

CHINA SMART EV MARKET BOOM

Jun 2023

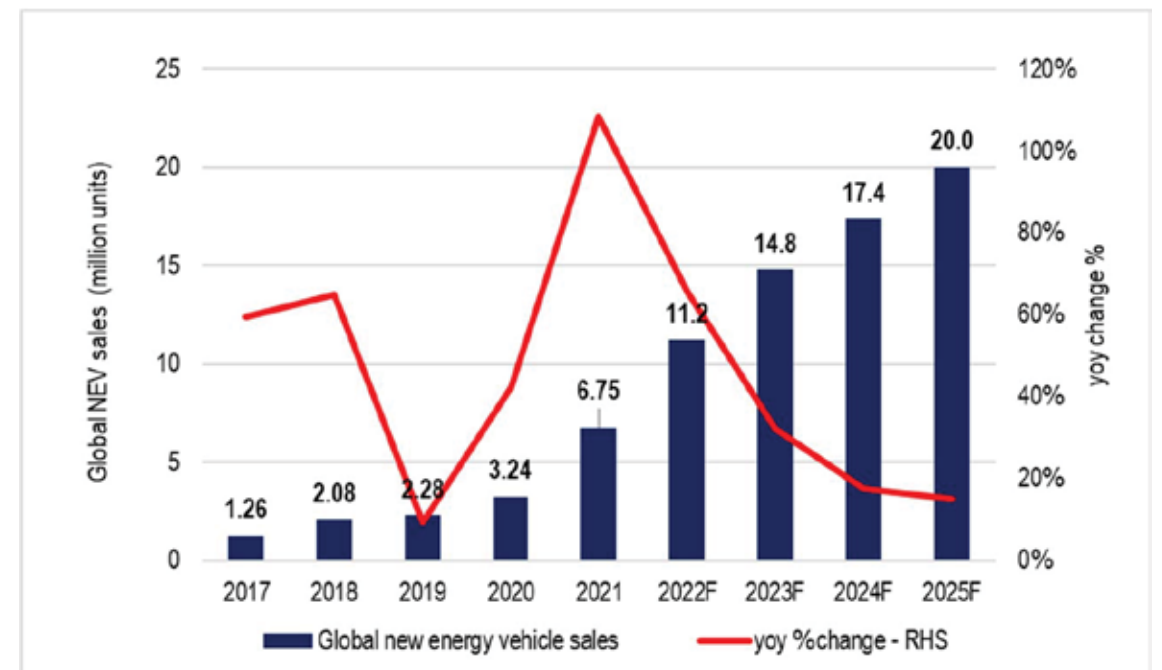


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GLOBAL EV MARKET GROWING FAST

- Global new energy vehicle (NEV) sales volume reached 11m units (+66% yoy) in 2022.
- Estimated to reach 20m units in 2025F, a CAGR of 21%.

Global NEV shipments and yoy growth (2017 – 2025F)



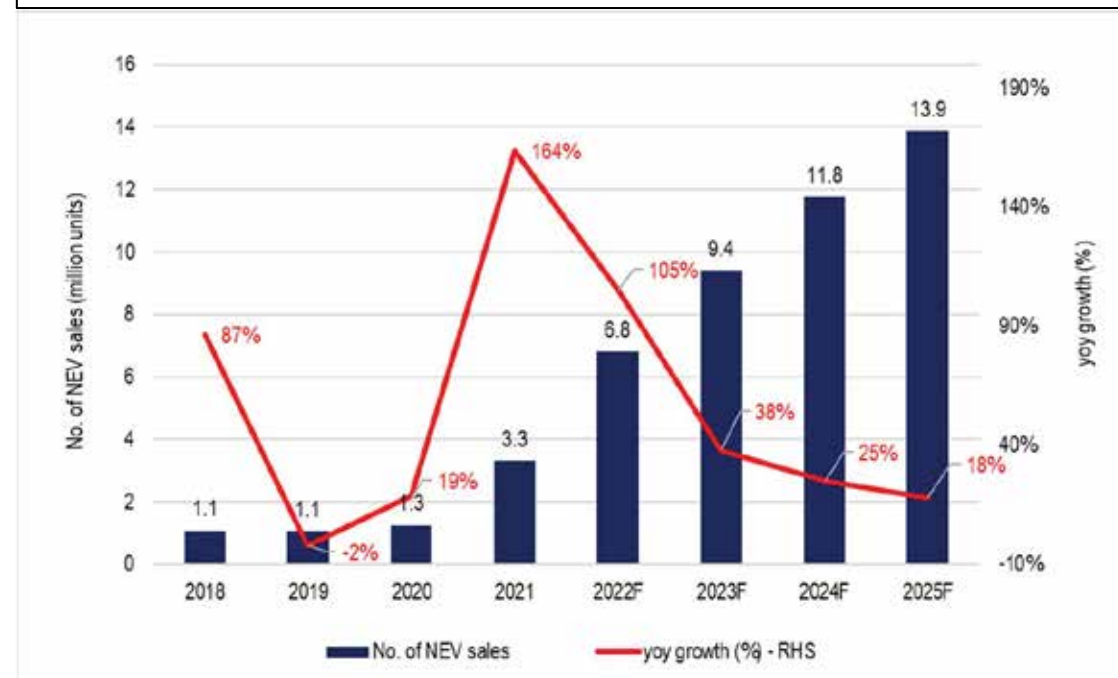
CHINA'S FAST-GROWING NEV MARKET IS THE WORLD'S LARGEST

- China NEV volume sales reached 6.8m units in 2022 (+105% yoy).
- Estimated to reach c.14m units in 2025F, a CAGR of 27%.

The strong China EV sales driven by:

- Supportive government policies
- Rising popularity of smart EV on improving autonomous driving technologies
- Narrowing price gap between EVs and ICE vehicles
- Rapid EV infrastructure expansion

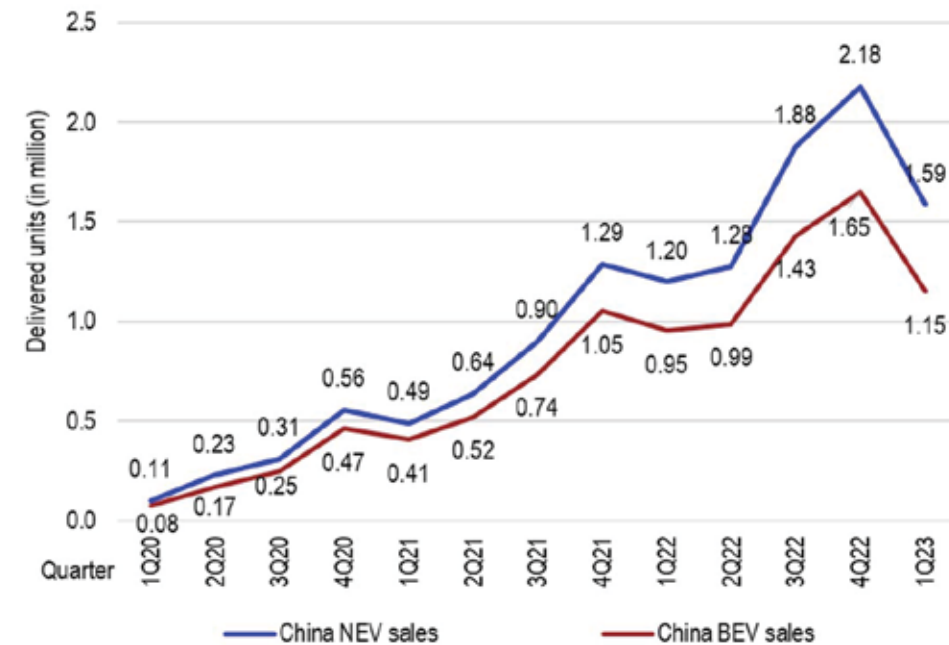
China NEV shipments and yoy growth (2018 – 2025F)



CHINA NEV SALES IN 1Q 2023

- China NEV sales in 1Q23 grew 32% yoy to 1.6m units, penetration rate was 26% (31% in 4Q22)
- Massive Price cut affected consumers' confidence and rising competition from ICE
- Expected China NEV market to continue maintaining fast growth in 2023-2030F

China NEV / BEV Sales



GOVERNMENT POLICIES

The major government supportive policies for consumers (demand side) and automakers (supply side)

Demand-side Policies	Description
NEV purchase subsidy	Termination of purchase subsidy on 1 Jan 2023 The purchasing subsidy ranges from Rmb4,800 to Rmb12,600, depending on the types of NEV and the NEDC range, while the decreasing rate of the subsidy is set universally at -10%/-20%/-30% for 2011/2021/2022, deducted from the previous year's subsidy.
NEV purchase tax exemption	The purchase tax exemption first began in 2014, allowing most consumers who buy NEVs to save about Rmb10,000 relative to those who buy traditional vehicles, given that the purchase tax rate for internal combustion engine vehicles was 10%. The policy has been extended to the end of 2022, and recently, the government confirmed that it is further extended to the end of 2023.
Supply-side Policies	
Parallel Credit Administration	The policy required automakers to meet the CAFC and NEV credit targets set by the government. The current NEV credit target is based on 14%/16%/18% of the vehicle output of the manufacturer itself in 2021/2022F/2023F. Automakers can trade their extra credits to earn income but will be penalised if they do not meet the targets.
Charging network expansion	China has the largest charging infrastructure networks for NEVs in the world, with over 1.3m public charging piles. Most of these charging piles are located in regions such as Guangdong, Shanghai and Beijing. The central government planned to expand the charging coverage for at least 60% of expressways by 2025F.
Sodium-ion battery development	In the 14th Five-Year Plan (2021-2025), the central government encouraged the development of the sodium-ion battery industry to guarantee a fair EV market structure by offering different types of batteries to the market.

GOVERNMENT POLICIES

- China's carbon neutrality targets
- favourable policies for consumers' subsidies and automakers
- Introduction of Parallel Credit
- Tax benefits from local governments and development of charging infrastructure

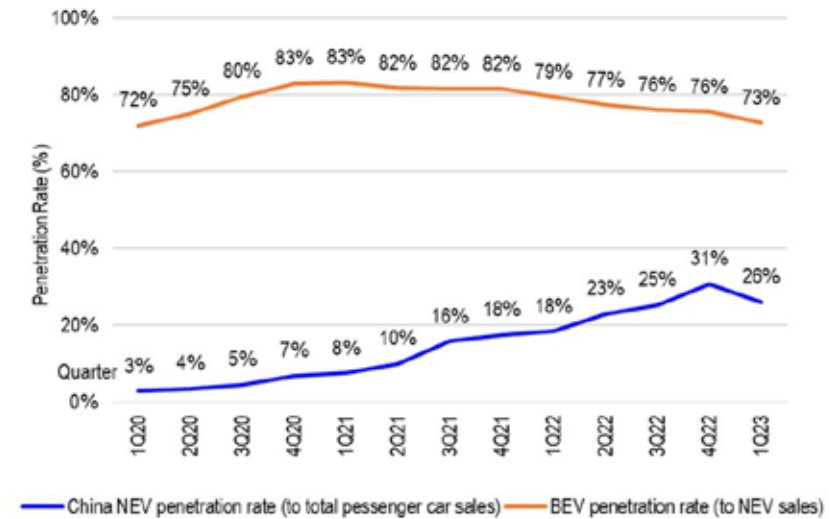
In conclusion:

- **Demand side policy:** Financial incentive for consumers are short-term policy that will help modify consumption patterns and solidify consumer demand for EV.
- **Supply side policy:** Administrative policies will be the key over the longer timeframe for guaranteeing healthy EV market development.

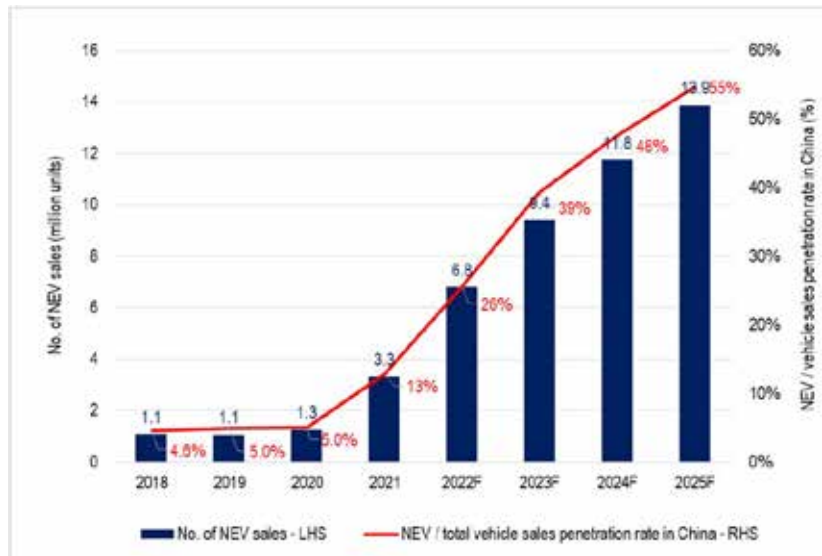
POPULARITY OF SMART EV

- China consumers are switching from ICE to EV
- China NEV penetration rate reached 26% in 2022
- Mobility experience improvement:
 1. Intelligent features – Smart Cockpit
 2. Improved connectivity
 3. Safety and quality

China NEV/BEV Penetration Rate



China NEV penetration rate, by annual



SMART FEATURE – ADAS, OTA, HMI

- **Advanced Driver Assistance System (ADAS)** => is the key smart element that ultimately target to perform all operations of a vehicle with no driver is needed.

ADAS – XPeng



- **Over-the-air (OTA)** => allows users to update vehicle software such as ADAS, HMI, etc. remotely through a cloud network



Firmware and software updates download the new code on an embedded device

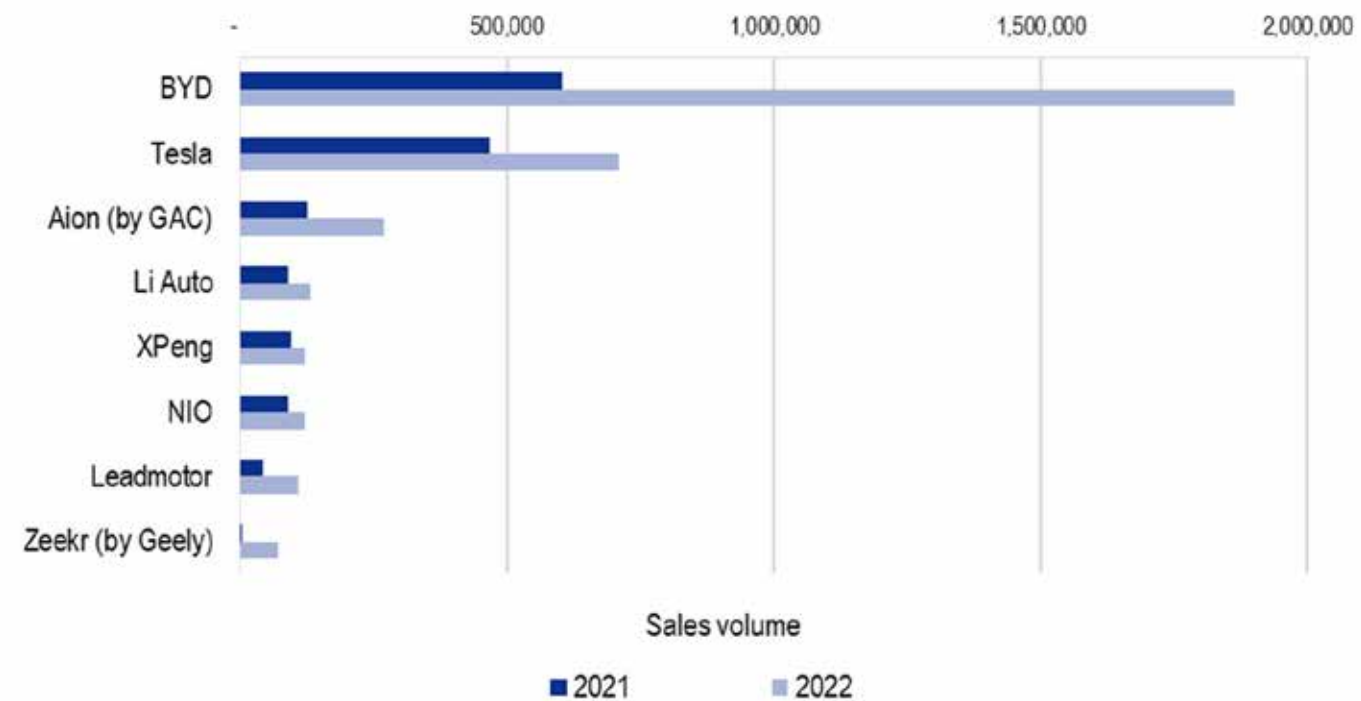
- **Human-Machine Interaction (HMI)** => One of the smart elements that smoother users' interaction with the vehicle

HMI – Li Auto



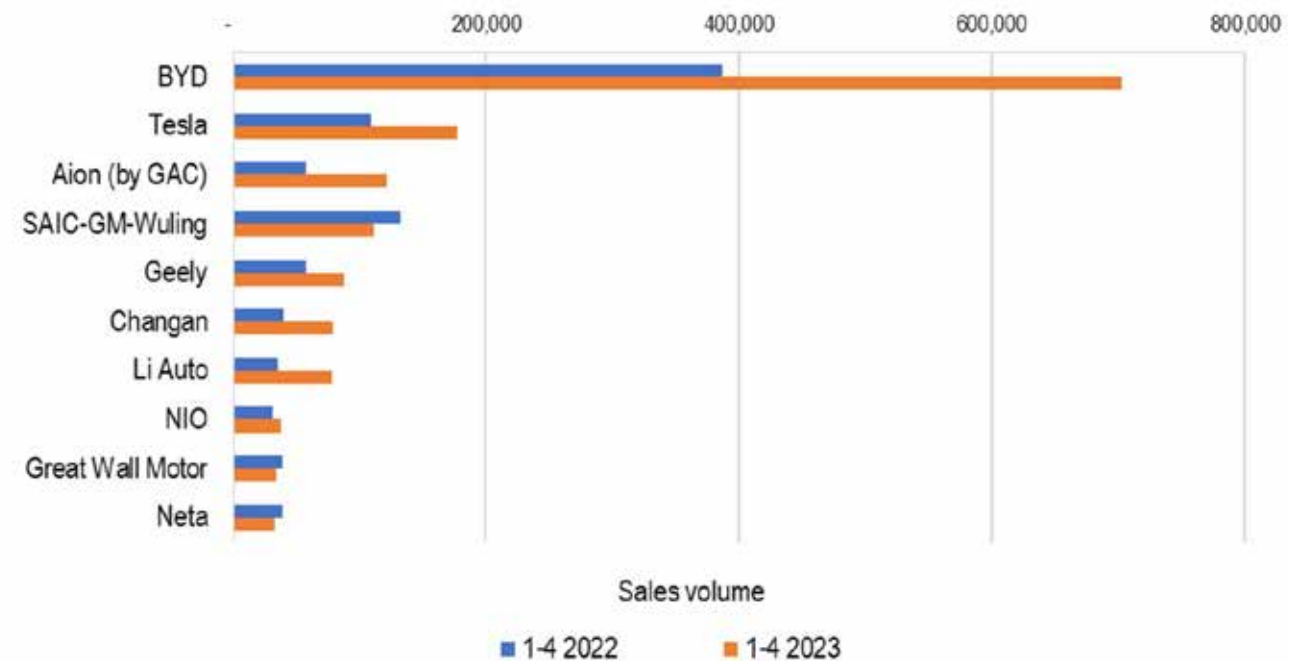
KEY EV'S DELIVERY TREND IN 2022

The highest NEV sales by EV makers, by volume (2022 vs 2021)



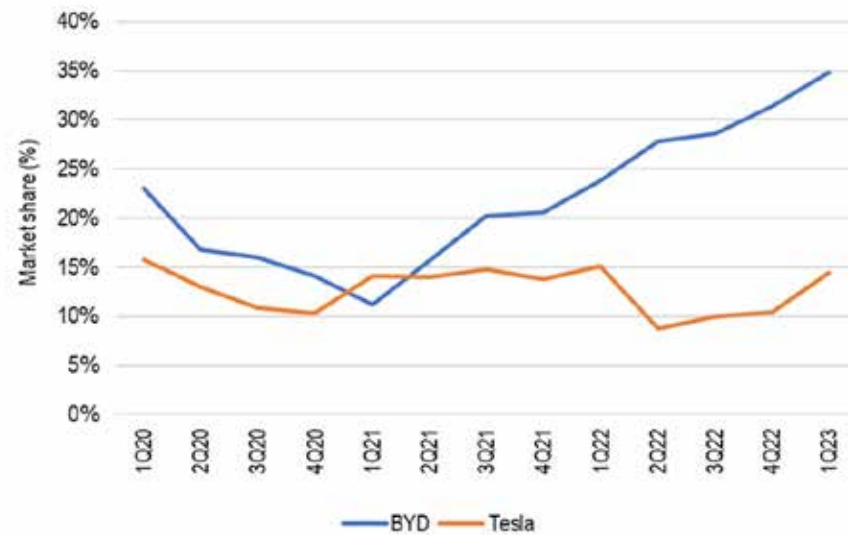
KEY EV'S DELIVERY TREND IN JAN-APR 2023

The highest NEV sales by automakers (Jan – Apr 2023 vs Jan – Apr 2022)

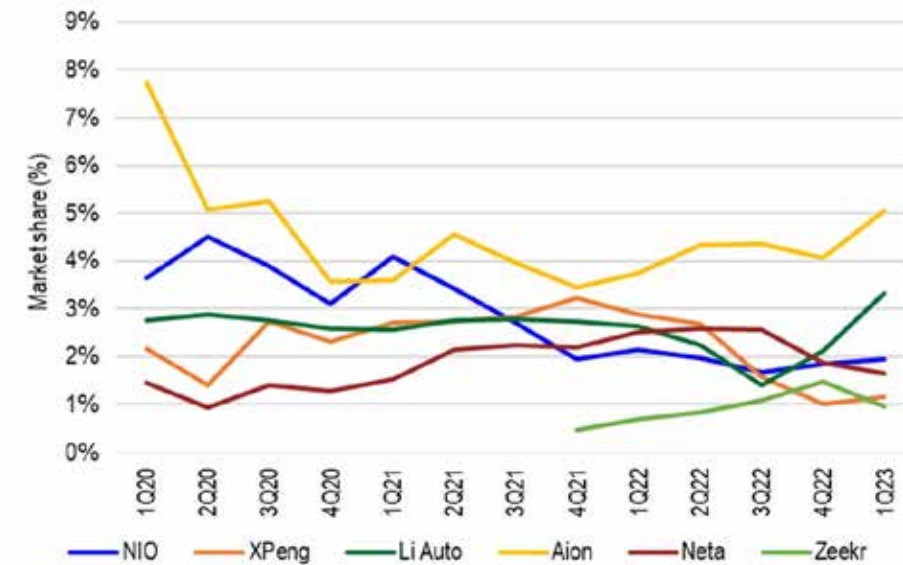


KEY EV'S MARKET SHARE IN CHINA

BYD and Tesla's NEV market share, by quarter








NXL and other emerging EV manufacturers quarterly market share (%), by quarter



COMPARISON BYD'S MODEL SPECIFICATION

BYD Qin Plus, Tang/Tang DM-p/i and Atto 3/Yuan Plus (specifications)

	Delivery Date	MSRP Starting from (USD)	Segment	Wheelbase (mm)	Driving Range (km)	Acceleration Time (0 to 100km/h)	Peak power (kW)	Maximum Torque (N·m)	Autonomous Driving Package
 QIN Plus EV  QIN Plus DM-p/i	May-2016	20,000 - 25,000	Mid size Sedan (BEV)	2,718	400/500 /600	4 / 4.4 (0 to 50 km/h)	100	180	DiPilot
		16,000 - 22,000	Mid size Sedan (PHEV)		55/120	7.3/7.9	81	316/325	
 TANG EV  TANG DM-p/i	Jul-2018	40,000 - 48,500	Mid-large SUV (BEV)	2,820	505/565	4.4/8.9	168/180 /380	350/700	
		30,000 - 40,000	Mid-large SUV (PHEV)		112/252	4.3 (0 to 50 km/h)	102	231	
 Atto 3 / Yuan Plus	Jun-2018	20,000 - 33,500	Mid size SUV (BEV)	2,720	430/510	7.3	150	310	

PROFITABILITY UNDER PRESSURE

EV makers are facing huge margin pressure on EV sales

The reasons:

- 1) Surge in the prices of battery components including lithium, nickel and cobalt,
- 2) Keener competition
- 3) Escalating R&D expenses
- 4) Economic weakness and softened demand in China

BATTERY TECHNOLOGIES MAKE DIFFERENTIATION

BYD continue to embrace for hybrid EVs (PHEV), become very competitive to ICE vehicle

Li Auto is the market leader in the premium smart extended range electric vehicles (EREV)

NIO and **XPeng** have their own unique battery technologies to avoid:

- 1) the charging efficiency issue
- 2) uneven distribution of charging piles across cities in China

Battery Tech – XPeng



Battery Tech – NIO



EV TYPE ILLUSTRATION

	BEV	PHEV	HEV	FCEV	EREV
Battery	YES	YES	YES	YES	YES
Electric Motor	YES	YES	YES	YES	YES
Internal Combustion	NO	YES	YES	NO	YES (which is also a range extender)
Working Principle	A BEV is powered from its batteries and electric motors. Its electric motor uses batteries that can only be recharged by an electric power source	A PHEV is powered by both its electric motor and gas engine. They work together, or separately on its own to power the powertrain. As a result, the car can either be recharged or refilled.	A HEV is powered by an ICE in combination with electric motors that use energy stored in batteries. However, A HEV cannot be plugged-in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine.	A FCEV generates electricity to power the motor, generally using oxygen from the air and compressed hydrogen. Therefore, instead of recharging a battery, FCEVs store hydrogen gas in a tank. The fuel cell in FCEVs combines hydrogen with oxygen from the air to produce electricity.	A EREV is powered by its electric motor only. Despite install with an ICE, aka range extender, EREV's gas engine is used for generating additional electricity for the battery, rather than driving the vehicle directly. In fact, a EREV can either be recharged or refilled. The major difference between PHEV and EREV is the use of ICE
Graph illustration	<p style="text-align: center;">PEV Plug-in Electric Vehicle</p> <div style="display: flex; justify-content: space-around; text-align: center;"> <div> <p>BEV Battery Electric Vehicle</p> </div> <div> <p>PHEV Plug-in Hybrid Electric Vehicle</p> </div> <div> <p>HEV Hybrid Electric Vehicle</p> </div> <div> <p>FCEV Fuel Cell Electric Vehicle</p> </div> </div>				

EV BATTERY TYPE

New type batteries:

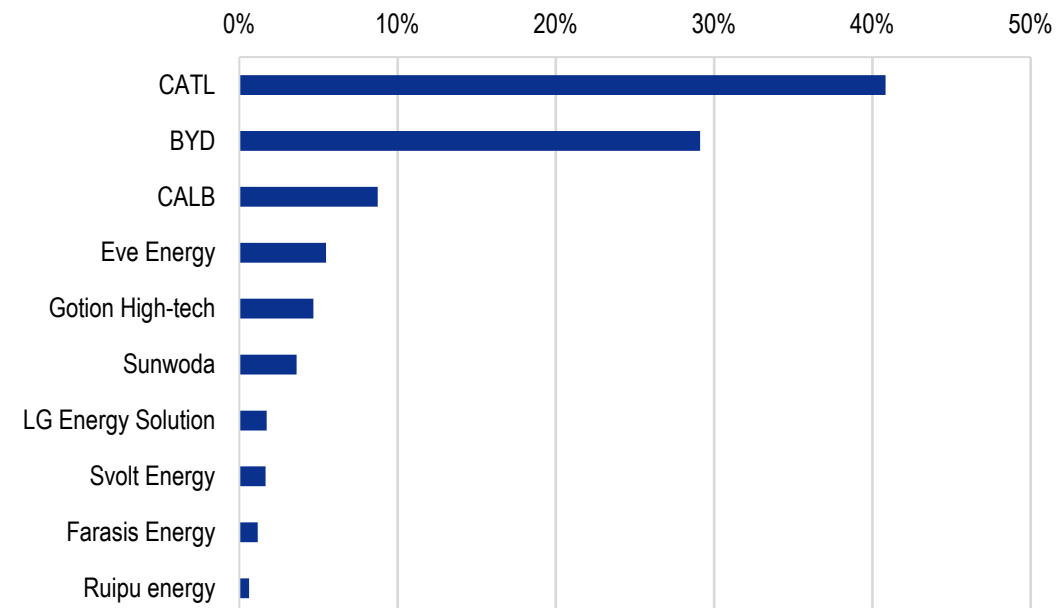
- BYD's Blade LFP battery can
- Ganfeng LMFP battery can ?
- CATL Qib LFP battery can ?

	lithium nickel manganese cobalt oxide (NMC)	lithium nickel cobalt aluminium oxide (NCA)	lithium iron phosphate (LFP)	Sodium-ion battery (Na-ion battery)
Mineral composition	Lithium, nickel, cobalt, manganese	Lithium, nickel, cobalt, aluminium	Lithium, Iron and phosphorous	Sodium, iron carbon and nitrogen
Energy Density (Wh/kg)	150 - 220	150 - 220	90 - 160	75 - 165
Pros & cons	Higher energy density level than LFP, and it is the most common EV battery type found in today's Evs	Similar energy density level as NMC's but longer lifespan due to the swap from manganese to aluminium	Lower production cost, safer in use, and longer lifespan when compared to NMC and NCA, but also the second lowest in energy density level among these 4 types of battery	Better performance in low temperature environment and fast charging than LFP, but also the lowest in energy density level among these 4 types of battery

BATTERY MAKERS TO BE THE KEY BENEFICIARIES

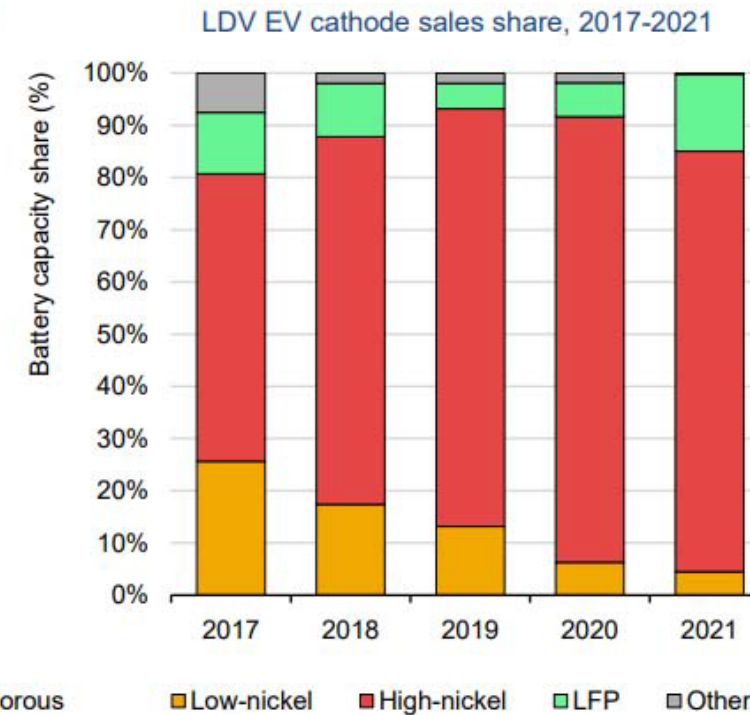
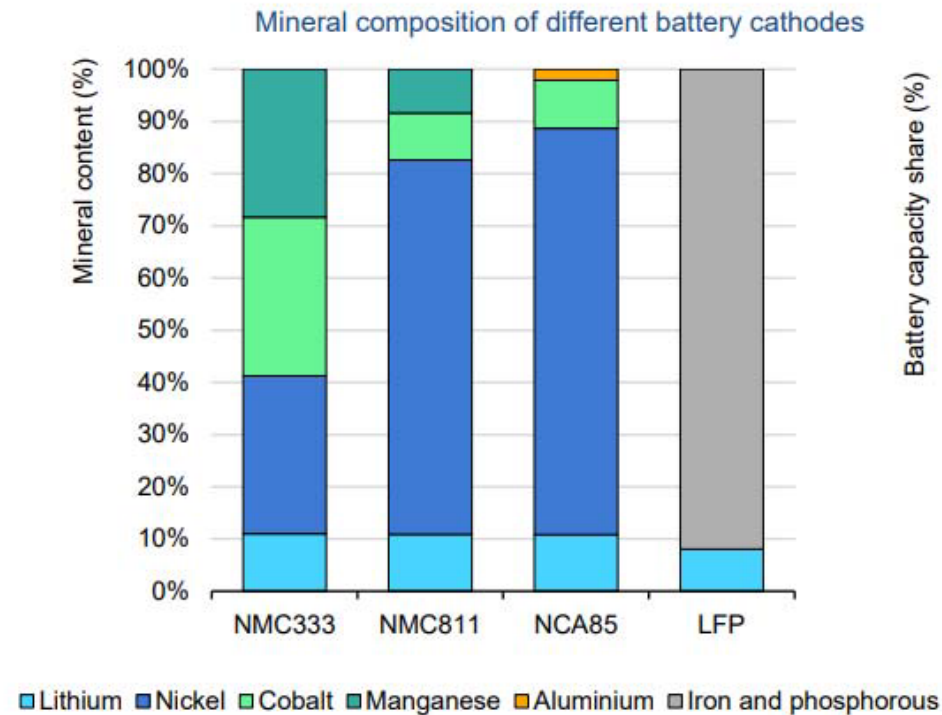
- Batteries makers to benefit from robust EV battery demand
- Volatile materials prices to ease the profitability.
- Secured the resources to become the key to maintain competitiveness

Top 10 EV Battery makers in China (Apr 2023)



CATHODE BATTERY CHEMISTRIES

- High-nickel cathode battery chemistries remain dominant
- Lithium-ion phosphate is making a comeback due to rapidly-growing of BYD EV shipments



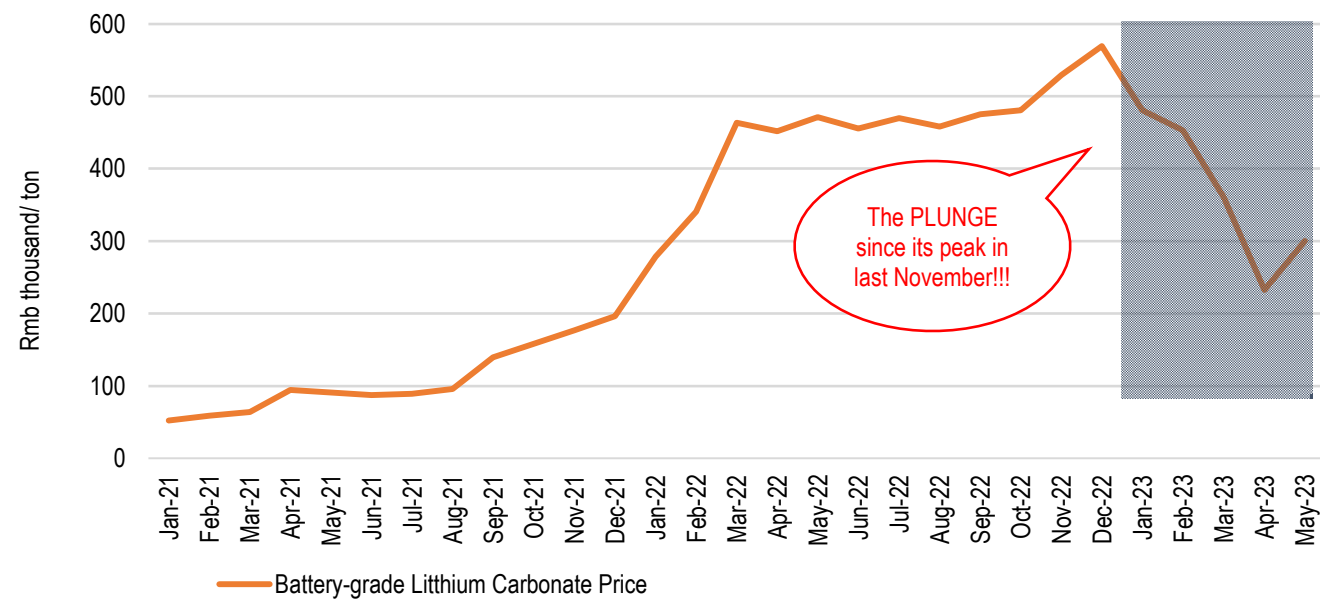
Source: IEA

APPENDIX I - LITHIUM CARBONATE PRICE

We estimate Lithium carbonate prices will gradually go down in 2023

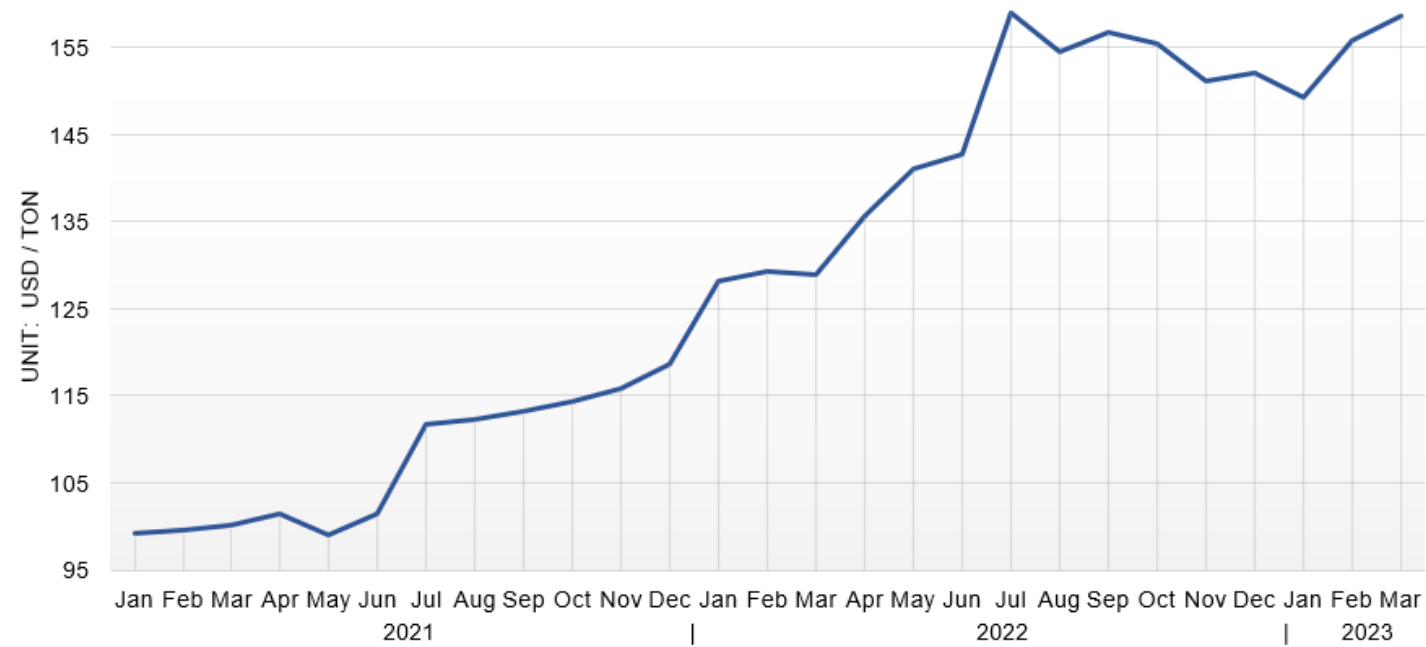
Lithium carbonate prices trend (Dec 2019 to May 2023)

Battery-grade Lithium Carbonate Price



APPENDIX II – HIGH-NICKEL PRICE

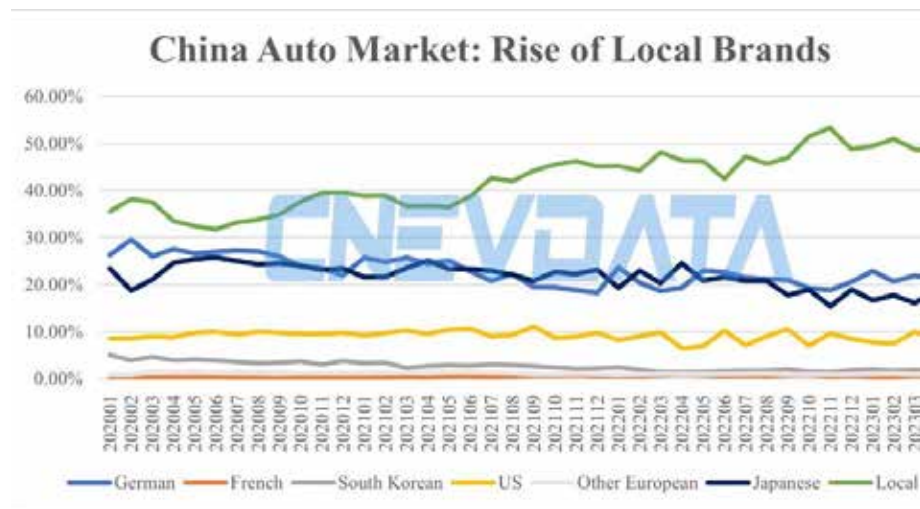
High-nickel prices trend (Dec 2019 to May 2023)



APPENDIX III – CHINA'S AUTO MARKET

- Passenger cars priced above Rmb300k accounted for c.14% of China's auto market (source: CPCA)
- That said, below Rmb300k are the mainstream and account for c.86%
- Local brands dominated and gained market share in China's auto market

Rise of Local brands in China auto market



Models priced <Rmb300k are main sellers



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