

Retrospective and Outlook of M&A in China's New Energy Industry in 2022



Lithium battery and solar technology drive M&A deals to an all-time high; cross-border investments to see a rebound

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 refers 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 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 data in China's new energy industry in 2022





M&A deal volume in China's new energy industry in 2022 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.).

- In 2022, the disclosed M&A deal value of China new energy industry M&A amounted to RMB391.7 billion, with a total of 716 deals, hitting a record high level since the start of our reporting. The compound annual growth rate stood at 45% in the past three years, and it is expected to remain high in the future.
- In terms of sector, the accelerated development of new energy vehicles has led to the steady increase in investment value of the whole industry chain. With lithium batteries being a core component of new energy vehicles, the sector's deal value and volume has doubled compared with 2021; Wind power & PV, energy storage and hydrogen energy sectors have also embraced growth in varying degrees; Due to the decline of mega-deals over large-scale, centralised power plants, both investment value and volume of the infrastructure sector have dropped.
- In terms of investment direction, while domestic deals remained dominant in 2022 (accounting for 95% of deals), outbound M&A deal volume was largely unchanged from that in 2021 with slight growth. With the adjustment of the epidemic prevention and control policy in the second half of 2022, local governments have been actively promoting cross-border investment and trade development plans, as a result, the crossborder M&A market will gradually rebound.

 $[\]ensuremath{\mathsf{Source}}$ CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Highlights of M&A deals by sector



Lithium batteries

- **Vertical extension:** Battery pack and component firms extend upstream through investment, and form strategic alliances to ensure the supply of raw materials and control costs.
- New materials and new technologies: Performance improvement and demand for cost reduction prompt solidstate batteries and silicon-based anode materials to be favoured by investors.
- Cell recycling has entered the stage of large-scale investment and has been drawing attention from the market with new energy vehicles gaining increasing popularity.

Energy storage

- **Energy storage integrators** highlight advantages of extending both upstream and downstream and are favoured most by investors.
- New energy storage technology: The commercialisation of sodium-ion and flow redox batteries speed up to be implemented and the scale of early-stage deals has increased significantly.
- Mandatory generation-side energy storage requirements increase the certainty of market size; Consumer-side energy storage has multiple business models and higher profitability; "Dual engine" drives energy storage sector to attract investors.

Wind power & PV

- Technology upgrading promotes midstream capability expansion and iteration, while various investors continuously increase investment in different technology routes.
- Deepened cost reduction and acceleration in R&D and development of auxiliary components. The willingness to reduce cost and increase efficiency drives industry participants to seek long-term development.
- Offshore wind power has emerged as the new battlefield for wind turbines, while product differentiation accelerates the competition of investments in the industry.
- Upsizing of equipment drives continuous cost reduction, with turbines and components back into investors' sights.

Infrastructure

- "Year of Compliance" for large-scale, centralised power plants; investors tend to be rational and prudent.
- The new policies concerning industrial and commercial electricity prices were carried out intensively in various provinces, highlighting the **regionalised** investments of distributed power plants.
- Financial institutions and cross-border investors accelerate rollout, with investors taking on **diversified characteristics**.

Hydrogen energy

- **Fuel cell system** continues to be the absolute mainstream of the hydrogen energy sector investments and leading enterprises are gradually moving to later financing rounds, with the support of national policies and government as the main driving factor.
- The midstream storage, transportation and refilling sector cuts a striking figure, while industrial capital focuses on leading equipment enterprises, while high valued single investments.
- The upstream hydrogen production sector has seen a rise, but the financing value and scale are still limited. Leading enterprises have obvious competitive advantages, and the investment and financing activities focus on innovative cutting-edge technologies.
- Application scenarios of new energy with hydrogen production are expected to embrace a prosperous future.



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 batteries industry chain during 2020-2022



In 2022, the lithium cell industry chain witnessed rapid development, large-scale expansion, active financing and diversified participants. According to data released by the Ministry of Industry and Information Technology, in 2022, the total capacity of lithium cell for new energy vehicles was 295GWh in China, with a YoY growth of 91% compared with 154.4GWh in 2021.

For M&A deals in general, the annual M&A deal value of lithium cell industry chain reached RMB212.2 billion, with a YoY growth of 130%, while the M&A deal volume stood at 272, recording a YoY growth of 100%.

Among segmented investment field

- Lithium cell enterprises dominate deal value. CATL completed the private placement of RMB45 billion while most of the top ten enterprises have been listed.
- Lithium cell materials enterprises take the lead in deal volume. Leading enterprises of cathode and anode electrode materials, electrolyte and diaphragm, i.e. the four main materials, have gone public and completed financing through private placement.

M&A deal volume of lithium batteries industry chain during 2020-2022 (by investor type)



In terms of investor type, PE/VC accounted for nearly 50%. Both volume and the proportion increased significantly compared with those in 2021. The proportion of private enterprise/foreign enterprise decreased but the volume increased. SOE investors remained stable:

- In private placements for listed companies, PE, SOE and strategic investors are more active.
 Business growth certainty for listed cell and cell material enterprises, as well as business synergy between investors and targets, are the main investment considerations for such investors.
- VC investors are more active in new technologies. Compared with PE and enterprise industrial investment/corporate strategic investment, VC investors pay more attention to the R&D of cuttingedge technologies, with solid-state cell becoming the hot spot for investment.
- **Private enterprise and foreign enterprise:** Private enterprises mainly carried out vertical M&A or investments within the industry to secure supply and stabilise costs, and focus on cell recycling and other fields.

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

Overview of lithium batteries industry chain and M&A hotspots



Supply chain continues to be one of the main factors restricting the capacity of lithium cell enterprises. Based on the demand of ensuring supply chain security and reducing cost, lithium cell enterprises put more efforts into establishing stable investment or cooperative relations with upstream mineral resource enterprises and material enterprises through investment, equity participation, alliance and other ways. At the same time, lithium cell industries put more efforts to expand production capacity by rushing to stake a claim. By the end of 2022, the total capacity planning of 44 initiated lithium cell projects exceeds 1.2TWh, among which the amount of projects with a total investment of more than 10 billion yuan are more than half, reaching 23.The financial pressure of factory-construction investment promotes the lithium cell enterprises to accelerate the expansion of financing channels. Domestic leading listed enterprises such as CATL have launched private placement and fundraising. CALB, SVOLT Energy Technology (Hong Kong) Co., Limited and Beijing Pinyuan Intellectual Property Agency Co., Ltd. are also on the way to IPO. In addition, GDRS such as Gotion High-tech Co.,Ltd. and Sunwoda Electronic Co., Ltd. listed to raise overseas capital to arrange overseas factory construction. On the other hand, the lithium cell industry is currently in a period of dense technological innovation. The process of material innovation and structural innovation centering on performance improvement and cost control is deepening, at the same time heating up investing in solid-state cell, silicon-based anode materials, sodium ion cells and other.

- —— Lin Li, PwC China Deal Strategy & Operation Partner

M&A trend of lithium batteries industry chain

M&A deal volume of lithium batteries industry chain in 2022



Lithium cell enterprises and materials enterprises continue to expand production, spurring the need for capital. Especially in the new energy vehicle market, the continued growth of downstream production and sales of new energy vehicles have brought development opportunities for the industry. Thus the capacity demand of lithium batteries has achieved rapid growth, while the market of LPFP and ternary cell have been experiencing obvious growth and embraced broad space. On the one hand, it has attracted investors in the industry to actively participate in financing activities, expand production, and rapidly improve production capacity through self-construction or M&A.



Listed enterprises, such as CATL, Cngr Advanced Material, Guizhou Zhenhua E-chem Inc., Ningbo Ronbay New Energy Technology and Changzhou BTR New Material Group, etc., have carried out private placement and raised funds to meet the robust demand for capital.

On the other hand, it has also attracted enterprises from automotive component and material manufacturing, traditional energy and other fields to actively integrate into the cell material industry through investment and other ways.



Changchai Company increased investment in Jiangsu Horizon New Energy Technology, a lithium diaphragm enterprise.

Due to the "vertical extension" of enterprises in the lithium batteries industry chain to the upstream resource-side and the "horizontal expansion" and "offshore" acquisition of metal mineral resource enterprises, M&A in upstream mineral resources remains hot. On the one hand, cell companies and cell material companies actively seek out upstream lithium, manganese, nickel and other mineral resources to be able to secure raw material supply, stabilise prices and ensure quality so as to improve cost structures, increase profit margins and avoid large fluctuations in gross margins.



Tianqi Lithium Industries has obtained the private placement of CAAC Lithium Electricity, Shenzhen Dynanonic and other cell enterprises and material enterprises

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

On the other hand, considering the long-term prospects of new energy vehicle and energy storage market, metal mineral resource giants have also expanded the investment and M&A layout of lithium, manganese and other mineral resources.



Zijin Mining acquires part of Tibet Summit Resources and Ganfeng Lithium acquires Bacanora across the border. Bacanora's Sonora project, a lithium clay extraction project located in Mexico, is currently one of the largest lithium resource projects in the world, with a total lithium resource of approximately 8.82 million tonnes of lithium carbonate equivalent.

Continuous R&D of new technologies also drives investment and financing activities in related fields. The current lithium technology has room for improvement in cycle times, energy density, multiplier performance. Among the related fields, the solid-state cell enterprises are the most active in financing, while some of them have completed financing twice in the year.



Mercedes-Benz China invested nearly EUR100 million in ProLogium Technology, and Enpower received over USD20 million in Round A+ financing co-led by Sequoia Capital and Dayone Capital.

In addition, the cell recycling sector also ushered in a financing boom in 2022. It saw a significant increase in financing activities as compared to 2021, owing to the change of lithium carbonate's supply and demand relationship. In addition, the lithium batteries recycling field attracted more attention from the market, while the whitelist enterprises are more favoured by investors.



Some whitelist enterprises have completed at least one financing round of over RMB50 million in 2022, such as Keyking Recycling, Jinsheng New Energy, Hengchuang Ruicycle, and Beijing SDM.

Review of major deals

Date	Investors	Target	Investmen t Industry	Investment Direction	Amount (RMB in 100M)	Deal Background
2022- 06-23	Guotai Junan Securities, Caitong Fund Co., Ltd. HHLR Advisors, Jiangsu Xiangzhang Venture Capital Co., Ltd, SCOP Asset Management Co., Ltd., Macquarie Bank, HSBC, JPMorgan Chase Bank, Morgan Stanley, J.P. Morgan Securities Plc, Barclays Bank, GF Securities, CPIC Asset, Foresight Fund, Bosera Funds, Golden Eagle, Taikang Asset, Shenwan Hongyuan Securities, Sun Life Everbright Asset Management	CATL	Lithium cell factory	Domestic	450	Private placement mainly for lithium batteries and energy-storage projects
2022- 07-13	CPIC Asset, China Aviation Lithium cell Technology Co., Ltd., LG Chem, Dynanonic, Sichuan Energy Investment, Gold Mountain (H.K.), etc.	Sichuan TianQi Lithium Industries,I nc.	Lithium and other mineral resource enterprises	Domestic	116	H-share cornerstone investment
2022- 10-06	Tianqi Lithium (H.K.), Wang Sing International Resources Limited, Han's Laser (H.K.), CNGR (H.K.), Tibet CAS Testing, Zhenshi Holding Group, Jingce Electronic, Xing Fa (H.K.) IMP.& EXP. Ltd., Xpeng Inc, TMA International Private Limited, Jiangsu Pure Precise Technology Co., Ltd., VAVIOS, Jiangmen Haina New Energy Investment, Beicheng Group	CALB Co., Ltd.	Lithium cell factory	Domestic	91	H-share cornerstone investment
2022- 08-24	Infinity (Zhuhai), JiangXia Green Investment Fund, Shenzhen Investment Holdings, String Capital, NGDF, Sunwoda, etc.	SUNWODA	Lithium cell factory	Domestic	69	Round A, financing mainly for R&D and production expansion of lithium batteries and energy storage cell business

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

Review of major deals (cont'd)

Date	Investors	Target	Investment Industry	Investment Direction	Amount (RMB in 100M)	Deal Background
2022- 06-10	Undisclosed	Cngr Advanced Material Co.,Ltd.	Lithium cell materials actory	Undisclosed	67	Private placement mainly for nickel smelting, nickel sulfate, iron sulfate projects
2022- 06-14	Undisclosed	Guizhou Zhenhua E- chem Inc.	Lithium cell material factory	Undisclosed	60	Private placement mainly for production expansion of cathode material projects
2022- 03-28	Undisclosed	Ningbo Ronbay New Energy Technology Co., Ltd.	Lithium cell material factory	Undisclosed	54	Private placement mainly for production expansion of cathode material projects
2022- 06-23	Undisclosed	Btr New Material Group Co., Ltd.	Lithium cell material factory	Undisclosed	50	Private placement mainly for production expansion of graphite and silicon - based anode material projects
2022- 07-20	Shanghai Zhijin Investment Management Co., Ltd., YinHe YuanHui Investment Co., Ltd., Beijing Mingde Boya Investment, EBI Capital, Galaxy Capital Management Co., Ltd., Haitong- Fortis Private Equity Fund Management Co., Ltd., Cathay Capital, Hubei Gaotou Zhonghesheng Investment Management Co., Ltd., Kaitou HR Capital, Hubei Gaotou Technology, SDIC.	Beijing Rt.Hitech technology development co., Ltd.	Lithium cell material factory	Domestic	50	Round D financing mainly for production expansion of LPFP anode material projects
2022- 07-29	Shanghai Topcare Medical Service Co., Ltd.	Privately owned enterprises	Enterprises of Lithium and other mineral resources	Domestic	50	Cross-border layout of new energy track

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 2020-2022



The energy storage sector witnessed a boom in 2022: The bidding volume of domestic large-scale energy storage projects increased substantially, while overseas demands for household and portable energy storage witnessed explosive growth, leading to soaring domestic enterprises' exports. According to CNESA, the loading capacity of new energy storage projects in operation reached 6.9GW in China in 2022, with an increase of over 180%. Meanwhile, the energy storage remain hot, attracting more and more capital:

For M&A deals in general, benefiting from favourable trends such as the substantial scale growth of energy storage projects in operation and the profitability improvement, the M&A deal value of energy storage in 2022 surged about 219%, while the deal volume increased by about 51%, accounting for 8% of the new energy sector, up from 6% in 2021. In addition, energy storage integrators continued extending upstream and downstream, which further enhanced the integration ability of supply chain. Thus, the energy storage sector has become the most favoured for capital. The accelerated commercialisation of new energy storage technologies such as sodium-ion and flow redox cell, is also a key investment project for capital. M&A deal volume of energy storage industry during 2020-2022 (by investor type)



In terms of investor type

- PE/VC is core of M&A deals in the energy storage industry, and the corresponding proportion rises continuously. Since many of market entities in the energy storage industry are leading enterprises from the lithium batteries and PV industries, most of which are listed enterprises, the energy storage industry has gradually shifted its investment focus to integrators and innovative technology enterprises in the growth/start-up stage. In particular, the past two years have witnessed a significant acceleration of the implementation of commercialisation of new energy storage technologies, with a growing proportion of early-stage financing and a surge in PE/VC investment activities.
- The equity investment of SOEs in the energy storage industry is dominated by relatively mature lithium batteries energy storage enterprises (usually lithium batteries start-ups); power enterprises deploy the energy storage sector mainly through investment and bidding of "new energy + energy storage" projects, thus, fewer SOEs are involved in M&A deals.
- Most private and foreign enterprises are from energy storage related industries, such as cell manufacturing, automobile manufacturing, mineral resources, commercial real estate, etc., and set investment direction as upstream and downstream industry chain layout to ensure raw material supply/project order demand, mostly business cooperation; there are also many cross-border enterprises from machinery manufacturing, environmental protection, plastics, electronics manufacturing and other fields, and enter the energy storage/new energy field based on the overall strategic planning.

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

Overview of energy storage industry chain and M&A hotspots



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

The energy storage market saw explosive growth in 2022. According to GGII, China's energy storage lithium batteries shipments reached 130GWh in 2022, with a YoY growth rate of 170%. The global energy storage market is expected to continue to grow rapidly, especially the lithium batteries-based energy storage cell sector in the next 2-3 years. In terms of application scenarios, we are bullish on the large-scale storage and household storage market. Affected by the epidemic in 2022 and the high price of lithium, the global demand for large-scale storage was suppressed or forced to delay, and will burst in 2023. In addition to the storage configuration needs coming along with the new installation of new energy such as wind power and PV, we are very optimistic about the development of the energy storage market. 2022 was a fantastic year for household storage due to the overlap of various factors. It may be difficult to replicate the previous year's remarkable growth rate in 2023, but the sector will nevertheless achieve rapid growth in revenue and products, and carry out all kinds of connected utility grid and unconnected utility grid scenarios simultaneously. In terms of energy storage technology, in addition to lithium batteries, we are also optimistic that new technologies such as sodium-ion cell and flow redox cell will undergo rapid process iteration under the impetus of capital. Whether from the perspective of cost performance or national energy security, energy storage technology will likely continue to flourish. At the same time, along with the cost reduction of energy storage products and the frequency increase of use, new power electronic control technology will also usher in a good opportunity for development, for integration technology which can improve the safety and reduce the electricity cost of energy storage system has always been our key direction for investment and layout. In short, we believe the energy storage will be one of the sectors with the highest investment value in 2023.

----- Borui Zhou, Managing Director of Fenghe Fund

M&A trend of energy storage industry chain

M&A trends of energy storage industry chain in 2022

Energy storage integrators have become the hottest sector by industry chain extension and operational advantages; at the same time, the deepening commercialisation process of new energy storage technologies has also attracted many investment institutions.

The M&A deal volume proportion of energy storage industry by sector in 2022



[1] New energy storage technology in this report refers to new nonlithium cell technology, including flow redox cell, sodium-ion cell, compressed air energy storage, etc.

Energy storage system integrators, with the application and operation advantages in the downstream of the industry, tend to extend upstream and downstream: upstream into 3S system R&D, PACK and other fields while downstream into power station development, system sales, construction and O&M, etc. The advantages have attracted not only large investment institutions including Hillhouse Capital, SCGC, Triniti Capital for industry layout, but also upstream cell manufacturers to engage in system integration and open up more market space.



The financing entity of 37 (~66%) of the 56 deals that occurred in the energy storage industry in 2022 was energy storage integrator, while the extensive financing rounds covered from Angel Round/Round A to acquisitions, IPO and private placement.

With lithium batteries storage technology dominating, the commercialisation of a variety of new energy storage technologies, such as sodium-ion cell and flow redox cell, is rapidly implemented and attracts capital for layout.

Electrochemical energy storage continues to be the mainstay of investment and financing in the energy storage industry, but the trend that new energy storage technologies co-exist to supplement has emerged.

Electrochemical energy storage is evolving around safety, economical property, high capacity, longer cycle life, etc. Therefore, the commercialisation of inexpensive and safe sodium-ion cell and long-cycle-life and safe flow redox cell has accelerated significantly.



Among the 13 deals concerning new energy storage technology in the energy storage industry in 2022, sodium-ion cell (6) and vanadium redox flow cell (5) dominated, with the financing rounds mostly at Round A.

Under the "dual carbon" context, the mandatory quota of energy storage on the generation side ensures the largest increment, while the user side attracts continuous capital injection with diversified business models and higher profitability.

On the generation side, energy storage is mostly implemented in the form of PV and wind power mandatory allocation and storage, which will usher in a incremental market with higher certainty:

The new energy generation side mandatory quota policy covered 40 provinces (cities) in 2022 more than 25 in the last year. According to CNESA, the installed capacity of new energy storage in operation has increased by 180% to 6.9 GW in China in 2022. According to energy storage and power market data, new energy allocated and independent storage are the two main types of new projects, which accounted for 45% and 44% of capacity respectively.

Independent energy storage mode gradually emerged:

with capacity leasing (sharing mandatory quota), auxiliary services, peak-valley arbitrage, capacity compensation and other revenue models, independent energy storage has seen rapid development. According to energy storage and power market data, among 44GWh of bidding projects in 2022, independent energy storage took the lead, having accounted for nearly 50% of the total.

The business model of user side energy storage is diversified, with good investment returns and high enthusiasm of capital.

With improved profitability, commercial and industrial energy storage is a favourite among investors: With the wider gap between the peak and valley commercial and industrial electricity prices, and the further enhancement of energy-using enterprises' requirements for energy stability, independence and economical property, commercial and industrial energy storage will usher in a new development opportunity, while system integrators have been favoured by capital.



KOYOE Energy, a distributed energy storage provider, received tens of millions of RMB from Fosun in Round A financing.

Household energy storage benefits from the explosive growth of overseas market demand. Domestic distributed energy storage enterprises exporting household and portable energy storage mostly achieved a two-fold growth in 2022, alongside huge investment opportunities.



PowerOak, a user side energy storage enterprise, has completed four rounds of financing since April 2021, raising a cumulated RMB600 million.

In digital energy service field, with value more recognised by investors, the organic coupling of digital technology and virtual power plant is expected to become a key point for regulating the balance of power supply and demand and promoting the construction of new power systems.



PowerShare, an energy digitisation AI innovation enterprise with new power system received investment from Volvo Tech Fund, BP and other strategic investors.

Review of major deals

Date	Investors	Target	Investment Industry	Investment Direction	Amount (RMB in 100M)	Deal Background
2022- 06-09	Undisclosed	Pylon Technologies C o., Ltd.	Energy storage integrators	Undisclosed	50	Private placement, mainly for energy storage business expansion
2022- 10-18	Agricultural Bank of China International, CCB Private Equity Investment Management Co., Ltd., Xiamen Venture Capital Co., Ltd., Matrix Partners, Dayone Capital, Jinfeng Investment Holding Co., Ltd., Xiamen Torch Group Venture Capital Co., Ltd., Fenghe Fund, Shenzhen Mangrove Growth Investment Management Ltd., Hubei Changjiang Cowin Industry Fund Management, LianDao Asset Management, Shenzhen CMB Telecom Equity Investment, Wider Profit Investment Limited, Shenzhen ChengTun Group Co., Ltd.	Xiamen Hithium Energy Storage Technology Co., Ltd.	Energy storage integrators	Domestic	20	Round B, mainly for capacity expansion, technology R&D and other business layout
2022- 08-06	Beijing Triniti Capital Management Co., Ltd.	Cospower	Energy storage integrators	Domestic	5	Cospower Technology focuses on communications, power storage and other fields, with fund raising mainly for LPFP capacity expansion
2022- 09-14	Hangzhou Yuanchi Investment Partnership, Shenzhen Kunpeng Equity Investment Management Co.,Ltd., Shanghai Nuohui Investment Management Co., Ltd.	PowerOak	Energy storage integrators	Domestic	5	Round B+, with product positioning as user side energy storage track
2022- 10-25	Huaihai New Energy Vehicle Co., Ltd., Anfeng Venture Capital Co., Ltd., Veken Technology Ltd., RealYou Investment Limited	Natron Energy	New energy storage technology	Domestic	5	Round A, sodium-ion cell industry chain
2022- 12-28	Xiaoka Capital, Shanghai Shanshan Chuanghui Venture Capital Management Co., Ltd.	Evps Ningbo Energy Storage System Co., Ltd.	New energy storage technology	Domestic	5	Round A+, planning to built large cylinder cell and sodium-ion cell production line
2022- 09-21	Gaorong Capital, Green Pine Capital Partners, Zhen Fund, Beijing Greatnumbers Asset Management Company Limited, Xihao Investment, Ningbo Meishan Bonded Port Area Xiaoji Shida Investment Management Co., Ltd., Yuhan Enterprise Management, Yunhai Enterprise Management, Chongju Enterprise Management	Beijing smart valley intellectual property agency co. Ltd.	New energy storage technology	Domestic	4	Round A, mainly for technological innovation and capacity construction of zinc-iron flow redox cell
2022- 05-26	Tsinghua Holdings Capital, CASSTAR, China Merchant Bank International Capital Management (Shenzhen) Ltd., Legend Star, Puhua Capital, Gaorong Capital, Beijing XingDingRongSheng Capital Co., Ltd., Haitong-Fortis Private Equity Fund Management Co., Ltd., China Three Gorges Renewables (Group) Co., Ltd., Beijing Cuiwei Tower Co., Ltd.	China National Energy (Beijing) Technology Co., Ltd.	New energy storage technology	Domestic	3.2	Round pre-A, Zhong- Chu-Guo-Neng focuses on compressed air energy storage technology and is currently building a 100MW demonstration project
2022- 12-04	Kunlun Tech Co., Ltd.	Beijing Green Vanadium New Energy Technology Co., Ltd.	Energy storage integrator	Domestic	3	Cross-border investors, adding new energy field on the original investment business segment, the Target's main business is the core cell stack and all system equipment for flow redox energy storage
2022- 09-19	Wuhan Nusun Landscape Co., Ltd.	Guangdong Lakepower Technology Co., Ltd.	Energy storage integrators	Domestic	2.8	Non-control acquisition, planning to turn to cell and energy storage industry through asset replacement

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



Wind power & PV supply chain

Overview of M&A in wind power and PV supply chain

M&A deal value and volume of wind power and PV industry during 2020-2022



M&A deal volume of wind power and PV industry during 2020-2022 (by investor type)



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

Wind power and PV industry continued its rapid development, high-quality operation and large-scale expansion in 2022. The annual wind new installed capacity of power and PV was close to 125GW, hitting a record high.

For M&A deals in general, affected by the external macro environment, industry supply and demand mismatch and other factors, the M&A deal value and volume in manufacturing decreased, while application and service ushered in investment fever with the rapid increase in asset scale. 2022 The annual M&A deal value in wind power and PV industry chain amounted to RMB49.7 billion, similar to last year, while the deal volume fell 11.7%, with the value per single deal standing mostly below RMB1 billion.

Among segmented investment field

- PV industry continues to dominate, driven by technology iteration and innovation, capacity expansion, upstream and downstream industry extension. The potential investment opportunities hidden by market layout uncertainty have received continuous attention from industrial investors and financial investors inside and outside the industry.
- The deal scale in wind power industry shrank amid intensifying market competition in the post-"installation rush" era and a significant decline in industry profitability, with M&A deals focused largely on core segments such as wind power turbines. Deal value averaged RMB620 million, similar to that in the previous year.

In terms of investor type, the deal volume by investor type remained broadly stable. The private/ foreign enterprise experienced a slight decline in proportion, while PE/VC saw an uptick in growth.

In the investment direction, the investment key points varied significantly with investors:

- The relatively mature enterprises and technology were favoured by SOEs. The share of asset O&M deals has grown due to the rising O&M demand associated with asset scale expansion.
- PE/VC paid more attention to the R&D of cutting-edge technologies, such as perovskite and thin-film cell.
- Private and foreign enterprises were involved in M&A deals, to carry out vertical M&A to ensure the stability of raw material supply and production costs, conduct active advanced production capacity expansion to ensure the core competitiveness, and quickly cut into the new energy track with the new round of technological iteration as an opportunity.

Overview of PV supply chain and M&A hotspots



Overview of hotspots

Technology upgrade drives midstream capacity expansion and iteration. With rising substitution of N-type cell technology, the falling costs, and the maturity of equipment manufacturers' production line supply in 2022, the development focus of the technology routes represented by TOPCon and HJT has shifted from R&D to marketisation acceleration, while traditional enterprises, market newcomers and cross-border enterprises were actively carrying out financing and M&A to expand capacity rapidly. Forward-looking technologies, like perovskite have garnered huge attention from financial investors by virtue of the broad development space and commercialisation prospects.

Deepen cost reduction and promote R&D and progress of auxiliary materials and components. Auxiliary material, component and inverter and other more in-depth industry chain links continue to seek performance improvement and domestic substitution. The mainstream enterprises actively deploy enterprises with product technology leadership and core R&D capabilities to establish stronger synergies and further reduce production costs.

Among the core auxiliary materials of the PV supply chain, the core materials of PV supply chain, EVA is the mainstream material of PV encapsulation film in PERC era, with fierce competition among the leading manufacturers, while POE film provides a more open competition opportunity for the auxiliary materials to cut into the market. However, the price of POE particles and import dependence have raised some limitation on the POE market, thus the promotion of localisation will provide market opportunities for domestic chemical material manufacturers. At the same time, N-type high-efficiency cell, the next generation of mainstream technology, put forward higher requirements on the film packaging, for which POE film materials' performance is more suitable. The back panel materials required for double-sided components has been dominated by PV glass for a certain period of time, and the structure of the module market will also change with the continuous improvement of transparent back panel technology in the future. In terms of cell and component side, 2023 Topcon cell's efficiency will enter a high-speed ramp-up period in 2023. At the same time, the maturity of the technology need to be further improved in terms of maturity of the whole industry chain will occupy a leading position, while other technology routes such as HJT cell and perovskite technology need to be further improved in terms of maturity of the whole industry chain including process, material and equipment.

---- Chris Zou, PwC China Deal Strategy and Operation Partner

Overview of wind power supply chain and M&A hotspots

M&A hotspots in wind power industry in 2022



Overview of hotspots

Offshore wind power has become a new scenario for wind turbines. The offshore wind power is undergoing rapid development, bringing massive market demand. Coupled with the downward movement of raw material cost, the profitability of the machine has improved. Thus, sea wind power machine faces fierce competition in high sea and offshore, high wind speed and mid-to-low wind speed and other scenarios, and sea wind technology has received more investments from investors in the industry.

Continuous cost reduction relies on large-scaling equipment. Large-scale wind turbine generation system has become the most certain technology development direction in the "fair price" era of land and sea wind. The turbines and components have returned to the spotlight, with investors mostly being enterprises in the industry. The enterprises extend towards various links of the industry chain, explore the technology synergy progress of the whole industry chain, and jointly promote cost reduction.



M&A trend of wind power and PV supply chain

M&A trends of wind power and PV industry in 2022

Upstream and midstream technology iteration drives the continuous evolution of the PV industrial chain

PV cell technology is rapidly iterating. TOPCon route, by virtue of its compatibility with the existing production lines, has become the main choice of the existing leading manufacturers, and taken the lead to start the industrialisation process. HJT route has carried out more thorough technology update, leading to more imaginative process and cost advantage in the future, and has become the first choice of cross-border enterprises and new industry entrants. Perovskite and other forward-looking technologies still need time to realise their commercial advantages of theoretical efficiency improvement and production cost reduction, but the broad development space and huge prospect of stacking technology has attracted Tencent Investment, Triniti Capital, Country Garden Venture Capital and other large investment institutions to continue to increase the capital.

Core auxiliary material, inverter and other sectors continue to undergo development. For the in-depth sectors of the industrial chain, such as PV silver paste, EVA particle and other etc., the development trend of domestic substitution, performance enhancement and collaborative cost reduction implies huge investment value. Compared with the high valuation, high capital threshold and fierce M&A competition of the main parts, investment in auxiliary material is more flexible, with reasonable valuation, and attracts crossborder investors and financial investors.



CICC leads the investment in Sinopont, a PV film enterprise



Wind turbines and component manufacturing sector regains investors' attention. In the upstream and

midstream of wind power industry, earnings are expected to improve from turbines and components, thereby bringing in more investments from upstream and downstream enterprises and investment institutions. This is mainly due to: 1) With increasing downstream installed demand, coupled with falling raw material prices, including steel, copper, wind turbine and component manufacturing enterprises are expected to improve profitability; 2) With rising deal volume concerning offshore wind power, the enterprises conduct technology upgrade and differentiated competition in various application scenarios; 3) Demand for cost reduction drives the development of large-scaling wind turbines, with bearing, blade and other links' iteration receiving continuously rising attention. Overall, the wind power manufacturing is back on investors' radar.



Shengtun Mining obtained 8.5% equity interest in Shenli through equity transfer

Terminal construction, O&M and service are undergoing integrated development, while digital empowerment

value is favoured. With the enhancing scale, rising operation needs and highlighting value of the built power stations, it is of greater importance to ensure the comprehensive market revenue of new energy power stations. The future digital empowerment trend allows investors to see the huge value of the operation market, while the IoT platform based on O&M of wind power and PV stations has attracted large investment institutions.



Sequoia China and IDG Capital invested \$210 million in Envision Digital. The intelligent IOT operating system built by VEnvision Digital now links and collaborates with over 400GW of global energy assets and 200 million smart device terminals, provides intelligent product solutions for multiple scenarios such as energy, factories and travel, reflecting that enterprises with industrial technology and digital empowerment advantages have ignited investors' enthusiasm for M&A.

The PV industry has formed a fully competitive landscape through historical development, and enterprises in the silicon material, cell and component fields are actively cultivating and establishing their core competencies: For silicon material field with several oligopolies, the competitive advantage of enterprises mainly depends on investment intensity and their own strength, in addition, the cost reduction efforts and technological innovation progress in project construction and material manufacturing side will also bring new competitive opportunities for the industry; For cell field, 2022 was the first year of mass production of N-type cells -TOPCon cell stepping into a period of rapid development, technological progress and team support being core competitiveness of the leading enterprises; For component field, enterprises' brand effect, channel scale and new technology application will become an important factors for determining the competitive advantages. In addition, after the silicon material expansion and price rollback, the profits of upstream industry chain are gradually shifting downward, while the profits of cell and component manufacturers are gradually increasing, indicating that the industry will usher in a healthier development. From the perspective of technology route, TOPCon is undoubtedly the mainstream technology in the "post-PERC era", and HJT cell is expected to fully compete with TOPCon cell in the future as a product of further innovation and progress in crystalline silicon cell technology. The rise of N-type cell also brings development opportunities for the localised substitution of auxiliary materials such as POE encapsulation film and POE particles. In addition, the significant expansion of silicon wafer production has raised the demand for high purity quartz, the main material of crucibles. Due to the high concentration of high-quality quartz ore resources, the quality of ore and the domestic integration technology become the key. In the short term, the overall development direction of the industry will still focus on cost reduction, so advancements in materials, process and technologies, such as reduction in silver paste consumption and improvement in welding technology, are worth looking forward to. In the long term, perovskite laminated cell technology has a broader scenario in terms of mid- and long-term application, while improving performance stability, reducing the cost of thin film process, and narrowing the gap between actual efficiency and theoretical limit efficiency. It will likely become an important direction for technological breakthroughs in the perovskite field. In the face of the current international situation with great powers' confrontation intensified, the exploration of "going abroad" is still underway for domestic enterprises in the PV industry.

> - — 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	Investment Industry	Sector	Amount (RMB in 100M)	Deal Background
2022- 07-20	Aegon-industrial Fund Management Co., Ltd., Caitong Fund Management Co., Ltd. and other 19 investment institutions	Xinjiang Daqo New Energy Co., Ltd.	PV	Silicon material	110	Private placement, mainly for silicon material project expansion
2022- 12-09	Undisclosed	GCL System Integration Technology Co., Ltd.	PV	cell pieces, component	60	Non-public issuing, mainly for the implementation of the PV cell industry, active layout of the energy storage industry and relief the financial pressure of the enterprise
2022- 04-27	Construction Investment Tuoan (Anhui) Equity Investment Management Co., Ltd., JA Solar Technology Co., Ltd., China Orient Asset Management Co., Ltd., Agricultural Bank of China Financial Leasing Co., Ltd.	JA Solar Technology Yangzhou Co., Ltd.	PV	cell pieces, component	27	SEO and market-based debt- to-equity transfer, mainly for debt repayment and production and operation
2022/1 1/10	Zhejiang Zheneng Electric Power Co., Ltd.	Jolywood (Suzhou) Sunwatt Co., Ltd.	PV	Backboard	18	Zheneng Electric Power entered the PV industry field such as N-type high-efficiency cell components through M&A. As a private enterprise, Jolywood introduced external state-owned strategic investment to achieve diversified capital structure
2022/1 2/6	Jiangshan Investment, Guotai Junan Securities Co., Ltd., Lord Abbert China Asset Management Co., Ltd.,CaiTong Fund Management, China Southern Asset Management Co., Ltd., Sichuan Development Securities Investment Fund Management Co., Ltd., etc.	Crown Advanced Material Co., Ltd.	PV	Backboard, film material	17	Private placement, mainly for expand the production line of fluorine-free organic back panels and aluminium film
2022- 05-05	Zhuhai Hengqin Shunhe Enterprise Management Partnership (LP)	Shanghai Aiko Solar Energy Co., Ltd.	PV	cell pieces	17	Non-public issuing, SEO, mainly for Zhuhai N-type ABC cell project.
2022- 06-15	Hainan Drinda New Energy Technology Co., Ltd.	Shangrao Jietai New Energy Tech Co., Ltd.	PV	cell pieces	15	Drinda acquired a 49% equity and transformed from automotive trim business to PV cell business.
2022- 06-09	Sequoia China GIC (Beijing) Co., Ltd.	Beijing Vision Intelligent Transportation Technology Co., Ltd.	PV	Internet of Things platform	14	Round A; the Target engaged in low-carbon and intelligent IoT technologies, mainly for global expansion
2022- 10-28	Entities controlled by Tam Man Wah and/or Mr. Tan Xin, China Lesso Group Holdings Limited	Qujing Solargiga New Energy Co., Ltd.	PV	Silicon wafer	14	Transferring all the shares held, mainly for streamlining business to better focus on PV components, PV systems (including BIPV) and semiconductor business
2022- 06-06	Undisclosed	Eaglerise Electric & Electronic (China) Co., Ltd.	PV	Inverter	13	Private placement, mainly for expansion of smart compact substation and energy storage transformer business

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

Infrastructure

Overview of M&A in infrastructure sector

M&A trends of infrastructure industry in 2022

Wind power and solar power generation plants

2022 was a "compliance year" for large-scale, centralised power plant deals that will embrace high-quality development: Since the beginning of the year, M&A deals of the surface power plant stock have remained as active as in the past few years. However, with the verification of state subsidies and the post-investment evaluation of enterprises at the end of the first quarter, issues, such as the compliance and less-than-expected returns of some acquisitions, were revealed. M&A deals of centralised power plants slowed down in the second half, and will likely move to a development stage with higher rationality and quality in the future.

With external policy regulation coupled with a longer internal decision-making process, central SOEs have come to view deal scale with as much importance as project quality, further uplifting the deal scale thresholds. On the other hand, central SOEs are also actively seeking overseas M&A opportunities for centralised power plants and strengthening overseas acquisition efforts.



SOEs slowed down the pace of domestic acquisitions, and provided an opportunity for foreign enterprises to invest in China's new energy assets.



Sembcorp acquired wind power assets of 658MW from CNPEC, and minority stake in Xingling New Energy held by SDIC New Energy and SPIC Hunan branch

With new time-of-use tariff policies, earnings of distributed power plants tend to be regionalised: Since the end of the year, many provinces and cities have issued commercial and industrial time-of-use tariff policies, aiming to guide the allocation of power resources and enhance the ability to ensure power supply and new energy accommodation. Some provinces and cities (such as Shanghai city) further widened the peak and valley tariff difference, and enhanced the profitability of distributed PV power plants. Some provinces and cities (e.g. Shandong Province) set deep valleys and single peak for the whole day, which has brought a negative impact on the profitability of distributed PV power plants. Affected by the policies, earnings of distributed power plants showed a regionalised trend, while commercial and industrial tariff policy dividends would lead the direction of investment.

M&A deal value and volume of infrastructure industry during 2020-2022



Financial institutions and cross-border investors accelerate layout, while high-quality assets are traded at a premium: Under the "dual carbon" target, traditional financial institutions, represented by banks, have further increased their recognition of green infrastructure, reduced financing and replacement costs and actively participated in asset trading by means of fund equity investment and others. On the other hand, as the green power trading market further matures, the cross-border investors, represented by energyusing enterprises, are more willing to hold new energy assets for the long term. In this context, high-quality asset stock with good owner resources and regional management synergy are favoured by investors.

Charging and battery swap stations of NEV

Sectors related to application of new energy vehicles, such as charging and battery swap, have also attracted attention of investors: With strong market demand and high certainty of industry development, cross-border companies from manufacturing, chemical, environmental protection, transportation and logistics, energy and other fields, have entered the new energy vehicle industry in succession. In addition to the traditional lithium manufacturing, fields, like charging pile, battery swap station, are also popular with GCL Energy, Rifeng Electric Cable, Golden Ponder, ABB China and other enterprise for cross-border development or horizontal extension.

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

Review of major deals

Date	Investors	Target	Investment Direction	Amount (RMB in 100M)	Deal Background
2022- 05-13	China Life Asset Management Co., Ltd., Sichuan Chuantou Energy Co., Ltd., etc.	China Nuclear Exchange Energy Co., Ltd.	Domestic	75.0	CNNC, a listed state-owned enterprise, introduced strategic investors into its new energy investment platform to boost its new energy business
2022- 08-18	Zhongxin Fund Management Co., Ltd., Fujian Yingke Venture Capital Co., Ltd., etc.	Cecep Solar Energy Co., Ltd.	Domestic	59.8	Non-public issuing, mainly for expanding the company's industrial layout and optimizing the financial structure
2022- 05-19	Shandong Hi-Speed Holdings Group Limited	BE Clean Energy Co., Ltd.	Domestic	40.3	Shandong State-owned Assets Investment increased the investment in Shandong Hi-Speed New Energy Group, the listed company in HKEx. After that, Shandong Hi- Speed became the controlling shareholder. The funds are expected to be used develop power plants and repay debt
2022- 12-14	Gentari Sdn Bhd	Part equity of Taiwan Hailong Offshore Wind Power Project	Domestic	40.2	A subsidiary of Petronas acquired an offshore wind power project in Taiwan from Northland Power Inc. The original shareholder remained the largest shareholder and plans to take a leading role in the construction and operation phase of the project
2022- 02-17	Undisclosed	Nyocor Company Limited	Domestic	32.6	Non-public issuing by a listed company, to expand the installation capacity of new energy power stations and optimise the financial structure
2022- 12-20	Cheetah Bid Trust	Stockyard Hill Wind Farm (Holding) Pty Ltd.	Overseas	32.2	Sale of an Australian subsidiary focused on wind farm development and construction by listed company Goldwind to Cheetah Bid Trust, a large Australian fund company
2022- 03-18	Undisclosed	Zhejiang Provincial New Energy Investment Group Co., Ltd.	Domestic	30.0	Non-public issuing by a listed company, to provide funds for wind farm projects and optimise the financial structure
2022- 12-21	Green Development Fund Private Equity Investment (Shanghai) Co., Ltd., Sino Russian Energy Cooperation Equity Investment Fund (Qingdao) Partnership (LP)	Zhengtai Anneng Digital Energy (Zhejiang) Co., Ltd.	Domestic	22.3	A subsidiary of the listed company, Chint Electrics, conducted a private placement for strategic investors, to provide financial support for the development of household PV business and to improve the financial structure
2022- 12-31	CCB Investment	Xinyuan Green Power (Beijing) Co., Ltd.	Domestic	20.0	A subsidiary of HKEx-listed company, CLP Holdings, issued private placement to CCB Investment, to raise funds and bring in strategic partners to accelerate the Group's development in green and sustainable energy
2022- 06-15	China Resources Power Holdings Company Limited	Guangdong Runneng New Energy Co., Ltd.	Domestic	14.4	China Resources Power acquired high-quality wind power assets to supplements its green power transformation efficiency. Guangdong Runneng has 8 subsidiaries with installed wind power projects of 440.3 MV

The current capital market does not lack capital, but qualified investment products, especially high-quality assets suitable for mid- and long-term investments. The new energy infrastructure represented by wind power and PV power plants should be a good choice - large volume, long term, relatively stable returns; and the green environmental value of wind power and PV power plants has not been fully reflected due to the lack of legislation in place, and the unsound trading mechanism, as a result, the current investment is expected to lock long-term high-quality carbon assets at a low price. However, only from the transaction data, with low market activity and limited exit channels, the participation of social and financial capital is rather low; Due to the insufficient pricing ability and risk prevention ability of financial institutions for new energy assets, it is common that financing is difficult and expensive among non-state enterprises. Driven by the "dual carbon" target, wind power and PV power stations undergo scale expansion of more than 100GW per year, so the "obstacle" for investment and financing of new energy assets at the current stage need to be "unlocked". This not only depends on the promotion of policies and the improvement of market mechanism, but also requires professional institutions including PwC to play a more active role in comprehensive risk assessment, pricing of new energy assets, exploration of new business models and recommendation of project leads, etc., so as to build a bridge between high-quality green assets and increasingly diversified investors.

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

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

Hydrogen

Overview and hotspots observation of M&A in hydrogen industry

2020-2022 M&A deal value and volume of hydrogen industry



Storage & transportation & refilling and core equipment H2 production Others — Deal volume

In the whole year of 2022, under the influence of the capital market affected by the epidemic and international instability, the total deal value reached RMB9.3 billion. Of particular note was GuoHydrogen Technology which completed the largest single financing of RMB4.5 billion hydrogen energy in history during this period, with a post-investment valuation of RMB13 billion – a new high in the industry.

Downstream fuel cell system financing remains mainstream

In the field of investment, the financing of fuel cell system and cell stack still accounts for the absolute mainstream, and the financing rounds are gradually moving backward. The financing amount accounts for 91 % of the total disclosed financing amount. The reason is that **the national support policy is relatively clear, which is closest to the downstream application part.** In recent years, many head companies have impacted IPO listing. For example, Beijing SinoHytec Co., Ltd. has become the first hydrogen energy company listed in A-share and Hong Kong stock market. At the end of 2022, Guohong Hydrogen Energy also submitted a prospectus in Hong Kong. Other fuel cell and its core parts companies have also entered the listing process, but they also face many obstacles.

2020-2022 M&A deal volume of hydrogen industry (by investor type)



The heat of storage, transportation and refuel in midstream appears initially, and the single financing amount of head equipment companies is large

Due to its **asset-heavy infrastructure and resourceoriented** attributes, investment institutions of hydrogen refuelling stations are industrial capital. For example, Sinopec Group invested in Hunan Linwu Shunhua Duck Industrial Development Co., Ltd., Sany Group lead-invested in Zhongding Hengsheng, a domestic compressor leading enterprise, and PFA Power invested in Hypel, a company with a background in transportation, transportation and energy.

Storage and transportation have high technical barriers, high costs, and technical routes are divided into gas, liquid and solid storage and transportation forms. The development of domestic hydrogen gas storage and transportation is relatively mature. Liquid organic carrier and solid hydrogen transportation new technology direction has attracted capital attention due to high safety and convenience of storage and transportation.

The upstream hydrogen production track market is hot, but the financing amount and scale is still limited

In March 2022, the National Development and Reform Commission and the National Energy Administration jointly issued the "Medium and Long-term Plan for the Development of Hydrogen Energy Industry (2021-2035)", which for the first time made it clear that hydrogen energy is an important part of the national energy system. electrolyser, the core equipment of hydrogen sector, have been hot for 22 years, and the number of enterprises has increased rapidly in recent years. The leading electrolyser enterprises have certain advantages in technology accumulation, capital and project reserve. The project involves hydrogen production infrastructure. As the core equipment supplier, electrolyser enterprises do not have much financial pressure, so the market heat remains high, but the enterprise M&A are limited. The investment direction is towards "light" assets and more cutting-edge innovative enterprises, such as core materials

(catalysts), solid oxide hydrogen production (SOEC), and electronic control system integration and other innovative cutting-edge technology fields

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 2022



Early-stage financing is the main theme of hydrogen energy industry, while capital increases investment in leading enterprises, indicating room for enhancement in confidence of the primary capital market in the hydrogen energy industry

Financing has been mostly early-stage rounds, i.e. Angel Round - Round B. Because the hydrogen energy industry is in the early stages, and there is insufficient information from investment institutions due to the long hydrogen energy industry chain, various technology tracks, massive enterprises and unsettled competition landscape. On the other hand, continued financial support is needed for R&D of hydrogen energy technologies, and capital is concentrated among leading enterprises amid the limited market capacity at present.

Overview of IPOs in the hydrogen industry

Name	Main business	Listing exchange	Latest progress
Beijing SinoHytec Co., Ltd.	Hydrogen fuel cell system	HKSE	First hydrogen energy enterprise to be listed on both A-share and H-share.
Shanghai Hydrogen Propulsion Technology Co.,Ltd.	Fuel cell	SSE STAR Market	December 2022: Listing verification process resumed
Guangdong Nationsynergyhydrogenpo wertechnology Co., Ltd.	Fuel cell	HKSE	November 2022: Form submitted to the HKEx
Shandong Dongyue Future Hydrogen Energy Material Co., Ltd.	Proton exchange membrane	SSE STAR Market	Listing process delayed due to shareholding change
Shanghai Refire Group Limited	Hydrogen fuel cell system	SSE STAR Market	August 2021: Listing application was withdrawn after two inquiries
Guangdong Zhizhen Hydrogen Energy Technology Co., Ltd.	Metal bipolar plate	SSE STAR Market	 November-December 2022: Listing applications were withdrawn successively
Jiangsu Guofu Hydrogen Energy Equipment Co., Ltd.	Hydrogen energy equipment	SSE STAR Market	

The Sprint to IPO Dilemma for leading hydrogen energy enterprise

It is worth noting that many leading enterprises in hydrogen energy industry declared IPO this year to obtain sufficient capital reserve for technology R&D and capacity expansion, and then terminated or suspended IPO for SSE STAR Market in the second half. The disclosed reasons mainly lay in the **industry scale**, **business model**, **technology independence and advancement**, **and profitability**, which are also common issues encountered in the early stage of development of most industries.

A-share and HKEx are markets with complementary advantages. Enterprises need to evaluate the appropriate node for initiating listing and the choice of listing exchange, combining the business growth, cash reserves, valuation level, shareholders' demand, perfection level of corporate governance and internal control, etc. The main differences between SSE STAR Market and HKEx Chapter 18C are as follows:

- **Positioning:** the SSE STAR Market focuses more on hard technology enterprises of strategic importance to the country, while the outreach of HKEx Chapter 18C is relatively broader;
- Stock valuation and liquidity: the overall valuation and liquidity of the A-share Market are better than those of HKEx;
- Investment direction: A-share Market has stricter requirements on the use, management and information disclosure of the raised funds;
- International development: Hong Kong market is more conducive to international visibility and expansion of international business than A-share Market, but is more susceptible to the general environment of the global financial market.

 $[\]ensuremath{\mathsf{Source}}$: CV Source, Thomson Reuters, Pedata, Mergermarket and PwC analysis

Review of major deals

Date	Investors	Target	Investment Industry	Investment Direction	Amount (RMB in 100M)	Deal Background
2022- 12-08	Xiamen Guohe Investment Management Co., Ltd., Beijing Daxing Investment Group Co., Ltd., Beijing Xuhui Investment Mangement Co., Ltd., Tangx Capital, Shanghai Green Development Fund Management Company, Chengtong Mixed Reform Private Fund Management Co., Ltd., Shenzhen Guokai Investment Co., Ltd., Beijing Shangrong Capital Management Co., Ltd., China Xinda Asset Management Inc., Ltd., Chengdu Caihong Environmental Protection Technology Co., Ltd., Wuhan Economic Development Investment Co., Ltd.	State Power Investment Group Hydrogen Technology Development Co., Ltd.	System, cell stack	Domestic	45.0	After two financing rounds of 1.1 billion and 2.5 billion in 2011, SPIC's financing amount is 4.5 billion in 2022, which is a new high of single financing for hydrogen energy
2022- 11-30	China Building Materials Private Equity Fund Management (Beijing) Co., Ltd., SDIC Investment Management Co., Ltd., Tianjin Liben Energy Technology Co., Ltd.	Ftxt Energy Technology Co., Ltd.	System, cell stack	Domestic	5.6	CNBM New Materials Fund led the investment, with the lead investor in Round A, SDIC, increasing its capital
2022- 01-17	Henan CICC Huirong Private Equity Fund Management Co., Ltd., Tus Yunze Capital (Beijing) Co., Ltd., Shandong Jiangzhi Venture Capital Co., Ltd., Jianxin Investment, Shanghai Blue Hydrogen Enterprise Management Consulting Partnership (LP)	Jiangsu Jihong Hydrogen Energy Technology Co., Ltd.	System, cell stack	Domestic	5.0	The current financing to be used to build up R&D capabilities, establish capacity, expand the team and product batch application
2022- 06-20	Beijing E-town International Investment and Development Co., Ltd., Yao Jinlong, GF Venture Capital Co., Ltd., and other private investors	Xinyan Hydrogen Energy Technology Co., Ltd.	System, cell stack	Domestic	5.0	Funds to be used to construct the headquarters in Yizhuang, Beijing and Chengdu base and expand the team in the Beijing and Dalian R&D centres, carry out product upgrade and market expansion
2022- 09-20	Hefei Innovation Scitech Venture Capital Co., Ltd., Anhui Provincial Enterprise Reform and Development Fund Management Co., Ltd., CITIC Construction Investment Co., Ltd.	AnHui MingTian Hydrogen Technology Co., Ltd.	System, cell stack	Domestic	5.0	Three preferred strategic investment institutions
2022- 02-25	SIP Oriza PE Fund Management Co., Ltd., Horgos Hua Control Venture Capital Co., Ltd., Beishou Capital Management (Beijing) Co., Ltd., Zhejiang Fuhua Ruiyin Investment Management Ltd., Chengding Capital, Taizhou Asset Management Co., Ltd., Linsheng Investment (Hainan) Co., Ltd.	Cemt Co., Ltd.	System, cell stack	Domestic	4.0	Led by SIP Oriza PE Fund and Huakong Fund
2022- 08-28	SANY Group Co., Ltd., Ming Yang Smart Energy Group Limited, Guangdong South New Media Capital Co., Ltd., Shenzhen Oriental Fortune Capital Co., Ltd., Founder Hesheng Investment Co., Ltd., Anhui Zhongan Capital Management Ltd., Shenzhen Co-stone Venture Investment Management Company Limited, Shenzhen Capital Group Co., Ltd.	Zhongding Hengsheng Gas Equipment (Wuhu) Co., Ltd.	Storage, transportat ion and refueling core equipment	Domestic	4.0	More than ten well- known investment institutions or listed companies
2022- 04-29	Sinopec Group Capital Co., Ltd., Shandong New Kinetic Energy Sinochem Green Fund Partnership (LP), Beijing Green Technology Innovation Suihebei Industry Equity Investment Fund Partnership (LP), Hangzhou Junze No. 2 Enterprise Service Partnership (LP), Beijing Xingtou Youyou Venture Capital Fund (LP), Xinyu Zhike Yunda Hydrogen Energy Equity Investment Center (LP), Beijing Phase II Zhongke Chuangxing Hard Technology Venture Capital Partnership (LP), Shanghai Lingang New District Kechuang Phase I Industrial Equity Investment Fund Partnership (LP)	Beijing Sinoscience Fullcryo Technology Co., Ltd.	Storage, transportat ion and refueling core equipment	Domestic	3.0	Led by Sinopec Capital with 6 old shareholders

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

Review of major deals (Cont'd)

Date	Investors	Target	Investment Industry	Investmen t Direction	Amount (RMB in 100M)	Deal Background
2022- 10-20	Guangfa Qianhe Investment Co., Ltd., Shanghai Yonghua Investment Management Limited, Guangzhou Financial Innovation Investment Holding Co., Ltd., Shenzhen Zhongzhong Changrong Asset Management Co., Ltd., Huiyin City Investment Equity Fund Management Co., Ltd., E Fund Overseas Investment (Shenzhen) Co., Ltd., Guangzhou Chengtou Jiapeng Industrial Investment Fund Management Co., Ltd., Guangzhou Emerging Industry Development Fund Management Co., Ltd., Zhuhai Hongyun Chuangzhan Technology Investment Partnership (LP), Guangdong Jinneng Capital Investment Co., Ltd., Shengchuang Future (Shenzhen) Enterprise Management Co., Ltd.	SinoHykey Technology Guangzhou Co., Ltd.	System, cell stack	Domestic	3.0	The valuation was about RMB3 billion before the investment. It Doubled on comparison with the previous round
2022- 05-30	Huadian Heavy Industries Co., Ltd.	General Hydrogen Corp., Ltd.	Core componen ts of cell stack system	Domestic	2.5	HuaDian Heavy Industries Co., Ltd. invested in General Hydrogen Energy to accelerate research on key technologies of hydrogen energy business and the development of core equipment
Major de	als in China's hydrogen energy industry in 20)22				

 The value of single deal in the hydrogen energy industry in 2022 was significantly higher than that in 2021, mainly due to the backward financing stage of leading fuel cell targets. Mega deals were also concentrated in hydrogen energy storage, transportation and refuelling equipment enterprises, mainly due to the indispensability of leading enterprises in technology, business accumulation, future industry scale and the urgent breakthrough of the link to support the valuation of enterprises.

• Financial investment institutions continue to dominate, but there are many corporate VCs with strong industrial backgrounds, indicating that the industry has entered an important stage of strengthening industry chain cooperation and synergy.

 Half of the top ten deals in the year involved follow-on investment by old shareholders, indicating that the original investors are optimistic about the future development of the Targets.

China's energy transformation and independence are the most important drivers for hydrogen energy development. The continuing decline in renewable energy costs has shown economic advantages over fossil energy sources, but green hydrogen is needed to help address the huge space-time imbalance between power sources and load centres. Green hydrogen can support deep carbon reduction in long-distance midand heavy-loading logistics and transportation, steel/chemicals and other industrial fields. China can achieve energy self-sufficiency through wind power and PV green power + green hydrogen, with advantages on costs.

The whole industry chain of hydrogen energy involves three core technologies: fuel cell technology, water electrolysis hydrogen production technology, and hydrogen energy storage and transportation technology, which can be catergorised into three major application fields: transportation (long-distance mid- and heavy-loading trucks, cold chain, ships, rail transportation, aerospace, etc.), industry (chemical industry, metallurgy, etc.), and building (combined supply of heat and power, distributed energy system), with broad application prospects. However, these large-scale applications and commercialisation processes will evolve with the progress of engineering technology, industry chain development and the evolution of business models.

As the transportation field can afford the highest-cost hydrogen, relying on the by-product hydrogen resources in China's current industrial system at a stage when large-scale wind power and PV hydrogen production is not yet in place, the first large-scale application of hydrogen fuel cell vehicles can be formed within the regional scope where conditions are available. In addition, the national demonstration and promotion policies for hydrogen fuel cell vehicles that has gradually been implemented in the past two years, have driven the growth of the fuel cell vehicle industry chain (hydrogen fuel power system, cell stack and core components and materials, fuel cell vehicle manufacturing and operation) and the hydrogen refuelling station industry chain (station compressor, hydrogen storage and transportation equipment), which are the main investment areas in the past two years. However, as it is still in the early stage of policy guidance and technology industrialisation, enterprise technology product development and business model evolution are still immature, coupled with weak financial capability, while the industry competition landscape is still evolving and changing, so the capital market is still cautiously embracing the current pioneer leading enterprises in the hydrogen energy industry. However, from an investment point of view, enterprises focusing on application scenarios where hydrogen fuel cells have advantages (cold chain, long-distance heavy trucks), digging deeply into the whole life cycle economic value of commercial vehicle users, positively developing fuel cell vehicle and power technology, and providing more complete solutions for users based on industry chain synergy, will establish sustainable competitiveness and are expected to achieve scale development with significant capital value in the 14th Five-Year Plan period.

Besides, since hydrogen energy involves national strategy and great prospect, China's central and local state-owned energy enterprises have actively deployed renewable energy and hydrogen energy, which has led to the current wind power and PV green power for green hydrogen production projects in China's renewable energy resource-rich areas, especially in western Xinjiang and Inner Mongolia, while even the local governments have set the planning of green hydrogen and downstream application industry as a prerequisite for enterprises to participate in renewable energy projects. It has driven the investment in hydrogen production technology and equipment, hydrogen storage and transportation technology and equipment, and hydrogen industrialisation application projects to be launched. For this reason, the large-scale hydrogen production and supply based on the wind power and PV base is the development trend in the future. The hydrogen production technology of alkaline electrolyser is more suitable for industrial development than PEM based on the comprehensive advantages of performance and cost, and is expected to become the mainstream solution for hydrogen production, while technologies such as hydrogen liquification and hydrogen supply chain. The hydrogen energy industry has grown over several decades and has a broad investment space, which is worthy of continuous attention and expectations.

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- Li Gang, Founding Partner of Yield Capital

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

Application trends and outlook of hydrogen industry

Promising outlook for new energy coupling hydrogen production application

Based on the M&A trend throughout 2022, the M&A hotspots not only maintain the downstream application of fuel cells, but also present the trend to shift to the midstream and upstream. In addition to the transportation field, there is unlimited development space in the application of hydrogen production coupling renewable energy, such as in energy, steel and chemical industry.

The development of hydrogen energy industry is still restricted by hydrogen source, storage and transportation, using cost, and hydrogen refuelling station infrastructures. Furthermore, to promote the rapid development of hydrogen energy industry should be combined with the advantages of regional resources around China to differentiate the development according to local conditions.

Low-cost renewable energy sources are utilised to produce green hydrogen in the upstream, or coal, natural gas and by-products are combined with CCS to produce grey hydrogen and blue hydrogen as a hydrogen source of the transition phase. As a raw material and energy carrier, low-cost hydrogen can be subsequently used as an energy carrier for grid peaking adjustment, as a raw material for hydrogen to ammonia, methanol synthesis and as a reductant for steel smelting, and be applied in the power market and industrial scenarios, forming a closed loop of hydrogen production, transportation and consumption. The closed loop can be completed in specific regions and can also be used to expand the sales channels by means of a mature chemical industry transportation system. Finding the differentiated application of hydrogen energy is key to propelling the development of the hydrogen energy industry and breaking through the existing limitations of the whole industry chain.



produce ammonia As a clean energy, green ammonia is used in various scenarios, including carbon fixation, hydrogen storage, shipping fuel and blended power generation, in addition to traditional agricultural and industrial uses Typical project: China Jidian's Daan Integration Project for Hydrogen Production and Ammonia Synthesis through Wind Power and PV **Energy Storage & Power Application** Hydrogen energy storage can play an important role in the construction of new power system Hydrogen energy can help accommodate the surplus wind power and PV energy at the **power side** and store it for energy In the peak period of grid load, it can be incorporated into the public grid for grid-side auxiliary peak regulation Typical project: Ningxia Baofeng Energy's Research and Demonstration Project on Solar Electrolysis for Hydrogen Production and Energy Storage Steel & Metallurgy Field Hydrogen energy metallurgy is an important way to reduce carbon emission in the metal smelting industry. R&D and applications are

Ammonia/Methanol Production Field

Nitrogen is prepared through the separation

of air, and synthesised with hydrogen to

- currently concentrated primarily in the iron and steel industry
- The hydrogen energy steelmaking process with grey hydrogen and blast furnace plus rich hydrogen at this present stage may gradually shift to gas-based shaft furnace with rich hydrogen in the future.

Typical project:

HBIS Group's Hydrogen Metallurgy Demonstration Project

Under the guidance of national mid- and long-term planning on hydrogen energy industry and the promotion of demonstration city cluster policy, the development potential of hydrogen energy and fuel cell industry is gradually released. The current industry financing is still dominated by cell stack system and hydrogen storage equipment, which indicates that the industry is the first to be recognised by capital and is in the key stage of market competition. Subsequently, these enterprises will highly follow the application market and policy support in the cities. In terms of the trend, the gradual scale expansion of hydrogen fuel cell vehicles, will accordingly bring about the competition and investment opportunities for the upstream hydrogen gas source side and the key component material side, while the investment opportunities will be highlighted in advanced and high-efficiency hydrogen production and storage equipment and materials such as proton exchange membrane, carbon paper and catalyst. Central enterprises have already entered the mid- and long-term layout of the energy side; foreign energy industry giants and investment institutions will also gradually enter the domestic market to carry out M&A and investments. The domestic and overseas trade of hydrogen, green hydrogen traceability certification and competitive equipment and automotive products will also enter the international market.

Chen Hailin, Deputy Secretary General, Hydrogen Energy Task Force of Shanghai Lingang Economic Development Group



New energy cell

Newly-built capacity and continuous expansion of cell enterprises and cell material enterprises: 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. It is expected that the first-tier and second-tier cell enterprises will continuously expand capacity in the next 3-5 years, but the actual capacity may be less than the announced. Enterprises will consider the rationality of capacity layout and capacity expansion based on price, supply and demand relationship and other factors.

Decline of raw material prices: Since the supply side expands capacity to enhance supply, and cell material enterprises consider priority digestion of inventory, the price of lithium carbonates has gradually dropped compared to the peak of nearly RMB600,000/tonne in 2022, and is expected to be stable after a certain period of fluctuation. As a result, the heat of upstream deals and domestic enterprises' outbound M&A of lithium mines may decay, but the controllable supply of raw materials and price stability are also beneficial for the overall development of the industry.

Cell companies going abroad: With the accelerated development of global new energy vehicles, China's lithium batteries technology system, capacity scale, supply chain construction has taken a leading role around the world. As a result, first-tier cell enterprises have begun to build factories overseas from 2022, while second-tier cell enterprises will likely accelerate the overseas layout in the future and engage in the local market through self-built or co-built factories with automobile enterprises or M&A deals. At the same time, battery supply chain enterprises may look into deploying relevant supporting capacity locally.

Continuous development of cell technology: At present, lithium batteries have been able to better meet new energy vehicle owners' needs in terms of safety, energy density and cycle times. But the whole industry chain, whether lithium batteries enterprises or start-ups, is still actively investing in R&D, and optimising cells' performance, such as using nickelic or lithium ferromanganese phosphate as cathode materials, using silicon-based anode electrode as anode materials, while solid-state cells, sodium ion cells have undergone continued R&D and commercialisation. In 2022, a number of R&D enterprises in the industrial chain have completed 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.

The lithium battery industry has benefited from the rapid development of new energy vehicles. Lithium battery enterprises and cell material enterprises have been competing in various dimensions, such as technology R&D, capacity construction, supply chain control, and enterprises going overseas. Industry competition will likely further intensify, causing system cost to decrease and technology to improve. The industry is expected to prosper with a relatively high growth.

Energy storage

Industrial and commercial and independent energy storage are expected to get better development and investment opportunities: With the further reform of power market and the wide gap between industrial and commercial electricity price, the efficiency of industrial and commercial energy storage will be further improved. The independent energy storage benefits from policy support and diversified revenue model, and its earnings certainty is expected to increase in the long term. Therefore, integrators whose products are orientated in industrial and commercial energy storage/independent energy storage are expected to achieve rapid market breakthroughs and attract attention from investment institutions.

The diversity of application scenarios drives the flourish of various technology forms, such as sodium-electric, flow redox battery and physical energy storage, and promotes the deepening of commercialisation process: For different energy storage duration, charging and discharging requirements, different energy storage technologies play unique performance advantages in their respective application scenarios. For example, compressed air energy storage (CAES), as a representative of long-time energy storage technology, has attracted investors due to its wide application scenarios and fast-paced commercialisation process. In addition, short-time high-power flywheel energy storage has gradually started pilot applications in rail energy saving and primary frequency regulation of power network, and its technology and applications will gradually mature in the future.

Wind power, PV

in the new round of competition.

Production efficiency and product quality will become the main theme of competition with new technologies. The industry with PV as a typical representative presented a unified integration trend in the past year, due to the sharp changes in upstream raw materials as well as the withdrawal of subsidies and other factors. Looking ahead, under the influence of technology reform as well as market changes, the reliability, stability and profitability of wind power and PV products will become the new hot spots, while the enterprises that take the lead in obtaining advantages in cost and efficiency and product quality will establish core advantages

Continuous expansion of application models, coupled with across-border integration to seize the new blue ocean market. The iteration of new technologies and industrial integration has led to a further extension of wind power and PV application scenarios. The integrated zerocarbon park with lower production cost and green product attributes has attracted great interest from investors and enterprises in the industry. The integration of green energy with hydrogen, ammonia and other industries has also become a new development direction which merits active exploration.

Cross-border M&A deals are expected to grow, while new energy enterprises will face more complex and challenging international market: Fewer cross-border M&A deals occurred in 2022 due to the challenges and impacts of the external market environment. However, as new energy sources such as PV entering the development phase driven by global diversified market, cross-border deals are expected to gradually recover. Meanwhile, influenced by the geopolitical environment and trade protectionism, Europe and the United States are actively promoting the localisation level of the industry chain, while more Chinese new energy enterprises will face the challenges of a more fragmented global market in the long term. Local enterprises will continue to expand overseas production capacity and penetrate deeply into overseas markets. Continued innovation in technology and leading product quality will be crucial to becoming part of the international industry chain.

The power commercialisation trend is highlighted, actively embracing market deals: In terms of centralised wind/PV power stations, the maturity of the mid and long term deals and spot trading market will lead to a further reduction of the guaranteed acquisition part of power stations' revenue. Also, with the new provincial ToU tariff, the revenue of distributed wind/PV power stations will show regionalised characteristics with the net load fluctuation of the power system in the province. With wind/PV power stations fully participating in future market transactions, forecast power demand can be reasonably supported and corresponding power trading hedging strategy developed for revenue growth. A variety of business models around the power market trading will emerge, and thereby bringing a new round of investment opportunities.

Hydrogen

Diversified application scenarios, especially industrial, chemical and power grid applications, are worthy of expectation. As mentioned above, hydrogen energy needs to explore a business model that is economical and adaptable to regional liquid synergy according to local conditions, and form a closed loop of hydrogen energy production, transportation and application, and create a benign development ecology.

The process of localisation for substitution is accelerating, and the competition among enterprises is intensifying. With the implementation of the model city cluster plan, the number of hydrogen energy enterprises has increased significantly amid localisation in recent years, and the current limited market capacity is bound to intensify the competition among enterprises. Innovative enterprises with core technology barriers, the ability to continuously obtain orders and the ability to make breakthroughs will gain competitive advantages in the short term, while in the long term, they need to enhance their synergy with the upstream and downstream of the industry chain and link with various resources to boost development in the long term.

Domestic enterprises are expected to rely on the cost advantage resulting from the market capacity to explore the international market in the future. With the increasingly urgent demand for clean energy transformation and energy security, Europe, the United States, Japan and South Korea, have temporarily accumulated more leading technologies and business cases owing to their early layout and large investments in the hydrogen energy industry. In addition, some Middle East countries have proposed strategic planning for hydrogen energy. The reasons are as follows: 1) Fossil fuel will be depleted; 2) With hydrogen energy sharing similar properties with oil as an energy material, the Middle East is more suitable for renewable energy production, especially green hydrogen; 3) The acceleration of global electrification process will challenge the export of oil in the Middle East. At present, the countries mentioned above have yet to form a mature hydrogen energy industry chain or a sound business model. The vast market scale of hydrogen energy will likely bring more development opportunities for Chinese enterprises and manufacturers.

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Shanghai Lingang Economic Development Group: a driving force in the transformation, development, and construction of Lingang District, adheres to national strategies in serving the new Lingang District, Shanghai Science and Technology Innovation Center, and Yangtze River Delta integration construction. It focuses on the development of Shanghai's "3+6" new industrial system and the Lingang District's "4+2+2" industrial clusters, cultivating highquality industries, constructing high-quality properties, and attracting high-quality talents to form a highly dynamic ecosystem.



Fenghe Fund, established in 2021, a professional investment institution in China focused on the energy storage sector. The current management scale exceeds RMB 2 billion. The investment field encompasses the entire energy storage industry chain, from upstream materials to midstream energy storage cells to downstream system integration and application, and fully outlines the new technologies and new materials that represent the future industry's development trend. It has made investments in a number of projects, including Xiamen Hithium Energy Storage Technology Co., Ltd., Xi'an Singularity Energy Technology Co., Ltd., Guangzhou Rimsea Technology Co., Ltd., and Fujian BLUE Ocean & Black STONE Technology Co., Ltd.

Yield Capital, a venture capital platform affiliated to Beijing Tsinghua Institute of Industrial Development and Research, invests in scientific and technological innovation and integrated applications in the fields of hydrogen transportation, intelligent medical treatment, information technology, and related new materials.

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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