



# TECH Report 2018-6: Styrene/Ethylbenzene

**Styrene Monomer/Ethylbenzene (SM/EB) is one in a series of reports published as part of Nexant's 2018 Technoeconomics – Energy & Chemicals (TECH) program.**

## Overview

Styrene monomer is used in a broad range of polymer derivatives, ranging from commodity polymers to engineering plastics and synthetic rubber, namely polystyrene, expandable polystyrene (EPS), acrylonitrile butadiene styrene (ABS), styrene acrylonitrile (SAN), styrene butadiene rubber (SBR), styrene butadiene latex (SBL), and other copolymer resins.

This TECH report provides an updated overview of the technological, economic, and market aspects of styrene and its precursor ethylbenzene. The following issues are addressed in this report:

- What are the major technologies for styrene and ethylbenzene production? How do the technologies differ? Which technologies are available for license?
- How do the process economics compare across processes and different geographic regions?
- What is the current market environment for styrene? How does growth compare in different regions? Where will new capacity be added?

## Commercial Technologies

Two main processes are used for the production of styrene. The conventional technology employs catalyzed dehydrogenation of ethylbenzene to styrene and hydrogen in the presence of steam. Another widely used process is the hydroperoxidation technology for the production of styrene, which features co-production of propylene oxide. Ethylbenzene is typically produced via zeolite catalyzed alkylation of benzene and ethylene. An alternative process in use combines catalytic reaction and distillation in a single operation, utilizing a dilute ethylene source such as fluid catalytic cracker (FCC) offgas.

Technologies developed by Lummus, Badger Licensing, Versalis, Shell, LyondellBasell and GTC Technology are described and analyzed, with a focus on recent developments.

## Process Economics

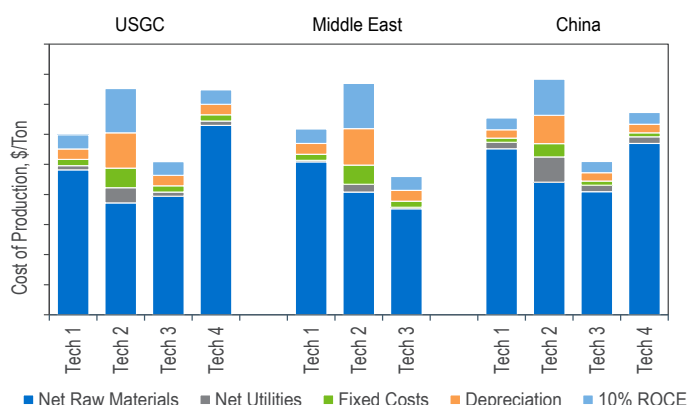
Detailed cost of production estimates for various technologies are presented for USGC, coastal China, and Middle East locations. Estimates are developed for two commercial routes to ethylbenzene and styrene and two developmental routes to styrene.

## Commercial Overview

Global styrene consumption grew to 29.4 million tons in 2017, with the largest applications being the production of polystyrene, EPS, and ABS. Increased demand has been driven by investment in downstream derivatives in the Middle East and China. With new global capacity, demand growth of 1.98 percent per year through 2023 is expected.

An overview of the supply, demand, and trade of styrene on a global and regional (North America, Western Europe, and Asia Pacific) basis is provided in this TECH report.

**Regional Cost of Production Comparison of Styrene Technologies**





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