Who will be the winner of Lithium Battery Market?

——A comparison of LFP Battery and Ternary Battery

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Abstract:

- Long-term view favorite Ternary Battery over LFP battery from technical view as the latter has reached its tech ceiling;
- From a cost predictability perspective, LFP battery will remain its high growth in 2022 Q3-Q4, and grow moderately afterward while Ternary battery growth will be more reliable to raw materials;
- From a policy perspective, the LFP battery win over the Ternary battery for its cost advantage;
- From the demand side, the winner of the LFP-Ternary duel is relevant to the sales structure of future EVs due to the nature of LFP and Ternary batteries

Contents

Market Overview

As the main power source of new energy vehicles, power batteries are the core components of new energy vehicles, and the cost of batteries accounts for about 40% of the total production cost of new energy vehicles. The energy density, power output, cold resistance, and safety performance of professional power batteries determine the endurance, stability, and safety of the entire vehicle. Therefore, power batteries play a decisive role in the performance and safety of new energy vehicles. Therefore, it is of great significance to study the power battery for the study of new energy vehicles. In the process of realizing high-quality economic development and green and low-carbon transformation, the automobile industry, especially the new energy automobile industry, will be the focus of attention. Several policies have been introduced to benefit the new energy automobile industry.

The entire power battery industry chain can be divided into upstream metal and non-metallic materials, midstream power battery components, including cathode materials, anode materials, separators, electrolytes, structural parts, etc., and downstream power battery main manufacturers and supporting models, etc.

The types of power batteries for new energy vehicles can be roughly divided into lead-acid batteries, ternary lithium-ion batteries, nickel-metal hydride batteries, and lithium iron phosphate batteries. Lead-acid batteries are low in cost, but have low energy density and service life, and cause greater pollution to the environment. Nickel-metal hydride battery technology is relatively mature and durable, but it is bulky and contains heavy metals. The ternary lithium-ion battery has a higher energy density and longer cycle life. Tesla Model 3 uses this battery, but it has insufficient stability at high temperatures. The lithium iron phosphate battery has strong thermal stability, safety, and low cost, but its biggest power-on is the low charging efficiency at the low temperature. At present, the mainstream power batteries in the market can be divided into ternary lithium batteries and lithium iron phosphate batteries. The remaining power batteries, such as lithium manganate batteries, lead-acid batteries, and cobalt-acid batteries, are less used in the field of new energy vehicles due to factors such as battery performance and cost and are gradually eliminated from the market.

Key Comparisons

	LFP Batteries	Ternary Batteries
Cycling Life	Long	Short
CTP	Will be fully applied	Have been fully applied (Major suppliers)
Price	Predictable. Low but will experience a sharp increase in the 1st half of 2022 but is expected to convert to steady growth at the end of 2022.	Variable. High and expect to have sustained high growth in 2022 due to the lack of raw material.
Energy Density	Low	High
Stability	High	Low
Low Temperature Performance	~50%	~80%
Charging Speed	Low	High

Technical Analysis

1. Mechanism

LFP Battery

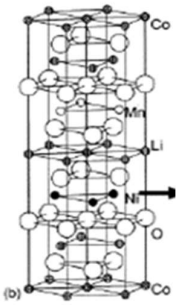
The anode material is lithium-ion adsorbed by graphite, and the cathode material is transformed between LFP and FP (ferrophosphate).

In the charging process, the cathode material is transformed from LFP to FP, during which the detached lithium-ion is adsorbed by the graphite. The chemical reaction equation is as follows:

$$LiFePO_4 - xLi^+ - xe^- \rightarrow xFePO_4 + (1-x)LiFePO_4$$

In the discharging process, the lithium-ion is detached from the graphite and is captured by the reduced FP, forming the LFP. The chemical reaction equation is as follows:

$$FePO_4 + xLi^+ + xe^- \rightarrow xLiFePO_4 + (1-x)FePO_4$$



Ternary Battery:

The anode material is the same as the LFP battery, which is the graphite adsorbing lithium-ion. The cathode material is a composite material made of nickel, manganese, and cobalt. However, since the different proportions of these three elements have very different features, there is no single chemical reaction equation for the ternary batteries. During the reaction, three elements have their usage. The tetravalent manganese doesn't participate in the chemical reactions, but is the stabilizer of the cathode material, providing high thermal stability as well as high structural stability. The cobalt is mainly tetravalent and partly participates in the reaction, mainly used to improve the conductivity of the material. The divalent nickel is the main element participating in the reaction. Nickel is charged and recharged under the chemical reaction.

2. Features of Materials

LFP Battery

The phosphate bond, the covalent bond of P—O, in the LFP is extremely stable. Thus, LFP is born with high thermal stability and pressure stability. Neither high-temperature situations nor overcharging will result in disintegration or spontaneous combustion. Besides, the capture and detachment of lithium-ion do not influence the structure of FP, so the LFP batteries have a relatively longer cycling life.

However, due to the poor conductivity of the LFP itself, the velocity of diffusion of lithium is not fast enough, which has an impact on the charge-discharge performance. This disadvantage is even worse in the low activity environment brought by coldness. At -20℃, the chemical activity of LFP is only around 50%~60% of its original, whereas the ternary batteries remain at an activity level of 80%. Moreover, the most important drawback is the low energy density

of LFP. One single electron requires a whole phosphate to participate in the reaction, resulting in less energy carried within the same weight compared to the ternary batteries. In addition, the granularity of LFP makes it hard to compress, which leads to less energy carried within the same volume.

Ternary Battery

Manganese, cobalt, and nickel have different pros and cons. The manganese can improve the safety and stability of ternary batteries, but having too much manganese will greatly reduce the energy density; the cobalt can significantly improve the conductivity and then improve the charge-discharge performance as well as the performance under low-temperature situations, but cobalt is expensive and thus having too much may increase the cost; the nickel can improve the capacity of the battery, but having too much nickel will reduce the cycling life and the safety of the batteries.

Based on the inherent property of the ternary battery, it obtains a higher energy density compared with the LFP batteries. The capacity of the ternary battery is around 1.5 times an LFP one. Also, the better conductivity of ternary batteries supports better charge-discharge performance and performance under low-temperature circumstances.

Inevitably, the thermal stability of ternary batteries is relatively poor. This feature leads to a higher possibility of disintegration under high temperatures. In extreme situations, the bound oxygen can be released, which may cause disintegration and even an explosion. This is the main bottleneck of the ternary battery technology.

3. Structure of batteries

The technology of the LFP battery has already reached the bottleneck and is almost impossible to utilize. Thus, the main direction of utilizing an LFP battery is to adjust the physical structure of the battery, to improve the poor energy density. The ternary battery has no optimal solution now and can be improved in many distinct aspects. The following will only concentrate on the physical structure of batteries.

LFP battery

There is CTP technology led by CATL (Contemporary Amperex Technology Co., Limited), and Blade Battery technology led by BYD (BYD Co., Limited). Both of these are focusing on improving space utilization to improve the capacity per unit volume.

The CTP technology utilizes the junction of original small cells of the batteries. By packing more cells into larger cells, it reduced the volume of the shell so the capacity is improved.

The Blade Battery technology is to flatten the cells while making them larger, through which the cells can be arranged closely to each other. This method acquires better space utilization as well as better heat dissipation.

Ternary battery

GAC Aion (GAC Aion New Energy Automobile Co., Ltd.) released Magazine Battery technology. By placing each battery cell into a single safe compartment, the safety and stability of ternary batteries can be secured. The nano-scale coating material is used to wrap the unstable cathode. The adiabatic compartments secure those cells will have no impact on each other to avoid spontaneous combustion and explosion.

Cost Analysis

Summary

The LFP battery will keep its price advantage in the short term due to the rising price of both LFP and ternary batteries. This will become clearer after the major companies put the second phase of the LFP battery project into operation and fill up the gap between supply and demand in the second half of 2022. In the middle and low-end markets, LFP's advantage will be more obvious. While in the high-end market, the ternary battery will continue to lose market share due to its great price disadvantage. In the long run, the maturity of CTP and CTC technology and the improvement of nickel and cobalt inventory will continue to inject vitality into the cost reduction of ternary batteries.

1. Impact of CTP and CTC technologies on costs

With the deep cooperation between CATL and Dynanonic in 2021, CATL's CTP technology released in 2019 will also be used in LFP in all aspects. Meanwhile, BYD's new "Blade Battery" in 2020 will also be installed on a large scale in its vehicles in the future. In the past, the main target of CTP technology was ternary batteries, so the cost of ternary batteries is approaching LFP. After CTP technology is fully applied to LFP, it is believed that the cost of LFP will be further reduced, thus expanding the advantage of LFP in the low-end and mid-end market.

The following figure (Figure 1) shows the estimated cost comparison of different types of batteries before and after the application of CTP technology.

Battery	LFP	NCM523	NCM622	NCM811	LFP	NCM523	NCM622	NCM811
Battery Pack	Traditional	Traditional	Traditional	Traditional	CTP	CTP	CTP	CTP
Unit Cost	0.57	0.7	0.68	0.69	0.48	0.61	0.59	0.59
Cathode Material	0.06	0.19	0.17	0.19	0.06	0.19	0.17	0.19
Diaphragm	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Copper Foil	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Electrolyte	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Graphite Anode	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Aluminum Battery Case	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04
NMP	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01
Battery Management System	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03
Battery Box	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02
Other	0.18	0.18	0.18	0.18	0.12	0.12	0.12	0.12
Unit Energy Cost	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Unit Labor Cost	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Unit Production Cost	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Total Unit Cost	0.7	0.82	0.8	0.82	0.57	0.69	0.67	0.68
Total Cost YoY					-19%	-16%	-16%	-17%

Figure 1

Source: 《CTP 降本增航，助 LFP 渗透续航 500km 以下乘用车》，新时代证券研究所 , 2020

CATL will realize the integrated CTC technology in 2025, and further realize the intelligent CTC technology in 2030. Nowadays, CTC technology is still far away from us. But in the long run, CTC technology will become an important part of power batteries to continue to reduce costs in the future.

2. Impact of cathode materials on cost.

The main difference between ternary battery and LFP is their cathode materials which more than 30% in the total cost of power battery.

LFP Battery

The cathode material of the LFP battery is LFP material. Since the subsidy policy slipped and the price advantage of LFP was highlighted to 90,000 yuan in the closing stage. in 2022, the rising trend of LFP material price continued, breaking 100,000 yuan in the opening year, and is expected to have a lot of room for growth in the middle of the year. The reasons for the surge of LFP battery price are the following two points. First, from the increase in its raw material price, lithium carbonate. lithium carbonate was RMB 88,500 per ton 500 per ton representing an increase of 71.84%. Lithium carbonate mainly comes from the Salt Lake lithium extraction, the Salt Lake in the winter production capacity will decline, in April-October is the peak production season, this seasonal cycle will lead to the supply and demand of lithium carbonate show cyclical changes, further leading to the price of lithium carbonate has a cyclical rise and fall. But in terms of the overall trend, the price of lithium carbonate is continuing to go up. The second reason for the rapid increase in demand led to the production capacity cannot match it, thus creating a supply-demand imbalance. The main expansion of lithium iron phosphate processing plants on the market is concentrated in the second half of 2020 and 2021, which cannot reach production in a brief period. Several major companies are expected to put the second phase of the project into operation in the second half of 2022. All, in early 2022, lithium iron phosphate will be extremely short supply, which may lead to a new price growth peak.

Ternary Battery

The ternary battery is divided into NCM and NCA, NCM ternary battery's cathode is mainly composed of nickel cobalt manganese and lithium, NCM represents three different raw materials, the number behind represents the ratio of the content of these three. The ternary battery is currently mainly available in NCM523, NCM622 and NCM811. Among these three main materials, manganese is less expensive and accounts for a lower percentage, so here we only consider the highest percentage of nickel and the most expensive cobalt.

The following (Figure 2, Figure 3) shows the global production of cobalt and nickel resources:

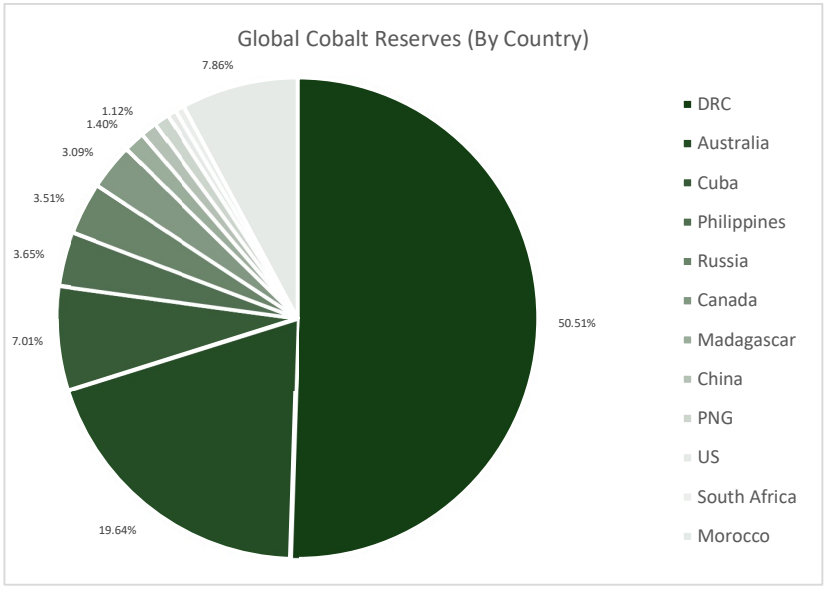


Figure 2

Source: 《钴行业专题：钴价创三年新高，行业成长性较强》，国信证券经济研究所，2021

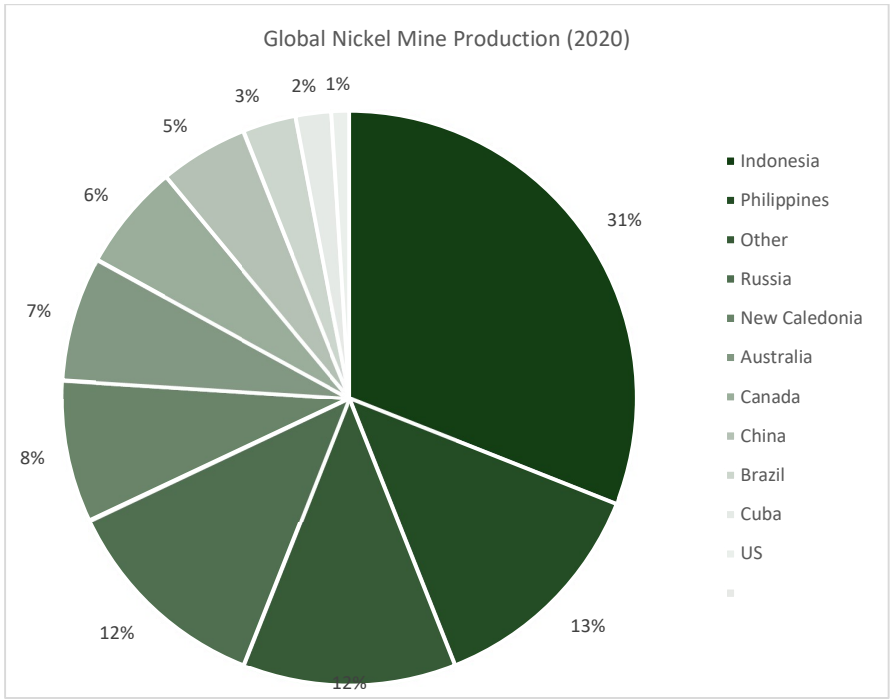


Figure 3

Source: 《镍行业专题：镍的供需变革》，国信证券经济研究所，2021

It can be seen from the charts that the world's major cobalt and nickel resources are not in the NEV producing and consuming countries, which also makes the future of these two resources more uncertain. At the same time, soon the production of ternary batteries may also have the possibility of being made containment on the raw material end.

Nickel

For nickel, as of December 31, 2021, the price of nickel sulfate was 38,000 yuan per ton, up 18.75% from the beginning of the year. From the graph (Figure 4) we can see that the price of nickel has been rising since 2019 and the growth rate has now slowed down. A large part of this is due to the impact of the COVID-19, after the start of the epidemic, some minerals were forced to shut down production, while during this period ternary batteries are benefiting from the rapid development of policy dividends, demand has increased dramatically, thus leading to an imbalance between supply and demand, the price of nickel all the way up. In the beginning of 2022, though nickel stocks have remained on a downward trend in the last twelve months, it is believed that they will be replenished to a certain extent in 2022 with the increase in capacity. Nickel prices should trend higher and then lower in the coming period, moving from a shortage to a surplus. However, with the outbreak of the omicron virus and the war between Russia and Ukraine, nickel prices continue to rise. This has led several new energy vehicle manufacturers to announce price increases for their vehicles. The price increase of Nickel will still be a trend in short run. In the long run, we believe the price of Ni will finally decline after the volatility of the market. At that time, it will benefit the ternary battery, which is moving towards a high nickel trend today.

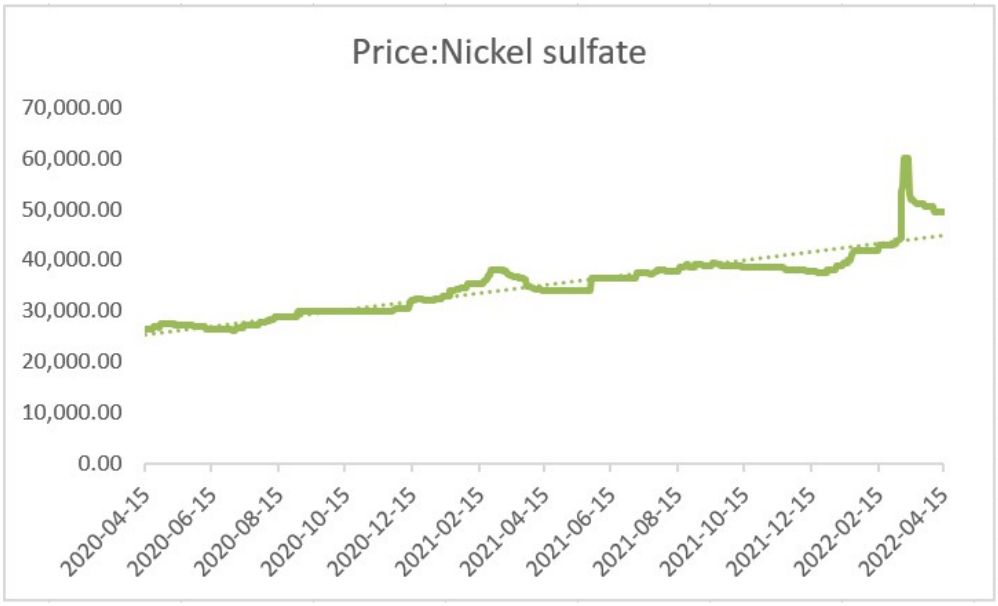


Figure 4

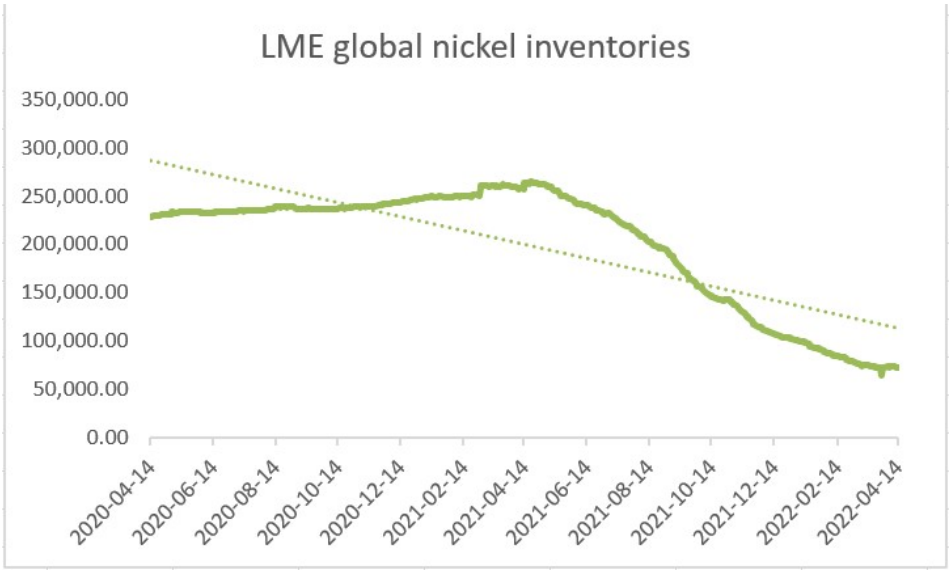


Figure 5

Source: Wind, ccmn.cn

Cobalt

For cobalt, as of December 31, 2021, the price of cobalt sulfate was 106,000 yuan per ton, with an increase of 81.2% from the beginning of 2021. At present, the high price of cobalt is one of the biggest barriers to the cost of raw materials for ternary batteries, which is one of the reasons

why many manufacturers are vigorously developing and implementing NCM811 and high nickel and no cobalt for ternary batteries. From the chart below (Figure 6), we can see that the price of cobalt has been rising continuously after 2019 and has been maintaining a high growth rate in recent times. Although ternary batteries are moving towards high nickel and cobalt-free, this is still bad news for the cost control of ternary batteries in a short period of time. At present, cobalt prices are said to rise mostly because of the extreme imbalance between supply and demand. Since Glencore announced the shutdown of the Mutanda copper and cobalt mine in 2019, cobalt stocks have been at a low level. For the future, whether Glencore, a supply-side oligarch accounting for 33% of the total global cobalt production, can resume the cobalt output from the Mutanda copper-cobalt mine in 2022 or recent years is the biggest variable of the future cobalt price. In the short term, the price of cobalt will continue to rise. After the initial recovery of cobalt production capacity and the shortage of inventory is eased, it may show a high and bumpy trend.

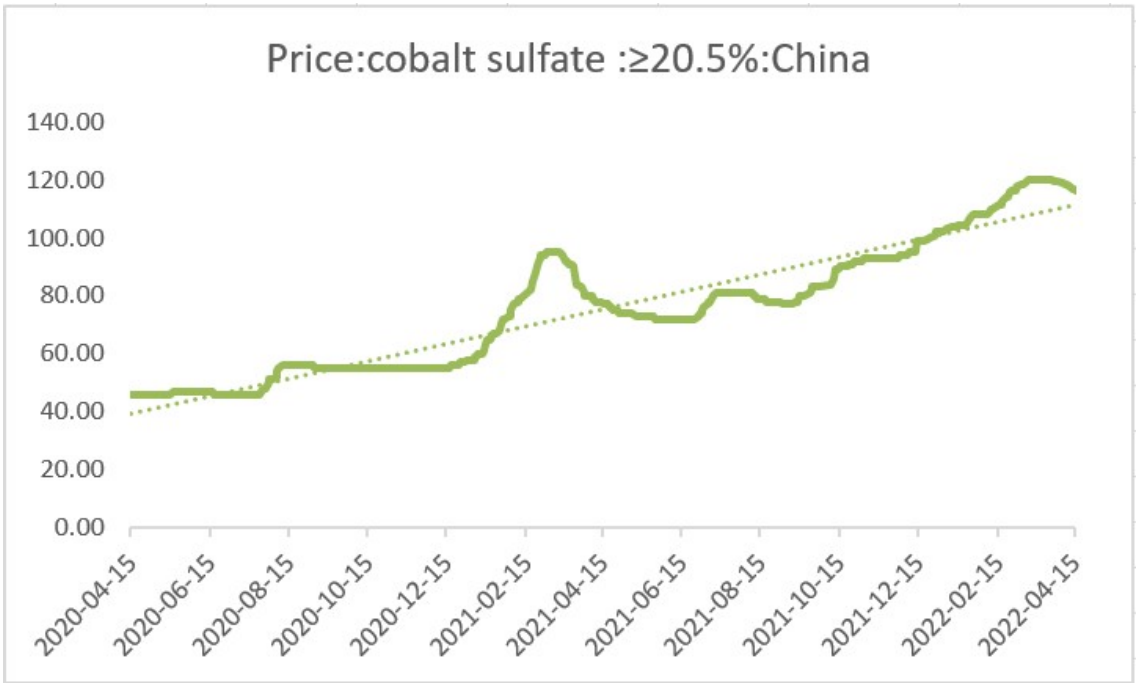


Figure 6

Source: Wind, ccmn.cn

Lithium Hydroxide

As of July 28, 2021, the price of lithium carbonate was RMB 88,500 per ton and the price of lithium hydroxide was RMB 97,500 per ton, representing an increase of 71.84% and 98.98%, respectively, during the year. (Figure 7) Among them, lithium carbonate is mainly used to manufacture LFP and some non-high nickel ternary batteries, while high nickel ternary batteries must be manufactured using lithium hydroxide. Lithium hydroxide is derived from the way lithium ore is smelted, and this determines the price of lithium hydroxide is closely related to the price of lithium. The price of lithium concentrate is trending up slightly, which will have a negative impact on the cost of lithium hydroxide in the future. Overall, the price increases of both types of lithium used to make power batteries are exceptionally large, and the growth rate of lithium hydroxide is much higher than that of lithium carbonate, which will further widen the cost gap between high nickel ternary batteries and LFP.

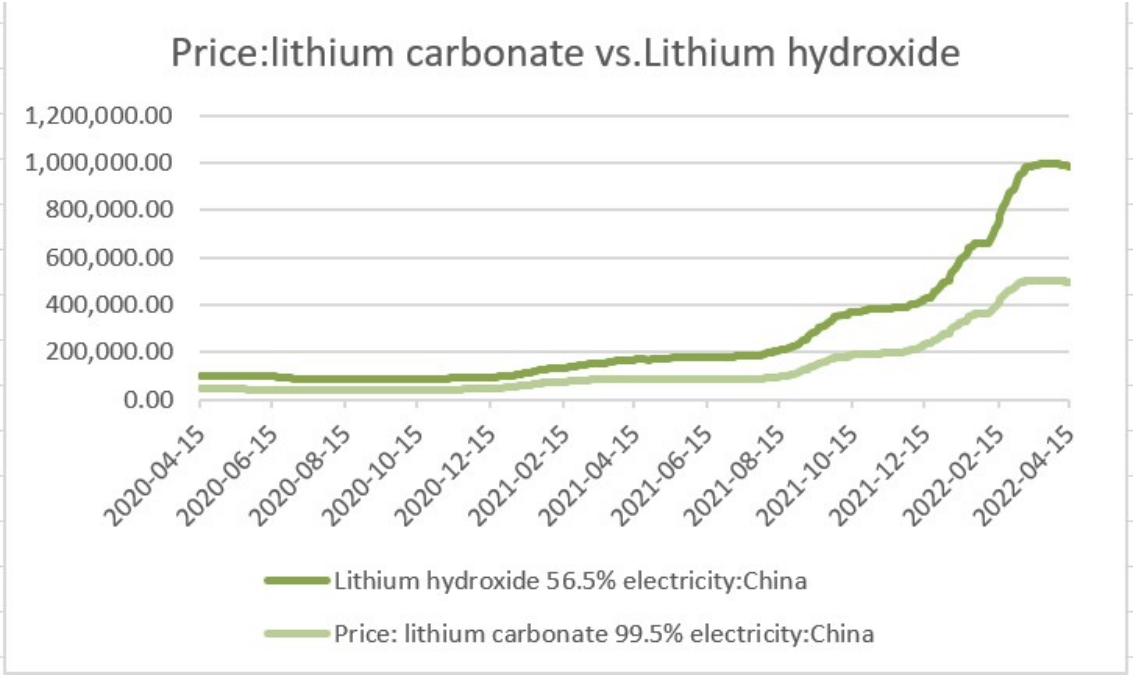


Figure 7

Source: Wind, ccmn.cn

3. Impact of anode materials on cost.

For ternary battery and LFP, there is no difference between the negative materials of the two, however, the negative materials account for a different proportion of the total cost (Figure 9).

	Cathode	Anode	Electrolyte	Diaphragm	Model	Pack	BMS	Labor	Production	Total
Ternary(523)	238.99	122.59	20.93	31.29	102.8	58.15	74	24	52.16	724.91
%	32.97%	16.91%	2.89%	4.32%	14.18%	8.02%	10.21%	3.31%	7.20%	100.00%
LFP	106.27	131.87	25.28	34.86	105.77	58.19	74	24	52.16	612.4
%	17.35%	21.53%	4.13%	5.69%	17.27%	9.50%	12.08%	3.92%	8.52%	100.00%

Figure 8

Source: 《动力电池成本结构拆分》，信达证券研发中心，2020

(Figure 10) We can see that the cost of cathode material accounts for 16.91% in ternary batteries, but 21.53% in LFP, which means that the change of cathode raw material price has more influence on the cost of LFP in terms of percentage. From the current power battery on the market, the anode material of both is graphite. From the data on the market, we can see that most of the graphite electrodes are on a slight upward trend overall in 2021 but have fallen in the last 90 days. And this will also have a slight impact on the price of ternary batteries and LFP.

Product	Low	High	Latest	30-day	60-day	90-day	180-day	360-day
Graphite Electrode R.P.D400mm EXW China	-	-	1.19%	8.50%	8.56%	8.85%	17.29%	27.20%
Graphite Electrode H.P.D300mm FOB China	-	-	0.00%	-0.94%	-2.54%	-1.62%	0.15%	4.47%
Graphite Electrode H.P.D400mm EXW China	-	-	0.00%	-1.74%	-4.21%	-3.35%	4.15%	6.89%
Graphite Electrode H.P.D450mm FOB China	-	-	0.00%	-1.04%	-3.12%	-2.38%	0.20%	5.91%
Graphite Electrode H.P.D500mm EXW China	-	-	0.00%	-1.80%	-5.76%	-5.15%	2.04%	5.29%
Graphite Electrode U.H.P.D500mm EXW China	-	-	0.00%	-1.62%	-2.73%	-5.50%	-3.80%	-3.33%
Graphite Electrode U.H.P.D500mm FOB China	-	-	0.00%	-0.60%	-1.93%	-1.31%	0.22%	7.21%
Graphite Electrode U.H.P.D600mm EXW China	-	-	0.00%	-0.86%	-3.68%	-3.87%	-2.25%	-2.06%

Figure 9

Source: Asian Metal 2022.1.15

Policies

Summary

At the beginning of the development of new energy vehicles, the LFP battery dominates the market by the advantages of its cost, safety and cycle life, but due to the dividend of the national subsidy policy since 2016, making ternary batteries rely on high energy density to overtake the original market share occupied by LFP. Another turning point is 2020, the national subsidy policy slippage, as well as technological innovation led by CATL and BYD, ternary batteries high cost and low safety disadvantages, LFP regained the market share.

Policy Roadmap and Highlights

Year	Policy	Illustration
2009	*Notice on The Pilot Work of Demonstration and Promotion of Energy Conservation and New Energy Vehicles* *《关于开展节能和新能源汽车示范推广试点工作的通知》*	The policy started the era of NEV subsidies. LFP batteries are widely used in commercial vehicles due to better safety and rapid development driven by the policy.
2016	*Notice on Fiscal Subsidy Policies Adjustment for The Promotion and Application of New Energy Vehicles* *《关于调整新能源汽车推广应用财政补贴政策的通知》*	For the first time, the policy set requirement on the energy density of batteries, which promoted ternary batteries due to its high energy density.
2019	*Notice on Further Adjustment on Fiscal Subsidy Policies for The Promotion and Application of New Energy Vehicles* *《关于进一步完善新能源汽车推广应用财政补贴政策的通知》*	Subsidies slipped by 50% on average.
2020	*Notice on Adjusting Fiscal Subsidy Policies for The Promotion and Application of New Energy Vehicles* *《关于完善新能源汽车推广应用财政补贴政策的通知》*	For the subsidies in the year 2020, 2021, and 2022, the amount will lower by 10%, 20%, and 30% compared to the previous year.

Figure 10

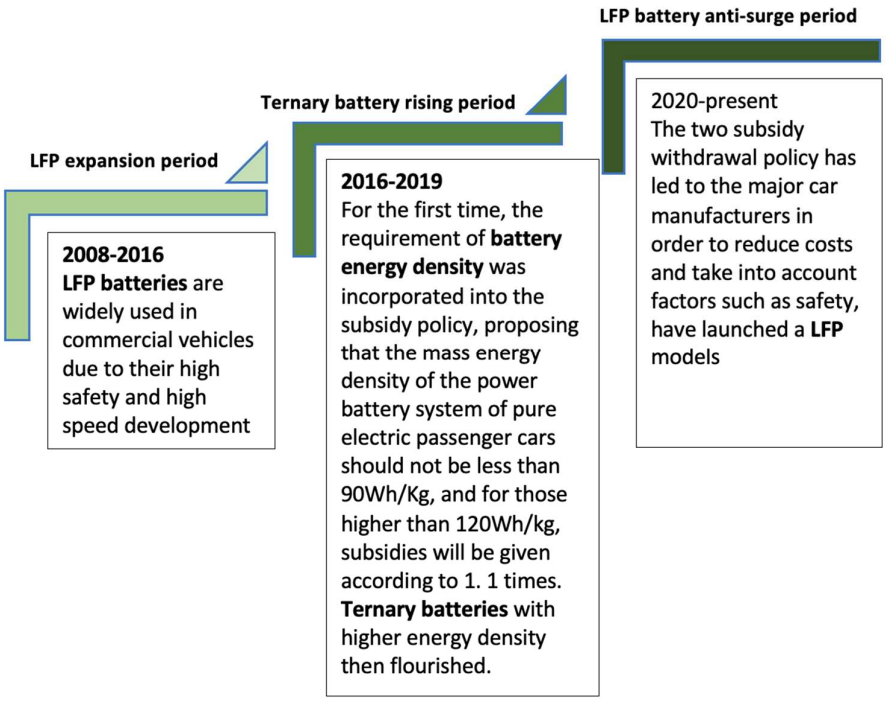


Figure 11

Phase I: LFP expansion period

At the beginning of the development of new energy vehicles, in the "Notice on The Pilot Work of Demonstration and Promotion of Energy Conservation and New Energy Vehicles" mentioned in the policy of subsidies for the public service sector to purchase new energy vehicle(EV) demonstration and promotion of pilot work of commercial vehicles. It can be seen that, taking into account emissions and fuel economy, the policy is tilted to commercial vehicles, while LFP batteries with its high safety, long cycle life and other advantages, so that it quickly became the first choice for commercial vehicle batteries, market share is far ahead. As of 2016, LFP batteries in the domestic power battery market share of up to 69%.

Phase 2: Ternary battery rising period

After 2016, in the "Notice on Adjusting the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles", the state for the first time included the energy density of the battery system in the assessment criteria, proposing that the mass energy density of the power battery system of pure electric passenger cars should not be less than 90Wh/Kg, and the subsidy should be given to those higher than 120Wh/kg by 1. 1 times. It can be seen that

higher energy density, longer range products will receive higher subsidies, the policy directly promotes the rapid expansion of the ternary battery market with higher energy density. 2017 with the national adjustment of new energy vehicle subsidy policy, the first time the battery energy density into the subsidy reference index, LFP and ternary battery market position has changed. LFP battery energy density is mainly concentrated in 70-80Wh/Kg, cannot meet the standard of "pure electric passenger car power battery system mass energy density of not less than 90Wh/kg, higher than 120Wh/kg by 1.1 times to subsidize", which led to the market This has led to a gradual shift in the market towards ternary lithium batteries with higher energy density.

In 2018, the market share of LFP batteries was surpassed by ternary lithium batteries for the first time. According to the Power Battery Alliance data, in 2018, the cumulative output of domestic power batteries reached 70.6 GWh, of which ternary batteries accounted for 55.5%, and the share of LFP batteries dropped to 39.7%.

Phase 3: LFP battery anti-surge period

The rapid development of ternary cathode materials after 2017, without the help of subsidies, and since 2019, in the "Notice on Further Improving the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles", the subsidy standard for new energy vehicles has slipped by about 50% on average. With the gradual retreat of new energy vehicle subsidies, the state has also stopped further promotion of vehicle battery pack energy density and range, and the cost has become something that each vehicle manufacturer has to consider. At the same time, the policy to enhance battery safety to the extent that the policy, due to LFP battery safety is higher, while the cost is lower, these two advantages become an important boost factor for the return of LFP batteries.

With CATL (588.000, -2.00, -0.34%) CTP technology and BYD (268.120, 0.99, 0.37%) blade battery technology launched one after another, the lower cost, improved performance of LFP battery has again gained the favor of OEMs.

Demand Analysis

Summary

Driven by skyrocketing demand of electrical vehicles in China, Chinese automotive battery is a highly concentrated market with the majority of market share by few big players. We propose an analytical framework to predict the favourability of either LFP battery and Ternary battery through the sales structure of EVs by individual and institutional customers, with the assumption that institutional needs of EVs have looser spatial requirement and therefore lower bar for energy density level of automotive batteries.

Automotive Battery is a highly concentrated market

CATL, the bellwether of the power battery market, has 45.6% and 58.9% market share in the LFP market and Ternary Battery market respectively. Together with other smaller top players BYD Co., LG Chem, China Aviation Lithium Battery Co., and Gotion High Tech Co., these sellers in the market feature strong bargaining power. Thus, top runners' technical roadmap and focuses are important investment factors to consider. The above sections have covered the upper and middle stream factors, this section will focus on the bottom steam factor—demand analysis of Electrical Vehicles (EVs).

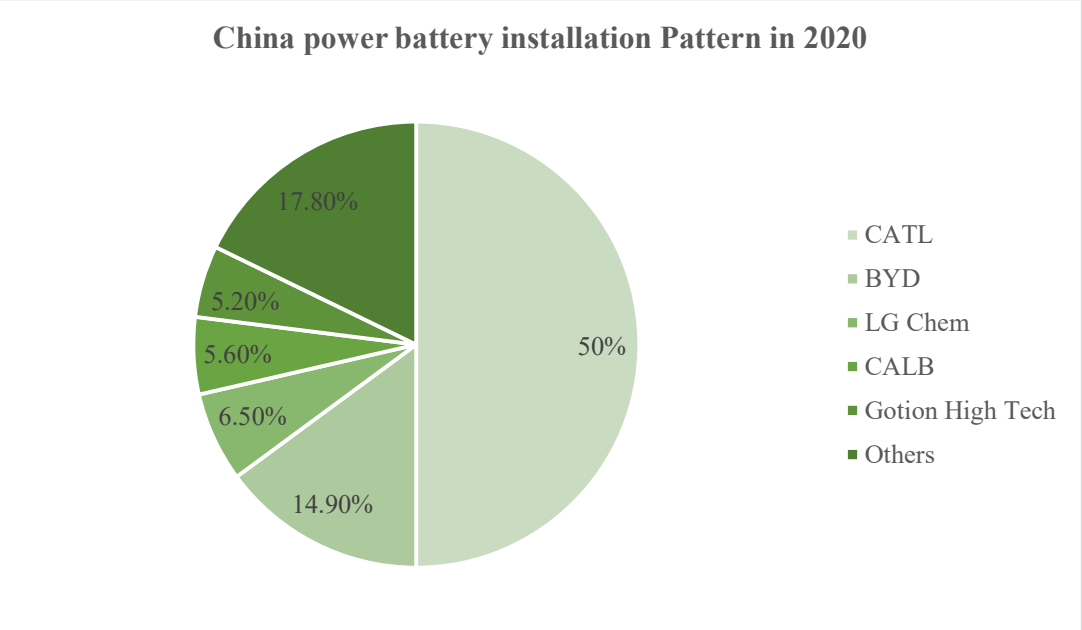


Figure 12
Source：动力电池产业创新联盟，平安证券研究所

Rising demand for EVs drives the growth of Chinese Automotive Battery Market

According to the China Society of Automotive Engineers publication "*Energy-saving and New Energy Vehicle Technology Roadmap 2.0*" in 2020, Chinese New Energy Vehicle (NEV) penetration rate will grow from 12.9% (2020) to 40% in 2030 and more than 50% by 2035. The sales of passenger NEV will grow from 3,311k to 16,400k, pushing the forecasted output volume from 158.2GWh in 2020 to 919.4GWh in 2025.

Ternary Battery Versus LFP Battery from application scenarios

While the booming prospect of Chinese NEV drives the growth of Automotive Battery, and current market leaders in the Battery market like CATL have not yet tilted their resources on a single technical direction between Ternary Battery and LFP, both directions have their comparative advantages when we dive deeper into different vehicle categories.

Featured with higher energy density and better performance under cold weather, ternary batteries have occupied larger market share in recent years. Although with lower energy density, LFP battery features safer performance as well as low cost, gaining its popularity among public transportation. Currently, LFP has a larger market share (~90%) in the specialist and public NEV market in China. Specialist NEV and public NEV have looser requirements on spatial efficiency and thermal management since these categories of vehicles are generally more spacious, leaving the doors for prolonging recharge milage through packing more batteries.

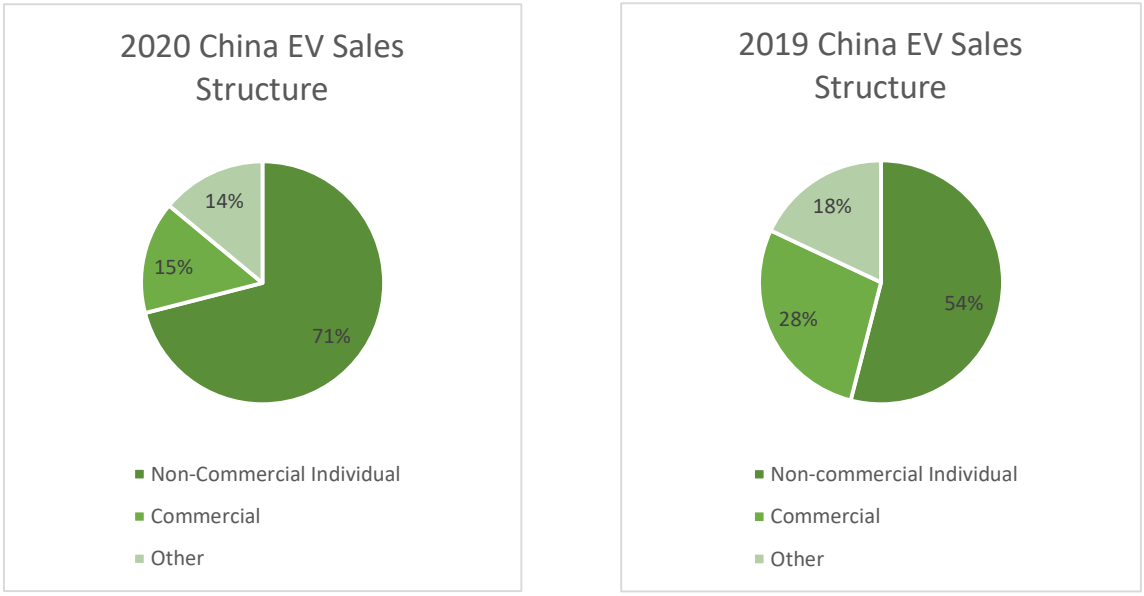


Figure 13

Source：交强险，平安证券研究所

The market share of NEV for individual use (passenger NEV) is growing and has already outweighed the organizational used cars, giving more comparative advantage to the ternary battery from logic stated above.

Conclusion

As the main power source and core components of new energy vehicles, the future development direction of power batteries will have an important impact on the development of new energy vehicles, and the impact of lithium iron phosphate batteries and ternary batteries in technology, policy, and demand direct different development trends.

As far as the technical route is concerned, the chemical process and improvement of lithium iron phosphate batteries have reached the technical bottleneck, and theoretically there is no room for improvement, so it is only possible to optimize the physical structure; and the current chemical optimal solution for ternary batteries is still not available. In conclusion, there is a trend of high nickel and cobalt-free in general. The inherent properties of lithium iron phosphate materials are destined to have a low energy density, but the safety problems of ternary batteries may be solved through deeper research and development. Therefore, lithium iron phosphate has better stability in the short term, but has limited prospects in the long run, and will inevitably be replaced by more advanced batteries.

In the early stage of the development of new energy vehicles, lithium iron phosphate batteries dominated the market with their advantages in cost, safety and cycle life. However, due to the dividends of the national subsidy policy since 2016, ternary batteries have surpassed iron phosphate with higher energy density. Lithium's previously occupied market share. With the decline of the national subsidy policy in 2020, as well as technological innovations led by CATL and BYD, and the disadvantages of high cost and low safety of ternary batteries, lithium iron phosphate will counterattack in the future and occupy a larger market share.

In the short term, lithium iron phosphate will be relatively favored by automakers in the next 1-3 years due to its advantages in price and safety; in the long run, the problem of ternary battery safety may be solved, while the price will also be well controlled with technological improvements such as more advanced packaging. Higher energy density and technical upper limit also give ternary batteries a better prospect in the long-term duel with lithium iron phosphate batteries.

Though the long-term duel depicted in this report seems to have a final winner, it's possible that another wave of electrical vehicles revolution rules out the lithium battery and introduce the next-generation battery that's not in consideration of this report.