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Flywheel Energy Storage System Market ? Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Component (Rotor System, Bearing System, Generator System) By Application (Uninterrupted Power Supply, Power Quality, Frequency Regulation, Voltage Control, & Others) By End User (Transportation, Data Centres, Aerospace, Renewable Energy, Defence, & Others) By Region & Competition, 2021-2031F

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Abstracts

The Global Flywheel Energy Storage System Market is projected to expand from USD 492.39 Million in 2025 to USD 924.96 Million by 2031, achieving a compound annual growth rate of 11.08%. This market focuses on mechanical devices that store kinetic energy by accelerating a rotor within a vacuum-sealed enclosure, subsequently reconverting that rotation into electricity. The sector is primarily driven by the critical need for grid stability services such as frequency regulation, where the technology's rapid response and high cycle life provide significant benefits over traditional methods. Furthermore, the rising demand for uninterruptible power supply (UPS) systems in data centers and industrial facilities serves as a strong catalyst for adoption, distinct from broader renewable energy trends.

However, market expansion faces a substantial hurdle due to high initial capital costs compared to electrochemical solutions like lithium-ion batteries, restricting deployment to niche high-power applications rather than long-duration storage. This economic factor makes flywheels less competitive for extended storage needs. Despite these challenges, the technology is proving its scalability; according to the China Energy

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Storage Alliance (CNESA), the world's largest utility-scale flywheel energy storage project, with a 30 MW capacity, was successfully connected to the grid in Shanxi, China, in 2024. This achievement underscores the industry's progress in delivering grid-scale capacity.

Market Driver

The increasing demand for grid stability and frequency regulation serves as a primary driver for the Global Flywheel Energy Storage System Market, utilizing the technology's ability to provide immediate power bursts. Unlike chemical batteries, flywheels employ kinetic principles to absorb and inject electricity with sub-second latency, a feature essential for balancing fluctuations from intermittent renewable energy sources. This technical advantage is illustrated by the Torus Nova Spin system, which, according to ESS News in November 2024, offers a response time of less than 250 milliseconds, demonstrating the speed necessary for modern grid resilience and revenue generation in frequency regulation markets.

Concurrently, the expansion of data center infrastructure requiring reliable UPS solutions is significantly boosting market adoption. As digital transformation drives up power consumption?projected by the International Energy Agency in January 2024 to potentially reach 1,000 TWh globally by 2026?flywheels are increasingly preferred over lead-acid batteries for their smaller footprint and lower cooling needs. To meet these massive energy demands, substantial funding is being directed toward large-scale storage projects; for instance, ESS News reported in September 2024 that the 30 MW Dinglun Flywheel Energy Storage Power Station involved a total investment of RMB 340 million, highlighting the significant capital entering this sector.

Market Challenge

The high initial capital expenditure required for flywheel energy storage systems represents a significant barrier to widespread market adoption. While the technology offers superior operational durability, the upfront financial investment is considerably higher than that of established electrochemical competitors like lithium-ion batteries. This cost disparity makes flywheels economically less attractive for long-duration storage applications, thereby confining their deployment to niche power-intensive sectors rather than broader energy management roles.

The restrictive impact of this economic limitation is evident in recent installation data, which reflects the continued dominance of lower-cost alternatives. According to the

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China Energy Storage Alliance (CNESA), flywheel energy storage accounted for only 0.4 percent of the total cumulative installed capacity of new energy storage technologies in China as of April 2024. This minimal market penetration underscores how high capital costs continue to suppress the technology's expansion within the global energy storage landscape, preventing it from securing a substantial share of mainstream grid capacity.

Market Trends

The deployment of Hybrid Flywheel-Battery Storage Systems is emerging as a crucial trend aimed at overcoming the cycle-life limitations of standalone electrochemical batteries. By combining high-power flywheels with high-energy lithium-ion batteries, operators can assign rapid, short-duration power fluctuations to the flywheel, thereby protecting the chemical battery from thermal stress and frequent cycling. This synergistic approach extends the battery's operational lifespan while optimizing the system for both frequency regulation and longer-duration needs, a trend evidenced by the China Energy Storage Alliance (CNESA) report that construction began in May 2024 on a 200 MW independent hybrid energy storage project in Shanxi Province.

Simultaneously, the integration of flywheels into Electric Vehicle (EV) fast-charging infrastructure is gaining traction as a solution to grid capacity constraints. These systems function as kinetic power boosters at charging stations, drawing energy from the grid at a low, steady rate and releasing it in high-intensity bursts for ultra-fast charging, which eliminates the need for expensive local transmission upgrades. Illustrating this expansion, EV Tech Insider reported in October 2024 that ZOOZ Power's flywheel-based technology was successfully operational at four charging sites across Germany, validating the commercial viability of mechanical storage in the e-mobility sector.

Key Market Players

Active Power Inc.

Amber Kinetics Inc.

Beacon Power LLC

Calnetix Technologies LLC

Piller Group GmbH

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Powerthru

VYCON Inc.

Stornetic GmbH

Energiestro

Oxto Energy

Report Scope

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

Flywheel Energy Storage System Market, By Component

Rotor System

Bearing System

Generator System

Flywheel Energy Storage System Market, By Application

Uninterrupted Power Supply

Power Quality

Frequency Regulation

Voltage Control

& Others

Flywheel Energy Storage System Market, By End User

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- Transportation
- Data Centres
- Aerospace
- Renewable Energy
- Defence
- & Others

Flywheel Energy Storage System Market, By Region

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

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India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Flywheel Energy Storage System Market.

Available Customizations:

Global Flywheel Energy Storage System Market report with the given market data, TechSci 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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