

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



How can energy storage help the electric grid? Three distinct yet interlinked dimensions can illustrate energy storage's expanding role in the current and future electric grid: renewable energy integration, grid optimization, and electrification and decentralization support.



Can stationary energy storage improve grid reliability? Although once considered the missing link for high levels of grid-tied renewable electricity, stationary energy storage is no longer seen as a barrier, but rather a real opportunity to identify the most cost-effective technologies for increasing grid reliability, resilience, and demand management.



Does grid energy storage have a supply chain resilience? This report provides an overview of the supply chain resilience associated with several grid energy storage technologies. It provides a map of each technology's supply chain, from the extraction of raw materials to the production of batteries or other storage systems, and discussion of each supply chain step.



Which technologies are commercially available for grid storage? Several technologies are commercially available or will likely be commercially available for grid storage in the near-term. The technologies evaluated provide storage durations that range from hours to days and response times of milliseconds to minutes. Four families of battery technologies and three LDES technologies are evaluated.



Why does the United States lag in grid storage? Reliance on other countries for critical raw and refined materials, components, and products? The United States lags Asia, and especially China, in the manufacture and supply of materials, components, and end products for grid storage.

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



What drives energy storage growth? Energy storage growth is generally driven by economics, incentives, and versatility. The third driver??? versatility??? is reflected in energy storage???s growing variety of roles across the electric grid (figure 1).



Currently, energy storage industry in China is extending from demonstration project stage to commercial operation stage, but series of development dilemmas exist. For example, cost of energy storage device is still high, the average cost of 1.5???1.8 yuan/kWh is far over the current electrovalence. The Smart Grid's Cost-benefit Analysis



This subsegment will mostly use energy storage systems to help with peak shaving, integration with on-site renewables, self-consumption optimization, backup applications, and the provision of grid services. We believe BESS has the potential to reduce energy costs in these areas by up to 80 percent.



In summary, our results show that a 2050 decarbonized grid with greater storage energy capacity would reduce daily and seasonal variability in the marginal price of electricity while also reducing

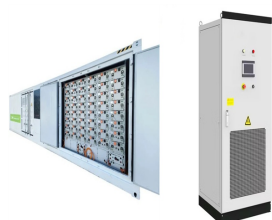


America's economy, national security and even the health and safety of our citizens depend on the reliable delivery of electricity. The U.S. electric grid is an engineering marvel with more than 9,200 electric generating units having more than 1 million megawatts of generating capacity connected to more than 600,000 miles of transmission lines.

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



One answer, explored in a new industry report with insights and analysis from McKinsey, is long-duration energy storage (LDES). The report, authored by the LDES Council, a newly founded, CEO-led organization, is based on more than 10,000 cost and performance data points from council technology member companies. Long duration energy storage



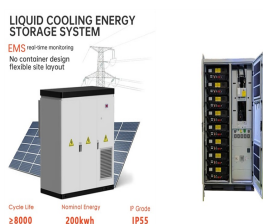
Battery Energy Storage Market Size, Share & Industry Analysis, By Type (Lithium-Ion Battery, Lead Acid Battery, Flow Battery, and Others), By Connectivity (Off-Grid, On-Grid), By Application (Residential, Non-Residential, Utility, and Others), By Ownership (Customer-Owned, Third-Party Owned, and Utility-Owned), By Capacity (Small Scale {Less



Energy storage systems (ESS) are continuously expanding in recent years with the increase of renewable energy penetration, as energy storage is an ideal technology for helping power systems to counterbalance the fluctuating solar and wind generation [1], [2], [3]. The generation fluctuations are attributed to the volatile and intermittent



The global energy storage system market was valued at \$198.8 billion in 2022, and is projected to reach \$329.1 billion by 2032, growing at a CAGR of 5.2% from 2023 to 2032. Renewable energy integration has become increasingly important due to environmental concerns and technological advancements



Supported over 14 World Bank lending projects (including six mini-grid projects) to deploy renewable energy and storage solutions and increase battery storage capacity by 2,527 MWh. Helped finance India's largest battery project to date???a 120 MWh facility commissioned in November 2023 by the Solar Energy Corporation of India (SECI).

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



The Office of Electricity's (OE) Energy Storage Division's research and leadership drive DOE's efforts to rapidly deploy technologies commercially and expedite grid-scale energy storage in meeting future grid demands. The Division advances research to identify safe, low-cost, and earth-abundant elements for cost-effective long-duration energy storage.



Cost and Performance Assessment provided installed costs for six energy storage technologies: lithium-ion (Li-ion) batteries, lead-acid batteries, vanadium redox flow batteries, pumped storage hydro, compressed-air energy storage, and hydrogen energy storage.



Energy storage systems (ESS) in the U.S. was 27.57 GW in 2022 and is expected to reach 67.01 GW by 2030. The market is estimated to grow at a CAGR of 12.4% over the forecast period. The size of the energy storage industry in the U.S. will be driven by rising electrical applications and the adoption of rigorous energy efficiency standards.



More recently, Evlo Energy Storage Inc. announced, on October 5, 2023, that it will provide the Ontario grid with 15MW energy storage capacity through an equipment supply agreement with solar project developer SolarBank Corporation. Quebec economy minister flagged battery-making for electric vehicles as a top economic priority.



In 2023, the US power and utilities industry raised the decarbonization bar, deployed record-breaking volumes of solar power and energy storage, and boosted grid reliability and flexibility with a healthy assist from landmark clean energy and climate legislation. All of this will likely continue in 2024.

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



Battery Energy Storage System (BESS) is on the rise and quickly becoming one of the most talked-about topics in the energy industry. With renewable energy sources becoming more prevalent, there is a demand for storage systems to ensure that the energy produced can be used when needed.



Energy Storage . An Overview of 10 R& D Pathways from the Long Duration components, grid controls and communications, and grid-scale energy storage. These advancements ensure that every American energy storage industry members, national laboratories, and higher



As part of the U.S. Department of Energy's (DOE's) Energy Storage Grand Challenge (ESGC), this report summarizes published literature on the current and projected markets for the global ???



Energy storage is an issue at the heart of the transition towards a sustainable and decarbonised economy. One of the many challenges faced by renewable energy production (i.e., wind, solar, tidal) is how to ensure that the electricity produced from these intermittent sources is available to be used when needed ??? as is currently the case with energy produced ???



storage to contribute 10,000 megawatts to the grid between 2021 and 2023???10 times the capacity in 2019. Energy storage plays a pivotal role in enabling power grids to function with more flexibility and resilience. In this report, we provide data on trends in battery storage capacity installations in the United

OVERVIEW OF THE ENERGY STORAGE GRID INDUSTRY



Energy storage technologies. Source: KPMG analysis. Based on CNESA's projections, the global installed capacity of electrochemical energy storage will reach 1138.9GWh by 2027, with a CAGR of 61% between 2021 and 2027, which is twice as high as that of the energy storage industry as a whole (Figure 3).



Energy storage is the key to facilitating the development of smart electric grids and renewable energy (Kaldellis and Zafirakis, 2007; Zame et al., 2018). Electric demand is unstable during the day, which requires the continuous operation of power plants to meet the minimum demand (Dell and Rand, 2001; Ibrahim et al., 2008). Some large plants like thermal ???



The energy storage market size in United States exceeded USD 68.6 billion in 2023 and is projected to register 15.5% CAGR from 2024 to 2032, impelled by the increasing demand for refurbishment and modernization of the existing grid network.



Under the background of the power system profoundly reforming, hydrogen energy from renewable energy, as an important carrier for constructing a clean, low-carbon, safe and efficient energy system, is a necessary way to realize the objectives of carbon peaking and carbon neutrality. As a strategic energy source, hydrogen plays a significant role in ???



A framework for understanding the role of energy storage in the future electric grid. Three distinct yet interlinked dimensions can illustrate energy storage's expanding role in the current and future electric grid???renewable energy integration, grid optimization, and electrification and ???