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Global Clean Hydrogen Market - 2025 -2032

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Abstracts

Clean Hydrogen Market Overview

Global Clean Hydrogen Market reached US$ 5.45 billion in 2024 and is expected to reach US$ 16.52 billion by 2032, growing with a CAGR of 14.87% during the forecast period 2025-2032.

In 2023, the global hydrogen demand increased by 2.5% from 2022, reaching 97 Mt. With fossil fuel-based hydrogen comprising the majority of supply, this demand remains concentrated in the chemical and refining sectors. The future is anticipated to see substantial growth, despite the fact that low-emissions hydrogen will account for less than 1 million tonnes of output in 2023.

According to the announced initiatives, the production of low-emission hydrogen could surpass the Global Hydrogen Review 2023's projections by 30% by 2030, with a potential capacity of 49 Mtpa. The majority of this expansion is attributed to electrolysis projects, which have a stated capacity of nearly 520 GW. Additionally, the anticipated production of 3.4 Mtpa has been the subject of final investment decisions (FIDs). This production is divided between electrolysis (1.9 Mtpa) and fossil fuels with carbon capture, use, and storage (CCUS) (1.5 Mtpa). These data illustrate a burgeoning industry that is poised for rapid expansion in response to heightened government support, climate objectives, and clean energy regulations.

Clean Hydrogen Market Trend

The hydrogen economy is currently experiencing a substantial transformation as governments and corporations transition to more environmentally friendly alternatives. The current dominance of grey hydrogen, which accounts for approximately 90 Mtpa of the global supply, is expected to be replaced by clean hydrogen in new hydrogen

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production capacity beginning in 2025. Gray hydrogen is anticipated to gradually disappear as clean hydrogen becomes more cost-effective.

By 2050, the demand for clean hydrogen is expected to exceed 125 to 585 Mtpa, which would represent 73 to 100 percent of the global hydrogen consumption. This transition will be initiated by the conversion of existing industries, such as fertilizer and refining, to blue and green hydrogen. Subsequently, developing sectors, including steel, synthetic fuel generation, and heavy transportation, will follow. The long-term demand for hydrogen fuels will be bolstered by private and public sector measures, including CO2 pricing mechanisms, fuel quotas, and sector-specific emissions objectives, which will accelerate growth after 2040.

Clean Hydrogen Market Dynamics

Government initiatives accelerate the clean hydrogen movement

The clean hydrogen market is being stimulated by robust government initiatives that are designed to mitigate carbon emissions. Nations are being encouraged to explore low-emission energy alternatives due to concerns regarding the increase in greenhouse gas emissions from industrialization, including CO2, methane, and nitrous oxide.

Hydrogen is being actively supported by countries in a variety of applications, such as power generation, manufacturing, construction, and transportation. For instance, California is allocating $230 million to hydrogen initiatives, while India intends to achieve 450 GW of renewable energy capacity by 2030. It is anticipated that these initiatives will facilitate the development of a resilient green hydrogen ecosystem.

India's ambition to generate 5 million metric tons of green hydrogen annually by 2030 solidifies its status as a significant global player. The Hydrogen Economy Roadmap posits that clean hydrogen may satisfy 14% of the nation's energy requirements by 2050, with a particular emphasis on sectors that rely on high-temperature processes and fertilizer manufacturing. Consequently, clean hydrogen is a critical component of the US' energy agenda.

Competitive scale is restricted by high production costs

The clean hydrogen market is confronted with a substantial constraint in the form of high manufacturing costs, despite optimistic projections. Electrolysis, the primary method for the production of green hydrogen, remains significantly more expensive than

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conventional fossil fuel-based alternatives.

The cost of producing hydrogen through electrolysis is estimated to be approximately US$10.3 per kilogram. In contrast, conventional production methods, such as steam methane reforming, produce hydrogen for US$1.5 to US$2.3 per kilogram. This enormous cost disparity poses a substantial obstacle to market entry and scalability, particularly in price-sensitive sectors and emerging economies.

Although costs will probably decrease over time as a result of technological advancements and economies of scale, the rate of reduction is uncertain. The widespread adoption of green hydrogen may be delayed until these discrepancies are resolved, particularly in industries where immediate financial benefits and low input prices continue to drive decision-making.

Clean Hydrogen Market Segment Analysis

The global clean hydrogen market is segmented based on technology, distribution, end-user, and region.

Transport transitions and clean hydrogen’s emerging role in decarbonizing mobility networks

Transport is becoming a critical area for the implementation of clean hydrogen. Industrial sectors, including refining and fertilizers, continue to dominate hydrogen demand. However, transportation is expected to experience a substantial increase after 2030 as green and blue hydrogen become more cost-effective. Due to the constraints of battery-electric solutions in these sectors, heavy-duty road transport and long-haul logistics are poised for early adoption.

It is anticipated that hydrogen's involvement in new transportation applications, such as maritime and aviation, will increase between 2030 and 2040, facilitated by the development of legislative frameworks that mandate CO2 reductions and sustainable fuel restrictions. These trends indicate a gradual but discernible change in end-user dynamics, with transportation emerging as the primary driver of clean hydrogen growth in the medium to long term. It is anticipated that clean hydrogen, particularly in liquid and derivative fuel forms, will become a significant element of the decarbonization initiatives of national and regional mobility networks.

Clean Hydrogen Market Geographical Share

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Policy and decarbonization drive European adoption of clean hydrogen

Europe is the pioneer in the implementation of clean hydrogen solutions, a result of its strategic investments and robust policy frameworks. In the majority of energy transition scenarios, the European Union and the UK are anticipated to eliminate grey hydrogen by 2050, demonstrating a clear governmental commitment. FID has been obtained for numerous projects that employ fossil fuels with CCUS, primarily in North America and Europe.

The production capacity of these projects has increased by over twofold, from 0.6 Mtpa in September 2023 to 1.5 Mtpa in 2024, suggesting a genuine improvement. Europe's initiative is under the overarching objectives of decarbonization, as evidenced by the EU Green Deal legislation and financial incentives to encourage the use of hydrogen in transportation, industry, and power generation.

Additionally, Europe's objective of establishing a global hub for hydrogen innovation and deployment is furthered by its leadership in the promotion of CO2 pricing and fuel quotas in the aviation and maritime sectors, particularly through the integration of renewable energy and cross-border hydrogen trade.

Sustainability Analysis

Clean hydrogen production is a critical component of the global climate goals, as it reduces reliance on fossil fuels and reduces greenhouse gas emissions. Green hydrogen, which is produced through electrolysis with renewable energy, is a carbon-neutral energy carrier that has the potential to be used in a variety of sectors. A transitional pathway to decarbonize existing infrastructure while scaling green hydrogen technologies is provided by blue hydrogen, which is produced from fossil fuels with carbon capture.

Clean hydrogen contributes to the mitigation of global warming and the enhancement of air quality by replacing grey hydrogen, which currently dominates production. In addition, its implementation in sectors that are difficult to mitigate, including steelmaking, chemicals, and heavy transport, addresses emissions that are difficult to eradicate through electrification alone.

Nevertheless, sustainability necessitates the implementation of a robust CCUS, responsible sourcing of renewable electricity, and transparent lifecycle assessments.

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Sustainability will continue to be a fundamental pillar of support for the sector's transformative impact on global energy systems as governments and industries align their strategies around clean hydrogen.

Clean Hydrogen Market Major Players

The major global players in the market include Linde plc, Air Products & Chemicals, Inc., Air Liquide, BP p.l.c., Aramco, Engie, Siemens Energy AG, Equinor, ACWA Power, Plug Power.

Key Developments

In September 2024, Thermax has partnered with Ceres Power to manufacture large-scale Solid Oxide Electrolysis Cells (SOEC) for green hydrogen production, focusing on utilizing industrial waste heat. This collaboration aims to create efficient systems tailored for industries such as steel and refineries. Thermax plans to establish a manufacturing facility and localize components, marking a significant advancement in India's green hydrogen sector.

In September 2024, Jindal Steel (JSPL) and Jindal Renewables (JRPL) announced a partnership. This partnership highlights both companies' strong commitment to decarbonization and leadership in green energy within India's steel sector. Under the agreement, JSPL plans to integrate green hydrogen into its Direct Reduced Iron (DRI) units at the Angul facility in Odisha, marking a substantial advancement toward low-emission steel production.

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