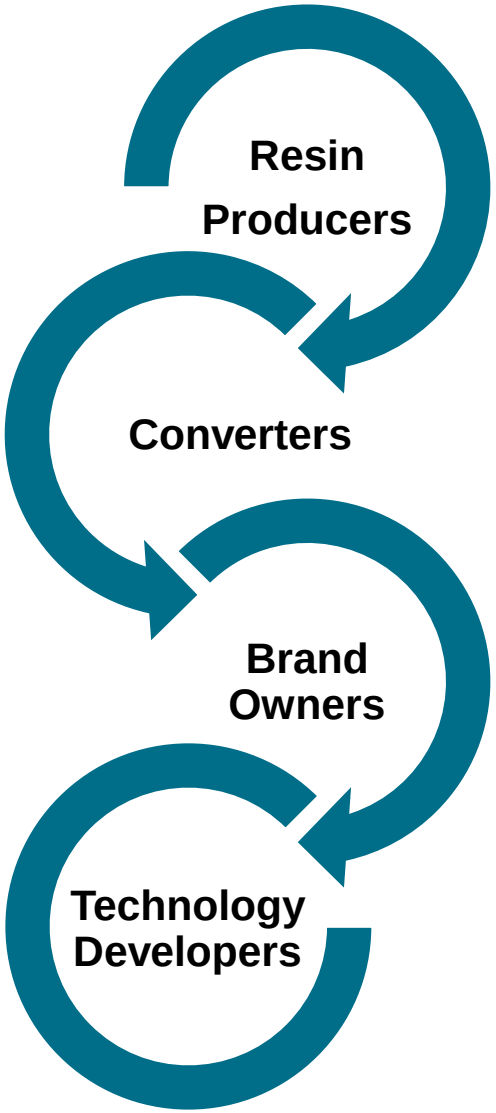
Irrespective of your place in the value chain, this report offers an insightful analysis on whether polyethylene markets would be able to absorb a price premium for new production technologies



Provides cost of production analyses for different technologies to produce low carbon polyethylene, leveraging our expertise and data.

Discusses willingness to pay price premiums for low carbon polyethylene. Identifies main sensitivities impacting potential price premiums.

Determines market segments most likely to sustain price premiums based on fieldwork conducted throughout the development of the study.

Compares internal rate of returns for each technology modeled in this study. Evaluates the impact of regulations and incentives. Offers insights on carbon intensity of the technologies.

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