



# Battery Energy Storage Systems: Powering the Future of Sustainable Energy



**Subhash Sethi**  
Chairman, SPML Infra Limited

The energy sector globally is going through a major change, not just by using new energy sources, but because of the urgent need to fight climate change, reduce carbon emissions and support more sustainable future. Countries and companies around the world are turning to clean energy options like solar, wind, hydrogen, and geothermal, moving away from traditional fossil fuels and reshaping how we produce and use energy.

This shift is focused on cutting greenhouse gas emissions, improving energy security, and reducing our dependence on limited natural resources. At the same time, the renewable energy industry is driving innovation, creating jobs, and

building a stronger, more sustainable energy system. Beyond helping the environment, this transition is also boosting economies. In 2024, the global renewable energy market was valued at around USD 1.48 trillion, showing its powerful role in driving both clean energy and economic growth. This represents a significant increase compared to 2022 when the renewable energy sector generated around USD 972 billion.

India's renewable energy landscape is also experiencing rapid growth, with focus on diversifying energy sources and reducing reliance on fossil fuels. Solar power, wind power, and hydroelectricity are key contributors, with India aiming for 500 GW of renewable energy capacity by 2030.

## Battery Energy Storage Systems

In the rapidly evolving landscape of global energy, Battery Energy Storage Systems (BESS) have emerged as a transformative technology, reshaping how we generate, distribute, consume, and conserve electricity. These sophisticated systems represent a crucial link in the transition towards renewable energy sources, offering solutions to the most persistent challenge in sustainable energy generation.

Battery Energy Storage Systems are large setups that store electricity so it can be used when needed, helping balance supply and demand. Unlike traditional power plants that must generate electricity in real-time to meet demand, BESS technology allows energy to be stored during periods of low demand or high production and released when needed, creating a buffer between generation and consumption.

Modern BESS installations typically utilize advanced battery technologies, with lithium-ion currently dominating the market due to its favourable energy density, efficiency, and declining costs. However, the sector continues to evolve with emerging alternatives including flow batteries, sodium-ion, hybrid hydrogen, and solid-state technologies each offering distinct advantages for specific applications.

### Role of Energy Storage

The significance of battery storage in modern energy management systems cannot be overstated. It plays a crucial role in balancing supply and demand, storing excess energy generated from renewable sources like solar and wind, and ensuring a stable and reliable power supply even during outages or periods of low generation. Battery storage also helps reduce dependence on fossil fuels, supports grid stability and enables smarter, more efficient energy usage. As the world moves toward cleaner energy solutions, battery storage is emerging as a key pillar of sustainable and reliable energy systems, playing a vital role in the future of clean power infrastructure.

Some of the key benefits of battery storage in energy management systems include:

- **Grid Stability:** Helps balance fluctuations in energy supply and demand, especially with intermittent sources like solar and wind.
- **Energy Reliability:** Provides backup power during outages, ensuring uninterrupted supply for critical operations.
- **Load Shifting:** Stores excess energy during off-peak hours and releases it during peak demand, reducing strain on the grid.
- **Cost Savings:** Lowers energy costs by optimizing usage and reducing the need for expensive peak-time power.
- **Support for Renewable Integration:** Enables better use of clean energy by storing surplus generation and minimizing curtailment.
- **Reduced Carbon Emissions:** Helps cut reliance on fossil fuels, contributing to cleaner, greener energy system.
- **Scalability and Flexibility:** Can be deployed at various

scales; residential, commercial, or utility-level, to meet different energy needs.

### Market Growth

The global BESS market has experienced extraordinary growth, expanding from approximately 1.5 GWh of annual deployments in 2015 to projected installations exceeding 40 GWh in 2025, potentially reaching 1 TWh (1,000 GWh) by 2030. This explosive growth trajectory has been fueled by dropping battery costs, which have declined by over 85% in the past decade coupled with supportive policy frameworks and technological advancements.

The energy storage market in India is poised for a substantial growth, driven by the country's target of achieving 500 GW of non-fossil fuel electricity capacity by 2030. According to the National Electricity Plan 2023, the country's energy storage capacity requirement is projected to reach 236.2 GWh by 2031-32, with the market size estimated at approximately USD 57 billion by 2032 and going upto USD 443 billion by 2047. Government policies mandating at least 10% battery energy storage capacity for new solar and wind power projects are further expected to drive demand.

*SPML Infra's move into battery energy storage systems (BESS) marks a significant step toward supporting India's clean energy future. As the country progresses towards its ambitious renewable energy goals, aiming for 500 GW of renewable capacity by 2030, SPML's entry into BESS addresses some of the most critical energy storage challenges, such as integrating intermittent renewable sources like solar and wind, ensuring grid stability, and managing peak demand.*



### Technology Landscape

Battery energy storage systems (BESS) use different technologies to store and supply electricity when needed. Some common types include lithium-ion, sodium-sulphur, flow, and lead-acid batteries. Among these, lithium-ion batteries, accounting for approximately 90% of new installations are the most widely used for large projects because they can store a lot of energy and have better life span. Newer options like sodium-ion and solid-state batteries

are also becoming more popular as the technology improves.

Sodium-ion batteries are emerging as a promising alternative to lithium-based systems, as they rely on more abundant and cost-effective raw materials like sodium, which is widely available in the earth's crust and can be sourced from common salts. These batteries offer the potential for lower production costs, improved safety, and better performance in cold temperatures. As research and development progress, sodium-ion technology is expected to play a key role in expanding energy storage solutions, particularly for large-scale grid applications and regions with limited lithium resources. Solid-state batteries, which promise higher energy density and enhanced safety, are still in the early stages of development, especially for large-scale grid applications. However, their potential to revolutionize energy storage makes them a key area of focus for future innovation.

In addition to electrochemical storage, thermal and mechanical energy storage technologies such as compressed air, liquid air, and gravity-based systems are being explored for specific use cases. These alternatives are particularly suited for long-duration storage needs, helping to ensure grid reliability and support renewable energy integration over extended periods.

SPML Infra has signed an exclusive agreement with Energy Vault of USA to accelerate the manufacturing and deployment of battery energy storage systems in India. Energy Vault employs a hybrid approach to energy storage, offering both gravity-based and battery-based solutions. The gravity-based technology, EVx, uses a mechanical system that involves raising and lowering heavy composite blocks within a structure, storing potential energy that can be converted back to electricity when needed. They also have a modular battery energy storage system, B-VAULT that can be tailored for various applications and scales with configurations (AC and DC coupled) allowing for flexible integration with other systems and energy sources.

## Strategic Significance of SPML's Entry

*By investing in advanced energy storage technologies, SPML Infra is contributing to a more reliable, flexible, and resilient power infrastructure in India. This transition not only supports the vision of Viksit Bharat, but also positions SPML as a key player in India's evolving green energy ecosystem.*

the production and rollout of Energy Vault's B-VAULT battery energy storage systems and its VaultOS energy management software in the Indian market. This collaboration aims to manufacture between 30 to 40 GWh of BESS solutions in

next 10 years, aligning with India's increasing demand for energy storage and its ambitious renewable energy targets. By combining Energy Vault's advanced technology with SPML's strong market presence and the benefits of domestic manufacturing, the partnership is poised to deliver cost-effective, high-performance energy storage solutions tailored for India's rapidly expanding clean energy sector.

SPML's battery storage systems can help keep the power grid stable when demand is high, making sure people have reliable electricity even as India uses more solar and wind power, which don't always generate electricity consistently. These storage systems also make renewable energy more practical. They store extra energy produced on sunny or windy days for use when the sun is not shining or the wind is not blowing.

## Way Forward

Battery Energy Storage Systems represent much more than simply another component in our electrical infrastructure; they are the enabling technology for a fundamentally transformed energy system. By decoupling the timing of energy production from consumption, BESS creates much needed flexibility that was previously impossible in electrical systems, allowing higher penetration of renewable resources while maintaining and improving reliability.

As costs continue to decline and technologies advance, the deployment of energy storage will accelerate, reshaping electricity market, grid architecture, and the relationship between consumer and energy suppliers. In this transformation lies the potential for a more sustainable, resilient, and economically efficient energy future, with battery storage serving as the critical hub connecting renewable generation to reliable services.

The question is no longer whether battery storage will play a central role in our energy future, but rather how quickly the transition will occur and which combination of technologies, policies, and business models will ultimately prevail in different markets around the world.

### Brief about the author:

Mr. Subhash Sethi is the Chairman of SPML Infra Limited, a publicly listed infrastructure development company. Under his leadership, SPML Infra has completed 700+ projects, delivering clean drinking water to over 50 million people across India. He is also the author of the acclaimed book REBOUND, which shares his personal journey through cancer and inspires others facing similar challenges. A TEDx speaker, he frequently speaks on business, leadership, and wellness.

An active contributor to key industry bodies, he serves in leadership roles, driving national policy, innovation, and sectorial advancement. His remarkable contributions to infrastructure and power development have earned him numerous awards, including the prestigious Economic Times Asian Business Leadership Award. Widely respected as an industry spokesperson, his work continues to inspire innovation, resilience, and sustainable growth.