

# Low Carbon Intensity Hydrogen: A Technoeconomic and Carbon Intensity Study



**Low Carbon Intensity Hydrogen** is one in a series of reports published as part of NexantECA's Special Reports—previous report topics include **Low Carbon Intensity Ethylene** and **Low Carbon Intensity Aromatics**

## Overview

Hydrogen is a major feedstock for petrochemicals and fuels—and is of particular importance for low carbon intensity fuels such as e-ammonia and e-methanol. Low CI hydrogen aims to replace high CI incumbent hydrogen in the chemical industry, serving as a “drop-in replacement”, as well as expanding uses (e.g., renewable fuels).

## Technologies

This report covers hydrogen technologies by existing and potential major licensor/producers:

- Electrolysis (PEM and Alkaline) – Green, Pink, Yellow
- Other Green – Gasification, SMR or ATR of RNG, SMR or ATR of RNG with CCS, RNG Methane Pyrolysis, and Other
- Blue – SMR or ATR of Natural Gas with CCS
- Turquoise – Natural Gas Methane Pyrolysis
- Other Nuclear – Purple, Red
- Other Fossil-Based: Grey, Brown, Black
- Other: Gold, white

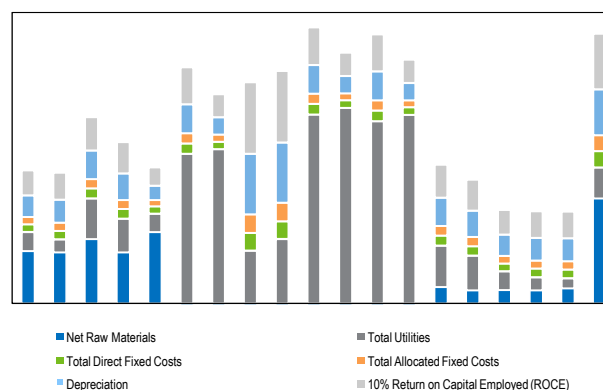
## Process Economics

Cost of production estimates for four locations (USGC, Brazil, Western Europe and China) are presented for production of hydrogen from various routes.

- Green (RNG SMR, RNG ATR, Biomass Gasification, PEM Electrolysis, Alkaline Electrolysis)
- Green / Blue - (RNG SMR w/ CCS, RNG ATR w/ CCS)
- Green / Turquoise - (RNG Pyrolysis)
- Pink – (PEM Electrolysis, Alkaline Electrolysis)
- Yellow – (PEM Electrolysis, Alkaline Electrolysis)
- Turquoise - (Natural Gas Methane Pyrolysis)
- Blue – (Natural Gas SMR w/ CCS, Natural Gas ATR w/ CCS)

- Grey – (Natural Gas SMR, Natural Gas ATR, Natural Gas POx)

## Example Regional Economic Comparison

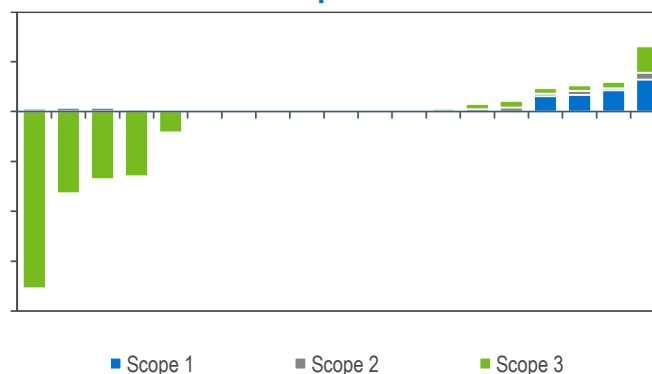


Regional pricing is set on Q4 2022 basis.

## Carbon Intensity

This report includes models of scope 1, 2, and 3 emissions, as well as regional carbon intensity baselines and breakeven values for carbon intensity reduction required for economic competitiveness.

## Example Regional Carbon Intensity Comparison

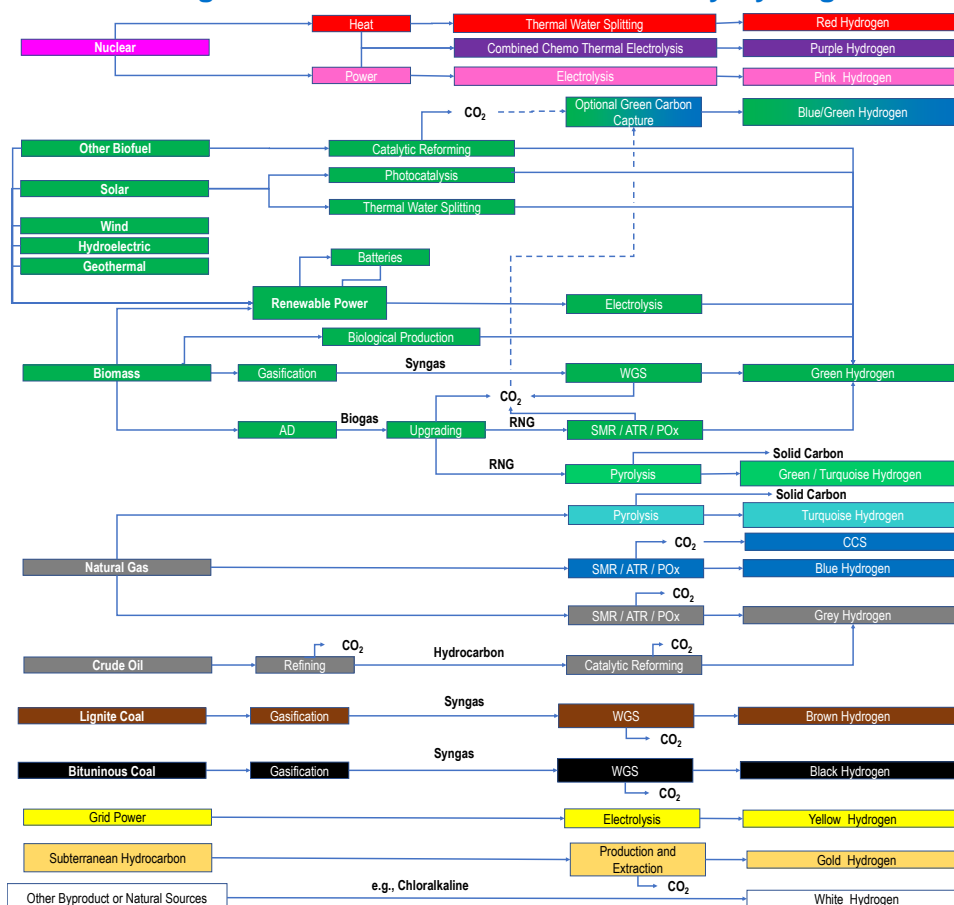


**For more information. please contact**  
[contactus@NexantECA.com](mailto:contactus@NexantECA.com) or [www.NexantECA.com](http://www.NexantECA.com)

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## Investigated Routes to Low Carbon Intensity Hydrogen



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Technology@NexantECA.com or www.NexantECA.com

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**Americas**  
Tel: +1 914 609 0300  
44 S Broadway,  
5th Floor White Plains  
NY 10601-4425  
USA

**Europe, Middle East & Africa**  
Tel: +44 20 7950 1600  
110 Cannon Street  
London EC4N 6EU  
United Kingdom

**Asia Pacific**  
Tel: +662 793 4600  
22nd Floor, Rasa Tower I  
555 Phahonyothin Road  
Kwaeng Chatuchak  
Khet Chatuchak  
Bangkok 10900  
Thailand

For more information. please contact  
[contactus@NexantECA.com](mailto:contactus@NexantECA.com) or [www.NexantECA.com](http://www.NexantECA.com)