

# The Global Market for Hydrogen Technology and Production 2023-2033

https://marketpublishers.com/r/GBBFD18A692EEN.html

Date: May 2023 Pages: 370 Price: US\$ 1,250.00 (Single User License) ID: GBBFD18A692EEN

### Abstracts

Hydrogen technology and production is a key part of decarbonization strategies and a means to achieve direct electrification. The three main types of hydrogen are grey hydrogen, blue hydrogen and green hydrogen.

The Global Market for Hydrogen Technology and Production 2023-2033 covers all elements of this fast-growing market. Future market development and low-carbon innovation is driven by green hydrogen (electrolyzers) and blue hydrogen technologies. Other important elements include:

storing and transporting hydrogen.

hydrogen fuel cells.

hydrogen vehicles including taxis, planes and cars.

Report contents include:

Analysis of current hydrogen production (grey, brown etc.) and demand forecasts to 2033.

Market value chain and industry map.

Market drivers, trends and challenges.

Hydrogen production processes and costs.



Recent industry developments and investments and start-up funding.

Market analysis of hydrogen technology and production including blue hydrogen (from decarbonised natural gas), green hydrogen (from renewable power and electrolysis), carbon capture, hydrogen storage & transport, hydrogen fuel cells and hydrogen vehicles.

Profiles of 175 companies including multi-nationals, large corporations and startups. Companies profiled include Advanced Ionics, Electric Hydrogen, Enapter, FuelCell Energy, Heliogen, HiiROC, Ionomr Innovations, Monolith Materials, Ohmium, PowerCell Sweden, Thiozen and Verdagy.



### Contents

#### **1 RESEARCH METHODOLOGY**

#### **2 INTRODUCTION**

- 2.1 Hydrogen classification
- 2.2 Global energy demand and consumption
- 2.3 The hydrogen economy and production
- 2.4 Hydrogen value chain
- 2.5 National hydrogen initiatives
- 2.6 Market challenges

#### **3 MARKET ANAYSIS**

- 3.1 Industry developments 2020-2023
- 3.2 Start-up and investment funding
- 3.3 National hydrogen initiatives
- 3.4 Market map
- 3.5 Global hydrogen production
  - 3.5.1 Current Annual H2 Production
  - 3.5.2 Hydrogen production processes
  - 3.5.3 Production costs
  - 3.5.4 Global hydrogen demand forecasts
- 3.6 Green hydrogen
  - 3.6.1 Role in energy transition
  - 3.6.2 Electrolyzer technologies
  - 3.6.2.1 Alkaline water electrolysis (AWE)
  - 3.6.2.2 Anion exchange membrane (AEM) water electrolysis
  - 3.6.2.3 PEM water electrolysis
  - 3.6.2.4 Solid oxide water electrolysis
  - 3.6.3 Market players
- 3.7 Blue hydrogen (low-carbon hydrogen)
- 3.7.1 Advantages over green hydrogen
- 3.7.2 Production technologies
  - 3.7.2.1 Steam-methane reforming (SMR)
  - 3.7.2.2 Autothermal reforming (ATR)
- 3.7.2.3 Partial oxidation (POX)
- 3.7.2.4 Sorption Enhanced Steam Methane Reforming (SE-SMR)



- 3.7.2.5 Methane pyrolysis (Turquoise hydrogen)
- 3.7.2.6 Coal gasification
- 3.7.2.7 Advanced autothermal gasification (AATG)
- 3.7.2.8 Biomass processes
- 3.7.2.9 Microwave technologies
- 3.7.2.10 Dry reforming
- 3.7.2.11 Plasma Reforming
- 3.7.2.12 Solar SMR
- 3.7.2.13 Tri-Reforming of Methane
- 3.7.2.14 Membrane-assisted reforming
- 3.7.2.15 Catalytic partial oxidation (CPOX)
- 3.7.2.16 Chemical looping combustion (CLC)
- 3.7.3 Projects
- 3.7.4 Carbon capture
- 3.7.4.1 Pre-Combustion vs. Post-Combustion carbon capture
- 3.7.4.2 What is CCUS?
- 3.7.4.3 Carbon Utilization
- 3.7.4.4 Carbon storage
- 3.7.4.5 Transporting CO2
- 3.7.4.6 Costs
- 3.7.4.7 Market map
- 3.7.4.8 Point-source carbon capture for blue hydrogen
- 3.7.4.9 Carbon utilization
- 3.7.5 Blue hydrogen process materials
  - 3.7.5.1 Catalysts
  - 3.7.5.2 Membranes
  - 3.7.5.3 Vessel materials
- 3.7.6 Market players
- 3.8 Hydrogen Storage and Transport
  - 3.8.1 Market overview
  - 3.8.2 Market players
- 3.9 Hydrogen Fuel Cells
  - 3.9.1 Market overview
  - 3.9.2 Market players
- 3.10 Hydrogen Vehicles
  - 3.10.1 Market overview
  - 3.10.2 Market players

#### 4 COMPANY PROFILES 188 (175 COMPANY PROFILES)



#### **5 REFERENCES**



### **List Of Tables**

#### LIST OF TABLES

- Table 1. Hydrogen colour shades, Technology, cost, and CO2 emissions.
- Table 2. Overview of hydrogen production methods.
- Table 3. National hydrogen initiatives.
- Table 4. Market challenges in the hydrogen economy and production technologies.
- Table 5. Hydrogen industry developments 2020-2023.
- Table 6. Hydrogen start-up and investment funding.
- Table 7. National hydrogen initiatives.
- Table 8. Hydrogen production processes and stage of development.
- Table 9. Estimated costs of clean hydrogen production.
- Table 10. Characteristics of typical water electrolysis technologies
- Table 11. Advantages and disadvantages of water electrolysis technologies.
- Table 12. Market players in green hydrogen (electrolyzers).
- Table 13. Key players in methane pyrolysis.
- Table 14. Blue hydrogen projects using Coal gasification (CG.
- Table 15. Biomass processes summary.
- Table 16. Blue hydrogen projects.
- Table 17. CO2 utilization and removal pathways
- Table 18. Approaches for capturing carbon dioxide (CO2) from point sources.
- Table 19. CO2 capture technologies.
- Table 20. Advantages and challenges of carbon capture technologies.
- Table 21. Overview of commercial materials and processes utilized in carbon capture.
- Table 22. Methods of CO2 transport.
- Table 23. Carbon capture, transport, and storage cost per unit of CO2
- Table 24. Estimated capital costs for commercial-scale carbon capture.
- Table 25. Point source examples.
- Table 26. Assessment of carbon capture materials
- Table 27. Chemical solvents used in post-combustion.
- Table 28. Commercially available physical solvents for pre-combustion carbon capture.
- Table 29. Carbon utilization revenue forecast by product (US\$).
- Table 30. CO2 utilization and removal pathways.
- Table 31. Market challenges for CO2 utilization.
- Table 32. Example CO2 utilization pathways.
- Table 33. CO2 derived products via Thermochemical conversion-applications, advantages and disadvantages.
- Table 34. Electrochemical CO? reduction products.



Table 35. CO2 derived products via electrochemical conversion-applications, advantages and disadvantages.

Table 36. CO2 derived products via biological conversion-applications, advantages and disadvantages.

- Table 37. Companies developing and producing CO2-based polymers.
- Table 38. Companies developing mineral carbonation technologies.
- Table 39. Market players in blue hydrogen.
- Table 40. Market overview- hydrogen storage and transport.
- Table 41. Market players in hydrogen storage and transport.
- Table 42. Market overview- hydrogen fuel cells.
- Table 43. Market players in hydrogen fuel cells.
- Table 44. Market overview- hydrogen vehicles.
- Table 45. Market players in hydrogen vehicles.



## **List Of Figures**

#### LIST OF FIGURES

- Figure 1. Hydrogen value chain.
- Figure 2. Market map for hydrogen technology and production.
- Figure 3. Current Annual H2 Production.
- Figure 4. Global hydrogen demand forecast.
- Figure 5. Schematic of alkaline water electrolysis working principle.
- Figure 6. Schematic of AEM water electrolysis working principle.
- Figure 7. Proton Exchange Membrane Electrolyzer.
- Figure 8. Schematic of PEM water electrolysis working principle.
- Figure 9. Schematic of solid oxide water electrolysis working principle.
- Figure 10. SMR process flow diagram of steam methane reforming with carbon capture and storage (SMR-CCS).

Figure 11. Process flow diagram of autothermal reforming with a carbon capture and storage (ATR-CCS) plant.

Figure 12. POX process flow diagram.

Figure 13. Non-Catalytic Partial Oxidation with dual syngas coolers to generate highpressure steam (Shell).

- Figure 14. Process flow diagram for a typical SE-SMR.
- Figure 15. Methane pyrolysis process flow diagram.
- Figure 16. Coal gasification (CG) process.
- Figure 17. Flow diagram of Advanced autothermal gasification (AATG).
- Figure 18. Schematic of CCUS process.
- Figure 19. Pathways for CO2 utilization and removal.
- Figure 20. A pre-combustion capture system.
- Figure 21. Carbon dioxide utilization and removal cycle.
- Figure 22. Various pathways for CO2 utilization.
- Figure 23. Example of underground carbon dioxide storage.
- Figure 24. Transport of CCS technologies.
- Figure 25. Railroad car for liquid CO? transport
- Figure 26. CCUS market map.
- Figure 27. Estimated costs of capture of one metric ton of carbon dioxide (Co2) by sector.
- Figure 28. Global capacity of point-source carbon capture and storage facilities.
- Figure 29. Global carbon capture capacity by CO2 source, 2021.
- Figure 30. Global carbon capture capacity by CO2 source, 2030.
- Figure 31. Global carbon capture capacity by CO2 endpoint, 2021 and 2030.



- Figure 32. Post-combustion carbon capture process.
- Figure 33. Postcombustion CO2 Capture in a Coal-Fired Power Plant.
- Figure 34. Oxy-combustion carbon capture process.
- Figure 35. Liquid or supercritical CO2 carbon capture process.
- Figure 36. Pre-combustion carbon capture process.

Figure 37. CO2 non-conversion and conversion technology, advantages and disadvantages.

- Figure 38. Applications for CO2.
- Figure 39. Cost to capture one metric ton of carbon, by sector.
- Figure 40. Life cycle of CO2-derived products and services.
- Figure 41. Co2 utilization pathways and products.
- Figure 42. Plasma technology configurations and their advantages and disadvantages for CO2 conversion.
- Figure 43. LanzaTech gas-fermentation process.
- Figure 44. Schematic of biological CO2 conversion into e-fuels.
- Figure 45. Econic catalyst systems.
- Figure 46. Mineral carbonation processes.
- Figure 47. Enapter Anion Exchange Membrane (AEM) Water Electrolysis.
- Figure 48. KEYOU-H2-Technology.
- Figure 49. Proton Exchange Membrane Fuel Cell.
- Figure 50. Tevva hydrogen truck.



#### I would like to order

Product name: The Global Market for Hydrogen Technology and Production 2023-2033 Product link: <u>https://marketpublishers.com/r/GBBFD18A692EEN.html</u>

Price: US\$ 1,250.00 (Single User License / Electronic Delivery) If you want to order Corporate License or Hard Copy, please, contact our Customer Service: <u>info@marketpublishers.com</u>

### Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <u>https://marketpublishers.com/r/GBBFD18A692EEN.html</u>

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name: Last name: Email: Company: Address: City: Zip code: Country: Tel: Fax: Your message:

\*\*All fields are required

Custumer signature \_\_\_\_\_

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <u>https://marketpublishers.com/docs/terms.html</u>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970