



Biorenewable Insights: CO₂ Electrolysis

CO₂ Electrolysis is one in a series of reports published as part of NexantECA's 2024 Biorenewable Insights program.

Overview

The emerging "Power-to-X" space depends on carbon monoxide feedstocks to provide needed carbon in products. However, current methods of providing it use thermo-catalytic transformations with hydrogen or methane, which variously feature issues with scaling, energetic efficiency, and feedstock restrictions when paired with water electrolysis for hydrogen production.

Carbon dioxide electrolysis is an emerging, high-efficiency technology that directly converts carbon dioxide sources into carbon monoxide. This is a method of carbon monoxide production with similar characteristics to water electrolysis used for hydrogen production at equally high levels of efficiency. Although not yet commercially available, CO₂ electrolysis offerings are at a high state of technical readiness and will represent a major part of future power-to-X investment.

This report covers the complex technology involved in CO₂ Electrolysis for CO production and co-production of CO and H₂, focusing on near-commercial methods of production and their associated manufacturing economics in comparison to conventional processes.

Technologies

This report covers CO₂ electrolysis technologies including:

- Anion-exchange room temperature CO₂ electrolysis systems
- Proton-exchange room temperature CO₂ electrolysis systems
- Solid oxide membrane high temperature CO₂ electrolysis systems

As well as co-electrolysis of CO₂ and water for production of CO and H₂ in all systems.

Process Economics

This report focuses its economic investigation on near-commercial methods of producing CO and co-production of CO and H₂ in various location scenarios. These costs are compared and contrasted with conventional methods of CO production including steam reforming with cryogenic fractional distillation and dry reforming of methane.

Carbon intensity analysis is included on the basis of electricity sourcing scenarios with grid and 100 percent renewable bases.



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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

Subscription Options

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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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