



TECH 2023-1: Ethylene

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

Overview

Sustainability has become increasingly important in the chemical and energy industries in recent years. Driven by pledges of carbon neutrality (mainly by 2050, the timeframe for constraining global temperature rise to 1.5 to 2.0 degrees Celsius), the chemical industry is searching for options to reduce the carbon intensity of their products.

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. As such, understanding the options for ethylene decarbonization has far reaching impacts in the broader petrochemical industry.

This TECH report provides an overview of the commercial and developing technologies for producing ethylene and includes coverage of conventional processes and sustainable and developing technologies to achieve low or net-zero emissions for ethylene production, and addresses questions such as:

- What are the major production technologies for ethylene and how do they differ? Who are the technology holders and licensors?
- What are the on-going and upcoming decarbonization projects by the major ethylene producers and technology licensors?
- What are the possible near, medium- and long-term options for decarbonization? What are the working principles of these technologies and how do they reduce the carbon intensity?
- What are the benefits, challenges, and constraints of the respective technologies? Why do these challenges remain? How can they be addressed?
- What is the resulting technology readiness level (TRL) of the decarbonization options?

Commercial Technologies

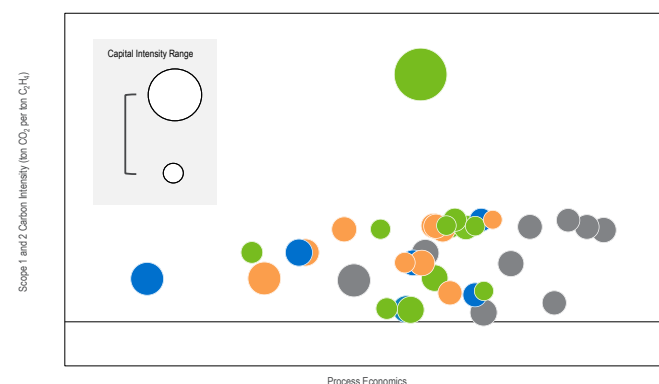
Included in the report are process descriptions, cost of production models for steam cracking of natural gas liquids, heavy liquids and a mixture of several feedstocks (i.e., ethane with propane, naphtha with

ethane). Decarbonization technologies are also discussed, especially if these technologies reduce the carbon intensities significantly. Also included are other commercial non-steam cracking technologies such as coal-based methanol-to-olefins and merchant-methanol based methanol-to-olefins (MTO).

Process Economics

The report provides detailed cost of production estimates for different ethylene production technologies by region (U.S. Gulf Coast, Western Europe, Middle East, and China) based on Q1 2023 pricing. Economics for representative crackers that are integrated with carbon capture systems are also presented. The process economics for these decarbonization cases are mapped against carbon intensity and capital intensity to understand the cost of decarbonization.

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



Commercial Overview

Global ethylene capacity was estimated at 223 million tons per year in 2022. Ethylene is mainly consumed for the commercial production of polyethylene for packaging, carrier bags, trash liners. A complete global capacity list by producer and global cost curve are also provided in this report.

For more information. please contact
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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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- 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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