

Pumped Hydro Storage Market Driven by Renewable Integration & Grid Stability | DataM Intelligence

Pumped Hydro Storage Market grows as nations boost renewable energy adoption, ensuring grid reliability, peak load management, and long-duration energy storage.

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EINPresswire.com/ -- The global [pumped hydro storage \(PHS\) market](#) reached US\$ 332.12 billion in 2024 and is anticipated to almost double to US\$ 666.38 billion by 2032, growing at a robust CAGR of 9.20% from 2025 to 2032.

Pumped hydro storage is the cornerstone of grid-scale electricity storage worldwide, accounting for more than 90% of installed energy storage capacity, underscoring its critical role in enabling renewable energy integration, grid stability, and load balancing.

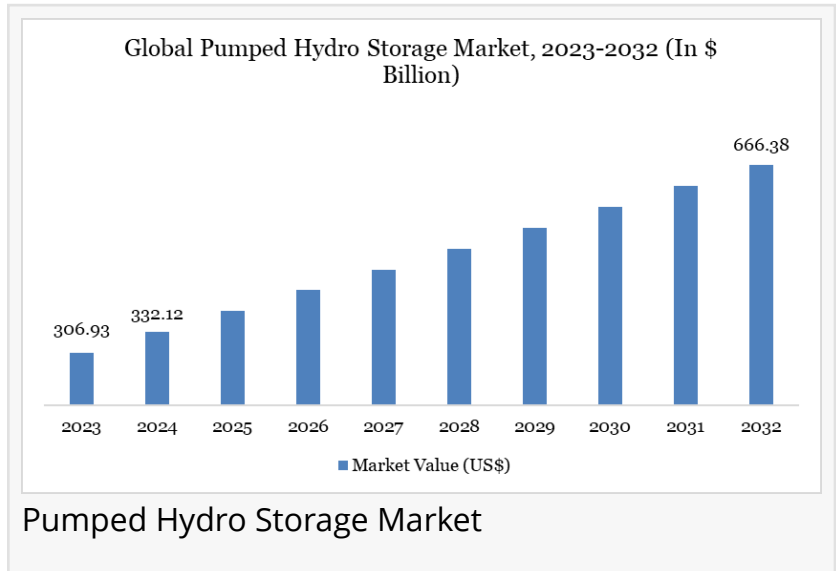
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Market Trends and Technological Advancements

A defining trend in the PHS market is the modernization and retrofitting of existing hydropower infrastructure with energy storage capabilities, thereby increasing system flexibility without extensive new construction. Between 2001 and 2021, hydropower capacity surged by 70%, much of it through upgrades that incorporate pumped storage systems.

Closed-loop or off-stream pumped storage systems are gaining prominence, currently representing about 67% of projects in development. These systems reduce environmental impacts by eliminating dependence on natural water bodies, facilitating faster permitting processes, and increasing site availability, particularly in arid or ecologically sensitive regions. An example is the proposed Goldendale Energy Storage Project in Washington State, a 1.2 GW



closed-loop system with a US\$ 2 billion investment estimate.

Variable-speed turbine technologies and digital grid management integration enhance PHS operational efficiency and grid services, supporting the increasing penetration of intermittent renewables such as wind and solar.

Market Dynamics

- **Drivers:** The increasing global focus on renewable energy deployment particularly wind and solar, which are forecasted to add approximately 935 GW annually by 2030 is accelerating the demand for reliable, long-duration storage solutions like pumped hydro. PHS helps balance supply-demand mismatches by storing excess renewable generation and releasing energy during peak usage. The International Renewable Energy Agency (IRENA) estimates that available global PHS potential exceeds 8,000 GW, far beyond current capacity.
- **Restraints:** High upfront capital expenditure and lengthy project development timelines often spanning several years for permitting, construction, and commissioning impede rapid expansion. Large infrastructure and environmental reviews contribute to project complexity and risk.

United States: Recent Industry Developments

- In September 2025, NextEra Energy secured approval for a 1.2 GW pumped hydro storage project in Colorado. The facility will integrate with solar and wind resources. It enhances grid reliability for the Western U.S.
- In August 2025, Duke Energy began construction of a 900 MW pumped hydro expansion in North Carolina. The project includes modern turbine technology. It will provide long-duration energy storage by 2029.
- In July 2025, Pacific Gas and Electric (PG&E) launched feasibility studies for pumped hydro storage in California's Sierra Nevada. The initiative supports renewable integration. It aims to reduce reliance on natural gas peaker plants.
- In June 2025, LS Power invested \$400 million in upgrading its existing pumped hydro plant in Arizona. The modernization improves efficiency by 15%. It extends the plant's operational lifespan.
- In May 2025, Dominion Energy partnered with Voith Hydro to test digital twin applications at its Virginia pumped storage facility. The project enhances predictive maintenance. It reduces downtime and costs.

Japan: Recent Industry Developments

- In September 2025, J-Power announced plans for a new 800 MW pumped hydro storage project in Hokkaido. The facility will store excess renewable energy. It supports Japan's transition to carbon neutrality.

- In August 2025, Tokyo Electric Power Company (TEPCO) began upgrading its Yagisawa pumped hydro plant. The modernization includes AI-based monitoring systems. It boosts operational efficiency and safety.
- In July 2025, Kansai Electric Power introduced hybrid pumped hydro storage integrating with hydrogen production. The pilot project in Wakayama enhances multi-energy flexibility. It supports Japan's clean energy strategy.
- In June 2025, Chubu Electric Power invested in refurbishing its Nagano pumped hydro facility. The upgrades extend plant life by 25 years. They strengthen resilience against peak demand surges.
- In May 2025, Kyushu Electric Power initiated digital twin modeling for pumped hydro assets. The technology enables real-time performance optimization. It aligns with Japan's smart grid initiatives.

Market Segmentation

The PHS market is segmented by:

- Type: Open-loop (utilizing natural water bodies) and closed-loop systems.
- Plant Type: Pure pumped storage and mixed pumped storage plants.
- Storage Capacity: Plants under 100 MW, between 100-500 MW, and above 500 MW.
- Application: Grid stabilization, frequency regulation, load shifting, renewable integration, and energy arbitrage.

Regional Analysis

North America leads the global PHS market, driven by significant grid reliability needs and renewable energy integration efforts. The U.S. operates approximately 43 PHS plants with 553 GWh of capacity and has identified over 36 GW of additional feasible closed-loop projects. Canada is also investing heavily, with approved 1-GW projects in Ontario and over US\$ 3.3 billion in broader energy storage funding. The retirement of fossil plants and renewable mandates reinforce adoption.

Asia-Pacific and Europe follow closely, with Europe noted as the fastest-growing region. Europe emphasizes expanding hydropower in mountainous areas and has invested in upgrading aging PHS plants. Asia-Pacific's growth is underpinned by new project pipelines and regional commitments to renewable transitions.

Competitive Landscape

Major global players in the PHS space include ANDRITZ Hydro, GE, Voith Hydro, Siemens Energy, Toshiba Energy Systems, Hitachi Energy, Mitsubishi Power, Dongfang Electric, Harbin Electric, and Bharat Heavy Electricals. These companies focus on technology upgrades, turnkey projects, and digital solutions integration.

Key Developments

- In January 2025, the International Hydropower Association (IHA) launched a toolkit addressing policy and development barriers to pump storage hydropower expansion, supporting a projected 200 GW installed global capacity.
- Energiasalv's 2024 tender invites alliances for a 500 MW underground PHS plant in Paldiski, showcasing increasing interest in innovative underground storage to mitigate environmental impact and acceptability challenges.

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Sustainability Impact

PHS is a critical enabler of clean energy systems, offering long-duration, large-scale storage with minimal environmental emissions once operational. Upgrades in turbine efficiency and grid service capabilities enhance sustainability benefits. Governments and organizations globally support PHS through funding and policy frameworks aligned with carbon neutrality goals.

Conclusion

Pumped hydro storage remains the backbone of global electricity storage and will continue playing an indispensable role in the transition to renewable energy. Despite cost and development challenges, its unmatched capacity, longevity, and grid flexibility solidify PHS's position as a cornerstone technology for stable, sustainable, and resilient energy systems worldwide through 2032 and beyond.

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Global [Hybrid Energy Storage Market](#) reached US\$ 16.56 billion in 2024 and is expected to reach US\$ 28.22 billion by 2032, growing with a CAGR of 6.89% during the forecast period 2025-2032.

[Hydrogen Storage Market](#) is expected to reach significant value by 2031, growing at a steady CAGR during the forecast period

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