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Technology and Costs

# Biorenewable Insights: Ethanol

**Ethanol is one in a series of reports published as part of NexantECA's 2023 Biorenewable Insights program.**

## Overview

The bioethanol sector is mature and largely continues to be populated with first-generation ethanol producers. Concerns about competition with food resources and doubts about the environmental sustainability of first-generation processes, as a well as a search for a sustainable cost advantage over first-generation production methods, continue to motivate the development of advanced ethanol technology.

Despite the second-generation ethanol technology having been developed for several years, however, success has been difficult to achieve with many developers exiting the sector, leaving only the most promising technologies still operating. These remaining second-generation technologies have embraced a broadly diversified set of strategies to continue the process of commercialization.

Understanding the ethanol sector requires knowledge of the following key strategic questions:

- What is the current status and cost position of the first-generation ethanol sector?
- What second-generation ethanol technologies have remained operational, and which promising candidates are nearing commercialization?
- What is the expected capacity of second-generation ethanol likely to be in the near future, and how does it compare to the conventional first-generation ethanol industry?

## Technologies

This report has three major technology areas of coverage:

- Baseline conventional ethanol from sugarcane, corn (maize), and other minor feedstocks
- "Generation 1.5" technologies to give bolt-on second-generation functionality to existing first-generation facilities
- Second generation technologies using hydrolysis and fermentation, syngas fermentation, or gasification and syngas reforming
- "Third generation" technologies using algae cultivation.

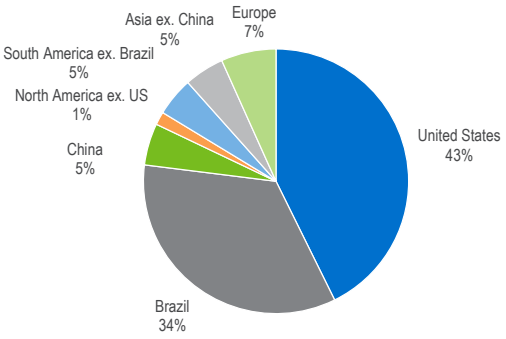
## Process Economics

This report assesses cost of production of three major routes to ethanol: first-generation process as a baseline, two second-generation processes broadly representing biomass hydrolysis and fermentation processing and syngas fermentation processing. The regions that are benchmarked in the report are the United States, China, and Brazil.

## Commercial Impact

This report focuses on the commercial impact of the second-generation ethanol tracking of announced commercial capacity, with first-generation capacity given for context of potential impact. The report also focuses on government policy, which is the main driver and also the constraint to the market growth and technology developments.

**Global Ethanol Capacity by Regions, 2022**

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- Process economics – comparative costs of production estimates for different technologies across various geographic regions
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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.

NexantECA serves its clients from over 10 offices located throughout the Americas, Europe, the Middle East, Africa, and Asia.


**Americas**
Tel: +1 914 609 0300
44 S Broadway,
5th Floor White Plains
NY 10601-4425
USA

**Europe, Middle East & Africa**
Tel: +44 20 7950 1600
110 Cannon Street
London EC4N 6EU
United Kingdom

**Asia Pacific**
Tel: +662 793 4600
22nd Floor, Rasa Tower I
555 Phahonyothin Road
Kwaeng Chatuchak
Khet Chatuchak
Bangkok 10900
Thailand


**For more information. please contact**
**Technology@NexantECA.com or www.NexantECA.com**