



TECH 2022S9: Methane Pyrolysis for Turquoise Hydrogen

Methane Pyrolysis for Turquoise Hydrogen is one in a series of reports published as part of NexantECA's 2022Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Methane pyrolysis is an emerging route to low-carbon hydrogen, producing “turquoise” hydrogen along with a carbon co-product that can displace fossil-derived products such as carbon black or which can be independently sequestered. Riding the wave of new advanced hydrogen projects and industry decarbonization, commercialization already underway and promises to be an important component of future sustainable chemical industry development – but is unlike any other option in terms of cost structure, scalability, and technical risk.

This report focuses on the following major issues:

- What are the major routes to turquoise hydrogen?
- What is the current status of commercialization?
- What are the strengths and weaknesses of the technology from the perspective of a new entrant?
- How competitive is methane pyrolysis hydrogen vis-à-vis other low-carbon hydrogen production methods?
- How scalable is methane pyrolysis, both in terms of capital intensity and in terms of addressable market?
- How is the carbon co-product important to methane pyrolysis processes, and how can it be understood in the context of the carbon black and advanced carbon material markets?
- How can methane pyrolysis integrate with renewable power production to decrease carbon intensity?
- What is the potential for turquoise hydrogen installations to take advantage of national and regional low-carbon hydrogen incentives?

Commercial Technologies

This report covers five major technical approaches to methane pyrolysis, with detailed coverage of the newly commercial player Monolith as well as of BASF, TNO, Hazer, and HiiROC. It also provides a high-level technical maturity assessment for 11 other emerging or former players in the turquoise hydrogen space.

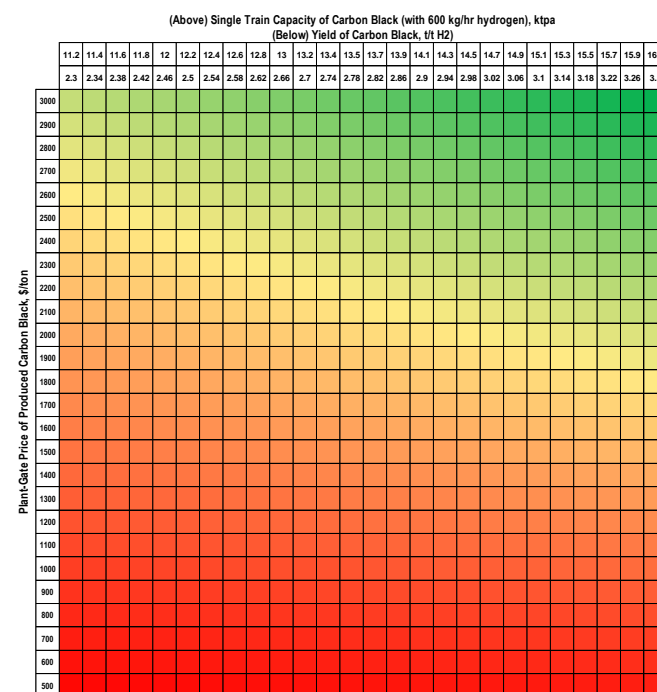
Process Economics

This report includes a detailed cost of production estimate for magnetically confined thermal plasma methane pyrolysis, the currently commercial turquoise hydrogen production route, on the basis of a world-scale installation. Economics are provided regionally for the U.S. and Western Europe in Q3 2022, and detailed sensitivities are used to assess potential effects of capital intensity, natural gas pricing, and carbon co-product yield and value.

Commercial Overview

This report provides a high-level overview of global hydrogen demand and supply, with snapshot projections to 2050 in the context of the decarbonization of the hydrogen sector and growth in future hydrogen applications. Coverage also includes discussion of competing sources of low-carbon hydrogen, available government incentives for turquoise hydrogen, and the effects of geopolitical risk on gas feedstock pricing and supply.

Dual Sensitivity of Cost of Production of Hydrogen, Carbon Black Yield vs Carbon Black Pricing





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The 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 energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- 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
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

Subscription Options

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- PDF reports including detailed technology analyses, process economics, as well as commercial overviews and industry trends
- Cost of production tables in spreadsheet format
- Consultation time with the project team

An annual subscription to TECH includes twenty reports published in a given program year. Reports can also be purchased on an individual basis, including reports from previous program years.

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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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