



Biorenewable Insights: Power to Liquids: eChemicals

Power to Liquids - eChemicals is one in a series of reports published as part of NexantECA's 2023 Biorenewable Insights program.

Overview

"Power to X" is a chemical and fuel manufacturing concept that uses electricity and low-value, energetically stable feedstocks into value-added products. It is increasingly important because of its inherent capability to deliver valuable molecules without high emissions of greenhouse gases in comparison to traditional feedstocks, and can produce so-called e-chemicals.

With the current wave of renewable electricity deployment and commercial deployment of electrolysis technologies, e-chemicals manufacturing can become a key part of the march to net zero emissions by marrying electrolysis with established technologies and value chains, or using electrical energy to power industrial biotechnology.

E-chemicals manufacturing faces many hurdles as well as opportunities. Ventures are subject to unusual constraints sourcing feedstock and electricity, and have to contend with ongoing regulatory changes as carbon accounting standards become harsher. At the same time, a broad set of policies for decarbonization are providing support for deployment and disadvantaging fossil feedstocks.

This report covers the complex technology involved in e-chemicals manufacturing and addresses the economics and carbon intensity of manufacturing.

Technologies

This report covers in detail the electrolysis-based production of hydrogen, carbon monoxide, ammonia and methanol for e-chemicals production as well as innovative routes in microbial electrosynthesis.

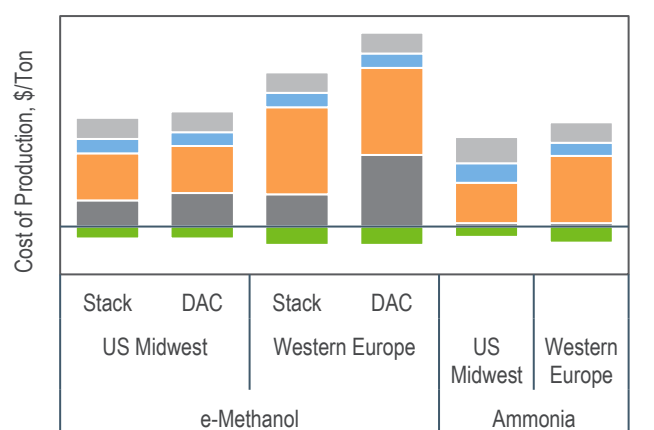
Each technology is addressed with an eye to the unique challenges of a power-to-X context, including carbon intensity impacts of technology selection and sourcing, engineering, performance, and issues for project planning. Processes coverages emphasizes commercially available technologies for manufacturing, and separately covers nascent technologies with near-term commercialization potential.

Process Economics

This report features detailed manufacturing cost benchmarks and carbon intensity analysis of currently available routes to e-ammonia and e-methanol in the United States and EU. Potential current competitiveness is investigated with sensitivities to carbon dioxide input cost and a intermittent price-following operations under different plant-gate pricing scenarios.

Microbial electrosynthesis variable costs are also covered on a speculative basis using a biochemical and industrial biotechnology model in order to assess future product targets and illustrate relative competitiveness.

Manufacturing Economics for e-Chemicals



- Depreciation (\$/ton product)
- Total Fixed Costs (\$/ton product)
- Total Utilities (\$/ton product)
- Total Raw Materials (\$/ton product)
- Total Byproduct Credits (\$/ton product)

Strategic Analysis

Current regulatory, technology, and commercial trends are used along with the report's economic conclusions to assess the outlook for e-chemicals manufacturing and its impact on the conventional sector. Special emphasis is paid to the EU and United States as the top areas of interest for current power-to-X investments.



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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 technologies 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
- Strategic/business overviews and/or developer profiles
- 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, 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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