



Biorenewable Insights: Green Hydrogen

Green Hydrogen is one in a series of reports published as part of NexantECA's 2022 Biorenewable Insights program.

Overview

The growing focus on renewable hydrogen or green hydrogen is due to its potential in decarbonizing sectors that have traditionally been difficult to decarbonise. It is also seen as a potential way to monetise stranded low-cost renewable power locations, through the generation and export of green hydrogen to markets with limited access to renewable resources. Green hydrogen's uses include it being an energy carrier for the transport, manufacturing, heating and power generation sectors, as well as a feedstock for replacing traditional hydrogen.

Green hydrogen's low carbon intensity (CI) profile compared to fossil fuels and conventional hydrogen (conventional hydrogen has a very high CI owed in part to the MW disparity between H₂ and CO₂) has resulted in an increasing number of announced projects globally. The expectation that production cost will decline significantly by 2030 to reach price parity with traditional hydrogen and/or the wide expectation of carbon taxes and cross border adjustment mechanisms has also helped fuel growing interest in it. There are some green hydrogen production routes that reached price parity with traditional hydrogen in 2022, though this has been regionally specific: in Western Europe due to high natural gas prices (feedstock for traditional hydrogen) as a result of the Ukraine/Russia war and in the US supportive subsidies from the U.S. Inflation Reduction Act of 2022.

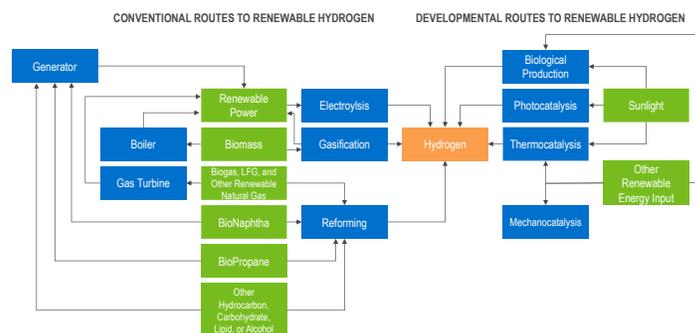
This report focuses on assessing the future sources of green hydrogen from the perspective of technology, cost, and application. The report also examines regional/country's policy, the existing barriers to adoption and if and to what extent green hydrogen could feature in the future energy and industrial landscape. Key questions addressed include:

- What technologies are available for green hydrogen production, and how technically mature are they?
- What is the current commercial status of green hydrogen?
- What is the cost of the production of hydrogen based on the current available technology?

Technologies

The main renewable hydrogen production routes generally involve replacing fossil fuel feedstock or fossil power with bio-based feedstocks and renewable/nuclear power. Despite the embryonic nature of renewable hydrogen supply capacity, there are several renewable hydrogen routes that are technologically proven but have not been adopted due to high production costs, inability to secure appropriate volumes of biomass feedstock and/or a lack of supportive regulations. These "conventional" renewable hydrogen production routes include:

- Reforming
- Biomass Gasification
- Ethanol Conversion
- Electrolysis
- Virtual Hydrogen Pipelines



Process Economics

This report assesses cost of production of five major routes to renewable hydrogen: biomass gasification, reforming of bio-based methane at small and large scales, and renewable electricity-based PEM and alkaline electrolysis. The regions that are benchmarked in the report are the United States, China, Brazil, and Western Europe.

Commercial Impact

This report presents implications for conventional technology in terms of price competitiveness regarding conventional hydrogen prices by region and examines current and potential market adoption.

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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.

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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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