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Technology and Costs

TECH 2018-1: Ethylene

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

Overview

Ethylene is the most widely used olefin building block for petrochemicals and their derivatives. It serves as a key starting material for products in industrial and consumer markets such as packaging, transportation, electronics, textiles and construction. Historically, nearly all ethylene was produced by thermally cracking hydrocarbons in the presence of steam, relying on hydrocarbon feedstocks ranging from light gases like ethane to heavy liquids such as naphtha and gas oil. Then in 2010, the first methanol to olefins plant started up in China that produced ethylene from coal-based methanol. Since then, MTO has exhibited tremendous growth with about half of new ethylene capacity additions in China based on MTO technology. Oxidative coupling of methane is a developing technology that is now also on the verge of commercialization, but can it compete with steam cracking and MTO? This TECH report provides an overview of the commercial and developing technologies for producing ethylene and addresses:

- What are the major production technologies for ethylene and how do they differ? Is the technology available and who are the technology holders and licensors?
- How do different feedstocks impact the design of an ethylene plant?
- Are certain feedstocks or processes more competitive than others and how do the economics of producing ethylene change across different geographic regions?
- What is the market environment for ethylene like today?

Commercial Technologies

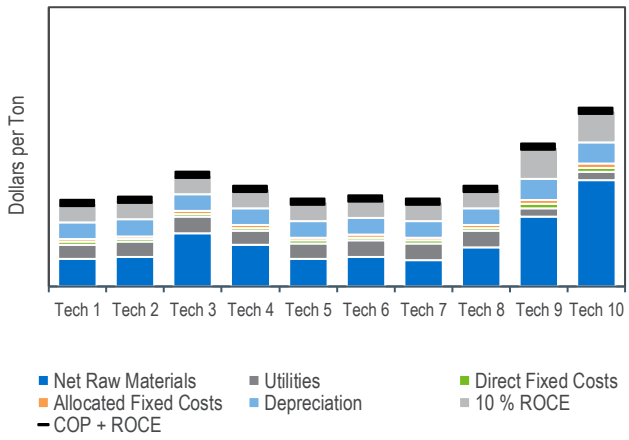
Steam cracking is the dominant production route for ethylene, accounting for nearly 97 percent of global ethylene capacity in 2017. The process converts saturated and long-chain hydrocarbons into shorter chain paraffins, olefins, and hydrogen. Steam cracking plants can generally be divided into two sections: the heating and quench section or "hot end", and the compression and separations section or "cold end" with the complexity of each end of the plant dependent on the hydrocarbon feedstock. MTO technology converts methanol feedstock primarily to ethylene and propylene. Methanol can be supplied from the merchant market or can be produced from coal gasification integrated with methanol synthesis.

An overview of the steam cracking process and MTO process are described, as well as technology developed by KBR, Linde, McDermott Lummus Technology, TechnipFMC, and Honeywell UOP. Siluria's OCM process, while not yet commercial, is also analyzed in this report.

Process Economics

Detailed cost of production estimates for various technologies are presented for USGC, Middle East, China, and Western Europe locations. Estimates are developed based on steam cracking feedstocks ranging from ethane to gas oil, MTO, bioethanol dehydration, and OCM.

Ethylene Production Technology Comparisons



Commercial Overview

Global ethylene consumption in 2017 reached 152 million tons. Polyethylene continues to lead demand for ethylene with this derivative segment accounting for 62 percent of consumption. Going forward, average annual demand for ethylene is expected to grow at almost four percent through 2022. An overview of the supply, demand, and trade of ethylene on a global and regional (North America, Middle East, Western Europe, and Asia Pacific) basis is provided in this TECH report.

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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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