



China's Evolving EV Industry

Executive Summary

The electric vehicle (EV) market offers bright prospects in the long term supported by technological progress and strong incentives offered by many governments and China's in particular.

Opportunities to accelerate growth come from a variety of areas:

- Infrastructure development continues to progress with not just the number of charging stations but also charging speeds continuing to improve.
- Increased battery ranges and declining costs per kwh continue to improve EV competitiveness compared to traditional gasoline vehicles.
- EVs are also often associated with better software and digital technology, featuring large information screens and strong connectivity options.
- Government incentive schemes also continue to be favourable.

Risks include:

- Surging raw material costs driven by a supply-demand gap for batteries and battery materials which could be difficult to close due to long lead times for raw material capacity expansion and accelerating end demand.
- Fire risks for certain battery chemistries, the need to develop recycling infrastructure and an increasing impact on energy grids as EV penetration grows present technical challenges to be overcome.
- The need to drive consumer acceptance still exists as while charging times have improved noticeably, they still exceed refuelling times for gasoline vehicles.
- Competing technologies such as fuel cells, hydrogen engines, biofuels etc.

Overall prospects for continued EV penetration growth remain strong though in the short to medium term risks of disappointing volume growth are significant due to bottlenecks in the supply chain and surging raw materials prices which could reduce consumer affordability.

By segment we believe prospects for EVs are most promising in the premium segment where performance advantages can be significant and cost competitiveness is not as much of a priority. In addition, at the lower end, we believe EVs can be competitive as small, limited-range, city vehicles as smaller battery sizes negate many of the traditional disadvantages of EVs. In the mass market segment, cost, recharging times and intensifying competition with the entry of traditional automakers could make profitability a challenging prospect even without surging material prices. In addition, hydrogen-based technologies could eventually enjoy infrastructure advantages due to stronger synergies with renewable and green transition technologies that make them more suitable for the mass market.

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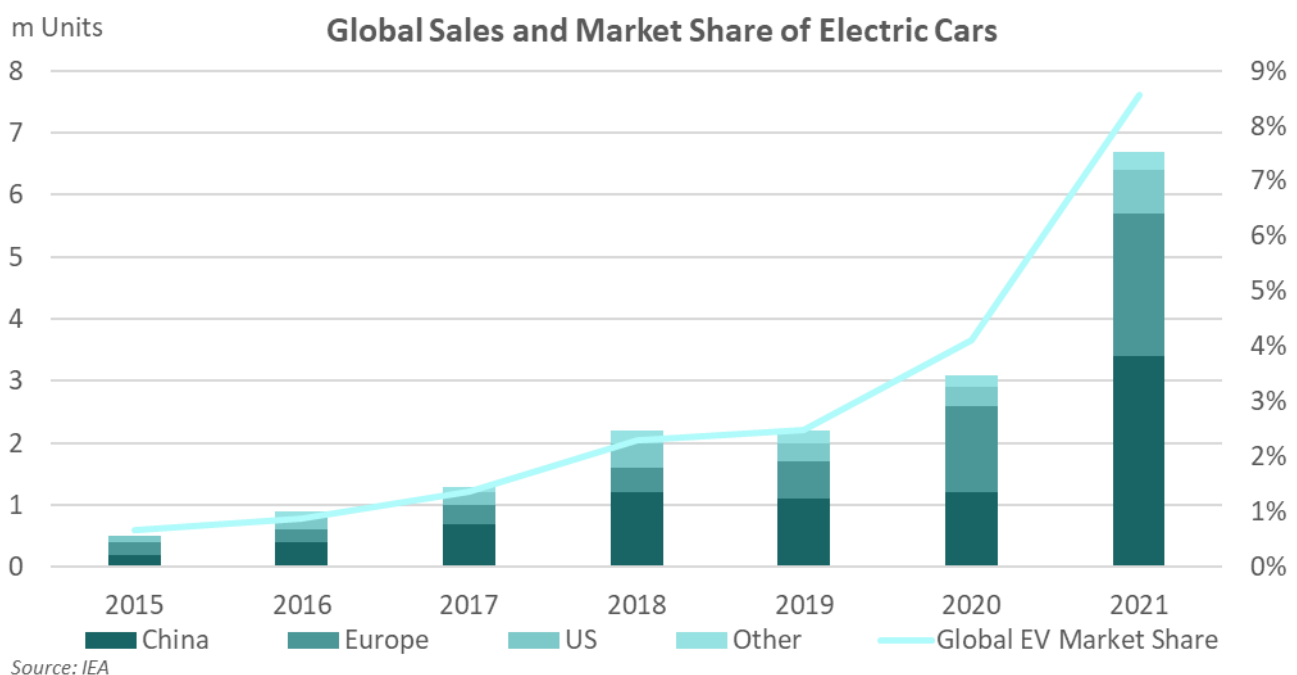
Industry Overview

EV technology has existed for over a century but EVs have only recently begun to challenge the dominance of the internal combustion engine.

- Improved battery technology has increased driving range and rapidly expanding production scale has driven significant reductions in battery costs resulting in lower production costs for EVs.
- In addition, increased environmental awareness globally among both governments and consumers has led to the implementation of ever stricter emission standards with the goals to achieve zero emissions for passenger vehicles generally being pulled forward.

In 2012, only around 130k EVs were sold globally, which is roughly equal to current weekly sales. Global EV demand during the last three years has been impressive. Even during the covid pandemic, global EV sales continued to grow while the demand for conventional cars declined mainly due to supply chain bottlenecks.

In 2019, EV sales were 2.2m (2.5% of the global car market) and in 2020 they grew by 36% YoY to 3m representing 4.1% of the total global car market. Further, EV sales volume more than doubled in 2021 to 6.6m units representing close to 9% of the global car market. According to the IEA, globally there are around 16.5m electric cars on the road today.



In 2021, EV sales in China were 3.3m units which was more than double the number of EV sales in 2020. EV sales volume represented 16% of total vehicle sales in China in 2021 compared to 11% in 2020. The proportion of electric cars sales in China continues to rise and hit 20% in December 2021.

- The Chinese government had extended subsidies for electric cars for two years during the pandemic and this helped to grow EV sales volume despite declines in the sales of conventional vehicles.

- The government revised its original plan to eliminate EV subsidies and decided to continue offering subsidies for EVs instead reducing the value of subsidies by 10% in 2020, 20% in 2021 and 30% in 2022.
 - In addition to that, China's government opened the domestic market wider to foreign companies by abolishing investment restrictions on foreign auto companies.
 - As a result, foreign companies making electric vehicles can now manufacture vehicles in China without first forming a joint venture with a domestic counterpart, and this unlocks greater investment potential which should further benefit the evolving EV supply chain.
 - Therefore, we expect Chinese EV production capacity to expand further in 2022 and beyond, as investments from previous years ramp up.
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Key Industry Drivers

Favourable Government Policies on EV Industry

The Chinese government's initial strategy regarding EVs was to offer subsidies only until the end of 2020 but due to the negative impact of the coronavirus the government eventually extended its subsidies program for another 3 years by cutting subsidies by 10% in 2020, 20% in 2021 and 30% in 2022 instead of a complete removal. Based on unofficial sources, the Chinese government is now considering a further extension of the subsidies beyond 2022.

Alongside its subsidy program the Chinese government is pushing to improve the quality of EVs by implementing stricter quality supervision and higher standards.

- According to the Xinhua News Agency, the Ministry of Industry, and Information Technology plans to strengthen the supervision of New Energy Vehicle (NEV) quality and promote the integration of EVs with intelligent networking, and other technologies.

The Chinese government also recently announced a goal to develop sufficient charging infrastructure to meet the needs of 20m NEVs by 2025.

- Currently, there are 810k public charging piles in China and the scale of public charging piles in the top ten regions such as Guangdong and Shanghai account for more than 70% of the total.
- On the other hand, there are 13,800 charging piles on highways in China, mainly concentrated in Beijing-Tianjin-Hebei-Shandong, Yangtze River Delta, Pearl River Delta and other regions.
- Therefore, the country needs to improve infrastructure development related to charging stations to support EV demand growth and inflation of the installed base. The government's "New Energy Vehicle Development Plan (2021-2031)" and "Energy Conservation and New Energy Vehicle Technology Roadmap 2.0" released in October both aim to shift support to the construction of charging infrastructure.

The government has set guidelines to strengthen the management of its rapidly expanding lithium-ion battery industry and to promote high-quality development of its sodium-ion battery industry during 2021-25.

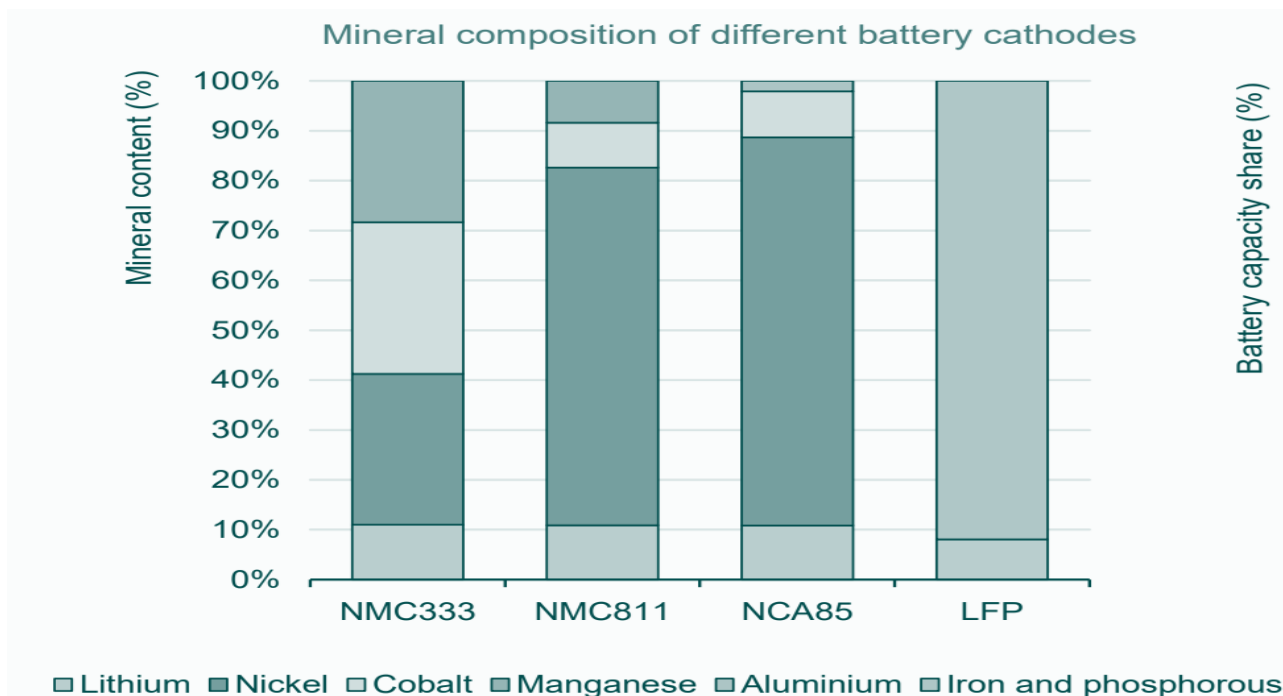
- The government plans to include standards to get quality products by setting up minimum production requirements prior to expanding capacity, minimum technical battery performance standards, plant operating conditions and land development requirements related to the lithium-ion battery industry.
- Contemporary Amperex Technology Co. Ltd. (CATL) is investing heavily in new sodium-ion battery technology as the technology offers benefits such as high-energy density, fast-charging capability, strong thermal stability, and low-temperature performance, as well as high-integration efficiency. The company expects to build an industrial supply chain by 2023.
- The government is promoting high-quality development of its sodium-ion battery industry during 2021-25. The Ministry of Industry and Information Technology, will formulate product and industry standards for sodium-ion batteries in due course to achieve scale, lower costs and improve the performance of sodium-ion batteries.

Resurgence of LFP Battery Technology

Current battery technologies can broadly be divided into three broad categories namely, lithium nickel manganese cobalt oxide (NMC); lithium nickel cobalt aluminium oxide (NCA); and lithium iron phosphate (LFP).

NMC and NCA cathodes are heavily used technologies in the automotive sector over the years due to the technologies having high energy density based on higher nickel content in the cathode.

However, LFP is a lower cost and more stable chemistry, with lower risk of catching fire and a longer cycle life. In addition, it does not require cobalt. One of the main drawbacks of LFP technology is that it has 65 - 75% of the energy density compared with a high-nickel NMC and NMC811. However, recent technology innovations have significantly improved their energy density.



Source: IEA

Recent increases in the material cost of cobalt have driven increases in the cost of NMC and NCA technologies and cobalt mining is associated with several humanitarian issues. Therefore, LFP has become more attractive as it contains no cobalt or nickel and instead uses abundant and low-cost iron and phosphorous.

Recent developments in LFP bring it much closer to substituting for NMC and NCA technologies even in longer range vehicles. The recent innovation of cell-to-pack (CTP) technology which eliminates the need for modules to house cells in the battery pack reduces the dead weight in the pack and improves the energy density of LFP batteries.

CTP technology was introduced by BYD and it continues to be improved. CATL also released their third-generation CTP battery increasing the LFP pack energy density to around 85% of a conventional NMC811 battery.

Currently, LFP batteries are used in key high-volume models such as the Tesla Model 3/Y, the Wuling Hongguang Mini, and by BYD's line-up with BYD also supplying Toyota.

EV Growth Aligns with Broader Climate Goals

China has made a commitment to achieve carbon neutrality by 2060, and EVs will also become one of the strategic industries to help China achieve its climate goals.

Therefore, the Chinese government will continue to support electrification due to EVs ability to reduce China's dependence on imported oil, reduce air pollution and help the country to become carbon neutral.

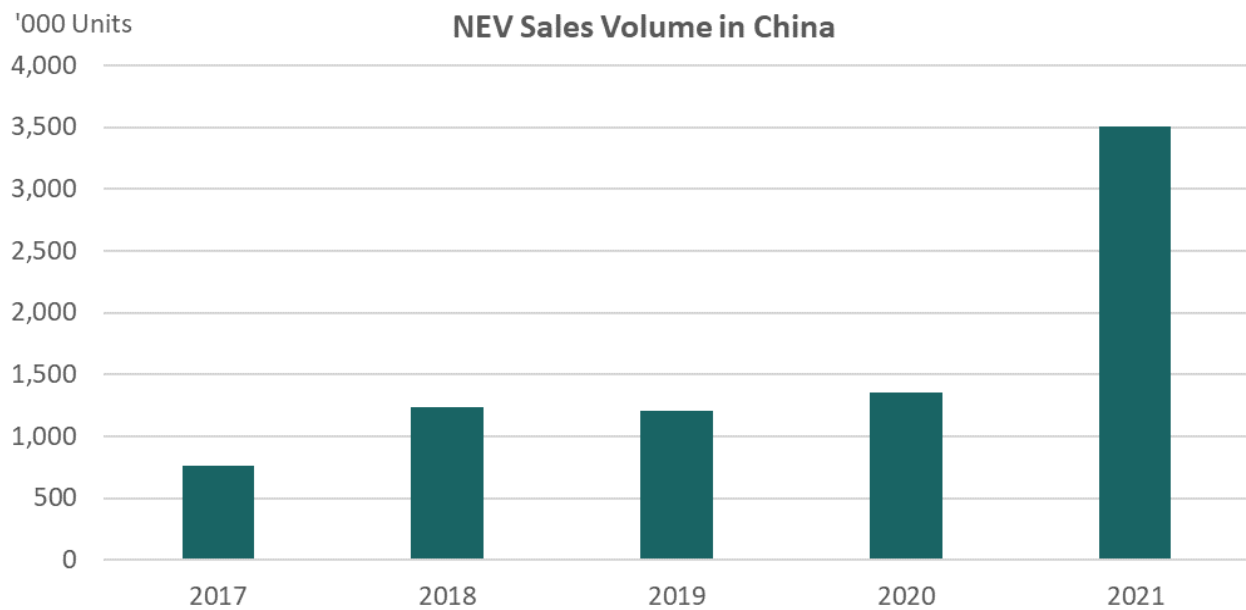
It should be noted, however, that recent regulatory shifts point to China now moving the industry to the consolidation phase with greater scrutiny of production quality and technological capability throughout the supply chain.

Key Industry Outlook and Trends

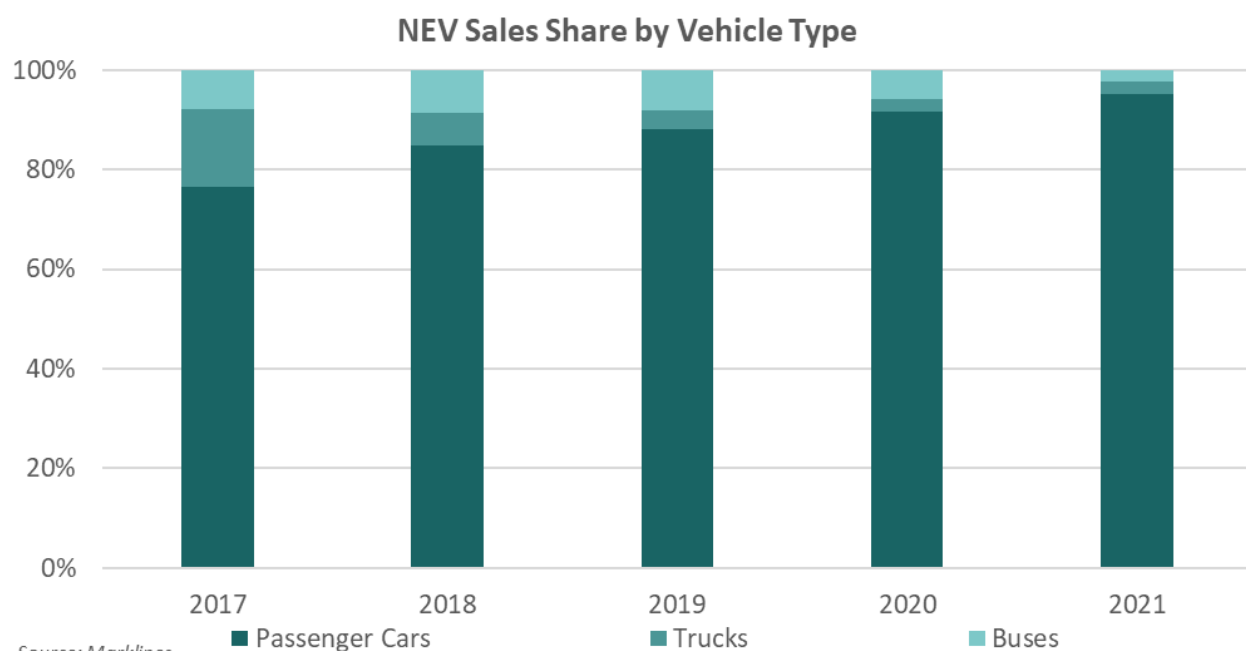
NEV Market Overview in China

China's New Energy Vehicle (NEV) volume was around 3.5m units in 2021 which is equivalent to a penetration rate of 14.5% (double that of 2020). NEVs include battery-powered electric vehicles (BEV), plug-in gasoline-electric hybrids (PHEVs) and hydrogen fuel cell vehicles (FCEVs). In 2021, EVs represented 82.7% of total NEV sales volume while PHEVs accounted for 17.2%.

- According to the China Association of Automobile Manufacturers (CAAM), sales of New Energy Vehicles in December 2021 increased by 18.1% MoM to 529k units.



Source: Marklines



Source: Marklines

Lowering Battery Cost Will Help to Reduce the Price Gap Between EVs and Conventional Vehicles

The electric battery is a core component of electric vehicles and typically accounts for 30% to 50% of the EV's cost. Since 2014, battery costs have fallen by more than 70% and this has resulted in the closing of the price gap between electric and conventional gasoline vehicles.

- Recently, there have been some significant improvements in battery technology like CTP (module-free battery pack), and BYD's advanced blade battery technology which uses for LFP technology but improves range and efficiency. These developments help drive further declines in effective battery cost as LFP technology does not use materials like Nickel and Cobalt.
- These improvements have raised hopes for EVs to achieve price parity with gasoline vehicles though this is threatened by recent material cost inflation.
- At the same time, the efficiency and range of electric vehicle batteries have also improved resulting in improved consumer convenience and acceptance.

Open Chinese Market for Foreign Player Increases Competition and Improves Negotiation Power Over Suppliers

In 2018, the Chinese government relaxed restrictions on foreign investment in China's automotive industry which has mostly benefited EV manufacturers.

- As result of easing restrictions on foreign investment China has regained its position as the largest EV market in the world, with foreign investment starting to flow into the NEV sector in China.
- Toyota and BYD established a JV to jointly develop car batteries and electric vehicles while Volkswagen plans to invest around €2.1bn in EVs in China following in the footsteps of Tesla's capacity investments.

Therefore, we expect the Chinese EV market to be more competitive than before as EV manufacturers continue to introduce attractive new models more regularly than before and traditional automakers introduce new EV models into their product line up.

On the other hand, if more automakers enter the EV market including tradition large automakers, there will likely be a shift in negotiating power with suppliers and costs could be expected to fall further as a result of greater scale and intense negotiations.

Chinese EVs are Becoming Popular Overseas

According to the China Association of Automobile Manufacturers, domestic auto exports grew by 87.7% YoY to 231k units in January 2022. The export volume of new energy passenger vehicles (NEV) grew by 538.7% YoY to 54k

It is evident that in recent years the popularity of Chinese EV brands has risen, particularly in Europe. Chinese auto brands like by SAIC, Great Wall, and NIO have all targeted the European market for their overseas exports.

The second-largest source of BEVs registered in Europe in 2021 was China and China accounted for nearly 15% of BEVs registered in 2021, second only to Germany in share.

The Premium EV Space

EV technology is becoming mature and EV penetration has started to grow significantly in the premium-branded luxury segment. Tesla is the first mover to offer premium EVs and now many EV manufacturers are introducing premium EVs to the market.

Currently, Tesla's EV models compete with the Mercedes EQs, BMW i cars, Audi E-trons, and new-groove Porsches as Mercedes-Benz, BMW, Jaguar Land Rover and Volvo continue to expand in the premium EV segment. In addition to that, NIO is also among a small group of Chinese challengers, having launched its ES8 premium electric SUV.

During the last two years, demand for EVs has grown significantly in Europe and traditional manufacturers are gradually shifting their large vehicle ranges over to electric.

NIO has revealed its overseas expansion strategy focused on the premium segment, starting with Norway and also plans to enter Germany, the Netherlands, Denmark, and Sweden in 2022, and reach 25 countries by 2025. It also seeks access to the U.S. market.

The company expects to introduce the ET5 model which is one their key premium EV models and expects to launch the more expensive ET7 electric sedan shortly after. The NIO ET7 is a luxury vehicle targeted at Mercedes, Audi or BMW purchasers and signals the brand's intent to compete with them in their own home market. The ET7 will be one of the brand's first cars launched in Europe and takes on the luxury legends in Germany by offering a range of up to 1,000 Km with an interchangeable 150 kWh battery. NIO models are not necessarily cheap as most are selling at prices above \$70k and the company will have to rely on strong technology, quality and service to develop their brand in international markets and compete with Tesla and European brands.

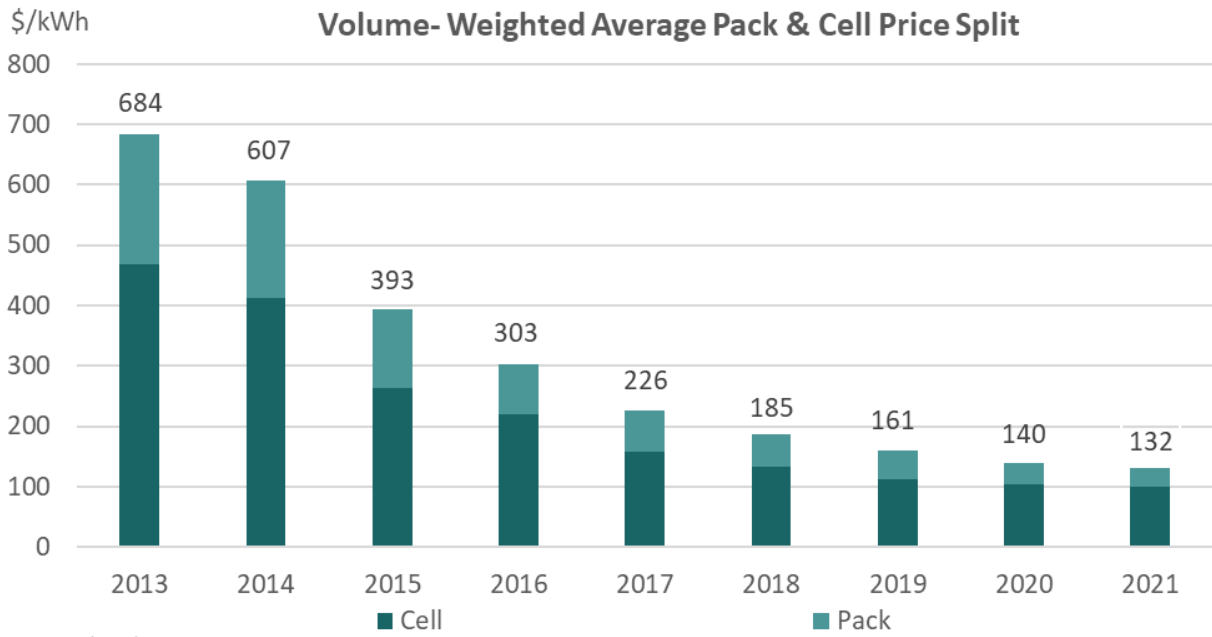
Soaring Raw Material Prices will Dent EV Demand Short Term

During the last few years, EV battery prices have dropped sharply and in 2021, the average price of a lithium-ion battery pack was \$132 per kWh (\$101 per kWh on a cell basis), down from \$140 per kWh in 2020. However, the recent increase in material prices of nickel, lithium, and other materials has resulted in an increase in EV battery prices. The increased raw material prices were mainly due to scarcity of resources and Russia's invasion of Ukraine which impacted nickel prices which have hit record highs as concerns surround Nornickel, the Russian mining company which produces around 20% of the world's high-purity class one nickel.

According to E Source, the current battery cell cost basis is roughly \$128 per kWh and by next year costs were expected to decline to \$110 per kWh but estimates have battery cell prices surging 22% from 2023 through 2026. Even the lower cost LFP technology has seen prices driven up due to supply chain issues resulting in an increase in LFP battery prices by 10% to 20% by Chinese manufacturers.

Further, the increase in raw material prices will delay the timeline on cost parity between EV and ICE vehicles. Experts across the industry broadly place the \$100 per kWh price point as where the cost of EVs will match the prices of ICEs.

Long-term we expect lithium to be a key bottleneck and tracking prices of lithium carbonate and especially lithium hydroxide will be key. [New contracts for battery materials on SGX could be ideal for this purpose as they are based on Fastmarkets prices that are often benchmarked in contracts.](#)



Key players in China

Chinese EV Market is Fragmented, but Signs of Consolidation

China's EV sector is too fragmented as according to state-owned Xinhua there are about 300 EV makers in China. This was due to Chinese government tax breaks and subsidy schemes for consumers who purchased EVs encouraging new EV start-ups as well entry into the space by companies from disparate industries.

Recently, the government has started to address this issue by setting up minimum production capacity utilisation rates for EV manufacturers on a per province basis. If the manufacturers fail to achieve the minimum capacity utilisation threshold, Beijing will prohibit the local government from green-lighting new production facilities until firms close the shortfall.

China's big EV manufacturers are best positioned to benefit from the government's push for market consolidation, as tighter regulations should pressure smaller firms with less access to capital and lower technological capability as has happened with past such moves.

Tesla and BYD are the Market Leaders

Tesla and BYD remained by far the market leaders in China's battery electric car market in 2021, while new competitors emerged against smaller rivals like NIO. In 2021, Chinese automaker BYD sold more electric and hybrid vehicles in China than Tesla.

Many of BYD's electric vehicles and hybrids are priced between CNY100-200k which is well below Tesla's electric models that start at around CNY300k.

Other than BYD, low price EVs have tended to capture the growing demand in China. SAIC-GM-Wuling's low-priced electric car is taking off in China's rural areas with the budget electric car known as the Hongguang Mini retaining the best-selling spot more than tripling sales volume in 2021 to 395k units.

EV Manufacturer	Total Deliveries in 2021	YOY growth
SAIC Motor *	732,646	129%
Tesla	473,078	110%
BYD	320,622	146%
Lynk & Co. *	220,516	26%
Great Wall Motor *	136,953	82%
XPeng Motors	98,155	263%
NIO	91,429	109%
Li Auto *	90,491	177%
WM Motor	44,157	199%
Zeekr	6,007	N/A

Source: electrek, * Total is for all NEVs including PHEVs



EV Manufacturer	Type	Description
SAIC Motor	Local legacy players moving into EVs, JV and offering Low End products	SAIC Motor Corporation Limited (SAIC) is owned by the Shanghai municipal government and operates two major passenger car joint ventures - Shanghai Volkswagen and Shanghai GM. The company's bestselling EV model is the Hongguang Mini.
Tesla	Pure EV Player, High End products	Tesla is a US based EV manufacturer which entered Chinese market in 2013 and its Model 3 and Model Y remained no 2 & 3 in terms of EV sales volume in China. Recently, the company introduced cheaper version of the Model Y SUV with a shorter driving range to compete with Chinese EV models
BYD	Local legacy players moving into EVs, Full range of products	One of China's largest electric vehicle manufactures which recently stopped making combustion engine vehicles to focus only on full electric and heavily electrified plug-in hybrid cars. The company also manufactures EV batteries and it is among the top 5 largest EV battery manufactures in globe. In April 2022, BYD reached a 50% market share in LFP batteries, surpassing CATL in China.
Lynk & Co,	High End products and JV	Lynk & Co is a Chinese-Swedish automobile brand that is the result of a Joint venture between Geely Auto and Volvo Car.
Great Wall Motor	Local legacy players moving into EVs	Great Wall Motor is a Chinese privately-owned automobile manufacturer. The company is the 8 th largest automobile manufacturer in China, having 1.3m units of sales volume in 2021. The company produces EVs like the ORA.
XPeng Motors	Pure EV Player, High End	The company was founded in 2014 and introduced its first vehicle, the G3 compact SUV, less than three years ago. Since then, the company has introduced several models to the market including the P7 long-range sports sedan to its lineup, and recently, announced its next vehicle, the P5 sedan.
NIO	Pure EV Player, High End products	The company was founded in 2014 to design and develop EVs. The company has developed battery-swapping technology and deployed battery swapping stations for its vehicles to differentiate itself.
Li Auto	Pure EV Player, High End products	The company was founded in 2015 and specializes in developing electric vehicles to cater to the luxury segment in China. It focuses more on PHEV products.
WM Motor	Pure EV Player, Low End products	Weltmeister is owned by WM Motor Technology, and it launched its first production car, the EX5 in 2018. The company plans to launch its first sedan, the M7, which has range of over 700 Km.
Zeekr	Pure EV Player, High End products	Zeekr owned by Geely Automobile was founded in 2021. The brand offers premium electric vehicles and has international expansion plans including to the US where it has partnered with Waymo for autonomous technology.

Source: electrek, Company disclosures

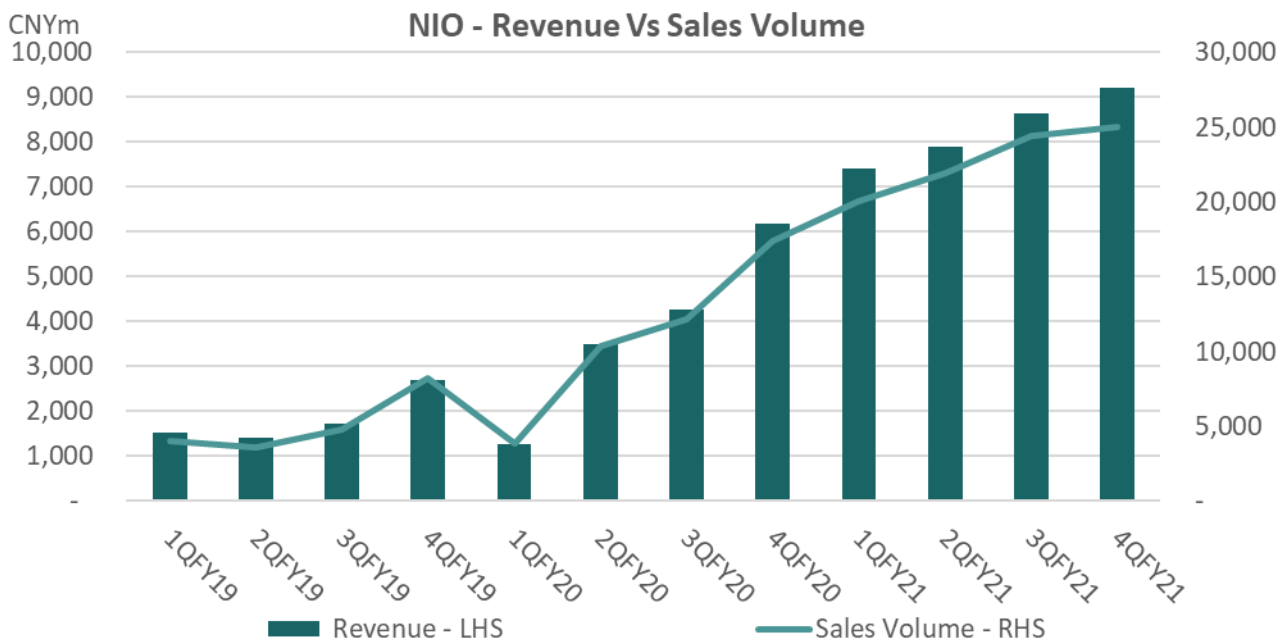
Company	Exchange: Ticker	Market Cap - \$bn	EV/Sales			FY2 EV/EBITDA	FY2 EV/EBIT
			FY0	FY1	FY2		
SAIC Motor	SHSE:600104	29.4	0.3	0.3	0.2	5.3	4.1
Tesla	NasdaqGS:TSLA	745.0	13.7	8.5	6.4	25.1	36.3
BYD	SEHK:1211	129.2	3.8	2.6	2.1	24.0	51.9
Great Wall Motor	SEHK:2333	38.4	1.8	1.4	1.1	13.9	20.3
XPeng Motors	NYSE:XPEV	22.3	5.4	2.9	1.7	- 5.4	- 3.6
NIO	SGX: NIO	31.1	4.8	2.9	1.7	230.8	- 17.5
Li Auto	NasdaqGS:LI	30.0	5.6	3.2	1.7	53.2	229.8

Source: CapIQ

NIO

NIO is a Chinese EV manufacturer which was founded in 2014. The company focuses on developing high performance premium electric vehicles and is financially backed by companies such as Tencent, Lenovo and Baidu.

Similar to other EV players in China, the company experienced higher growth during the pandemic driven by extended government subsidies.



Source: Company disclosures, LSR

NIO's Top Performing Models in China

Model	Price	Battery	0-100Km/h	Range	Top Speed	Seating
NIO ES8	\$59,000	70-84 Kwh	4.4s	355-425 Km	200 Km/h	7
NIO ES6	\$55,000	70-84 Kwh	4.7-5.6s	420-510 Km	200 Km/h	5
NIO EC6	\$51,000	100 Kwh	4.5s	615 km	200 Km/h	5

Source: Company disclosures, evcompare

The company focuses on continuous development of technology to offer differentiated product from their competitors and it has been investing heavily in R&D. NIO has filed more than 300 patent applications during the last five years related to communication systems, safety features, lighting, HVAC systems, distribution, and electric power conversion. The company's long-term strategy is to grow revenue through creating an ecosystem for users including community spaces called NIO Houses across 47 global locations, swappable batteries and even plans to enter the smartphone market.

NIO Autonomous Driving (NAD)

NIO's autonomous driving technology includes NIO Aquila Super Sensing and NIO Adam Super Computing. NIO Aquila consists of 33 high-performance sensing units which includes 8-MP high-resolution cameras, 1 ultralong-range high-resolution LiDAR, 5 mm-wave radars, 12 ultrasonic sensors, and 2 high-precision positioning units. NIO Adam is a supercomputer that process data to create high-clarity images. The company first introduced the autonomous driving technology in the NIO ET7, in January 2021.

Battery as a Service (BaaS)

BaaS is a subscription model or leasing service which is offered by NIO to reduce costs for their customers enabling them to save up to CNY100k by not choosing to own the battery of their EV. Instead of owning it, the consumer can pay a fee of around CNY1,280 per month for six years. This allows NIO to provide better value addition to their customers as it resolves issues of battery degradation, upgradability, and lower second-hand market value. NIO's battery swapping technology is what enables this unique business model.

During the last few years, NIO has accelerated its innovative battery-swapping technology for electric vehicles with the introduction of a new Battery-as-a-Service (BaaS) subscription model and its NIO Power Swap Station 2.0. Currently, NIO has 900 Power Swap Stations around China where customers can have a battery pack installed in about five minutes.

In FY2021, NIO's revenue from vehicle sales was \$5.2bn (+223% YoY) while other revenue was \$465.5m (+282% YoY). NIO's other sales includes its Battery as a Service (BaaS) and One-Click-for-Power services for emergency situations on the road, such as dead batteries or flat tires. By 2025, NIO has set a target to install more than 4,000 battery swap stations globally, with 1,000 of them based outside China. NIO has already launched the first battery swap station in Norway where it intends to have 20 by the end of 2022.

NIO's battery service has also reduced the price of each electric vehicle by \$10,000 because the battery service is decoupled from the sale of the car and users have more options to choose different battery sizes at the Power Swap stations based on their driving needs.

According to Frost & Sullivan, China's battery swap market is to grow at a CAGR of 73% during 2020-25 and they expect an increase in the number of battery swap stations from around 555 stations to 8,600 over the same time period.

In addition to their own expansion strategy, NIO is partnering with Shell Group, which they expect to accelerate growth of the combined battery swapping and fast charging hubs at Shell Stations in China and Europe. NIO may face more competition in future as several automotive manufactures have shown interest in offering battery swapping services in China and overseas.

However, some concerns remain about NIO's charging technology as existing NIO fast charging technologies require up to 50 mins for a full charge while Tesla's technology takes about 30 minutes. In addition, the company needs to invest capital expenditure of \$500K per BaaS station compared to a typical charger unit costing \$100K.

NIO Power

NIO Power provides solutions for "One Click for Power," a 24/7 on-call valet charging system. This service is integrated as an option on the NIO app. It provides a pick-up and drop service to recharge a NIO within the shortest time based on selecting the best option at the given time (Power Swap, Mobile, or Charger). As of January 2022, the company had 800 battery swapping stations, 637 supercharging stations, and 645 destination charging stations which connected with over 460k public chargers in China.

Major EV Manufacturers in China

SAIC Motor

The company is the largest auto manufacturer in China and the company manufactures both passenger and commercial vehicles. In 2021, the company sold 5.4m vehicles including 733k NEV units. The company is actively promoting the commercialisation of new energy vehicles and connected cars.

SAIC group includes subsidiaries including foreign equity-funded JVs such as SAIC Volkswagen Automotive, SAIC General Motors, SAIC Passenger Vehicle, which has its own brands "Roewe" and "MG", and SAIC GM Wuling Automobile. SAIC-GM-Wuling produces the Wuling Hongguang MINIEV which leads the NEV passenger car market in China.

SAIC Motor produces auto parts including power drive systems, chassis, interior and exterior trims, and the core components and smart product systems of new energy vehicles such as batteries, electric drives and power electronics. The company experienced a downtrend in its total sale volume from 2018, but NEV sales and export volumes increased significantly during the last few years. In 2021, the company sold 5.5m vehicles (-2.4% YoY), of which 733k were NEVs (+129% YoY) and 390k (+79% YoY) exports.

SAIC disclosed its five-year plan (2021-2025) and expects to invest CNY300bn in smart EVs and they expect to achieve sales volumes of more than 2.7m NEVs globally and increase the NEV ratio of commercial vehicle sales to 38% by 2025 and hit overseas sales volume of 1.5m units or 15% total sales volume.

BYD

The company was founded in 1995 and manufactures and offers traditional ICE vehicles, and NEVs. The company also manufactures and sells rechargeable batteries, photovoltaic products, handset components and other electronic products.

BYD has four manufacturing plant bases in China in Shenzhen, Xi'an, Changsha and Changzhou, with a capacity of 600,000 units in 2021. The company is currently building new production bases in Hefei, Zhengzhou, Jinan and Xiangyang to expand both battery and EV production capacity.

In April 2022, the company sold 106k (+1% MoM, +313% YoY) NEVs despite the Covid impact. Out of total sales of 106k units, 57k were EVs which grew 256% YoY while PHEV sales grew 439% YoY to 48k. Higher growth in BYD's PHEV was due to its new DM-i system that provides substantial battery range.

In 1Q2022, BYD sold 286k EVs and hybrid vehicles which was nearly equal to Tesla's all-electric deliveries in China and BYD's sales are significantly higher than Chinese pure EV players like NIO, Li Auto and Xpeng. In addition to its EV business the company also produces batteries for EVs and expects to expand its LFP battery production capacity.

In addition to using their batteries to produce BYD EVs, the company also sells its batteries to other OEMs. Currently, the company sells batteries to the made-in-China Ford Mustang Mach-E. GM and Toyota expect to use BYD batteries for upcoming small EVs for the Chinese market where BYD's Blade battery has proven particularly competitive.

XPeng Motors

XPeng Motors is a Chinese pure EV manufacturer founded in 2017. The company experienced a phase of very fast growth and reached a milestone of producing 100,000 EVs in October 2021 and now expects to double the production capacity of its Zhaoqing manufacturing plant to 200,000 units.

The company's revenue grew by 259% YoY to CNY21bn in 2021 as result of a 263% increase vehicle deliveries to 98,155. Like other Chinese EV manufactures, XPeng also expects to expand its business overseas. Marketing has begun in Denmark, Norway, and Sweden and Xpeng has begun shipping its G3 SUVs and P7 sedans in Norway with further expansion slated for 2022.

Li Auto

Li Auto is one of the leading premium smart EV manufacturers in China, founded in 2015. The company introduced its first EV model, the "Li ONE" 4 years after founding and released it in May 2021. The Li ONE, is a six-seater premium electric SUV of which a cumulative 160k units had been delivered. Currently, the company has production capacity of 100k EVs per annum and 206 retail centres in China covering 102 cities, and 278 after-sales maintenance centres covering 204 cities.

Li Auto expects to introduce new models including BEVs and EREVs, to target a broader consumer base in China and the company will add three models in 2022 and 2023. In 2022, Li Auto plans to introduce a large SUV with electric-only propulsion and the company considers the vehicle to be a close substitute and competitor for Audi's Q7 and BMW's X5.

Tesla

Tesla entered the Chinese market in 2013 but only built its Gigafactory in Shanghai in 2019 and delivered the first China-made Tesla car in 2020. The company plans to expand its factory in Shanghai to meet the growing demand from Europe and China and expects to produce 1.5m autos in 2022, an increase of 50% YoY. Tesla's Model Y became the top-selling model among all crossover/SUVs in 1Q2022.

Great Wall Motor

Great Wall Motor was founded in 1984 and is currently the 8th largest automobile manufacturer in China, with 1.3m unit sales in 2021. In its strategic plan for 2025 the company expects to sell 4m vehicles, of which 3.2m vehicles (80%) are to be NEVs. In 2021, the company sold 137k NEVs representing 10.3% of total sales. The company launched the HAVAL H6 HEV, HAVAL JOLION HEV, ORA GOODCAT and WEY Mocha PHEV in overseas markets in 2021. Great Wall Motor plans to invest \$1.9bn in Brazil during the next decade to build manufacturing facilities for EVs and hybrid vehicles. Further, the company launched more affordable EVs in Thailand in 2021 and aims to expand within Asian by launching nine different EV models within three years.

Lynk & Co

The company was founded in 2016 as a JV between Geely Auto Group and Volvo Car Group. In 2021 the company sold 221k units, an increase of 26% YoY and currently has 319 sales and experience centres across China. They continue to expand with seven permanent Lynk & Co Clubs in the Netherlands, Sweden, Belgium and Germany and plans to enter new markets in the Gulf and Asia Pacific, starting with Kuwait. Lynk & Co introduced its first EV model, the “Lynk & Co 01” compact SUV in 2017 and has introduced 8 EVs since with the “Lynk & Co 09” mid-sized PHEV being the latest.

WM Motor

The company was founded in 2015 as a Chinese pure EV player backed by Lenovo, Baidu and Tencent that is well known for electric SUVs, but the company recently introduced a new sedan model. Initially, three electric SUVs were launched, namely the EX5 (electric compact sedan in 2018), EX6 (mid-size SUV in 2019) and W6 (electric compact SUV in 2021). The M7, a sedan model was introduced in 2022. In addition to EV manufacturing, the company also provides a range of charging solutions and a charging network of over 200,000 public chargers in China. In 2021, the company delivered 44,157 units (+96.3% YoY) and as of the end of 2021, had cumulative total deliveries of 88,686 units.

Zeekr

The company is a pure Chinese EV manufacturer, and is part of Geely. The company was founded in 2021 to specialise in offering premium EVs. Since its founding, the company delivered 20,000 EVs producing just one model, the Zeekr 001, however they expect to expand the product line to 7 models by 2025. The company expects to reach a cumulative delivery goal of 70k units by the end of 2022 and reach 650k units sold annually by 2025. Like other pure EV manufacturers, the company also intends to expand its business overseas mainly in Europe and North America.

Current Opportunities and Risks in China

Opportunities

Increasingly Competitive Technology

- As the Chinese government eases restrictions regarding foreign investments, foreign players have entered the Chinese market chasing lucrative growth in China's EV sector and during the last few years most conventional auto manufacturers have expanded their presence in China. Some of the foreign players have set up JVs with Chinese players to develop EVs.
- Establishing JVs with global players and opening the Chinese market to foreign players will help Chinese manufactures improve their EV technology and become more competitive. In addition to that, it is evident that most of the Chinese manufactures have invested in some degree of internal research and development of electric batteries and are proactively incorporating other technologies like autonomous driving into their EVs which is good sign for their competitiveness.
- Currently, Chinese EV players have demonstrated significant improvements in the EV technology that they utilise and have lowered the technology gap between themselves and global players like Tesla in terms of range, efficiency and charging times.
- Therefore, this shrinking of the technological competitive gap for Chinese EV manufacturers will allow them to better compete in the global market as they offer products at competitive prices even if lacking some brand power.

Growing Overseas Demand for NEVs

- Chinese EV manufactures have started to expand their business overseas, especially in Europe, the second largest EV market to China.
- MG owner SAIC expanded its presence in the European EV market using MG which already has 350 dealers in 16 European countries. Two other Chinese EV automakers, NIO and BYD, entered Europe through the Norwegian market. Great Wall Motors also launched an all-electric compact and plug-in hybrid EV (PHEV) SUV in 2022.
- The ASEAN region is one of the fastest growing in the world for auto sales. According to the International Renewable Energy Agency, sales of new energy vehicles in Southeast Asia will increase to 10 million by 2025. This represents a further opportunity for Chinese players which can build up strong ties with the region.
- In recent years, more and more Chinese new energy vehicle companies have entered the Southeast Asian market, strengthening cooperation with local partners and ASEAN countries are increasingly paying attention to the development of new energy vehicles.
- Therefore, we believe that the ASEAN region will be the logical next move for Chinese EV players after expanding in Europe.

Risks

Overcapacity

- Over the last few years, the majority of the EV manufacturers have invested aggressively to increase their production capacity as they expected to gain a higher market share of global automotive sales volume as EV penetration increases.
- For example, the JV between Volkswagen and Audi is building a factory for producing 150k vehicles a year, Honda Motor plans to get approval for capacity expansion at a JV and Dongfeng Motor has invest in capacity to make 100k NEVs a year.
- According to the China Passenger Cars Association the annual production capacity for passenger car NEVs totalled 5.7m with a utilisation rate of 58% in China as at the end of 2021.
- Generally, it takes around 2 years to start operations for NEV production after the start of construction. Based on current capacity expansion plans, total NEV production capacity will reach an annual capacity of 15m units in 2025.
- If the production utilisation rate falls below 50% there is a material risk of making losses and to reach a 50% utilisation rate China's NEV sales volume would have to reach 7.5m units by 2025. This means that the NEV sales volume in China would have to grow at a CAGR of 29% which looks aggressive without further extension of government subsidies.

Supply Chain Disruption & Inflated Material Prices

- EV manufacturers in China face challenges from supply chain disruptions due to Covid and inflated EV battery material costs.
- In China, Shanghai, Guangzhou and other parts of the country remain under Covid controls and these cities are automobile manufacturing hubs in China.
- The China Passenger Car Association estimates a volume decline of 48% YoY in April and Tesla's production volume in China fell 81% MoM to 10,757 units in April.
- In addition to that, Chinese and other EV automakers are experiencing rapidly rising battery costs due to soaring prices for lithium carbonate and lithium hydroxide as well as cobalt and nickel. This has forced Tesla, BYD and other EV manufacturers to raise the prices of their EVs.
- While LFP technologies could offer some insulation from surging nickel and cobalt prices, the pace of EV manufacturing expansion is likely to result in continued upward pressure on lithium prices and potentially simple shortfalls in production at almost any price.

Hydrogen, PHEVs and Hybrids

- While BEVs are the frontrunner in China's NEV landscape the government continues to support fuel cell and hydrogen technology and even hybrids.
 - Competition thus remains for market share not just within BEVs but also amongst carbon neutral and low carbon passenger vehicle technologies.
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