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INVESTMENT MANAGERS

Investment viewpoint

Asia is dominating the electric vehicle battery market

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Key points

- Most developed countries have set their electric vehicle (EV) penetration rate targets above 50% by 2030.
- China is leading the world with the highest EV penetration rate of 32%, followed by 27% in Europe. The US and Japan are behind with only 8% and 4% respectively.
- Global EV battery capacity is anticipated to grow 21% per annum until 2030.

Larry Pun
Senior Analyst

Introduction

Car electrification is an unstoppable structural trend. We are past the inflection point of this revolution, often understood to be when a new technology reaches 5% of total industry sales. In the first half of 2023, global EV penetration rate (EV sales as a percentage of total sales) reached 15%. So far, the outperformer is China, which is leading the world with its 32% EV penetration in the first half of 2023. The laggards are the US and Japan, which had significant ground to make up. Most developed countries have nevertheless set their electric vehicle (EV) penetration rate targets above 50% by 2030. With a roadmap of reaching their ambitious target by the end of this decade, the industry is almost certainly guaranteed to deliver strong growth.

In order to ride on this structural trend, the market is looking beyond EV brands, into its whole supply chain. Recently, EV battery cells have been in focus which makes sense, as it is the largest and most expensive component within an electric vehicle. In fact, car electrification is not even possible without a sharp increase in production from the battery industry.

The dynamics of the battery industry are less visible than those of the vehicle manufacturers, but it is equally complicated. Given the undoubted growth potential, many new companies have joined the race. While these new joiners have credible ideas for product development, those ideas may not be backed by sufficient financial support. The convertible bond asset class can work hand in hand with issuers to drive this revolution. Recently, we have seen several new issues from the EV battery space. This is likely to be just the beginning of their entry to the convertible bond market. We expect many more to come.

Like all new industries, growth comes with volatility. Not all players will survive this fierce survival of the fittest race. A sound understanding of the complicated industry landscape and different geopolitical considerations is important before engaging with the industry evolution.

GLOBAL BATTERY VALUE CHAIN

Battery material upstream	Lithium, Nickel, Cobalt, Manganese	Graphite	LiPF6 (Solute)	Separator • Asahi Kasei • Toray Industries • SKIET
Battery components	Cathode • Posco Future M • Ecopro BM • L&F • LG Chem • Umicore • Shanshan	Anode • Posco Future M • Mitsubishi Chem • Shanshan	Electrolyte • Shanshan • Mitsubishi Chem	
Cell Assembly/Module Production	Mono Cell → Module			
Pack assembly	Battery Pack: LG Energy Solution, Samsung SDI, SK Innovation, Panasonic, BYD, CATL			
EV OEM	Tesla, Rivian, Lucid, Mercedes, BMW, Ford, BYD, Nio, Li Auto			

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The electric battery supply chain has already become the largest thematic exposure in our Asia Convertible Bond strategy. With our knowledge and experience, we are confident in our ability to choose the winners for investors wishing to participate in this revolution.

Structure of a battery cell

Batteries are not intuitively an exciting product. It is also true that there has not been much innovation. However, without the emergence of lithium-ion batteries, the whole mobile movement, which led to the introduction of laptops and smartphones, would not have been possible. That same battery technology is now breaking into the car industry to drive the electrification revolution. Also, the economies of scale already achieved by the EV battery sector are benefiting the grid energy storage sector, often using the same batteries.

The basic structure of a battery has not really changed. It is still made up of electrodes (cathodes and anodes) separators and electrolytes and all batteries still work on the same principle, with current being produced by charged atoms flowing from one end to the other. Lithium-ion batteries refer to a category of batteries which use lithium ion as the charged atom. Different material has been used for the electrodes to improve either cost structure or performance.

If we look at the cost breakdown of a battery, by far the single largest cost component is cathode material, which makes up 52% of total material cost. It is followed by separators at 16% and 14% for anode material. Cathode material does not only constitute the most value creation along the supply chain, but also largely dictates the performance of a battery. Naturally, its production has drawn in many new manufacturers.

In cathode material production, an active material is mixed with other additives to form a paste. Then this paste is deposited on to the current collector. Currently there are several possible choices of active material, different oxides of lithium, nickel, cobalt and manganese.

BATTERY TYPE COMPETITION

	NCM	NCMA	NCA	LFP	LFMP
Chemical Formula	Li(Ni, Co, Mn)O2	Li(Ni, Co, Mn, Al)O2	Li(Ni, Co, Al)	LiFePO4	LiFe0.5Mn0.5PO4
Capacity	170~210mAh/g	180~220mAh/g	190~220mAh/g	150mAh/g	150~170mAh/g
Voltage	3.6V	3.6V	3.6V	3.2V	3.4V
Energy Density	600-700Wh/L	~720Wh/L	650-750Wh/L	~480Wh/L	520-580Wh/L
Capacity retention (%)	80-97	85-95	80-90	>97	>95
Players	L&F, EcoproBM, Posco Future M, Umicore, Nichia, Shanshan, Ronbay, Easpring	L&F, EcoproBM, Posco Future M, LG Chem	EcoproBM, Sumitomo, BASF Toda, Nichia, SDI in-house	Dynanonic, BTR, Hunan Yuneng, Hubei Wanrun, BYD in-house, Pulead	Dynanonic began world's first commercial production in 4Q22

Source: Nomura research.

Each element is added for a reason. For example, nickel content mainly determines energy density and cathode capacity. As for cobalt, it is added to increase battery life and improve better structural stability. Manganese can also help to improve thermal stability.

Battery cell production business model

Higher electric vehicle penetration necessarily implies lower prices to reach consumers in the mass market. So far, EV brands have been passing this pricing pressure onto the supply chain. Battery makers are an obvious target, given that the battery cell pack is the most expensive component of an EV, accounting for almost one-third of its value.

Battery makers are not just subject to pricing pressure from customers, but also to high raw material costs from suppliers further upstream. In battery production, material processing is the core step, which is a high variable cost operation, mostly undertaken by cathode and anode producers. A large part of that cost comes from the raw materials. The selling price of processed material is also highly dependent on the raw material cost. Under this kind of pricing and cost structure, it makes sense for the industry overall to adopt a cost-plus business model, to charge a fixed processing fee on the amount of processed material. The price risk of raw material is mostly borne by the EV makers.

With this business model, volume growth is the key earnings driver. As a result, all the upstream supply chain and EV battery makers are motivated to increase their market share as much as possible. Sharp industry capacity expansion is guaranteed in the foreseeable future, in our view. Nomura expects global EV battery capacity to grow 21% per annum until 2030. While this rapid growth has led to substantial plant overcapacity in China, we do not think there will be structural over-supply outside China, where demand growth is outpacing existing supply capacity. Ultimately, we expect there will be a handful of winners with meaningful market share.

Looking at the current industry landscape, there are two battery supply chains globally. The largest supply chain is located in China. South Korea is also catching up in the race to build a stronger presence in higher-end battery production although they are still lagging.

China was an early mover in EV adoption with supportive government policy. Its EV penetration is the highest of all the major economic blocs, hence, it makes sense that it has developed its battery supply chain on-shore. It is estimated that China accounts for an overwhelming 73% share of global battery capacity. In terms of capacity, Korea's presence is still small at this stage, but its battery type is considered to be at the higher end of the scale.

China's choice of cathode active material is lithium iron phosphate (LFP), which is not only cheaper, but its patent also expired in 2021. One drawback is that its energy density is considered less efficient. Considering all the pros and cons, LFP is still battery type of choice in China.

Outside China though, different cathode materials are being used. Nickel manganese and cobalt (NMC) cathodes were initially adopted by global EV brands albeit LFP is increasingly used by western carmakers like Tesla, Ford or VW[1] due to its low-cost and safety. Korea however has been moving in the direction of NMC adoption. Material cost is higher, but performance in terms of longer EV range is also higher.

Generally, EV batteries are moving to higher energy density with a longer life-cycle and better thermal stability. All these qualities directly link to the performance of the vehicle. In the near term, the battery industry targets energy density to reach 800 Wh/L, which can provide EVs with a driving range of 600-700 km per charge, with less than 15 minutes of charging time.

The choice between different battery types is a trade-off between price and performance. At this stage, the two battery types still work well within their geographical territories. In the future, our current view is that different battery types may suit different EV segments. LFP based batteries can be used for lower end or entry-level EVs,

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while higher nickel content batteries can be adopted by the premium segment. This could mean that cathode makers will mostly benefit from the growing volume of 'mass market' EVs using LFP batteries. Regardless, what is clear is that Asian makers are dominating the EV battery supply chain.

Geopolitical considerations

Apart from complicated industry dynamics, geopolitical considerations add yet another layer of complexity. So far, China is still leading the world with the highest EV penetration rate of 32%, followed by 27% in Europe. The US and Japan are far behind with only 8% and 4% respectively. China's high penetration has been well supported by government policy. Following in Beijing's footsteps, governments in both the US and Europe have also started to provide more support. In the US, the Inflation Reduction Act (IRA) is expected to have a meaningful impact on the battery production landscape.

The scheme is highly complex with numerous requirements to fulfil. Full subsidies can reach USD 7,500 per car. As a start, half of the full tax credit is given, provided that 40% of the battery critical material is either extracted or processed in the US or by its free trade partners. There is also a step-up mechanism, with a goal of encouraging more onshore battery material capacity.

A current challenge is that 63% of global lithium supply is refined in China. We are yet to see whether the IRA will also encourage the expansion of the onshore lithium supply chain in the US.

Nevertheless, with this policy support, the US market will no doubt increase its EV penetration rate. Seeing this opportunity, many Korean battery makers have plans to ramp up their US operations. Korea is well positioned to ride on this wave. China has been leading the car electrification race, but as for the next growth market, our bet goes to the US.

New technology

The above are just some topics for discussion regarding the EV battery industry landscape. Apart from all these moving parts, there is also the subject of constant technological innovation. There are many studies on sourcing the next materials to be used in battery chemistry. Many companies have been investing substantial amounts of capital and effort to win the race of developing solid state batteries.

However, sodium-ion batteries seem a more immediate evolution than solid state batteries. Sodium-ion batteries just use sodium, the world's sixth most abundant element, instead of critical battery materials like lithium, cobalt, or nickel. Because of this difference, sodium-ion battery cost is expected to be between 40-70% cheaper than the standard EV batteries today. However, their drawback is that their energy density is substantially lower than standard EV batteries. Regardless, Chinese carmakers like Chery, JAC, JMEV[2] are planning to use these batteries from 2024 in low-end vehicles. It is important to monitor these developments, since the winners of this race will likely reshape the battery industry.

Instrument Name	Underlying Company	Country	Rating	Price (%)	Equity Sensitivity (%)	Premium (%)	YTB (in USD)	Duration (years)
L&F Co Ltd 2.5% 2030 USD	L&F Co Ltd	South Korea	B+	78.00	26	78	8.3%	4.3
LG Chem Ltd 1.25% 2028 USD	LG Energy Solution	South Korea	A-	100.60	32	40	1.1%	2.8
LG Chem Ltd 1.6% 2030 USD	LG Energy Solution	South Korea	A-	100.00	38	44	1.6%	4.7
Posco 0.0% 2026 €	Posco Holdings Inc	South Korea	BBB+	130.25	70	8	6.9%	3.0
Li Auto Inc 0.25% 2028 USD	LI Auto Inc	China	BB-	149.75	77	11	-8.3%	4.6
Nio Inc 0.0% 2026 USD	Nio Inc	China	B-	96.40	0	793	9.8%	0.4
Nio Inc 0.5% 2027 USD	Nio Inc	China	B-	86.00	0	697	11.8%	1.4
Nio Inc 3.875% 2029 USD	Nio Inc	China	B-	104.25	60	30	3.1%	5.4
Nio Inc 4.625% 2030 USD	Nio Inc	China	B-	103.50	65	30	4.0%	6.0
Umicore SA 0.0% 2025 €	Umicore SA	Belgium	BBB-	90.50	4	112	7.6%	1.8
MP Materials 0.25% 2026 USD	MP Materials	USA	B+	88.25	21	82	5.2%	2.5
Siemens Energy 5.625% 2025 €	Siemens Energy	Germany	BBB	92.75	85	0	11.9%	1.9

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Conclusion

In our convertible bond space, there are three names[3] offering direct exposure to this exciting battery theme so far. All of them are South Korean companies. This is due to the fact that the Chinese battery market is severely oversupplied, and Korean battery makers were quick to move to the factories in Europe and the US, where there is currently a tight market balance given high growth. Moreover, Korean battery makers have a strong foothold in the US where Chinese battery makers are less likely to gain market or subsidies access due to geopolitical tensions.

The first one is L&F, which is a standalone cathode material maker. It has already landed a contract with Tesla, which is also planning to produce part of its battery cells in-house. The second issue is an exchangeable issued by LG Chemical, with LG Energy Solution as its underlying shares. LG Energy Solution is the largest and most visible EV battery producer outside China. It is more positioned in downstream, but its parent LG Chemical has also been working to build up its own cathode material production. The third name is Posco, which is better known as the largest steel maker in Korea. Its case is less immediately obvious; its subsidiary Posco Future M aims to become a major cathode material producer. Posco has also made investments in lithium mines outside of China.

We strongly believe that vertical integration and deep pockets are two critical prerequisites for future success in battery competition. In our view, both LG Group and Posco are well positioned to benefit from the evolution of the battery industry.

In conclusion, car electrification is challenging the whole vehicle production supply chain. Our view is that battery cell production will end up becoming commoditised; at some point there will be market consolidation and not all manufacturers will come through this fierce survival-of-the-fittest competition. Besides, a growth industry usually comes with substantial volatility given the high level of uncertainty. In our view, the convertible bond asset class is an ideal vehicle through which to gain this exposure. We are not only confident that we can choose the future winners for our investors, but we also believe our experience and knowledge have prepared us well to navigate through the peaks and troughs of market sentiment.

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IMPORTANT INFORMATION