The information and statistics presented in this section and other sections of this document unless otherwise indicated, were extracted from different official government publications and other publications, and from the industry report prepared by Frost & Sullivan, an independent market research and consulting company that was **[REDACTED]** *by us, in connection with this* **[REDACTED]**. *The information from official government sources has not been independently verified by our Company, our Directors, the Sole Sponsor* **[REDACTED]** *or any of their respective affiliates or advisors or any other party involved in the* **[REDACTED]**, *and no representation is given as to its accuracy.*

SOURCES OF INFORMATION

We engaged Frost & Sullivan, an independent market research consultant, to conduct an analysis of, and to prepare a report on global and China's digital energy solutions industry for the use in this document, which was **[REDACTED]** by us for a fee of RMB580,000. In compiling and preparing the Frost & Sullivan Report, Frost & Sullivan adopted the following assumptions: (i) the social, economic and political conditions globally currently discussed will remain stable during the forecast period, (ii) China's government policies on digital energy solutions industry will remain consistent during the forecast period, and (iii) global and China's digital energy solutions market will be driven by the factors which are stated in the report in the forecast period. Except as otherwise noted, all of the data and forecasts contained in this section are derived from the Frost & Sullivan Report. The Frost & Sullivan Report has been prepared by Frost & Sullivan independently without any influence from us or other interested parties.

OVERVIEW OF GLOBAL AND CHINA DIGITAL ENERGY SOLUTIONS INDUSTRY

Digital energy solutions refer to digital technologies that test, validate, manage, control and optimize electrical equipment and power systems through simulation and analysis of operating conditions of physical world. They are designed to support the full lifecycle of electrical equipment and power systems, spanning planning, design, construction and operation.

The new power system industry has been driven by greater penetration of renewable energy and power electronics, while the advanced equipment electrical system industry has witnessed increasing electrification. Against this backdrop, traditional physical testing methods alone can no longer accommodate these significantly more complex, dynamic scenarios. Accordingly, digital energy solutions are increasingly demanded and adopted across new power systems and advanced equipment electrical systems.

Digital energy solutions primarily consist of specialized software and hardware underpinned by industry-specific know-how and expertise, covering modeling, simulation and analytical technologies. There are generally two types of solutions designed to support different stages of an asset's lifecycle.

Planning, design, and construction solutions. these solutions support the planning, design, R&D, testing and construction stages of electrical equipment and power systems. Leveraging simulation technologies, these solutions enable reliability assessment and risk identification under complex or extreme operating conditions in a virtual environment, which otherwise are costly, dangerous or impractical to do so in real life. These solutions also help shorten R&D cycles and improve system development efficiency and reliability.

O&M solutions. these solutions are designed for system-level management and control over increasingly complex, dynamic power systems, supporting their long-term operation and optimization. These solutions enable real-time monitoring, intelligent dispatch, predictive maintenance, energy efficiency optimization and coordinated system control. Growing system complexity is driving increasing reliance on digitalized control and management systems to enhance operational efficiency, reliability and safety through real-time system-wide perception, intelligent decision-making and closed-loop control.

Core value of digital energy solutions

Full-lifecycle support. Digital energy solutions provide value across the full asset lifecycle including planning, design, construction and operation stages. Digital energy solutions enable optimization of R&D efficiency in the planning and design stages, enable verification process in the construction stage, support forecasting and optimization of predictive maintenance in the operation stage.

Verification of extreme system conditions. With advanced simulation technologies, digital energy solutions are increasingly used to replicate extreme, high-risk or destructive scenarios, such as overvoltage surges, undervoltage events, broadband oscillation and short-circuit faults, that are difficult or costly to test physically, offering high value for system reliability verification.

Value chain of digital energy solutions

Upstream: hardware and software

This segment provides computing infrastructure and development tools, encompassing simulation and modeling software, real-time operation systems, high-performance computing equipment, signal interface and power hardware, serving as the foundation of digital energy solutions.

Midstream: system solution services

This segment converts upstream general-purpose technologies and industry know-how into scenario-specific, ready-to-use solutions. Participants in this segment are required to have both IT capabilities and operational expertise. Companies with technological advantages and deep industry know-how accumulated through extensive real-world project deployment are generally in a strong position.

Downstream: application scenarios and end customers

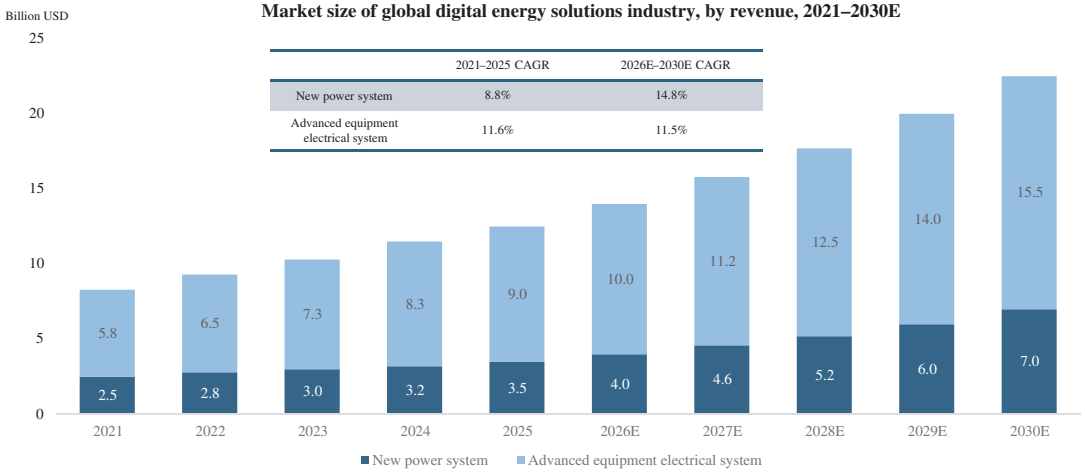
Digital energy solutions are primarily applied in the following two industries: (i) new power system industry, where customers are mainly grid companies, power generation groups, and power electronic equipment manufacturers. In this industry, digital energy solutions are widely applied across the "source-grid-load-storage" value chain; (ii) advanced equipment electrical system industry, where customers comprise AIDCs, aerospace and aviation, rail transit, marine engineering, and NEV manufacturers.

Market size of global and China digital energy solutions

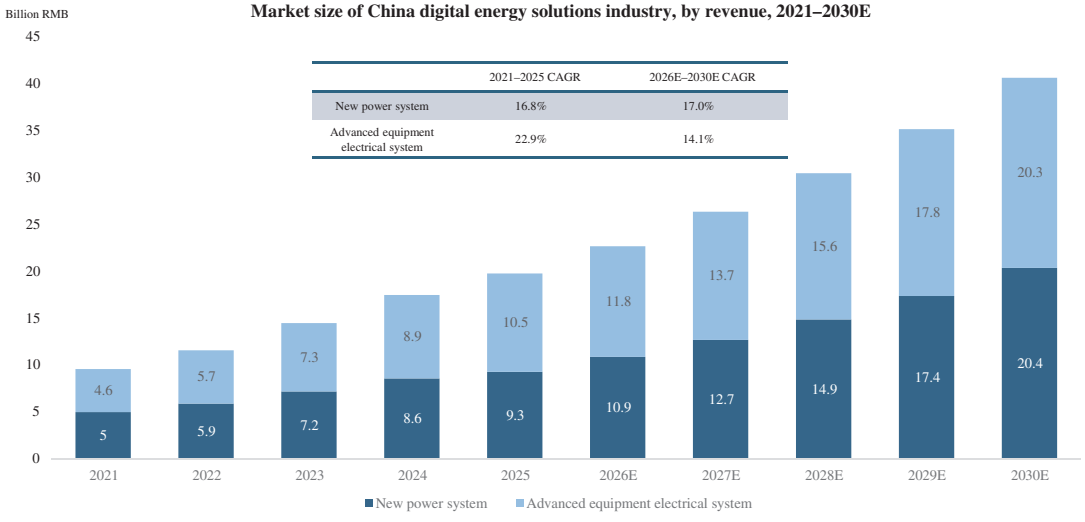
Driven by technology upgrades, increasing demands, and favorable policies, the global and China digital energy markets are both expected to grow steadily. Globally, the overall market continues to expand steadily, reaching US$22.5 billion by 2030. In China, the market is expected to exceed RMB40.7 billion by 2030 at a CAGR of 15.5% from 2026 to 2030, outpacing the global growth rate of 12.5% during the same period.

Specifically, the digital energy solutions market for the new power system industry is expected to achieve faster growth compared to the advanced equipment electrical system industry, mainly due to the accelerating construction of new power systems and rising demand for full-lifecycle optimization support across the "source-grid-load-storage" value chain. As a result, both the global and China digital energy solutions markets for the new power system industry are expected to grow rapidly at a CAGR of 14.8% and 17.0% from 2026 to 2030, respectively.

Market size of global digital energy solutions industry, by revenue, 2021–2030E



Market size of China digital energy solutions industry, by revenue, 2021–2030E



Market drivers of global and China digital energy solutions industry

Increasing demand for full-lifecycle support, system-level verification and long-term operation. New power systems have exhibited a trend toward higher penetration of renewable energy and power electronic equipment with complex operating conditions, while advanced equipment becomes more electrified and intelligent. Customers have increasing requirements for full-lifecycle support, system reliability, safety verification and regulatory compliance. This trend brings industry-wide challenges that cannot be adequately addressed by traditional solutions. Digital energy solutions, supported by advanced simulation technologies, have therefore become indispensable tools to fulfill the multi-faceted needs of the increasingly technically demanding markets.

Continuous advancement of technologies. Technological advancement has been profoundly enhancing the fidelity, efficiency, and scalability of digital verification solutions. By enabling ultra-complex modeling, high-fidelity simulation, online real-time scenario analysis, and proactive intelligent decision-making, these critical technological breakthroughs accelerate widespread commercial deployment of digital energy solutions across both the new power system and advanced equipment electrical system industries.

Growth of downstream application industries. The global and China digital energy solutions industry is driven by the two main downstream application industries: (i) The new power system industry is fueled by continuously growing electricity demand, policy incentives and increasing investment, and technology development. See "— Application Field Of Digital Energy Solutions: New Power System Industry — Market drivers of the global and China new power system industry" for more details. (ii) At the same time, the advanced equipment electrical system industry is driven by favorable policies, increasing electrification, and technology development. See "— Application Field of Digital Energy Solutions: Advanced Equipment Electrical System Industry — Market trend and market drivers of the advanced equipment electrical system industry" for more details.

Technology trends of global and China digital energy solutions markets

Real-time perception, interaction, and control. Supported by edge computing and low-latency communications, digital energy solutions have evolved from one-way monitoring to intelligent, interactive systems with an online "real-time perception-interaction-analysis-control" feedback chain, enabling nanosecond- to millisecond-level response and adaptation.

AI-enabled intelligent decision-making. Across industries, AI is driving a paradigm shift from experience-based judgment toward data-driven, human-machine collaborative intelligence, enabling faster pattern recognition, predictive analytics and autonomous optimization in complex systems. In the field of digital energy solutions, this trend is accelerating the transition from traditional experience-driven operational management to simulation-based intelligent decision-making. Combination of specialized AI applications and industry expertise and operational know-how facilitates faster, better strategy formulation and solution optimization.

Rising technological capabilities in China. Chinese companies have made significant progress in core areas such as simulation software, model libraries, and full-lifecycle solution delivery. As one of the world's most complex and fast-evolving power markets, China has provided domestic players with extensive experience in demanding scenarios such as large-scale renewable energy integration and grid stability management. As power systems worldwide face similar technical challenges in their transition toward carbon neutrality, leading Chinese companies are increasingly expanding into international markets, leveraging domestically proven reliability to serve global demand.

Cost analysis of global and China digital energy solutions industry

The digital energy solutions industry is technology- and knowledge-intensive, with its cost primarily comprising software and hardware. Software-related costs have historically remained relatively stable. However, hardware costs, particularly high-performance computing equipment utilized in simulators, have experienced an upward trend in recent years. This trend is primarily affected by global supply and demand dynamics. Specifically, the explosive worldwide demand for AI computing infrastructure has impacted the supply chain of advanced electronic and computing components, structurally driving up hardware procurement prices. Nevertheless, given the highly customized and value-added nature of digital energy solutions, industry players generally possess strong pricing power for their solutions, enabling them to effectively pass on the cost pressure to downstream customers.

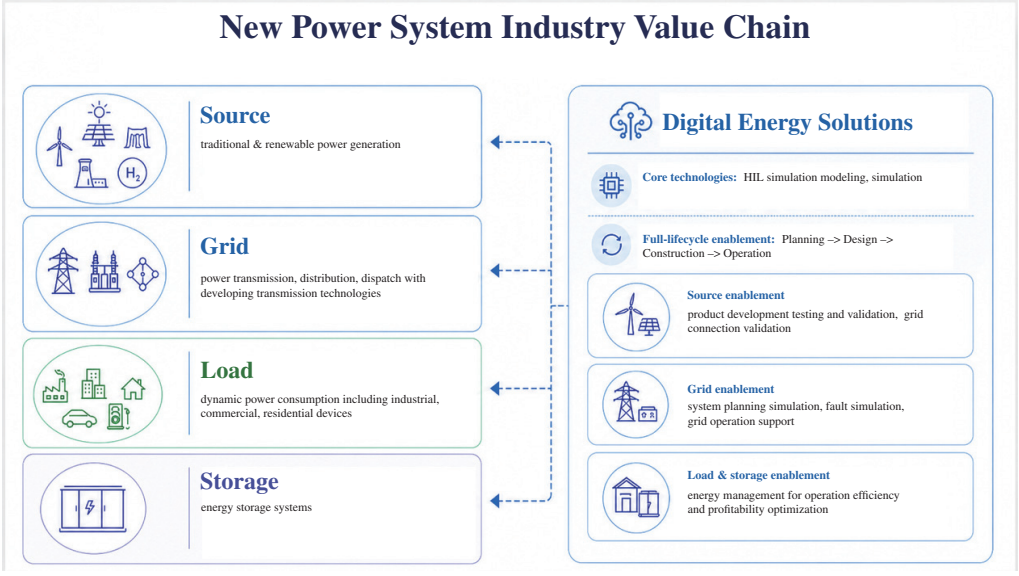
APPLICATION FIELD OF DIGITAL ENERGY SOLUTIONS: NEW POWER SYSTEM INDUSTRY

New power system refers to a comprehensive energy system powered primarily by renewable energy such as wind, solar photovoltaic, and hydropower. It structurally integrates power generation, power transmission, dynamic energy consumption, and energy storage to guarantee a stable and reliable power supply.

China introduced new power systems to systematically optimize its national energy structure, promote sustainable development, and meet the country's commitment of peaking carbon emissions before 2030 and achieving a fully carbon-neutral economy by 2060. Driven by the growing international consensus on achieving net-zero emissions, new power systems are expected to be increasingly adopted globally.

Value chain analysis of the new power system industry

The new power system can be categorized into four core segments: "source, grid, load, and storage," forming a complete closed-loop value chain.



Source: Frost & Sullivan

Source Segment. The segment of power generation, characterized by the rapidly growing penetration of renewable energy.

Grid Segment. The segment of power transmission, distribution, and dispatch, comprising both long-distance and regional networks integrated with leading transmission technologies.

Load Segment. The segment of power consumption, encompassing dynamic demand across all sectors including industrial, commercial, and residential devices.

Storage Segment. The segment of power storage, acting as the flexible buffer in power systems to optimize stability of the new power system and balance between demand and supply.

Core value of digital energy solutions in the new power system industry

Digital energy solutions for new power systems provide technical support across all segments of "source-grid-load-storage." These solutions are widely adopted for multiple functions including (i) testing and validation of electrical equipment and products that are used in all segments of source, grid, load and storage, (ii) simulation of system conditions, for the purpose of enhancing system safety and stability, improving operational efficiency and supporting the development of new power systems.

"Source" segment. Digital energy solutions provide essential product testing and verification for the construction of new energy power generation. To ensure the stability of new power system, only those renewable energy products or components with the validation of digital energy solutions are qualified to be connected to the grid and put into operation.

"Grid" segment. Digital energy solutions have become an integral part of the grid construction process. It is required for any power transmission line under planning to pass the testing and assessment of the safety and reliability through simulation by using digital energy solutions before obtaining approval of construction.

"Load" and "storage" segments. Digital energy solutions are being increasingly applied in the storage and load segments for energy management and operational optimization. Through its powerful real-time perception and control capabilities, digital energy solutions help systems realize optimized charge and discharge strategies, thus improving operational efficiency and profitability.

Characteristics of the new power system industry

High penetration of renewable energy and power electronic equipment. Driven by the accelerating energy transition both globally and in China, the penetration of renewable energy is expected to further increase as clean energy installed capacity grows alongside the widespread adoption of new energy load devices and distributed energy storage. This trend renders the power system highly complex, and unpredictable, posing formidable challenges to overall system stability.

Increasing system complexity. The deeper integration of "source-grid-load-storage" has made the new power systems increasingly complex networks involving interactions across equipment, distribution networks and bulk power grids, as well as multi-equipment coupling dynamics. As the system expands and operational boundaries continue to broaden, traditional experience-driven management approach faces increasing limitations, creating stronger demand for coordinated optimization and intelligent resource allocation.

Increasing requirements for security and stability. Security and stability are fundamental requirements for the development of new power systems, where the zero-fault-tolerance nature of operations means that system failures can result in severe consequences. It is estimated that major power outages cause economic losses of approximately US$100 billion globally each year, representing approximately 0.1% of global GDP. Greater system complexity has therefore increased the urgency of ensuring safe and stable operation, requiring security and stability management to shift from passive response to proactive prevention and control.

Adoption of advanced digital technologies. As the complexity of new power systems increases, legacy energy management technologies are inadequate to meet evolving operational demands. The industry is rapidly adopting advanced digital technologies, including real-time data collection and analysis and AI-powered simulation and optimization, to enable system-wide real-time perception, intelligent decision-making, and full-lifecycle operational management.

Challenges in global and China new power system industry

The development of new power systems, both globally and in China, faces a number of significant technical challenges.

Challenges in system planning. The inherently unpredictable nature of renewable energy generation introduces significant instability into power supply. As renewable energy capacity continues to grow, planning is further complicated by structural imbalances. Most notably, the temporal misalignment between power generation and consumption, and the spatial mismatch between centralized wind and PV facilities located in resource-rich but remote regions and load centers where electricity is consumed. Together, these factors have substantially increased the difficulty of system planning.

Challenges in system simulation and verification. The high penetration of renewable energy and power electronic equipment has fundamentally altered the dynamic behavior of new power systems, making conventional simulation methods increasingly inadequate for characterizing overall risk profiles and stability patterns. At the same time, real-world trial and error in such systems is prohibitively costly and operationally impractical, creating a critical need for more advanced and reliable simulation and verification technologies.

Challenges in system control. The large-scale integration of distributed energy resources has expanded the scope of dispatch and control to cover vast numbers of terminals across the network. Common challenges include: broadband oscillation arising from the complex coupling of power electronic equipment across power generation, transmission, and consumption; coordinated control in hybrid AC/DC systems, where the underlying mechanisms of oscillation remain poorly understood; and the transition toward low-inertia systems that demand millisecond-level precision in dynamic response.

Challenges of traditional O&M approaches. Traditional O&M practices rely heavily on manual labor and experience-based judgment, including periodic on-site inspections and reactive fault response. These conventional approaches are constrained by limited monitoring coverage and delayed fault detection. As new energy assets are deployed at scale across remote and dispersed environments, these conventional approaches are fundamentally inadequate to maintain complex systems at optimal operational conditions. Consequently, there is growing demand for simulation-based, intelligent O&M solutions for data-driven, predictive decision-making.

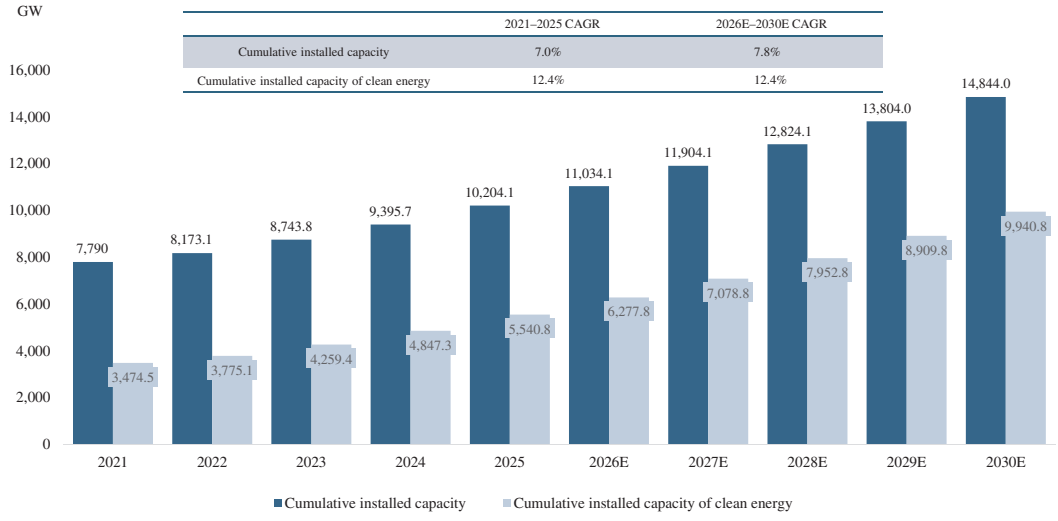
Market size analysis of global and China new power system industry

Electricity generation both globally and in China is expected to maintain steady growth from 2021 to 2030, driven by rising power demand, accelerating electrification across industries and end-use equipment, and the transition toward cleaner energy sources. Globally, total electricity generation is projected to increase from 28,259.1 TWh in 2021 to 37,125.0 TWh in 2030, while clean energy generation is expected to grow faster, with a CAGR of 7.1% from 2026 to 2030, compared with 2.8% for total electricity generation. In China, total electricity generation is projected to rise from 8,497.0 TWh in 2021 to 13,438.1 TWh in 2030, with clean energy generation recording stronger growth at CAGRs of 11.5% and 10.5% for 2021–2025 and 2026–2030, respectively.

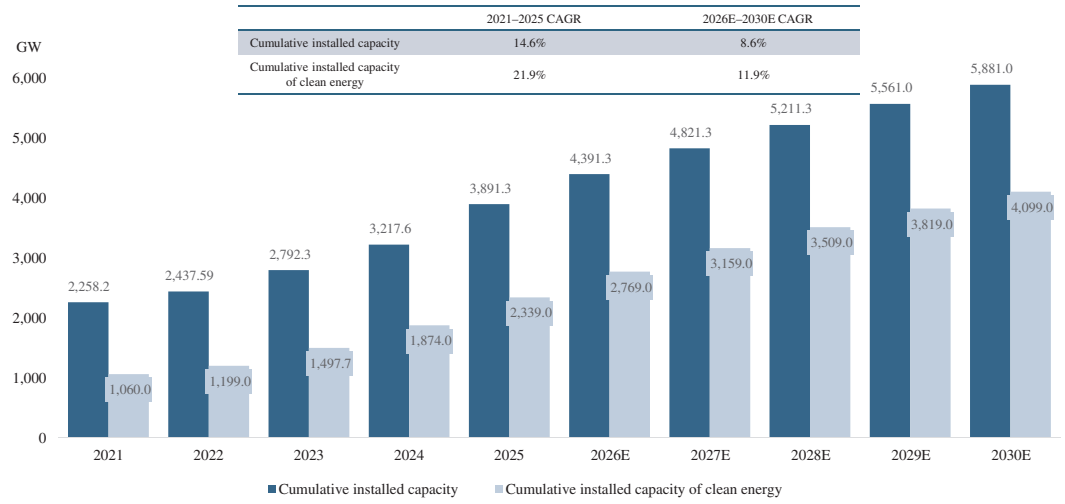
Installed power generation capacity

Installed power generation capacity is expected to continue expanding both globally and in China from 2021 to 2030, with installed power generation capacity of clean energy growing significantly faster than the overall installed capacity and becoming the key driver of capacity additions. Globally, the overall cumulative installed capacity is projected to increase from 7,790 GW in 2021 to 14,844.0 GW in 2030, while cumulative installed capacity of clean energy is expected to grow at CAGRs of 12.4% for 2021–2025 and 2026–2030, respectively. In China, cumulative installed capacity is projected to increase from 2,258.2 GW in 2021 to 5,881.0 GW in 2030, with cumulative installed capacity of clean energy growing at a CAGR of 11.9% during 2026–2030 and reaching 4,099.0 GW by 2030.

Global cumulative installed power capacity, 2021–2030E



China cumulative installed power capacity, 2021–2030E

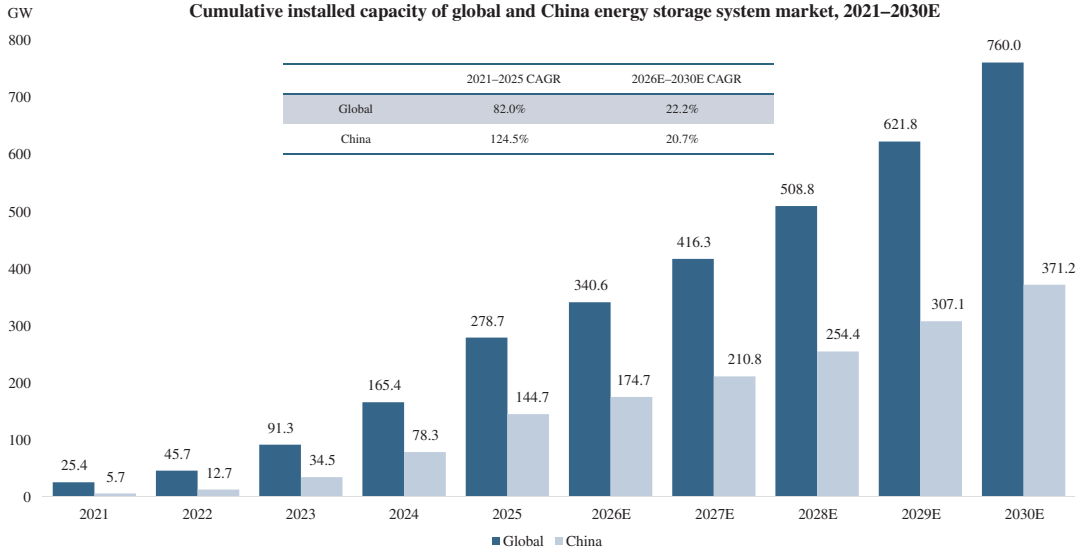


Source: Frost & Sullivan

Global and China energy storage market size

The cumulative installed capacity of energy storage systems is expected to grow rapidly both globally and in China, driven by the increasing share of renewable energy, rising demand for grid flexibility and the need for "source-grid-load-storage" coordination. Globally, cumulative installed capacity is projected to increase from 25.4 GW in 2021 to 760.0 GW by 2030, with a CAGR of 82.0% during 2021–2025 and 22.2% during 2026–2030. China is expected to remain a key growth engine, with cumulative installed capacity increasing from 5.7 GW in 2021 to 371.2 GW by 2030, after recording a CAGR of 20.7% during 2026–2030.

Cumulative installed capacity of global and China energy storage system market, 2021–2030E



Source: Frost & Sullivan

Market drivers of global and China new power system industry

Continuously growing electricity demand. Demand for electricity, particularly clean and reliable electricity, is expected to grow in the long term, driven by the accelerating electrification of industrial processes and end-use equipment, as well as the expansion of emerging high-power-consumption sectors such as AIDCs.

Policy incentives and investment. The Chinese government has been actively encouraged the development of and sustained capital investment in the new power system. Over the next few years, huge amount of capital investment is projected to be introduced across the industry value chain. Specifically, on the power generation side, investments will structurally pivot from fragmented project deployment toward the integrated capacity expansion of utility-scale renewable energy hubs. Another investment focus would be upgrade of digital energy solutions including smart operation. On the power grid side, cumulative grid investment during the 15th Five-Year Plan period is expected to exceed RMB5 trillion, focusing primarily on construction of smart distribution networks and inter-provincial transmission networks. On the energy storage side, massive investments will be directed toward long-duration energy storage to enable critical source-grid-load-storage coordination. Collectively, these investments will collectively drive the market demand for digital energy solutions.

Technology development. Technological innovations are fundamentally reshaping the operation and management of new power systems. The application of VSC-HVDC transmission facilitates efficient long-distance renewable energy delivery and grid architecture optimization. Concurrently, AI technology will empower the high-frequency processing of massive source-load data, driving intelligent dispatch decisions. Furthermore, the integration of new technologies such as digital twins, real-time simulation, and high-fidelity modeling will significantly enhance system-wide scenario analysis and proactive risk assessment.

APPLICATION FIELD OF DIGITAL ENERGY SOLUTIONS: ADVANCED EQUIPMENT ELECTRICAL SYSTEM INDUSTRY

Advanced equipment refers to high-tech and high-value-added equipment such as AIDCs, aircraft, rail transit, marine vessels, and NEVs. The electrical system is a core subsystem of advanced equipment, comprising power electronics, automatic control and information technologies that operate and control the equipment. Its performance directly affects equipment efficiency, response speed and operational safety. As equipment becomes larger, more intelligent and more complex, the requirements for electrical system development and reliability have increased. Traditional physical testing methods are costly, time-consuming and often unable to replicate extreme operating conditions. Digital energy solutions, supported by HIL simulation, provide virtual verification environments to identify potential system risks at an early design stage, shorten R&D cycles and improve system stability, thereby supporting technology iteration and quality improvement in advanced equipment.

Core value of digital energy solutions in the advanced equipment electrical system industry

Digital energy solutions are being increasingly deployed in the electrical systems of advanced equipment, driven by intensifying demands for higher performance, enhanced reliability and stringent safety standards. As advanced equipment becomes more electrified, intelligent and power-intensive, digital energy solutions built on simulation and verification are utilized to support R&D testing, system validation and operational risk management, thereby shortening development cycles and improving overall system reliability.

The technological requirements for electrical systems of advanced equipment vary across different application scenarios. For AIDCs, digital energy solutions facilitate high-power distribution and green power supply. In shipbuilding, they are applied to the development and validation of all-electric power systems. In the NEV sector, such solutions support the implementation of higher-voltage platforms and intelligent chassis electrical control systems. In rail transit, they are deployed in traction power supply, system operation and digitalized maintenance. These applications underscore the increasingly critical role that digital energy solutions play in the development, testing and safe operation of electrical systems for advanced equipment.

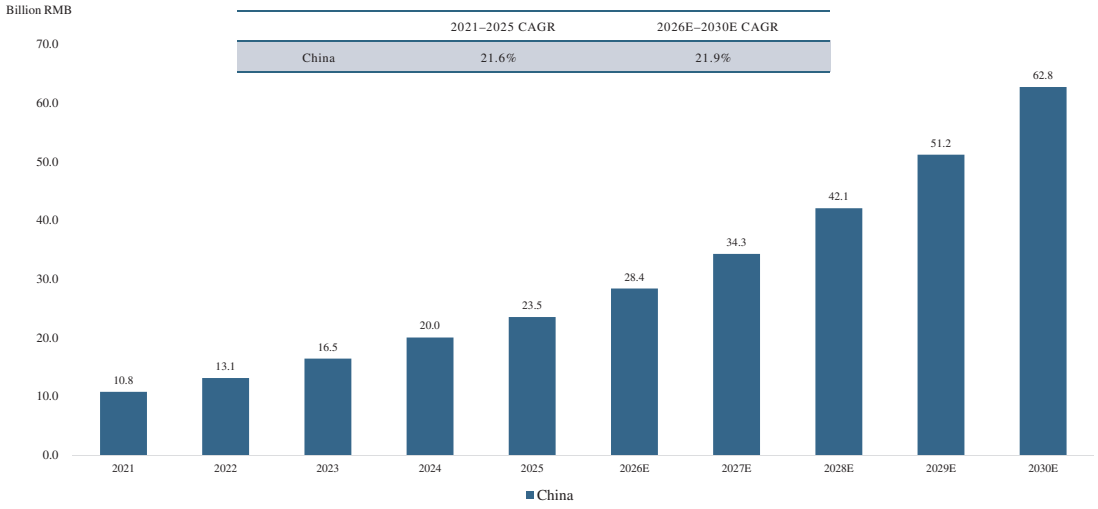
Market size of global and China Advanced equipment electrical systems industry

The global advanced equipment electrical systems industry is expected to expand steadily from 2021 to 2030. Globally, the overall market size increased from US$212 billion in 2021 to US$309 billion in 2025, and is projected to reach US$506 billion by 2030, representing a CAGR of 10.8% from 2026 to 2030.

Driven by more robust growth momentum of the domestic advanced equipment market, China's advanced equipment electrical system industry is growing faster than the global market, which increased from RMB10.8 billion in 2021 to RMB23.5 billion in 2025, and is projected to reach RMB62.8 billion by 2030, representing a CAGR of 21.9% from 2026 to 2030.

Market size of Global advanced equipment electric system industry, by revenue, 2021–2030E

Market size of China advanced equipment electric system industry, by revenue, 2021–2030E



Market trend and market drivers of the advanced equipment electrical system industry

Favorable policies. In China, national policies promote large-scale equipment renewal and upgrades, combined with a regulatory shift from direct financial subsidies toward stricter technical standards. Advanced equipment manufacturers are encouraged to continuously upgrade their electrical systems with a focus on energy efficiency and smart integration.

Increasing electrification. Demand for advanced electrical systems is rapidly expanding, driven by widespread electrification across sectors such as NEVs and low-altitude aerospace, the explosive growth of AI infrastructure and data centers; and the critical need for next-generation systems featuring higher voltages, enhanced intelligence, and increased power density.

Technology development. Continuous breakthroughs in power density, energy efficiency, and reliability along the dimensions of "high voltage, intelligence, and integration" are driving next-generation product upgrades. Additionally, the adoption of AI technologies is transforming electrical systems from passive response to proactive intelligent control.

COMPETITIVE LANDSCAPE OF CHINA DIGITAL ENERGY SOLUTIONS INDUSTRY

Participants in China's digital energy solutions market comprise domestic independent providers, domestic non-independent providers, and international providers. The market is dominated by domestic players, who are considered more competitive, attributable to their deep understanding of local markets, technological capabilities, and responsiveness to customer requests.

Major market players analysis

Domestic independent providers. Domestic independent providers are companies with a focus on digital energy solutions which account for a substantial majority of their business. Leading players possess deep hardware-software integration experience and industry know-how. They excel in solution customization, technological agility, and responsiveness to customer requests, delivering seamlessly integrated hardware-software closed-loop solutions.

Domestic non-independent providers. Domestic non-independent providers are companies in the power industry with digital energy solutions accounting for a small proportion of their business. Leveraging their affiliations with major grid companies, power generation groups and electrical equipment manufacturers, they generally possess regional advantages and stable customer resources.

International providers. International providers primarily comprise specialized software providers and industrial conglomerates. The specialized software providers excel in certain areas with technological accumulation. The industrial conglomerates are well-established industrial groups such as Siemens and Dassault Systems. However, both types of international providers face challenges in providing solutions within China due to insufficient localized service capabilities.

Industry ranking

Ranking of Digital Energy Solution Providers in China's New Power System Industry, by Revenue, 2025

Company Name	Company Category	Revenue (*RMB100 million*)	Market share
Company A[(1)]	Domestic non-independent provider	16	17.2%
Company B[(2)]	Domestic non-independent provider	7	7.5%
The Company	**Domestic independent provider**	**5.1**	**5.5%**
Company C[(3)]	Domestic non-independent provider	4.5	4.8%
Company D[(4)]	Domestic non-independent provider	4	4.3%
Company E[(5)]	Domestic non-independent provider	3	3.2%
Company F[(6)]	Domestic independent provider	1	1.4%
Company G[(7)]	Domestic independent provider	0.6	0.7%

Source: Frost & Sullivan

Notes:

(1) Company A is a leading research institution affiliated with the State Grid Corporation of China (SGCC). It is primarily engaged in the R&D of power system technologies, including smart grid control, high voltage technology, and distribution networks. It serves as a key technical support unit for the smart grid division of SGCC. It is a non-listed state-owned enterprise.

(2) Company B is a research institute established by China Southern Power Grid (CSG). It focuses on R&D in power grid technologies, smart grid, and renewable energy integration within the southern China region. It acts as a think tank and technical support for the smart grid division of CSG. It is a non-listed state-owned enterprise.

(3) Company C is a technology enterprise under CSG, listed on the STAR Market of the Shanghai Stock Exchange. It specializes in smart grid technology services, energy storage system integration, and power equipment testing. It provides comprehensive digital solutions for power system construction and operation.

(4) Company D is a leading provider of energy internet and smart grid solutions, affiliated with SGCC. It specializes in the R&D, manufacturing, and sales of power automation equipment, industrial control products, and software. Its products are widely applied in power generation, transmission, and distribution. It is a listed company on the Shanghai Stock Exchange.

(5) Company E is a high-tech enterprise focusing on power equipment manufacturing and system integration, now part of China Electrical Equipment Group. It specializes in UHVDC transmission, smart distribution networks, and electric vehicle charging infrastructure. It is a listed company on the Shenzhen Stock Exchange.

(6) Company F is an independent solution provider established in Shanghai. It focuses on energy management systems, microgrid solutions, and digital energy services. It provides customized software and hardware solutions for industrial and commercial energy users. It is a non-listed company.

(7) Company G is a well-known enterprise in the power automation industry. It focuses on the R&D and production of relay protection devices, substation automation systems, and power dispatching automation systems. Its products are widely used in power and industrial sectors. It is a listed company on the Shanghai Stock Exchange.

Entry barriers and analysis of success factors

The digital energy solutions market, both globally and in China, is characterized by high barriers to entry. Developing competitive simulation software, model libraries, and integrated solutions requires sustained R&D investment and extensive real-world engineering deployment experience that cannot be readily replicated. Established players further benefit from self-reinforcing advantages, as proprietary models are continuously refined through field-measured data from a growing base of completed projects, creating a virtuous cycle that widens the gap with potential new entrants. These factors, combined with rigorous customer qualification cycles and a significant shortage of talent, make it difficult for new entrants to disrupt the existing competitive landscape in the short term.

Technology, R&D and IP barriers. The industry's core barrier is the ability to model complex physical systems with high precision and run real-time simulation. Leading players hold advantages in core technologies. These capabilities require sustained R&D investment and extensive patent portfolios, creating a gap that new entrants cannot close in the short term.

Industry experience and data barriers. High-value industrial solutions depend on deep industry understanding and years of field data accumulation. These data assets and practical know-how are inherently cumulative and exclusionary, forming a deep competitive moat.

Customer qualification barriers. Customers in power system and advanced equipment sectors impose strict reliability and data security requirements, with long and rigorous qualification cycles for solution providers. Establishing a track record of proven results sufficient to be recognized as a qualified supplier requires significant time and investment, making it difficult for new entrants to gain initial access.

Talent barriers. The industry demands deep integration of technology and practical experience, and faces a significant shortage of cross-disciplinary talent in the fields of electrical engineering, electrical automation, and computer science.