NexantECA

Technology and Costs

Biorenewable Insights: Ethylene, Ethylene Oxide, and Ethylene Glycol

Ethylene, Ethylene Oxide, and Ethylene Glycol is one in a series of reports published as part of NexantECA's 2020 Biorenewable Insights program.

Overview

Bio-ethylene and derivative production are a collection of methods of producing bio-based plastics using drop-in feedstock into existing value chains. These bio-based plastics have gained a significant price premium in recent years as concerns over sustainability mount and offer an attractive alternative to unconventional bioplastics in the race for sustainability in the chemicals industry. NexantECA believes that the sector will only grow in importance as environmental paradigms move towards a more holistic model of industrial sustainability from the simplistic "bio-based" model.

The industry has thus far been dominated by ethanol dehydration, providing limited capacity at relatively high cost. However, increasing demand and decreasing price premiums as sustainable plastics become more mainstream mean that the technoeconomics of the sector must be re-evaluated in the context of higher scale production. New potential routes to renewable ethylene can potentially provide lower costs at higher scales, including options that can drop-in to existing olefin production or take advantage of innovative technologies.

This report aims to answer the following strategic questions:

- What major routes are available to produce drop-in renewable ethylene, and what routes can bypass ethylene to produce ethylene glycol?
- How will cost competitiveness of various technologies and routes to renewable ethylene and derivatives change with scale and more holistic understandings of sustainability?
- How much capacity is available globally, and how likely are recent announcements of capacity additions to come to fruition?

Technologies

This report covers technologies on basis of product:

- Ethylene – Bioethanol to ethylene, bio-naphtha steam cracking, bio-methanol to olefins, oxidative coupling of methane, direct fermentation, plants as plants
- Ethylene Oxide – Oxidation of ethylene
- Ethylene Glycol – Ethylene oxide hydration, partial hydrogenation of sugar, glycerine to ethylene glycol, carbon dioxide photocatalytic transformation

Process Economics

This report focuses on the comparative economics of ethylene production and ethylene glycol production. Economic assessments are on the basis of 2Q 2020 pricing for the United States, Brazil, Western Europe, and China location scenarios.

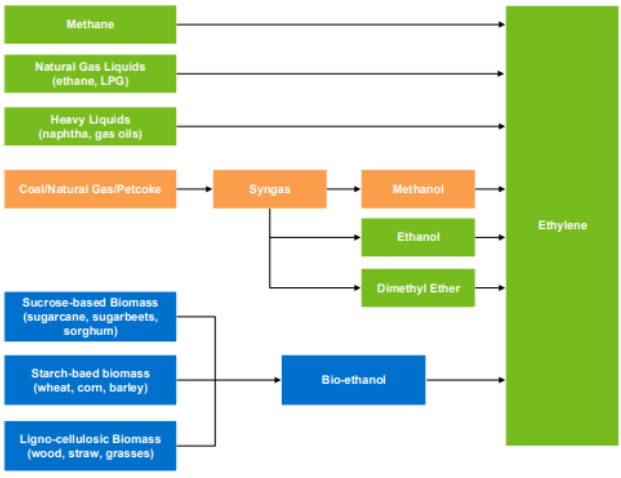
For ethylene, bioethanol-based routes are taken as the current standard and compared to large-scale steam cracking of bio-naphtha, bio-methanol to olefins, and speculative oxidative coupling of methane production.

For ethylene glycol, ethylene oxide hydration is contrasted with glucose hydrogenation, glycerine hydrolysis and photocatalytic production as practiced by an innovative technology developer.

Commercial Impact

Renewable ethylene and derivative capacity is analyzed in the context of global petrochemical ethylene and announced future capacity.

Major Raw Materials Used in Ethylene Production



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The BI program (sister program to the world renowned TECH program, formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging of interest to the renewable energy and chemical industries.

BI's comprehensive studies include detailed technology analyses, process economics, as well as capacity analysis and impacts on conventional industry. Reports typically cover:

- Trends in technology
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- 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
- Capacity tables of plants and analysis of announced capacities
- Regulatory and environmental issues where relevant

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- Cost of production tables in spreadsheet format (as requested)
- Consultation time with the project team

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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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