

Water Electrolysis Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Type (Alkaline Electrolyzer, Proton Exchange Membrane (PEM) Electrolyzer, Solid Oxide Electrolyzer Cell (SOEC), Anion Exchange Membrane (AEM) Electrolyzers), By Application (Refining Industry, Power and Energy Storage, Ammonia Production, Methanol Production, Transportation/Mobility Industry, Others), By Region and Competition, 2019-2029F

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Abstracts

Global Water Electrolysis Market was valued at USD 4.42 billion in 2023 and is anticipated to project robust growth in the forecast period with a CAGR of 4.31% through 2029. The increasing utilization of renewable energy sources like wind and solar power is a key factor propelling the global water electrolysis market. Electrolysis plays a vital role in converting and storing surplus renewable energy, especially in regions with high renewable energy penetration. By leveraging excess electricity from renewable sources for hydrogen production through electrolysis, surplus energy can be stored and utilized across various sectors such as power generation, transportation, and industrial processes, thereby enhancing grid stability and flexibility.

The growing focus on decarbonization and the transition to low-carbon energy systems is fueling demand for green hydrogen generated via water electrolysis. Green hydrogen, produced using renewable electricity, offers a carbon-neutral alternative to conventional methods like steam methane reforming. With governments and industries globally

setting ambitious carbon reduction goals and addressing climate change, the demand for green hydrogen is anticipated to escalate, driving the expansion of the global water electrolysis market.

Advancements in electrolyzer technologies and the decreasing costs of renewable energy are bolstering the commercial feasibility of water electrolysis systems. Manufacturers are investing in research and development to enhance the efficiency, reliability, and scalability of electrolysis technologies, making them more competitive against traditional fossil fuel-based processes. The declining costs of renewable energy sources such as solar and wind power are lowering the overall hydrogen production costs through electrolysis, further stimulating market growth.

Supportive government policies and incentives aimed at promoting renewable energy and hydrogen technologies are also contributing to the growth of the global water electrolysis market. Governments worldwide are implementing various measures like subsidies, tax incentives, and regulatory frameworks to facilitate the development and deployment of electrolysis systems and green hydrogen infrastructure. These policies are fostering investments in electrolysis projects and encouraging collaboration among governments, industries, and research institutions to expedite the adoption of water electrolysis technology.

Key Market Drivers

Growth in Power Industry

The rapid expansion of renewable energy sources like wind and solar power stands as a primary catalyst propelling the global water electrolysis market forward. With nations worldwide committing to ambitious targets for reducing greenhouse gas emissions and addressing climate change, the deployment of renewable energy technologies has surged. Wind and solar power, in particular, have experienced exponential growth, fueled by declining costs, technological advancements, and supportive governmental policies.

Water electrolysis plays a pivotal role in facilitating the integration of renewable energy into the power grid. Electrolyzers can harness surplus electricity generated by wind and solar farms during periods of low demand to produce hydrogen via electrolysis. This green hydrogen can then be stored and utilized as a clean energy carrier for diverse applications, spanning power generation, transportation, and industrial processes. As the proportion of renewable energy in the energy mix continues to rise, the demand for

water electrolysis systems to yield green hydrogen is poised to skyrocket, propelling market expansion.

The burgeoning power sector is fueling investments in electrolysis projects and infrastructure development. Power firms are increasingly investing in electrolysis facilities and hydrogen production plants to leverage surplus renewable energy and facilitate grid stabilization. Partnerships between power entities, electrolyzer manufacturers, and research institutions are fostering innovation in electrolysis technologies, driving the creation of more efficient and economically viable electrolysis systems.

The transition toward decarbonizing the power sector is generating fresh avenues for water electrolysis. As power entities aim to shrink their carbon footprint and adhere to stringent environmental regulations, hydrogen generated through electrolysis emerges as a clean and sustainable substitute for traditional fossil fuel-based power generation. The escalating adoption of hydrogen as a power generation fuel, coupled with advancements in electrolysis technologies, is steering the expansion of the global water electrolysis market.

Surge in Technological Advancements

Technological progress has spurred the emergence of advanced electrolysis technologies like proton exchange membrane (PEM) electrolysis and solid oxide electrolysis cells (SOECs). These innovations boast heightened energy efficiency, swifter response times, and enhanced durability compared to conventional alkaline electrolysis methods, rendering them more appealing for commercial use. PEM electrolysis is gaining momentum due to its capability to operate at elevated current densities and lower temperatures, resulting in diminished energy consumption and augmented rates of hydrogen production.

Innovations in materials science and engineering have yielded more resilient and enduring electrolysis components, encompassing catalysts, membranes, and electrodes. These breakthroughs have elongated the lifespan of electrolysis systems, reducing maintenance expenses and downtime while enhancing overall system dependability. Enhanced durability is indispensable for commercial electrolysis applications, where uninterrupted operation and minimal upkeep are imperative.

Technological advancements have facilitated the integration of water electrolysis systems with renewable energy sources like solar and wind power. These systems can

now dynamically adapt their operations to match the fluctuating output of renewable energy sources, optimizing energy utilization and bolstering grid stability. The fusion of water electrolysis with renewable energy sources enables the generation of 'green hydrogen,' characterized by minimal carbon footprint, which can aid in decarbonizing diverse sectors such as transportation, industry, and power generation.

Key Market Challenges

Availability of Renewable Energy

One of the primary hurdles related to utilizing renewable energy for water electrolysis lies in the intermittent nature of renewable energy sources such as solar and wind power. Unlike conventional power sources like coal or natural gas, which offer a consistent and dependable electricity supply, renewable energy sources are subject to external factors like weather conditions and time of day. This intermittency can result in fluctuations in power generation, posing challenges in maintaining steady electrolysis operations and hydrogen production.

Another challenge stems from the disparity between the availability of renewable energy and the demand for hydrogen. In numerous regions, renewable energy generation may surpass demand at certain times, leading to energy curtailment or wastage. There may be instances where renewable energy supply falls short of meeting demand, thereby limiting the availability of clean electricity for water electrolysis. Achieving a balance between renewable energy supply and hydrogen demand to optimize the utilization of electrolysis systems presents a logistical and technical obstacle for stakeholders across the hydrogen value chain.

The integration of renewable energy sources into existing electrical grids and infrastructure introduces further complexities for the water electrolysis market. Grid integration necessitates the implementation of smart grid technologies, energy storage solutions, and grid stabilization mechanisms to manage fluctuations in renewable energy output and ensure grid reliability. The availability of infrastructure for transporting renewable energy from generation sites to electrolysis facilities may be constrained, particularly in remote or underserved areas.

Key Market Trends

Growing Focus on Green Hydrogen

The electrolyzer technology market is experiencing rapid evolution, characterized by efforts to boost efficiency, trim costs, and enhance scalability. Innovative designs like proton exchange membrane (PEM) and alkaline electrolyzers are gaining traction, particularly for their capacity to operate effectively alongside renewable energy sources.

The increasing emphasis on green hydrogen as a sustainable energy carrier is poised to drive substantial growth in the global water electrolysis market in the foreseeable future. Critical factors such as technological breakthroughs, supportive governmental policies, market incentives, and collaborative ventures are set to fuel market expansion, accelerating the shift towards a hydrogen-centric economy.

The amalgamation of electrolysis with renewable energy sources, coupled with advancements in hydrogen storage and distribution infrastructure, will bolster the feasibility and competitiveness of green hydrogen as a clean energy alternative. As the world endeavors to meet ambitious climate targets and transition to a low-carbon trajectory, the significance of green hydrogen and water electrolysis in facilitating decarbonization and fostering energy sustainability will become increasingly indispensable.

Segmental Insights

Type Insights

Based on the category of type, the alkaline electrolyzer emerged as the fastest growing segment in the global market for water electrolysis in 2023. For numerous years, alkaline electrolyzers have been actively utilized in commercial settings, boasting a longstanding presence as a tried-and-tested technology. Renowned for their reliability, durability, and scalability, they stand out as a favored option across diverse applications such as industrial hydrogen generation, energy storage solutions, and power-to-gas initiatives.

Operating at elevated efficiencies, alkaline electrolyzers excel in converting electrical energy into hydrogen while minimizing energy losses. This heightened efficiency is instrumental in optimizing the utilization of renewable energy sources and facilitating cost-efficient hydrogen production, rendering alkaline electrolyzers particularly appealing for the generation of green hydrogen.

Application Insights

The power and energy storage segment is projected to experience rapid growth during the forecast period. Water electrolysis is instrumental in the integration of renewable energy by transforming surplus electricity from sources like wind and solar power into hydrogen through electrolysis. This process, referred to as Power-to-Gas (P2G) or Power-to-Hydrogen (P2H), facilitates the storage of renewable energy as hydrogen for later use in power generation, transportation fuel, or industrial applications. By leveraging water electrolysis, power and energy storage applications enable efficient utilization and storage of renewable energy, addressing challenges related to intermittency and variability in renewable power generation.

In power and energy storage applications, water electrolysis aids in grid balancing and peak shaving by absorbing excess electricity during periods of low demand or high renewable energy generation, and releasing it during periods of high demand or low renewable energy availability. Integrating electrolyzers into the electricity grid infrastructure allows for grid-scale energy storage, supporting grid stability and mitigating issues such as grid congestion, voltage fluctuations, and frequency regulation.

Regional Insights

Europe emerged as the dominant player in the Global Water Electrolysis Market in 2023, holding the largest market share in terms of value. European nations have taken proactive steps to promote renewable energy and advance decarbonization agendas through favorable government policies and incentives. Key initiatives like the European Green Deal, national hydrogen strategies, and carbon neutrality targets have spurred investments in clean hydrogen technologies, particularly water electrolysis.

The integration of renewable energy sources such as wind and solar power into Europe's energy portfolio has been notably successful. This has resulted in ample availability of renewable energy resources for utilization in water electrolysis, rendering it an appealing option for hydrogen generation.

Europe benefits from a robust research and innovation landscape focused on clean energy technologies, including electrolysis. Research institutions, universities, and technology firms in Europe lead the charge in developing cutting-edge electrolysis technologies, materials, and manufacturing processes. Their efforts drive innovation and enhance global competitiveness in the market.

Key Market Players

Asahi Kasei Corporation

Nel ASA

thyssenkrupp AG

Cummins Inc.

Toshiba Energy Systems & Solutions Corporation

Teledyne Technologies Incorporated

Suzhou Green Hydrogen Energy Co., Ltd.

ITM Power PLC

Clean Power Hydrogen plc

Plug Power Inc.

Report Scope:

In this report, the Global Water Electrolysis Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Water Electrolysis Market, By Type:

- o Alkaline Electrolyzer
- o Proton Exchange Membrane (PEM) Electrolyzer
- o Solid Oxide Electrolyzer Cell (SOEC)
- o Anion Exchange Membrane (AEM) Electrolyzers

Water Electrolysis Market, By Application:

- o Refining Industry
- o Power and Energy Storage
- o Ammonia Production
- o Methanol Production
- o Transportation/Mobility Industry
- o Others

Water Electrolysis Market, By Region:

- o North America
 - ? United States
 - ? Canada
 - ? Mexico
- o Europe
 - ? France
 - ? United Kingdom
 - ? Italy
 - ? Germany
 - ? Spain
- o Asia Pacific

? China

? India

? Japan

? Australia

? South Korea

o South America

? Brazil

? Argentina

? Colombia

o Middle East & Africa

? South Africa

? Saudi Arabia

? UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Water Electrolysis Market.

Available Customizations:

Global Water Electrolysis Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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