Nexant

Technology and Costs



TECH 2019S5: Maximizing Petrochemical Production from Refineries

Maximizing Petrochemical Production from Refineries is one in a series of reports published as part of Nexant's 2019 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Historically, refineries have been oriented towards production of fuels, with chemicals yields from 5 to 20 percent. However, in light of growing consensus around "peak oil" demand and significant expected growth in chemicals demand, refiners have sought to maximize profitability by obtaining higher yields of chemicals and thereby balance supply/demand dynamics between fuels and chemicals.

Crude oil to chemicals (COTC) represents this major shift in the degree of refinery-petrochemical integration and focuses on employing technologies which maximize the yield of olefins and aromatics from crude oil. New refineries currently being built are configured to achieve chemicals yields of 40 to 50 percent, while companies like Saudi Aramco are pursuing new technologies to increase chemicals yield to 70 to 80 percent.

This TECH report focuses on the approaches used by COTC developers to achieve petrochemical yields of 40-50 percent since commercially proven technologies are not currently available to obtain yields of 70-80 percent. The following issues are addressed in this report:

- What are the different technology options available? Who are the technology holders?
- How are these technology options integrated together in a COTC complex?
- How do the economics for COTC complexes compare with traditional refinery/petrochemical complexes?
- What is the supply impact of COTC projects on the refining and petrochemical industries?

Commercial Technologies

COTC complexes currently being built to achieve chemicals yields of 40 to 50 percent are doing so through reconfiguring existing bottom-of-the-barrel refinery technologies which are commercially proven and readily available from several licensors. These projects generally involve the following approaches, amongst others:

 High level of residue upgrading through residue hydrocracking, delayed coking, etc.

- Full conversion hydrocracking of vacuum gasoil and atmospheric gasoil to produce naphtha, while minimizing production of middle distillates
- Fluidized catalytic cracking with high olefins yields

Process Economics

To compare the return on capital (ROCE) for COTC complexes versus refinery/petrochemical complexes with chemicals yields from 5 to 20 percent ("traditional"), Nexant has prepared 4 different configurations, which broadly resemble world-scale refineries currently operational or in the construction phase. Process economics are prepared for China and the Middle East, since most developments are focused in these regions.



ROCE Analysis for Different Cases

Commercial Overview

The potential petrochemical production from a world-scale COTC facility is significantly higher than a traditional refinery/petrochemicals complex, which can have severe implications for the number of "conventional" petrochemical plants being built. This report discusses the implications of the COTC projects on current producers of ethylene and *para*-xylene.

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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
- 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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- PDF reports including detailed technology analyses, process economics, as well as commercial overviews and industry trends
- 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 (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.

Nexant serves its clients from over 30 offices located throughout the Americas, Europe, the Middle East, Africa and Asia.

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