Retrospective and Outlook of M&A in China's New Energy Industry in 2023

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Data Specification

About the data

Data in the report is based, unless noted, on information provided by Thomson Reuters, Mergermarket, CV Source, Pedata, public news, and PwC analysis

Deal volume and deal value

- The deal volume figures presented in the report refer to the number of deals announced, whether or not a value is disclosed for the deal
- The deal value figures presented in the report refer only to those deals where a value has been disclosed and where a disclosed value is rounded to the nearest order of magnitude; as deal information or the value has not been disclosed in some deals, the comprehensiveness and trends of our analysis are affected to some extent. If the disclosed deal value is the approximate amount mentioned in the following table, we adopt the corresponding rounding for calculation

Disclosed amount	Converted amount (in RMB)
Hundreds of thousands	500,000
Nearly 1 million / million	1,000,000
Millions	5,000,000
Nearly 10 million / 10 million (level)	10,000,000
Tens of millions	50,000,000
Nearly 100 million / 100 million	100,000,000
Hundreds of millions	500,000,000

- Unless otherwise noted, the unit of the amounts presented in the report is RMB in billions. Among them, for deals where the value disclosed is in foreign currencies, we convert it into RMB based on the central parity rate issued by Bank of China on the disclosure date

Investment direction

- We classify transactions into domestic transaction, outbound M&A and inbound M&A according to the investment direction, where:
  - "Domestic transaction" refers to the transaction of which both the investor and the target are located in mainland China, Hong Kong or Macau
  - "Outbound M&A" refers to M&A abroad by enterprises in mainland China, Hong Kong and Macau
  - "Inbound M&A" refers to the acquisition of domestic companies in mainland China, Hong Kong or Macau by an overseas enterprise

Description of clean energy industry sectors

- Including lithium cell, energy storage, wind power and PV (Photovoltaic) supply chain (including manufacturing supply chain and applications and services in downstream), infrastructure (including clean energy power plants, new energy vehicle charging and battery swap stations, etc.), hydrogen energy and other clean energy (biomass energy, waste incineration, geothermal energy, tidal energy, etc.);

Please note that the above classification criteria are based on PwC's understanding of the industry in terms of policies and regulations, trading characteristics, and future trends, and do not represent industry standards.

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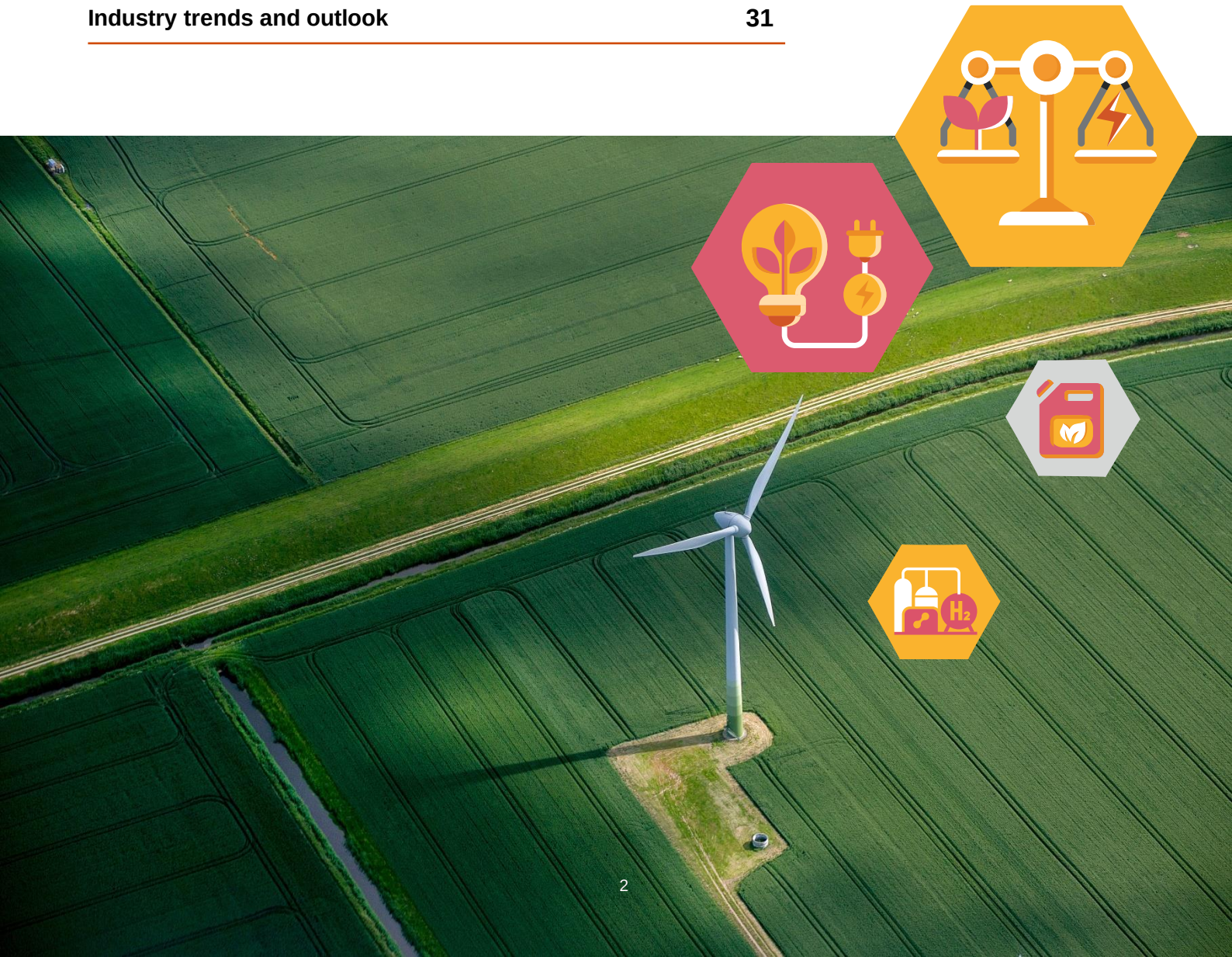


Overview of M&A trends in the new energy market

Overview of investment and M&A trends in China's new energy industry

Overview of M&A deals in China's new energy industry in 2023

Total deal value in 2023

RMB **220.4** bn

a **34%** drop compared with that in 2022

Total deal volume in 2023

784

a **17%** increase compared with that of 2022

Avg. disclosed deal value

RMB **398** mm

a **25%** drop compared with that of 2022

M&A mega deals

2 mega deals exceeding RMB10 billion, with a total value of nearly

RMB **32.6** bn

Overview of M&A deals in China's new energy industry in 2023

Major investment sectors

Infrastructure, lithium battery industry, and ESS industry chain were the most active among all sectors, with deal volume accounting for

36%, **19%** and **17%** of the total respectively

Active investors

State-owned enterprises participate in M&A deals as sellers, and more participate in greenfield investment and project development. **PE/VC** and other financial investors are more actively involved in investing in cutting-edge technology enterprises in the upstream of the industrial chain

Main investment direction

M&A deals continued to be **dominated by domestic deals**, accounting for

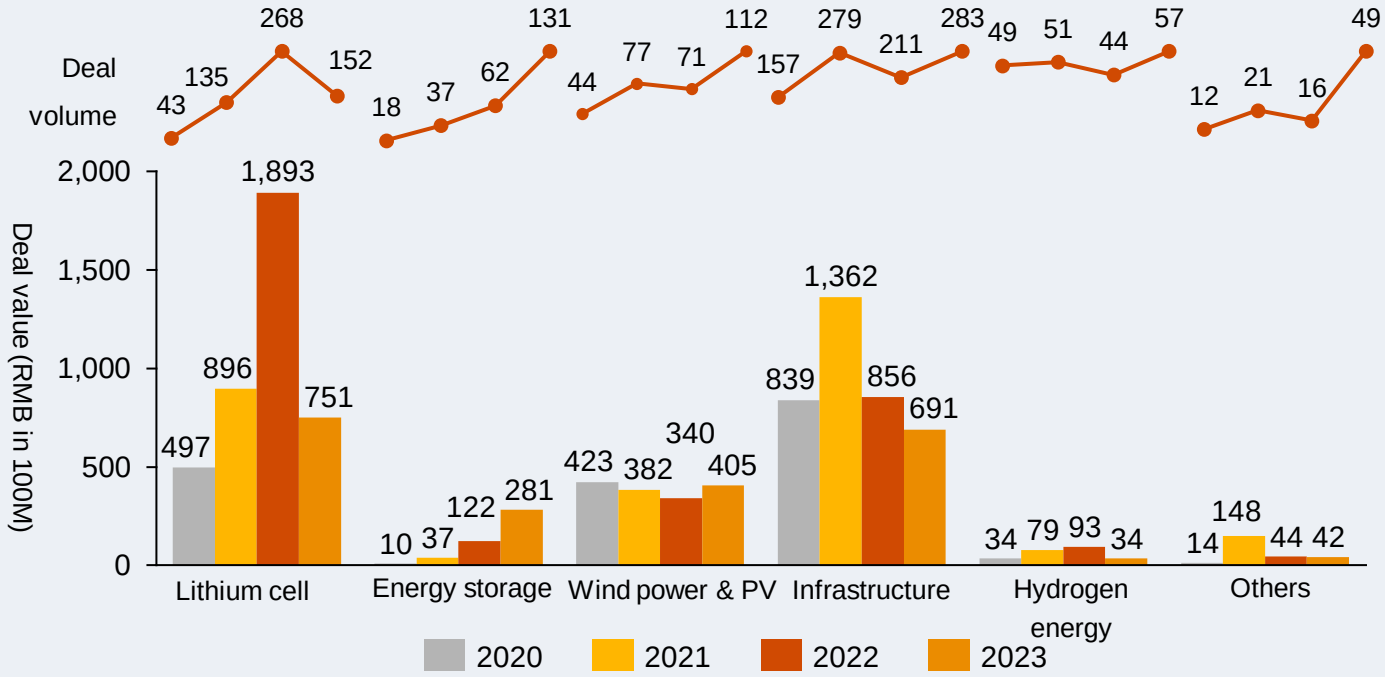
97%

of total deal volume

Cross-border deals

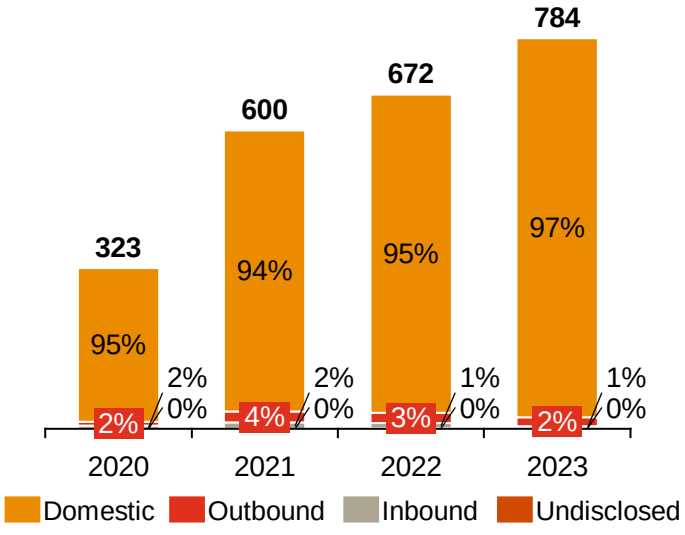
The cross-border deal volume was basically the same as the previous year, and with the macroeconomic recovery, the cross-border investment enthusiasm will be further improved urgently

M&A deal value and volume in China's new energy industry during 2020-2023 (by sector)



*Data classification adjusted compared to previous years

M&A deal volume in China's new energy industry in 2023 by investment direction



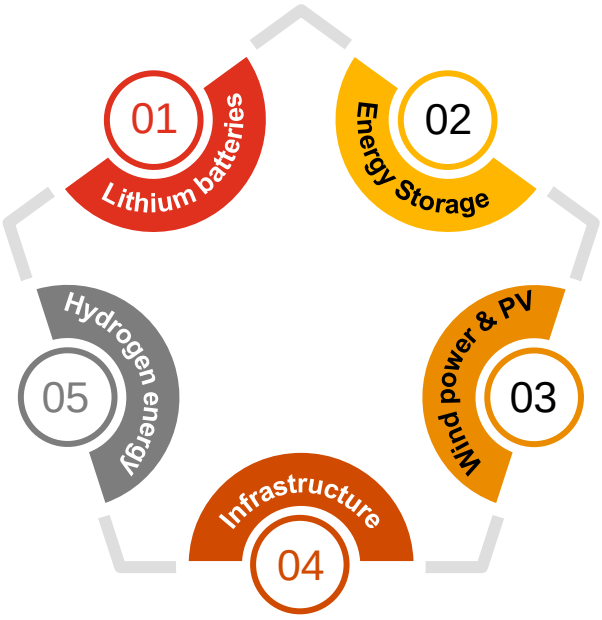
Note: The new energy industry mainly includes lithium batteries, energy storage, wind power and PV (including manufacturing supply chain and downstream applications and services), infrastructure (including clean energy power plants, new energy vehicle charging and battery swap stations, etc.), hydrogen energy and other clean energy (biomass energy, waste incineration, geothermal energy, tidal energy, etc.).

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

In 2023, the disclosed M&A deal volume of China's new energy industry further increased to 784, reaching a new record high, and the disclosed deal value reached RMB220.4 billion.

- After experiencing rapid growth and development in the past few years, the trend of transactions in the lithium battery industry has slowed down, and the deal value has fallen from its peak but still maintains a scale of over RMB75 billion.
- Benefiting from multiple favorable factors such as power market reform, policy support, and improved project economics, both the deal value and volume in the energy storage sector have significantly increased. New types of energy storage technologies represented by sodium-ion batteries and liquid flow batteries have become the most capital-attracted tracks due to their complementarity with lithium batteries. Energy storage integrators focusing on industrial and commercial sectors remain a key area favored by capital.
- Despite slowing capacity expansion, wind power and photovoltaic industry chains continue to attract investors due to gradual industrialisation of advanced technologies. Infrastructure investments such as wind and solar power stations are mainly focused on greenfield development; however, M&A transactions still maintained, driven majorly by: 1) continuous decrease in power generation cost; 2) under the background of accelerating integration between production and financing, state-owned enterprises gradually shift from leveraged buy-out through borrowings to using funds as carriers to participate in power station asset acquisitions; 3) non-energy SOEs focus on their core businesses while accelerating sales of power stations.

Highlights of M&A deals by sector



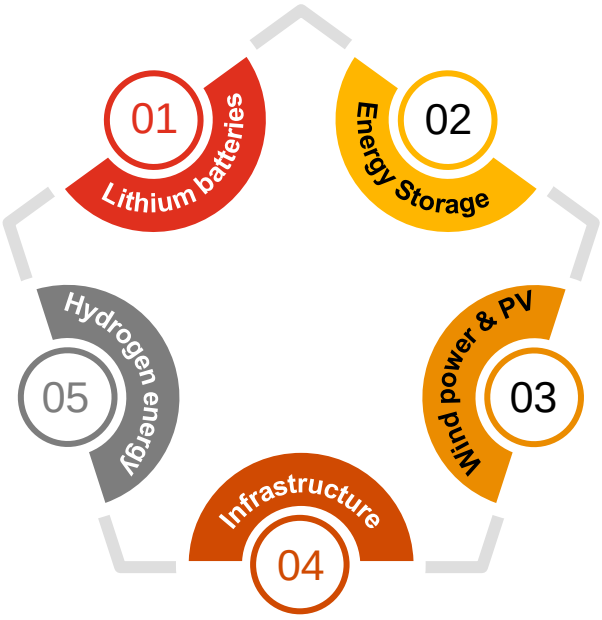
01 Lithium batteries

- The pattern of the **battery manufacturing industry** has become increasingly mature, with financing mainly for IPOs, private placements, and mergers and acquisitions of mature companies to further expand capacity and maintain a leading position.
- Financing for **positive electrode materials and precursor-related** enterprises still accounts for more than 80% of the overall transactions. The market will continue to explore the high density and cost-effectiveness of lithium iron phosphate positive electrode materials, as well as the ternary high-nickel cobalt-free route; in addition, early-stage capital attention is given to **lithium-rich manganese-based materials** with various performance advantages.
- **Negative electrode materials**: **artificial graphite** continues to consolidate its position as a mature negative electrode material through continuous integration and expansion; **silicon-based negative electrode materials**, which are considered as the main development route in the future, are accelerating commercialisation, attracting attention from financial and strategic investors focusing on early-stage investments in silicon-based negatives. Silicon-based material chemical companies enter into the negative electrode industry chain through across-industry acquisitions, jointly exploring continuous optimisation of related technologies and industrialisation
- The expectation for commercial landing of **solid-state batteries** is further strengthened while industrialisation accelerates; upstream materials such as **solid electrolytes represented by solid-state batteries** have also received attentions from capital markets.

02 Energy storage

- While lithium battery energy storage technology is dominant, the commercialisation of various **new energy storage technologies** such as **sodium-ion batteries and flow batteries** accelerates in 2023, attracting capital layout. Investment in **sodium-ion batteries** gradually extended from the cell to upstream material since 2022. With the continuous acceleration of downstream commercialisation, diversified development is emerging.
- The profitability of peak-valley arbitrage in energy storage has been fully demonstrated, and demand continues to grow explosively. In addition, with the demand for energy stability, security and ESG goals from industrial enterprises and industrial parks, **ESS integrators** are continuously sought after by capital markets.
- The source-side energy storage market will gradually shift from policy-driven to market-driven, making **independent ESS** a key player in front-end source-side markets.

Highlights of M&A deals by sector



03 Wind power & PV

- **Photovoltaic production capacity iteration has gradually been implemented**, with intense competition driving manufacturers to prioritise **technological innovation and efficiency improvement**, thereby creating new opportunities for the industry.
- The global photovoltaic market is expansive, and **localisation policies** are compelling Chinese manufacturers to expedite their **global manufacturing layout.**
- **Offshore wind power** has presented new opportunities, leading to the emergence of domestic equipment in the global market.
- **The demand for wind and solar power station services** is increasing, while **digital energy management** is entering a period of high demand.

04 Infrastructure

- The **integration of production and financing** is intensifying, with **funds** playing a crucial role.
- **Non-energy SOEs** are prioritising their core operations, while the divestment of renewable energy assets is gaining momentum.
- In order to facilitate the transition towards low-carbon, high-quality development, **local SOEs** are actively investing in decentralised platforms that utilise regional resources to address the dual challenges of peak-valley substitution for on-grid electricity.
- The integration of **solar power generation and energy storage** holds significant potential as the most optimal solution.

05 Hydrogen energy

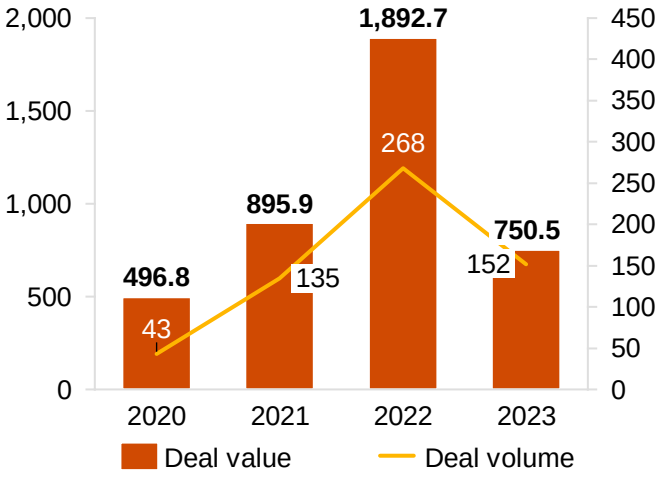
- The focus of financing is gradually shifting from downstream fuel cells to the upstream of the hydrogen energy industry chain. The investment landscape is becoming more diverse and segmented, with early-stage financing continuing to dominate the hydrogen energy sector.
- Overall M&A value remains relatively modest, highlighting the need for increased confidence in the capital market for the hydrogen energy sector.
- Hydrogen energy companies are accelerating their global expansion efforts.

Overview of M&A trends by sector

Lithium batteries

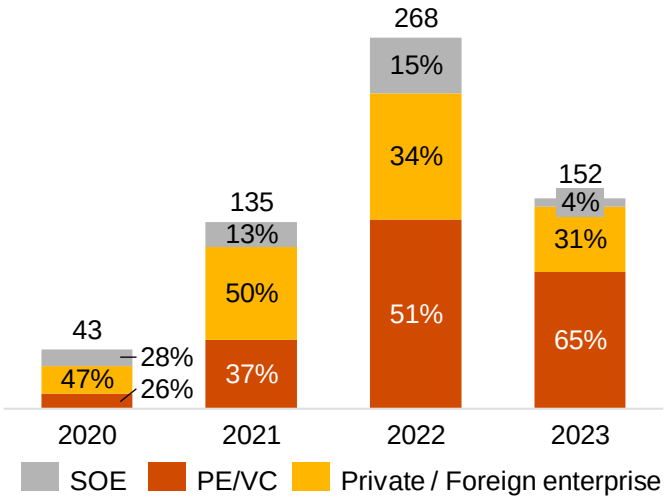
Overview of M&A in lithium batteries industry

M&A deal value and volume of lithium cell industry chain during 2020-2023



*Data classification adjusted compared to previous years

M&A deal volume of lithium batteries industry chain during 2020-2023 (by investor type)



After experiencing rapid growth and development in the past few years, M&A in the lithium battery industry chain has slowed down in 2023. The deal value has fallen from its peak but still maintains a scale of over RMB75 billion. Deal volume has also decreased compared to 2022 but still at relatively high level.

For M&A deals in general, deal value of lithium batteries industry chain reached RMB75.1 billion, with a YoY decrease of 60%, while deal volume decreased by 43%.

Among segmented investment field: Lithium battery companies continue to dominate in terms of deal value, exemplified by Penghui Energy's 1.5 billion private placement in 2H23 and Farasis Energy's 1 billion Series B financing. Furthermore, with Rept Battero successfully completing its Hong Kong IPO in December 2023, the TOP10 companies in the industry have essentially finalised their listings. The primary financing channels for lithium battery companies have shifted from the primary market to the secondary market; downstream applications of financing companies are increasingly diverse, expanding into ESS, ships, engineering machinery, and other application scenarios like EV and consumer electronics.

Lithium battery material companies continue to lead in terms of deal volume, although slight declined compared to 2022. Both positive and negative electrode materials, as major components of lithium batteries, are continuously exploring the optimisation of material systems, with related M&A deals accounting for approximately 70% of lithium battery material transactions; positive electrode materials account for about 40% of overall transaction volume. However, due to reduced profitability of related enterprises, transactions for lithium battery materials accounted for about 35% of total annual transactions in 2H23, indicating a decrease in investment activity. Nonetheless, new material-related targets continue to attract attention.

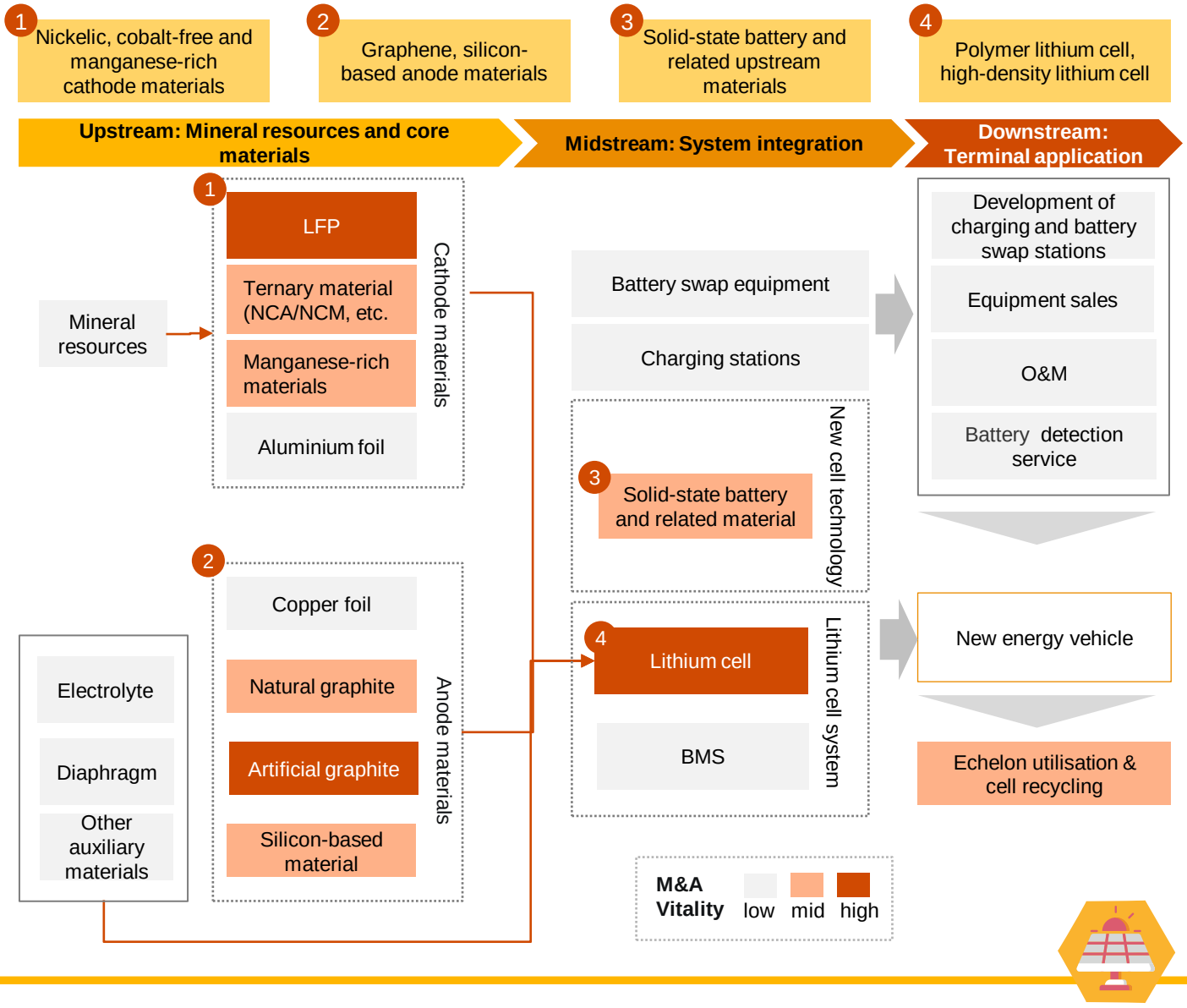
In terms of investor type: proportion of PE/VC has consistently exceeded 50% over the past four years, indicating a strong preference for these investment types. In contrast, direct investment by SOEs has seen a significant decline.

- **PE/VC funds are particularly active in the new technology sector,** with a focus on cutting-edge materials and nano-conductive auxiliary materials. Additionally, fund investors have led approximately 77% of transactions in new battery technologies, particularly solid-state batteries.
- **Strategic investors from private and foreign enterprises continue to concentrate on the lithium battery track, with cross-industry investments making up 73% of their activities,** primarily from manufacturing companies, traditional energy companies, and chemical companies. Manufacturing companies in industries such as automotive and electronics strengthen upstream-downstream synergy through investments or cross-industry synergy; traditional energy companies and chemical companies are strategically positioning themselves for new energy businesses through investments in upstream materials for lithium batteries and lithium mining resources.
- **SOE:** Deal volume have decreased significantly in 2023, but we also note that many PE/VC funds have seen the presence of state assets behind them; state-owned enterprises and government funds are gradually changing their investment methods.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Overview of lithium cell industry chain and M&A hotspots

M&A hotspots in lithium cell industry chain in 2023

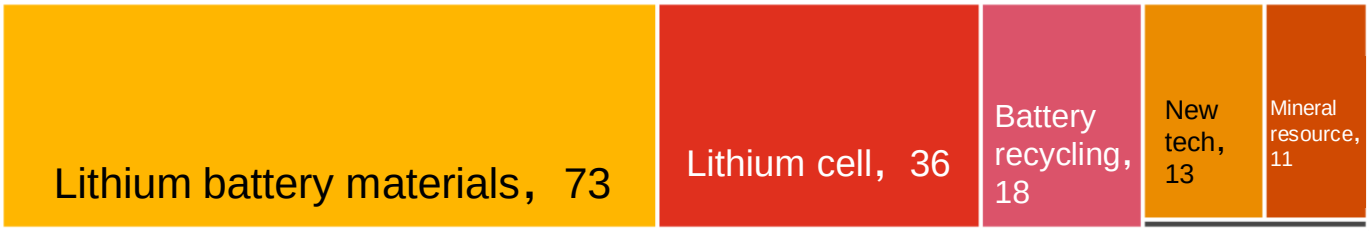


With the rapid growth of lithium cell delivery volume year by year, the attention of capital has also expanded from manufacturers to upstream material suppliers. All kinds of funds have made layouts in lithium cell materials, expanding from cathode materials to anode and other auxiliary materials, from the mainstream technical route-related materials to the new technology route. In addition, domestic lithium cell manufacturers have begun to increase their efforts to make deployment in overseas capacity while stabilising the domestic capacity deployment. The financial pressure of investment and construction overseas and the policies of various countries have prompted domestic lithium cell enterprises to accelerate the expansion of overseas financing channels and introduce more overseas partners. At the same time, the lithium call industry is still in an intensive period of technological innovation. The process of material innovation and structural innovation around performance improvement and cost control continues to deepen, and the investment heat in solid-state batteries, silicon-based anode materials, and other fields has increased simultaneously. On the other hand, with the gradual increase in the average service life of installed lithium cells, cell recycling has attracted more attention, thus, more and more OEMs have begun to consider the construction and operation of recycling networks.

— Franklin Zhai, PwC China Energy, Utility and Mining Deals Lead Partner

M&A trend of lithium cell industry chain

M&A deal volume of lithium cell industry chain in 2023



As the core part of the lithium cell, there are many battery plants established with large-scale capacity in 2023. The newly-built capacity has brought abundant capital needs, and most of the top battery manufacturers have finished listing or capital supplement through private placement

- REPT completed IPO HKSE in December 2023
- Sunwoda completed a private placement of RMB4.8 billion on the secondary market in March 2023

Meanwhile, many enterprises with synergies between their own industries and lithium cell manufacturing choose to quickly enter the battery manufacturing subsector through self-construction or M&A

- Lithium sodium cell manufacturer Li-Fun Technology completed round B+ financing in August. The investment was led by Guangdong Meilian New Materials, a leading listed chemical company
- Acer, the global laptop computer group, acquired an 11% stake in Changli Technology, a major manufacturer of lithium iron phosphate cell

As the main downstream industry of lithium batteries, the national installed capacity of new energy vehicle lithium batteries is expected to reach 387.7GWh in 2023, compared to 295GWh in 2022, an increase of 31.6% YoY. This growth rate is lower than the 90.7% YoY increase in 2022**, indicating a slowdown in downstream demand growth.** At the same time, battery factories continue to expand production capacity, with data showing that the total investment in battery projects in the first half of this year alone reached approximately RMB 440 billion. The continuous expansion of production capacity has led to **low utilisation rates on the supply side; supply-demand imbalances and continuous declines in upstream raw material prices** have **triggered price wars, leading to decreased profitability and shrinking profits for companies.** As a result, current targets are less attractive for financial investors; meanwhile, the battery manufacturing industry is becoming increasingly mature with large-scale mergers and acquisitions becoming scarce investment targets and opportunities for secondary market investments increasing, collectively leading to a decline in transaction activity within related sectors. **It is expected that the industry will further differentiate in the future as leading companies consolidate their positions through economies of scale and cost advantages while continuing research and development efforts as they wait for inventory clearance.**

In 2023, investors are demonstrating a more focused and refined trend in the selection of lithium battery materials, **while also emphasising the economic benefits brought by upstream and downstream integration**. Financing for positive electrode materials and precursor-related companies still accounts for over 80% of overall transactions. The market share of lithium iron phosphate installations continues to rise to 66%, with more than half of the transactions related to lithium iron phosphate materials. The market will continue to explore the high density and cost-effectiveness of lithium iron phosphate positive electrode materials. Certainly, the exploration of the ternary high-nickel cobalt-free route is being pursued. Early-stage capital attention has also been directed towards rich lithium manganese-based materials, which offer various performance advantages. Additionally, integrated enterprises covering multiple links from smelting and extraction to battery recycling have garnered increased attention due to their cost advantages.

- Ningxia Hanyao, a leading researcher in high-energy density rich lithium manganese-based positive electrode materials completed a B+ round financing in January 2023 totaling over 500 million combined with its B round financing in September 2022.

- In June 2023, Foshan Topu Technology, a provider of rich lithium manganese-based power battery solutions completed an angel round financing worth millions.

M&A trend of lithium cell industry chain

M&A deal volume of lithium cell industry chain in 2023

In terms of anode materials, artificial graphite has gradually solidified its position as a mature negative electrode material through continuous integration and expansion of production. By 2023, through continuous optimisation of its key energy-consuming process and further release of production capacity, the transaction price will gradually decrease and the penetration rate will be further improved. Silicon-based negative electrode materials are accelerating commercialisation in the lithium battery field as a major development route. Leading battery companies have achieved mass production and installation of related products, attracting attention from financial and strategic investors for early investment targets focusing on silicon-based negative electrodes. Silicon-based material chemical enterprises are entering the negative electrode industry chain through acquisitions, aiming to jointly explore continuous optimisation of related technologies and further accelerate industrialisation in the future.

- Hebei Kuntian New Energy completed the Pre-IPO round financing of more than RMB2 billion, which focuses on graphitisation furnace technology to reduce power consumption, leading the process improvement of the anode material industry.
- Sichuan Science Gold Silicon New Materials, focusing on R&D of silicon-based anode material, completed the round A+ financing of about RMB10 million.
- In January 2023, Zhejiang Xin'an Chemical Group, a silicon-based new material production and R&D enterprise, acquired Huzhou Qiyuan Jincan New Energy, a negative electrode material company, for 190 million yuan to layout the production and R&D of silicon-carbon negative electrodes.

In addition, among the four major primary materials, wet membrane coating technology and the replacement process of lithium hexafluorophosphate in electrolyte still attract attention from capital, but overall they are showing a downward trend.

In terms of new battery technologies, the commercialisation of solid-state batteries is expected to further strengthen, making it the only track with an increase in quantity compared to 2022 among various sub-tracks. As industrialisation accelerates, investment in solid-state batteries becomes more refined, and upstream materials for solid-state batteries led by solid-state electrolytes also receive significant attention from capital.

- Chongqing Tailan New Energy, a solid-state battery company completed the round Pre-B financing of about RMB100 million, led by CICC funds.
- Langu New Energy, a solid electrolyte R&D enterprise completed the round A+ financing of about RMB100 million, led by Yinshan Capital.

In 2023, the price of lithium carbonate is experiencing a noticeable decline, driven by reduced activity in both upstream lithium mining and downstream battery recycling within the battery industry. Amidst escalating geopolitical tensions, the most significant transaction of 2023 occurred when Shengxin Lithium Energy was mandated by Canada's Department of Innovation, Science and Economic Development to divest its lithium mine assets in Argentina. While the battery recycling industry continues to attract capital attention due to dual carbon consensus and policy support, leading companies remain the focus of funding interest.

- The largest deal in the lithium cell industry in 2023 was the forced divestment of Shengxin Lithium in February, with a scale of RMB17.62 billion.
- Quannan Ruilong Technology, a battery recycling company completed round A and round A+ financing in January and November, respectively, and the investors included well-known enterprises such as NiO and Xiaomi.

Review of major deals

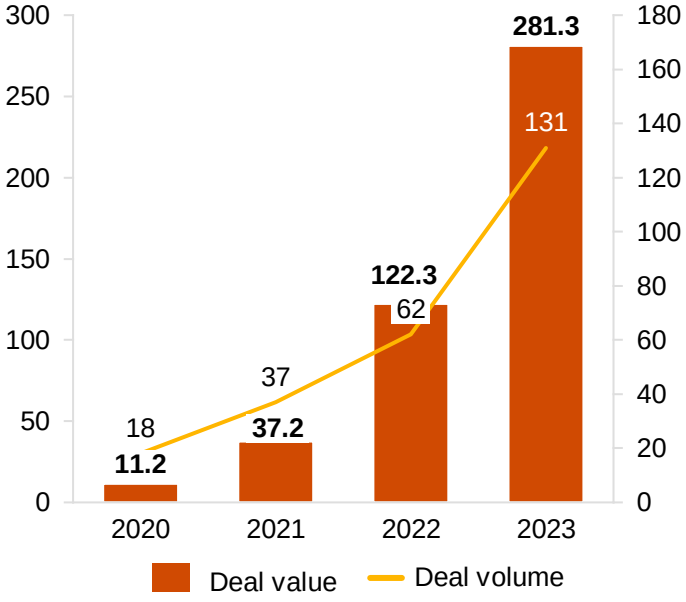
Date	Investors	Target	Industry	Direction	Amount (RMB in 100M)	Background & Characteristics
2023-02-17	Gator Capital	Lithium Chile	Lithium and other mineral resources enterprises	Overseas withdraw	176.2	Divestment (Chengxin Lithium Energy divested lithium assets in Argentina)
2023-10-31	Undisclosed	Envision Energy	Lithium cell enterprise	Undisclosed	71.0	Round B financing of USD1 billion for its global new orders and capacity layout
2023-04-13	Tuohai Equity Investment Fund	Tibet National Energy Mining	Lithium and other mineral resources enterprises	Domestic	46.8	Zangge MINING acquired shares in Tibet National Energy Mining to seize mineral resources
2023-03-08	GF Securities and others	Sinomine Resource	Lithium and other mineral resources enterprises	Domestic	30.0	Private placement, mainly for development of mineral project
2023-11-08	UBS Group and others	Putailai New Energy Technology	Lithium cell material enterprise	Domestic	28.2	Private placement, mainly for anode materials integration construction project
2023-05-25	SHANGQI Capital	Qingtao Energy Development	New battery technology	Domestic	27.0	Round B, mainly for solid-state battery industrialisation construction project
2023-04-13	RISE GRAND INVESTMENT	Libode New Materials	Lithium cell material enterprise	Domestic	25.8	Round B financing to speed up IPO
2023-12-27	Agricultural Bank Financial, Jianxin Financial Asset, The China Orient, Boc Financial Assets Investment	Guangxi Zhongwei New Energy Technology	Lithium cell material enterprise	Domestic	22.0	The wholly-owned subsidiaries of CNGR Advanced Material introduced new investors through capital expansion
2023-01-30	CICC CAPITAL, etc.	Kuntian New Energy	Lithium cell material enterprise	Domestic	20.0	Round Pre-IPO financing, mainly for anode materials integration construction project
2023-09-21	Caiting Fund and others	Guangzhou Great Power Energy and Technology Co., Ltd.	Lithium cell enterprise	Domestic	15.2	Private placement, mainly for business expansion

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

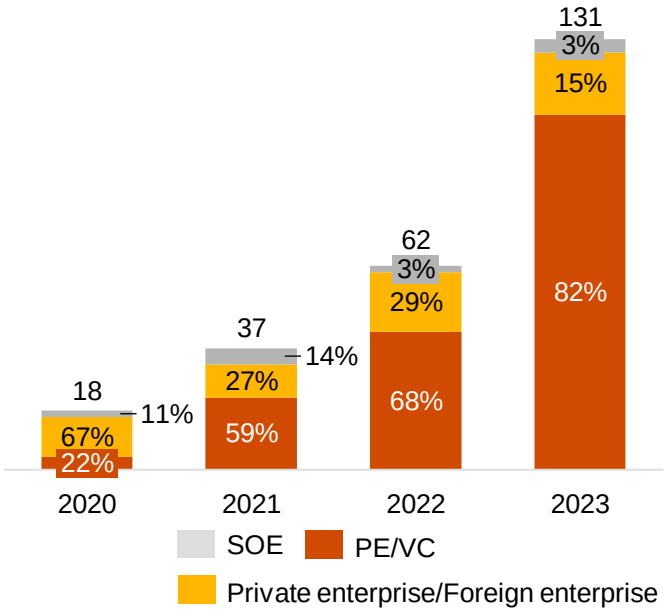
Energy storage

Overview of M&A in the energy storage industry

M&A deal value and volume of energy storage industry during 2020-2023



M&A deal volume of energy storage industry during 2020-2023 (by investor type)



Energy storage sector continues to heat up in 2023: According to EESA1 statistics, in 2023, China's new energy storage capacity reached 49.16GWh, three times higher than in 2022. Front-end independent energy storage increased to 55% and commercial and industrial energy storage added 2.45GWh behind-the-meter. Policies promoting independent energy storage participation in electricity markets have been introduced, leading to high growth for front-end independent energy storage. Additionally, provinces like Jiangsu-Zhejiang and Guangdong have seen increased profitability for commercial and industrial energy storage due to changes in electricity pricing policies and cost reductions within the industry chain.

For M&A deals in general, Overall, driven by various favorable factors such as power market reform, policy support, and improved project economics, the M&A deal value in the energy storage industry chain saw a 131% increase in 2023, with the deal volume also rising by 111%. Energy storage integrators and new energy storage technologies each accounted for over 40% of the total. Sodium-ion energy storage and flow batteries emerged as the most attractive tracks for investment due to their complementarity with lithium-ion energy storage. Meanwhile, capital continued to favor energy storage integrators focusing on industrial and commercial sectors in the integration sector.

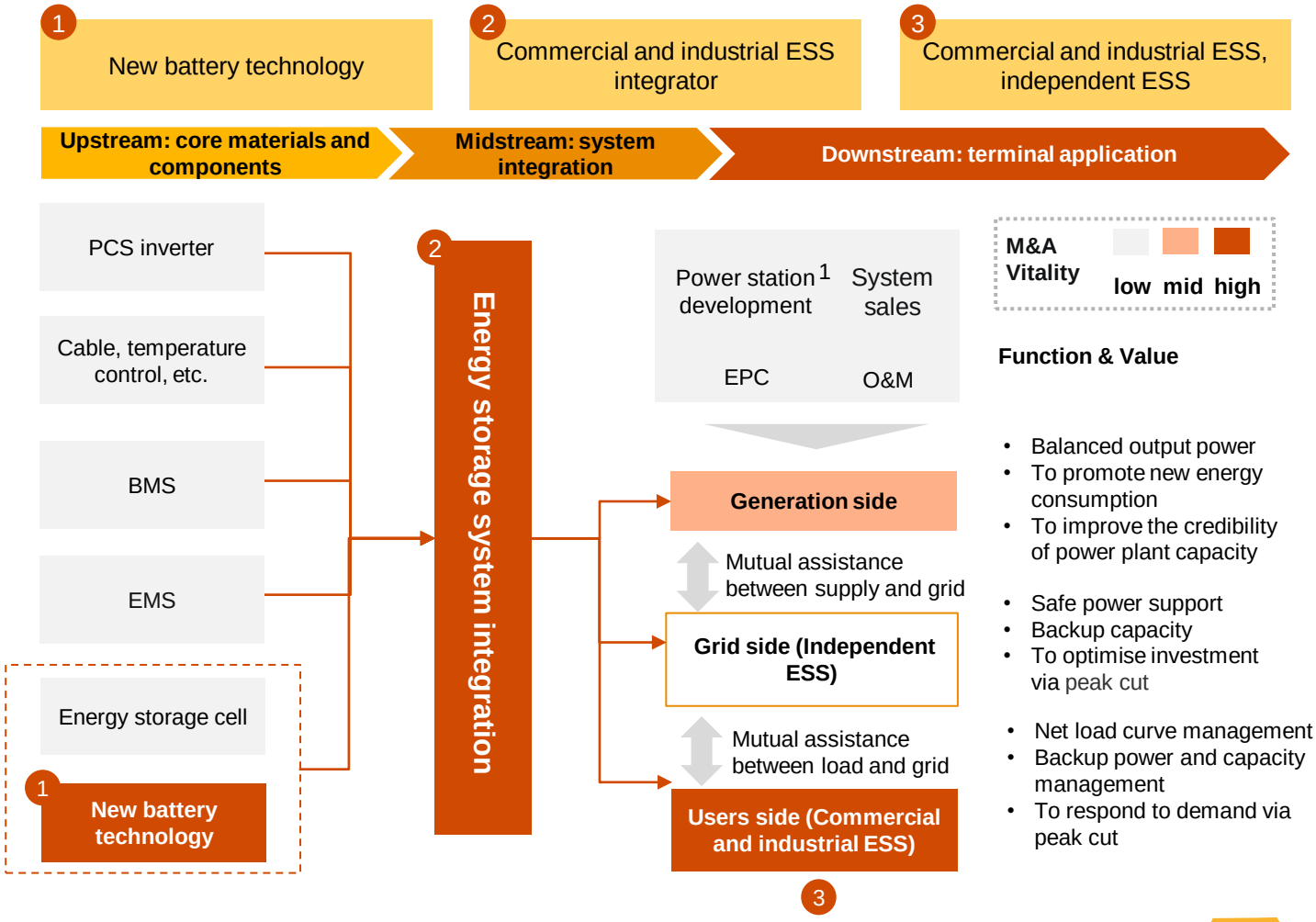
In terms of investor type,

- **PE/VC** is the major entity of M&A deals in the energy storage industry, with the proportion increasing year by year. Energy storage is an emerging industry, thus, the technology and market profitability model is not mature. In recent years, many growing/start-up enterprises with core technical barriers and market resources have emerged, which have been favored by PE/VC investors. With the continuous commercialisation process and the gradual prominence of profitability, it is expected that the investment activity of PE/VC will continue to increase.
- **Private and foreign enterprises** are mostly from new energy-related industries, which empower the energy storage business in terms of technology, equipment and market resources through synergies. There are also many cross-border enterprises from environmental protection, electronic manufacturing, home appliances, etc., trying to find the second growth point of business or realise the overall business transformation by entering the field of energy storage/new energy
- **SOEs** have limited direct involvement in M&A deals within the energy storage sector. Their primary focus remains on infrastructure development, particularly centralised power stations, as well as the production and supply of energy storage systems. SOE investors tend to prefer indirect investment through PE/VC funds when investing in companies along the energy storage industry chain.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Overview of energy storage industry chain and M&A hotspots

M&A hotspots in energy storage industry in 2023



[1] At present, the power station development mainly focuses on independent energy storage, industrial and commercial energy storage and other fields.

2023 is an important turning point for the development of energy storage. According to EESA data, the installed capacity of China's energy storage market in 2023 exceeded 50GWh, accounting for 59% of the global market, and China has replaced the United States and became the world's largest cumulative energy storage market. However, along with rapid growth, problems such as overcapacity, product homogenisation, and product safety have gradually emerged. We believe that the development cycle of the energy storage industry will fluctuate with technological breakthroughs and the continuous rebalance of supply and demand, and the phased downward trend will not hinder the rapid development of the energy storage industry. On the contrary, the "rat race" forces the industrial chain to reduce costs, and the clearance of low-end capacity will bring new vitality to the industry. As an important support force for energy transformation, energy storage is still one of the most valuable industries for investment on the path to global carbon neutrality in the long run, with the iteration of technology and the continuous exploration of business models. In 2024, user-side energy storage (industrial and commercial energy storage and household energy storage) and the supply-grid side (independent energy storage power stations) are still the directions we are optimistic about. At the same time, technical routes (lithium ion, sodium ion, liquid flow, fuel cells and materials, etc.), application scenarios (PV storage for charging, PV storage for heating, zero-carbon parks, etc.), and application fields (ships, miners, heavy trucks, etc.) are the subsectors that worth investing.

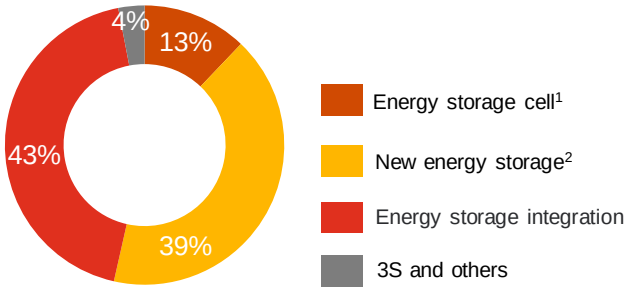
—— Li Yanming, Deputy Secretary-General of EESA

M&A trend of energy storage industry

M&A trends of energy storage industry in 2023

New energy storage technology has become the hotspot by the increase of installed capacity and the continuous progress of upstream material research and technologies. At the same time, the one-stop solutions of energy storage integrators are still attracting investors.

The M&A deal volume of energy storage industry by subsector in 2023



[1] Energy storage cell refer to enterprises whose battery products are centered around the new ESS market [2] New energy storage technology refers to new non-lithium cell technology, including flow redox cells, sodium-ion cell, compressed air energy storage, etc.

The overall deal volume and value of the energy storage cell subsector in 2023 are **relatively small** except for Hithium receiving round C financing of RMB4.5 billion. In 2023, besides Haichen Energy Storage securing a 4.5 billion C-round financing, there were relatively few transactions in the energy storage battery sector overall. However, there was a noticeable trend of large transaction amounts per deal and a higher number of transactions in the first half of the year compared to the second half.

Energy storage batteries are essential components of energy storage systems with high technological barriers. Many traditional track listed companies have successively entered this field, viewing the energy storage battery business as their "second growth curve" for business expansion. Despite the numerous participants and intense competition in the energy storage battery track, most private placement transactions of listed companies are categorised within their main business tracks, resulting in relatively few primary market enterprises and consequently lower overall transaction volume. Additionally, due to characteristics such as high capital investment and technological barriers in the battery track, continuous capital input is necessary. Despite fewer transactions, individual transaction amounts are generally large. In 2023, three of the top ten deals in the energy industry were from the energy storage battery field. Due to a shortage of battery cells in 2022 and overcapacity with declining raw material prices in 2023, overall prices for this sector have been decreasing and M&A transactions have cooled down in the second half of the year.

Hithium, the leading enterprise in energy storage industry, completed round C financing of RMB4.5 billion.

New energy storage technologies, such as sodium-ion batteries and flow batteries, are gaining momentum in commercialisation in 2023 despite the dominance of lithium-ion energy storage technologies. These emerging technologies are attracting significant capital investment, with new energy storage transactions accounting for 41% of the industry. Specifically, sodium-ion and flow batteries represent 57% and 19% of these transactions respectively. The commercial progress is evident, with 49% of companies engaging in transactions before or after Series A funding rounds. In 2023, there has been an increase in both the number and amount of transactions involving new energy storage technologies, as well as subsequent funding rounds. VC firms and local state-owned assets have shown a strong interest in investing in these innovative technologies.

Since 2022, **investment in sodium ion batteries has expanded from the cell level to upstream materials**. Positive electrode materials such as poly-anions, layered oxides, and Prussian blue/white, as well as negative electrode materials represented by hard carbon and soft carbon, have all received capital injection, leading to an increase in the number of transactions. Additionally, various forms of energy storage such as flow batteries, flywheel energy storage, and compressed air energy storage have also seen companies receiving financing. With the continuous acceleration of the commercialisation process of energy storage technology downstream, a situation of diversified development is emerging.

The financing rounds of leading companies in the new energy storage sector have extended to Series A.

Air compression energy storage company Zhongchuguoneng has completed a billion-dollar Series A financing; vanadium flow battery energy storage company Dalian Rongke has completed a billion-dollar Series B financing; sodium-ion positive electrode materials and electrolyte company Sodium Innovative Energy has completed a 500 million yuan Series A+ financing.

M&A trend of energy storage industry

M&A trends of energy storage industry in 2023

Deal value of **energy storage integrators** account for 44% of the energy storage industry, with industrial and commercial energy storage integrators having the highest proportion. In 1H23, they accounted for 57% of transactions, while in 2H23 43%. The financing rounds are widely distributed, ranging from early rounds such as angel rounds/A rounds to acquisitions, listings and etc.
With the continuous widening price difference between peak and valley electricity prices in many provinces and changes in time-of-use electricity prices, some provinces can completely achieve two charges and two discharges within a day with a peak-valley price difference of over 0.7 yuan/kwh. The profitability of peak-valley arbitrage has been fully demonstrated, leading to a sustained explosive growth in demand; coupled with the demand from many energy-consuming enterprises and industrial parks for energy stability, security and zero-carbon-related ESG goals, **industrial and commercial energy storage system integrators have continued to be sought after by capital in 2023.**

Qidian Energy, which focuses on the industrial and commercial energy storage market completed B round and C round financing totaling over RMB 1 billion in 2023.

Deal volume of grid-side energy storage integrators is relatively small due to their characteristics such as large project size, low interest rates, slow repayment etc., which require higher capital requirements for enterprises. Therefore, listed companies and state-owned enterprises are major participants involved in these transactions, resulting in fewer M&A deals. The energy storage market on the source side will gradually shift from policy-driven to market-driven, with independent energy storage becoming the main player in the forefront of the source-side market. The profitability of independent energy storage varies greatly among provinces, mainly depending on different revenue models and varying degrees of demand for flexible regulation resources in each province. However, with the deepening of power market reform and an increase in the proportion of wind and solar power generation, the economic viability of energy storage on the source side is expected to further improve.

The integrated deployment trend of the energy storage industry has been further strengthened in 2023: The integrators expand the upstream layout into the 3S system R&D, battery PACK manufacturing, with their own customer resources and operational advantages in the downstream of the industry. Energy storage battery companies are also extending their products to the integrated field, launching products for both large-scale energy storage and commercial and industrial applications.

However, with a large number of enterprises pouring into the energy storage integration subsector, the competition is becoming more and more fierce. The progress of overall technology has led to the rapid reduction of LCOS, when the downstream sell-side has competed on price. At the same time, the capacity utilisation rate of many upstream energy storage system manufacturers has been less than 50%. In the second half of 2023, many investors have been sidelined to the energy storage integration subsector. It is expected that the industry will enter a round of reshuffling stage in the future, and enterprises lacking core competitiveness and stable downstream customer resources will be challenged.

Review of major deals

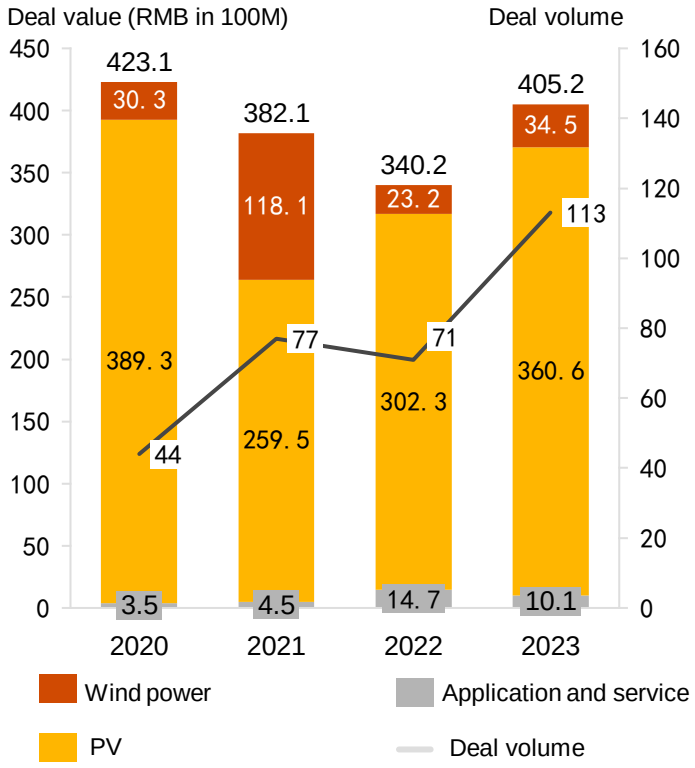
Date	Investors	Target	Industry	Direction	Amount (RMB in 100M)	Background & Characteristics
2023-07-04	China Life Private Equity Investment, Beijing Financial Street Capital and others	Hithium Energy Storage	Energy storage cell	Domestic	45.0	Round C financing for a leading energy storage cell enterprise, for capacity expansion and advanced equipment procurement
2023-05-27	CDB Transformation Fund, Xinda Kunpeng (Shenzhen) Equity and others	China National Energy	New energy storage technology	Domestic	Over 1000	Round A financing, for compressed air energy storage, with the overall R&D process and performance at the international leading level
2023-12-08	Haining Xinchao Investment	Zhejiang Jingke Energy Storage	Energy storage cell	Domestic	15.0	Jinko Solar transferred 49% equity of its subsidiary, Jinko Energy Storage
2023-04-17	Legend Capital, Rongtuo Capital, Dalian Gold Investment	Rongke Power Integration	New energy storage technology	Domestic	10.0	Round B financing for a VRB developer, mainly for capacity expansion and R&D investment
2023-02-07	Enjoy(Ningbo)Asset Management	Narada Power Source	Energy storage integrator	Domestic	8.7	The major shareholder transferred 5% equity to PE
2023-03-24	Youshan Capital and others	Narada Power Source	Daqin Digital Energy	Domestic	7.1	Round B financing, with a focus on industrial and commercial energy storage and household energy storage. The target completed round B and round C financing this year
2023-05-18	GoldStone Investment Co., Ltd.	Singularity Energy	Energy storage integrator	Domestic	7.0	Round B financing for an energy storage integrator for production line expansion and R&D investment
2023-03-18	Guohe Xinli (Beijing) Fund, Zhuhai Hengqin Investment	Weview Energy Storage	New energy storage technology	Domestic	6.0	Round A financing with a focus on flow battery manufacturing for the construction of multiple plants
2023-07-26	CICC Capital, Luwei Kaiteng, Jinqiu Fund, Shenqi Capital, Artemisia Capital	Daqin Digital Energy Technology	Energy storage integrator	Domestic	5.1	Round C financing with a focus on industrial and commercial energy storage and household energy storage. The target completed round B and round C financing this year
2023-02-03	Guohe Xinli Fund Management, Kunlun Capital, core energy Venture Capital, State investment Sheni	Sodium Innovation Energy	New energy storage technology	Domestic	5.0	Round A+ financing for a sodium-ion cell cathode material and electrolyte provider for mass production of core materials and subsequent capacity expansion
2023-05-18	GoldStone Investment Co., Ltd.	Singularity Energy	Energy storage integrator	Domestic	7.0	Round B financing for an energy storage integrator for production line expansion and R&D investment

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Wind power & PV industry

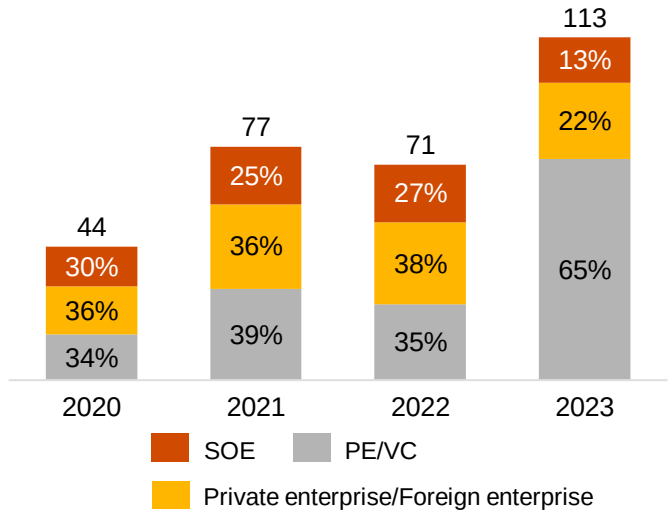
Overview of M&A in wind power and PV industry

M&A deal value and volume of wind power and PV industry during 2020-2023



*The classification of deal types has been adjusted from previous years

M&A deal volume of wind power and PV industry during 2020-2023 (by investor type)）



Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

In 2023, China's photovoltaic and wind power industries achieved a record high, with the annual new installed capacity of wind and solar surpassing 290GW, M&A transactions continued to be robust. The capacity of wind power has doubled, with a 20% annual growth. Photovoltaic capacity newly installed reached 216.88GW, making up half of global new capacity. China's domestic market is now the main driver for new energy manufacturing. Advanced technologies are maturing and expanding production, leading to an overall surplus in supply and demand. Downstream prices have stabilised, reducing electricity costs. Investors are interested in advanced technologies, which will help the industry develop in the long term..

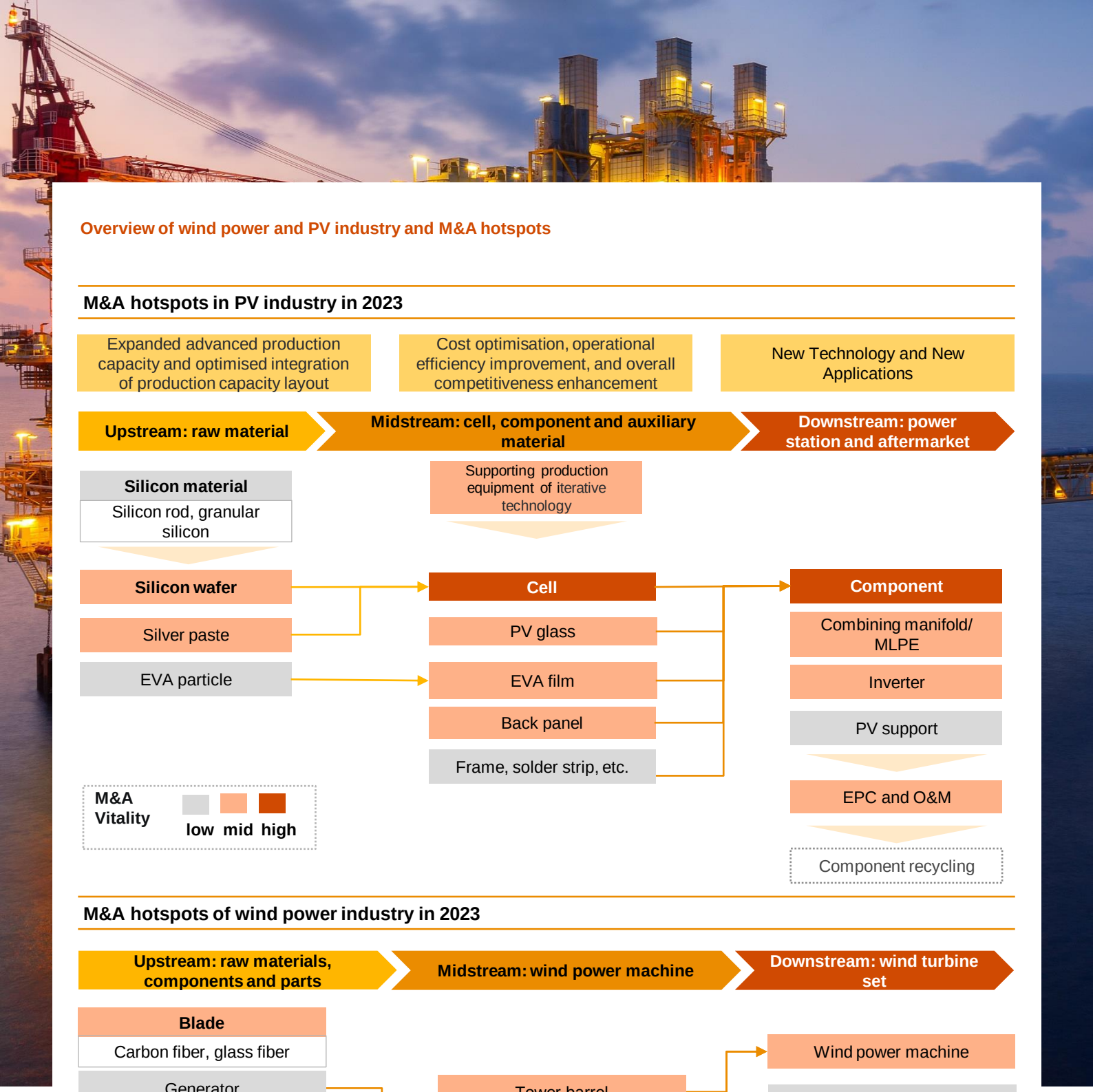
In terms of M&A deals in general, the total deal value and volume in the photovoltaic industry chain increased by 9% and 41% respectively compared to 2022, while the average unit deal value decreased to around 5billion.

In terms of specific sectors, the photovoltaic industry remains the absolute main body of M&A transactions in the solar industry, with a focus on battery cells and components. Due to its obvious latecomer advantage, as well as the comprehensive cost advantages brought about by rapid iteration of n-type technology and cost reduction measures, new production capacity has lower costs and higher efficiency, resulting in advanced capacity expansion and core technology research and development becoming the main focus of investment. In 2H23, due to market and policy changes, both the deal value and volume of investments related to n-type capacity enhancement have significantly decreased, with more focus on other new technologies. Thus, advanced capacity expansion, core technology R&D and iteration have become the hotspots of investment.

In terms of investor type, financial investors have seen a significant increase in the proportion of deal volume and value.

In the investment direction, investment priorities vary with investor types:

- **SOE investors show a preference for more established enterprises and technological routes**. However, there has been a significant decrease in direct investment from state-owned enterprises, with many opting to invest through the establishment of private equity funds.
- In contrast, **PE/VC investors are focusing on cutting-edge technology research and development,** prioritising advanced technology routes such as calcium titanium ore and xBC.
- **Private and foreign investors are placing greater emphasis on vertical industry mergers to ensure stability in raw materials and production costs**, actively expanding advanced production capacity to maintain core competitiveness, and seizing opportunities for a new round of technological iteration.



Overview of wind power and PV industry and M&A hotspots

M&A hotspots in PV industry in 2023

Expanded advanced production capacity and optimised integration of production capacity layout

Cost optimisation, operational efficiency improvement, and overall competitiveness enhancement

New Technology and New Applications

Upstream: raw material → **Midstream: cell, component and auxiliary material** → **Downstream: power station and aftermarket**

Supporting production equipment of iterative technology

Silicon material
Silicon rod, granular silicon

Silicon wafer

Silver paste

EVA particle

Cell

PV glass

EVA film

Back panel

Frame, solder strip, etc.

Component

Combining manifold/ MLPE

Inverter

PV support

EPC and O&M

Component recycling

M&A Vitality low mid high

M&A hotspots of wind power industry in 2023

Upstream: raw materials, components and parts → **Midstream: wind power machine** → **Downstream: wind turbine set**

Blade
Carbon fiber, glass fiber

Generator

Wheel hub (casting)

Converter

Bearing

Gear box

Engine room

…

Tower barrel

Wind power engine

Wind power machine

Sea/land cable

Wind power coating

Wind and lightning protection equipment

EPC and O&M

M&A Vitality low mid high

M&A trend of wind power and PV industry

M&A trends of wind power and PV industry in 2023

PV capacity iteration is gradually implemented, and fierce competition prompted manufacturers to focus on technological innovation and efficiency enhancement, bringing new opportunities

PV cell technology continues to iterate. Due to its compatibility and technical maturity with the PERC production lines, TOPCon route has become the mainstream of the new route in the industry, when collaborative cost reduction and technology improvement will become the key to winning the competition. HJT route is slightly less economical than TOPCon at this stage, but the future process and cost advantages are favoured by investors

Huasheng New Energy completed financing of more than RMB5 billion within a year. Its main high-efficiency HJT products, as well as the R&D of cutting-edge technologies such, are favoured by many investors, like CGDG and Hongtai Aplus.

The overseas PV market is vast, and the localisation policy has forced Chinese manufacturers to accelerate the global expansion

The global continuous energy transformation has brought huge market prospects, and local subsidies and restrictions have encouraged the development of localised capacity. Chinese manufacturing enterprises have begun to globalise, which also brings new opportunities to the industry.

Offshore wind power industry is booming, and domestic equipment has emerged in the global market. Offshore wind power industry is entering a period of vigorous development, and enterprises in the industry are upgrading technology and differentiating competition in this application scenario to seize the market. The trend of large-scale fans drives cost reduction, and the localisation technologies of bearings, blades, and other parts further bring cost reduction. Chinese wind power equipment is gradually recognised in overseas markets, and the increase in its penetration rate will create favorable conditions for enterprises to improve profit space. A series of positive initiatives will bring new growth opportunities for the wind power industry.

Wison Clean Energy, a leading enterprise in the marine field, was invested by CMC Capital and Guangfa Xinde

Dajin Heavy Industry, a wind power equipment manufacturer completed the private placement of more than RMB3 billion.

The service demand for wind power stations is rising, and digital energy management is ushering in an era of rigid demand

With the expansion of wind power and PV stations, the demand for high-quality professional services in construction, operation, monitoring, and maintenance continues to rise. The construction layout of new power systems is gradually clear, and digital energy management such as power trading, energy storage management, virtual power plants, power generation power forecasting, and electricity-carbon linkage is becoming indispensable rigid demands. The rapid growth of distributed energy plants brings challenges to grid security, and the overall management of aggregators will become the key to the industry development.

In 2023, the PV industry, driven by continuous technological innovation, officially began the process of large-scale conversion from P-type to N-type. Various technical routes represented by TOPCon, HJT, XBC, and perovskite compete for development in their respective industrialisation processes, attracting all kinds of enterprises and investors to enter the PV industry and jointly promote the PV industry to move forward. At the same time, with the large-scale investment of various players, the PV industry has also ushered in the negative sentiment of injecting overcapacity in the past period, which has caused market concerns. Considering that many cross-border enterprises have low professional ability, insufficient technology accumulation, and limited capital investment, there is great uncertainty in the future development of the PV sector, and the nominal planned capacity of each part will be far higher than the actual input capacity; On the other hand, the TOPCon production lines that have been built are mainly new production lines and a higher proportion of TOPCon production lines will be upgraded and expanded by the original PERC production lines in 2024. Some backward production capacity will be quickly replaced. Therefore, the actual overcapacity problem is not as serious as the market fears. After the panic has passed, the industry is expected to return to the stage of healthy development after about a year or a little longer.

From the perspective of subdivided technology, TOPCon has quickly entered the stage of industrialisation and large-scale market application based on the original PERC battery and with relatively mature technology accumulation. Its technology development has been relatively mature, the future of TOPCon's mass production efficiency improvement space is relatively limited, cost reduction and efficiency will be an important focus of future industrialisation. At present, the actual terminal application scale of HJT is relatively small, and its operation needs to be further verified. HJT is widely regarded in the industry as having higher ultimate efficiency and attention. Still, due to its more expensive initial equipment investment, as well as higher non-silicon costs such as silver paste and target material, its development has not met expectations in the past year, and continued cost reduction in all aspects of the future will be the theme of HJT route. Coupled with BC cell technology will bring higher ultimate efficiency and aesthetics for crystalline silicon cells, BC technology has received considerable attention. However, subject to the low double-sided rate of BC component products, relatively complex manufacturing process, and high cost, it will be mainly used in distributed scenarios in the short term. Laser graphics technology is becoming more and more mature, which will promote the accelerated development of BC technology, the major leading enterprises are also in the relevant deployment. Perovskite technology is still a concern for industry players and investors, but its development is limited in various aspects such as component efficiency, technology, cost, and industrial chain support, and it is difficult to achieve commercialisation in the short term. The combination of perovskite and other crystalline silicon technology routes will be the mainstream development direction in the future.

In summary, although the PV industry is in a cyclical wave of iteration, considering that the large-scale industrialisation of each technical route can be rapidly promoted relying on the close cooperation of the supporting industrial chain, the ideal of "bending overtaking" in the PV industry is more difficult to realise by betting on advanced technology. The development and innovation of all aspects of the PV sector need to cooperate with the industrial development stage, in the frontier technology exploration, the deployment of key aspects of supporting industries, the application of new generation products, and the accumulation of mature production capacity experience, the PV industry will be able to continue, stable and rapid development.

----- Prof. Shen Wenzhong, Honorary President of Shanghai Solar Energy Society, Director and Professor of Solar Energy Research Institute of Shanghai Jiao Tong University

Review of major deals

Date	Investors	Target	Industry	Subsector	Amount (RMB in 100M)	Background & Characteristics
2023-07-21	Goldman Sachs International and others	Flat Glass	PV	Glass	60	Private placement for the high penetration panel manufacturing project with capacity of 1.95 million tons and supplementary working capital
2023-02-13	Xingtaihe Equity and others	RISEN	PV	Cell	50	Private placement for the implementation of N-type ultra-low carbon HJT cells and efficient solar component projects
2023-07-28	Financial Street Capital and others	DASOLAR	PV	Cell	50	Pre-IPO for mass production based on TOPCon 3.0 technology and deployment of TOPCon 4.0 technology
2023-01-04	Haitong Securities and others	Dajin Heavy Industry	Wind power	Wind power machine	31	Private placement for sea wind project, production line upgrade, R&D center construction and technical transformation, etc.
2023-02-10	Jiangshan Investment Partnership and others	Ginlong Technologies	PV	Inverter	29	Private placement for the new project of cluster inverter to expand the business scale
2023-01-19	China Building Materials Private and others	Anhui Huasheng	PV	Cell	20	Round B financing for the capacity expansion of HJT cells and components and subsequent R&D investment
2023-07-24	Chaoxi Private Equity and others	Astronergy	PV	Component	20	Round C financing for capacity expansion of TOPCon cells and components
2023-11-17	China Green Development and others	Anhui Huasheng	PV	Cell	20	Round C financing for capacity expansion of HJT, as well as the R&D project of HJT-perovskite laminated battery technology
2023-02-13	Zhejiang Zheneng Electric Power	JOLYWOOD	PV	Component	18	Controlling interest acquisition deploy the new energy cell sector, promote the transformation and open up the new energy industry chain. Thus, the target, as a private enterprise, introduced state-owned capital and diversified its capital structure.
2023-04-28	Hefei Industry Investment Group and Jingneng Group, etc.	Qingdian PV	PV	Cell	15	Series A financing. Used for the construction and operation of Qingdian photovoltaic technology projects.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Infrastructure

Overview of M&A in infrastructure industry

M&A trends of infrastructure industry in 2023

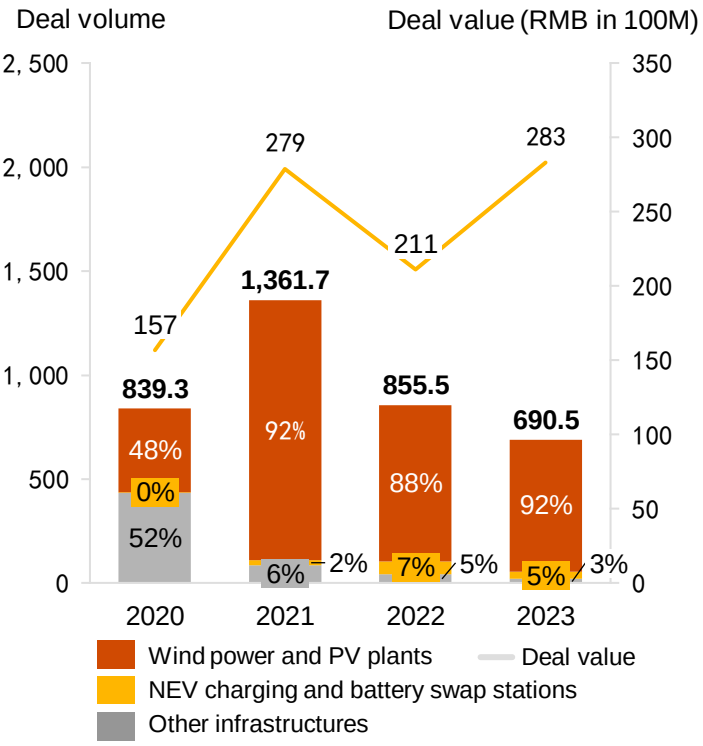
The integration of production and finance is heating up again, with funds serving as an important carrier.

Faced with the development opportunities of new energy infrastructure, the contradiction between the high debt ratio and investment demand of central enterprises in the power industry has become prominent. In order to meet the assessment requirements of SASAC, power central enterprises attract financial institutions represented by banks and insurance companies as limited partners (LP) through setting up funds to jointly participate in the investment of new or existing projects, while seeking to increase actual operating management installed capacity while transforming from on-balance sheet borrowing for construction model.

Non-energy central enterprises focus on their main business, accelerating the sale of wind and solar assets. Looking back at 2023, private enterprises are still the main sellers in the power plant transaction market, with reducing debt and developing a light asset strategy being their core demands for selling power plants. On the other hand, under the guidance and regulation of policies focusing on core responsibilities and businesses formulated by State Council, over past year non-energy core business central enterprises have significantly increased their participation as sellers in asset transactions. In future, with optimisation of layout structure and professional integration by central enterprises, new energy industry will shift from scale expansion towards intensification direction.

To promote low-carbon transformation and high-quality development, local state-owned assets actively deploy distributed platform investments based on regional resources; some local state-owned city investment companies mainly engaged in urban operations seek new business growth opportunities while also having low-carbon transformation needs anchored in new energy track. Due to weaker competitiveness than that of power central enterprises in obtaining large-scale ground station indicators，investment into distributed development platforms becomes an important measure for local state-owned assets to differentiate competition within new energy field backed by regional resources。For example，Shaanxi State-Owned Assets established Shaanxi Green Development Company focusing on building a full industrial chain for distributed photovoltaics；Hangzhou City Investment jointly established Hangtai Digital Intelligence together with Zhejiang Chint Electrics Co., Ltd., Zhejiang Energy Group etc.

M&A deal value and volume of infrastructure industry during 2020-20223



With the dual challenges of peak-valley substitution in the electricity market looming ahead, combining light and storage may be seen as the optimal solution.

The wind power and photovoltaic installation markets have witnessed explosive growth for several consecutive years which poses significant challenges to grid carrying capacity. Against this backdrop, multiple provinces have issued policy guidelines signaling an impending transformation in distributed photovoltaic on-grid electricity price market trading. Grid access is set to emerge as a "new indicator" that distributed photovoltaics will vie for competition. Meanwhile, regions with high proportions of new energy installations like Shandong, Henan, Hebei are closely monitoring the uncertainty brought by peak-valley substitution to absorption electricity prices which has become a major focus of investment attention. To adapt to a more open electricity trading market; solutions such as centralised convergence + energy storage are gaining considerable interest thereby presenting new opportunities for light-storage coupling.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Review of major deals

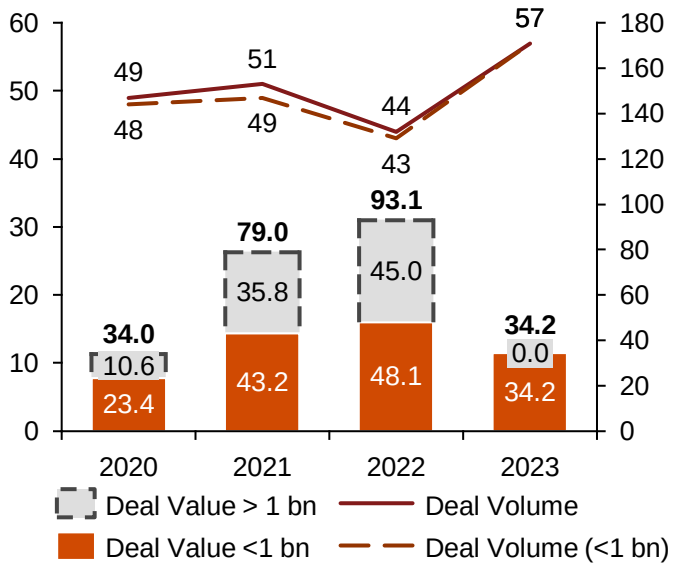
Date	Investors	Target	Subsector	Amount (RMB in 100M)	Background & Characteristics
2023-06-09	Nanwang Jianxin, Yunda Energy	China Electric Power Construction New Energy Group Co., Ltd.	Integrated power generation	76.3	A large central enterprise, China Electric Power Construction, introduced strategic investors for its power generation enterprises to promote the development of new energy business
2023-12-20	Gongrong Equity and others	Guangdong Wind Power Generation Co., Ltd.	Integrated power generation	45.0	Three Gorges Capital led the investment and became the third largest shareholder of Guangdong Wind Power Generation Co., LTD. The fund is for offshore and onshore wind power, PV and other projects in Guangdong Province
2023-09-29	Power Investment Qingneng	Gansu CLP Jiuquan Third Wind Power Generation Co., Ltd.	Wind power	38.7	CLP International and its controlled new energy company transferred part of the equity of the target to a SPV under the JV established with Minsheng Tonghui Asset Management and CLP International, introduced new strategic partners to jointly develop and further expand the Group's clean energy projects
2023-02-10	Nuode Asset Management and others.	Jinko Power Technology Co., Ltd.	PV	30.0	Non-public offering for multiple agriculture-PV power generation projects, distributed PV power generation projects, etc
2023-04-17	CICC Limited and others	Zhejiang Provinsional New Energy	Integrated power generation	30.0	Listed company's non-public offering, with funds intended for planning an offshore wind farm project with an installed capacity of 300MW
2023-07-10	Caitong Fund Management and others	Qingdao Tianneng Heavy Industries Co.,Ltd.	Wind power	15.0	Non-public offering for the company's wind power projects in the country
2023-09-07	Petrochina	Putian New Energy Co., Ltd.	EV power station	15.0	Petrochina will enhance the layout of the charging pile field and accelerate the expansion of the new energy charging network through the acquisition. The acquisition is also an important measure for Petrochina to build a "charging +" industrial ecology
2023-12-11	JilinPower Share	6 new energy power plant companies	Integrated power generation	12.7	JilinPower Share acquired minority shares in six new energy project companies to increase its layout of the new energy industry and improve profitability
2023-01-12	The Milky Way's farce capital management, China Yangtze Power	Gepic Energy Development Co., Ltd.	Integrated power generation	12.0	Non-public offering to further enhance the operation scale of its wind fields and PV power plants.
2023-12-04	Xirong New Energy and others	18 PV power stations	EV power station	11.8	Lin Yang Energy transfers 440MW of PV power station assets, accounting for 42% of Lin Yang's self-owned power stations at 1H23, to Shanghai Xirong New Energy Co., Ltd., a subsidiary of SPIC.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

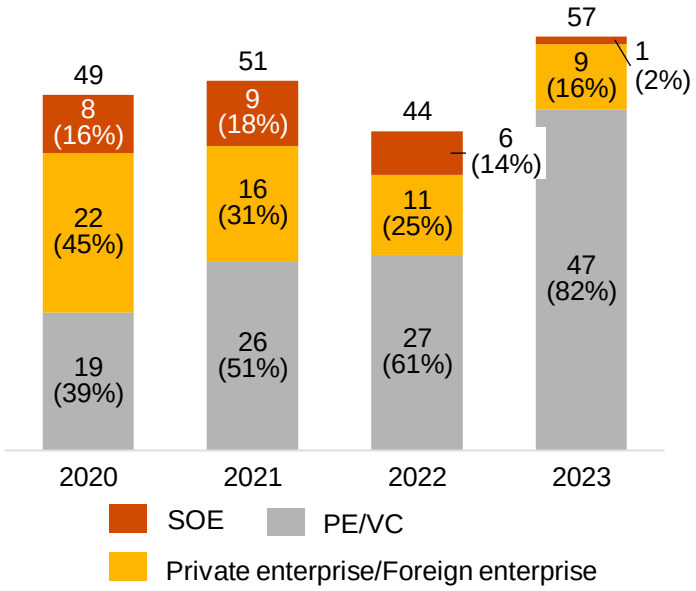
Hydrogen energy

Overview of hydrogen energy industry and M&A hotspots

M&A deal value and volume of hydrogen energy industry during 2020-2023



M&A deal volume of hydrogen energy industry during 2020-2023 (by investor type)



In August 2023, the National Standards Commission and other departments jointly issued the ***Hydrogen Energy Industry Standard System Construction Guide (2023 version)***, which is the first national standard system construction guide for the hydrogen energy industry chain, and will give full play to the standard's role in regulating and leading the development of the hydrogen industry.

In 2023, the hydrogen energy industry saw a total of 57 M&A deals, maintaining the highest level in the past four years. However, there was a significant decrease of about 66% in the total transaction amount compared to 2022's 9.3 billion. Excluding China Power Investment's hydrogen energy financing totaling 4.5 billion yuan in 2022, there was also a substantial decrease when comparing single financing amounts from the TOP10 transactions in 2022 (4 transactions of over 500 million, 2 transactions of over 400 million, and 9 transactions involving financing for leading fuel cell companies). In contrast, there was only one A+ round financing worth five hundred million yuan for Dongde Industry in 2023.Compared to 2022, there has been a gradual shift in financing focus within the hydrogen energy industry. Investment institutions are becoming more professional and China's hydrogen energy industry chain is gradually localising. As a result, enterprise valuations are returning to rational levels as the capital market cools down. The commercialisation path of hydrogen energy still needs clarification, and with the entry of new players into the industry, financing activities have become more diversified. These factors have collectively led to a decrease in the size of individual transactions in the field of hydrogen energy.

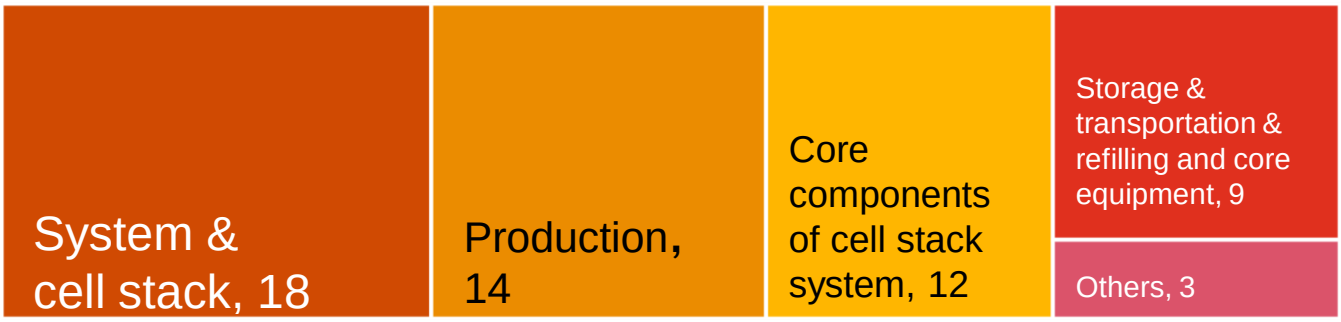
In terms of investor type

- **PE/VC's** proportion has increased year by year for the past four years, reaching 82% in 2023. It is worth noting that **more CVC with industrial backgrounds and local industrial capital, and many financial investors** continue to increase their investment. Overall, the hydrogen energy industry is still in the early stage, and financial investors are more inclined to invest in high-tech enterprises with **core technical barriers**, such as Sequoia China leading the investment in a proton exchange membrane enterprise Kerun New Materials, and electrolytic water hydrogen separator enterprise Zhongke Hydrogen Yi completing 3 rounds of financing in one year. Industrial capital is more inclined to invest in downstream applications with synergies. Local government funds are more focused on their local feeding effect, hoping to jointly establish industrial ecology, and achieve collaborative development, such as Guangxi Nanning government investing YC Simlan.
- **SOEs, private/foreign enterprises**: The deal volume of direct investments by SOEs and private enterprises, has decreased year by year. On the one hand, some enterprises realise indirect investment more through capital injection for investment risk and operation convenience. Among the remaining deals, many are conducted to accelerate **the horizontal layout of the whole industrial chain.** On the other hand, the investment of SOEs is **more in the development and investment field rather than equity investment**.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

M&A trends of hydrogen energy industry

M&A deal volume of hydrogen energy industry during 2023 (by subsector)



An obvious trend of investment in the hydrogen energy industry in 2023 is the gradual transfer from downstream fuel cells to the midstream and upstream. Compared with previous years when the system and stack enterprises dominated, the deal volume is as many as 14 with hydrogen production, storage, and transportation and processing enterprises as the entities, reflecting the development trend with the diversification of downstream applications.

In terms of hydrogen energy production, benefiting from the gradual increase of renewable energy and hydrogen energy coupling projects in various places, the diversification of downstream scenarios has brought about the growth of hydrogen energy production output, and promoted the increasing demands for production equipment, technology research and development and localisation to reduce costs. ALK is still the most mature means of electrolytic hydrogen production at this stage, and the **diaphragm**, as the core component with the highest technical barriers, has been attracting capital attention, among which, the composite diaphragm is the most popular for well-known financial investors. At the same time, enterprises that focus on the R&D of **PEM** hydrogen production technology are still favoured by capital

The data indicates that the majority of invested enterprises in recent years are newly established companies focused on emerging electrolyser equipment and materials, such as membranes and catalysts. There is also a noticeable trend of material companies expanding into downstream equipment. Analysis of the bidding situation for hydrogen production projects in China from January to November 2023 reveals a relatively high concentration among top players, with a CR3 of 74.3%. The top three winning bidders for electrolysers are Proton Energy Systems, Sunlight Power, and Longi Hydrogen Energy. These players have backgrounds in new energy industries, highlighting the continued reliance on investment from leading players with accumulated funds and technology for the application of production equipment.

Ningbo Zhongke, a developer of alkaline electrolytic cell membranes, completed 3 rounds of financing of nearly RMB100 million from seed round to round Pre-A within a year

Nuode, focusing on the R&D of key materials for PEM electrolytic water obtained the seed round financing from Hefei Local Production and Investment

In the short term, high-pressure gas-state compressed hydrogen storage is still the main way of hydrogen **storage and transportation**. However, liquid hydrogen storage technologies such as low-temperature liquid hydrogen storage and organic liquid hydrogen storage are more likely to achieve long-distance and high-density transportation in the future, attracting much capital attention

Shaanxi Hydrot-ransformer, a leading enterprise in the field of organic liquid hydrogen storage technology, received nearly RMB100 million in round A financing in November

In terms of fuel cell systems, stacks and components, the investment volume and value in 2023 has significantly reduced. On the one hand, the IPO process of leading enterprises is slow, and the commercialisation has not met expectations: As of October 2023, China's cumulative sales of hydrogen fuel cell vehicles reached 18,197, second only to South Korea's 34,000, becoming the world's second-largest fuel cell vehicle market. However, the current business model and profitability still pose certain challenges for enterprises to go public, and the exit route is blocked, which affects the confidence of investors.

However, it should also be noted that the financing rounds of the fuel cell subsector are gradually moving backwards, and the investment targets are developing towards **downsizing and subdividing application scenarios**, such as drones, two-wheeler and other products with small and medium-sized power. In addition, the **regionalisation** feature is still obvious for the fuel cell industry chain, and the Yangtze River Delta and Pearl River Delta are still the main gathering areas for domestic hydrogen energy companies and hotspots for M&A deals.

Qinghang Technology is committed to the R&D of lightweight hydrogen fuel cells, covering many applications such as power aviation, portable power banks, and small vehicles, and completed about the round A financing of RMB10 million in November

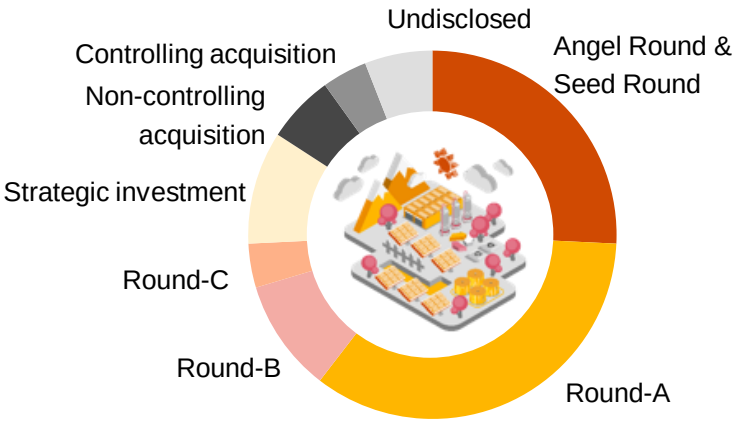
The localisation process of hydrogen fuel cells further extends to components with higher technical barriers upstream, and the localisation rate of core components led by **membrane electrodes** is expected to make a breakthrough, driving the overall cost-reduction process.

Tangfeng Energy Technology, a high-tech company with a whole set of core technologies for membrane electrodes, and core components of fuel cells, completed the round C financing of RMB300 million in early 2023

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Overview of hydrogen industry and M&A hotspots

Proportion of M&A rounds in hydrogen industry in 2023



The hydrogen sector is still dominated by early financing, and the overall financing volume is small, reflecting that the capital market's confidence in the hydrogen sector is still to be enhanced

Financing rounds mainly concentrated from angel round to round A, from seed round to round A of financing accounted for 61% of the total financing of the hydrogen sector; The reason is that the hydrogen energy industry is still in its early stage, the hydrogen energy industry chain is complex, the technology industry chain is diverse, the new influx of enterprises is numerous, and the competition pattern is uncertain, leading to more prudent investment decisions of investment institutions. But at the same time, it should also be seen that some subsectors of leading enterprises are accelerating their commercial implementation; And some subdivision technology parts enterprises have completed the localisation process; In the future, hydrogen energy financing will gradually differentiate, new technologies will continue to absorb early financing, while the commercialisation of the enterprises in the field can be further promoted to the later stage of financing

Overview of IPOs in the hydrogen industry

Name	Main business	Listing exchange	Latest progress
Beijing SinoHytec	Hydrogen fuel cell system	HKSE	• January 12, 2023, officially listed on HKSE • First enterprise to be listed on both A-share and H-share.
Nationsynergyhydro genpowertechnology	Fuel cell	HKSE	• December 5, 2023 officially listed on HKSE
Hydrogen Propulsion Technology	Fuel cell	SSE STAR Market	• In December 2023, the SSE disclosed a new round of listing materials and re-entered the listing approval process
Dongyue Future Hydrogen Energy	Proton exchange membrane	SSE STAR Market	• In September 2023, it handled the guidance and registration in the CSRC and got back to listing
Refire Group	Hydrogen fuel cell system	SSE STAR Market	• Restarted listed counseling, and institutions is CICC • By October 2023, four stages of counseling work progress reports have been published
Guofu Hydrogen Energy	Hydrogen energy equipment	SSE STAR Market	• Restarted listed counseling, and institutions is Haitong • By October 2023, two progress reports on counseling work have been published

Head hydrogen enterprise heading IPO

It is worth noting that many leading enterprises in the hydrogen energy sectors have restarted the listing guidance process in 2023 after withdrawing their listing applications or delaying the listing process in 2022; In addition, two leading fuel cell companies officially listed in HKSE this year. There is no doubt that **the success of the secondary market will improve investors' confidence in the hydrogen energy sector to some extent. For hydrogen companies, Hong Kong is still one of the preferred places to list overseas.**

With the advantages of mature capital markets and various regulatory reforms and optimisation measures, the additional listing rules *Chapter 18C* to allow specialised technology companies to list, and the friendliness of Hong Kong stocks relative to A-shares for pofit-losing companies, the IPO channel in Hong Kong is expected to continue to remain attractive to hydrogen energy companies; In addition, the hydrogen energy enterprises in the domestic market are still in the early stage, the market size is limited, need to rely on products to drive the revenue and profit growth of enterprises; Hong Kong, as an international financial center, on the one hand, listing in Hong Kong can promote global market collaboration to accelerate its products to go overseas, on the other hand, it can also attract more global capital attention.

Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Review of major deals

Date	Investors	Target	Industry	Direction	Amount (RMB in 100M)	Background & Characteristics
2023-05-13	Fortune Caizhi Venture and others	Dongde Industrial	Storage, transportation and refuelling core equipment	Domestic	5.0	Round A+ financing of RMB500 million in 2023 after round A financing of tens of millions in 2022
2023-01-19	Daohe Frontier Private Equity Fund and others	TANGFENG ENERGY	Core components of cell stack system	Domestic	3.0	Round C financing of RMB300 million, with several well-known investors
2023-01-31	Sequoia Capital, GENERAL Technology Venture, etc.	KERUN New Material	Core components of cell stack system	Domestic	2.4	Round C financing of RMB240 million, accounting for half of the domestic market share in the field of fuel cell proton exchange membrane
2023-07-31	Chaoxi Capital and others	Shan DONG Saikesaisi Hydrogen ENERGY	Hydrogen production	Domestic	1.8	Round B financing for the construction of a green hydrogen energy industrial park, product R&D, layout of intellectual property rights, and creation of a top talent team
2023-02-24	CapitalEdge Innovation	Yuchaixinlan New Energy	System, cell stack	Domestic	1.0	Angel round financing invested by the fund under the Nanning Government of Guangxi Province
2023-04-20	Zheneng Equity Fund and others	Zhongtai Energy Technology	Storage, transportation and refuelling core equipment	Domestic	1.0	Round A financing of RMB100 million, with a fund under Zhejiang Energy Group involved
2023-07-02	Shenyi Investment and others	Kunhua New Energy Technology	System, cell stack	Domestic	1.0	Round B financing of RMB100 million, led by a fund under Shenneng Group
2023-07-05	Shuimu Venture Capital and others	GENTEK ENERGY	Core components of cell stack system	Domestic	1.0	Round Pre-A financing, with well-known investors in the field of hydrogen energy and local government capital involved
2023-09-02	Rosefinch Asset Management and others	Carbon Energy Technology	Hydrogen production	Domestic	1.0	Round A++ financing with newly-introduced investors after round A+ financing in 2022
2023-11-07	Changjiang Securities Innovation Investment and others	Juna Technology	Hydrogen production	Domestic	1.0	Pre-Series A financing, the company has completed two rounds of financing totaling 150 million yuan since its official operation in 2022.

Review of major deals(continued)

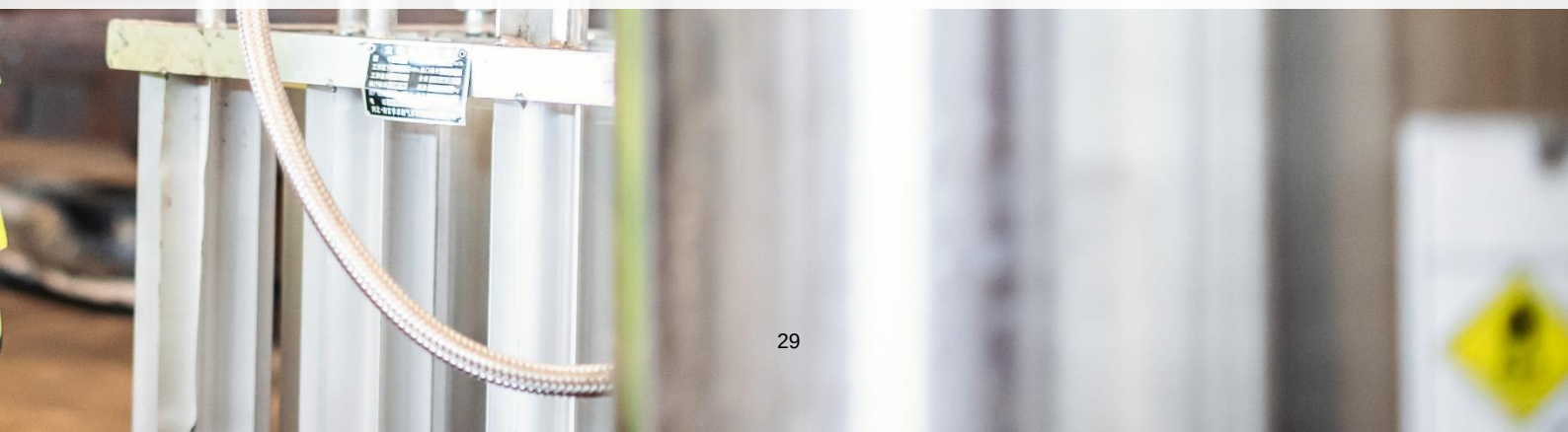
Major deals hydrogen energy industry in 2023

- Overall, the total value of major transactions in 2023 is significantly lower than that of 2022 due to the absence of significant transactions such as the high financing scale of 4.5 billion RMB by Guoqing Technology, which constituted a large portion of the annual transaction volume in 2022. Guoqing Technology not only encompasses the entire industry chain of fuel cells but also invests in hydrogen PEM electrolysers, representing leading fuel cell companies expanding their business in response to market demand changes. Additionally, fuel cell companies are actively exploring more high-power applications such as ship fuel cell systems.
- In 2023, both the total and individual transaction amounts of the top ten hydrogen energy transactions saw a significant decrease compared to 2022. Throughout the year, there were no large-scale transactions exceeding one billion RMB in the field of hydrogen energy. In contrast to nine out of ten top transactions being financing for leading enterprises in fuel cells in 2022, only four fuel cell companies made it into the top ten transactions in 2023. The Series C financing scale was within a range of three hundred million RMB, down from five hundred million RMB for Series A financing in 2022. This reflects an adjustment trend in background valuation and indicates that investment institutions are paying more attention to core components investment trends that have not yet formed a scale during domestic substitution process.
- Furthermore, the increasing number of high-value enterprises with limited access to complex and extensive core technology is intensifying competition in the storage and transportation industry, presenting opportunities for overcoming barriers in any specific raceway.
- Overall, the number of investors involved in each transaction has decreased. Investors now tend to favor targets with core technology capable of achieving partial commercial application at reasonable valuations in a cautious investment environment. While there are many well-known financial investors, an increasing number of enterprise investment institutions with downstream industrial backgrounds are choosing hydrogen energy investments as their future energy transformation goals due to the gradual diversification in downstream applications.
- Furthermore, numerous state-owned enterprises and officials from local governments were prominently involved in the top ten deals, aiming to cultivate the hydrogen industry as a key industrial ecosystem for their respective regions.

In the process of hydrogen energy deployment, enterprises should pay attention to the feasibility of the capitalisation path and the planning of the time." The hydrogen energy industry is still in the initial stage of development, stages should be considered when looking back and looking forward. In the past, the development of hydrogen energy with transportation energy as essential is equal to in the five fields of "production, storage, transportation, refueling, and use"; This year, due to the gradual attention to the chemical raw material properties of green hydrogen, hydrogen energy front-end has become a hot investment spot. In the future, the economies of scale brought about by the first development of the hydrogen production end will drive the development of the middle and downstream hydrogen energy. In terms of investment opportunities, at the hydrogen production end, the short-term opportunities are in alkaline electrolyser (ALK), while the medium-and-long-term opportunities are in proton exchange membrane (PEM) and solid oxide hydrogen production (SOEC). The core materials and core equipment of the electrolytic cell production will become the next investment hotspot, among which the diaphragm, electrode, and so on deserve attention. For storage and transportation, although high-pressure gas storage and transportation now dominate, the future development of hydrogen energy storage and transportation must be diversified, and different storage and transportation should cope with different scenarios and develop in tandem with downstream applications. On the use side, transportation, as the first essential for energy, was first proposed and is still the most noteworthy area. In the small cycle, hydrogen energy enterprises with strong technical strength, rich downstream resources, and reasonable valuation are especially worthy of attention.

------ Sun Rongtao, managing director of Sinopec Capital

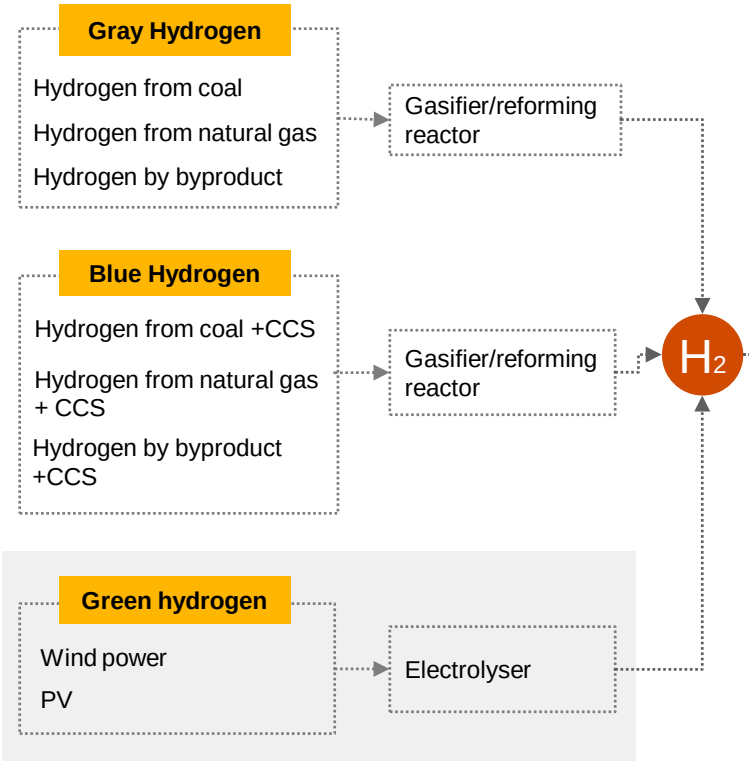
Source: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis



Application trends and prospect of hydrogen energy industry

Based on the annual M&A trends in 2023, the application direction of hydrogen energy downstream has become increasingly diversified, and the diversified application scenarios have also promoted the continuous improvement of upstream facilities and technologies, thus driving more investment and financing opportunities for the hydrogen energy industry: On the one hand, China's hydrogen fuel cell industry chain has been in the international leading level. Combined with the relatively rich by-product hydrogen resources in China at this stage, a closed loop of hydrogen energy application in the field of commercial vehicle transportation in some application scenarios in the economic area of hydrogen has formed. It is proposed in the Medium and Long-Term Plan for Hydrogen Industry (2021-2035) that fuel cell vehicles and pure electric vehicles are "complementary development" for different application scenarios, and combined with their long endurance and high power characteristics, commercial vehicles should be the best field for the promotion of domestic fuel cell technology routes.

In the industrial field, because the traditional petrochemical industry has its hydrogen supply, the certralised SOEs are more responsible for the construction of the "renewable energy - green hydrogen - green chemical" chain; In the field of iron and steel metallurgy, the use of green hydrogen instead of carbon as a reducing agent and the addition of electric furnace steelmaking model will become one of the most promising solutions to achieve carbon neutrality in the steel industry; In the chemical industry, renewable hydrogen has the potential to serve as an important low-carbon alternative chemical raw material in the production of three types of products: refining, synthetic ammonia and methanol. Finally, distributed applications such as construction-level cogeneration are the ones that need to be focused on for longer periods.



Ammonia/methanol production field

- As a clean energy, Green ammonia will be used in various scenarios of future application, In addition to **traditional agricultural and industrial uses, they apply to carbon sequestration, hydrogen storage, shipping fuel, and blended power generation**

CSSC Wind Power Inner Mongolia Tongliao 500,000kW wind power hydrogen and ammonia integration project was signed in February

Maersk and Goldwind signed a long-term green methanol purchase agreement with an annual output of 500,000 tons

Steel & Metallurgy field

- Hydrogen metallurgy is an important way to reduce carbon emissions in the metal smelting industry. At present, the hydrogen steel-making process of grey **hydrogen and blast furnace-rich hydrogen** should be popularised. In the future, **hydrogen enrichment of gas-based shaft furnaces** will be gradually promoted

International hydrogen metallurgy and chemical industry demonstration zone new energy hydrogen production coproduction of carbon-free fuel supporting wind power integration demonstration project was approved in Baotou

In December 2023, Baowu's first million-ton hydrogen-based shaft furnace was officially ignited and put into operation

Hydrogen fuel cell heavy truck and logistics field

- Fuel cells can solve the range anxiety of lithium cells, the fuel cell hydrogenation time is short, and the waste battery will not produce secondary pollution, which has obvious advantages in heavy-duty and long-distance scenarios, and is more suitable for commercial vehicles

From January to November 2023, fuel cell heavy truck sales reached 2,603 units, an increase of 919 units, an increase of 54% compared to last year

In December 2023, GAC Hino and Yuanshang Shares signed a strategic cooperation agreement for 1,000 hydrogen logistics vehicles

Industry trends and outlook

Lithium cells

The industry is facing a structural overcapacity crisis. The industry accelerates the integration and lagging enterprises may face the elimination: 8 of the top 10 deals in 2022 were related to private placement by listed cell enterprises and cell material enterprises for fund raising and production expansion. Half of the top 10 deals in 2023 are still related to addition of new and expanded capacity, but they have dropped compared with 2022. Accompanied by the supply side's continuous expansion in the past two years and the downstream demand side's growth rate slowdown, the industry is gradually showing the structural overcapacity. The related investment heat has dropped. It's expected that in the future, high-quality leading enterprises with high-quality and high-performance products will have advantages in cost control, order continuity and other aspects, and there is a large space for their development; Lagging enterprises may face a more intense market competition, accelerating their elimination; Leading companies take this opportunity to consolidate their market position and competitive advantages by integrating upstream and downstream supply chains.

Continuous decline of raw material prices: There were 2 upstream lithium resource mining deals in the top 10 deals, both concentrated in the first half of 2023. Accompanied by the global lithium capacity increase and downstream demand growth slowdown, the price of lithium carbonate has continued to fall after a brief fluctuation in the middle of the year, slumping in comparison to the 2022 lithium price. It's expected that in the future on the upstream supply side, the lithium resource mining high-cost capacity will continue to reduce the production. And the demand side will maintain growth, helping to stabilise lithium price.

Cell companies continue to go overseas: With the accelerated development of global new energy vehicles, China's lithium cells technology system, capacity scale, supply chain construction has taken a leading role around the world. According to CIAPS, China's lithium cells exports reached $59.7 billion (RMB 424 billion) in the first 11 months of 2023, with a YoY growth of 32.7%. With the growing downstream demand, it's expected that the future battery companies will continue to overseas. Cells companies' overseas business or will encourage enterprises in cell supply chain to deploy local supporting capacity.

Continuous development of cell technology: At present, lithium batteries have been able to meet new energy vehicle owners' needs in terms of safety, energy density and cycle times. However, the market continues to pursue higher standards in terms of charging speed, battery life, and higher endurance. The investment heat in related industry chain is mainly focused on the continuous excellence in upstream new materials and technologies, such as using high-nickel or manganese-rich materials as cathode, using silicon-based negative materials as anode, new materials related to diaphragm and electrolyte and other segments, while solid-state cells, sodium ion cells have undergone continued R&D and commercialisation. In 2023, a number of R&D enterprises in the industrial chain have completed early and growth financing, whether they are related to new cell technology or new cell materials. With the continued development of the industry, the lithium batteries are bound to see an improvement in performance.

Given that new energy vehicles' high-quality development, although the lithium cell industry is temporarily facing a series of challenges in terms of capacity and raw material prices, in the long run, upstream and downstream enterprises in the industry chain will continue to improve cost, supply chain, technology, materials and other aspects to achieve high-quality development. Meanwhile, along with the new energy vehicles going overseas, enterprises in lithium battery industry chain are bound to expand their horizons to the world and explore overseas industry chain layout, joint ventures, integration and other aspects, playing an increasingly important role in global competition.

Energy storage

Application-side commercial and industrial energy storage is thriving, and independent energy storage has a promising future: China has accounted for nearly 60% of the world's new installed energy storage capacity in 2023; With the increase of distributed PV installed capacity around the world, the time-sharing tariff mechanism is constantly adjusted, and the peak and valley tariff gaps are widened in various provinces. Industrial and commercial energy storage ushered in explosive growth in 2023; Looking ahead, the role of energy storage in regulating energy and saving costs on commercial, industrial and household side will become more prominent; And before the meter, as most provinces have enacted and implemented mandatory storage allocation policies for new energy generation, independent energy storage gradually replaces mandatory storage allocation as a new trend of concern; However, the independent energy storage doesn't have a clear business model and profitability, and it has large difference between provinces. The independent energy storage is expected to favoured by capital in the future after gradually run through the business model.

Competition on the manufacturing **side has intensified, and it's general trend for products to go overseas:** With the rapid growth of industrial and commercial energy storage sector, battery manufacturing enterprises, large storage enterprises, 3S equipment manufacturing enterprises and household storage enterprises have poured into this sector. Overcapacity, product homogeneity and product safety problems have also emerged. Looking forward to 2024, the competition of energy storage sector will become more intense, while the industry involution will also force the industry chain to reduce the costs and clear low-end capacity; On the contrary, the expansive opportunities in international energy storage will further prompt domestic enterprises with production capacity advantages to expand overseas and explore new markets. The accelerated global expansion of energy storage companies will emerge as a significant trend to watch in 2024.

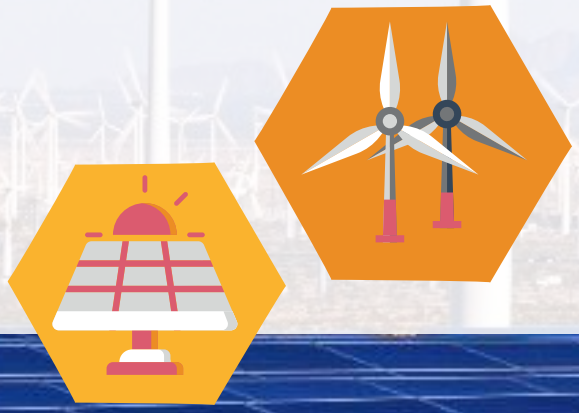
Wind power & PV

Technology iteration promotes capacity changes, and cost decreasing and benefit increasing breaks industry involution. Over the past year, the PV industry has experienced structural overcapacity and fallen prices during technology iteration. The overall trend of capacity expansion remains unchanged as new and old capacities are still in the process of iteration. Fierce competition requires higher standards on companies' technology research and development for cost decreasing and benefit increasing, quality and cost control, and marketing model innovation, etc. The concentration of the industry is expected to further enhance. With the breakthrough of various cost decreasing technology and marginal changes in many new capacities, N-type batteries gradually become competitive in the market, accelerating the elimination of old P-type capacity. With new technologies such as BC / perovskite, the efficiency ceiling of crystalline silicon cells will be significantly increased, which will become the general trend of industry technology development in the future.

Energy and supply chain security is a global concern. Under the influence of geopolitical environment and trade protectionism, countries actively promote the localisation of industry chain, bringing the challenge of global market fragmentation to more Chinese new energy enterprises. In order to maintain and deepen overseas market share and cope with policy risks, Chinese wind power and photovoltaic equipment manufacturers will undoubtedly focus unprecedented attention on overseas production capacity and supply chain investment.

Wind and PV installations have exceeded expectations, and there is an urgent need for innovative solutions. By energy synergies and green added value, the integrated power solution combining power generation, storage and use will attract more types of energy using enterprises and energy investors to actively explore new energy development models.

The construction of the power trading market has entered a new stage, and policy research has become a key element of value assessment. With the formal operation of Shanxi power spot market and the landing of the third round of transmission and distribution reform, the construction of China's power market system has entered a new stage. Under multiple tests such as valley peak replacement and market entry transactions, the long-term stability of asset value after M&As has become investors' focus, and full consideration of power structure and supply and demand differences between different regions has become an important guarantee for investment income.



Hydrogen energy

Continuous exploration of the diversified applications of hydrogen energy drives the rapid development of upstream related technologies and equipment in the industry chain. In addition to being a green fuel in transportation field, hydrogen energy has a wide application prospect in iron and steel metallurgy, petrochemical and other fields. At present, more than 60% of hydrogen in China is used in chemical (synthetic ammonia, synthetic methanol), oil refining and other industrial fields, but it is mainly produced by fossil fuels; There is significant space for carbon reduction in this industry by replacing gray hydrogen with green hydrogen under the great goal of carbon neutrality. Although green hydrogen has not yet been widely adopted in the transportation, electricity, construction, and other industries, we anticipate that industrial decarbonisation will drive its large-scale application, leading to significant development and cost reductions within the green hydrogen industry chain and attracting substantial investment.

The technology driven by localisation accelerates innovation and iteration, and the cost decreasing is expected **to come faster.** Although there are still challenges in the development of China's hydrogen energy industry at this stage, such as incomplete self-sufficiency of key components, inadequate infrastructure construction, and poor industrial economics; However, with the gradual improvement of China's "produce-store-transport-refueling-use" hydrogen energy industry chain, and the continuous development of renewable energy and new power systems, new energy installations are increasing year by year. The role of green hydrogen coupled renewable energy as long-term energy storage will gradually become prominent.

Supply chain and products go overseas, and international cooperation may be the new breakthrough for the development of domestic hydrogen energy enterprises. Throughout the country, the demand of marketisation has not been greatly promoted in the short term, and the project landing depends on government policies and demonstration project orders from centralised state-owned enterprises. Many countries worldwide have already recognised hydrogen energy as a crucial strategic component of national energy development. Forward-thinking Chinese companies have initiated efforts to seek international partners in order to enhance collaboration and research within the hydrogen energy sector. It is anticipated that the global expansion of Chinese hydrogen energy firms will emerge as a prevailing trend, consequently driving cross-border investment and mergers and acquisitions.

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- **Prof. Shen Wenzhong,** Honorary President of Shanghai Solar Energy Society, Director and Professor of Solar Energy Research Institute of Shanghai Jiao Tong University
- **Mr. Li Yanming,** Deputy Secretary General of Electrical Energy Storage Alliance (EESA)

The above persons have contributed to the content of this report.

**Listed in alphabetical order*

- **Sinopec Capital** is jointly established by China Petroleum & Chemical Corporation Limited and China Petroleum & Chemical Corporation Limited, and finds strategic investment opportunities through financial investment under market-based institutions and mechanisms, focusing on strategic emerging industries such as new energy, new materials, energy conservation and environmental protection, high-end intelligent manufacturing, big data and artificial intelligence. Sinopec Capital Company has a broad layout in the hydrogen energy industry chain, and its business departments have invested heavily in green hydrogen projects and hydrogen refueling station construction.
- Established in December 2017, **Electrical Energy Storage Alliance (EESA)** currently focuses its business ecology on electrochemical energy storage, with over 3,000 partners and over 1,000 member units, covering upstream advanced materials, devices and process equipment, midstream cell & Pack & BMS & EMS & system integration, and downstream EPC & project investment units.
- **Solar Energy Research Institute of Shanghai Jiaotong University,** affiliated to the School of Physics and Astronomy, School of Science, Shanghai Jiaotong University, conducts research of silicon based solar photovoltaic science and engineering, involving research fields such as high-efficiency crystalline silicon solar cells, thin film solar cells, and new solar cells, as well as photovoltaic materials, testing, and application technologies. The Solar Energy Research Institute is also an affiliated unit of the Shanghai Solar Energy Society, which organises and hosts the China Solar Grade Silicon and Photovoltaic Power Generation Seminar (CSPV) each year.

Data compilation methodology

and disclaimers

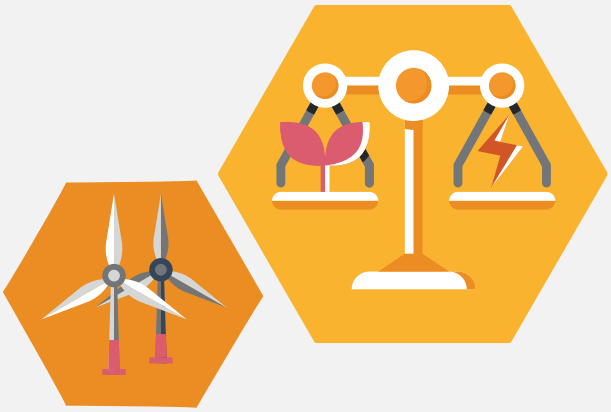
The data set forth in this presentation and press release may differ from the data in the prior press release. There are three main reasons for this: CV Source periodically update their historical data as deals are finalised or completed; PwC excludes some deals that are not in essence a transfer of control but are closer to an internal corporate restructuring; And adjusted the exchange rate data.

Included Deals

- Acquisitions of private/public companies resulting in change of control
- Investments in private/public companies (involving at least 5% ownership)
- Mergers
- Buyouts/buy-ins (LBOs, MBOs, MBIs)
- Privatisations
- Tender Offer
- Asset Spin-Off
- Spin-off of a wholly owned subsidiary when 100% sold via IPO
- Divestment of company, division or trading assets resulting in change of control at parent level
- Re-capitalisation
- Joint venture buyouts
- Joint Ventures
- Receivership or bankruptcy sales/auctions
- Reverse takeover

Excluded Deals

- Real Estate/ Property for individual properties
- Rumoured deals
- Options to acquire additional equity interests offered in the absence of a 100% equity acquisition
- Purchase of trademark rights
- Land acquisitions
- Equity placements in funds
- Stake purchases by mutual funds
- Open market share buyback/retirement of stock unless part of a privatisation
- Balance sheet restructuring or internal restructuring
- Investment in greenfield operations
- Going private deals
- Tracking stock
- Backdoor trading
- Non-publicly traded



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