

## INDUSTRY OVERVIEW

*The information in this section is derived from an independent report prepared by Frost & Sullivan. The industry report prepared by Frost & Sullivan is based on information from its database, publicly available sources, industry reports, data obtained from interviews and other sources. We believe that the sources of the information in this section are appropriate sources for such information and have taken reasonable care in extracting and reproducing such information. We have no reason to believe that such information is false or misleading or that any part has been omitted that would render such information false or misleading. The information has not been independently verified by us, the Sole Sponsor, the [REDACTED], the [REDACTED], the [REDACTED], the [REDACTED], any of their respective directors, officers, affiliates, advisors or representatives, or any other party (other than Frost & Sullivan) involved in the [REDACTED]. We, the Sole Sponsor, the [REDACTED], the [REDACTED], the [REDACTED], the [REDACTED], any of their respective directors, officers, affiliates, advisors or representatives, and any other party (other than Frost & Sullivan) involved in the [REDACTED] make no representation as to the completeness, accuracy or fairness of such information and accordingly such information should not be unduly relied upon.*

## SOURCES OF INFORMATION AND RESEARCH METHODOLOGY

The information and statistics set out in this section and other sections of this document were extracted from different official government publications, available sources from public market research and other sources from independent suppliers. In addition, we engaged Frost & Sullivan for preparing an independent industry report in respect of the [REDACTED]. The information from Frost & Sullivan disclosed in the document is extracted from the Frost & Sullivan Report, a report commissioned by us for a fee of RMB880,000, and is disclosed with the consent of Frost & Sullivan. The Frost & Sullivan Report has been prepared by Frost & Sullivan independently without any influence from us or other interested parties.

Frost & Sullivan is an independent global consulting firm founded in 1961 in New York and its services include, among others, industry consulting, market strategic consulting and corporate training. Frost & Sullivan conducted (i) primary research, which involved discussing the status of the industry with certain leading industry participants, and interviews with industry experts on a best-effort basis to collect information in aiding in-depth analysis; and (ii) secondary research, which involved reviewing company reports, independent research reports and data based on its own research database.

### Overview of New Energy Vehicle Market

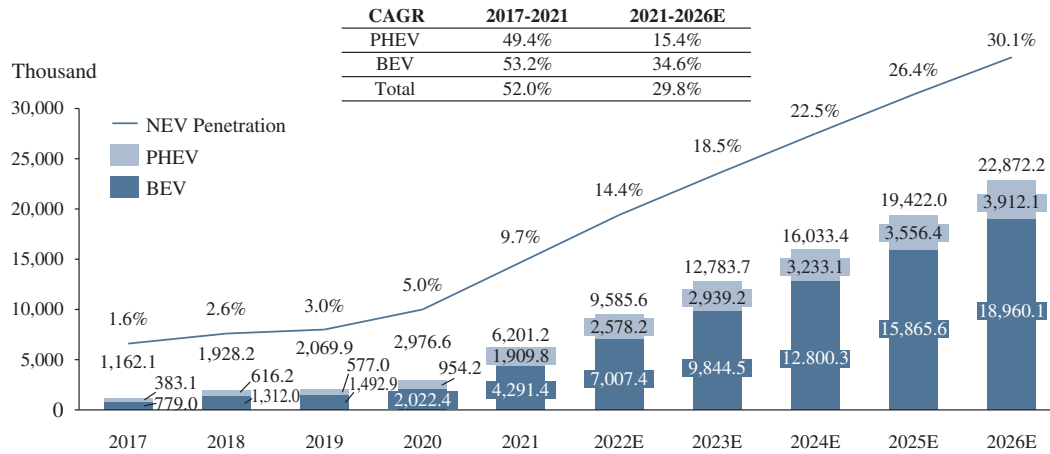
China expects to hit carbon peak before 2030 and the Chinese government aims to achieve carbon neutrality by 2060. The Chinese government has promulgated a number of policies to support the growth of NEV (New Energy Vehicle), which include BEV (Battery Electric Vehicle) and PHEV (Plug-in Hybrid Electric Vehicle). Currently, China is the largest NEV market in the world, with sales of 3,334.0 thousand units in 2021, and continues to account for nearly half of global NEV sales, according to Frost & Sullivan.

### *Global NEV Market Have So Far Achieved Remarkable Growth and China’s NEV Market Continues to Experience High Growth*

The uses of new energy, intelligent control system and telematics have become the most notable trends in the global automobile industry. Accordingly, the global sales volume of NEVs grew from 1,162.1 thousand units in 2017 to 6,201.2 thousand units in 2021. In the forecast period, global NEV sales are expected to grow at a CAGR of 29.8%, and the global NEV penetration is expected to reach 30.1% in 2026.

## INDUSTRY OVERVIEW

### New Energy Vehicle Sales Volume, Global, Breakdown by Type, 2017-2026E

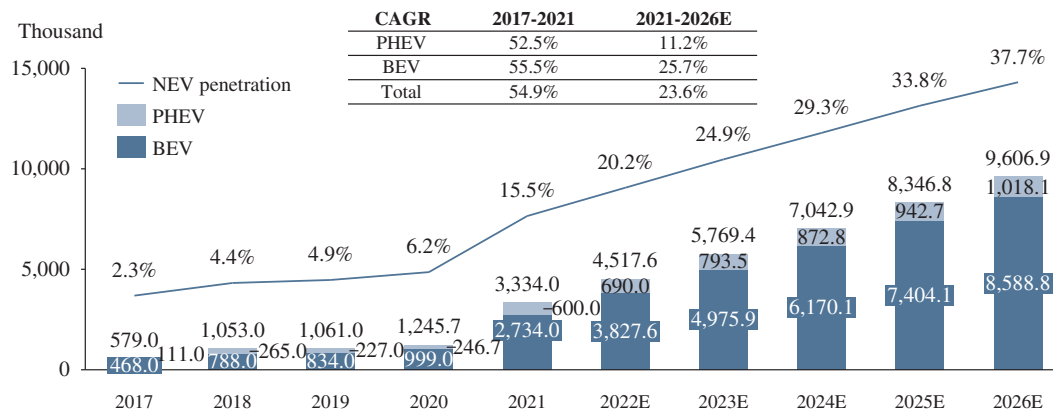


Note: NEV penetration refers to the proportion of NEVs in total passenger vehicles.

Source: Industry Associations, Frost & Sullivan

The total sales volume of passenger vehicles in China was 21.5 million in 2021, and is expected to reach 25.5 million in 2026 with a CAGR of 3.3%. With further policy support and technological development, consumer preference for NEVs is expected to grow, hence the NEV sales penetration is expected to climb from 15.5% in 2021 to 37.7% in 2026, and China’s market will represent the most sizable long-term market opportunity globally for NEV stakeholders.

### New Energy Vehicle Sales Volume, China, Breakdown by Type, 2017-2026E



Note: NEV penetration refers to the proportion of NEVs in total passenger vehicles.

Source: China Association of Automobile Manufacturers, China Passenger Cars Association, Frost & Sullivan

## INDUSTRY OVERVIEW

### *Key Market Drivers and Trends of China’s NEV Market*

**From consumer preference level:** consumers have growing concerns on personal health as well as urban environmental conditions, and actual benefits are granted to EV purchasers in China. Meanwhile, ICE (Internal Combustion Engine) OEMs (Original Equipment Manufacturer) need to invest more in the R&D to reduce the emission of CO<sub>2</sub>, NO<sub>x</sub> and other air pollutants.

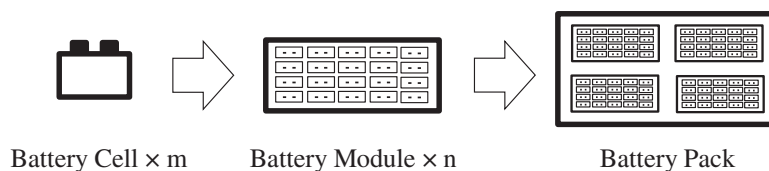
**From power type level:** BEV will become the mainstream models in future NEV market. At present, the mainstream types of NEVs include BEVs and PHEVs. From the perspective of infrastructure, governments around the world have been promoting the deployment of electric vehicle infrastructure, which in turn has been an important factor in consumers’ increasing adoption of BEVs. BEVs carry more battery capacity than PHEVs, which will drive the growth of battery industry.

### Overview of EV Battery Market

#### *Definition and Classification of EV Battery*

EV battery refers to a rechargeable electricity storage system used in NEV to provide driving energy. As one of the most critical parts of the NEV, EV battery directly affects the NEV performance including driving range, safety, service life, charging time and adaptability of temperature, etc.

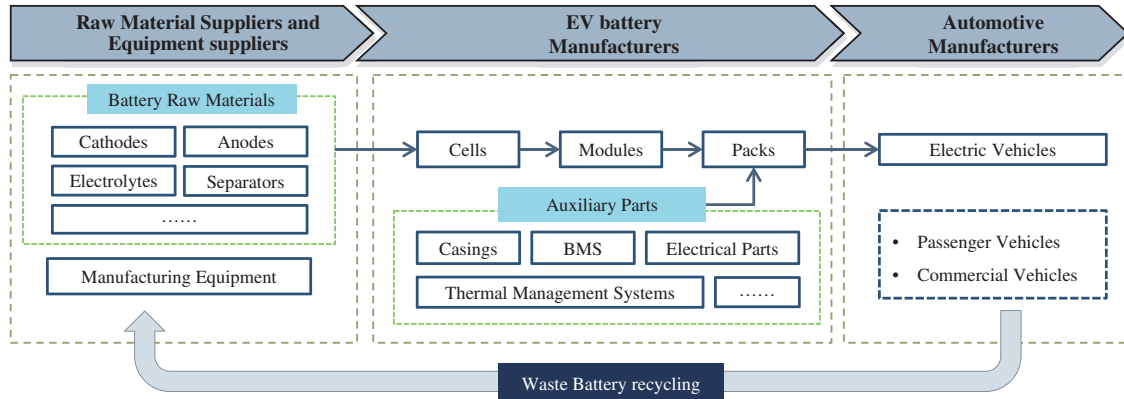
Battery cell is the smallest energy unit composed of cathode, anode, electrolytes and separators. A battery module contains many battery cells in parallel and series that shelled in the casing. Battery pack is a system integrating several auxiliary parts with multiple battery modules, and can be directly installed to the vehicles. The relation as shown below:



According to the difference of cathode materials, EV batteries can be classified into lithium titanate oxide battery, lithium manganese oxide battery, lithium iron phosphate (LFP) battery, and ternary battery. LFP and ternary battery are dominating the EV battery market with over 99% of the market share. Generally, ternary batteries have higher energy density, higher charging efficiency and better low temperature adaptivity, while LFP battery have relatively better safety performance and lower material cost.

## INDUSTRY OVERVIEW

### *EV Battery Value Chain Analysis*



Source: Frost & Sullivan

Battery manufacturing requires a variety of raw materials and manufacturing equipment from upstream suppliers as shown above. EV battery manufacturers are responsible for the design and production of EV battery products, which can be shipped and sold in forms of cells, modules and packs according to customer requirements. EV battery is the most valuable part for NEV which accounted for 20-40% of the total vehicle cost. Automotive manufacturers directly purchase EV battery from battery manufacturers. Due to the high-customized feature of EV battery, automotive manufacturers usually involve EV battery manufacturers early in the project development stage.

Waste battery recycling refers to collecting raw material from waste battery. There are both raw material suppliers and battery manufacturers engaging in this field of business to achieve an efficient utilization throughout the life cycle of batteries.

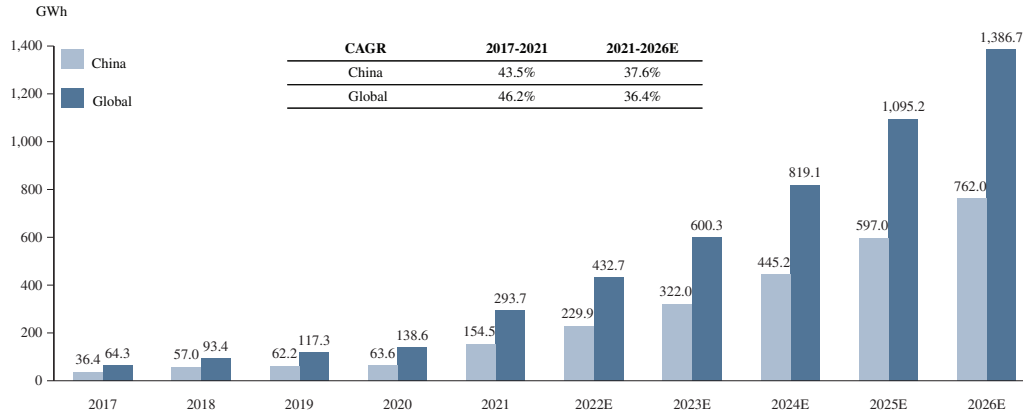
### *Global and China EV Battery Installed Capacity*

Benefits from the growth of global NEV market, the EV battery market gained a steady growth with the installed capacity grew from 64.3 GWh in 2017 to 293.7 GWh in 2021 with a CAGR of 46.2%. In the forecast period, in line with the continuous growth of global NEV market, the global EV battery installed capacity are expected to grow at a CAGR of 36.4% from 2021 to 2026 and reach 1,386.7 GWh in 2026.

China is the largest EV battery market in terms of installed capacity. The EV battery installed capacity in China grew at a CAGR of 43.5% from 2017 to 2021 and reached 154.5 GWh in 2021. With the rapid growing of NEV penetration rate, the sound industrial chain and effective pandemic control, China EV battery market will keep growing. The EV battery installed capacity is expected to reach 762.0 GWh in 2026 with a CAGR of 37.6% from 2021 to 2026.

## INDUSTRY OVERVIEW

### EV Battery Installed Capacity, Global and China, 2017-2026E



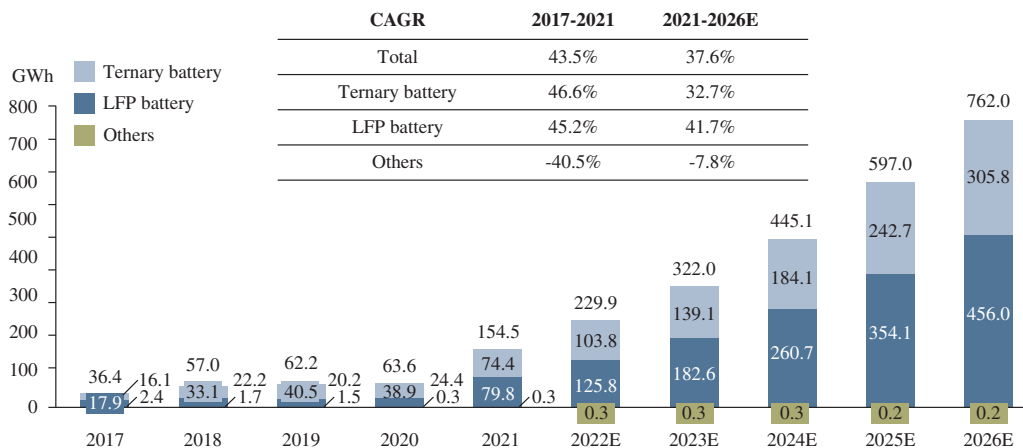
Source: China Automotive Battery Innovation Alliance, Frost & Sullivan

### China EV Battery Installed Capacity by Battery Type

Benefiting by government subsidies, ternary batteries highlighted its advantage of higher energy density and gained the most of market share from 2018 to 2020.

In the forecast period, the installed capacity of ternary battery is forecasted to reach 305.8 GWh in 2026 at a CAGR of 32.7% from 2021 to 2026. With comparatively lower cost, LFP batteries market is expected to grow faster and expand the market share. The installed capacity of LFP battery is forecasted to reach 456.0 GWh in 2026 at a CAGR of 41.7% from 2021 to 2026.

### EV Battery Installed Capacity, China, Breakdown by Battery Type, 2017-2026E



Note: Others refers to lithium titanate oxide battery, lithium manganese oxide battery.

Source: China Automotive Battery Innovation Alliance, Frost & Sullivan

---

## INDUSTRY OVERVIEW

---

### *Key Market Drivers of China EV Battery Market*

**Policy stimulation:** The development of EV batteries is highly consistent with the development of the NEV industry. *Action Plan for Carbon Dioxide Peaking Before 2030* published by State Council revealed the plan to reach the clean energy transport proportion of 40% by 2030 which lead a huge room for the growth of NEV market. The explosive growth potential of NEV market will continue to drive the demand for EV batteries.

**Battery performance improvement:** The insufficient driving range has been considered as one of the hindrances for purchasing NEV. Due to the technology advancement in recent years, the battery energy density, and charging speed have been greatly improved. Industry participants keep putting effort on improving battery performance, thus enhancing the consumers’ confidence and adoption of NEV.

**Cost reduction:** EV battery accounts for 20-40% of the entire vehicle cost. Due to the advancement of battery technology and the expansion of production scale, the average cost of EV batteries has dropped significantly in past few years. It is expected that the cost of EV batteries still has a potential to reduce. Battery cost reduction drives the price reduction of NEV, benefiting the NEV sales market, which in turn promote the EV battery market.

### *Future Trends of China EV Battery Market*

**Battery standardization:** In recent years, battery standardization is gaining more attention for its multiple advantages. Battery standardization can (i) improve battery consistency; (ii) promote the large-scale development of the waste battery recycling; (iii) promote the popularization of battery swapping modes. The development of battery standardization is of great significance to the progress of the EV battery industry.

**Structural innovation:** Battery structural innovation has become a distinctive feature of technological advancement. By optimizing the space utilization and reduce the usage of auxiliary parts, structural innovation can achieve higher battery energy density and lower the material cost. Industry participants are still working on battery structure improvement. In the future, battery structural innovation will continue to be an important technology route that battery manufacturers will put effort on.

**Material innovation:** Raw material system innovation has been an effective way to promote the battery comprehensive performance. High-nickel cathode material, carbon-silicon anode, lithium pre-doping anode, solid electrolyte, high voltage material, etc. are typical research routes in the industry to enhance battery energy density. In the context of pursuing higher battery energy density and low cost, the trend of battery material innovation will remain for the future.

## INDUSTRY OVERVIEW

**Efficient utilization throughout the life cycle:** Waste battery recycling such as raw material recycling and second use of waste battery, is significant to the battery industry to achieve the cost reduction and environment protection. Developing waste battery recycling system is a crucial strategy plan of leading battery manufacturers.

### *Competitive Landscape of Global EV Battery Industry*

Global battery industry is dominated by several core companies. Top 7 EV battery manufacturers took up 87.1% of the market share in 2021 in terms of installed capacity.

	<b>Installed capacity (2021, GWh)</b>	<b>Introduction</b>	<b>Market share</b>
Company A	97.3	A China-based third-party EV battery manufacturer listed in Shenzhen Stock Exchange.	33.1%
Company B	58.3	A Korea-based third-party EV battery manufacturer listed in Korea Stock Exchange.	19.9%
Company C	34.7	A Japan-based third-party EV battery manufacturer affiliated with an international comprehensive electronic technology company.	11.8%
Company D	25.9	A China-based EV battery manufacturer affiliated with a domestic vehicle manufacturer.	8.8%
Company E	17.3	A Korea-based third-party EV battery manufacturer affiliated with an international company with numerous businesses including energy industry, etc.	5.9%
Company F	12.8	A Korea-based third-party EV battery manufacturer affiliated with an international company engaging in consumer electronics, etc.	4.4%
Our Company	9.3	A China-based third-party EV battery manufacturer.	3.2%
<b>Top 7 EV battery manufacturers in total</b>			<b>87.1%</b>

*Note:* Third-party EV battery manufacturers indicate those companies whose businesses are not engaging in vehicle manufacturing and the EV battery products are mainly sold to external customers instead of their own brand of vehicles.

*Source: Frost & Sullivan*

## INDUSTRY OVERVIEW

### *Competitive Landscape of China EV Battery Industry*

China EV battery industry is highly concentrated. In 2021, top 3 EV battery manufacturers gained 74.2% of totally installed capacity in China.

	<b>Installed capacity (2021, GWh)</b>	<b>Introduction</b>	<b>Market share</b>
Company A	80.5	A China-based third-party EV battery manufacturer listed in Shenzhen Stock Exchange.	52.1%
Company D	25.0	A China-based EV battery manufacturer affiliated with a domestic vehicle manufacturer.	16.2%
Our Company	9.1	A China-based third-party EV battery manufacturer.	5.9%
Top 3 EV battery manufacturers in total			74.2%

*Note:* Third-party EV battery manufacturers indicate those companies whose businesses are not engaging in vehicle manufacturing and the EV battery products are mainly sold to external customers instead of their own brand of vehicles.

*Source:* China Automotive Battery Innovation Alliance, Frost & Sullivan

Battery safety performance is the priority when evaluating the performance of electric vehicles. Pursuit of a higher level of safety has always been the goal of the EV battery industry. Compared to LFP battery, ternary battery has advantages on energy density, charging efficiency and low-temperature adaptivity, but raises higher technological requirements to ensure battery safety performance. Nail penetration test is one of the most rigorous EV battery safety performance tests. Up to now, there are only two NEV brands in China have published the “pass” result for ternary battery nail penetration test, which represent the leading safety level of ternary battery in the world. The batteries for one of the brands are provided by our Company. Below table shows the test information for top three EV battery manufacturers.



## INDUSTRY OVERVIEW

	Our company	Company A	Company D
Ternary Battery Nail Penetration Test	✓	✓	×
NEV Brand	Aion	Zeeker	NA
Release Time	March 2021	July 2021	NA

*Notes:*

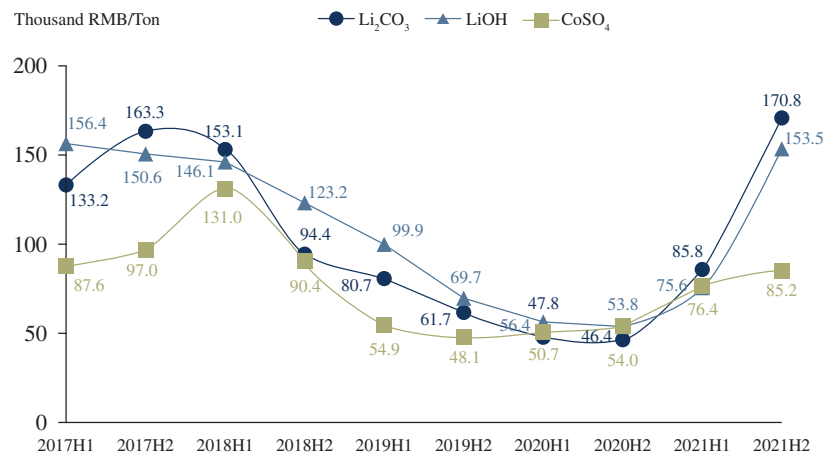
1. “Nail Penetration Test” indicates an EV battery thermal propagation test which requires that the EV battery pack should not explode or catch fire due to thermal runaway when it is entirely penetrated by a steel nail under required conditions.
2. “✓” indicates that the battery pack passed the test and the result have been posted in public.
3. “×” indicates that no “passed” result have been posted.
4. “NA” indicates that information not applicable.
5. Statistics by December 31<sup>st</sup> 2021.

*Source: Frost & Sullivan*

### **EV Battery Major Raw Material Price Analysis**

Battery cell is composed of cathodes, anodes, electrolyte and separators. Cathode material is the costliest part, which takes up around 30-55% of the total cost of the battery cell depending on the battery types. Lithium carbonate ( $\text{Li}_2\text{CO}_3$ ), lithium hydroxide ( $\text{LiOH}$ ) and cobalt sulfide ( $\text{CoSO}_4$ ) are the major raw material of synthesizing EV battery cathode. Given a great demand of raw material due to the rapid growth of EV battery installed capacity, the price of the major cathode raw material has climb up since 2021. The historical price trend as shown below.

### **Average Price of Major Cathode Raw Material, China, 2017-2021**



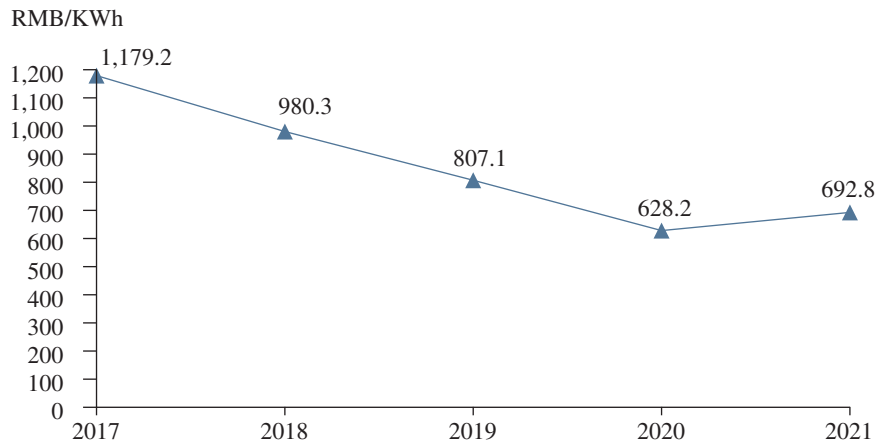
*Source: Frost & Sullivan*

## INDUSTRY OVERVIEW

### *EV Battery Cost Analysis*

Benefiting by technology advancement and effect of scale, the cost of EV battery plummeted from 2017 to 2020. In 2021, the EV battery cost increased taking into account the rising prices of the raw materials.

**Average Cost of EV Battery Pack, China, 2017-2021**



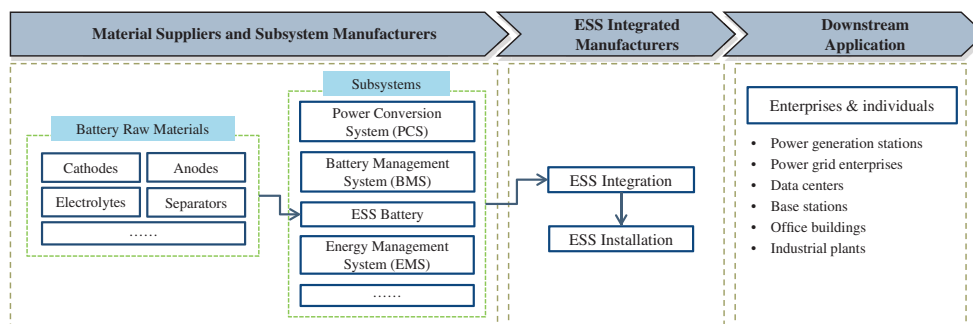
Source: Frost & Sullivan

### **Overview of China ESS Battery Market**

#### *Definition of ESS Battery*

Energy storage system (ESS) batteries, which mostly are lithium-ion batteries, are the core unit in ESS. ESS refers to the device that can store electricity power and output for usage when needed. Differ from EV battery, ESS batteries are deployed in a wide span of scenarios in power system including power generation, power transmission & distribution and power consumption by its function of peak shaving and valley filling, system frequency modulation, smooth new energy power output and etc.

#### *ESS Battery Value Chain Analysis*



Source: Frost & Sullivan

## INDUSTRY OVERVIEW

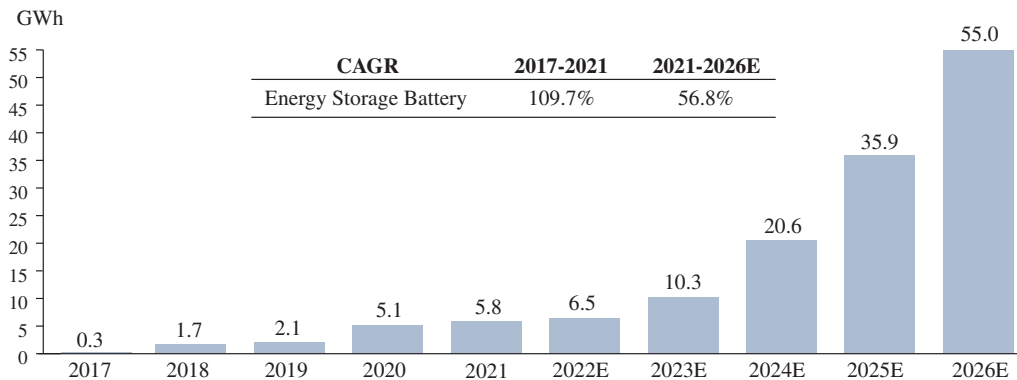
The subsystem manufacturers are upstream participants in the value chain. ESS is an integration of multiple subsystems, as shown above. ESS battery is the most valuable part which accounted for around 60% of the total cost of ESS. ESS integrated manufacturers in midstream are responsible for the system design, subsystem selection and subsystem integration to form a functional ESS, then sell to the customers. ESS is widely used in various scenarios by enterprises and individual users.

### *China ESS Battery Installed Capacity Analysis*

Benefiting by the continuous reduction of the battery cost and the stimulation of government policies, China ESS battery has achieved 5.8 GWh newly-installed capacity put into operation in 2021 from the basis of 0.3 GWh in 2017.

In the context of national strategy of energy transformation and carbon neutrality, ESS battery is an integral part in the power system reform and new energy power construction. The newly installed capacity is expected to reach 55.0 GWh in 2026 with a CAGR of 56.8% from 2021 to 2026.

**ESS Battery Newly Installed Capacity, China, 2017-2026E**



*Source: Frost & Sullivan*

### *Key Market Driver of China ESS Battery Market*

**Policy stimulation:** In the context of the national goal of carbon neutrality, China ESS market welcomes a series of favorable policies. For instance, *Action Plan for Carbon Dioxide Peaking Before 2030* issued by the State Council in 2021 unveiled a series of ambitious action plan to accelerate the ESS development. It is expected that the ESS industry will grow explosively under the stimulus of national and local policies.

---

## INDUSTRY OVERVIEW

---

**Cost reduction:** Technology advancement and production scale expansion promote the cost reduction for ESS battery. Moreover, the rapid development of the EV battery industry drives the related technologies applied into ESS batteries, which accelerates the cost reduction for ESS batteries. Continued cost reduction of ESS battery promotes the adoption intention for downstream users.

**Wide span of application scenarios:** ESS battery is deployed in a wide span of scenarios in power system including power generation, power transmission & distribution and power consumption. The rapid growing renewable energy power system construction lays the foundation for the large-scale deployment of ESS. As the energy transition accelerates, the ESS battery market will embrace new opportunities.

### *Future Trends of China ESS Battery Market*

**Improving performance:** ESS safety accidents have occurred around the world, which causes widespread concern in the industry. Improving safety performance of ESS battery is the most effective measure to solve the system safety problems. Pursuing higher safety performance and longer cycle life are the technological development trends of ESS batteries in the future.

**Distributed ESS:** ESS applications are undergoing an expansion from centralized models to distributed models, as so-called distributed ESS. The application of distributed ESS contributes to micro-grid construction. Distributed model development is expanding the market application scenarios of the ESS, and will drive the related technology development and market growth in the future.

**Cascade utilization:** Cascade utilization refers to the utilization of waste EV batteries as ESS battery. It has been identified as a cost-efficient and sustainable alternative for ESS construction. Large quantities of waste EV batteries are expected to be available in the future as NEVs are more widely adopted. Therefore, cascade utilization in field of ESS is expected to be a trend in the industry.