

INDUSTRY OVERVIEW

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OVERVIEW OF GLOBAL RENEWABLE ENERGY INDUSTRY

Overview

By the end of May 2026, 139 countries have established net-zero carbon targets, and the global energy is undergoing a fundamental transformation to renewable energy. The combined installed capacity of solar PV and wind power as a share of the cumulative installed capacity of global energy has increased from 4.4% in 2010 to 33.4% in 2025, and is projected to reach 68.0% by 2050. Concurrently, the energy supply model is evolving toward a more flexible and decentralized structure. Deployed close to the user side, distributed energy assets increase energy usage flexibility and strengthen grid resilience.

The continuously increasing grid-connection of highly volatile renewable energy assets poses significant challenges to the stability of power systems. In the construction of next-generation power systems, integrated sustainable energy generation, storage and management solutions have emerged as a key deployment model. These solutions enable the coordinated generation, storage, and consumption of electricity, thereby enhancing energy utilization efficiency, improving energy reliability, and supporting greater grid resilience. As adoption of these solutions continues to expand, the demand for intelligent energy management and flexible system configurations is growing.

OVERVIEW OF GLOBAL ENERGY STORAGE INDUSTRY

Definition and Overview

Energy storage refers to technologies that store electrical energy and release it on demand for power balancing, system management, and grid support. Energy storage system, or ESS, is primarily based on electrochemical batteries that enable bidirectional conversion between electrical energy and chemical energy. A typical ESS primarily consists of energy storage inverters, energy storage batteries, and energy management systems, or EMS.

1. Note: Source of information: We commissioned Frost & Sullivan to conduct market research on global energy storage and global PV inverter industries, and prepare the Frost & Sullivan Report. Frost & Sullivan is an independent global consulting firm founded in 1961 in New York that offers industry research and market strategies. We have contracted to pay RMB550,000 to Frost & Sullivan for compiling the Frost & Sullivan Report. In preparing the Frost & Sullivan Report, Frost & Sullivan conducted detailed primary research which involved discussing the status of the industry with certain leading industry participants and conducting interviews with relevant parties. Frost & Sullivan also conducted secondary research which involved reviewing company reports, independent research reports and data based on its own research database. Frost & Sullivan obtained the figures for the estimated total market size from historical data analysis plotted against macroeconomic data as well as considered the above-mentioned industry key drivers. Its market engineering forecasting methodology integrates several forecasting techniques with the market engineering measurement-based system and relies on the expertise of the analyst team in integrating the critical market elements investigated during the research phase of the project. These elements primarily include expert-opinion forecasting methodology, integration of market drivers and restraints, integration with the market challenges, integration of the market engineering measurement trends and integration of econometric variables.

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As a core component of an ESS, an energy storage inverter serves as the interface between the battery and the grid/load, enabling bidirectional AC/DC power conversion and energy flow management. Their performance directly impacts system efficiency, response speed, and operational stability. Hybrid energy storage inverters integrate solar PV input, battery storage, and grid interaction functions to enable coordinated operation of solar and energy storage systems. Building upon this, hybrid split-type residential ESS solution represents a modular system where the hybrid energy storage inverter and battery packs are installed as separate units. This architecture enables flexible system configuration and maintenance, well suited for a wide range of applications.

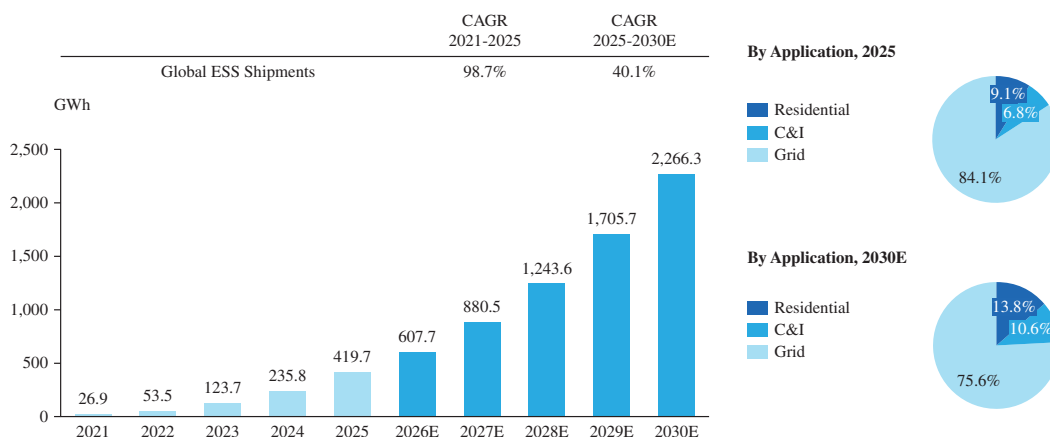
Value Chain Analysis of Energy Storage Industry

The upstream sector mainly provides core components required for ESS, including cells, thermal management systems and related structural parts. The midstream segment mainly covers the design, production, installation and commissioning of ESS. ESS solution providers deliver customized solutions for different application scenarios. The downstream applications cover both centralized and distributed scenarios. Centralized applications focus on grid side energy storage, while distributed applications cover residential and C&I energy storage scenarios. ESS solution providers usually cooperate with local system integrators, installers, EPCs, and distributors to improve market coverage and meet compliance requirements in various countries. Meanwhile, some leading enterprises establish local technical support and after-sales service teams to enhance market responsiveness and brand influence.

Market Size of Global Energy Storage Industry

From 2021 to 2025, global shipment volume of ESS increased from approximately 26.9GWh to approximately 419.7GWh, representing a CAGR of approximately 98.7% during the period. Against the backdrop of continuous sustainable energy transformation and improving economics generated from ESS products compared with traditional solutions, global shipment volume of ESS are expected to reach approximately 2,266.3GWh by 2030. Driven by rising residential electricity prices and growing demand for energy self-consumption, global shipment volume of residential ESS are expected to increase from approximately 38.1GWh in 2025 to approximately 311.8GWh in 2030, representing a CAGR of approximately 52.3%. In addition, with the accelerated development of high energy-consumption scenarios such as AIDC and advanced manufacturing, global shipment volume of C&I ESS are expected to reach approximately 241.0GWh by 2030. In 2025, China, Asia-Pacific (excluding China), the Americas, Europe and MEA accounted for approximately 60.2%, 7.5%, 17.3%, 8.7% and 6.3% of global ESS shipment volume, respectively. By 2030, their shares are projected to be approximately 54.3%, 7.5%, 16.4%, 11.7% and 10.1%, respectively.

Global ESS Shipment Volume, by Application, 2021-2030E



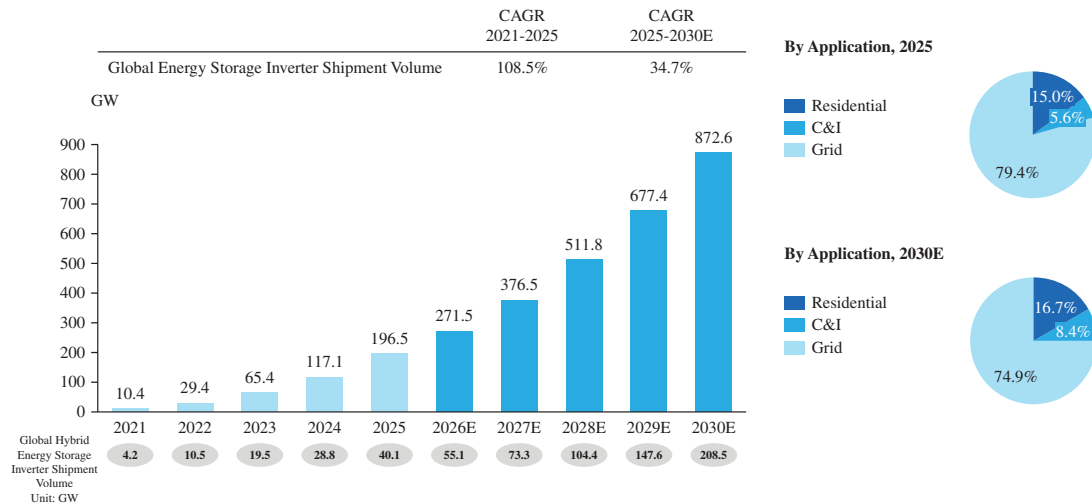
Sources: International Energy Agency (IEA), Frost & Sullivan

Note: The data presented above represent the market size of the lithium-ion ESS market.

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Energy storage inverters are critical devices for enabling bidirectional power conversion and operational control in ESS. From 2021 to 2025, global energy storage inverter shipment volume grew from approximately 10.4GW to around 196.5GW, representing a CAGR of 108.5%. With the continuous increase in global ESS installed capacity, global energy storage inverter shipment volume is projected to reach approximately 872.6GW by 2030. Meanwhile, the share of residential and C&I applications among global energy storage inverter shipment volume is expected to increase from 15.0% and 5.6% in 2025 to 16.7% and 8.4% in 2030, respectively, indicating increasing contribution from distributed ESS applications. Global shipments of hybrid energy storage inverters are expected to grow from approximately 40.1GW in 2025 to around 208.5GW by 2030, with the share of total energy storage inverters growing from 20.4% in 2025 to 23.9% by 2030.

Global Energy Storage Inverter Shipment Volume, by Application, 2021-2030E



Sources: International Energy Agency (IEA), Frost & Sullivan

Drivers and Development Trends of Global Energy Storage Industry

Improving Economics Promote Retrofits for Existing PV and Additions for Newly Installed PV

Advances in battery technology and scale expansion contribute to declines in energy storage costs. The global average levelized cost of energy (LCOE) for integrated PV and energy storage products fell to USD0.117/kWh in 2025, below the global commercial electricity price of USD0.170/kWh, and is projected to drop to USD0.090/kWh by 2030. This improving cost competitiveness is accelerating ESS adoption in both retrofit and new-build PV markets.

Global Policies and Regulations Propel the Energy Storage Industry

Driven by energy transition and power system upgrades, major economies around the globe have rolled out supportive policies for energy storage. For example, in September 2025, China released the Special Action Plan for Scale Development of New Energy Storage (2025-2027)(《新型储能规模化建设专项行动方案(2025-2027年)》), setting a target of at least 180GW of ESS by 2027. Additionally, the Renewable Energy Directive (RED III) accelerates the EU’s renewable energy penetration and boost ESS demand. In the United States, 13 states have established energy storage procurement mandates, deployment targets, and related incentive mechanism.

AI Empowerment Prompts Smart Energy Management

AI is being integrated into energy management, scheduling, operation and maintenance and energy trading, enabling ESS to evolve from passive response to autonomous decision-making and dynamic optimization. AI-empowered EMS enables real-time analysis based on weather, prices and user habits, optimizing energy management strategies and efficiency. AI-enabled, cloud-based platforms connect massive devices, enhancing safety and operation and maintenance efficiency through monitoring, fault early warning and diagnosis. Meanwhile, these platforms can deliver personalized recommendations and aggregate resources via VPP, further enhance ESS economic value.

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Accelerated Adoption of ESS in C&I Scenarios

Energy-intensive industries such as chemical and mining industries are electrifying and decarbonizing, thereby expanding ESS applications in C&I scenarios. Meanwhile, ESS is becoming essential to ensure stable operation of AIDCs with cabinet power density rising from under 10kW to over 60kW, and even exceeding 200kW. In addition, the rapid expansion of EV charging infrastructure is further increasing peak electricity demand and creating localized grid pressure. In these scenarios, ESS helps balance load fluctuations, supporting the transition toward a more integrated source-grid-load-storage power system.

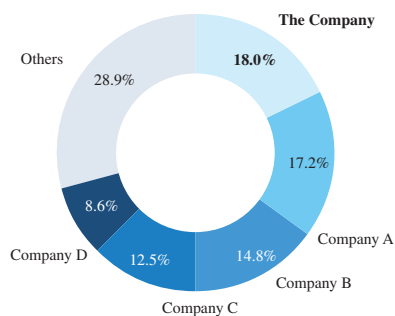
Opportunities and Challenges of Global Energy Storage Industry

The energy storage industry is benefiting from increasing sustainable energy penetration and ongoing sustainable energy transformation. In particular, ESS products support grid stability and enable end users to enhance economic benefits streams through mechanisms such as dynamic pricing and value-added services. The ESS industry also faces challenges, including changes in governmental policies, intensified global competition, and localization and compliance pressures in overseas markets, which may negatively affect product demand and project execution in a short term.

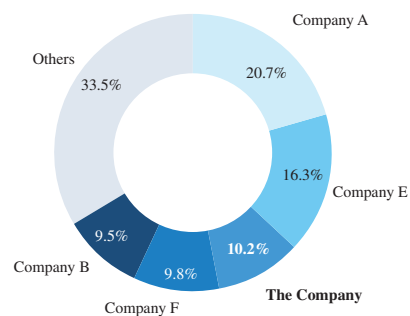
Competitive Landscape of Global Energy Storage Industry

In the hybrid split-type residential ESS segment, the top five global providers by shipment volume accounted for approximately 71.1% of the market. Among them, the Company ranked first globally with a share of 18.0%. In 2025, the top five global residential energy storage inverter providers by shipment volume accounted for approximately 66.5% of the total market share. Among them, the Company held a market share of 10.2%, ranking third in the industry.

Ranking of Global Hybrid Split-type Residential ESS Solution Providers, by Global Shipment Volume, 2025



Ranking of Global Residential Energy Storage Inverter Providers, by Global Shipment Volume, 2025

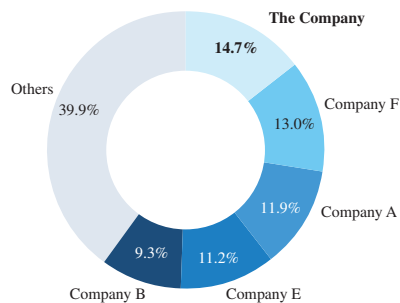


Sources: Annual Reports of Listed Companies, Frost & Sullivan

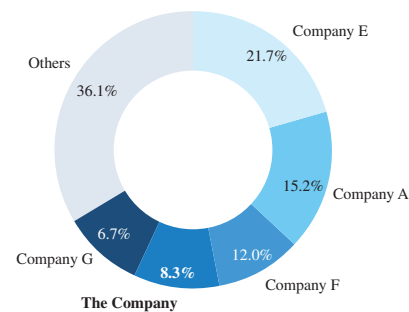
In 2025, the top five residential energy storage inverter providers in the Americas by shipment volume accounted for approximately 60.1% of the total market. Among them, the Company held a market share of 14.7%, ranking the first in the market. In 2025, the top five global hybrid energy storage inverter providers by shipment volume accounted for approximately 63.9% of the total market share, with the Company holding a global market share of approximately 8.3%, ranking fourth in the industry.

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Ranking of Residential Energy Storage Inverter Providers in the Americas, by Shipment Volume, 2025



Ranking of Global Hybrid Energy Storage Inverter Providers, by Global Shipment Volume, 2025



Sources: Annual Reports of Listed Companies, Frost & Sullivan

Notes:

1. Company A was established in 2000, headquartered in China, and is listed on the Shanghai Stock Exchange. Its main business covers PV inverters and energy storage system products, with a strong presence in Europe and emerging markets.
2. Company B was established in 2019, headquartered in China, with its main business focusing on residential energy storage system products and PV inverters, primarily serving Europe, Australia, and emerging markets.
3. Company C was established in 2012, headquartered in China, listed on the Shanghai Stock Exchange. Its main business covers energy storage systems products and related product, spanning Europe and other emerging markets.
4. Company D was established in 1995, headquartered in China, listed on The Stock Exchange of Hong Kong Limited and Shenzhen Stock Exchange, with its main business covering new energy vehicles, energy storage system products and other related products.
5. Company E was an unlisted company established in 1987, headquartered in China. Its business focuses on PV inverters, energy storage system products and digital energy solutions, with a global footprint.
6. Company F was established in 1997, headquartered in China, and is listed on the Shenzhen Stock Exchange. Its main business focuses on clean power conversion equipment such as PV inverters, energy storage system products and wind power converters. Its business mainly covers Europe, the Middle East, India, Latin America and Southeast Asia.
7. Company G was established in 2005, headquartered in China, and is listed on the Shenzhen Stock Exchange. Its main business focuses on PV inverters and energy storage system products spanning North America, Europe and Oceania.

Entry Barriers of Global Energy Storage Industry

The energy storage industry has high entry barriers, primarily in technology, certification, customer resources, and local adaptability. Technological competitiveness depends on R&D capabilities in system design, control, battery management, and the capability to develop inverters with efficiency, stability, and adaptability to diverse scenarios. Certification barriers are significant, as products must meet regional standards such as the EU’s CE/TÜV, Australia’s SAA, and the US’s ETL, requiring substantial investment in time and resources. Customer resource barriers exist as customers prioritize suppliers with mature experience, reliable delivery, and long-term service records. Local adaptability also poses challenges, as varying policies, grid conditions, and power demands across markets require tailored solutions for each market that new entrants often struggle to develop quickly.

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OVERVIEW OF GLOBAL PV INVERTER INDUSTRY

Definition and Overview

Solar PV is a power generation method that directly converts solar energy into electrical energy utilizing the photoelectric effect of semiconductor materials. As the core power electronics equipment, the PV inverter is responsible for converting DC power into AC power. Its conversion efficiency directly influences the overall power generation efficiency of the system.

Based on application scenarios, PV systems are divided into ground-mounted and distributed PV. Ground-mounted PV is typically constructed in open areas, primarily targeting centralized grid connection. Distributed PV can be further divided into residential and C&I PV. Residential PV is usually installed on the roofs of residential dwellings, while C&I PV is primarily applied in industrial parks and commercial buildings.

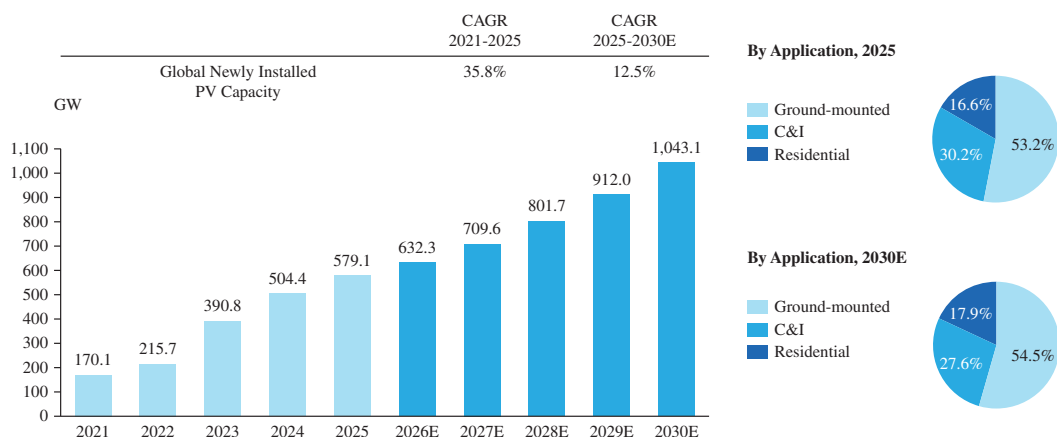
Value Chain Analysis of PV Inverter Industry

The upstream sector mainly includes manufacturing segments for core raw materials and modules, such as silicon materials, wafers, and solar cells. The midstream sector primarily includes the manufacturing of PV inverters and related power electronics equipment. The downstream sector centres on the PV system integration, and construction and operation of PV power plants. System integrators combine PV inverters, modules, brackets, and other equipment into complete power station.

Market Size Analysis of Global PV Inverter Industry

From 2021 to 2025, global newly installed PV capacity grew from approximately 170.1GW to around 579.1GW, representing a CAGR of about 35.8%. Driven by ongoing future policy support and the rising economics of PV power generation, global newly installed PV capacity is projected to reach approximately 1,043.1GW by 2030. The share of residential PV is expected to grow from roughly 16.6% in 2025 to about 17.9% by 2030, propelled by optimized subsidy policies and enhanced consumer awareness of energy use.

Global Newly Installed PV Capacity, by Application, 2021-2030E



Sources: China National Energy Administration (NEA), IEA, Solar Energy Industries Association (SEIA), Frost & Sullivan

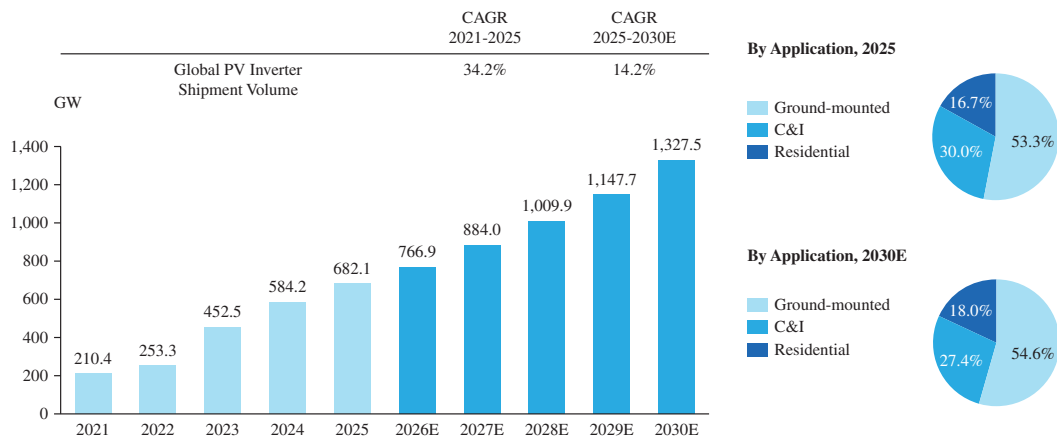
Note: The data is calculated on an alternating current (AC) basis.

Under the expansion of PV installed capacity, global PV inverter shipment volume increased from approximately 210.4GW in 2021 to around 682.1GW in 2025, at a CAGR of about 34.2%. Global PV inverter shipment volume is projected to further grow to approximately 1,327.5GW by 2030. Among these, global residential PV inverter shipment volume is expected to reach around 239.2GW by 2030, with the

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market share among global PV inverter shipment volume reaching 18.0%. In 2025, the market shares of China, Asia-Pacific (excluding China), the Americas, Europe and MEA in terms of shipment volume were approximately 52.5%, 17.9%, 12.1%, 12.8% and 4.7%, respectively, and are projected to reach around 38.4%, 26.4%, 13.1%, 13.3% and 8.8% by 2030, respectively.

Global PV Inverter Shipment Volume, by Application, 2021-2030E



Sources: China National Energy Administration (NEA), IEA, Solar Energy Industries Association (SEIA), Frost & Sullivan

Drivers and Development Trends of Global PV Inverter Industry

Rising Distributed Penetration Rates Drive Multi-Scenario Applications

China’s Measures for the Development and Construction Management of Distributed PV Power Generation (《分布式光伏發電開發建設管理辦法》), the UK’s Warm Homes Plan, and Germany’s Solarpaket I, are driving the accelerated expansion of solar power. In the C&I application scenarios, energy-intensive industries and data centres exhibit increasing demand for localized PV power supply. In the residential application scenarios, small-scale and plug-and-play systems such as balcony solar drive continued growth for PV inverters.

PV-generated Energy System Presents Enhanced Economic Benefits and Technological Improvement

Driven by economies of scale and supply chain synergies, PV power generation costs have continued to decline. The global PV LCOE decreased from USD0.417/kWh in 2010 to USD0.040/kWh in 2025 and is expected to further decrease to around USD0.030/kWh by 2030. Meanwhile, PV inverters are improving system conversion efficiency through advanced power devices and control technologies, enhancing PV system performance and overall economic returns for end users.

Accelerated Market-Oriented Reform of Electricity Industry

In February 2025, China issued the Notice on Deepening the Market-Oriented Reform of On-Grid Electricity Prices for New Energy and Promoting the High-Quality Development of New Energy (《關於深化新能源上網電價市場化改革促進新能源高質量發展的通知》), promoting broader participation of renewable energy in electricity market trading through market-based pricing mechanisms. Against this backdrop, PV inverters are evolving into intelligent energy management hubs, enabling optimal dispatch and coordinated operation of PV systems through integrated control and optimization functions.

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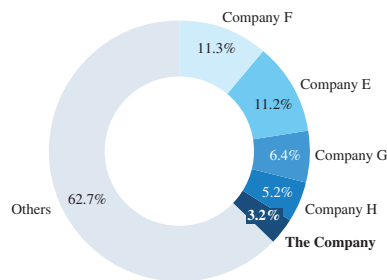
Opportunities and Challenges of Global PV Inverter Industry

The global PV inverter industry is benefiting from rising PV installations and accelerating distributed PV penetration, which is driving more diversified application requirements and increasing demand for higher power density, string-based architectures, and stronger system integration capabilities. However, the industry faces intensifying competition driven by technology convergence, while more complex application scenarios and stricter grid requirements continue to raise the bar for efficiency, reliability, and long-term operational stability.

Competitive Landscape Analysis of Global PV Inverter Industry

In 2025, based on shipment volume, the global top five distributed PV inverter providers collectively accounted for approximately 37.4% of the market. Among them, the Company had a market share of 3.2%, ranking fifth globally.

Ranking of Global Distributed PV Inverter Providers, By Global Shipment Volume, 2025



Sources: Annual Reports of Listed Companies, Frost & Sullivan

1. Company H was established in 2009, headquartered in China, with its main business focusing on the R&D, manufacturing, and sales of PV inverters, energy storage inverters, EV chargers, and energy management systems. Its distributed PV inverter business is primarily focused on markets in China, Europe and Australia.

Entry Barriers of Global PV Inverter Industry

The PV inverter industry has high entry barriers, primarily in technology, certification, customer resources, and large-scale production capabilities. Technological competitiveness depends on power electronics design, system control, and energy management capabilities, supporting product performance across diverse PV applications. Certification barriers are significant, as products must comply with different regional grid connection and safety standards, involving lengthy and costly testing and validation procedures. Customer resource barriers also remain high, as leading companies have established long-term relationships with system integrators, installers, and power companies. In addition, scale production capability is critical, because core components, such as IGBT modules and control chips, often require strong supply chain management and procurement capabilities, while large-scale manufacturing helps reduce unit costs and dilute R&D investment.

PRICE TREND FOR MAJOR RAW MATERIALS

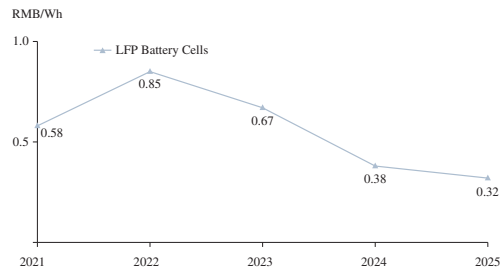
The Company's major raw materials primarily include (i) battery cells, (ii) power semiconductors; and (iii) others such as integrated circuits, inductors and capacitors. The operating results of providers of ESS and PV inverters products would be affected by price hikes or supply fluctuations of raw materials as a result of changes in the macroeconomic conditions, supply and demand, as well as market prospects.

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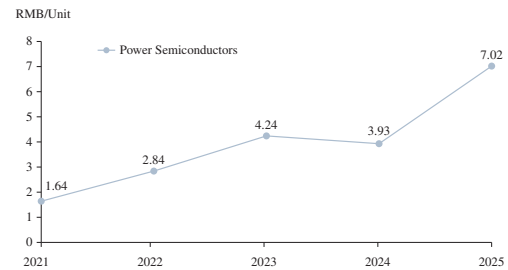
Lithium-iron phosphate (LFP) batteries cells are currently one of the major raw materials used in ESS. Driven by rising prices of core raw materials and rapid growth in downstream demand, the price of LFP battery cells increased from RMB0.58/Wh in 2021 to RMB0.85/Wh in 2022. Subsequently, primarily as a result of the increasing industry capacity, the average price of LFP battery cells continued to fall to RMB0.32/Wh in 2025.

Power semiconductors are one of the core components of PV inverters. From 2021 to 2025, power semiconductors prices rise significantly from RMB1.64/Unit in 2021 to RMB7.02/Unit in 2025, driven by strong downstream demand. In the near future, the price of power semiconductors is expected to remain at relatively elevated levels with continued volatility.

**Average Price of LFP Battery Cells,
China, 2021-2025**



**Average Price of Power Semiconductors,
China, 2021-2025**



Sources: General Administration of Customs of the PRC, Wind, Frost & Sullivan