



Think Energy and Environment

Opportunities and Challenges in Global Battery and EV Industry

Exhibitor Seminar - 2024 InterBattery Europe

June 19 2024

- 1 About SNE Research
- 2 xEV Battery Market Scale
- 3 xEV Battery Demand Outlook (~2035)
- 4 Next-Gen Battery Technology Issues
- 5 Current Market Issues

1 About SNE Research

2 xEV Battery Market Scale

3 xEV Battery Demand Outlook (~2035)

4 Next-Gen Battery Technology Issues

5 Current Market Issues



About SNE Research

“ SNE Research is dedicated to upholding the **core values** and **success of our clients.**”

Our mission is to deeply understand and prioritize the unique needs and goals of each client, providing unwavering support and innovative solutions to ensure their success.

Through our commitment to integrity, excellence, and client-centricity, we strive to be trusted partners in our clients' journey towards achieving their objectives.

We measure our own success by the achievements and satisfaction of those we serve, fostering long-term relationships built on mutual respect, collaboration, and a relentless pursuit of value creation.



Global Customers
300+



Special Reports
450+



Subscribers
45,000+



In-Depth Consulting
300+



About SNE Research

Since 2010, SNE Research has established a cooperative relation with pivotal market players around the world and expanded the global network from China and Japan to the US and Europe.





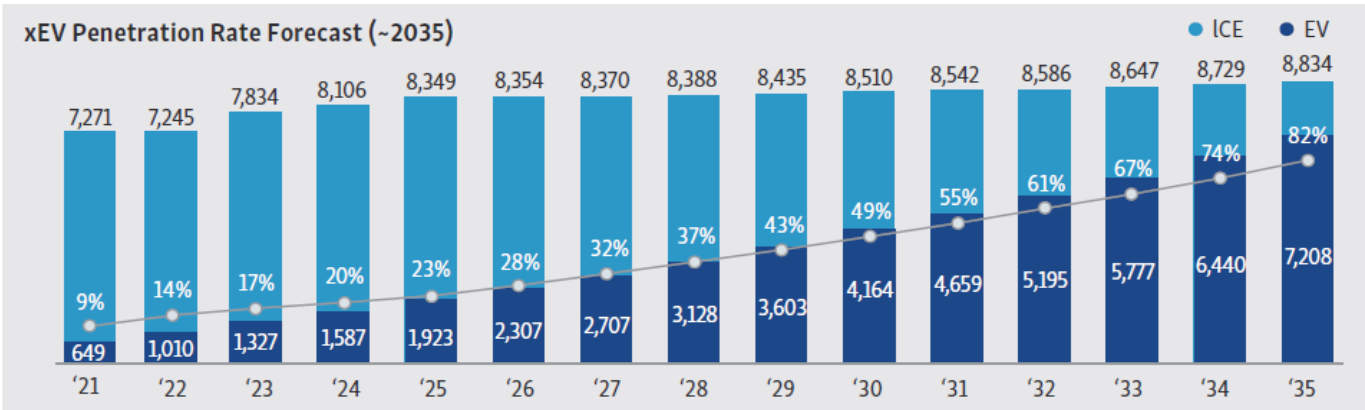
About SNE Research – Business Areas

1. Market Research Report

SNE Research publishes **30+ reports** annually, based on market research in the fields of battery, battery materials, electric vehicles, energy storage system, and next-generation battery technology.

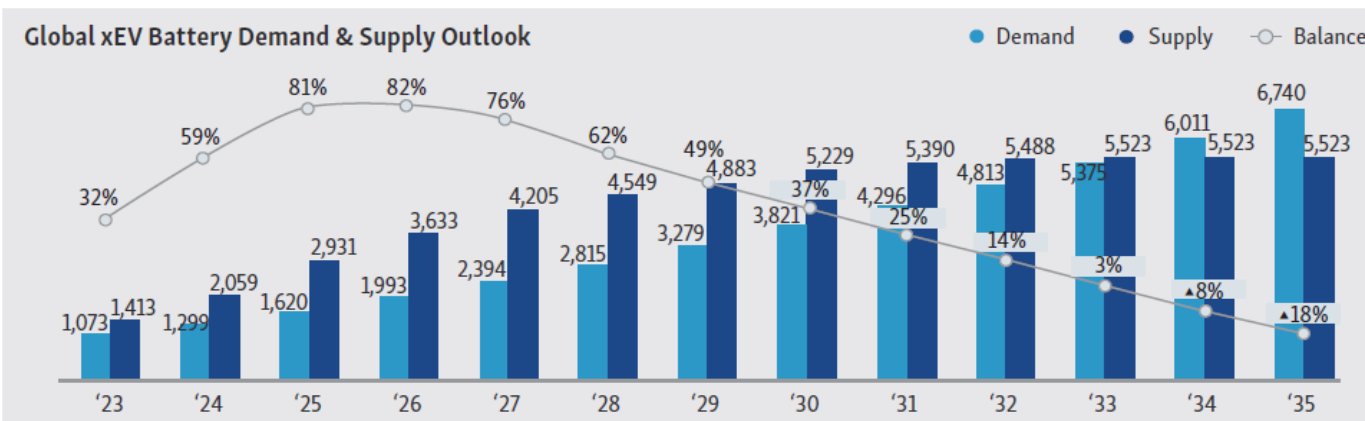
Global Electric Vehicle Market and Battery Supply and Demand Forecast

<Global Electric Vehicle Market and Battery Supply and Demand Forecast> is one of the representative reports published by SNE Research, providing an overview of the current status of EV and battery market and forecasting the future market.



Global Electric Vehicle Market Outlook

- Global Electric LV(Light Vehicle) Market Outlook
- EV Market Outlook by Region (NA, Europe, China, Japan, Korea, etc)
- Electric BUS Market Outlook
- Electric TRUCK Market Outlook



Battery Demand and Supply Outlook

- LIB Market and Selling Price Outlook
- xEV Battery Market Outlook
- Battery Demand Outlook by Car Maker (LV)
- Supply Outlook by LIB Maker
- Mid/Long-term Outlook for Battery Supply & Demand

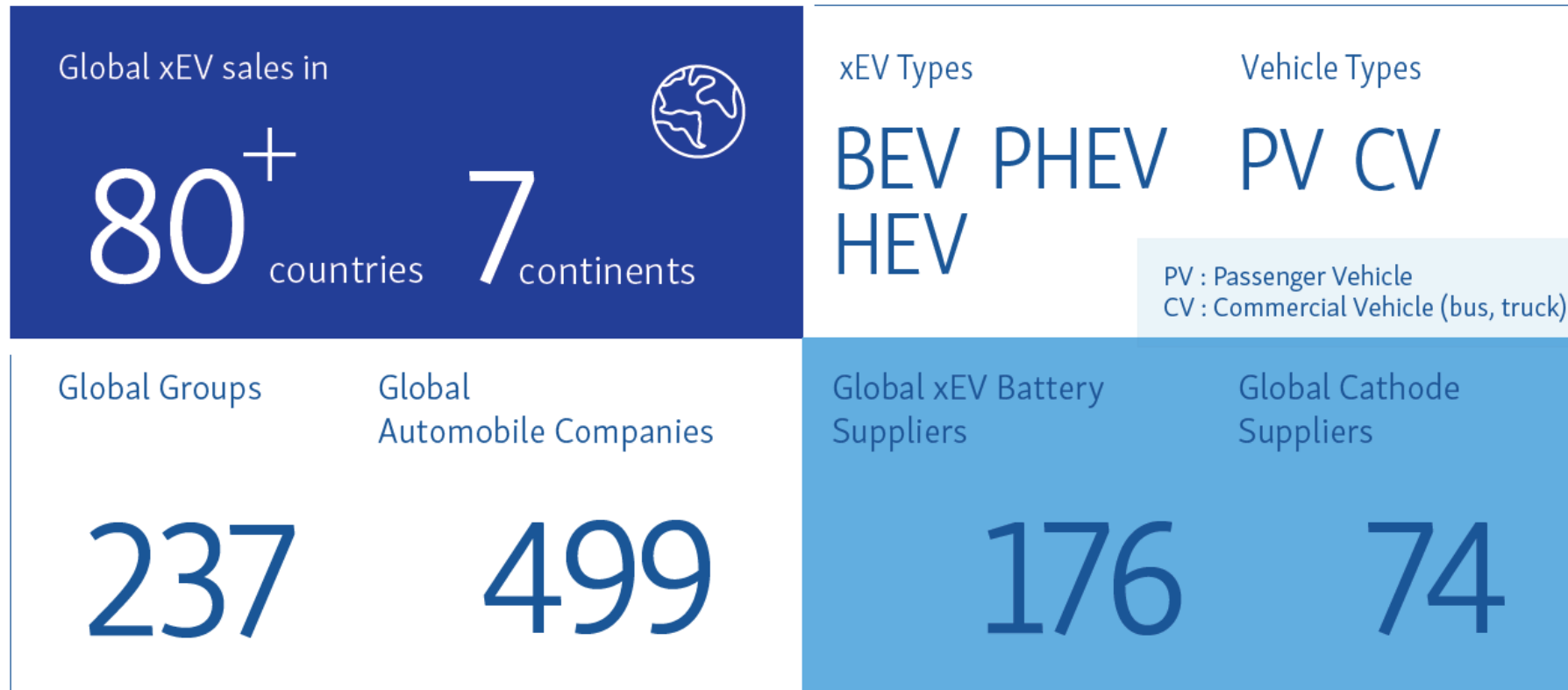


About SNE Research – Business Areas

2. Data Service : Global EV & Battery Monthly Tracker

Global EV & Battery Monthly Tracker by SNE Research tracks the number of registered EVs worldwide on a monthly basis, providing an [overview of supply chain](#) from OEMs to cathode suppliers and information on cathode and raw materials in EV batteries.

Global No.1 World's Only Global Monthly xEV, Battery, Cathode(Li, Co, Ni, Mn) Usage DB





About SNE Research – Business Areas

2. Data Service : Global EV & Battery Monthly Tracker

Comprehensive EV Sales Data

Global Coverage	Track sales by type, country, continent, group, OEM, and model
Reliable Sources	Data gathered from governments, associations, and car manufacturers
Monthly Updates	Stay informed with the latest trends in EV market

(units : no. of cars)

Maker (Units)	Jan-2023	Feb-2023	Mar-2023	Apr-2023	May-2023	Jun-2023	Jul-2023	Aug-2023	Sep-2023	Oct-2023	Nov-2023	Dec-2023	Jan-2024	Feb-2024	Mar-2024
TESLA	94,733	124,301	203,841	120,753	142,552	202,835	114,672	167,913	152,474	116,250	176,325	191,932	117,249	124,504	170,920
Model Y	52,646	80,917	141,051	76,190	96,044	133,108	75,530	114,890	119,629	78,955	114,720	129,025	78,364	84,315	122,768
BYD	0	0	0	0	0	0	216	407	602	233	229	232	0	0	0
Pr	0	0	0	0	0	0	216	407	602	233	229	232	0	0	0
CATL	15,694	28,137	64,353	29,096	32,802	61,099	24,329	52,111	51,614	29,279	54,534	60,442	28,864	24,404	58,427
Pr	15,694	28,137	64,353	29,096	32,802	61,099	24,329	52,111	51,614	29,279	54,534	60,442	28,864	24,404	58,427
LGES	7,093	18,947	43,394	12,499	26,805	33,204	15,707	26,095	34,088	13,908	30,708	38,302	20,485	28,727	35,618
Cy	7,093	18,947	43,394	12,499	26,805	33,204	15,707	26,095	34,088	13,908	30,708	38,302	20,485	28,727	35,618
Panasonic	29,859	33,833	33,304	34,595	36,437	38,805	35,278	36,277	33,325	35,535	29,249	30,049	29,015	31,184	28,723
Cy	29,859	33,833	33,304	34,595	36,437	38,805	35,278	36,277	33,325	35,535	29,249	30,049	29,015	31,184	28,723
Model 3	37,792	39,153	60,621	39,707	40,812	61,054	33,854	46,915	28,256	30,860	54,628	53,350	35,146	35,480	41,970
Model X	2,313	2,333	991	2,811	3,133	5,363	3,067	3,626	2,354	3,830	4,198	5,880	2,112	2,444	3,103
Model S	1,982	1,898	1,178	2,027	2,563	3,310	2,221	2,482	2,235	2,605	2,779	3,677	1,138	1,757	2,082
SEMI	0	0	0	18	0	0							0	0	0
CYBERTRUCK	0	0	0	0	0	0	0	0	0	0	0	0	489	508	997
Roadster	0	0										0	0	0	0



About SNE Research – Business Areas

2. Data Service : Global EV & Battery Monthly Tracker

Detailed Battery Usage Insights

In-Depth Analysis	Understand battery usage by supplier, type, and chemistry
Accurate Calculations	Battery installment multiplied with battery capacity of each model
Direct Information	Accurate battery installation data directly from battery makers

(MWh)

Battery Supplier (MWh)	Apr-2023	May-2023	Jun-2023	Jul-2023	Aug-2023	Sep-2023	Oct-2023	Nov-2023	Dec-2023	Jan-2024	Feb-2024	Mar-2024
CATL	16,769.1	18,956.9	24,541.3	19,407.2	22,961.5	24,841.3	23,381.5	27,921.8	32,095.0	19,857.8	15,339.5	24,943.5
TESLA	3,224.3	3,323.7	5,708.9	2,556.7	4,707.2	4,024.0	2,693.8	4,940.6	5,347.7	2,903.3	2,616.9	4,881.7
Model Y	1,745.8	1,968.1	3,665.9	1,459.7	3,126.7	3,096.8	1,756.7	3,272.0	3,626.5	1,731.8	1,464.2	3,505.6
Pr	1,745.8	1,968.1	3,665.9	1,459.7	3,126.7	3,096.8	1,756.7	3,272.0	3,626.5	1,731.8	1,464.2	3,505.6
LFP	1,745.8	1,968.1	3,665.9	1,459.7	3,126.7	3,096.8	1,756.7	3,272.0	3,626.5	1,731.8	1,464.2	3,505.6
Model 3	1,478.6	1,355.6	2,043.0	1,096.9	1,580.5	927.1	937.0	1,668.6	1,721.1	1,171.4	1,152.6	1,376.1
Pr	1,478.6	1,355.6	2,043.0	1,096.9	1,580.5	927.1	937.0	1,668.6	1,721.1	1,171.4	1,152.6	1,376.1
LFP	1,478.6	1,355.6	2,043.0	1,096.9	1,580.5	927.1	937.0	1,668.6	1,721.1	1,171.4	1,152.6	1,376.1
Geely	1,120.3	1,186.4	1,526.9	1,871.9	1,842.9	1,810.6	1,834.4	1,699.3	1,842.1	1,410.1	882.6	1,337.1
Lixiang Automotive	960.2	1,059.1	1,218.2	1,276.8	1,315.3	1,374.2	1,541.9	1,570.1	1,965.1	1,164.8	763.1	1,307.1
NIO (Weilai) (蔚来)	512.5	478.6	737.6	1,149.4	1,133.9	893.6	957.7	926.1	1,027.0	579.7	473.9	672.9
BMW	585.3	908.5	946.5	804.5	995.7	965.7	898.6	1,077.9	1,339.1	608.8	644.3	954.1
MG	502.9	775.1	905.0	702.8	741.2	941.7	820.8	825.9	1,063.0	572.4	610.8	622.3
GAC Aion	989.8	912.3	850.2	463.6	409.1	923.2	1,066.9	908.0	759.8	180.0	186.8	434.7
CHANGAN	512.3	545.4	631.0	655.1	593.1	955.2	842.4	724.3	821.2	648.8	409.8	1,120.5
SAIC-VW	315.5	463.3	423.1	767.9	738.2	899.4	927.4	1,161.4	1,233.0	642.3	490.2	555.2
BMW-Brilliance	458.3	515.0	519.6	368.2	675.1	696.6	660.5	759.7	729.4	759.1	339.3	435.2
SAIC	366.7	401.5	401.1	310.0	298.0	530.5	584.9	1,094.1	1,501.2	525.8	442.2	618.1
MERCEDES	489.7	553.7	615.0	401.7	471.8	546.8	497.0	577.1	634.4	394.5	419.0	536.6
SAIC-GM	186.2	291.2	523.7	482.2	489.1	619.2	615.4	913.7	1,137.7	740.0	299.8	331.2
FAW-VW	406.7	569.7	567.4	563.5	448.9	568.6	504.5	638.6	611.3	592.0	217.1	423.8
VOLVO	412.9	544.0	442.9	336.6	350.2	425.3	493.1	514.8	547.9	437.6	446.0	610.5



About SNE Research – Business Areas

2. Data Service : Global EV & Battery Monthly Tracker

Cathode and Raw Materials Usage Tracking

Material Insights Monitor monthly trend of cathode, lithium, nickel, cobalt, and manganese usage in batteries

Precise Methodology Accurate tracking of raw materials used in cathode, determining quantity of materials used in battery

(Kg)

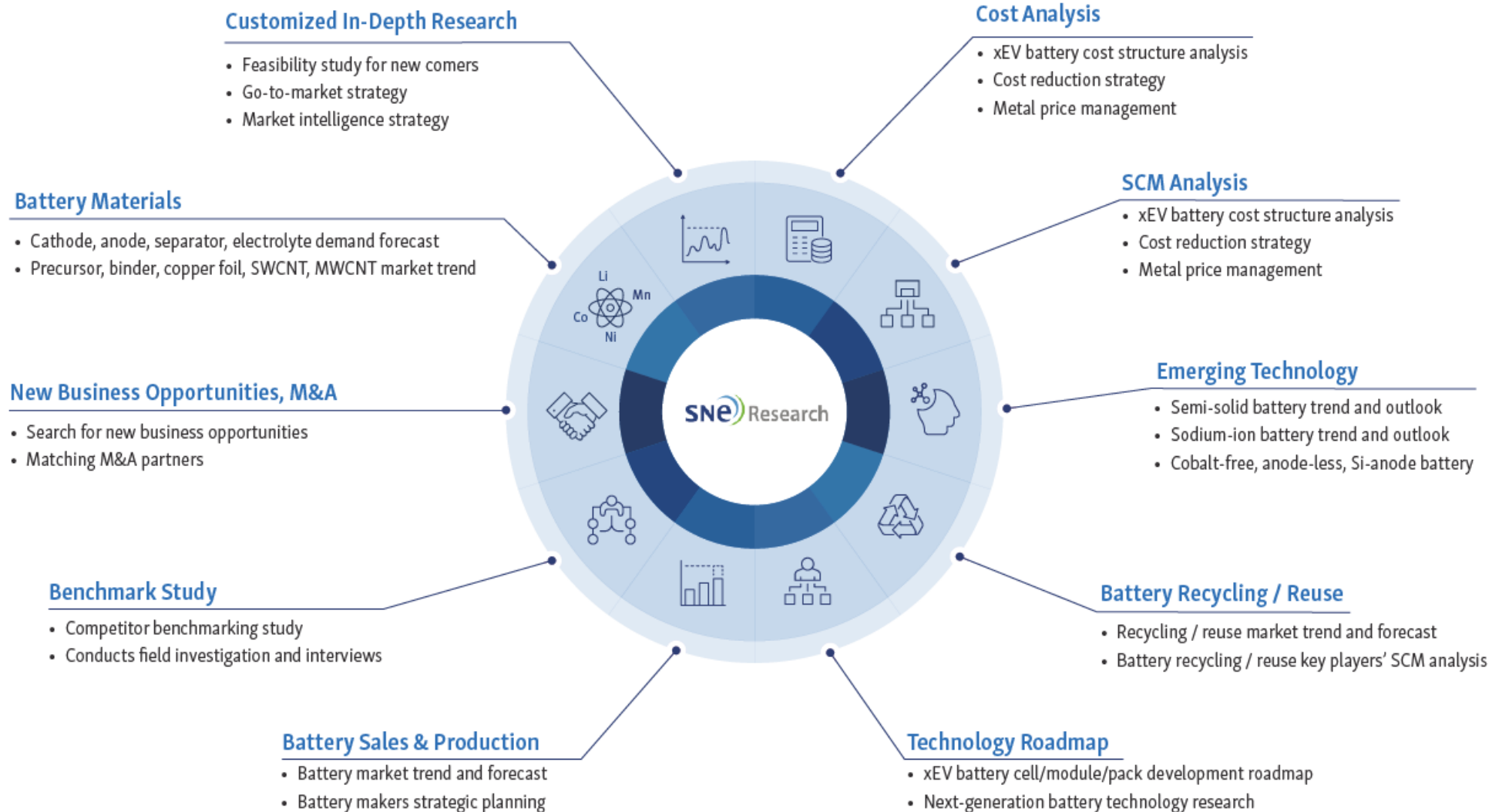
xEV OEMs (kg)	(Ca)			(Li)			(Co)			(Ni)			(Mn)		
	23 Y	Jan- Mar-23	Jan- Mar-24	23 Y	Jan- Mar-23	Jan- Mar-24	23 Y	Jan- Mar-23	Jan- Mar-24	23 Y	Jan- Mar-23	Jan- Mar-24	23 Y	Jan- Mar-23	Jan- Mar-24
TESLA	261,710,104	61,130,555	59,240,968	15,205,536	3,525,468	3,476,990	8,432,426	1,917,488	1,986,026	69,558,870	15,834,278	16,315,995	3,547,874	774,680	961,710
Model 3	76,425,335	19,899,554	16,389,723	4,139,079	1,046,201	897,447	1,851,916	415,335	418,354	15,108,586	3,412,833	3,394,171	1,096,560	199,818	283,474
B&M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dynanonic	45,960,895	13,077,867	9,499,433	1,957,045	556,864	404,492	0	0	0	0	0	0	0	0	0
L&F+LGC	19,442,556	3,542,875	5,026,135	1,386,254	252,607	358,363	1,176,275	214,344	304,081	9,384,922	1,710,146	2,426,115	1,096,560	199,818	283,474
Sumitomo+BASF	11,021,884	3,278,813	1,864,155	795,780	236,730	134,592	675,641	200,991	114,273	5,723,664	1,702,687	968,056	0	0	0
Model S	4,308,290	752,541	740,490	324,583	56,696	55,788	275,581	48,136	47,366	2,334,569	407,786	401,255	0	0	0
Sumitomo+BASF	4,308,290	752,541	740,490	324,583	56,696	55,788	275,581	48,136	47,366	2,334,569	407,786	401,255	0	0	0
Model X	6,285,459	888,021	1,206,555	473,541	66,903	90,901	402,051	56,802	77,178	3,405,954	481,199	653,806	0	0	0
Sumitomo+BASF	6,285,459	888,021	1,206,555	473,541	66,903	90,901	402,051	56,802	77,178	3,405,954	481,199	653,806	0	0	0
Model Y	174,662,664	39,590,439	40,462,632	10,266,286	2,355,669	2,401,370	5,901,140	1,397,214	1,416,414	48,695,037	11,532,460	11,653,618	2,451,314	574,861	653,331
B&M	32,736	7,911	4,092	2,334	564	292	1,981	479	248	15,802	3,819	1,975	1,846	446	231
BYD	272,658	0	0	11,610	0	0	0	0	0	0	0	0	0	0	0
Hunan Yuneng	77,556,224	16,664,368	17,205,193	3,302,394	709,580	732,608	0	0	0	0	0	0	0	0	0
L&F+LGC	43,430,281	10,184,666	11,579,798	3,096,579	726,167	825,640	2,627,532	616,172	700,578	20,963,797	4,916,138	5,589,568	2,449,468	574,415	653,101
Sumitomo+BASF	53,370,765	12,733,493	11,673,550	3,853,369	919,358	842,830	3,271,628	780,563	715,589	27,715,438	6,612,503	6,062,075	0	0	0
Roadster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sumitomo+BASF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEMI	28,356	0	0	2,047	0	0	1,738	0	0	14,725	0	0	0	0	0
Sumitomo+BASF	28,356	0	0	2,047	0	0	1,738	0	0	14,725	0	0	0	0	0
CYBERTRUCK	0	0	441,568	0	0	31,484	0	0	26,715	0	0	213,145	0	0	24,904
L&F+LGC	0	0	441,568	0	0	31,484	0	0	26,715	0	0	213,145	0	0	24,904



About SNE Research – Business Areas

3. Consulting Service

SNE Research provides 100% customized consulting service based on independent research and studies utilizing database and global network.



About SNE Research – Business Areas

4. Conference

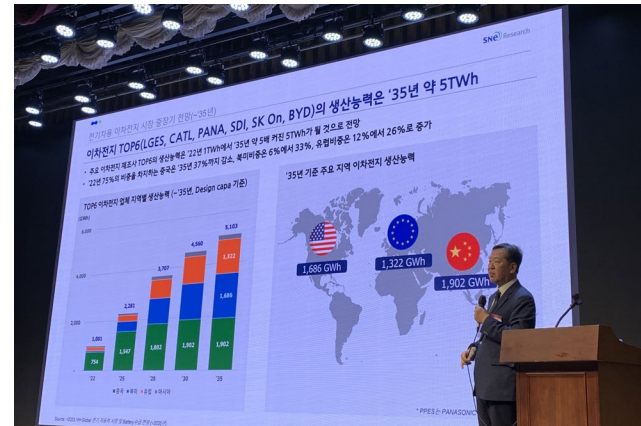
Our conferences and seminars successfully attract 300+ participants who come to learn more about the current market status and outlook as well as technology development roadmap by battery makers and OEMs.

Next Generation Battery Seminar (NGBS)

- Invites global speakers from leading companies
- Focuses on battery and xEV market trend and forecast

Speech Topics

LGES: Next-Gen Battery Development & Outlook
 Samsung SDI: All-Solid-State Battery Development
 CATL: Creative Battery Technology

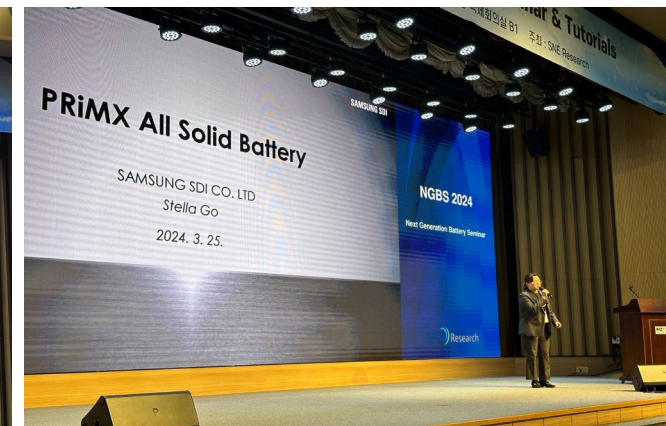


Korea Advanced Battery Conference (KABC)

- Addresses technology development issues
- Shares xEV battery roadmap

Speech Topics

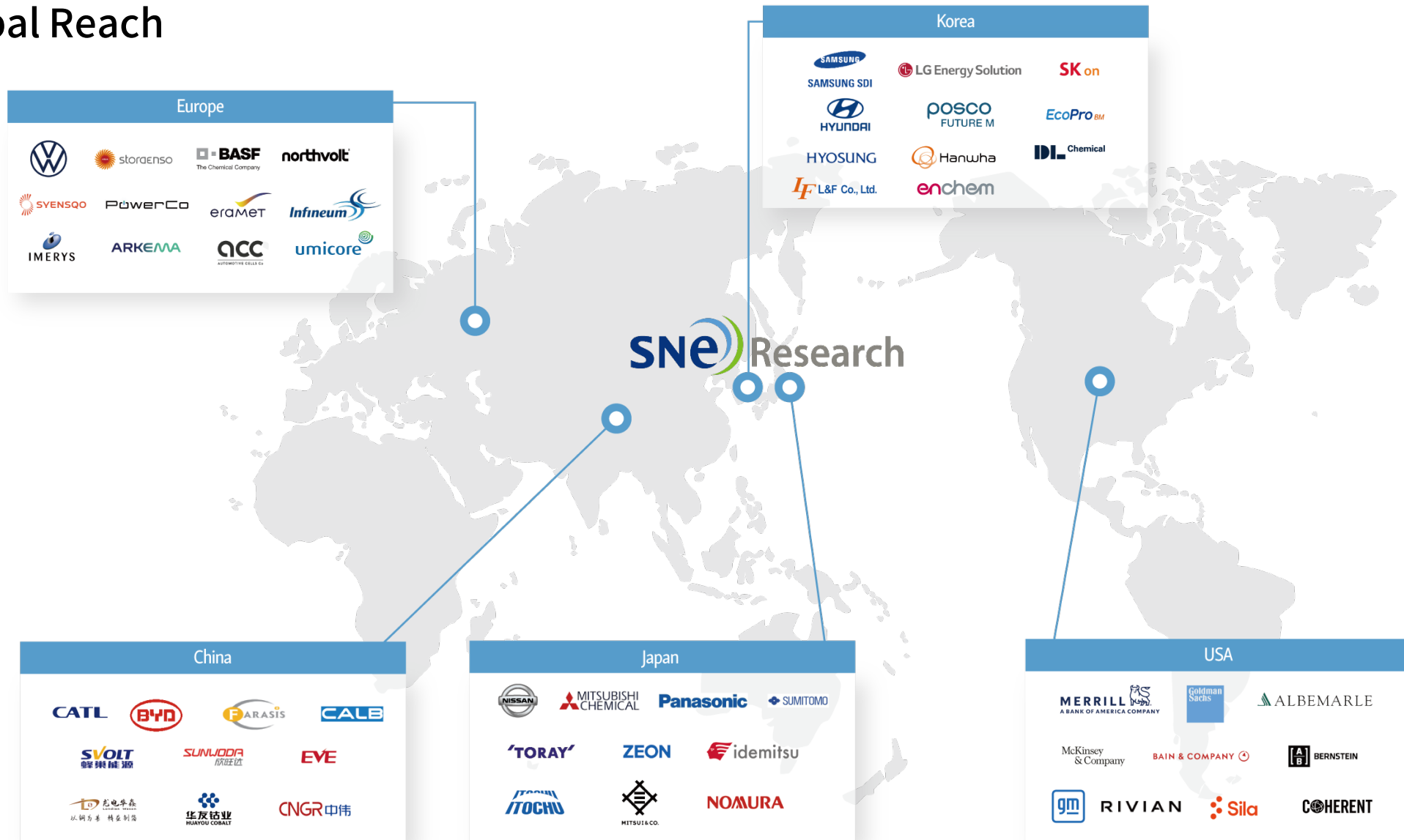
SK On: Strategy & Plan for Battery Development
 Hyundai Motors: Future Direction of EV Industry
 Huayou Cobalt: Closed Loop Total Solution





About SNE Research

Global Reach



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xEV(BEV+PHEV) Sales Volume and Battery Usage Review in 2023

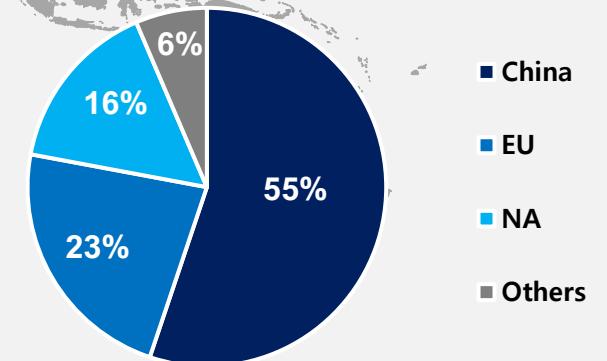
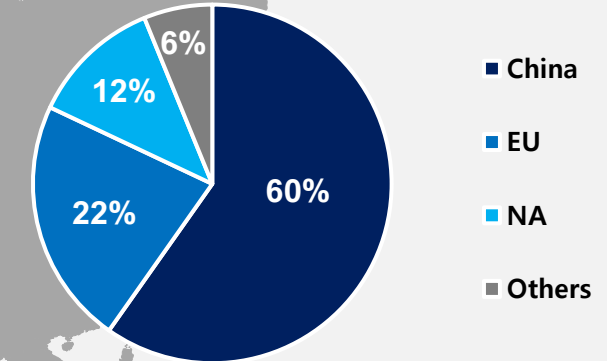
2023 Global EV(BEV+PHEV) Sales Volume (10k units)

	2022Y	(M/S)	2023Y	(M/S)	YoY
China	625	59%	841	60%	35%
EU	264	25%	313	22%	19%
NA	111	11%	166	12%	49%
Others	53	5%	86	6%	62%
Global	1,054	100%	1,407	100%	34%

2023 Global EV(BEV+PHEV) Battery Usage (GWh)

	2022Y	M/S	2023Y	M/S	YoY
China	285	57%	385	55%	35%
EU	119	24%	159	23%	34%
NA	71	14%	109	16%	54%
Others	28	6%	45	6%	61%
Global	503	100%	698	100%	39%

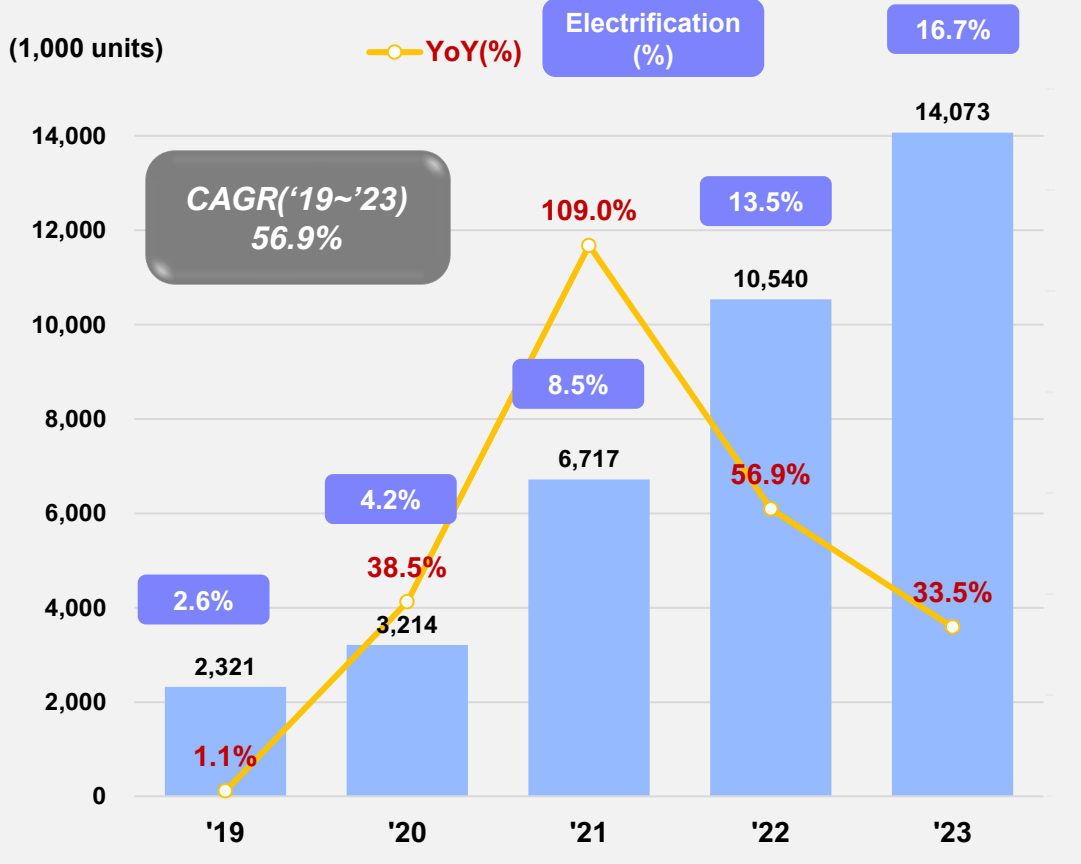
[2023 Market Share]



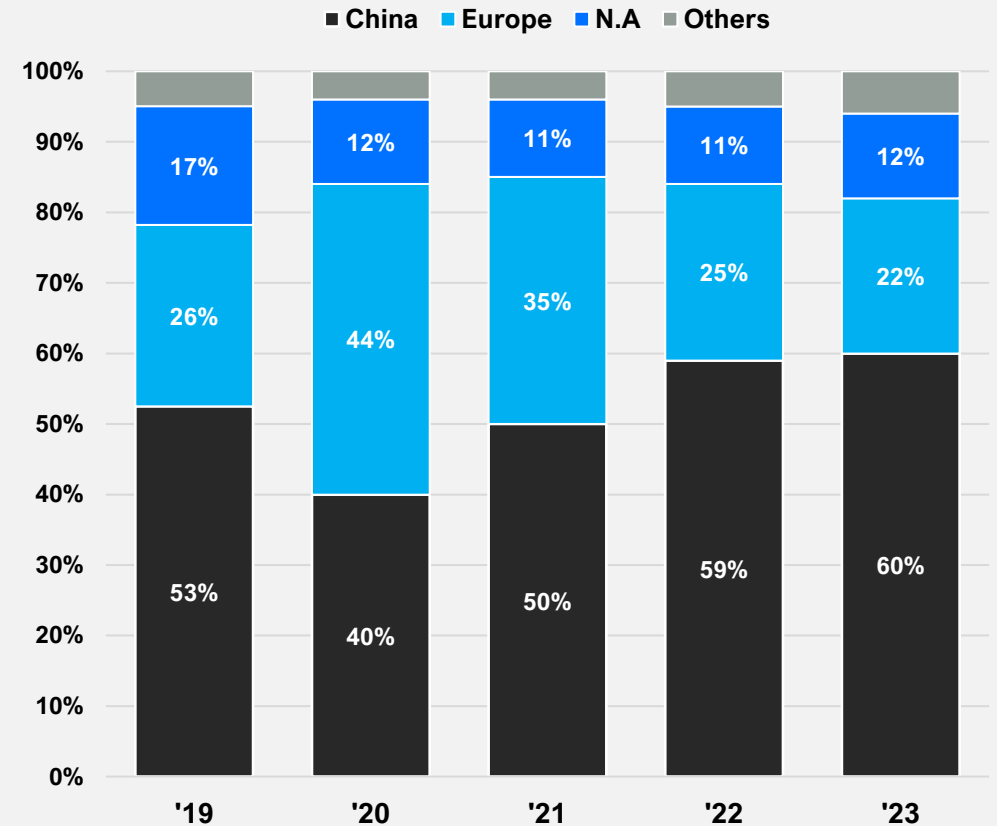
xEV Market Hitting Speed Bumps

- Short term slowdown in xEV market growth due to prolonged high interest rate, terminated demand from early adopters, and shortage of charging infrastructure. In mid/long-term, the movement towards electrification continues.
 - The current slowdown in xEV market can be regarded as [short-term growing pains](#).

Global EV(BEV+PHEV) Sales



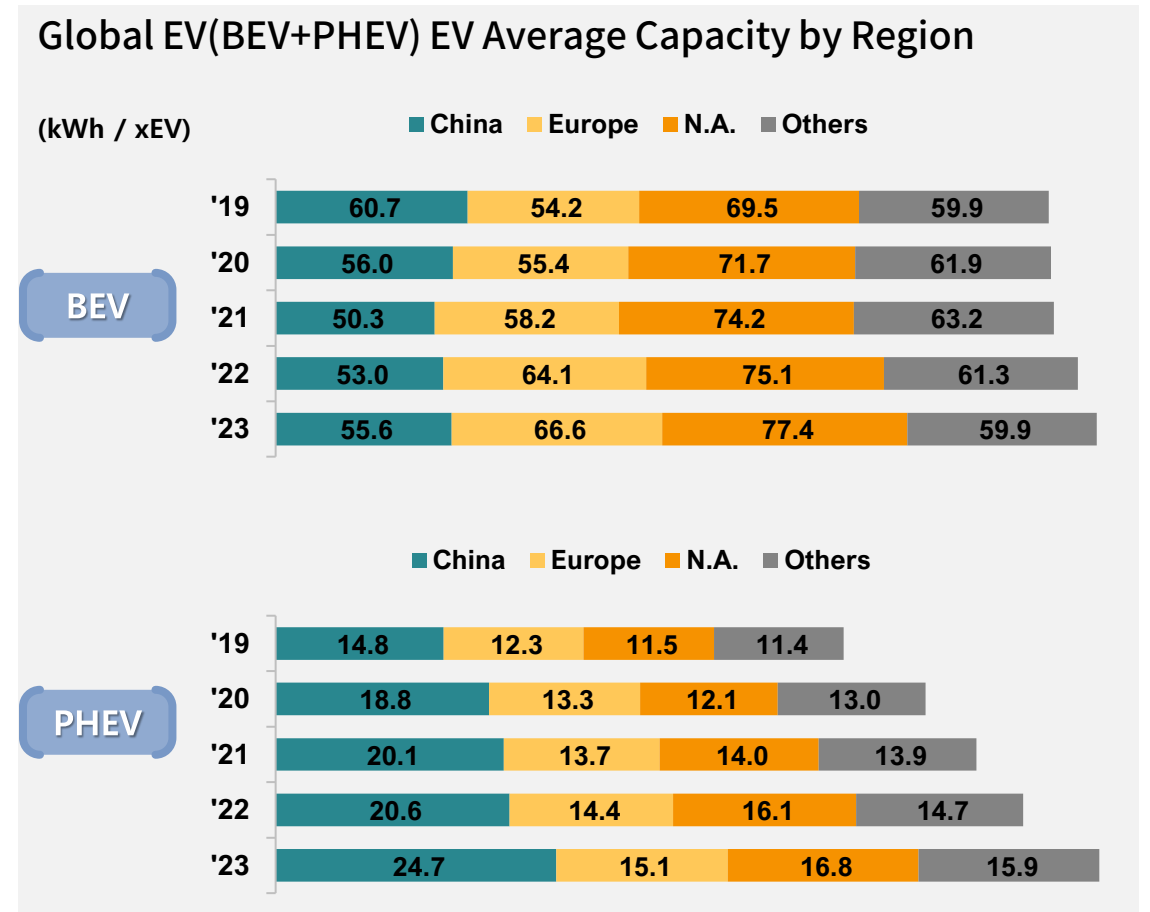
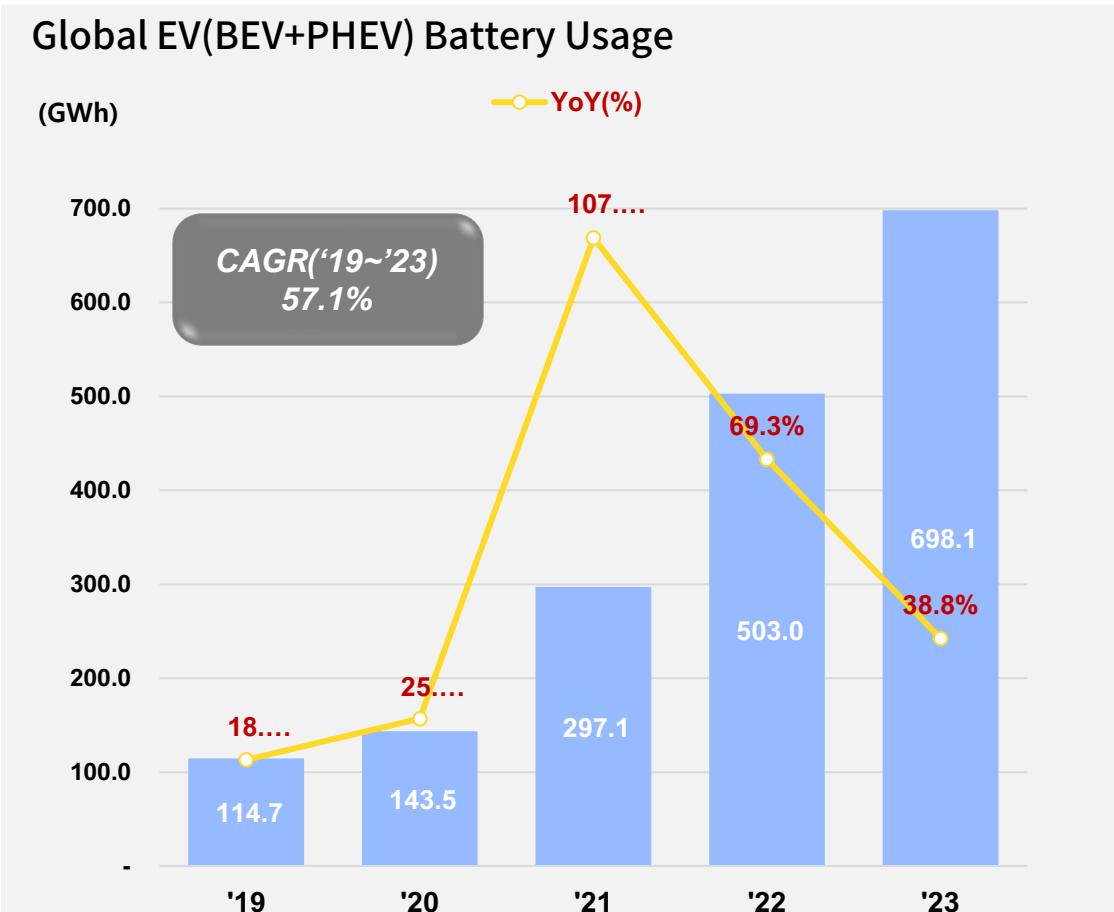
Global EV(BEV+PHEV) Regional Sales Portion





Reduction in Battery Usage Growth Due to Slowdown in xEV Demand

- Increase in pick-up trucks and high-capacity EV → Increase in the average EV battery capacity every year
- Increase in sales of PHEV with large-capacity battery (40kWh) installed: After Chinese Li-Auto successfully enters the market, BMW, Mercedes, and BYD launches 30kWh and higher.

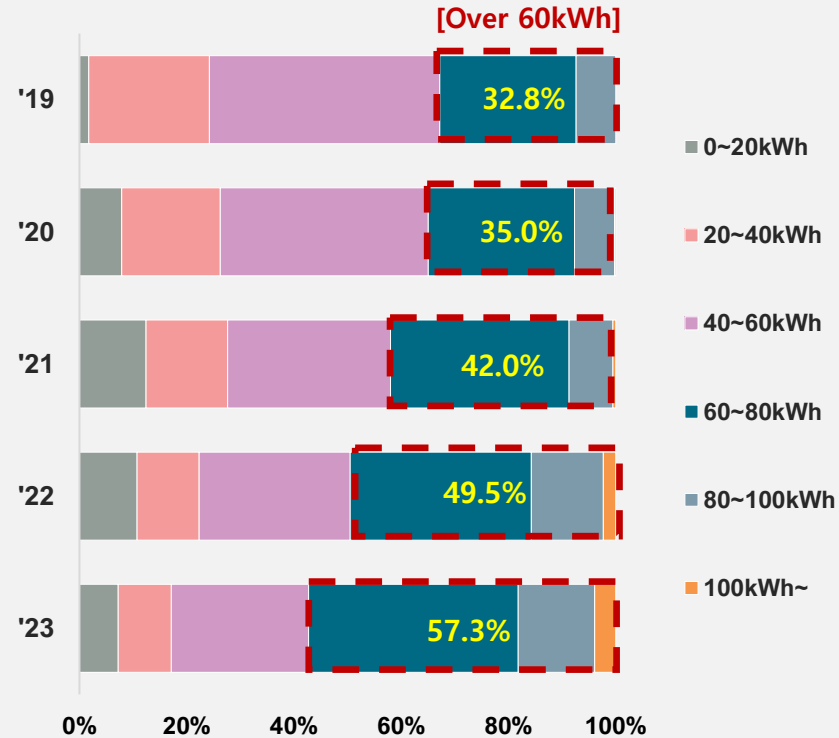


Increase in High-Capacity Battery EV Sales

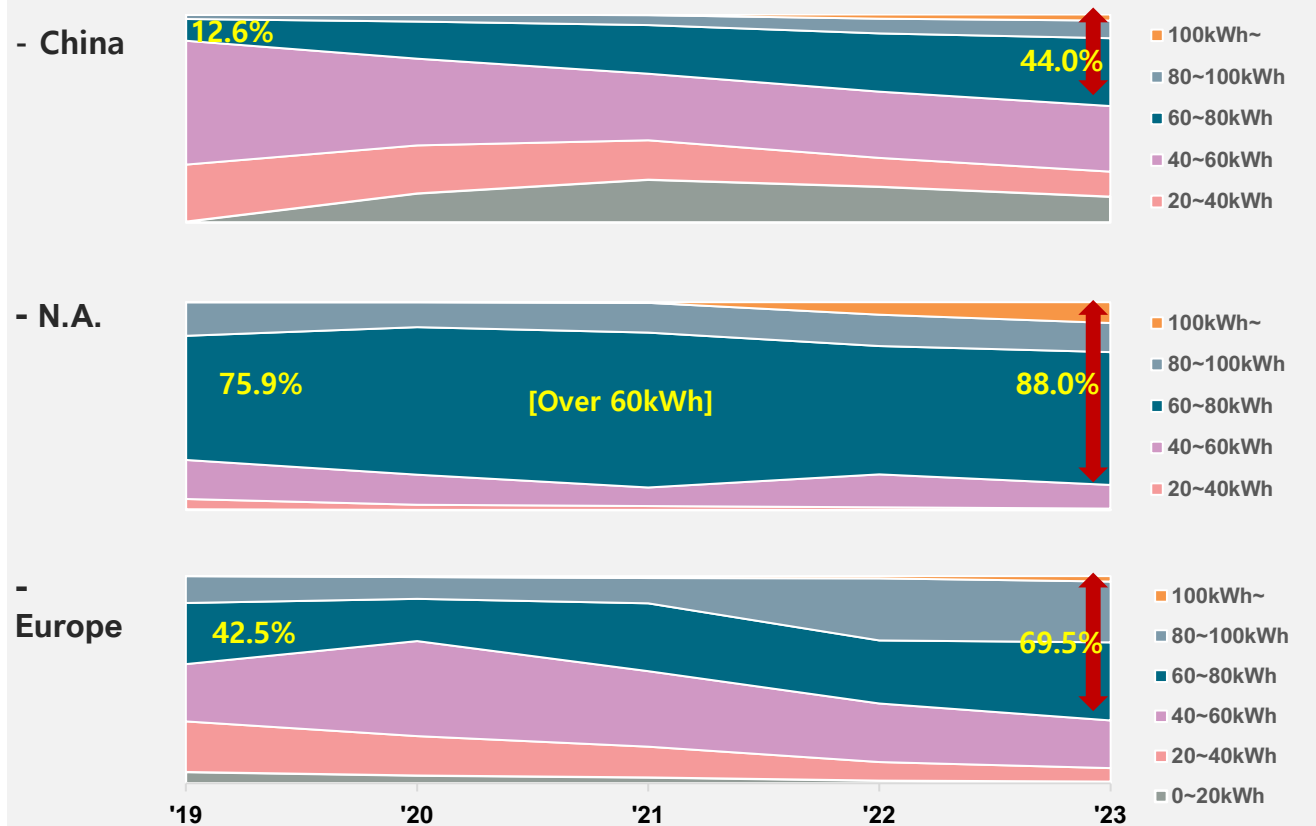
- Increase in EV sales with high-capacity battery installed based on customers' preference on large-size SUV with high-capacity battery and development of battery technology.
- Increase in sales of high-capacity EVs by Tesla and BYD in China and those by VW, Tesla, and Hyundai-Kia in Europe and N. America

Global EV(Only BEV) Segment Portion(Battery Capacity)

* Excl. BUS, TRUCK



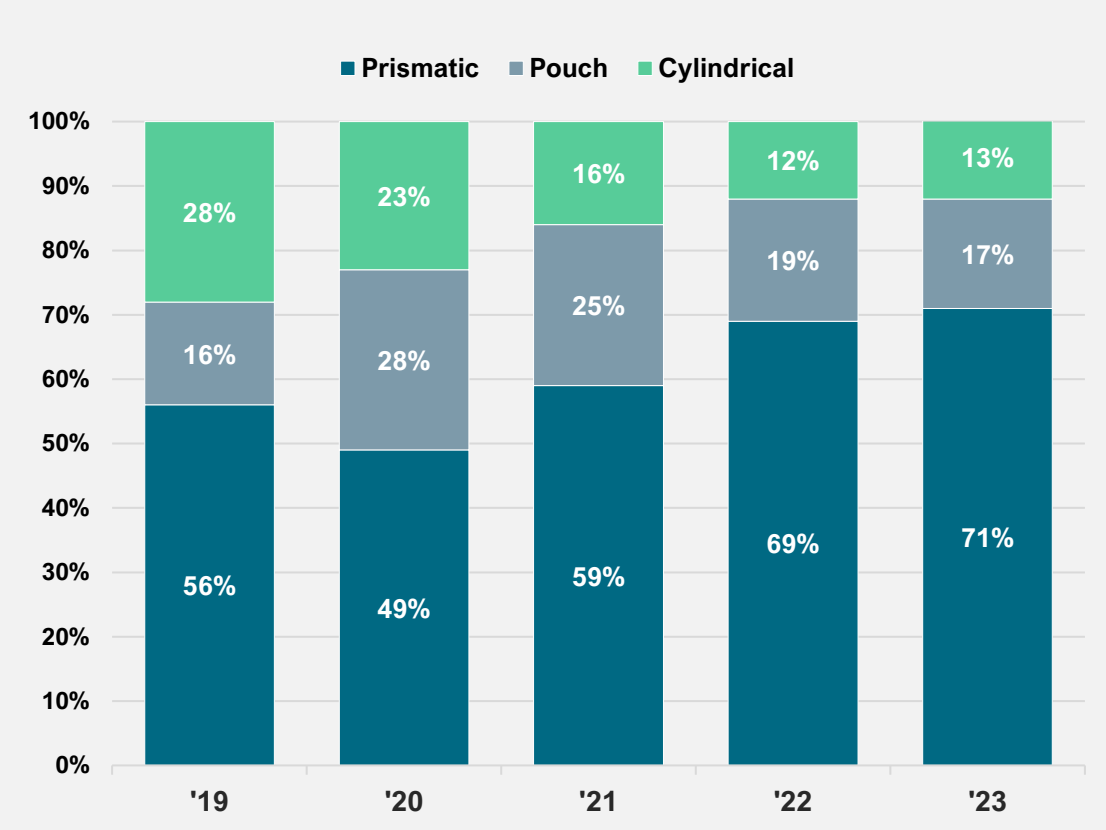
Global EV(Only BEV) Segment Portion by Region (Battery Capacity)



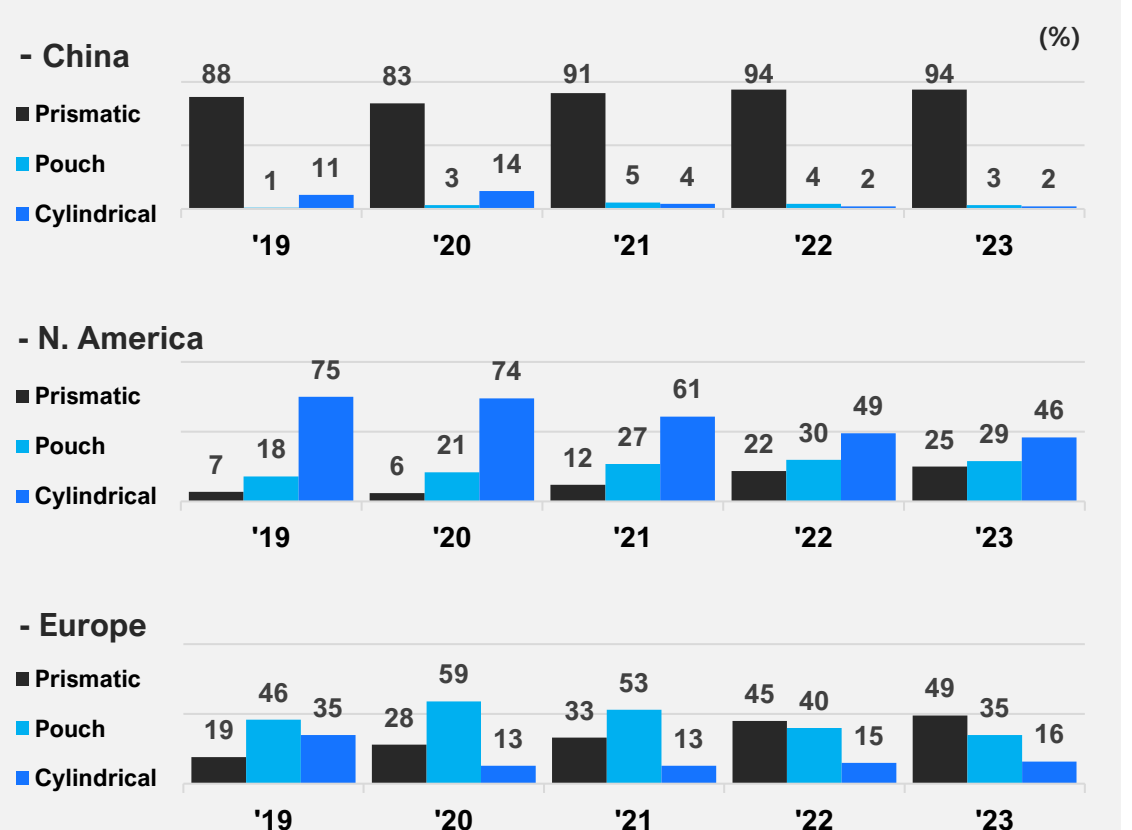
Expansion of Prismatic Battery Installation

- Gradual expansion of market share by prismatic battery which has strong points in terms of thermal propagation.
- With CATL expanding its presence in the global market, the portion of prismatic battery in Europe and N. America increases.
- If mass production of 46Φ cylindrical battery becomes in full swing, changes in portions by each form factor are expected.

Trend in Global Battery Usage by Form Factor (Based on Installed Capacity)

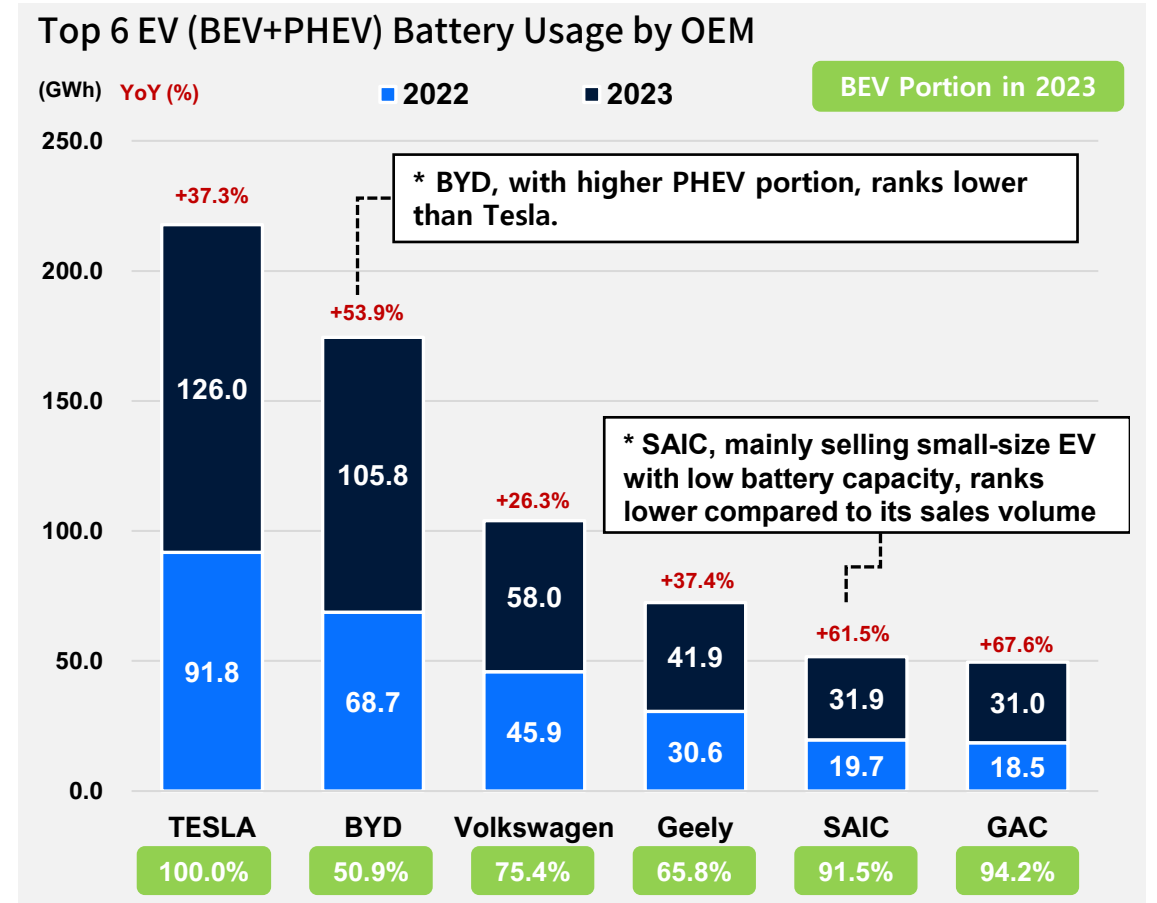
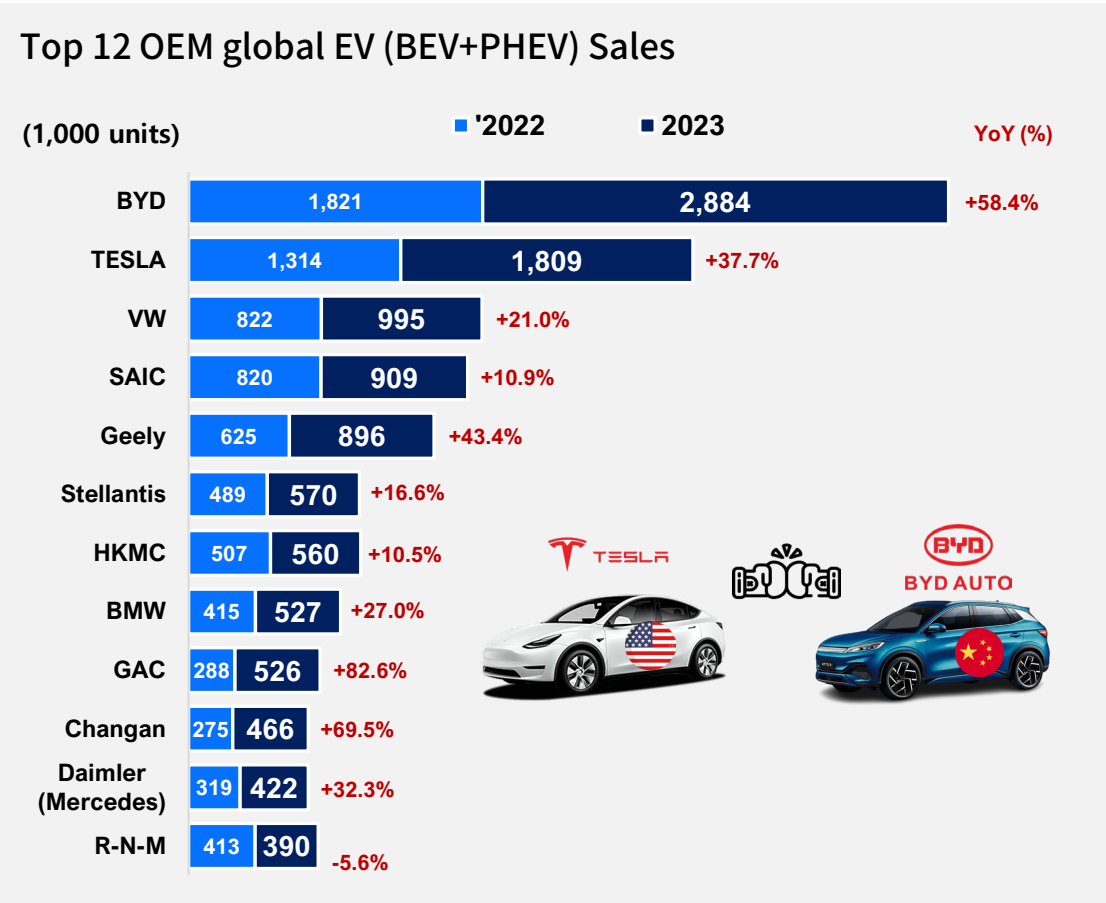


Trend in Battery Usage by Form Factor in Different Regions



Crisis of Traditional OEMs with Sudden Rise of New EV Makers

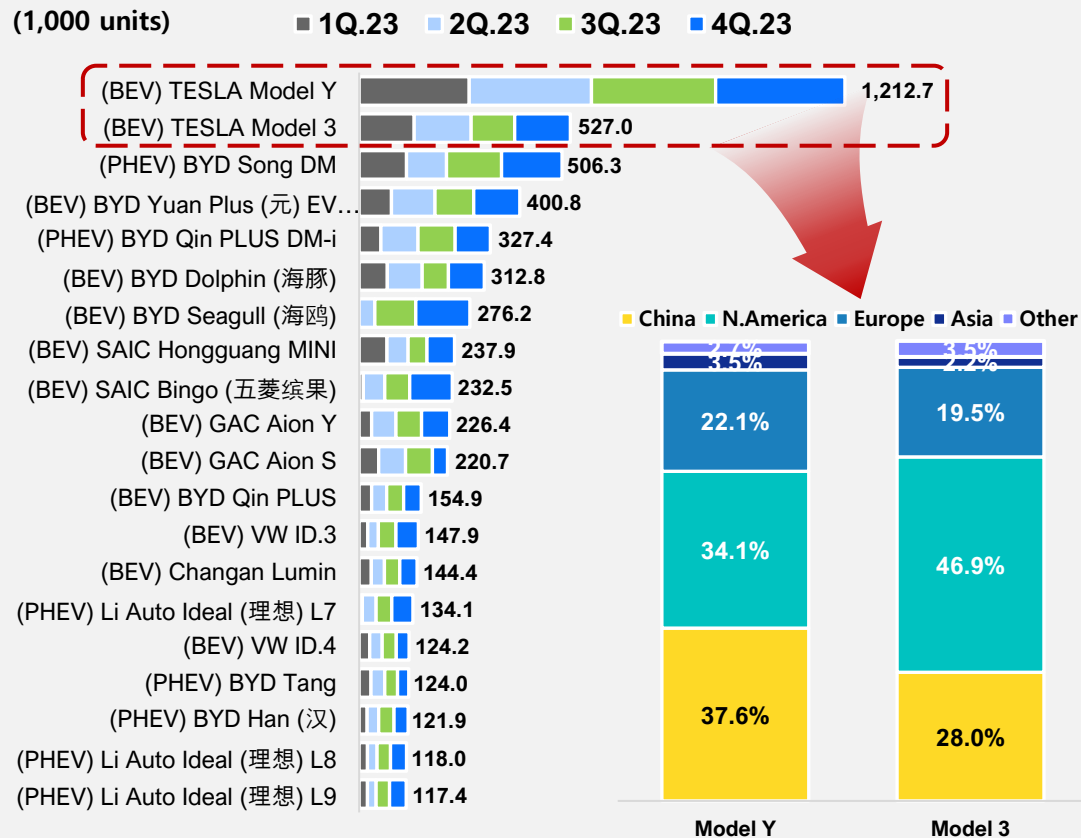
- BYD and TESLA have been broadening a gap with traditional OEMs.
- BYD has been growing as a global company by going beyond the Chinese domestic market to Europe and Asia.
- Low growth in EVs made by traditional OEMs (Toyota 201K, GM 200K, Ford 180K)



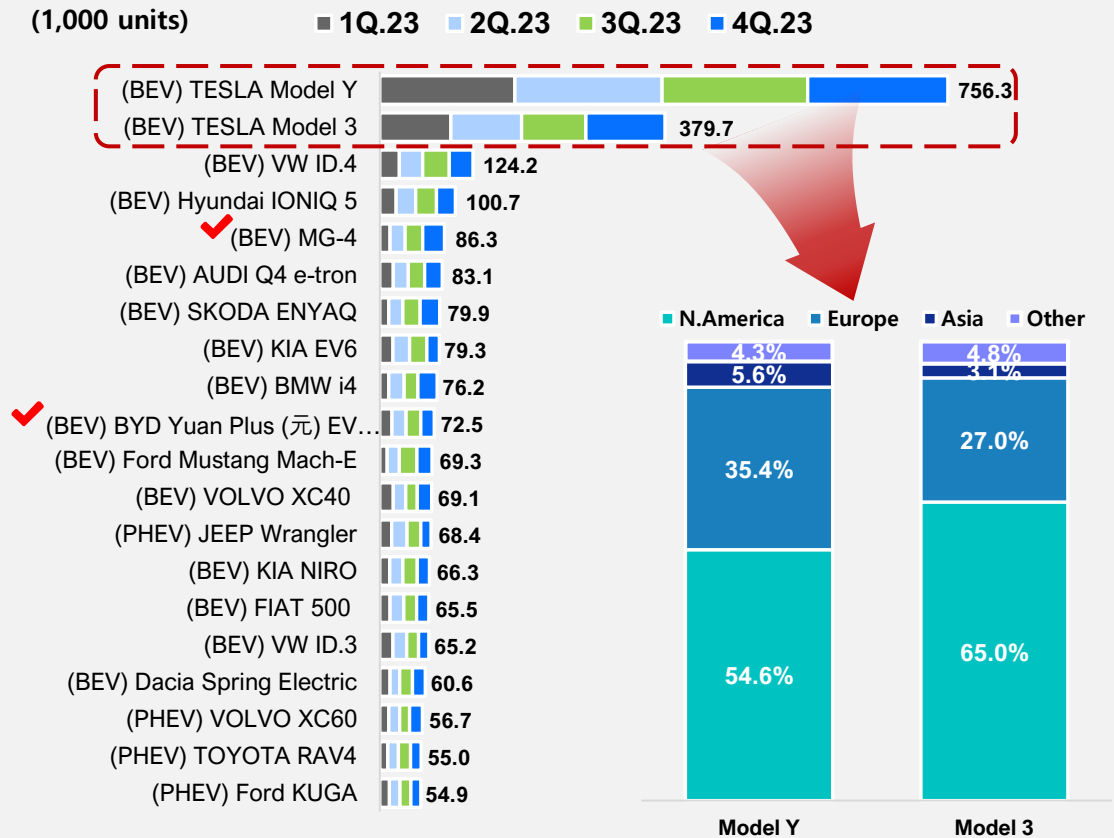
Consumers Disproportionally Focusing on Popular Models

- Tesla Model 3 & Y, opening the chapter of electrification in the world, dominated the medium/large-size market in advance where most of consumer demands are concentrated.
- In the Chinese domestic market, BYD continues its high growth based on sales volume based on diverse product portfolio.

Top 20 Models (BEV+PHEV) Sales Volume



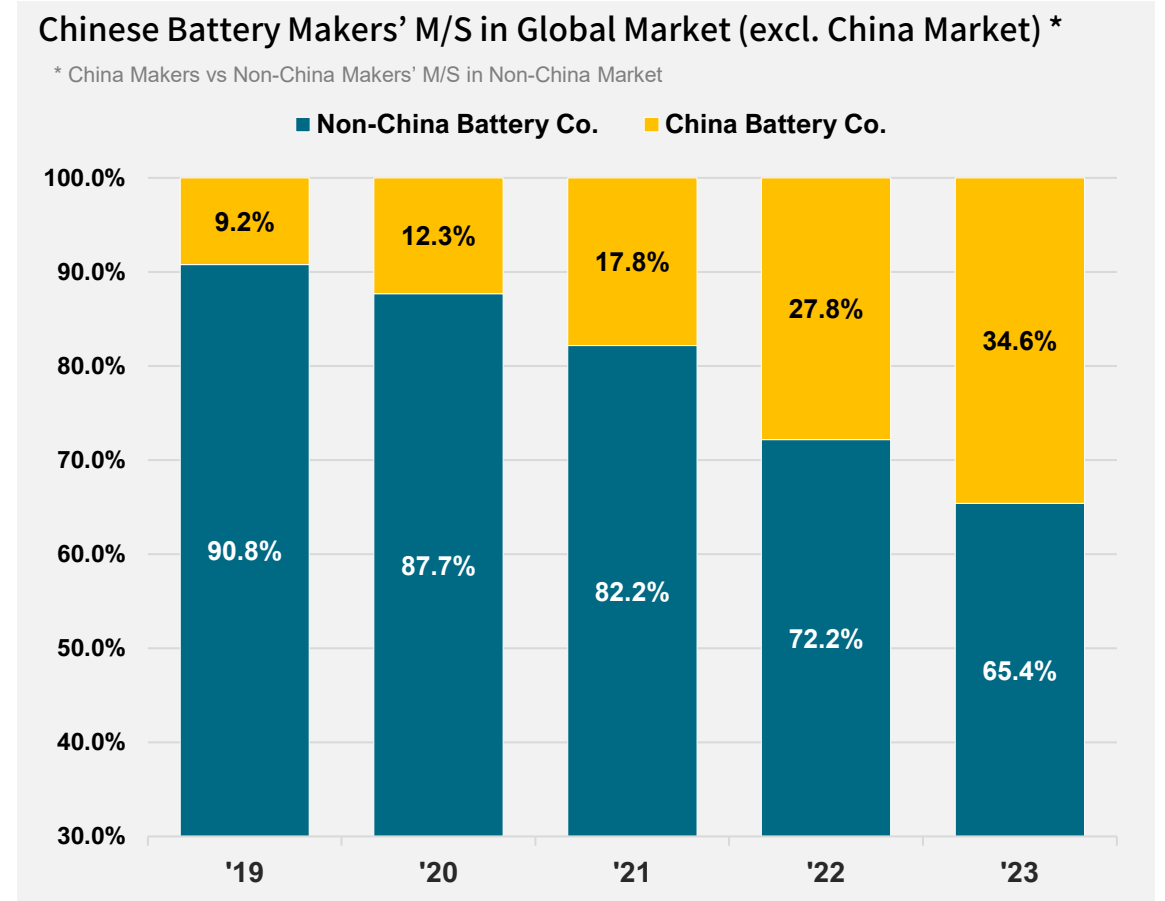
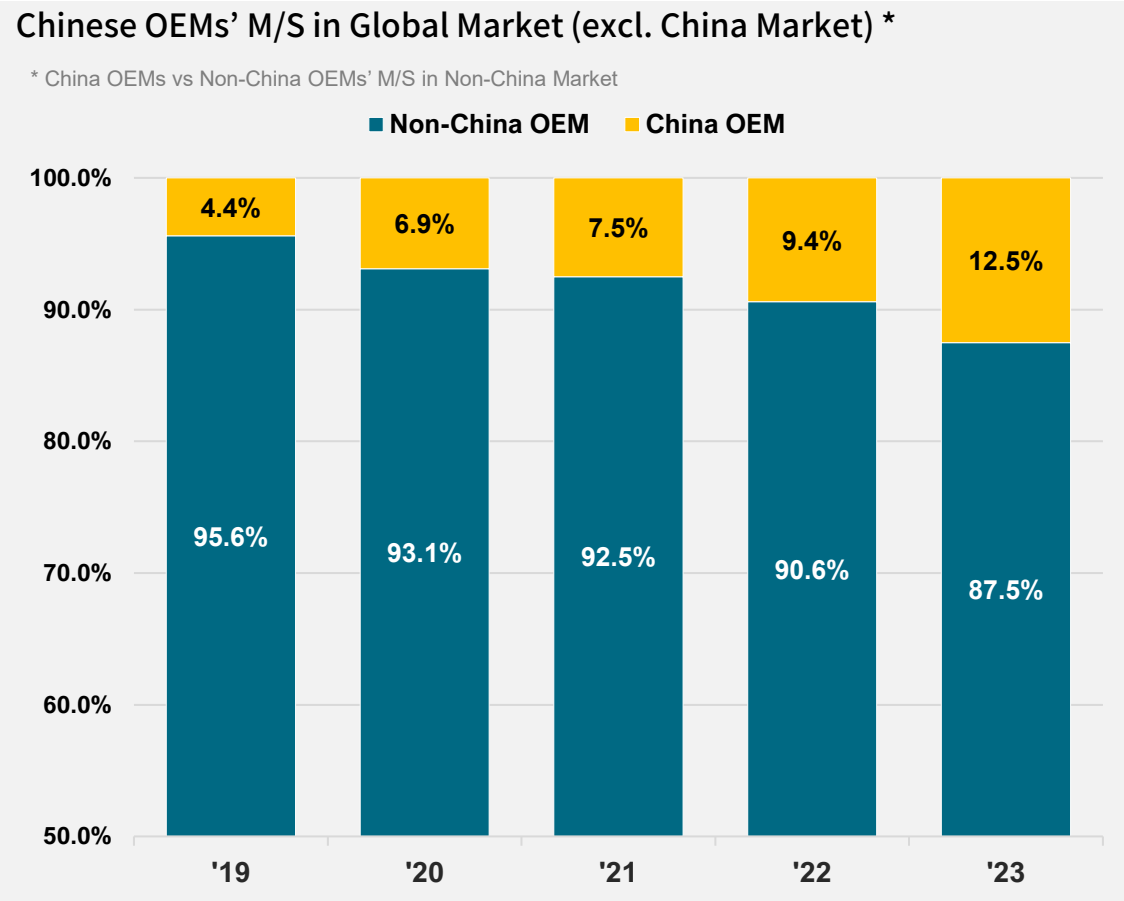
Top 20 Models (BEV+PHEV) Sales Volume (excl. China Market)





Expansion of Global Market Dominance by Chinese OEM and Battery Makers

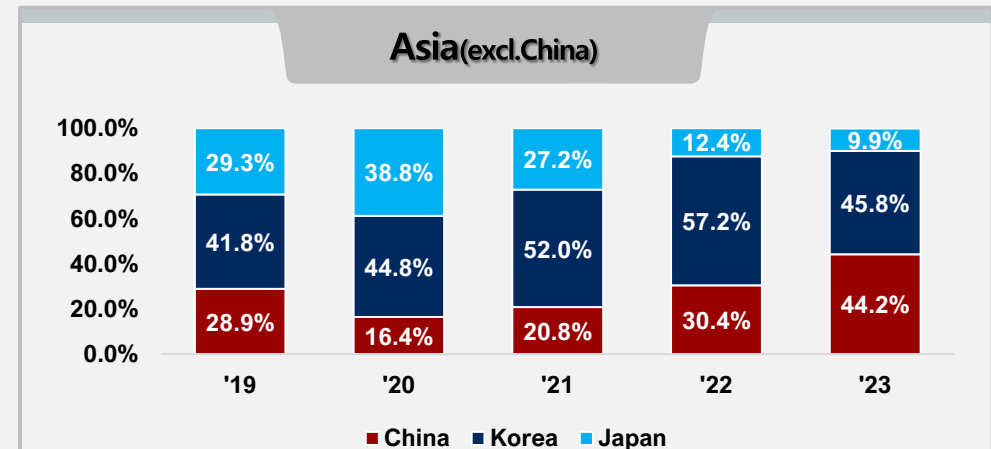
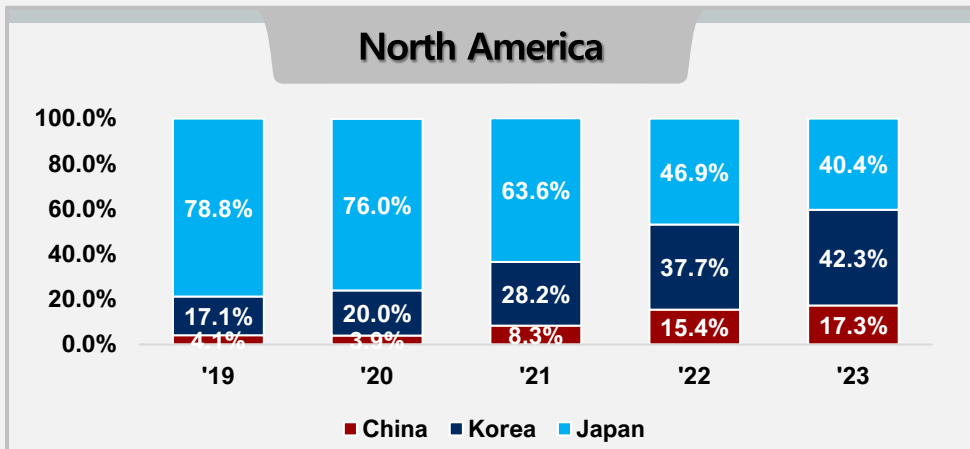
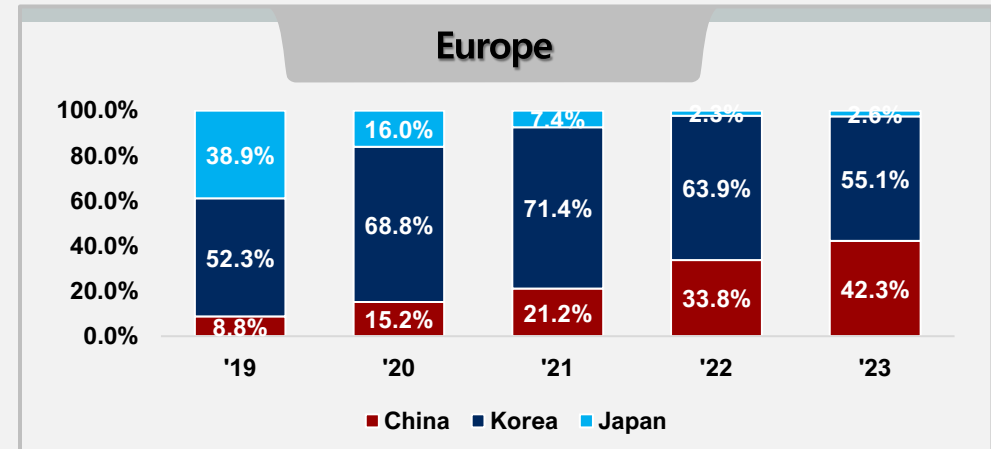
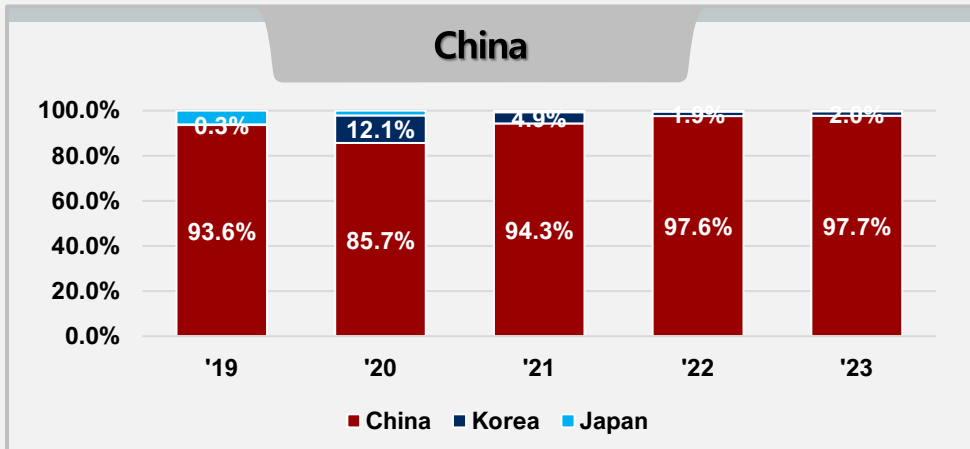
- Sales by SAIC, BYD, and Geely(the parent company of Volvo and Polestar) in Asia and Europe has increased (4.4% in 2019 → 12.5% in 2023)
- Among the EVs sales in Europe, N/America, and Asia, CATL and BYD’s M/S saw a high growth (9.2% in 2019 → 34.6% in 2023)
- Mainly in Thailand, the production and sales of Chinese makers have become in full swing, making the competition for EV market in ASEAN 5 fiercer.





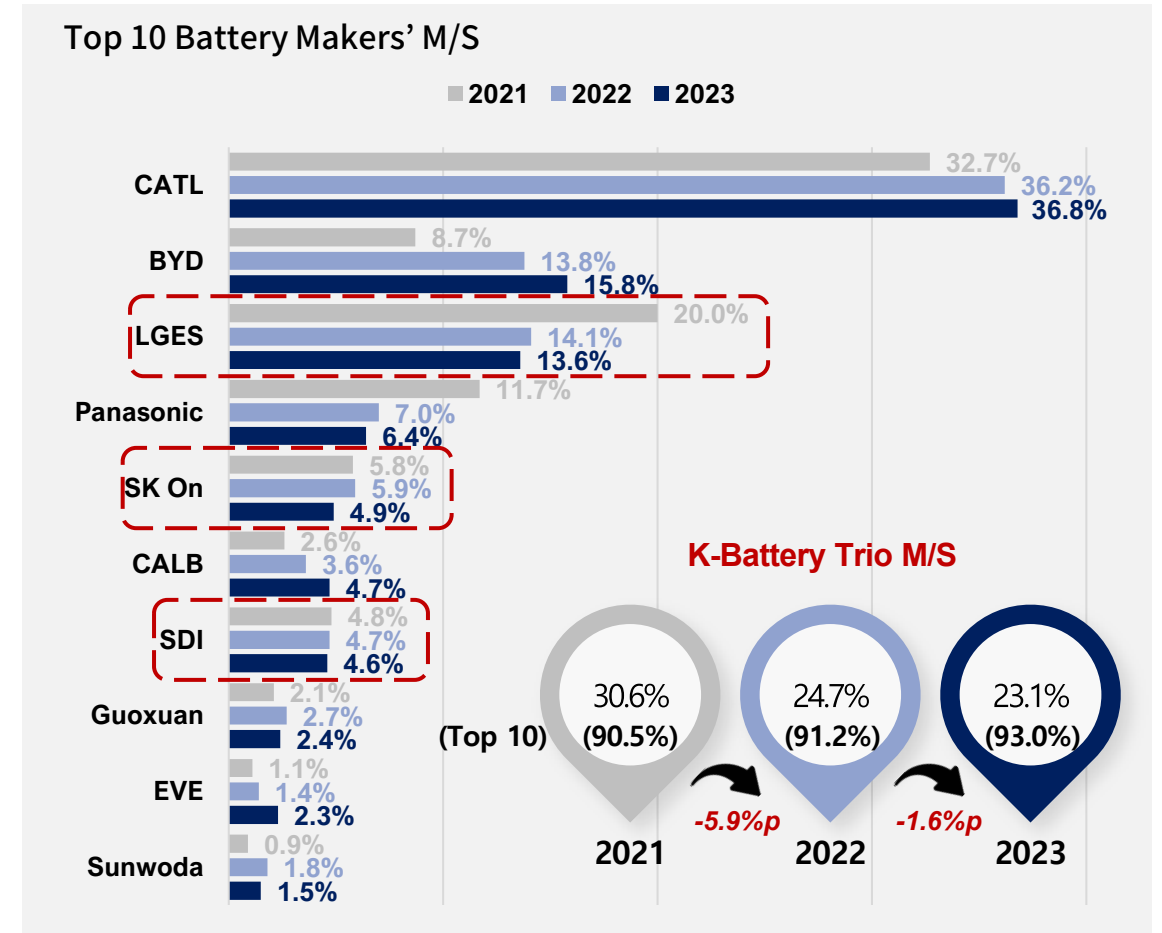
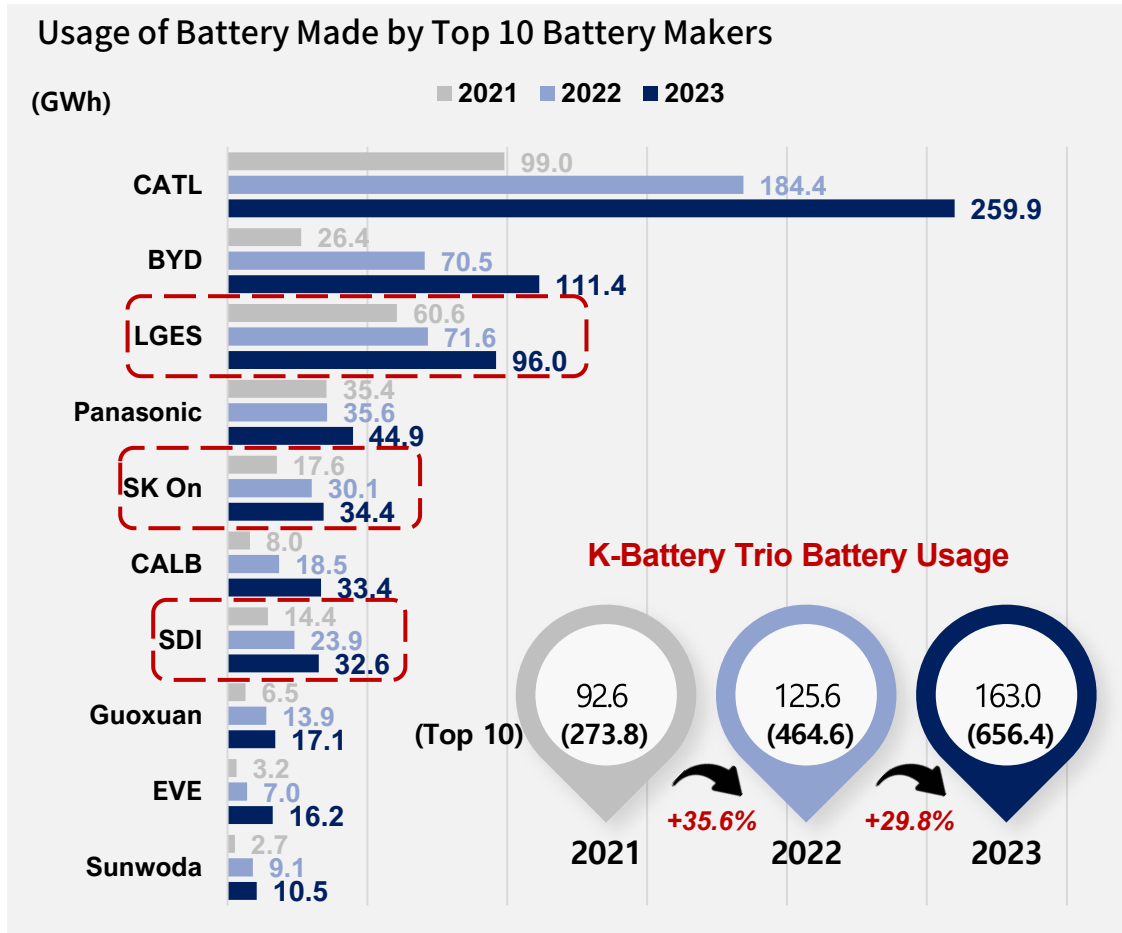
Korean, Japanese, and Chinese Battery Makers M/S by Region

- Chinese battery makers continuously expanding their M/S in Europe and Asia (M/S over 40%)
- Korean battery makers expanding their M/S in N. America, but sees a slight decline in Europe and Asia



Global Top 10 Battery Makers' M/S Currently Expanding

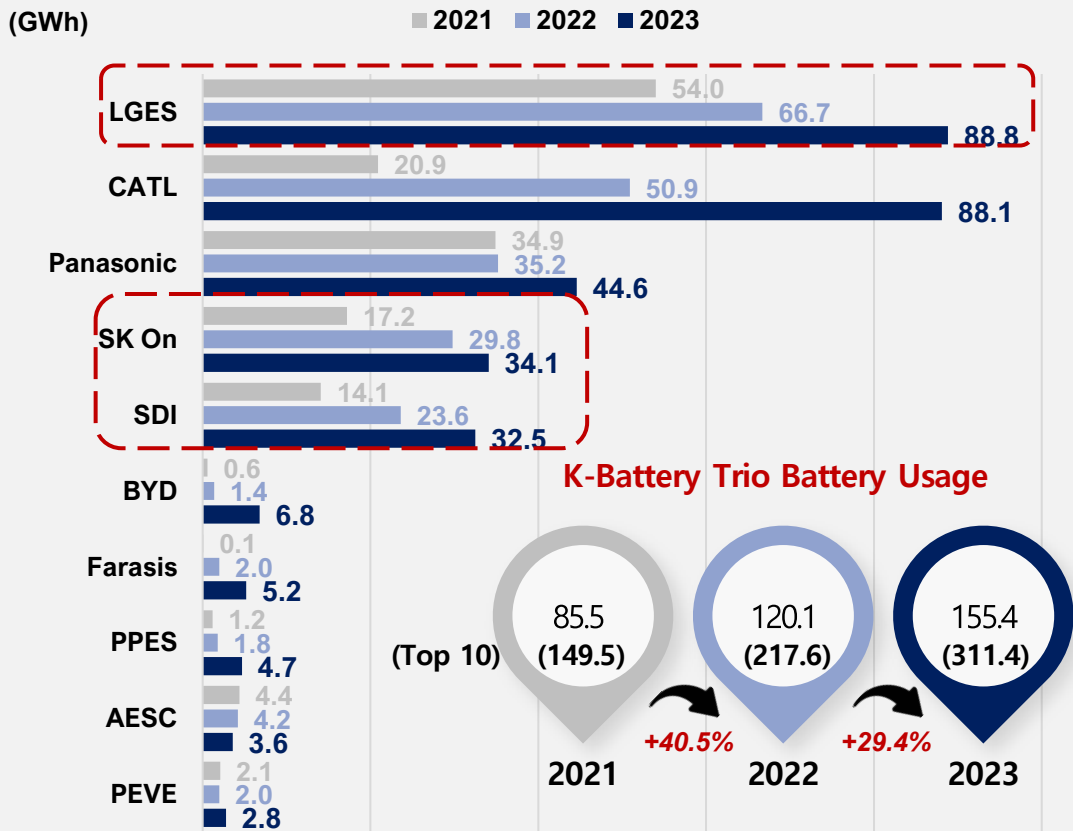
- Top 10 battery makers' M/S continuously expanding (91% in 2021 → 92% in 2022 → 94% in 2023)
- K-Battery usage is in an upward trend every year, but, due to the high growth of Chinese makers (CATL, BYD, CALB), K-battery makers' M/S has been declining



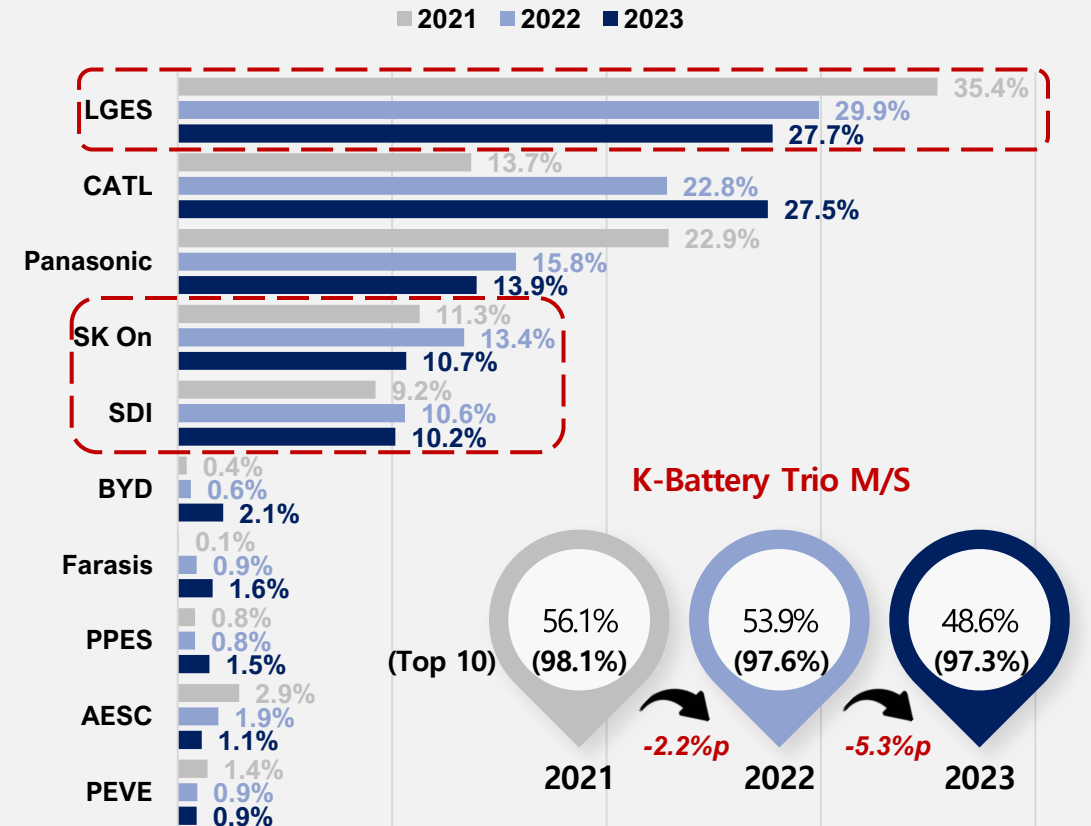
Chinese Battery Makers' Global M/S Increasing

- In 2023, the battery market shares (excl. China market) are taken by LGES(27.7%), CATL(27.5%), Panasonic(13.9%), and others.
- With Chinese battery makers entering the overseas market in full swing, K-battery trio's M/S has been in a downward trend.

Usage of Battery Made by Top 10 Battery Makers (excl. China market)



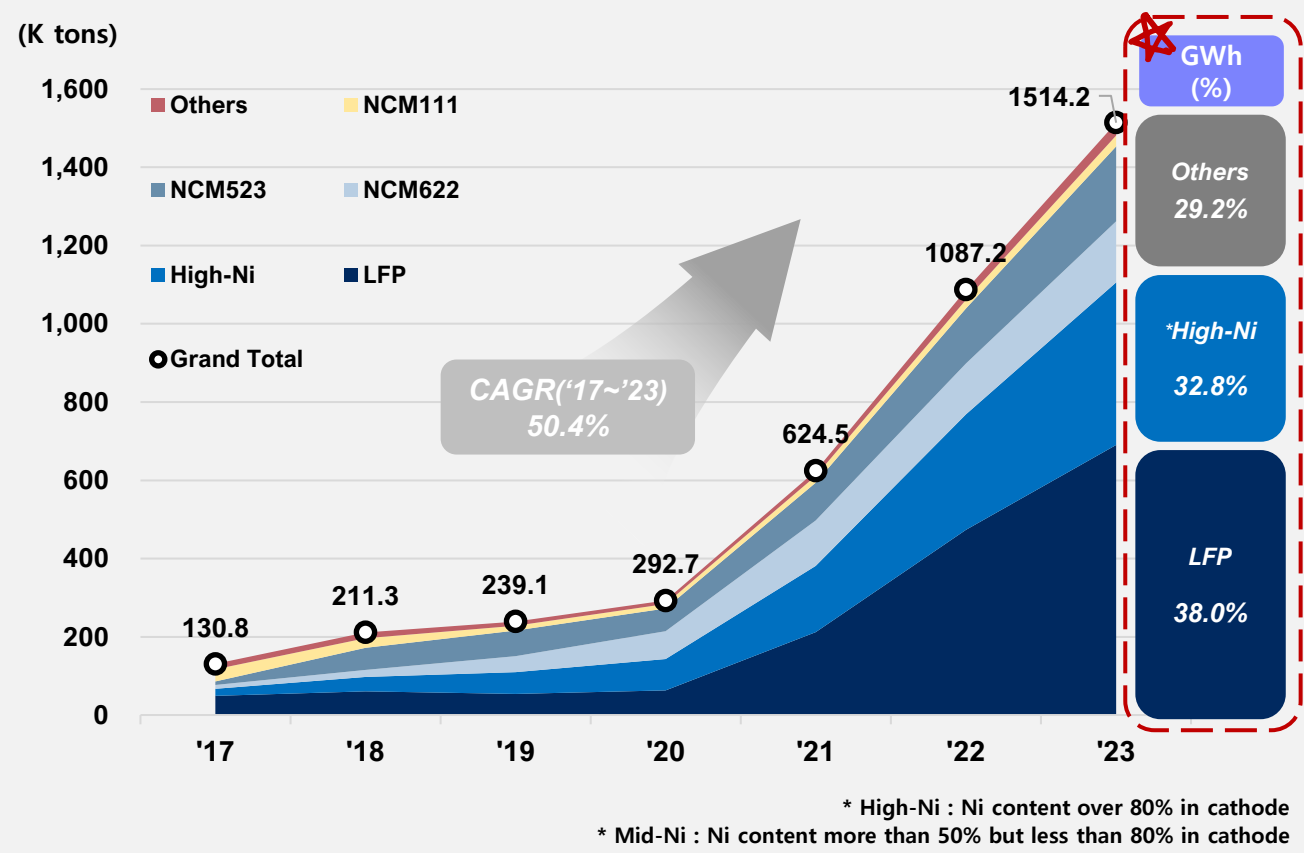
Top 10 Battery Makers' M/S (excl. China market)



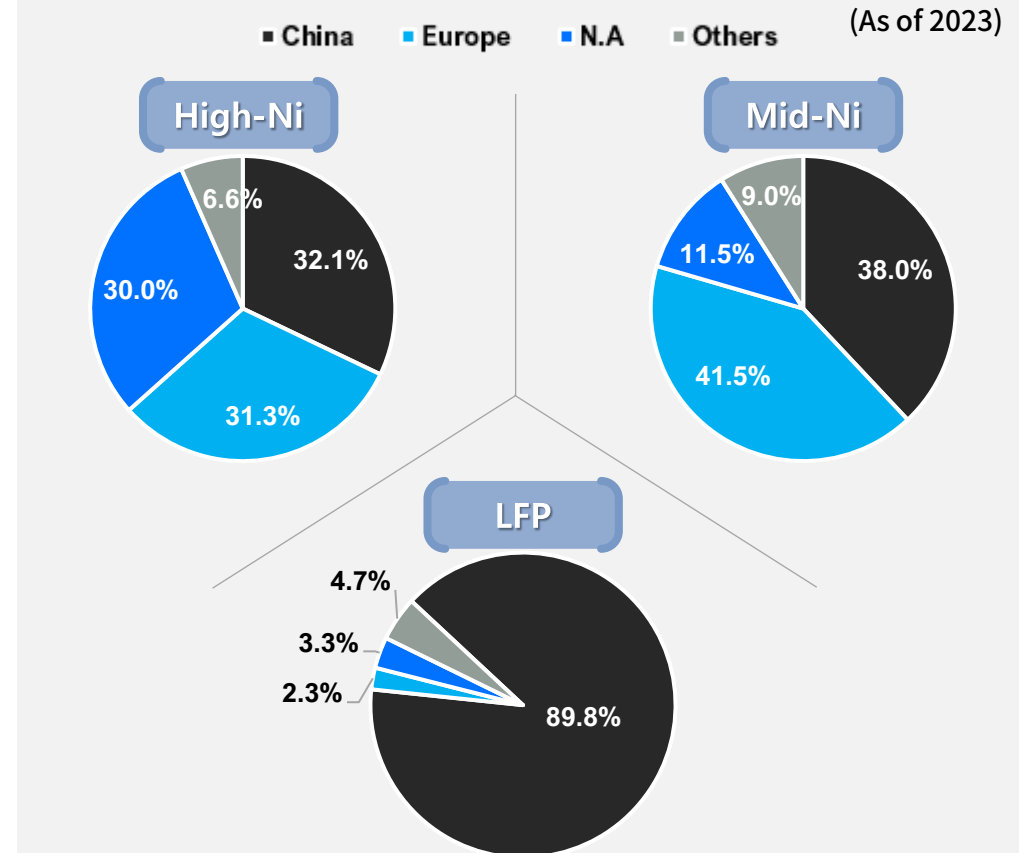
LFP Battery's M/S in Upward Trend Led by China

- In 2023, among approx. 15.142 million ton of cathode installation, LFP was 6.904 mil ton (45.6%), High-Ni was 4.157 mil ton (27.5%), and Mid-Ni was 3.473 mil ton (22.9%).
- With the competition in EV price getting fierce, Global OEMs plan to expand the adoption of LFP battery, leading to expectation for continuous expansion of LFP battery usage

Cathode Installation Trend from 2017 to 2023 (Based on weight)



LFP vs High-Ni vs Mid-Ni Usage Ratio by Region

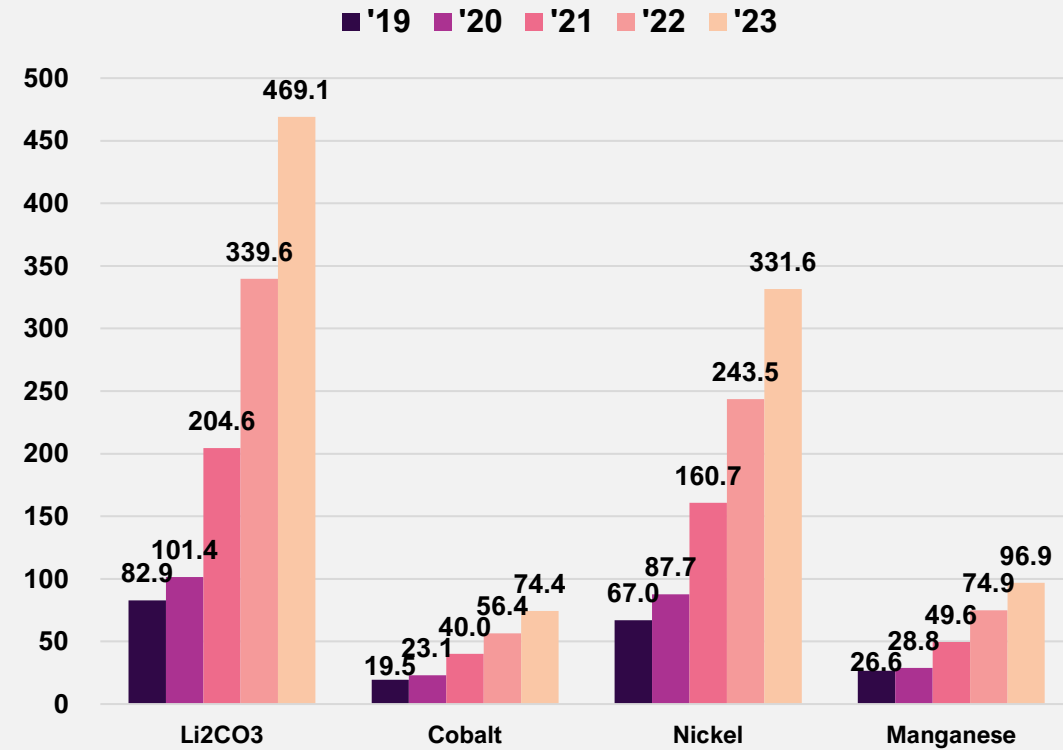


Expansion of Li / Ni-Focused Installation with LFP, Ni-Rich Cathode Usage

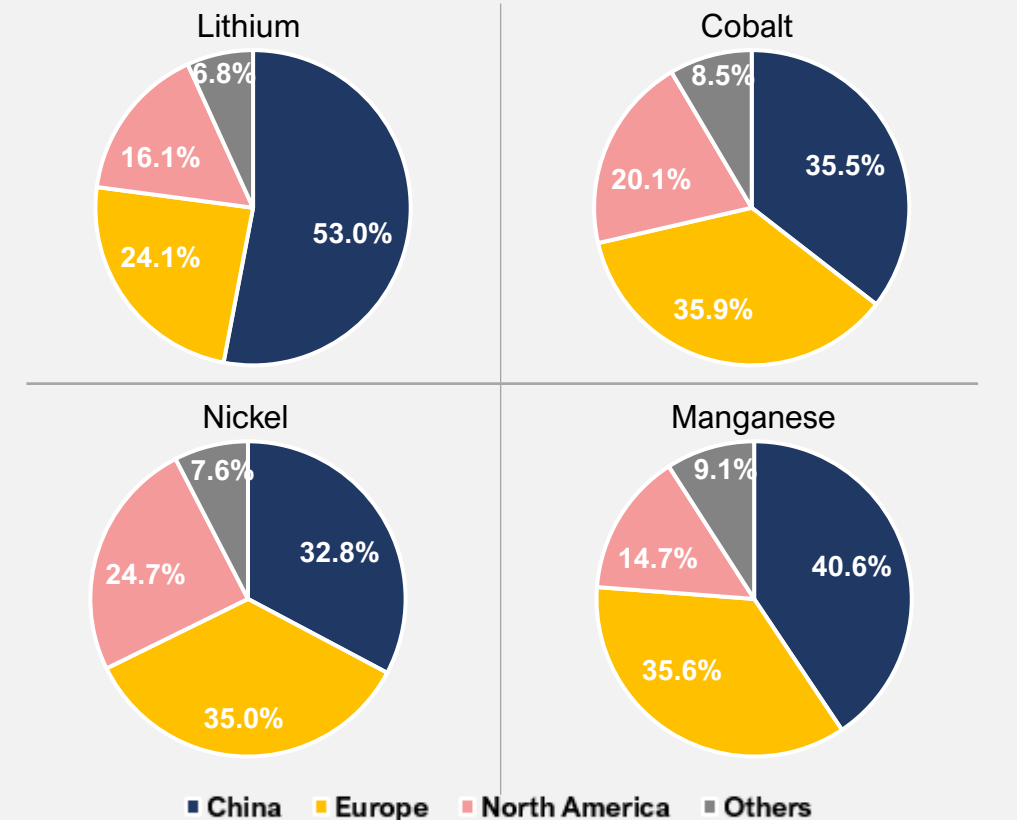
- In 2023, battery raw materials recorded 29.4%~38.1% of growth compared to 2022.
- Installation of Li₂CO₃, Co, Ni, and Mn are approx. 4,691k ton, 744k ton, 3,316k ton, and 969k ton respectively.
- The usage of Li₂CO₃ was high in China where the ratio of LFP battery installation is high.
- With increasing adoption of LFP and High-Ni, the installation of Li₂CO₃ and Ni has rapidly increased.

Trend in Raw Materials Installation from 2019 to 2023

(LCE, K tons)



Ratio of Raw Material Installation by Region in 2023

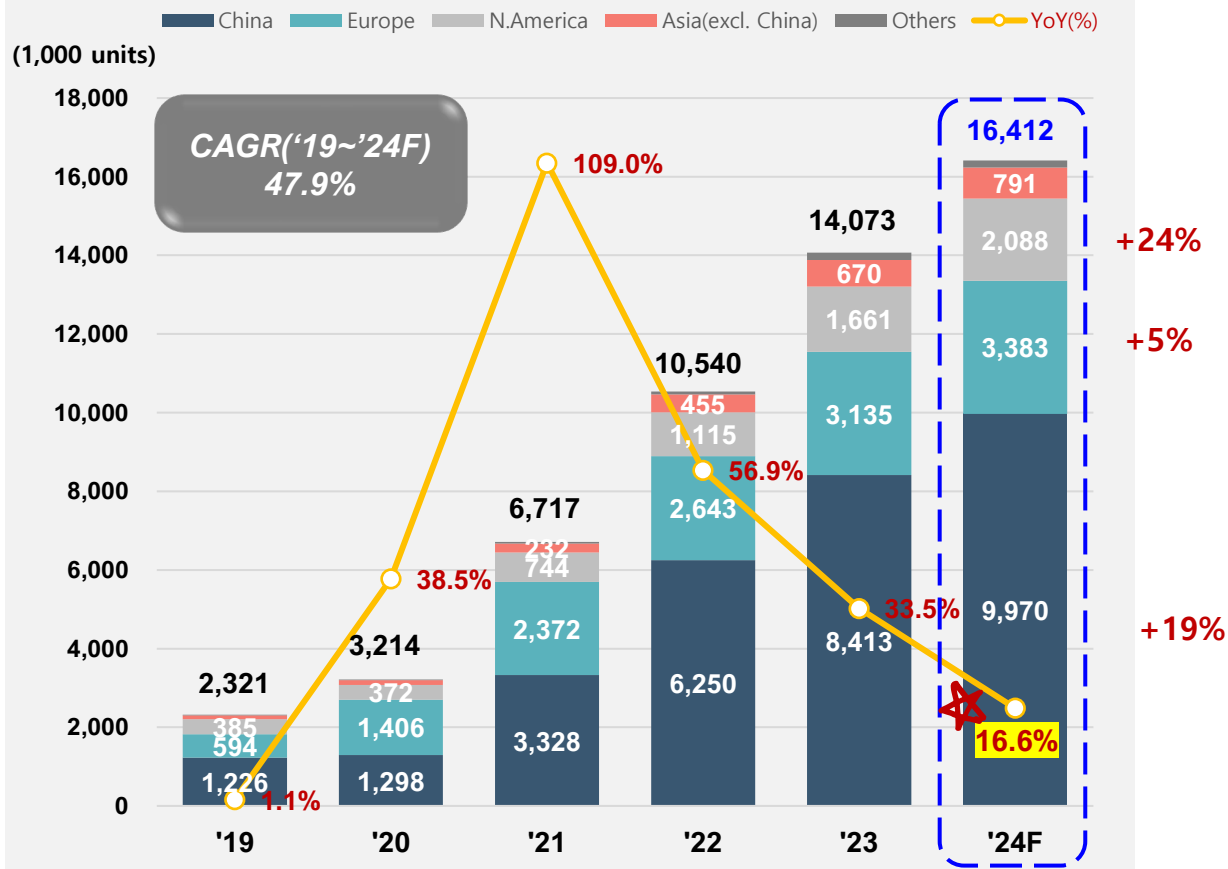




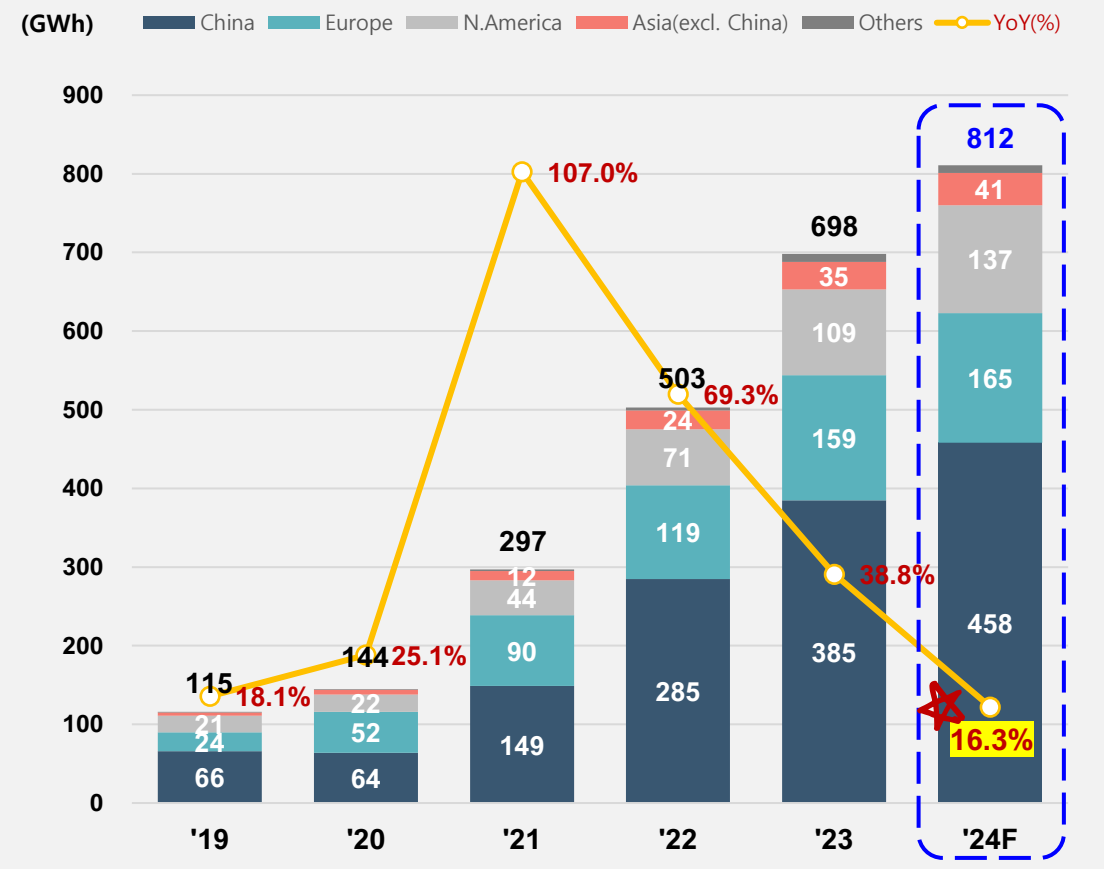
Visible Slowdown in Growth of EV Market in 2024

- EV sales is expected to record approx. 16.41 million units, and the xEV battery usage is forecasted to reach approx. 812 GWh.
- EV sales and battery usage are expected to record 16.6% and 16.3% of growth respectively, a significant decline from 33.5% and 38.8% from last year.
- After 2025, with environmental regulations strengthened, new EV models launched, and EV purchase conditions turned favorable to customers (EV price reduction), the growth of EV market is expected to recover.

2024 Global EV(BEV+PHEV) Sales Outlook



2024 Global EV(BEV+PHEV) Battery Usage Outlook



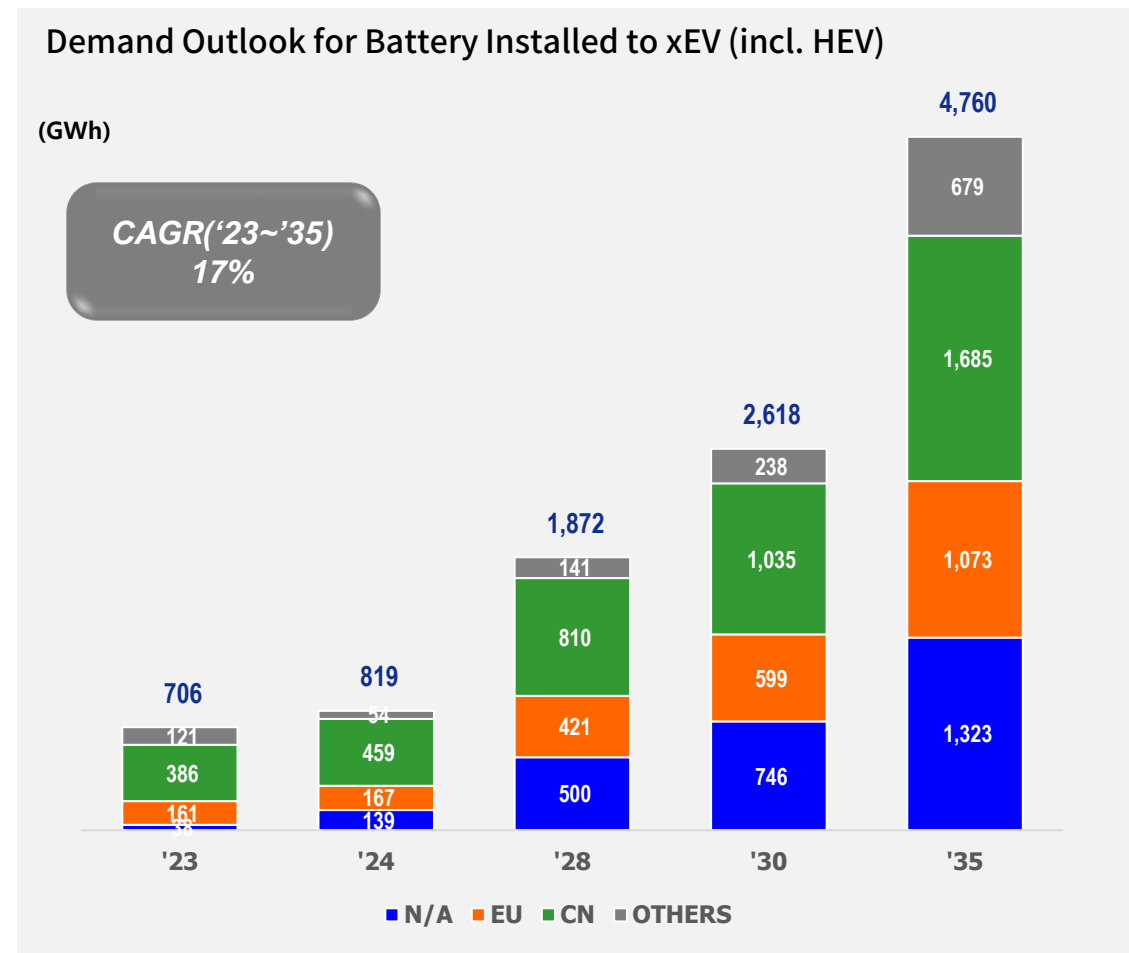
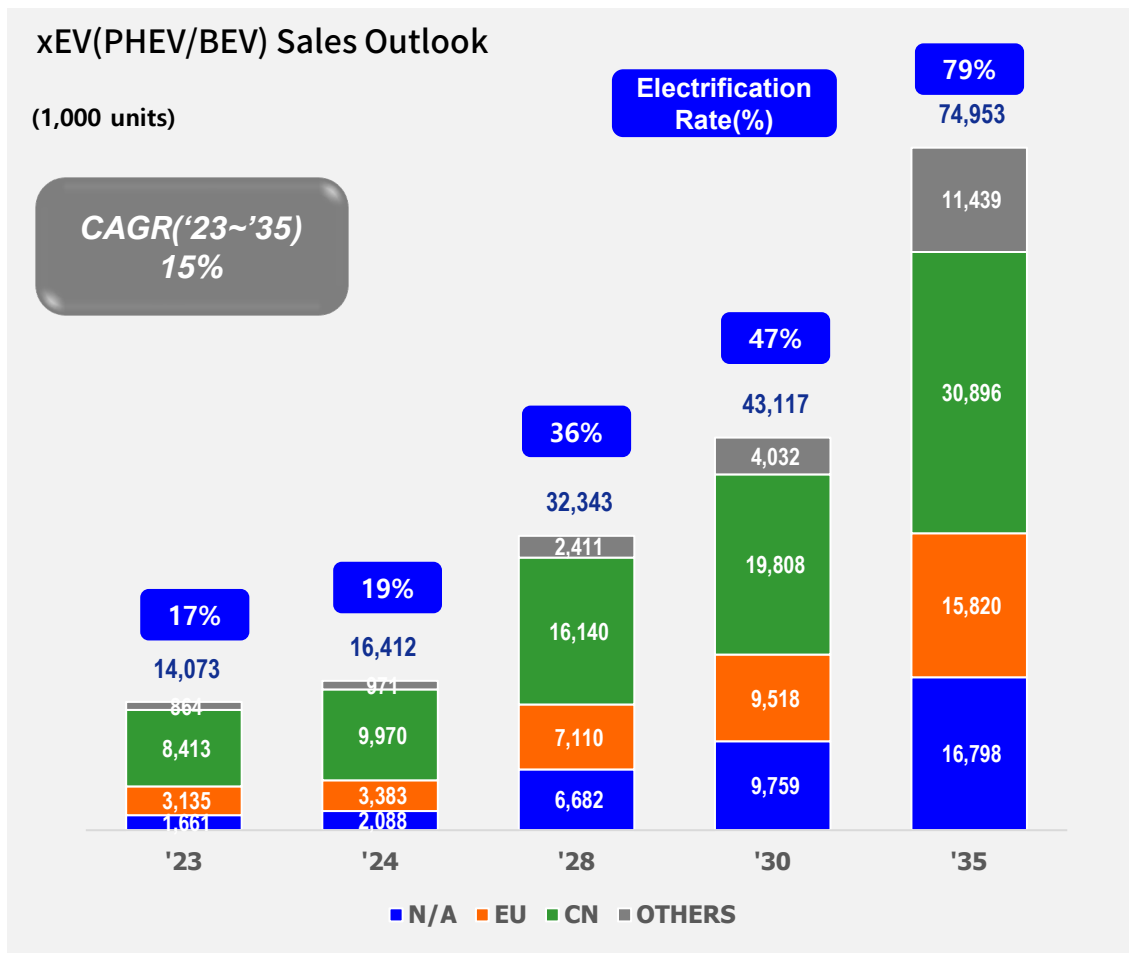
- 1 About SNE Research
- 2 xEV Battery Market Scale
- 3 xEV Battery Demand Outlook (~2035)**
- 4 Next-Gen Battery Technology Issues
- 5 Current Market Issues



xEV Battery Demand Outlook (~2035)

xEV Sales Posted 14.07 Mil Units in 2023; Expected to Grow at CAGR of 15% by 2035

- Mid/long-term EV(excl. HEV) sales volume is expected to grow at a CAGR of 15%, reaching 75 mil units by 2035.
- Battery for xEV is expected to grow at a CAGR of 17%, reaching 4,760GWh by 2035.



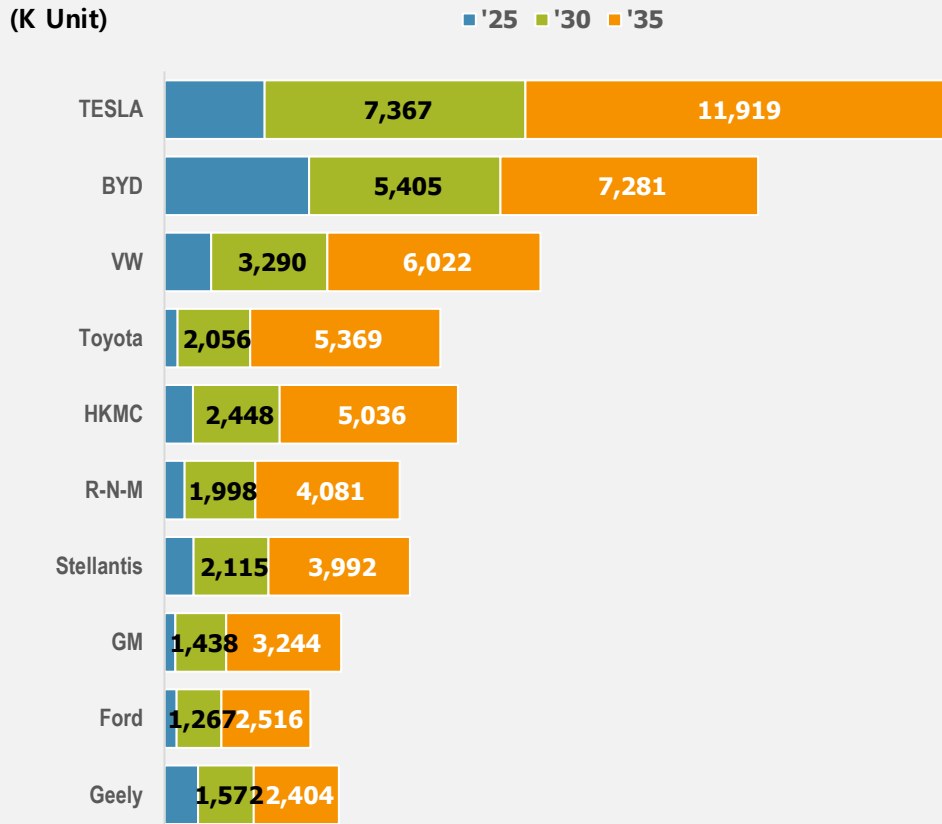


xEV Battery Demand Outlook (~2035)

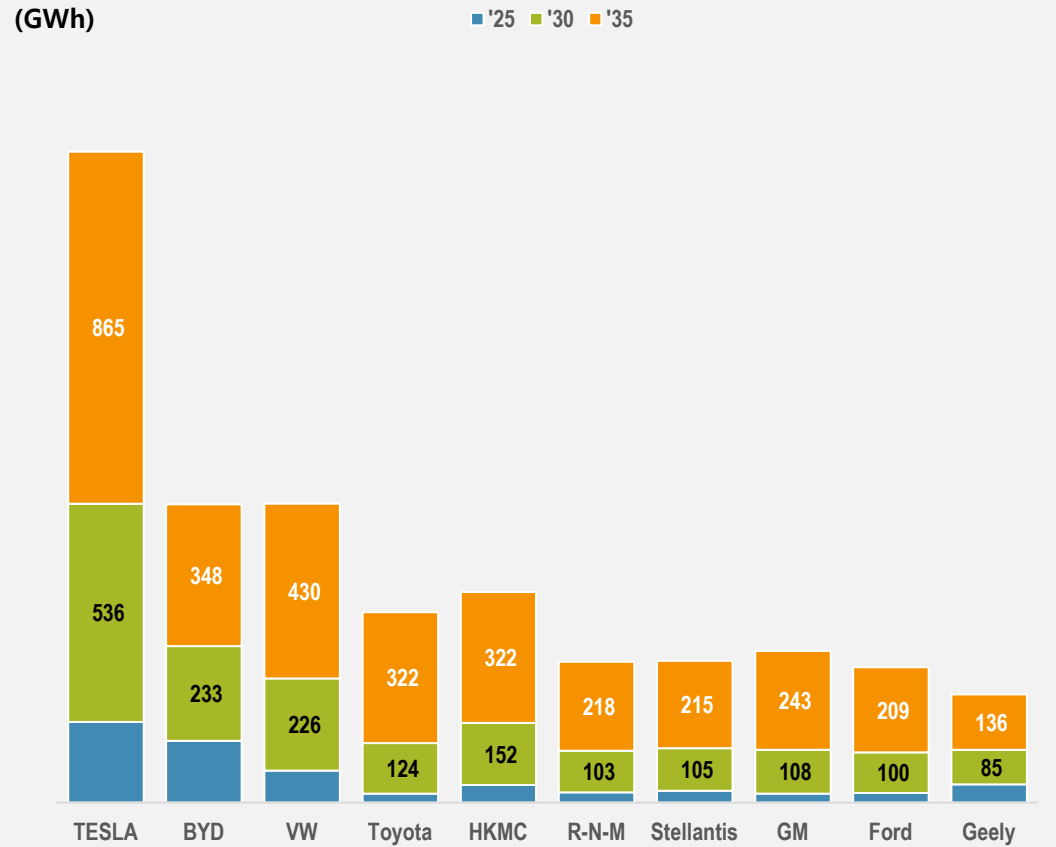
Battery Demand in 2035 Expected to Be 3,308 GWh Led by LV Electrification by Major 6 OEMs

- EV sales outlook for major 6 OEMs: Growth expected from 12 million units in 2025 to 52 million units in 2035
- Demand for battery installed to vehicles of these OEMs: Growth expected from 635GWh in 2025 to 3,308GWh in 2035

Top 6 OEMs' EV Sales Outlook in 2035 (LV, PHEV/BEV)



Battery Outlook for Top 6 OEMs' EV in 2035 (Incl. LV, HEV)



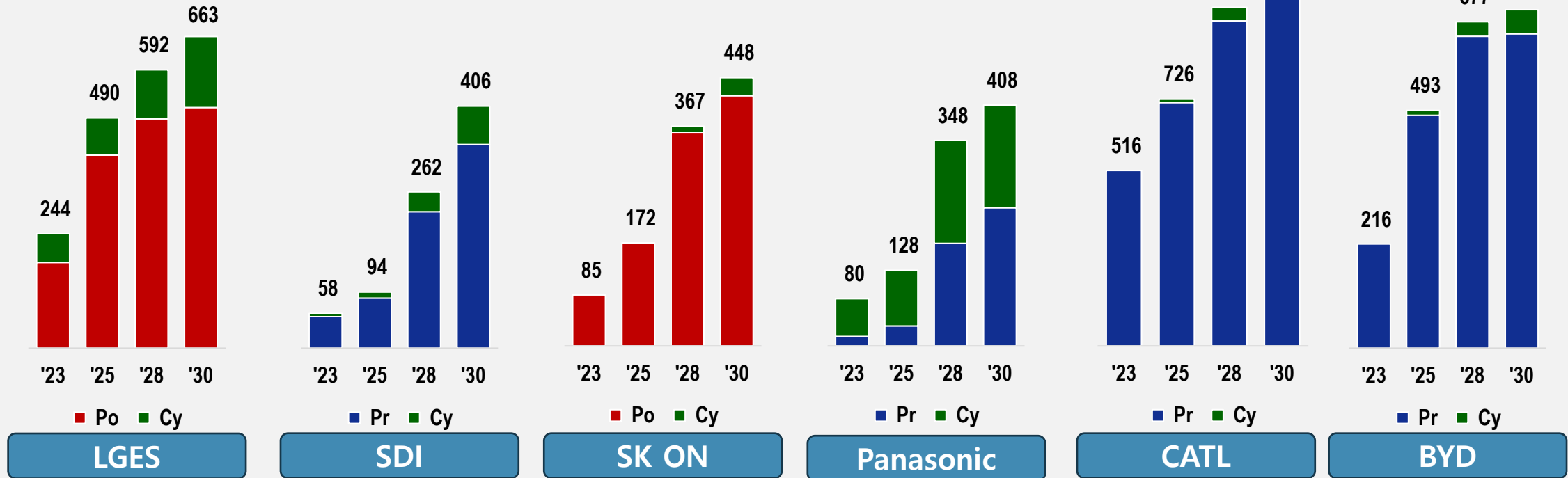


Major Battery Makers' Production Capacity for EV/ESS in 2030 Expected to Reach 3.9 TWh

- Total battery production capacity of major 6 battery makers for xEV/ESS is expected to grow from 1,169GWh in 2023 to 3,868GWh in 2030.
- 6 major makers are all have plans to build their new lines for cylindrical 46Φ line in addition to the existing lines for the other form factors.

Top 6 Battery Makers' Production Capacity Outlook (~'30, Based on Design Capacity)

(GWh)



*PPES included



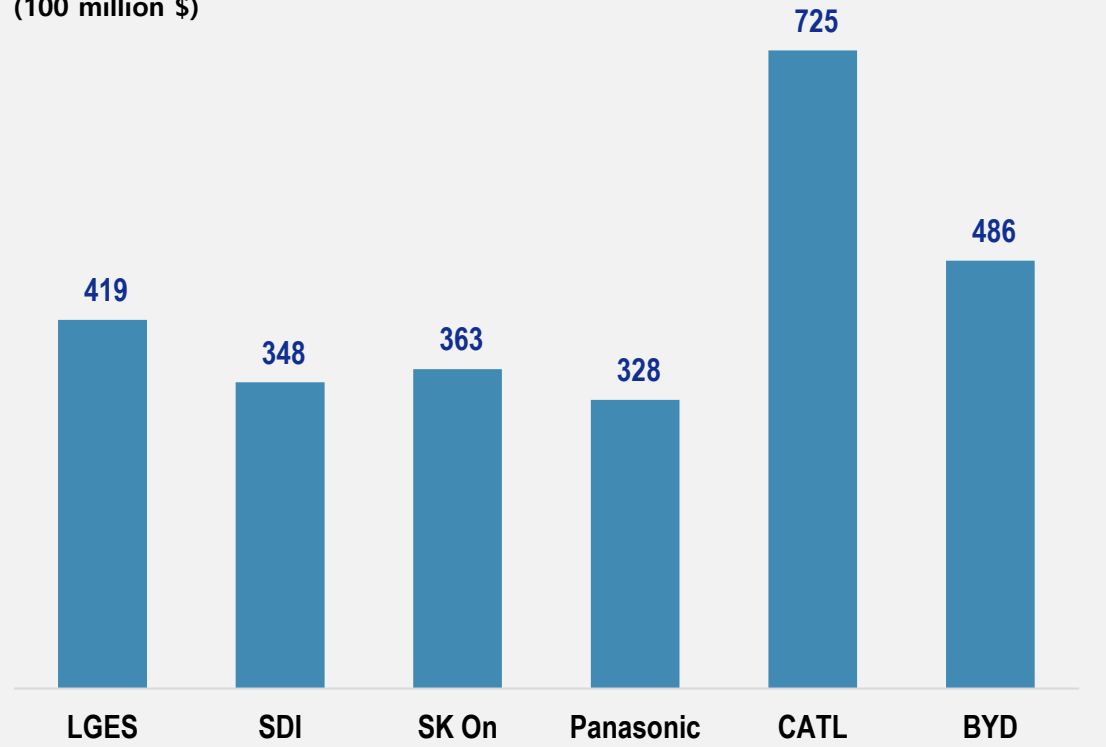
xEV Battery Demand Outlook (~2035)

Investment by Major Battery Makers for Production Line Expected to Be US\$270 Bil by 2030

- Investment for production line by 6 major battery makers are expected to be 30 billion to 70 billion dollars (0.1 billion dollars per 1GWh)
- By region, due to the IRA and CRMA regulations, investment is expected to concentrate on local production lines.

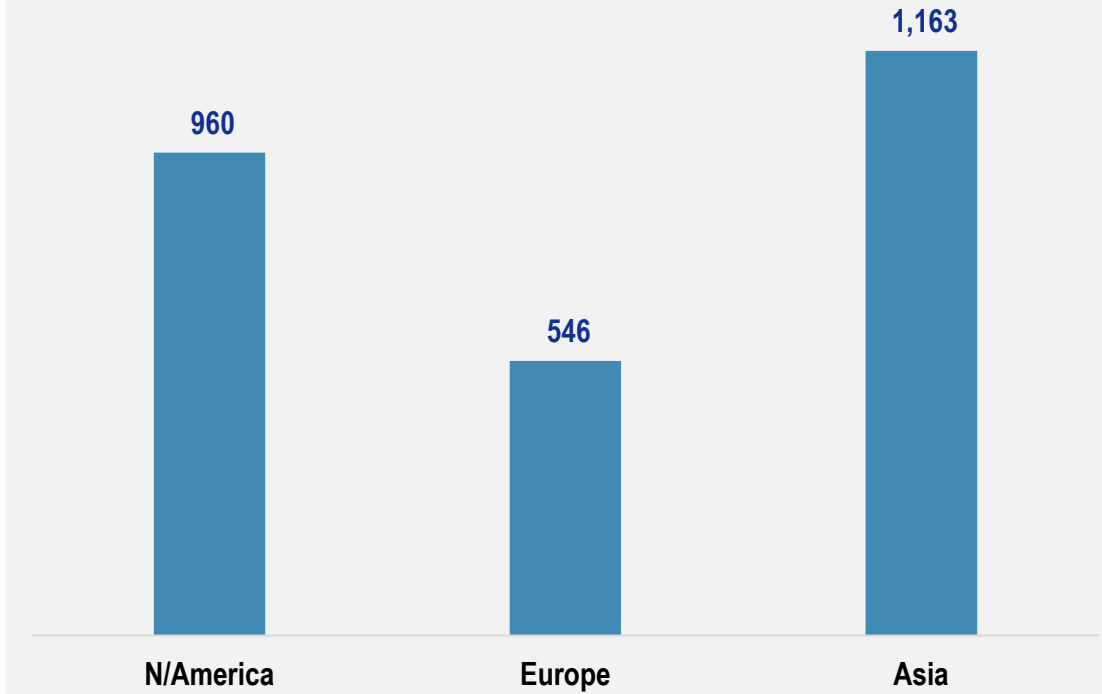
Outlook for Production Line Investment by Major Battery Makers (accumulated from '24 to '30)

(100 million \$)



Outlook for Production Line Investment by Major Battery Maker by Region (from '21 to '35)

(100 million \$)





xEV Battery Demand Outlook (~2035)

Cooperation b/w OEM and Battery Makers Expected to Reinforce in Various Formats (J/V)

- In 2023, OEMs who are proactive in electrification depend on supply from 1~2 particular battery makers.
- To respond to changes in market conditions such as the IRA and CRMA as well as future market growth, OEMs and battery makers are expected to take proactive strategies for battery supply.

J/V	Partner	Additional Partnership Announced
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Major OEMs and Battery Makers' SCM Status and Outlook

	CATL	BYD	LGES	Panasonic	SK On	SDI	Others
TESLA	China/N.America/ Others	Europe	N.America/Europ e/Others	N.America			TESLA
VW	China/Europe		Europe/Others		N.America	Europe	VW/N-Volt /Gotion
TOYOTA		China	N.America	Global(PPES)			
HKMC	Korea		N.America/Asia		N.America	Europe	
STELLANTIS	China		N.America			N.America	
BYD							
GM	China		N.America			N.America	
FORD		China	Europe		N.America	Europe	
HONDA	China		N.America				
R-N	China/Europe		N.America/Europ e		N.America		AESC(Europe)

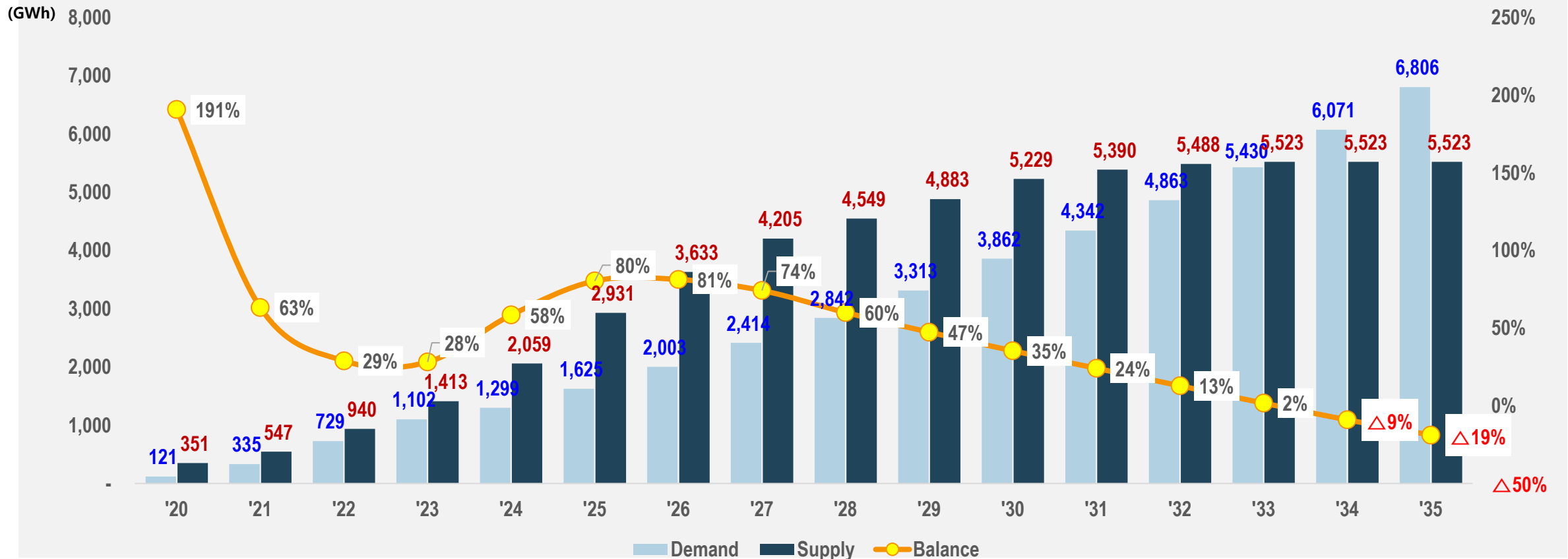


xEV Battery Demand Outlook (~2035)

Global Battery Supply Expected to Face Shortage from Mid 2030s

- As capacity ramp-up plans by battery makers are not fixed yet, the battery supply can be seen to face a shortage from 2030, but it is expected that no shortage would occur in battery supply.
- Given the competitiveness gaps between different battery makers (high battery dependence on top 10 battery makers) and new makers' issues with securing mass production technology, there is a possibility that some regions may witness a short-term shortage.

Global xEV/ESS Battery Supply & Demand Outlook



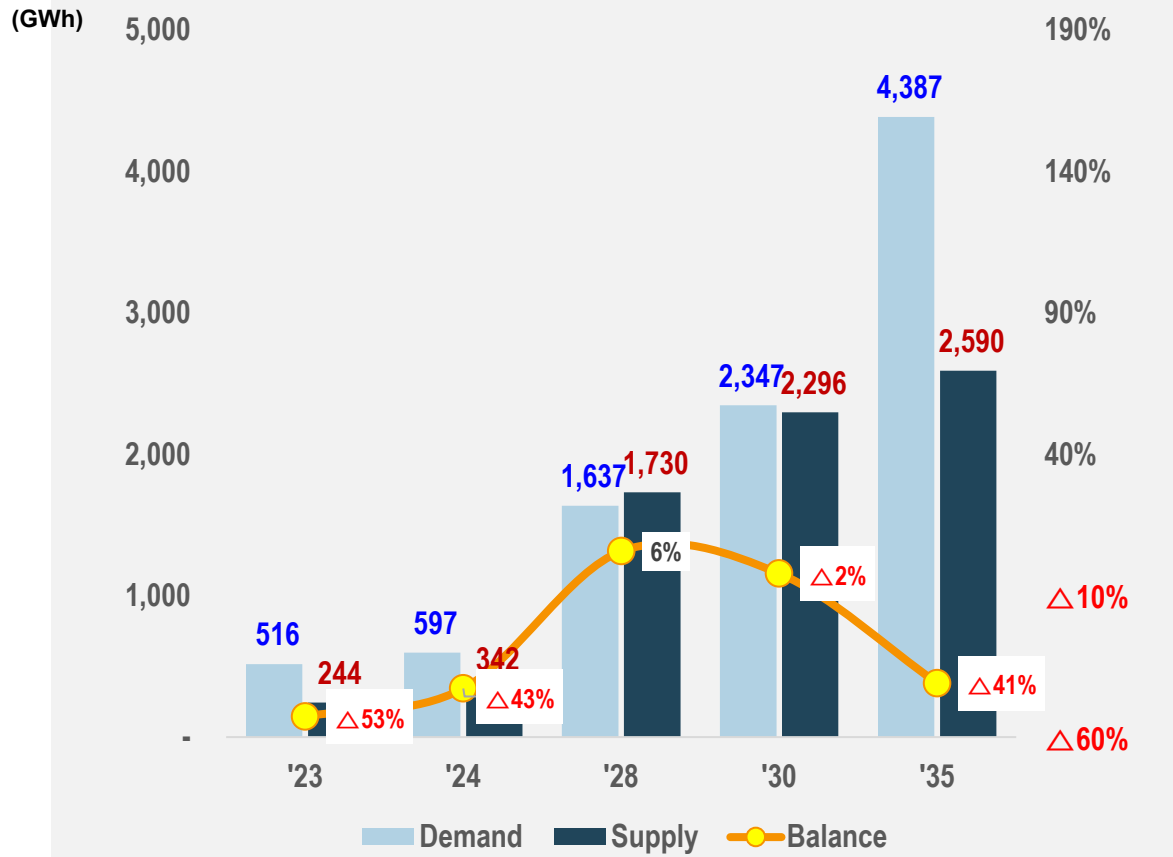
Source: SNE Research, < 2024.1H> Global Electric Vehicle Market and Battery Supply and Demand Forecast (~2035)



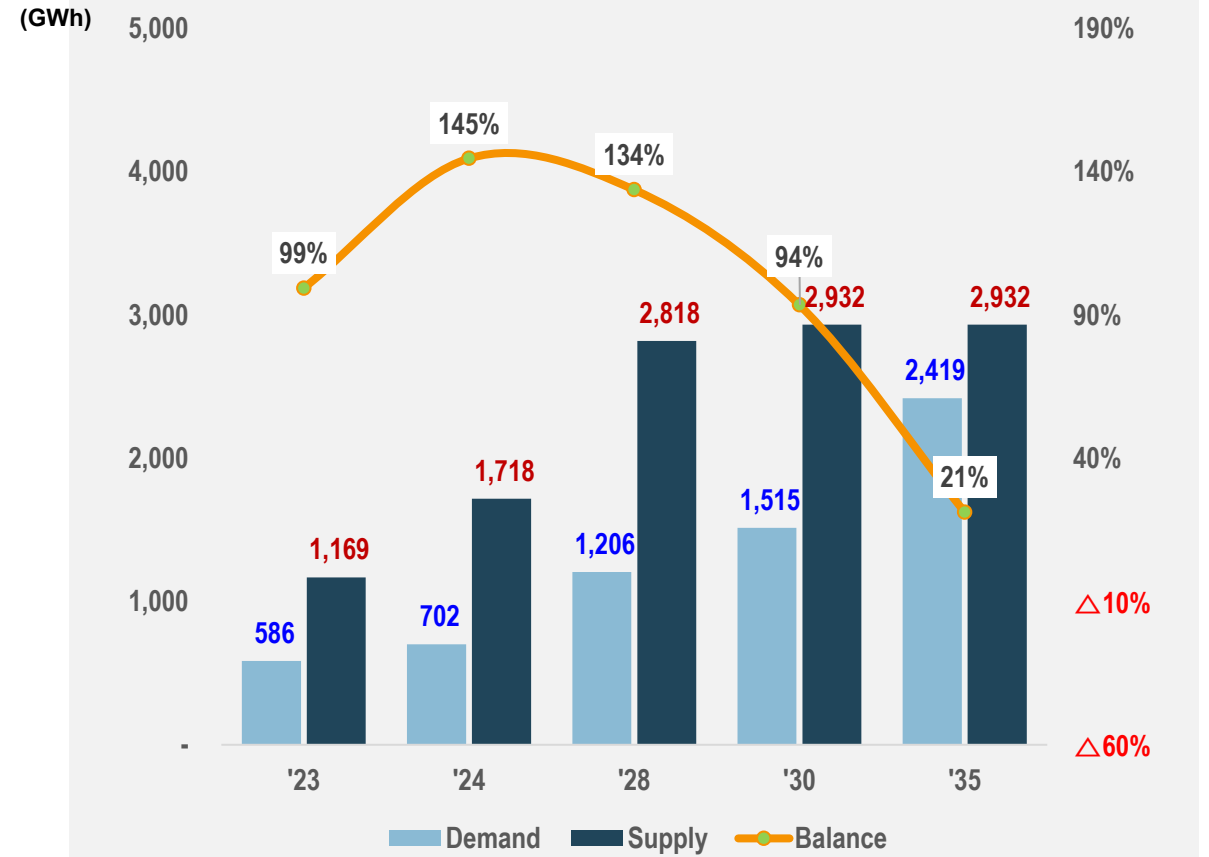
Battery Supply & Demand Outlook by Region

- Battery supply shortage in non-China regions is expected to be dealt with battery supply from China till 2025, but after 2025 the supply shortage is forecasted to be met by additional local ramp-up.
- Battery supply and demand in China is expected to go through restructuring in future.

Global Battery Supply & Demand Outlook (excl. China)



Battery Supply & Demand Outlook in China

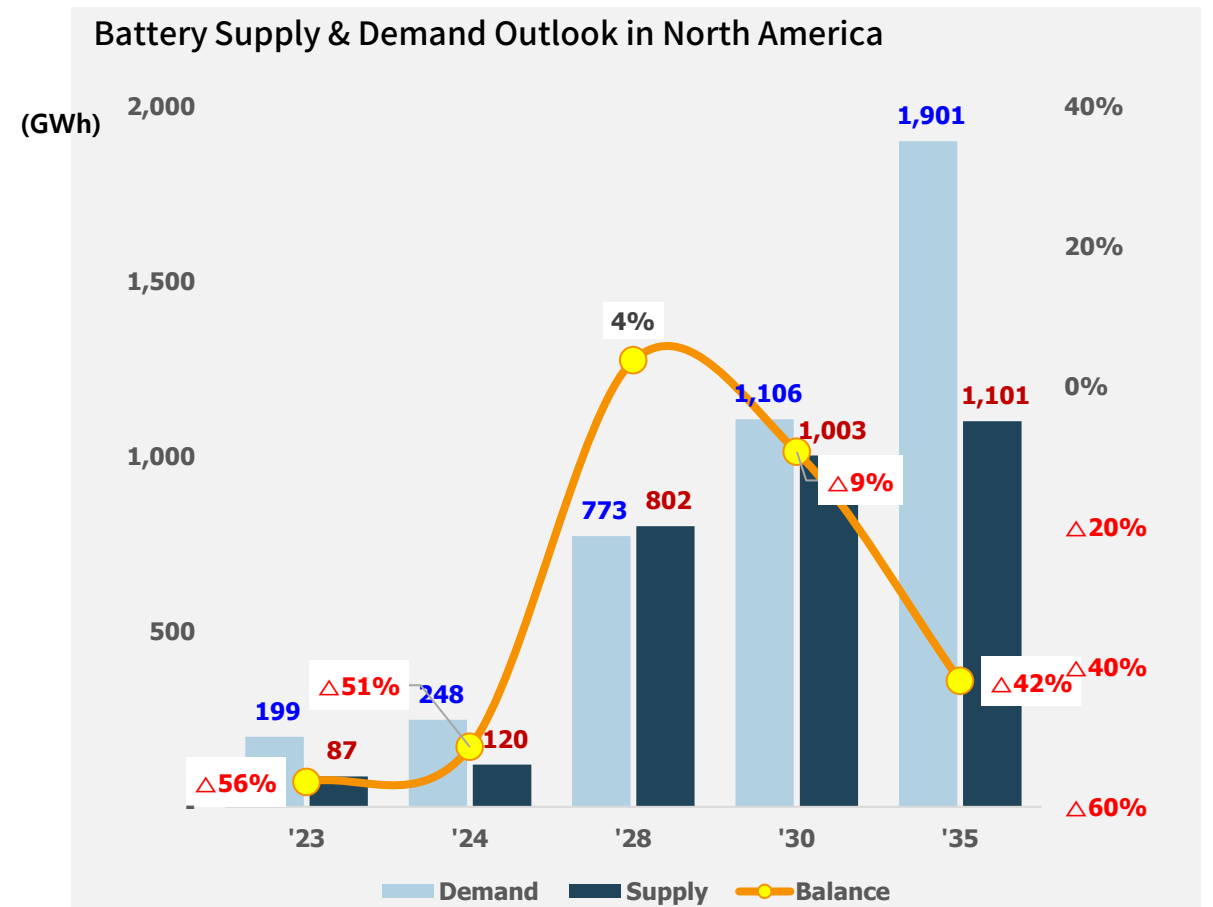
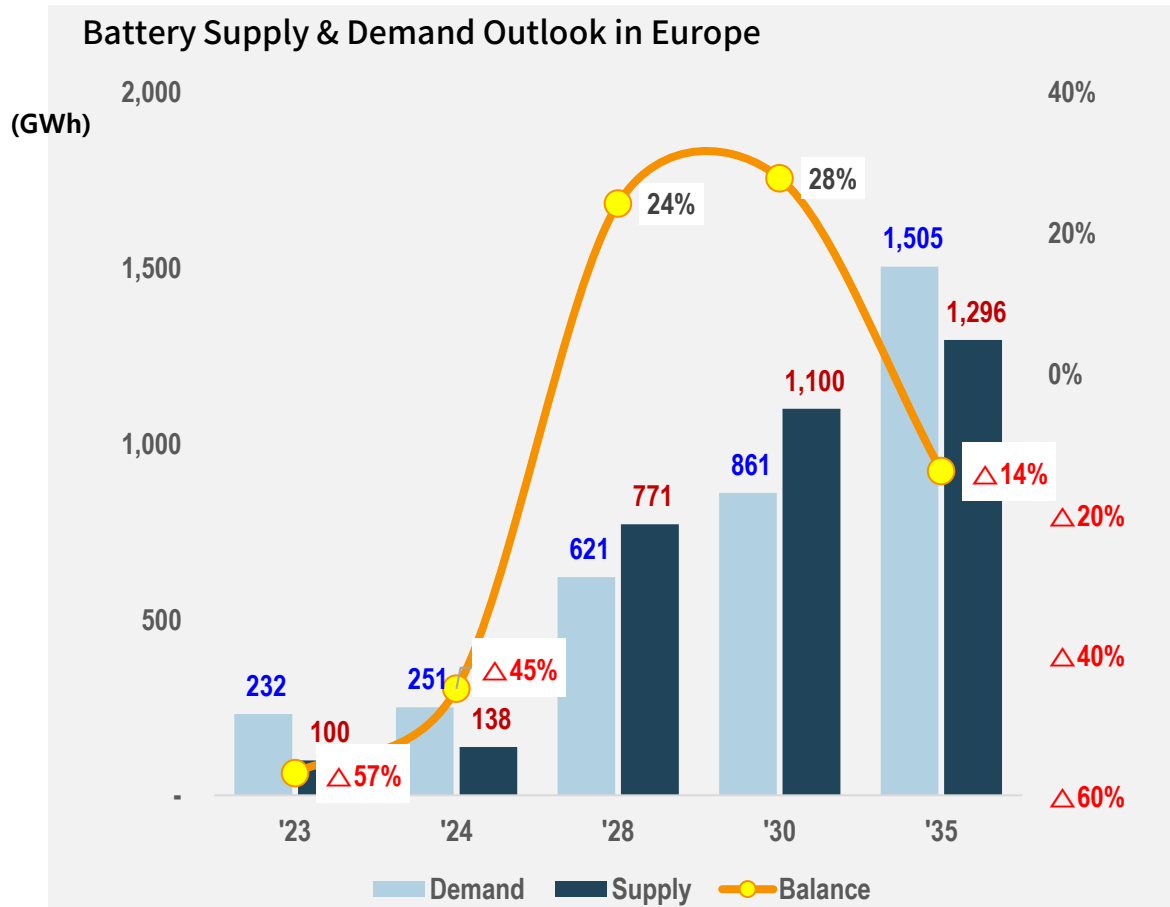




xEV Battery Demand Outlook (~2035)

Market Status in Europe/North America

- The Chinese battery makers are allowed to enter the market in Europe where there is no regulation against them. Although there is a possible concern about mass productivity issue, it is expected that no supply shortage would occur.
- The Chinese battery makers, on the other hand, face difficulties in entering the market in North America where additional ramp-ups by the Korean and Japanese battery makers are continuously required.



- 1 About SNE Research
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- 4 Next-Gen Battery Technology Issues**
- 5 Current Market Issues

Next-Gen Battery Technology Issues

4 Major Materials' Technology Roadmap (~'30)

- Cathode(high-nickel, single-crystal, cobalt-free), anode(SiOx/SCN, pure silicon), separator(high heat resistant coating separator), electrolyte(high-voltage, special salt)
- Polarization of market into 'Premium' and 'Standard / Volume' is expected to accelerate.

<Premium> market: High-nickel, single-crystal cathode. Silicon anode. Lithium-metal, high-heat-resistant separator, high-voltage fluorine electrolyte, special salt

<Standard(Volume)> market: Cobalt-free, L(M)FP, low-price graphite, low-price separator, low-price carbonate electrolyte

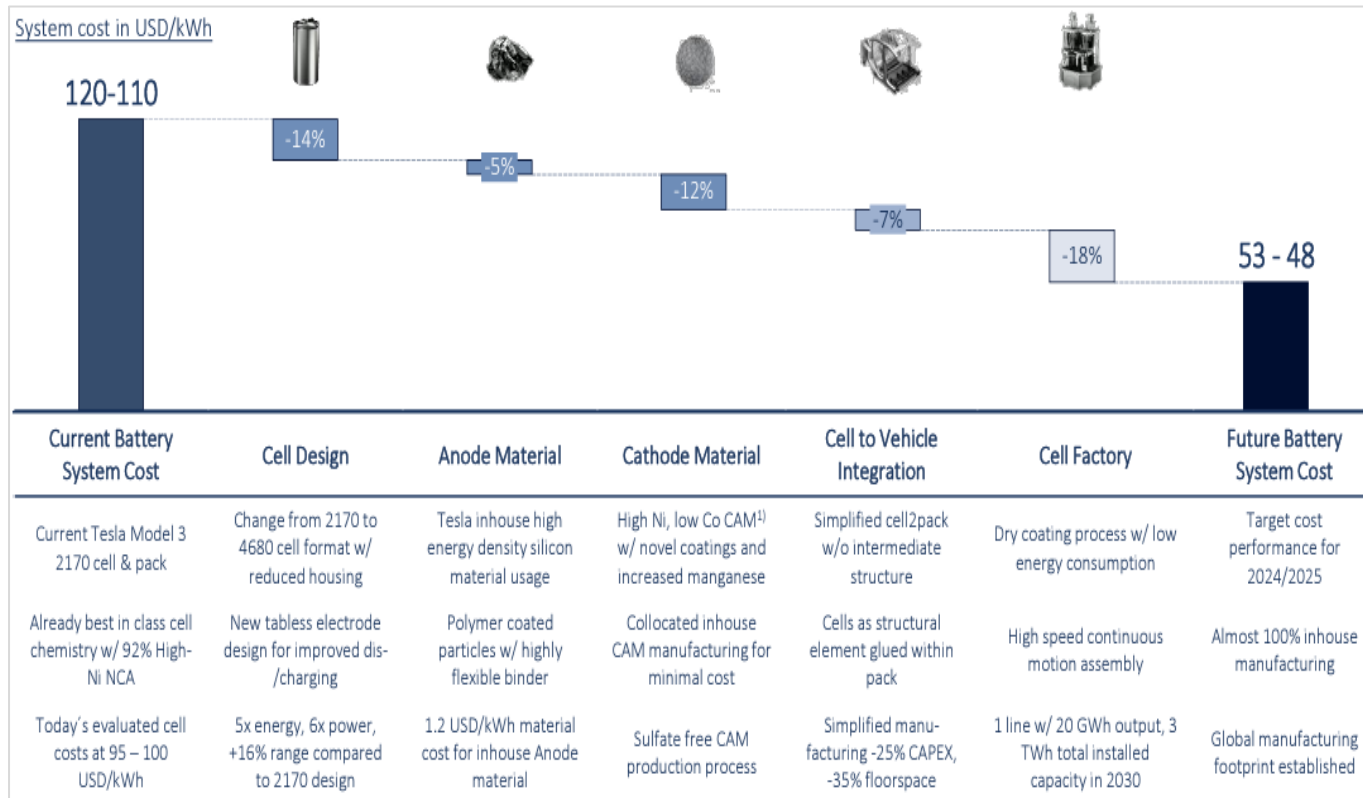
<4 Major Materials' Roadmap>

		'20	'21	'22	'23	'24	'25	'26	'27	'28	'29	'30
Energy Density		260Wh/kg		280Wh/kg	300Wh/kg	330Wh/kg		400Wh/kg				
Cathode	<Premium>	High Ni/ NCMA Ni-rich (Ni 88%) (single-crystal Ni 50~60%)		High Ni/ NCMA Ni-rich (Ni 91%) NCM 9½ ½ (single-crystal Ni 70~80%)	NCMA(Ni ≥90%), Co<5% Ni-rich (Ni 94%) (single-crystal Ni >85%)		NCMA(Ni ≥90%), Co <2% Ni 98% ('25~) (single-crystal Ni >90%)					
	<Standard>		Svolt 240Wh/kg NMx(Ni75%Mn25%)			260Wh/kg NMx(Cobalt-free)						
Anode	<Premium>	Graphite+SiO Gr+SCN(Si 2~5%)			Gr+SCN(Si 8%)		Gr+Pre-lithiated SiO Gr+SCN(Si 10%)	Pure Si (Pre-lithiation)				ASSB (Li-metal)
	<Standard>	Gr (low-price natural or artificial graphite)			Ultra low-priced artificial graphite		Pure Si	Pure Si (Pre-lithiation)				
Separator	<Premium>	PE base film + CCS (Double Coating 11+5+5 um) (Double Coating 12+3 um)		PE base film + CCS (high heat-resistant 200°C) (Double Coating 9+5+5 um) (Double Coating 9+3 um)		PE base film + CCS (high heat-resistant 250°C) (Double Coating <9+@+@ um)						
China LFP Cell	<Standard>	PP base film(CCS)		PP base film(CCS)								
Electrolyte	<Premium>	LiPF6+solvent+special additive (Korea) Solvent EC/EMC/DEC/DMC 20/30/0/30% (China LFP) Solvent EC/EMC/DEC/DMC 29/31/10/12%		5V high-voltage electrolyte			LiPF6 free electrolyte (special salt) (Korea) EC/EMC/DEC/DMC 18/26/0/33% (China LFP) EC/EMC/DEC/DMC 25/14/19/20%					ASSB(Solid Electrolyte)
	<Standard>			LiPF6+solvent+(special additive)								

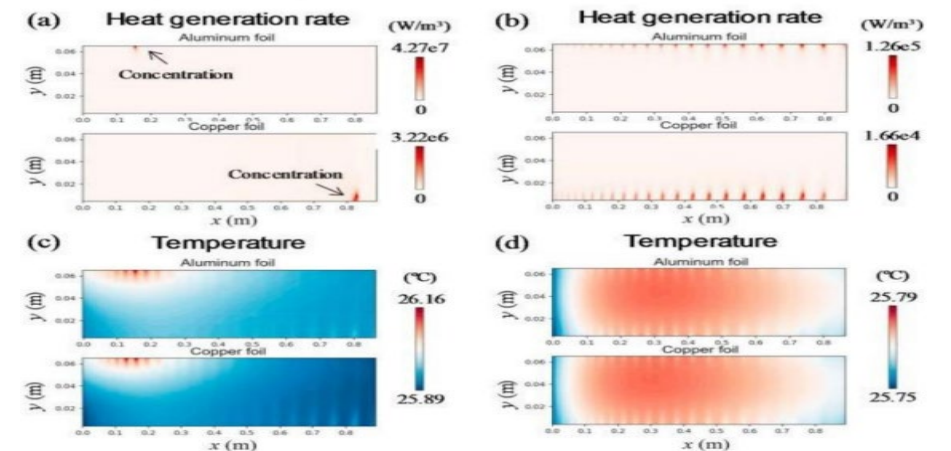
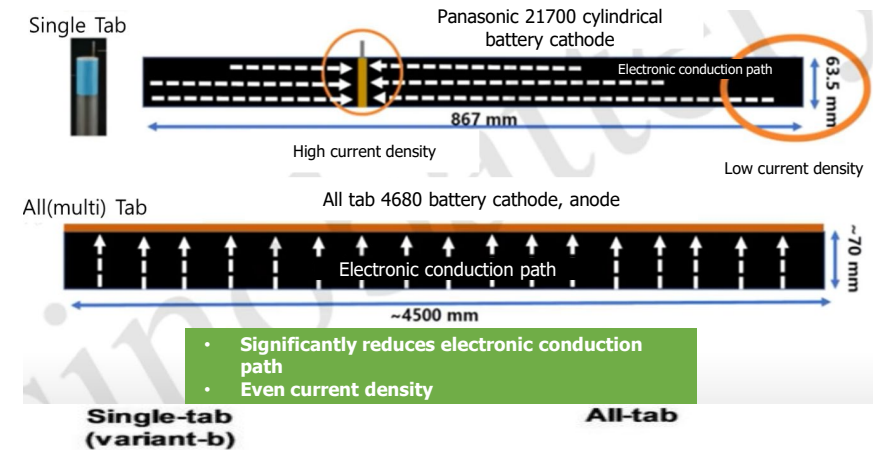
Next-Gen Battery Technology Issues

Enhancement of Battery Cost & Heat Stability Thru Application of 4680

- Compared to 2170 battery, 4680 battery is expected see 56% cost improvement per kWh in terms of cell design, anode active material, cathode active material, cell-vehicle integration, and cell factory.
- Cost of 2170 system (110~120\$/kWh), currently installed to Model 3, can be reduced to 48~53\$/kWh.
- All tab(tabless) design allows to shorten the path of current transfer, thereby significantly reducing impedance and having less increase in temperature during high-current charging/discharging which leads to the improvement of thermal stability.



Source: 2020 Tesla Battery Day presentation summarized by P3 Automotive GmbH



Source: LA Shen, Optimal cell tab design and cooling strategy for cylindrical lithium-ion batteries

4680 Battery Makers and OEMs' Current Status

- 46xx series large-size cylindrical battery has great potential in cost reduction and efficiency increase, and major battery makers are expected to expand the production of 46xx series battery in earnest around 2025.
- Panasonic postponed the production from Apr 2023 to Sep 2024 (due to yield issue caused by production rate and welding difficulty); LGES expected to start mass production from Aug 2024.

Major 4680 Battery Makers



Maker	Expected Mass Production	Can Size	Energy Density	Cathode/Anode	Expected CAPA	Production Site
TESLA	the end of 2023 (In-house)	4680	296Wh/kg	LFP, NCM +Gr / (or Silicon)	310GWh~	US Berlin
PANASONIC	2023.4→2024.9 (postponed) (for TESLA)	4680	244Wh/kg	NCA, NCM +Gr(Graphite)	200GWh~	Japan US
SDI	2026 (for BMW) (for GM)	4680 4695/46120	~400Wh/kg (860Wh/L)	NCA, NCM +SCN(Silicon)	50GWh~	US Hungary
LGES	mass production in 2024.8 (for TESLA)	4680 4695/46xxx	300Wh/kg~	NCM, NCMA +Gr / (or Silicon)	100GWh~	Korea(Ochang) Arizona Nanjing, China
CATL	2025 (for BMW)	4680 4695	300~350Wh/kg	LFP, M3P +Gr(+Silicon)	100GWh~	China Hungary
CALB	Undecided	4695 46110	300Wh/kg	NCM + Graphite	10GWh	Jiangsu Province
EVE	2022.3Q 2025 (for BMW)	4680 4695/46110	≥280Wh/kg	NCM + Silicon	100GWh	Jingmen Hungary
BAK	2022	4680 4695	280~330Wh/kg	NCM	30GWh	Cangzhou
AESC	2026 (for BMW)	4680		LFP	30GWh	US
Sunwoda	Undecided	4695	270~290Wh/kg	NCM	15GWh	Zhejiang
Guoxuan	Undecided	4680	230Wh/kg	NCM	10GWh	Anhui Province

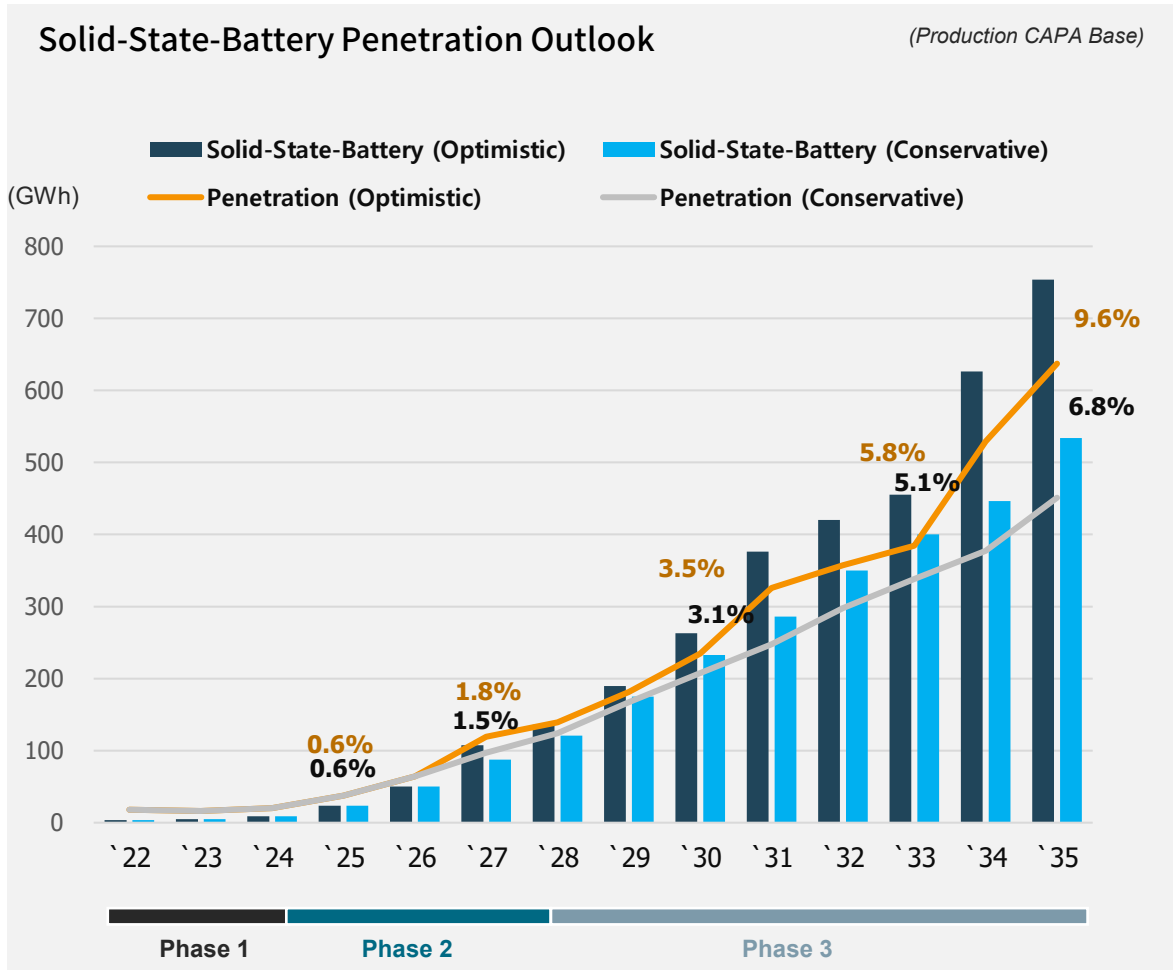
OEM	Battery Makers	Details
Tesla	<ul style="list-style-type: none"> • In-house(100GWh) • Panasonic • LGES 	'23.4Q(US) '26(EU) '28(Mexico) '24.1Q(JP) '24(US) '24.1Q(KR, 9GWh) '25(US Arizona, 37GWh))
BMW (Total 120GWh)	<ul style="list-style-type: none"> • SDI • CATL • EVE • AESC 	'26(US) '24 (CN) '25(EU) '25 (EU), '25(CN) '26 (North America Free Trade Area)
Others (Hyundai, Vinfast, Rivian, Lucid...)	<ul style="list-style-type: none"> • BAK • CALB • Sunwoda • Guoxuan • NiO , Storedot ... 	N/A (CN) N/A (CN) N/A (EU) N/A (CN) N/A (CN)

Source: Summarized by SNE Research (Based on industry information)



All-Solid-State Battery Expected to Mass Produce for EV in 2028

- Car OEMs and major LIB makers plan to start mass production in either 2027 or 2028.
- Given the utilization rate and demand, production and penetration rate is forecasted to be 9.6% (optimistic perspective) vs. 6.8% (conservative perspective) in 2035.



Source: SNE Research analysis

Applying for Solid-State-Battery by Phase

Phase 1

- Mainly in the IT(CE) market, oxide-based and polymer-based SSB to be applied
- Companies: TDK, FDK, Blue Solution, Prologium, 24M, TDL..
- Formation of small-scale market (1~ 10 GWh)

Phase 2

- Start-ups trying to apply SSB technology for mass production, forming pilot-level production
- Companies: Solid Power, ProLogium, Ganfeng Lithium, etc.
- Formation of market around 100 GWh (Penetration rate ~3 %)

Phase 3

- Applied to EV and mass production starts (Toyota, Hyundai Motors, etc.)
- LIB makers start mass production in earnest (SDI, LGES, CATL, BYD, etc.)
- Market matures in full swing (penetration rate ~10%)

(GWh)

Region	Company	Application	Material	2023
Europe	Blue solution	Vehicle/ESS	Polymer	0.6
USA	BrightVolt	CE	Polymer	0.1
Taiwan	Prologium	Vehicle/ESS	Hybrid	1
USA	Infinite Power Solutions	CE	Polymer	0.01
Europe	Ililka 기술	Vehicle/ESS	Oxide	0.108
Japan	Taiyo Yuden	CE	Oxide	0.001
Japan	TDK	CE	Oxide	0.002
Japan	FDK	CE	Oxide	0.002
Japan	SolidPower	Vehicle/ESS	Sulfide	0.05
China	Welion	Vehicle/ESS	Polymer	0.1
Japan	SES	Vehicle/ESS	Polymer	0.1
Japan	Murata	CE	Oxide	0.006
China	Ganfeng Lithium	Vehicle/ESS	Hybrid	1
Korea	TDL	Vehicle/ESS	Hybrid	0.1

Region	Company	Application	Material	2027
USA	Ionic Material	Vehicle/ESS	Polymer	0.3
USA	Solid Power	Vehicle/ESS	Sulfide	0.2
China	Coslight	Vehicle/ESS	Polymer	0.2
Taiwan	Prologium	Vehicle/ESS	Hybrid	12
China	Ganfeng Lithium	Vehicle/ESS	Hybrid	6
Japan	Hitachi Zosen	Vehicle/ESS	Sulfide	0.5
China	Welion	Vehicle/ESS	Polymer	5
USA	QuantumScape	Vehicle/ESS	Hybrid	2
USA	SES	Vehicle/ESS	Polymer	5

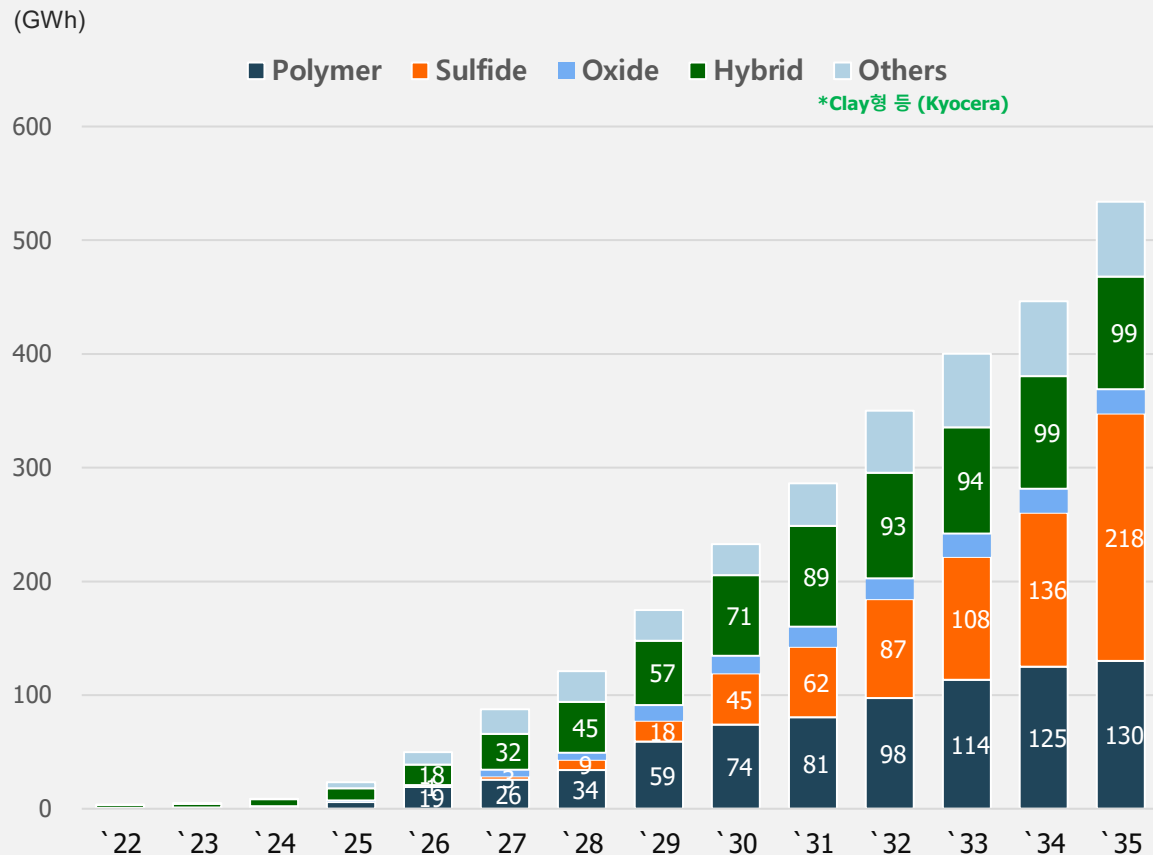
Region	Company	Application	Material	2035
Japan	Toyota	Vehicle/ESS	Sulfide	50
Japan	Hitachi Zosen	Vehicle/ESS	Sulfide	5
Korea	SDI	Vehicle/ESS	Sulfide	40
Korea	SDI	CE	Polymer	2
Korea	LGES	Vehicle/ESS	Sulfide	30
Korea	LGES	CE	Polymer	3
Korea	Skon	Vehicle/ESS	Sulfide	30
USA	QuantumScape	Vehicle/ESS	Hybrid	20
Korea	Hyundai Motors	Vehicle/ESS	Sulfide	25
Japan	Honda	Vehicle/ESS	Sulfide	15
Japan	Nissan	Vehicle/ESS	Sulfide	20



After 2030, ASS Battery Market Expected to Be Led by Sulfide-Based

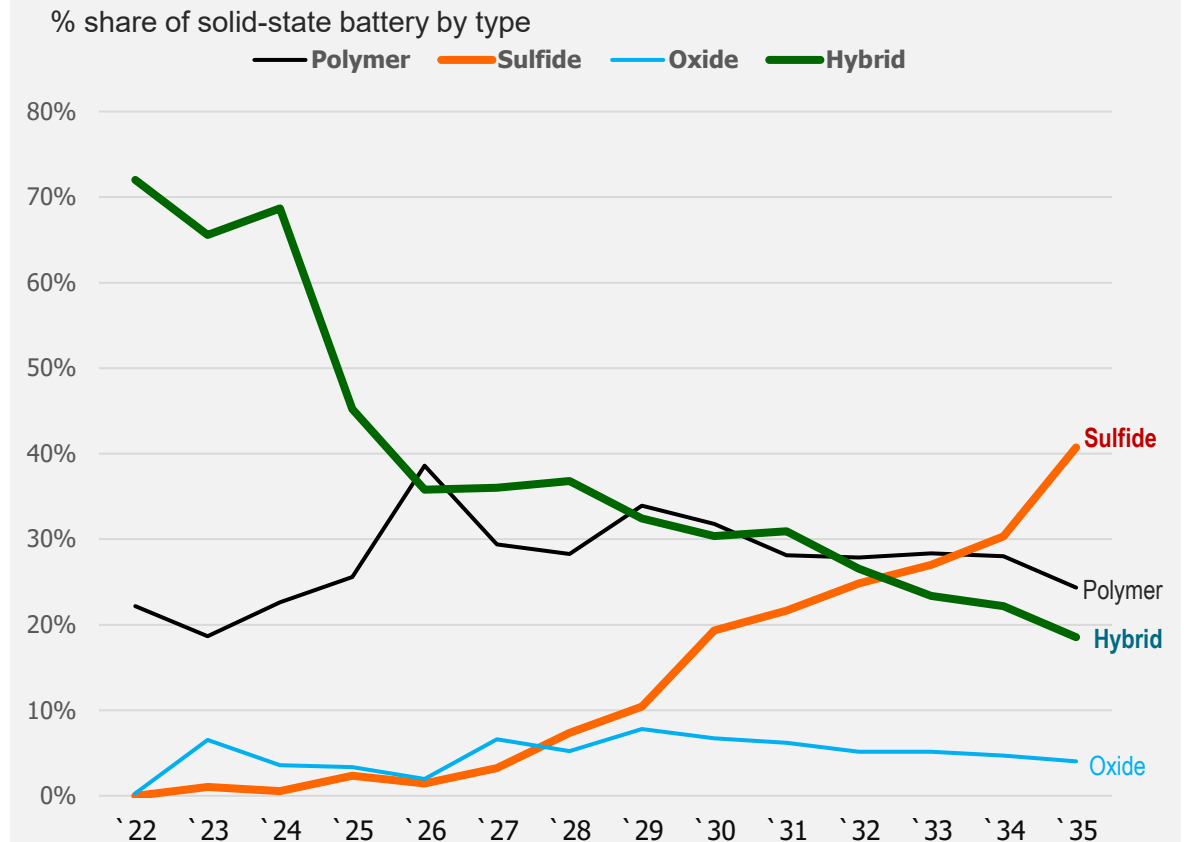
- Mainly by Chinese makers, semi-solid battery, which can utilize the existing production line and of which technical hurdles are relatively low, is made, and hybrid and polymer-based ASSB hold strong positions till the mid-2020s.
- Based on excellent battery features of sulfide-based solid electrolyte, the production cost is expected to reduce, and the manufacturing/production technology is forecasted to be developed, leading to the expansion of sulfide-based ASSB from 2030 (Approx. 40% M/S expected in 2035)

ASSB Market with Expected Competition among Various Types



Source: SNE Research analysis

Market Expected to Expand from Polymer, Hybrid and Oxide to Sulfide



Next-Gen Battery Preparation by Companies and Future Market Introduction

- Sulfide-based and oxide-based ASSB are expected to be applied after either 2026 or 2027; Polymer-based ASSB has been applied to EVs by Bolloré(2011), WeLion(2022), and Factorial(2023).
- Major battery makers focusing on development and commercialization of sulfide-based ASSB.
- Highly likely for hybrid semi-solid battery using oxide-polymer, rather pure polymer-based, to be commercialized first mainly by Chinese makers

Solid Electrolyte	Battery Makers & Car OEMs	Technology Trend & Current Status	Introduction Period
Sulfide-based	SDI	<ul style="list-style-type: none"> ▪ P/P line construction and pilot production ▪ Completion of ASSB development 	2023 2027
	LGES	<ul style="list-style-type: none"> ▪ Completion of ASSB development and mass production 	2030
	SK On	<ul style="list-style-type: none"> ▪ ASSB commercialization 	2028
	PPES-Toyota	<ul style="list-style-type: none"> ▪ Completion of ASSB development ▪ Applied to Toyota EV 	2025 2027~8
	Solid Power	<ul style="list-style-type: none"> ▪ Applied as prototype for vehicles ▪ 100Ah Li metal cell development completed ▪ Applied to BMW and Ford EV 	Before 2025 2028 Before 2030
	CATL	<ul style="list-style-type: none"> ▪ Completion of ASSB development 	2025
Oxide-based	SK On	<ul style="list-style-type: none"> ▪ Production of oxide-polymer based prototype ▪ Commercialization of oxide-polymer based 	2026 2028
	ProLogium	<ul style="list-style-type: none"> ▪ 1~2 GWh production CAPA ▪ 2.5kWh for Gogoro scooter ▪ Applied to Benz and VinFast EV 	2022 2022 2023
	Quantum Scape	<ul style="list-style-type: none"> ▪ 1GWh production CAPA ▪ Applied to VW EV prototype ▪ 20 GWh production CAPA 	2024 2025 2026
	Qingtao Energy	<ul style="list-style-type: none"> ▪ 1GWh production CAPA ▪ 10GWh optional production CAPA 	2020 2022

Solid Electrolyte	Battery Makers & Car OEMs	Technology Trend & Current Status	Introduction Period
Polymer-based	Bolloré-Benz	<ul style="list-style-type: none"> ▪ Already produced for Citi Taxi ▪ E-citaro Bus(441kWh LMP) 	2011 2020
	LGES	<ul style="list-style-type: none"> ▪ Commercialization of semi-solid battery ▪ Commercialization of all-solid battery 	2026 2028
	Factorial Energy	<ul style="list-style-type: none"> ▪ Battery for Stellantis EV (100Ah) ▪ Development of 40Ah battery for Hyundai Motors (200MWh~1GWh CAPA) 	2023 2023
	WeLion	<ul style="list-style-type: none"> ▪ Development of 150KWh battery for NIO ▪ 20 GWh 생산 CAPA 	2022 2022
	SES	<ul style="list-style-type: none"> ▪ Shanghai Giga 1GWh production ▪ LMB Development with Hyundai Motors (Considering JV) ▪ Li-metal battery mass production 	2022 2024 2025
	Ionic Materials	<ul style="list-style-type: none"> ▪ Prototype for Nissan-Renault-Mitsubishi EV ▪ Hyundai Motors applied to EV 	2025 2030+
	Hydro Quebec	<ul style="list-style-type: none"> ▪ Completion of ASSB development 	2025

Next-gen Battery Preparation by Makers and Future Market Introduction

- Toyota is at the forefront of next-gen battery development, announcing the commercialization of EV with ASSB installed in 2027 or 2028.
- Hyundai-KIA: Currently working on in-house development, and at the same time, trying to establish J/V with SES for LMB (targeting for production in 2025)
- In-house R&D effort or investment in ASSB maker or startups

Company	Technology Trend and Current Status	Company	Technology Trend and Current Status
Toyota	Targeting to commercialize EV with sulfide-based ASSB installed in 2027 or 2028 Goal: 10-minute charging to achieve 1,200km driving range	Hyundai/KIA	Goal to produce semi-solid-state battery in 2025 (Cooperate with SES in the form of JV for LMB) Invest in Ionic Materials to develop ASSB for EVs Working on in-house development of ASSB
Mercedes Benz AG (Daimler)	Release city bus(New e-Citaro) with polymer-based LFP ASSB	Nissan	Established ASSB prototype line and working on developing production technology at its Yokohama research center
Volkswagen	Invest in and collaborate with QuantumScape with an aim to launch EV with ASSB installed in 2025	Honda	Through the consortium with LIBTEC, participated in 500-mile ASSB development with Toyota and Nissan
BMW	Invest in Solid Power which develops ASSB with high-capacity Li-metal anode. Target to achieve commercialization in 2030	Stellantis	Together with Daimler, participated in the development of ASSB by Factorial Energy. Commercialization expected by 2026.
General Motors	Working on development of ASSB with LGES and Honda	BYD	Cooperate with CATL for development of ASSB. Targeting commercialization in 2030
Ford	Invest in Solid Power for developing next-gen ASSB for EV	Fisker	Working on developing luxury EV Emotion based on ASSB with driving range 750km

Sodium ion Battery (SIB)_ Expected to Be Used in 2024; Penetrate to ESS, 2-Wheeler, Small-Size EV Market

- SIB is expected to penetrate into the industry where lead-acid battery previously was dominant; with most of SIB production bases located in China, it is expected the SIB industry would first develop in China. In 2024, 2-wheelers and small-size EVs with SIB installed have been released in China
- Most of SIB makers (83.7%) are located in China, while some of SIB products are distributed to Europe, US, and Japan by utilizing related patents.
- One of strong points of SIB is low price of raw material, but if the price of raw materials for LIB stays low as it is now, the SIB market seems to have difficulties in expansion.

SIBs' Potential Areas in Global LIB Industry

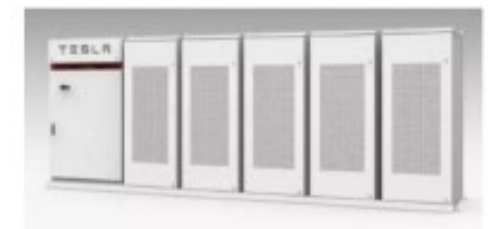
1. The electric 2-wheeler market in China is the most developed market in the world. The 2-wheelers which use lead-acid battery or other LIB applications can be replaced with SIBs at more affordable price.



2. In the EV area, SIBs may replace some of LIBs used in the A segment (0-20kWh) and the B segment (20-40kWh).



3. The ESS industry can be where SIBs have a great potential based on its price competitiveness as, for ESS, the heavy weight of SIBs does not need to be worried) and SIBs shows a high efficiency in low temperature.



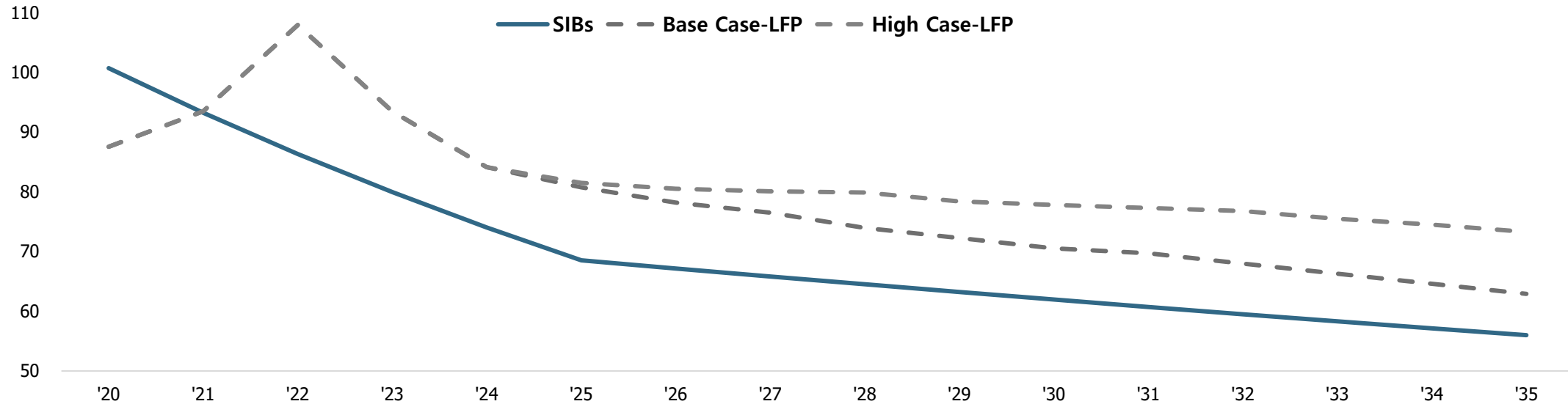


Sodium ion Battery (SIB)_ Possible to Be Max 24% Cheaper Than LFP in 2030

- According to a conservative scenario, SIBs cell price is expected to be 11% cheaper than that of LFP cell in 2035.
- Due to increase in raw materials for LIBs, LFP cell price (high case) is expected to be 73.3USD/kWh in 2035 while SIBs expected to cost 56USD/kWh, 24% lower than LFP.

Comparison of SIBs and LFP Cell Price by Different Scenario

Unit: USD/kWh



	'20	'21	'22	'23	'24	'25	'26	'27	'28	'29	'30	'31	'32	'33	'34	'35
SIBs					74.0						62.0					56.0
Base Case-LFP					84.15						70.55					62.9
High Case-LFP					84.2						77.8					73.3
B-Gap					<i>12%</i>						<i>12%</i>					<i>11%</i>
H-Gap					<i>12%</i>						<i>20%</i>					<i>24%</i>

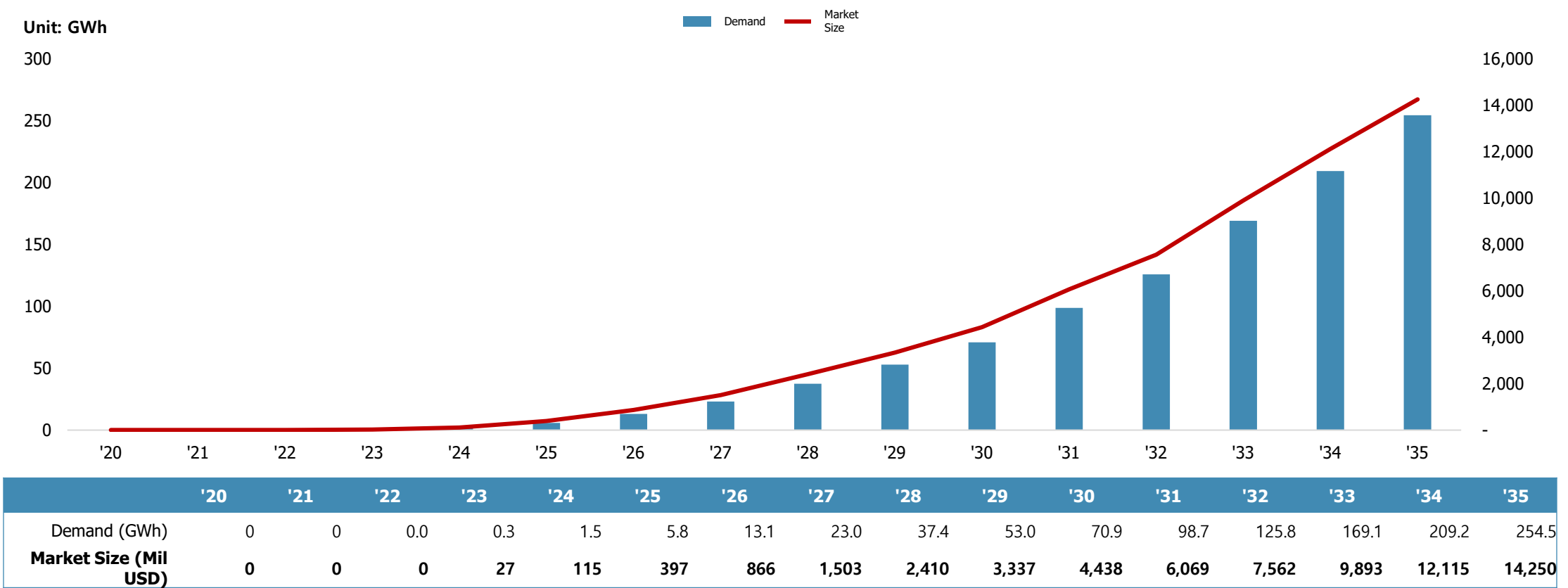
Source: SNE Research_ <2024> SIBs Technology Development Trends and Market Forecast (~2035)



Sodium ion Battery (SIB)_Expected to Grow Max US\$ 14.2 Bil in 2035

Given the possibility of increase in LIB raw material price, if SIB successfully expands its presence in the market, the SIBs market scale would grow to US\$ 0.39 Bil in 2025; 4.4 Bil in 2030; and 14.2 Bil in 2035.

SIB Market Size Outlook by Optimistic Scenario



Source: SNE Research_ <2024> SIBs Technology Development Trends and Market Forecast (~2035)

* Selling price is calculated by applying 20% to cost at the commercialization stage; Cell price standard (For cell cost, refer to cost analysis) 0.14USD=1RMB

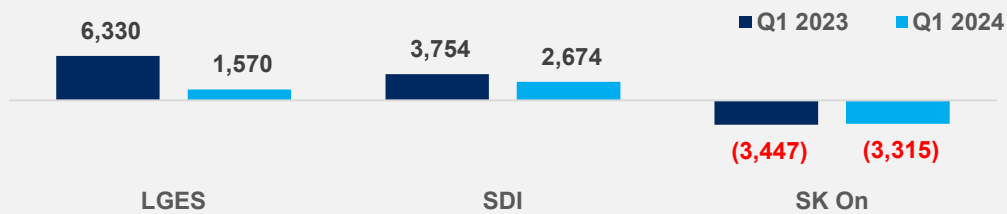
- 1 About SNE Research
- 2 xEV Battery Market Scale
- 3 xEV Battery Demand Outlook (~2035)
- 4 Next-Gen Battery Technology Issues
- 5 Current Market Issues**

Current Market Issues – Chasm Phase in EV and Battery Industry

In the process of technology innovation, a chasm phase inevitably arrives; the chasm phase in EV industry is expected to be overcome after the mid-2025

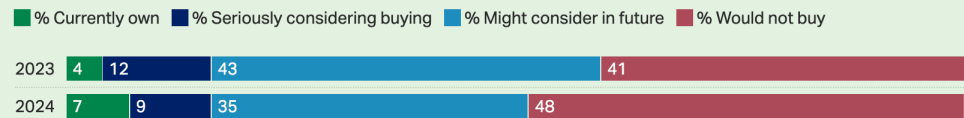
- EVs are still far from tapping into the public, beyond those early adopters, who places more importance on practicality.
- However, the chasm phase is temporary, and with the electrification strategies by OEMs and climate change policies, demand for electric vehicles is expected to continuously expand.
- Due to the shortage of EV-related infrastructure, high EV prices, and high interest rates, focuses are more on practicality and wise spending rather than ESG and climate crisis.

Decline in Operating Profit by K-trio

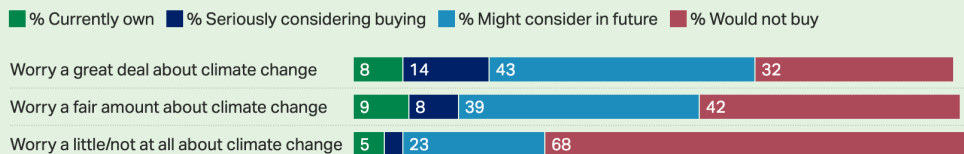


Survey Result on EV Ownership in the US in 2023 and 2024

Americans' Electric Vehicle Ownership and Potential Ownership



Americans' Electric Vehicle Ownership and Potential Ownership, by Concern About Climate Change



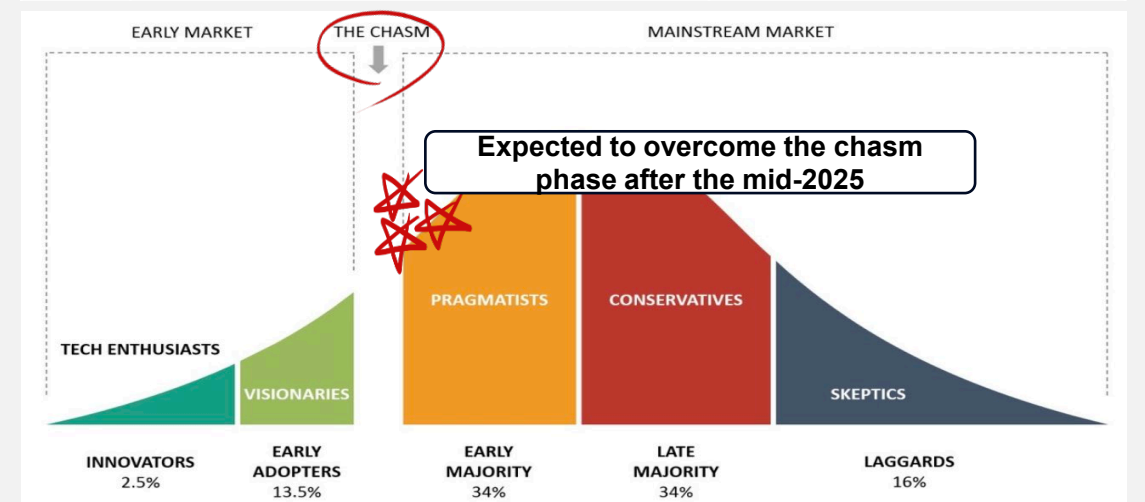
March 1-20, 2024
Percentage with no opinion is not shown.

Get the data • Download image

GALLUP

OEM Electrification Strategy & Chasm Phase

OEM	Electrification Strategy	Annual Global Sales Plan (% of EV among entire production volume)
Stellantis	• (EU) BEV to be 100% among new vehicles by 2030	Annual 5 mil units of BEV(70%) in 2030
	• (US) BEV to be 50% among new vehicles by 2030	
Ford	• (US) 16 EV models to be released by 2022	2.3 mil units in 2030 (40%)
	• (EU) PHEV for all vehicle models to be released by the mid-2026	
	• (EU) EV for all vehicle models to be released by 2030	
GM	• 30 EV models to be released by 2025 (20 models for North America)	1 mil units in 2025 (15%), 100% EV in 2035



Current Market Issues – Final Rules on Clean Vehicle Provisions of IRA (May 06, '24)

* Summary: Rules eased for areas in the US OEM supply chain where China cannot be ruled out, but still maintaining the anti-China stance

- As the rules exempt graphite contained in battery anodes from needing to meet FEOC-related regulations, other countries incl. the US earn more time to lower their dependence on China for graphite for a certain period of time.
- As more EV models become eligible for the IRA tax credits, it is expected to bring about a positive influence on sales of both OEMs and battery makers.

Reinforced	Expansion of FEOC prohibition	<ul style="list-style-type: none"> • Foreign entity determined as being engaged in unauthorized conduct that is detrimental to the national security or foreign policy of the United States in consultation with the US Department of Energy, Department of Defense, and Director of National Intelligence • If an entity receives a significant number of subsidies from the government of countries of concern, it can be regarded as an FEOC. 	
Eased	Postponing the application of FEOC Restriction	Graphite	<ul style="list-style-type: none"> • The application of FEOC restriction on graphite is postponed from 2025 to 2027. 1) With such a high dependence on Chinese graphite, if the FEOC restriction is applied on graphite, most of EV models would see a decline in the amount of tax credits. 2) Most of battery cell companies and OEMs expressed their concerns about the graphite supply chain issue and pled for postponing the application of FEOC restriction. → <u>The US seems to admit that it would be difficult to rule out China in the graphite supply chain.</u>
		Electrolyte Salt/ Electrode Binder	<ul style="list-style-type: none"> • Postponing the application of FEOC restriction on critical minerals used for processing electrolyte salt and electrode binder for 2 years → <u>Reflecting difficulties in procuring electrolyte and related minerals when ruling out China</u>
Neutral	Introduction of Battery Materials Concept	Copper Foil	<ul style="list-style-type: none"> • Copper foil, categorized as Battery Materials, not applicable to the FEOC restriction → <u>Price competition expected with the tariff increase by the US, not because of the IRA implementation</u>
		Separator	<ul style="list-style-type: none"> • Separator, categorized as Battery Materials; coated separator is categorized as Component 1) Non-FEOC companies expected to have less pressure on Capex increase by ramping up their coating facilities in North America 2) Non-FEOC companies expected to keep their demand for Chinese separator in short-term as the IRA allows the Chinese separator if they are coated in other regions. → <u>Price competition expected with the tariff increase by the US, not because of the IRA implementation</u>



Thank you

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