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Technology and Costs

TECH 2023-3: Propylene

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

Overview

Due to the increasing value of chemicals, improvement in fuel efficiencies and decarbonization or electrification of the transportation sector have reduced demand for gasoline. This has prompted FCC units to shift operations to increase propylene yields and maximize profits.

Sustainability concerns and pledges of carbon neutrality have also increased decarbonization initiatives, with significant activities related to the conversion of plastic wastes for producing propylene, improve circularity and reduce carbon emissions.

The report covers both commercial and developing technologies for producing propylene and addresses questions related to the above developments, such as:

- What has been done to improve the propylene yields from FCC units and are the improvements an economically viable solution?
- What are the challenges and technologies to use pyrolysis oil from the thermal processing of plastic wastes as drop-in feedstocks?
- Which companies are developing decarbonization solutions?
- What are the costs required to capture a ton of carbon dioxide if FCCs are integrated with carbon capture and storage (CCS) systems?

Commercial Technologies

The report has the process descriptions, cost of production models for byproduct propylene production technologies:

- Steam cracking of naphtha
- Vacuum gas oil-based processes that include conventional FCC units, deep catalytic crackers (DCC) and high-severity FCCs (HSFCC).
- Atmospheric residue-based processes that include high-severity FCCs (HSFCC), residual to propylene (R2P), and HSFCC integrated with the FlexEne technology (HSFCC+FlexEne^{TM})
- FCCs coupled with CCS units

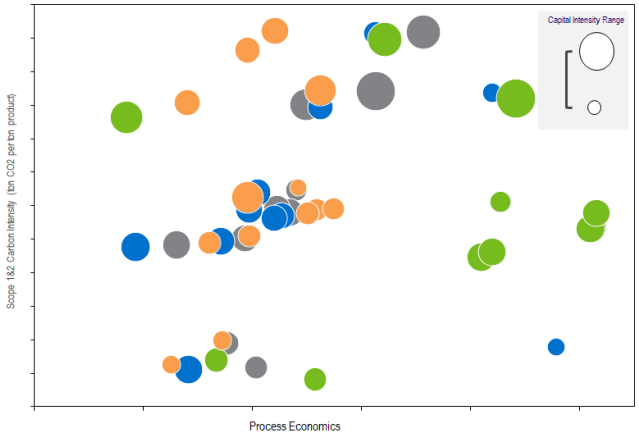
For on-purpose propylene production technologies:

- Refinery grade propylene fractionation
- Propane dehydrogenation
- Metathesis
- Methanol-to-olefins (for China only)
- Methanol-to-propylene (for China only)

Process Economics

The report analyses the cost of production for different technologies by region based on Q2 2023 pricing basis. For FCCs that are integrated with CCS systems, the breakeven carbon price is determined and compared to the current market carbon prices or credits. The process economics for each technology and region are mapped to the carbon and capital intensities to determine the cost required for decarbonization.

Example of Carbon Intensity Correlated to Production Economics for Different Technologies and Regions



Commercial Overview

Propylene is consumed for production of polypropylene, oxo alcohols, propylene oxide, cumene, methyl methacrylate, isopropyl alcohol/acetone, acrylonitrile, acrolein/acrylic acid and allyl chloride/epichlorohydrin. A complete global capacity list by producer and global cost curve are also provided in this report.

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Subscribe to TECH

The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging technologies of interest to the energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- Process Technology:
- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- 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
- Regulatory and environmental issues where relevant

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- Cost of production tables in spreadsheet format
- Consultation time with the project team

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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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