Energy Storage Industry White Paper 2022

(Summary Version)

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Foreword

Big Changes to Take Place in the Industry

In 2021, by taking advantage of China's strategy to peak carbon dioxide emissions and achieve carbon neutrality, the state and local governments introduced more than 300 policies related to energy storage, which put the energy storage industry under the spotlight and ushered in an investment boom in the industry. The State Council issued the *Action Plan for Carbon Dioxide Peaking Before 2030*, proposing that by 2025, the installed capacity of new types of energy storage would reach 30 GW or more; by 2030, the installed pumped-storage hydro power capacity would reach approximately 120 GW, an increase of more than 10 times and 4 times respectively over the current total installed capacity. The State Grid has recently proposed a plan for energy storage construction in the company's operating areas in the next decade, that is, by 2030, both the capacity of pumped hydro energy storage and new energy storage would reach 100GW, with an investment of more than RMB 1 trillion. During the "14th Five-Year Plan" and "15th Five-Year Plan" periods, China Southern Power Grid will put into production 5GW and 15GW of pumped hydro energy storage capacity, and put into production 20GW of installed capacity of new energy storage respectively in the company's operating areas. According to the statistics, in 2021, the investment plan of lithium-ion battery industry chain alone (especially in the middle and upper reaches of lithium-ion battery) has exceeded RMB 1.2 trillion.

In 2021, major countries around the world have taken the development of energy storage industry as a national strategy, and the international market continued to compete for seizing the dominant position of the energy storage manufacturing industry. The energy storage industry was still thriving amid the sluggish global economy in 2021. The United States launched the "Energy Storage Grand Challenge (ESGC)", which enabled its newly added installed capacity to surpass that of China again last year, and making the US the first nation that entered the 10GWH era; the Europe proposed the "BATTERY 2030+", with various tasks of technological research and development and industrial chain building being deployed in an orderly manner.

It can be said that the energy storage industry is riding the momentum.

Making progress by seizing the opportunities. We hope that practitioners in the energy storage industry can seize the opportunities, and more importantly, make every effort to develop technologies and manage enterprises so as to make the industry stronger. At the same time, we should stay calm, think deeply and keep an eye on the risks and hidden dangers in the development of the industry. **First, in terms of the supply chain**, the year of 2021 witnessed the emergence of endless "black swan" incidents such as the "Section 201 investigations" in the United States, "Tsingshan Nickel Incident", and the selling of Chinese concept stocks, the soared international commodity prices, and deterioration of the global supply chain system due to the impact of COVID-19 epidemic, the Russian-Ukrainian war and the fierce competition among major powers. The price of lithium-ion battery materials set new records over and again, with the price of lithium carbonate rising from RMB 55,000 per ton early last year to more than RMB 500,000 now. **Second, in terms of the industry**, in 2021, the capacity of new energy storage projects planned and under construction was 23.8 GW/47.8 GWh respectively, and the new operational capacity of new energy storage projects was 2.4 GW/4.9 GWh respectively in China. However, there's no stable and reasonable revenue model for most of the existing energy storage projects, or any detailed rules of market mechanism for peak load regulation, frequency control and capacity compensation. Some enterprises consider "Enclosure Movement" as the optimal development mode. In this case, overdeveloped projects and inactive grid-connected projects with energy storage allocation are common. **In terms of technology**, the lithium-ion battery industry chain was booming in 2021, but security remained the biggest challenge of the industry. Following the "4.16" Beijing Dahongmen Energy Storage Power Station Fire and Explosion, there have been more than a dozen major safety accidents around the world. Up to now, no uniform safety standards and recognized solutions have been established in the industry.

Signs of Change. 2021 marks a year of opportunity for the energy storage industry. Practitioners should lose no time to take advantage of its opportunity. If there are any signs of change, we should also be aware that, the uncertainties might greatly increase

in the future, and the development momentum of the industry might be overshadowed by the risks of the surrounding environment. The risks of the surrounding environment are reflected in four aspects. First, what price would human society pay to return to the normal order of life and production in the post-COVID-19 era? Second, the recent conflict between Russia and Ukraine would surely cause profound changes to the current international order. Third, the game between China and the US may have a subversive impact on economic globalization. The last aspect is international finance. The over-issuance of currencies dominated by the US dollar in the context of the epidemic is bound to drive global inflation, which will affect social stability, economic order and international relations of all countries. Could this lead to a new round of global financial crisis?

Changes to Take Place. As the managers and practitioners in the energy storage industry, we must think calmly, avoid blind confidence, keep solving problems dynamically, and cautiously deal with various risks and challenges inside and outside the industry.

In 2022, the industrial integration layout around energy storage has become a consensus in the industry. Central and state-owned enterprises, such as State Grid, China Southern Power Grid, CHN Energy, SPIC, and China Three Gorges Corporation, as well as large-scale private enterprises such as CATL, BYD, Huawei, SUNGROW, Envision Energy, are continuously strengthening their reserves of energy storage technology based on the demand of new energy business for energy storage. This provides opportunities for the development of many small and medium-sized enterprises (SMEs). However, many SMEs are still struggling due to imperfect market mechanisms. An industry is based on the market and must develop following the rule of the market. If we compare the backbone enterprises to the backbone of an industry, then the SMEs that are closest to the market and the most dynamic are the flesh and blood of the industry. The energy storage industry depends on the “State Owned Enterprise ” and more importantly, a market mechanism that is conducive to the healthy growth of the SMEs. We call on relevant departments and colleagues in the industry to build consensus, develop a sound and reasonable market mechanism, and

try to create space for the benign and sustainable development of the SMEs.

In terms of route options, lithium-ion battery becomes the dominant technology of the new energy storage sector. Sodium batteries are on the rise, and the launch of a number of semi-solid battery products will accelerate the formation of new formats and ecosystems. The lithium and sodium industry will continue to make progress in standard formulation, fire supervision, quality control, management and recycling. The digital and intelligent technologies will also shape the lithium-sodium energy storage industry in all aspects. Accessing the electricity ancillary services market with short-time high-frequency technology is a common solution for large-scale grid connection for wind power and photovoltaic generations. Therefore, power device technologies such as flywheels, capacitor batteries, and high-rate cells have attracted the attention of the market.

It is more promising for the long-duration energy storage technology that spans over a few days or weeks. Supporting the wind energy and photovoltaics as the main energy sources through the deployment of ultra-long-term energy storage in the future will be the development direction of energy storage. A number of long-duration energy storage technologies have begun to emerge. New flow batteries are competing, vanadium redox batteries and iron-chromium batteries are emerging; major breakthroughs have been made in the development of compressed air energy storage, and the ultra-long-duration compressed air energy storage with stand-alone capacity of 10MW and 100MW has been grid-connected and is advancing to the stand-alone capacity of 300MW; with the gradual maturity of flexible transformation technology and the progress of thermal energy storage technology, thermal power plants also began to explore new business format and mode; the technology development for several gravity energy storage projects is already underway.

The 2022 white paper comprises our observations of the industry over the past year, in which we strive to present the readers with the technical findings and industrial practical experience over the past year. There may be omissions or errors due to limitations of our ability and vision. Your comment and suggestion would be greatly appreciated. We need to think calmly for a popular industry by giving top

priority to its development. The development of an industry depends on the joint efforts from all. We are willing to work with all colleagues in the industry to promote the healthy development of energy storage industry!

Deputy Director and Secretary General of Energy Storage Committee, China Energy Research Society

Executive Vice Chairman, China Energy Storage Alliance

Johnson Yu

April 20th, 2022

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I. Global Energy Storage Market Scale

According to the statistics from the CNESA Global Energy Storage Project Database, by the end of 2021, global operational Electric energy storage project capacity totaled 209.4 GW, up 9% year on year. The pumped hydro energy storage accounted for less than 90% for the first time, fell by 4.1 percentage points year on year. This was followed by the new energy storage, which stood at 25.4 GW, with a year-on-year growth of 67.7%. Lithium-ion batteries comprised the largest portion of new energy storage, with a market share of more than 90%.

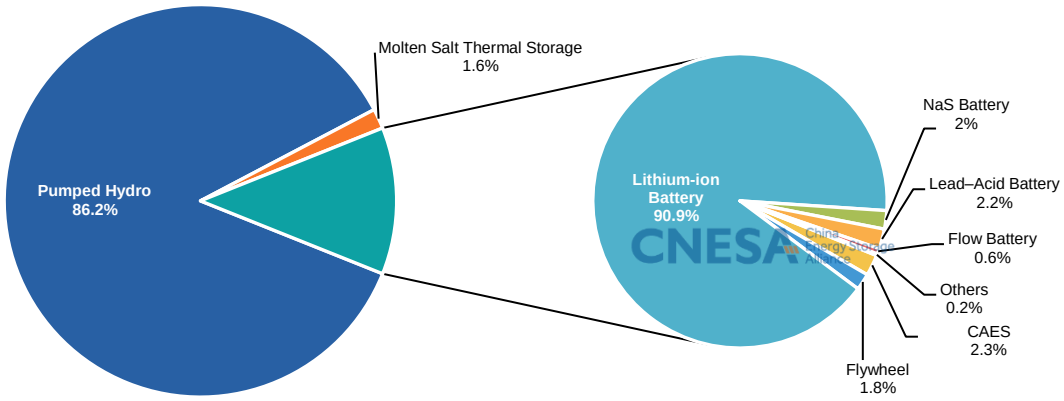

Figure 1: Global Power Energy Storage Market Capacity (MW%, by the end of 2021)

Data source: CNESA Global Energy Storage Project Database

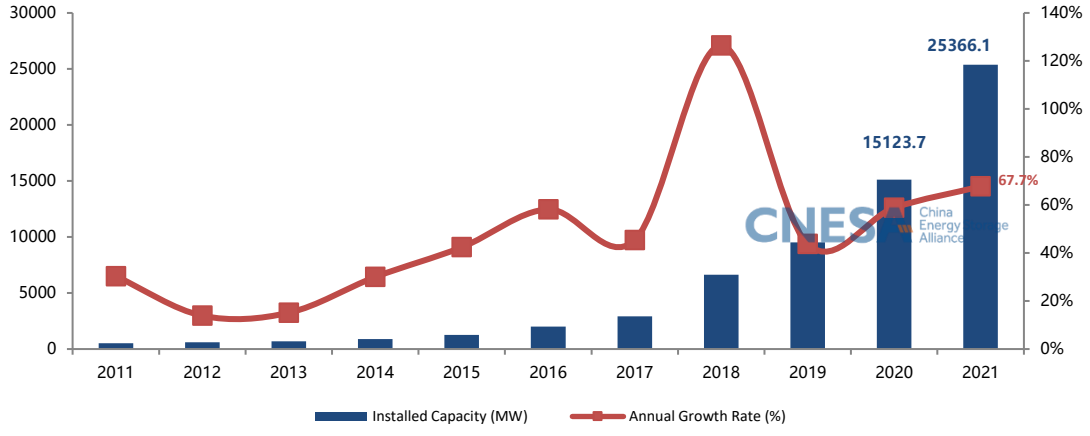

Figure 2: Global New Energy Storage Market Capacity (MW%, by the end of 2021)

Data source: CNESA Global Energy Storage Project Database

II. Global Major Energy Storage Markets Distribution

Energy storage is emerging as one of the key enabling technologies in many countries for achieving carbon neutrality goals. In 2021, the global new energy storage market continued to grow rapidly despite the impact of COVID-19 epidemic and supply chain shortages. In 2021, global new operational power energy storage project capacity totaled 18.3 GW, a year-on-year increase of 185%, with the new energy storage comprising the largest portion at 10.2 GW, exceeding 10 GW for the first time, 2.2 times that of 2020, with a year-on-year growth of 117%. The United States, China and Europe continued to lead the development of the global energy storage market, accounting for 80% of the global market together.

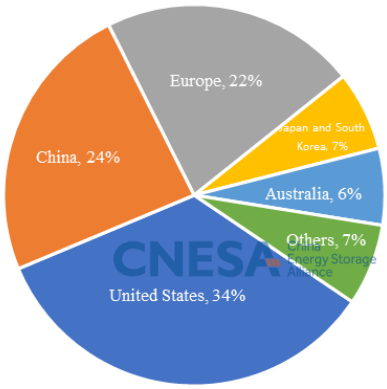

Figure 3: Distribution of Global New Operational New Energy Storage Projects by Region in 2021 (MW%)

Data source: CNESA Global Energy Storage Project Database

The United States: The US energy storage market achieved record growth in 2021, despite delays in some projects due to short supply of battery supply chain and rising prices, etc. On the one hand, the newly added energy storage project capacity exceeded 3GW for the first time, 2.5 times that of the same period in 2020. 88% of the installed capacity came from front-of-meter applications, mainly from generation-side "solar plus energy storage " projects and standalone energy storage stations. On the other hand, the installed capacity of individual projects was breaking records. The largest energy storage project completed in 2021 was the 409 MW/900 MWh Manatee Energy Storage Center of Florida Power & Light. At the same time, the United States is about to start a new era of gigawatt projects from megawatt projects.

China: 2021 marked the first year of China's energy storage from the initial stage of commercialization to large-scale development. China has set a target that the installed capacity of new types of energy storage would reach 30 GW or more by 2025; 14 provinces

have released energy storage plans; more than 20 provinces have defined the requirements for new energy storage allocation; the project installed capacity has been improved greatly; the new operational capacity exceeded 2 GW for the first time, 1.6 times that of the same period in 2020, which mainly came from generation-side renewable energy allocation and standalone energy storage applications. The number of new 100 MW projects (including those planned, under construction and in operation) again set a new record of 78, more than 9 times that of the same period in 2020, with a total capacity of 26.2 GW. In terms of technical application, in addition to lithium-ion battery, other technologies such as compressed air, flow battery and flywheel energy storage have also become major forces of new energy storage installations in China in 2021. In particular, some 100 MW compressed air energy storage projects have been connected to grid nationwide and even globally for the first time.

Europe: Driven by the renewable energy targets and commitments of the European countries, as well as the opening-up of market opportunities for grid services, the installed capacity of the European energy storage market has been continuously growing since 2016, and showing a rapid growth trend. In 2021, the new operational capacity in Europe reached 2.2 GW, with robust performance of the residential ES market, which exceeded 1 GW. Germany still enjoyed the absolute dominance in this field, with 92% of the new operational capacity came from residential ES and a total of 430,000 installations. In addition, the residential ES markets in Italy, Austria, the UK, Switzerland and other regions were taking off. The UK and Ireland have the most front-of-meter markets. With the approval of projects above 50 MW and 350 MW in England and Wales, the UK saw a rapid rise of installed capacity, with an average capacity increase to 54 MW per project. Ireland has opened up its ancillary services market for energy storage resources. At present, the planned capacity of its grid-scale battery energy storage projects has exceeded 2.5 GW. Its market capacity would continue to rise at high speed in the short term.

III. Chinese Energy Storage Market Scale

According to the statistics from the CNESA Global Energy Storage Project Database, by the end of 2021, China's operational power energy storage project capacity was 46.1 GW, accounting for 22% of the global total, with a year-on-year growth of 30%. The pumped hydro energy storage that comprised the largest portion was 39.8 GW, up 25% year on year, with a year-on-year decrease of 3 percentage points in its share. The market growth mainly came from new energy storage, with its capacity totaling 5729.7 MW, up 75% year on year.

In 2021, the new operational power energy storage project capacity in China totaled 10.5GW, breaking 10 GW for the first time. Pumped hydro energy storage was 8 GW, with a year-on-year growth of 437%; new energy storage was 2.4 GW, exceeding 2 GW for the first time, with a year-on-year growth of 54%. In the new energy storage, some 100 MW projects for both the lithium-ion battery and compressed air have been connected to the grid. The compressed air, in particular, achieved a leap-forward growth in 2021 with a new operational capacity of 170 MW, nearly 15 times the total installed capacity by the end of 2020.

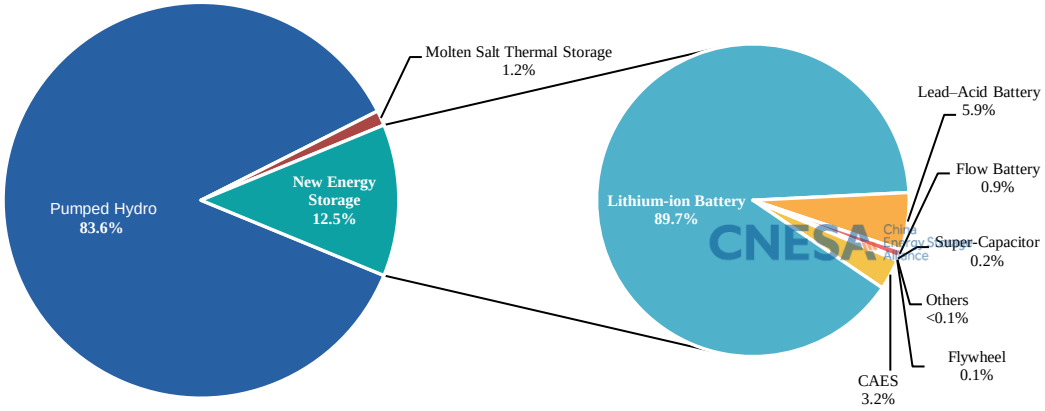

Figure 4: Chinese Power Energy Storage Market Capacity (MW%, by the end of 2021)

Data source: CNESA Global Energy Storage Project Database

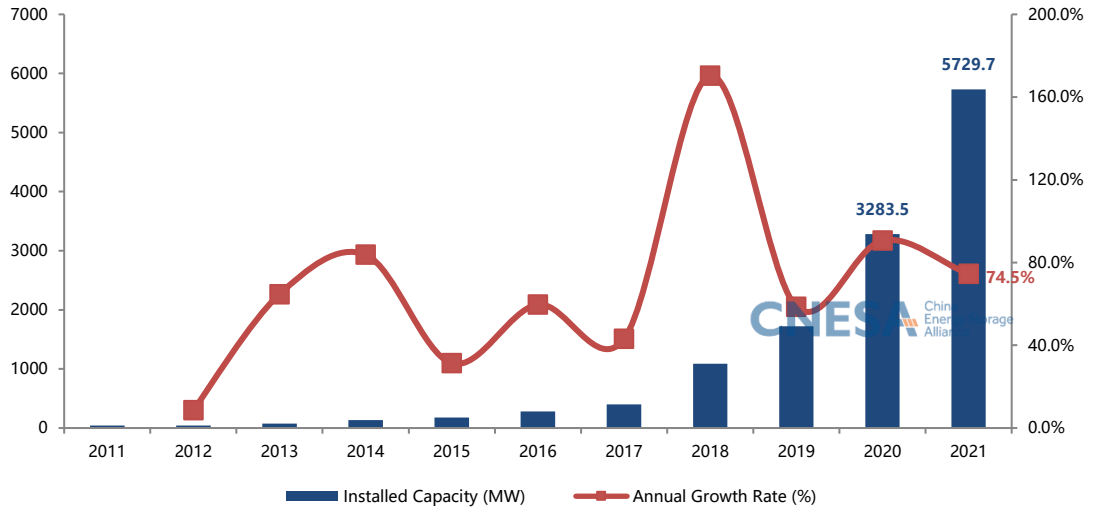

Figure 5: Chinese New Energy Storage Market Capacity (by the end of 2021)

Data source: CNESA Global Energy Storage Project Database

IV. 2021 Chinese Energy Storage Vendor Ranking

CNESA research department ranked the domestic energy storage technology providers, [1] energy storage PCS providers and energy storage system integrators [2] by their new operational project capacity in China in 2021 based on CNESA Global Energy Storage Project Database and the project information independently submitted by energy storage enterprises and obtained through open channels.

In addition to the above rankings, the Energy Storage Industry White Paper 2022 added four rankings: "2021 Ranking of Global Market Energy Storage Battery (excluding base station, data center backup batteries) Shipment", "2021 Ranking of Global Market Energy Storage PCS Shipment", "2021 Ranking of Domestic Market Energy Storage System Shipment" and "2021 Ranking of Overseas Market Energy Storage System Shipment".

1. Ranking of energy storage technology provider

In 2021, among the new operational new energy storage projects in China, the top ten Chinese energy storage technology providers in terms of installed capacity were CATL, Zhong-Chu-Guo-Neng (Beijing) Technology, EVE Power, Great Power, Narada, Higee Energy, Lishen, Envision AESC, CALB and ZTT.

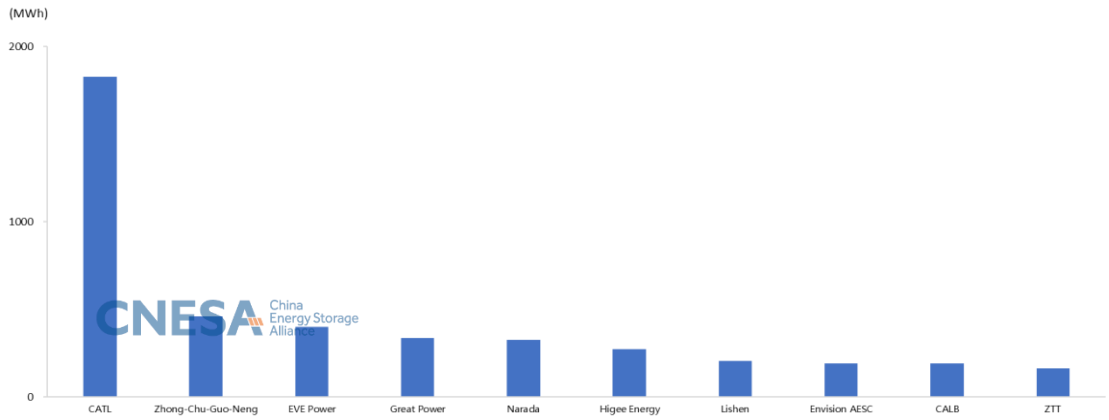

Figure 6: 2021 Ranking of Chinese Energy Storage Technology Provider by New Operational Capacity in Domestic Market

In 2021, the top 10 Chinese energy storage technology providers in global market in terms

[1] CNESA defines an energy storage technology provider as an enterprise that has the production capacity of energy storage technology and provides energy storage technology for customers.

[2] CNESA defines an energy storage system integrator as an enterprise that works on energy storage system integration and provides customers with complete sets of energy storage system products. The energy storage system products herein refer to a complete set of energy storage system equipment composed of energy storage technology, battery management system, energy storage inverter, energy management system and other accessories that can meet the actual needs of customers.

of energy storage battery (excluding base station, data center backup batteries) shipment were CATL, Great Power, BYD, EVE Power, PYLONTECH, GOTION HIGH-TECH, Higee Energy, CALB, Narada and ZTT.

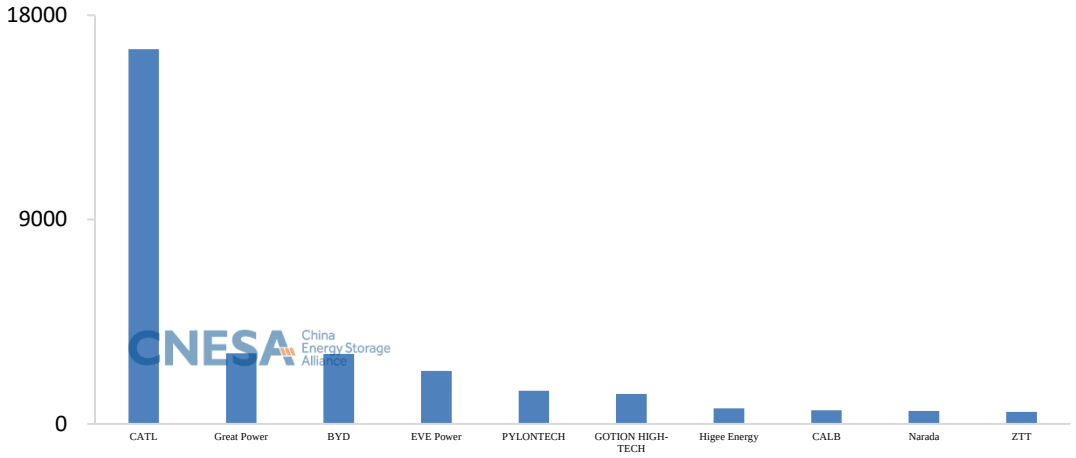

Figure 7: 2021 Ranking of Chinese Energy Storage Technology Provider by Energy Storage Battery Shipment in Global Market

2. Ranking of energy storage PCS provider

In 2021, among the new operational new energy storage projects in China, the top ten Chinese energy storage PCS providers in terms of installed capacity were Sineng, Kehua Tech, Soaring, NR Electric, SUNGROW, Sinexcel, HNAC, Zhiguang Energy Storage, INOVANCE and XJ Group.

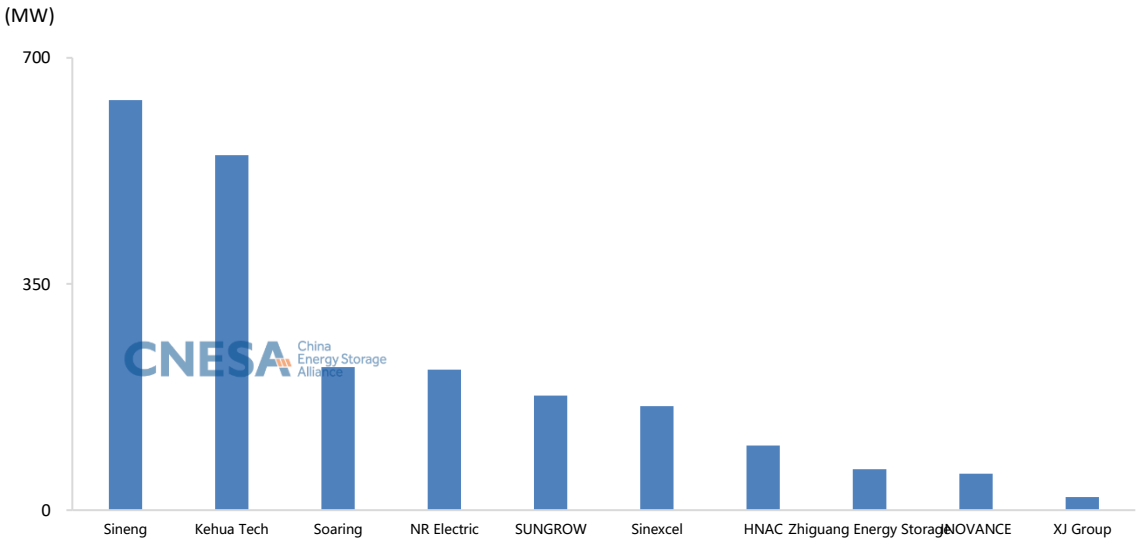

Figure 8: 2021 Ranking of Chinese Energy Storage PCS Provider by New Operational Capacity in Domestic Market

In 2021, the top ten Chinese energy storage PCS providers in global market in terms of

shipments of energy storage PCS were SUNGROW, Kehua Tech, BYD, GROWATT, Sineng, Sinexcel, Nari-Relays, INOVANCE, Soaring and KSTAR.

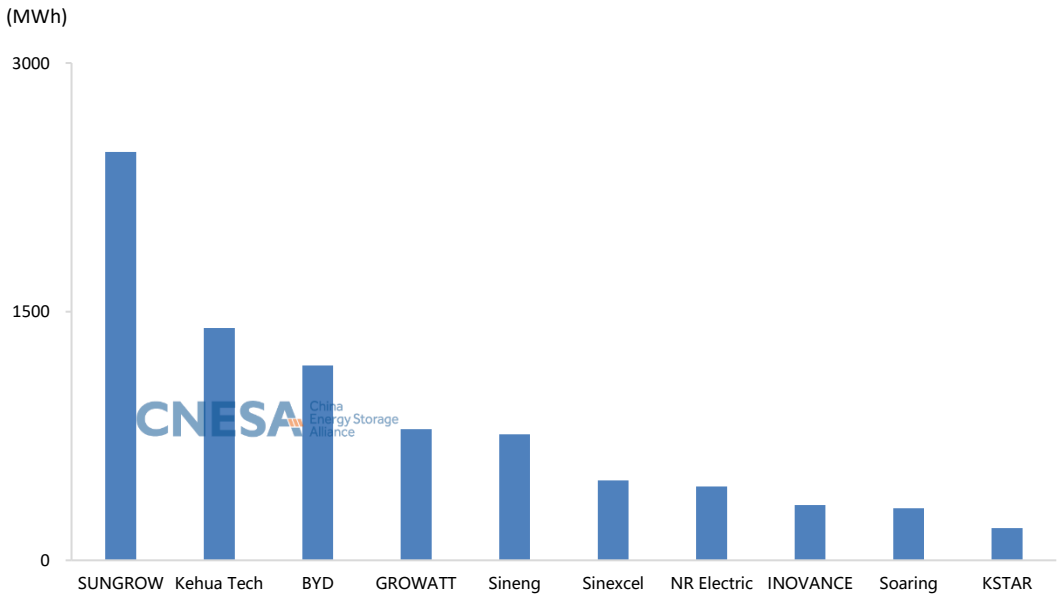

Figure 9: 2021 Ranking of Chinese Energy Storage PCS Provider by Energy Storage PCS Shipment in Global Market

3. Ranking of energy storage system integrator

In 2021, among the new operational new energy storage projects in China, the top ten Chinese energy storage system integrators in terms of installed capacity were HYPER STRONG, SCETL, Kehua Tech, SUNGROW, XYZ Storage, RHBESS, Envision Energy, Pinggao Group, CUBENERGY, and TrinaStorage.

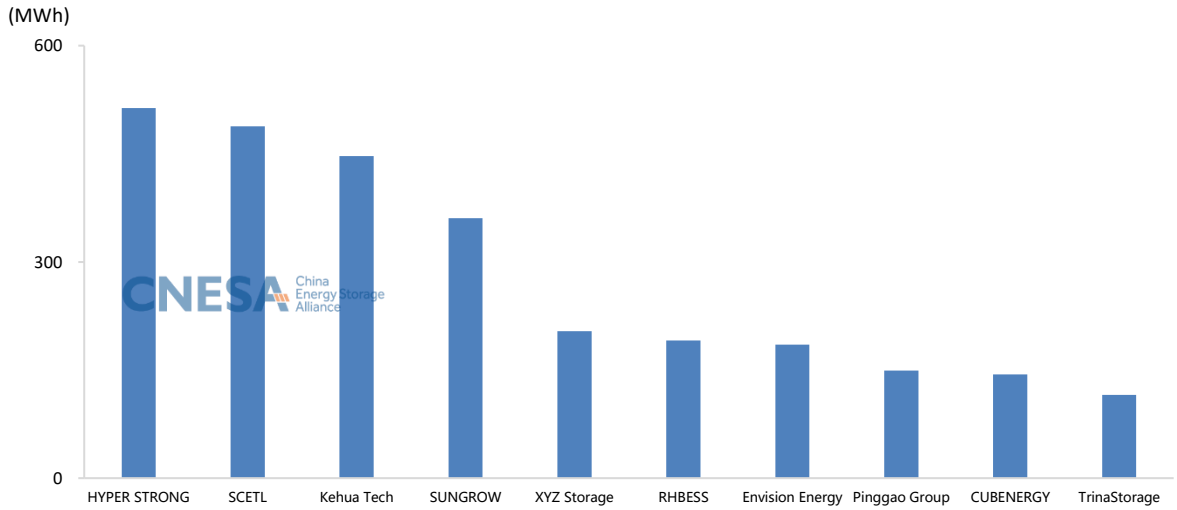

Figure 10: 2021 Ranking of Chinese Energy Storage System Integrator by New Operational Capacity in Domestic Market

In 2021, the top 10 Chinese energy storage system integrators by the shipments of energy storage system in domestic market were HYPER STRONG, SCETL, XYZ Storage, SUNGROW, Kehua Tech, EVE-Linyang, ZTT, ZONERGY, Pinggao Group and SERMATEC.

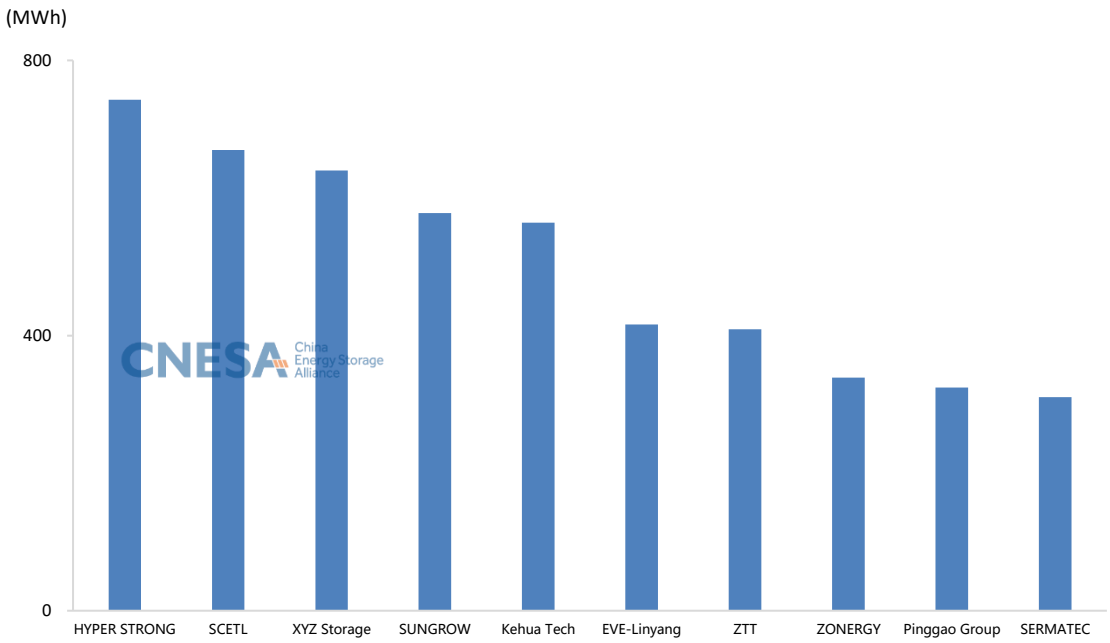

Figure 11: 2021 Ranking of Chinese Energy Storage System Integrator by Energy Storage System Shipment in Domestic Market

In 2021, the top 10 Chinese energy storage system integrators by the shipments of energy storage system in overseas market were SUNGROW, BYD, AlphaESS, KSTAR, CUBENERGY, NR Electric, Narada, CLOU, Kehua Tech and Shuangdeng Group.

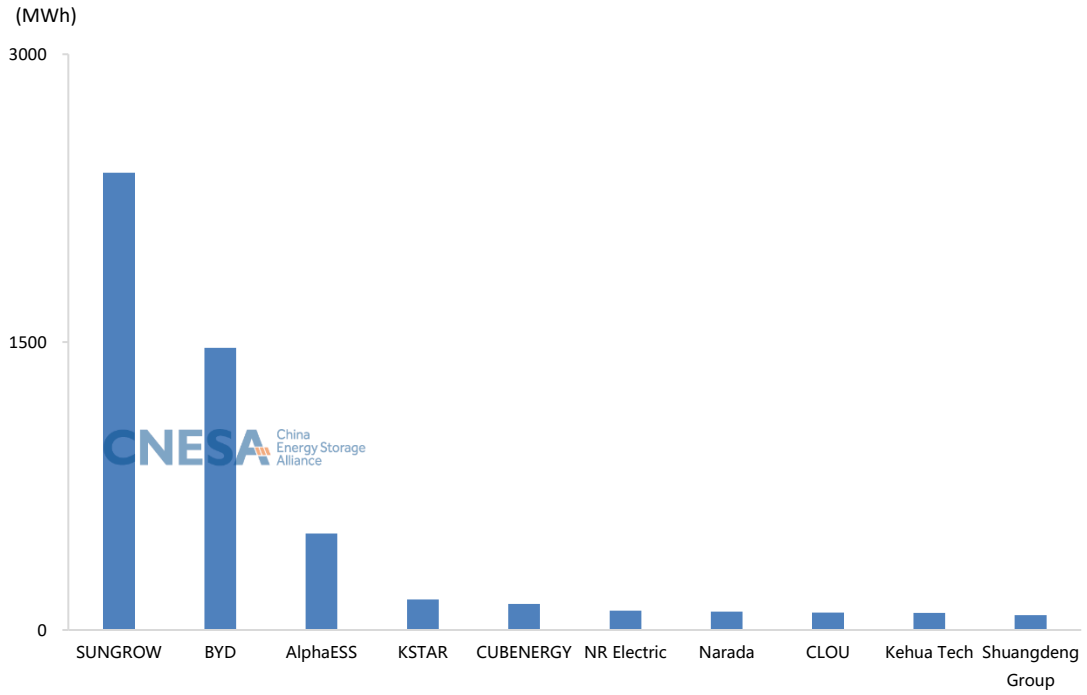

Figure 12: 2021 Ranking of Chinese Energy Storage System Integrator by Energy Storage System Shipment in Overseas Market

V. CNESA Energy Storage Index Performance Analysis

China Energy Storage Alliance (CNESA) released the energy storage industry prosperity index (hereinafter referred to as the "CNESA ES Index") on October 10, 2021. CNESA intends to observe and study the development trend of the energy storage enterprises through the secondary market, analyze the impact of important events on the industry, and improve the sensitivity of energy storage enterprises to the secondary market, so that more energy storage enterprises can leverage the capital market, and achieve rapid development of enterprises and accelerate the development of the energy storage industry.

The CNESA ES Index has been developed by referring to the indexing method of the Science and Technology Innovation Board Index, for which the companies with large market value and better liquidity in various upstream and downstream links (including system integrators, PCS, BMS, thermal management, batteries, cathode materials, anode materials, diaphragms, electrolytes, battery casings, lithium and other resources) of the energy storage industry chain were selected as index stocks, and adjusted and updated on an annual basis.

Table 1: Schedule of Index Stocks of CNESA ES Index

SN	Company	SN	Company	SN	Company
1	SUNGROW	19	Narada	37	Shida Shenghua
2	NARI	20	ZTT	38	DFD
3	XJ ELECTRIC	21	Farasis Energy	39	Kedali
4	BYD	22	PYLONTECH	40	Crown Material
5	SINOHYTEC	23	Shanshan	41	Tibet Mineral Development
6	Zhiguang Electric	24	RONBAY	42	Tianqi Lithium
7	Sineng	25	Zhenhua Science & Technology	43	Ganfeng Lithium
8	KEHUA DATA	26	Putailai	44	Huayou Cobalt
9	East Group	27	Baotailong	45	Yahua
10	Hopewind Electric	28	Zhongke Electric	46	Wenshan Electric Power
11	KSTAR	29	Fangda Carbon	47	Sunwoda
12	HNAC	30	SENIOR	48	GEM
13	Nebula Electronics	31	Shanghai Energy	49	Great Power
14	Yinlun	32	Cangzhou Mingzhu	50	Envicool
15	ZHONGDING	33	Sinoma Science & Technology	51	Sinexcel
16	CATL	34	Jiangsu Guotai	52	Hua Yang Group
17	GOTION HIGH-TECH	35	Tinci Materials	53	Pangang Group Vanadium Titanium & Resources
18	EVE Energy	36	Capchem	54	Dynanonic

Data source: CNESA Investment and Financing Database

2021 saw an optimum performance of structured market. The ES index outperformed 90% of public and private funds for the whole year. The ES index value was 1,647.97 on December 31, 2021, with an overall increase of 64.80%, while ChiNext index increased by 12.02% during the same period. With the successive introduction of policies related to energy storage since April 2021, the industry development expectations have been raised, and the ES index has increased significantly. But by December, most stocks in the industry seesawed and even fell. The decline of ES index has intensified the wait-and-see sentiment in the market, and the expectations for the sector in 2022 have also diverged to some extent. The divergence in expectations was more about the sustainability of valuations than industry prosperity.

Figure 13: ES Index Performance from January to December 2021

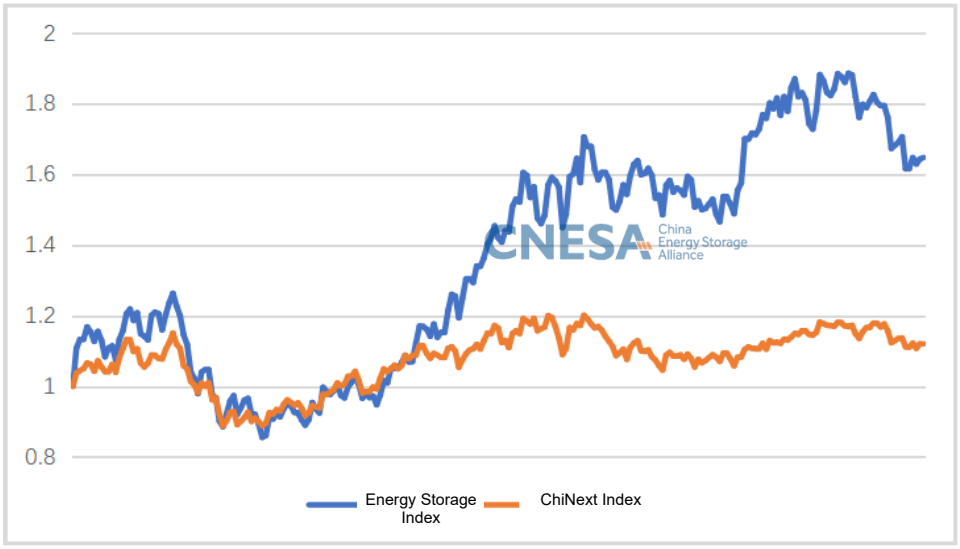

Figure 14: Comparison of ES Index and ChiNext Index in the Same Period

VI. CNESA Energy Storage Standardization Update

On March 30, 2018, the Standardization Administration of China officially authorized CNESA to launch an association standards pilot program. Since then, CNESA has released 12 association standards:

1. T/CNESA 1000—2019 Evaluation specification for electrochemical energy storage systems
2. T/CNESA 1001—2019 General specification for DC power connector of electrical

energy storage

3. T/CNESA 1002—2019 Technical specification for battery management system of electrochemical energy storage system
4. T/CNESA 1003—2020 Battery cable for electrical energy storage systems
5. T/CNESA 1004—2021 General test methods for lithium ion battery fire hazards
6. T/CNESA 1005—2021 Technical specification for coordinated controller of electrochemical energy storage station
7. T/CNESA 1006—2021 General specification for sodium-ion secondary batteries
8. T/CNESA 1101—2022 Guide for economic evaluation of electrical energy storage projects
9. T/CNESA 1201—2018 Design specification of gas-gathering pipeline for compressed air energy storage system
10. T/CNESA 1202—2020 General technical requirements for flywheel energy storage systems
11. T/CNESA 1203—2021 Performance test specification for compressed air energy storage systems
12. T/CNESA 1301—2020 Testing regulations of performance attenuation on phase-change thermal energy storage units

CNESA is currently developing standards in the categories of EES, CAES, FES, and TES, etc. Standards in progress include:

Table 2: List of CNESA Standards Currently in Development

SN	No.	Name
1	CNESA2018003	Technical Requirements for Fire Monitoring and Warning Systems for Electrochemical Energy Storage System
2	CNESA2019006	Guide for Planning and Design of Grid-Side Energy Storage Projects
3	CNESA2019007	Fire Suppression Device for Electrochemical Energy Storage Systems
4	CNESA2019009	Communication Between Battery Management System and External Equipment For Electrical Energy Storage
5	CNESA2020003	Technical Specifications for Hydro-Thermal Storage Devices
6	CNESA2020004	Technical Specification for User-Side Energy Storage on-site Monitoring System

SN	No.	Name
7	CNESA2021001	Guide for Online Monitoring and Evaluation of Lithium Ion Battery Energy Storage System
8	CNESA2021002	General Technical Guidelines for Power Battery Systems for Cascade Utilization of Electric Power Storage
9	CNESA2021003	Technical Specification for Gas Storage Site Selection of Compressed Air Energy Storage System
10	CNESA2021004	Design Specification for Complete Set of Lithium Ion Battery Energy Storage Devices
11	CNESA2021005	Technical Specification for Electrochemical Energy Storage System Accessing Virtual Power Plant
12	CNESA2021006	Performance Test Specification for Flywheel Energy Storage System
13	CNESA2021007	General Specification for Thermal Energy Storage
14	CNESA2022001	General Technical Requirements for Active Safety Early Warning of Lithium-ion Battery Storage Power Station
15	CNESA2022002	Test Methods for Fire Spread of Lithium Ion Battery System for Energy Storage
16	CNESA2022003	Technical Specification for Comprehensive Assessment of Thermal Runaway Fire Hazards in Electrochemical Energy Storage Power Stations
17	CNESA2022004	Safety Performance Evaluation Standard of Lithium-Ion Battery Energy Storage System
18	CNESA2022005	Evaluation Specification for Electrochemical Energy Storage Systems
19	CNESA2022006	On-line Estimation Method of State of Health of Lithium-ion Battery for Energy Storage

Source: CNESA Global Energy Storage Standard Database

VII. China's Policy Summary and Recommendations in 2021

Driven by the targets to peak carbon dioxide emissions and achieve carbon neutrality, 2021 saw an unprecedented popularity of China's energy storage industry and increasing policy efforts, laying a solid foundation for the large-scale and high-quality development of energy storage. However, challenges exist behind the vision of a thriving industry, which require the joint efforts of policymakers and practitioners. At present, the role and value of energy storage does not match the revenue and profit, and the business model and market mechanism are yet to be improved. Especially in the scenario of high proportion of renewable energy, the power market mechanism can hardly adapt to the new power system with new energy playing a leading role. The sharp decline in the quantity of thermal power weakened the pricing function of locational marginal price (LMP), resulting in the absence of price signals

in the spot market. At present, there is no reasonable allocation mechanism for the integration cost of new energy, nor pricing mechanism for the fixed cost of new energy. As a result, the capacity value of flexible resources cannot be reflected through market-based means.

CNESA puts forward some suggestions according to different application scenarios:

- **In terms of energy storage allocation of renewable energy**, an overall planning should be carried out for the allocation of renewable energy storage according to the local conditions to avoid invalid investment; reasonable cost dispersal and allocation mechanisms shall be established, and energy storage in the terminal should be regarded as an independent market player; the assessment requirements should be refined to reflect the values of energy storage in rapid adjustment, fluctuation smoothing and capacity reserve.

- **In terms of ancillary service energy storage,** we should continuously develop the market based on the idea of Pay-For-Performance; improve the sharing mechanism on all sides in accordance with the principles that "the producer shall be held accountable" and "the beneficiary shall be the payer"; establish a scheduling operation mechanism suitable for the new energy storage to ensure fair operation; study the linkage mechanism between the ancillary service market and the spot market; and explore the timing for new variety introduction as well as the market rules.

- **In terms of user-side energy storage, t**he coordination among the time-of-use (TOU) electricity price mechanism, the spot market, and the medium and long-term trading market should be improved to form a reasonable peak-to-valley power price difference; the role of user-side energy storage in optimizing and regulation of the system should be recognized under the existing dual control policy that seeks to curb both energy consumption and energy intensity, and it is recommended that custom-side energy storage power consumption should not be included in the assessment; greater support should be provided for demand response and virtual power plants based on the actual local demand, and the user-side energy storage should be encouraged to participate in market transactions as a player.

- **In terms of grid side energy storage,** the positioning of market-oriented and non-market-oriented grid side energy storage should be defined in accordance with the principle of "market comes before plan", and relevant policies should be introduced according to the positioning of different functions. Market-oriented grid side energy

storage should be allowed to participate in market transactions, and encouraged to obtain multiple values and play its role in system regulation. Non-market-oriented grid side energy storage should be included in the recovery of power transmission and distribution price; its value in replacing investment in transmission and distribution assets and safety assurance should be measured clearly, its role in system regulation should be assessed reasonably, provided that fair competition in the market can be ensured. It should also be subject to the strict government supervision and assessment to reflect its fundamental importance.

China is striving to build a national unified power market system, in such context, the value and benefits of energy storage will be reflected through the power market. Therefore, how to establish the market rules that fully reflect the value of flexible resources would be the focus in developing policies and market mechanisms.

VIII. Characteristics of Chinese Energy Storage Market Development

2021 bears much significance for the development of energy storage industry, seeing the leapfrog development and marking the first year of the "14th Five-Year Plan" period. The energy storage industry still grew steadily at a high speed despite the epidemic, achieving desirable results. This year saw a continuous development of energy storage science, rapid progress of energy storage technology, fast deployment of large-scale energy storage projects, continuous expansion of energy storage applications, intensive introduction of energy storage policies, and an industrial development that is beyond industry expectations.

Overall, the development of China's energy storage industry in 2021 has six characteristics:

- The new power energy storage capacity in a single year exceeded 10GW for the first time, with a year-on-year growth of 231%
- Various provinces have released their own energy storage planning targets, which exceeded those set out in the "14th Five-Year Plan"
- The policy system has been initially established, laying the foundation for the large-scale development of energy storage
- 100-megawatt energy storage projects have become the mainstream, and technological progress and security has become key enablers

- The energy storage applications have been further refined driven by rigid market demand
- Financial capital accelerated its investment pace to compete with high-tech enterprises in the energy storage sector

2021 is the first year of China's "14th Five-Year Plan" period. This year, the energy storage industry is ready to accelerate its pace and embrace its prime time. How can the energy storage industry go far and steadily, effectively support the construction of new power system with new energy playing a leading role, and play its due market value in the process of energy transformation? These are the missions and responsibilities of all energy storage practitioners. CNESA hereby invited the leaders from the Standing Council of the Alliance and experts from the Energy Storage Committee of China Energy Research Society to interpret the current situation and look into the future for industry colleagues.

IX. Chinese Energy Storage Market Development Forecast

In the next five years, "new energy + energy storage" will be the main application scenario of new energy storage, and policy promotion will be the main growth driver. CNESA Research Department has been forecasting the capacity of China's energy storage market since 2014. In this white paper, we will continue to forecast the size and development trend of China's new energy storage market from 2022 to 2026.[3]

In this year's white paper, CNESA Research Department forecast the size of the new energy storage market for the 2022-2026 period, in terms of both the conservative and ideal scenarios. The conservative scenario is the scenario where policy implementation, cost reduction, technical improvement and other factors fail to meet expectations, and the ideal scenario is the scenario where energy storage planning objectives are successfully achieved. The results include:

Conservative Scenario: It is estimated that the cumulative capacity of new energy storage will reach 48.5GW in 2026, and the compound annual growth rate (CAGR) from 2022 to 2026 will be 53.3%. The market will grow steadily and rapidly.

[3]Forecasting methods: A model has been set up for analysis and forecasting based on CNESA's 12-year global storage project database, combined with project planning information submitted by energy storage equipment suppliers, integrators and operators, while referring to the development plans of new energy storage and new energy in the "14th Five-Year Plan" of various provinces.

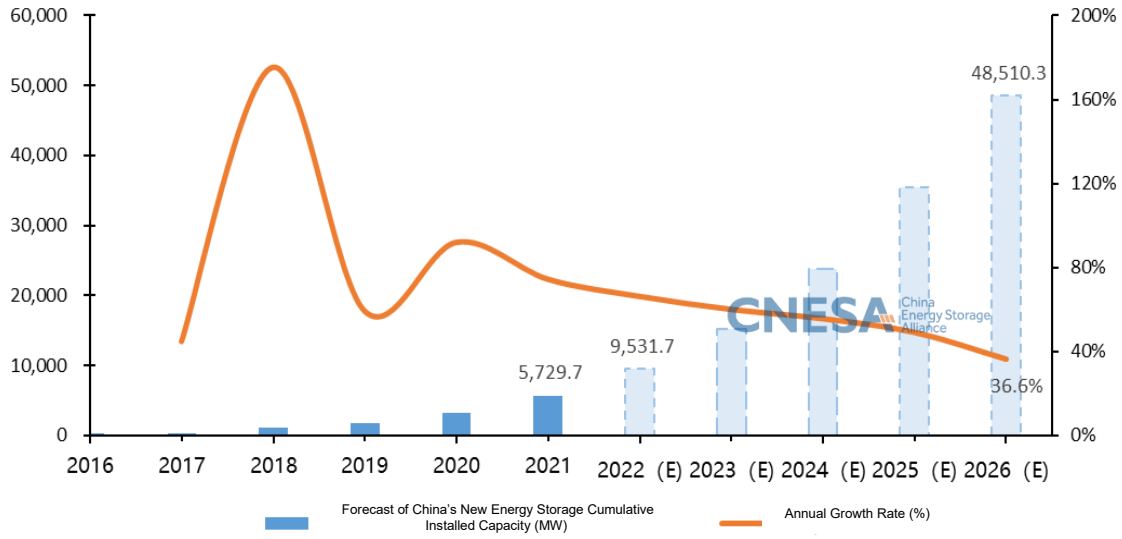

Figure 15: Forecast of China's New Energy Storage Cumulative Operational Capacity (Conservative Scenario, 2022-2026)

Data source: CNESA Global Energy Storage Project Database

Ideal Scenario: With the gradual improvement of the power market and the maturing of the energy storage supply chain support and business model, new energy storage is expected to stand out in the competition with its advantages of short construction cycle, low environmental impact and low site requirements. It is estimated that the cumulative capacity of new energy storage will reach 79.5GW in 2026, and the compound annual growth rate (CAGR) from 2022 to 2026 will be 69.2%.

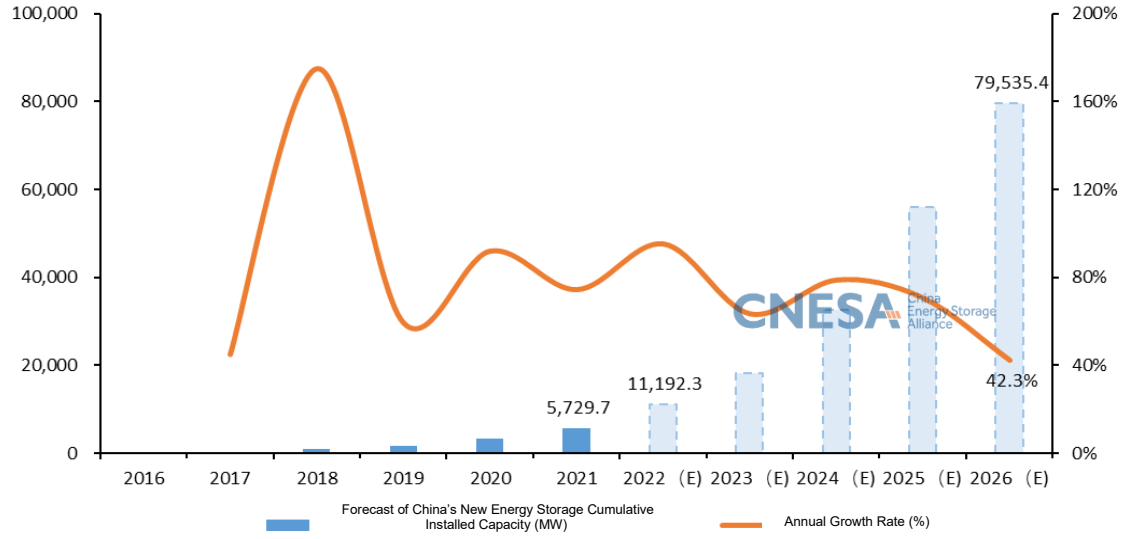

Figure 16: Forecast of China's New Energy Storage Cumulative Operational Capacity (Ideal Scenario, 2022-2026)

Data source: CNESA Global Energy Storage Project Database

The “14th Five-Year Plan” period is a critical period for accelerating the construction of a new power system with new energy playing a leading role and promoting the realization of the goal of carbon peaking. The *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy* proposed to accelerate the formation of development mechanisms for new power installed capacity based on energy storage and peak load regulation capacity. Large-scale grid connection of new energy brings about the balance of power supply and demand at different time scales. New energy storage can not only promote the large-scale and high-quality development of new energy and help achieve the carbon peaking and carbon neutrality goals, but also, as the core technology and strategic high ground of the energy revolution, new energy storage is expected to form a new industry with high technological content and great growth potential, and become a new economic growth point.

X. Ordering Instructions

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