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United States Green Hydrogen Market Assessment, By Technology [Polymer Electrolyte Membrane Electrolyzer, Alkaline Electrolyzer, Solid Oxide Electrolyzer, Proton Exchange Membrane Electrolyzer], By Renewable Source [Solar, Wind, Hydropower, Others], By Transportation Channel [Roadways, Waterways, Pipelines], By End-user [Power Generation, Transportation, Chemicals & Petrochemicals, Steel, Food & Beverages, Medical, Others], By Region, Opportunities and Forecast, 2016-2030F

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Abstracts

United States green hydrogen market size was valued at USD 440 million in 2022, and is projected to reach USD 1272.9 million by 2030, growing at a CAGR of 14.2% from 2023 to 2030. Energy is critical in worldwide development, economies, and sustainability, fueling industries, transportation, and meeting daily requirements. Nonetheless, the growing energy demand raises environmental apprehensions linked with greenhouse gas emissions and the consequences of climate change.

Green hydrogen addresses environmental concerns by providing a clean, carbon-neutral alternative for industries, transportation, and daily necessities, reducing greenhouse gas emissions, and aligning with global goals.

North America, the second-largest hydrogen market, aims to achieve 50 MT of annual hydrogen production by 2050. Almost 99% of hydrogen production in the United States

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is sourced from fossil fuels, with 1% from electrolysis. However, the United States is actively investing in green hydrogen initiatives, like the H2Global program and clean hydrogen hubs, which will drive the growth of the green hydrogen market in the region.

In the United States, green hydrogen is gaining momentum as a clean energy option to achieve carbon neutrality. Cost reductions, technological advancements, favorable policies, and growing awareness drive its rise. Government, businesses, and individuals are embracing green hydrogen to reduce carbon emissions, improve air quality, and attain energy self-sufficiency.

Green Hydrogen Serves as the Future Fuel

The UNFCCC's Paris Agreement aims to limit global warming to below 2 degrees Celsius. To align with the Paris Agreement, United States has set its own emissions target to become net zero emissions economy by 2050.

Green Hydrogen is a crucial solution for global net-zero targets, reducing greenhouse gas emissions in sectors like heavy industry, long-distance transport, shipping, and aviation. The United States Inflation Reduction Act's 45V Hydrogen Production Tax Credit (PTC) provides incentives of up to USD 3 per kg of hydrogen for low greenhouse gas intensity projects. The credit system consists of four tiers, with the lowest tier offering USD 0.6 per kg for GHG intensity ranging from 2.5 to 4.0 per kg of hydrogen.

Plug Power and Olin Corporation are collaborating on the St. Gabriel Green Hydrogen project in Louisiana, set to start operations by end of 2023. The plant will produce 15 tons of green hydrogen daily for the fuel cell market. Plug Power plans to increase production to 500 tons per day by 2025 and 1,000 tons per day by 2028, reducing North America's 4.3 million metric tons of CO2 emissions.

Technological Innovations Boost Green Hydrogen's Potential

North America, particularly the United States, is a key player in the hydrogen market and is projected to supply 9 million tons of hydrogen per annum (MTPA). By 2025, the region will lead with 2.8 MTPA of low-carbon hydrogen production. The US Inflation Reduction Act 2022 supports clean energy initiatives, including emission-free hydrogen production, encouraging government policies and private companies to adopt green hydrogen solutions.

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Advancements in hydrogen production technologies, like electrolyzers, have improved efficiency and reduced costs, making green hydrogen more economically competitive with conventional energy sources. As a fossil fuel-free option, green hydrogen offers a superior long-term solution for decarbonizing economies. The United States government's 'Hydrogen Shot' initiative aims to reduce green hydrogen prices to USD 1 per kg, increasing clean hydrogen usage by five times and achieving 50 MT annual production by 2050, with interim targets of 10 MT capacity by 2030 and 20 MT by 2040.

Using PEM electrolysis technology from Plug Power, New Fortress Energy plans to become North America's largest green hydrogen producer, generating over 50 TPD and scalability up to 500 megawatts (MW).

Government Promotes Green Hydrogen as a Clean Energy Future

In the United States, the government actively supports the development of green hydrogen through policy frameworks, incentives, and funding initiatives. This support accelerates the adoption and development of green hydrogen as a clean energy solution. Moreover, green hydrogen can enhance energy security in the United States by reducing reliance on imported fossil fuels.

The United States government's commitment to Green Hydrogen Development is reflected in the Department of Energy (DOE) issued a preliminary National Clean Hydrogen Strategy and Roadmap that outlined three primary objectives: prioritizing strategic, high-impact hydrogen applications; achieving a USD 1 per kg clean hydrogen cost by 2031 and establishing at least four regional clean hydrogen hubs. Along with it, the United States hydrogen tax credits under The United States Inflation Reduction Act (August 2022) grant tax credits up to USD 3 per kg for clean hydrogen producers over a decade based on the carbon emissions lifecycle made for lucrative investment opportunities.

Growing Viability of Green Hydrogen

As renewable energy costs decline, green hydrogen in the United States becomes a viable and cost-effective choice, enabling integration across sectors for improved energy system efficiency. It serves as valuable energy storage, converting excess renewable energy into hydrogen for later electricity generation. North America's operational clean hydrogen supply is approximately 740 KTPA, with a significant portion being low carbon. In 2022, the region boasted 33 operational Green hydrogen facilities, with a combined capacity of 691,000 tons per annum (TPA).

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Air Products and AES Corporation have collaborated on a green hydrogen plant in Texas, aiming to produce 220 tons of hydrogen daily using 1.4 GW of wind and solar generation. The project costs USD 4 billion. H2USA, led by the DOE, is advancing hydrogen infrastructure for diverse transportation energy options. As of 2023, the United States has 59 operational retail hydrogen stations, with 50 more in planning or construction. Green hydrogen has its application in various sectors, driving the market.

Infrastructure Development Enabling the Growth

Hydrogen infrastructure, encompassing storage, transportation, and refueling stations, is experiencing rapid expansion, laying the foundation for a thriving green hydrogen market. The growth facilitates the widespread adoption of clean hydrogen as a sustainable, low-emission energy solution. Several countries have announced plans and investments in large-scale green hydrogen production facilities. They are embracing comprehensive hydrogen ecosystems to support various applications, such as developing infrastructure to create a hydrogen-powered urban transport system to integrate hydrogen fuel cell buses and commercial vehicles.

The Infrastructure Investment and Jobs Act (IIJA) has allocated USD 8 billion to establish four Regional Clean Hydrogen Hubs (H2Hubs) nationwide. The Midwest Alliance for Clean Hydrogen (MachH2) plans to apply to the United States Department of Energy (DOE) for funding to develop a regional clean hydrogen production and distribution hub. The DOE will invest up to USD 8 billion in a national clean hydrogen network, contributing to decarbonizing various sectors of the economy.

Impact of COVID-19

The COVID-19 pandemic significantly impacted the United States energy sector, causing disruptions, reduced transportation fuel demand, and industrial contraction. The United States government and private sector invested heavily in green hydrogen projects, infrastructure, and research to build resilience and reduce carbon emissions. Renewable energy sources like solar and wind have experienced rapid growth. The United States DOE's Hydrogen Program, led by EERE and HFTO, plays a vital role in regulating and assisting the burgeoning hydrogen economy's development in various aspects.

CF Industries and ThyssenKrupp have accelerated green hydrogen technology development, partnering for the Donaldsonville Green Hydrogen Project in Louisiana.

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The 20 MW alkaline water electrolysis plant will produce 20,000 tons of green ammonia annually, becoming North America's largest facility and a key component in a cleaner, more sustainable energy future.

Impact of Russia-Ukraine War

The conflict between Russia and Ukraine has disrupted oil and gas supplies, emphasizing the vulnerability of relying heavily on fossil fuels. The United States and other nations are exploring alternative energy sources and technologies to improve energy security and reduce import dependence. Sanctions on Russia have motivated efforts to develop cleaner and more sustainable energy solutions.

The United States has invested in Green Hydrogen Development projects, such as Invenergy's Sauk Valley Green Hydrogen Plant in Illinois, which will produce 52 tons of green hydrogen annually and store 400 kg on-site. These projects have improved energy security during crises with domestically produced renewable hydrogen.

Key Players Landscape and Outlook

Key players in the United States green hydrogen market are actively involved in research and development (R&D) initiatives to improve technologies, lower production costs, and increase efficiency. They are investing in large-scale projects and forming partnerships to drive market growth and expand green hydrogen infrastructure globally. For instance, in February 2023, MachH2 announced its collaboration with the Indiana-led Midwest Hydrogen Corridor Consortium, creating a unified Midwestern hub.

This comes after Entergy Texas and an affiliate of New Fortress Energy entered a collaborative agreement to develop renewable energy and hydrogen infrastructure in October 2022. Under the agreement, Entergy Texas will work with NFE to utilize existing transmission infrastructure and establish a new high-side substation and transformer connections at NFE's 120-megawatt industrial-scale green hydrogen plant near Beaumont, Texas.

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