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Material-based Hydrogen Energy Storage Market Forecasts to 2030 – Global Analysis By Material (Metal Hydrides, Chemical Hydrides, Carbon-based Materials, Porous Materials, Glass Microspheres and Other Materials), Storage Method, Application, End User and By Geography

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Abstracts

According to Stratistics MRC, the Global Material-based Hydrogen Energy Storage Market is accounted for $1.82 billion in 2024 and is expected to reach $8.46 billion by 2030 growing at a CAGR of 16.2% during the forecast period. Material-based hydrogen energy storage refers to storing hydrogen using solid or liquid materials that absorb, adsorb, or chemically bond with hydrogen. This method enhances safety, efficiency, and storage density compared to conventional gas or liquid hydrogen storage. These materials enable reversible hydrogen storage and release under controlled conditions, making them suitable for fuel cells, renewable energy integration, and transportation applications.

According to the Energy Information Administration (EIA), solar, wind, and other non-hydroelectric renewables would be the fastest growing areas of the energy portfolio for the next two years.

Market Dynamics:

Driver:

Rising focus on reducing carbon emissions

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Governments and industries worldwide are investing in hydrogen as a clean energy carrier to replace fossil fuels in transportation, power generation, and heavy industries. Material-based storage solutions, such as metal hydrides and MOFs, enable safe and efficient hydrogen storage, supporting the transition to green energy. Stricter emission regulations, carbon neutrality goals, and increasing adoption of hydrogen fuel cell technology further accelerate demand, fostering innovation and boosting market growth.

Restraint:

Storage efficiency & durability issues

Storage efficiency and durability issues in material-based hydrogen energy storage arise due to challenges in hydrogen absorption/desorption rates, material degradation, and energy losses during storage and release. Some materials, like metal hydrides and MOFs, suffer from slow kinetics, limited recyclability, and reduced capacity over repeated cycles. These inefficiencies impact long-term performance, increasing maintenance costs and limiting large-scale adoption. As a result, industries hesitate to invest, slowing market growth.

Opportunity:

Increasing applications in transportation

Material-based storage, using metal hydrides, MOFs, and chemical carriers, offers higher energy density and safety compared to traditional gaseous or liquid hydrogen storage. Governments and automakers are investing in hydrogen mobility, fueling market expansion. As transportation sectors push for zero-emission alternatives, advanced storage materials become essential, accelerating R&D, production, and adoption, thereby propelling the growth of the material-based hydrogen energy storage market.

Threat:

Safety & handling concerns

Safety and handling concerns in material-based hydrogen energy storage arise due to the high reactivity, flammability, and potential instability of hydrogen storage materials. Some materials, like metal hydrides and chemical hydrogen carriers, require specific

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temperature and pressure conditions, posing risks of leaks, thermal runaway, or hazardous reactions. These safety challenges increase regulatory scrutiny, complicate transportation logistics, and raise operational costs, thereby, slowing market adoption.

Covid-19 Impact:

The covid-19 pandemic initially disrupted the material-based hydrogen energy storage market due to supply chain disruptions, project delays, and reduced investments in R&D. However, post-pandemic recovery accelerated market growth as governments prioritized green energy initiatives for economic recovery. While short-term challenges affected production and deployment, long-term trends favoured material-based hydrogen storage, particularly in renewable energy integration, transportation, and industrial applications.

The grid stabilization segment is expected to be the largest during the forecast period

The grid stabilization segment is expected to account for the largest market share during the forecast period. Material-based hydrogen energy storage plays a crucial role in grid stabilization by addressing renewable energy intermittency. Advanced materials like metal hydrides, MOFs, and chemical hydrogen carriers enable efficient hydrogen storage and controlled release, providing a reliable energy supply during peak demand. This technology helps balance power fluctuations, enhances grid reliability, and supports large-scale renewable energy integration.

The heavy industries segment is expected to have the highest CAGR during the forecast period

Over the forecast period, the heavy industries segment is predicted to witness the highest growth rate. Material-based hydrogen energy storage is crucial for decarbonizing heavy industries like steel, cement, and chemicals, which require continuous, high-energy processes. Metal hydrides, MOFs, and chemical hydrogen carriers enable safe, high-density hydrogen storage, providing a stable fuel source for industrial operations. This technology supports hydrogen-based heating, production of green steel, and ammonia synthesis while reducing reliance on fossil fuels.

Region with largest share:

During the forecast period, the Asia Pacific region is expected to hold the largest market share due to strong government support, rising clean energy demand, and increasing

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investments in hydrogen infrastructure. Countries like Japan, South Korea, and China lead the market with national hydrogen strategies, subsidies, and R&D funding. Japan is pioneering solid-state hydrogen storage, while China is advancing metal hydrides and chemical hydrogen carriers. Growing fuel cell vehicle adoption and renewable energy integration further drive demand.

Region with highest CAGR:

Over the forecast period, the North America region is anticipated to exhibit the highest CAGR driven by increasing government initiatives, clean energy targets, and investments in hydrogen infrastructure. The U.S. and Canada are driving market expansion with funding for hydrogen research, tax incentives, and collaborations between public and private sectors. Further, rising decarbonization efforts and technological innovations will continue to propel market growth.

Key players in the market

Some of the key players in Material-based Hydrogen Energy Storage market include Air Liquide, Linde plc, Air Products and Chemicals, Inc., ENGIE, FuelCell Energy, Inc., ITM Power PLC, GKN Hydrogen, McPhy Energy S.A., Plug Power Inc., Cummins Inc., Chart Industries, Hexagon Purus, Hydrogenious LOHC Technologies, HYGEAR, Cockerill Jingli Hydrogen, Pragma Industries, Uniper and Gravitricity Limited.

Key Developments:

In February 2024, Plug Power introduced innovative hydrogen storage tanks and a pioneering mobile liquid hydrogen refueler, significantly enhancing hydrogen storage and distribution capabilities. The newly launched hydrogen storage tanks are designed to efficiently store liquid hydrogen, supporting various applications across the energy and transportation sectors.

In August 2023, Uniper initiated the HyStorage research project at its Bierwang storage facility in Germany. This project aims to assess the feasibility of storing hydrogen in porous rock formations, marking a significant step toward large-scale underground hydrogen storage solutions.

Materials Covered:

- Metal Hydrides

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- Chemical Hydrides
- Carbon-based Materials
- Porous Materials
- Glass Microspheres
- Other Materials

Storage Methods Covered:

- Physical Storage
- Chemical Storage
- Other Storage Methods

Applications Covered:

- Grid Stabilization
- Remote Power Supply
- Chemical Manufacturing
- Refining Processes
- Metal Processing
- Other Applications

End Users Covered:

- Data Centers

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- Warehouses
- Heavy Industries
- Manufacturing Plants
- Utilities
- Automotives
- Other End Users

Regions Covered:

- North America
  - US
  - Canada
  - Mexico
- Europe
  - Germany
  - UK
  - Italy
  - France
  - Spain
  - Rest of Europe
- Asia Pacific

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- Japan
- China
- India
- Australia
- New Zealand
- South Korea
- Rest of Asia Pacific

South America

- Argentina
- Brazil
- Chile
- Rest of South America

Middle East & Africa

- Saudi Arabia
- UAE
- Qatar
- South Africa
- Rest of Middle East & Africa

What our report offers:

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- Market share assessments for the regional and country-level segments
- Strategic recommendations for the new entrants
- Covers Market data for the years 2022, 2023, 2024, 2026, and 2030
- Market Trends (Drivers, Constraints, Opportunities, Threats, Challenges, Investment Opportunities, and recommendations)
- Strategic recommendations in key business segments based on the market estimations
- Competitive landscaping mapping the key common trends
- Company profiling with detailed strategies, financials, and recent developments
- Supply chain trends mapping the latest technological advancements

Free Customization Offerings:

All the customers of this report will be entitled to receive one of the following free customization options:

Company Profiling

Comprehensive profiling of additional market players (up to 3)

SWOT Analysis of key players (up to 3)

Regional Segmentation

Market estimations, Forecasts and CAGR of any prominent country as per the client's interest (Note: Depends on feasibility check)

Competitive Benchmarking

Benchmarking of key players based on product portfolio, geographical presence, and strategic alliances

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Note: Tables for North America, Europe, APAC, South America, and Middle East & Africa Regions are also represented in the same manner as above.

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