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Technology and Costs

TECH 2018S3: Olefins via Enhanced FCC Processes

Olefins via Enhanced FCC Processes is one in a series of reports published as part of Nexant's 2018 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The Fluidized Catalytic Cracking (FCC) unit is the main conversion unit in complex refineries around the globe. Traditionally termed the "workhorse" of the refinery, FCC units play a key role in allowing for society to meet its gasoline demands, upgrading low value bottom of the barrel components of crude oil to high value transportation fuels. However, as fuel efficiencies increase globally, electric vehicles increase in market penetration, and diesel demand from developing countries continues to grow, many have questioned the future role of the FCC unit.

This report examines the FCC unit and its great potential for supporting future petrochemical demand globally. While refined fuel demand may decrease, petrochemical demand is expected to increase dramatically over the coming decades. The future FCC unit may be a workhorse for supporting the global chemicals economy as it produces large amounts of valuable olefins. The report specifically focuses on propylene production as it is currently the highest value stream in the FCC product slate and has experienced supply constraints through traditional production processes.

In this report, we address the following:

- Which technologies, equipment, and operating conditions may be implemented in order to construct an FCC unit with the potential for maximum propylene production? How do economics compare across technologies and in comparison to traditional FCC's with maximum gasoline production?
- How may the FCC of the future be integrated into the greater refinery and into a joint refining-petrochemical complex? What synergies may be realized by such an implementation? How may one view the future role of the FCC unit globally in terms of fuels and petrochemicals production?

Commercial Technologies

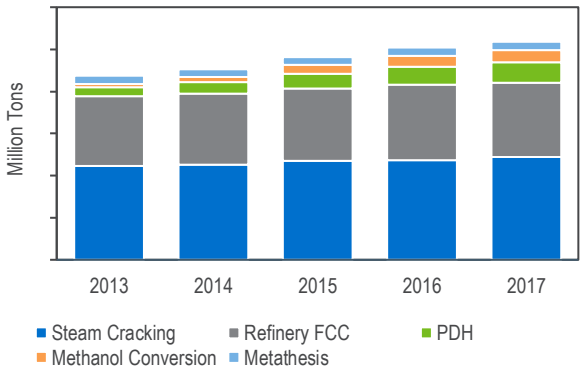
FCC units typically operate with a traditional refining structure aimed at converting low value vacuum gas oils into high value high octane gasoline blendstock. Most refineries exhibit some forms of integration with petrochemicals units but such integration is typically limited. FCC units are still traditionally viewed as "gasoline machines". Several commercial technologies exist to capture the value of an FCC unit for its great potential for olefins production. Such an FCC may be integrated fully with petrochemical units and may function as an upstream unit providing feedstock to petrochemical units in an integrated complex.

Major technologies covered in this report include those developed or licensed by TechnipFMC, Axens, Lummus Technology, Indian Oil, Sinopec, UOP, and KBR. These technologies vary considerably from one another and from traditional FCC design and operation as various strategies are employed in order to upgrade FCC feed into valuable olefin production. Modifications to riser operating temperature envelope, catalyst flow configuration, recycle streams, catalyst to oil ratio, catalyst formulation, and riser contact time are explored.

Process Economics

Cost of Production estimates and Returns on Capital Employed are provided for each technology analyzed. The report examines the economic effects of processing hydrotreated vacuum gas oil feedstock versus hydrotreated residue and also examines economics across the United States Gulf Coast, the Middle East, and Coastal China.

Global Total Propylene Production by Process



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The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging 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
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- Chemistry
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- 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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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program (formerly known as PERP), the Biorenewable Insights program (BI), the Sector Technology Analysis, 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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