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.

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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