

# Global Battery Market and Future Prospects

Aron Newman

Lithium Metal Battery Meeting, Dallas, Texas

May 30<sup>th</sup>, 2019

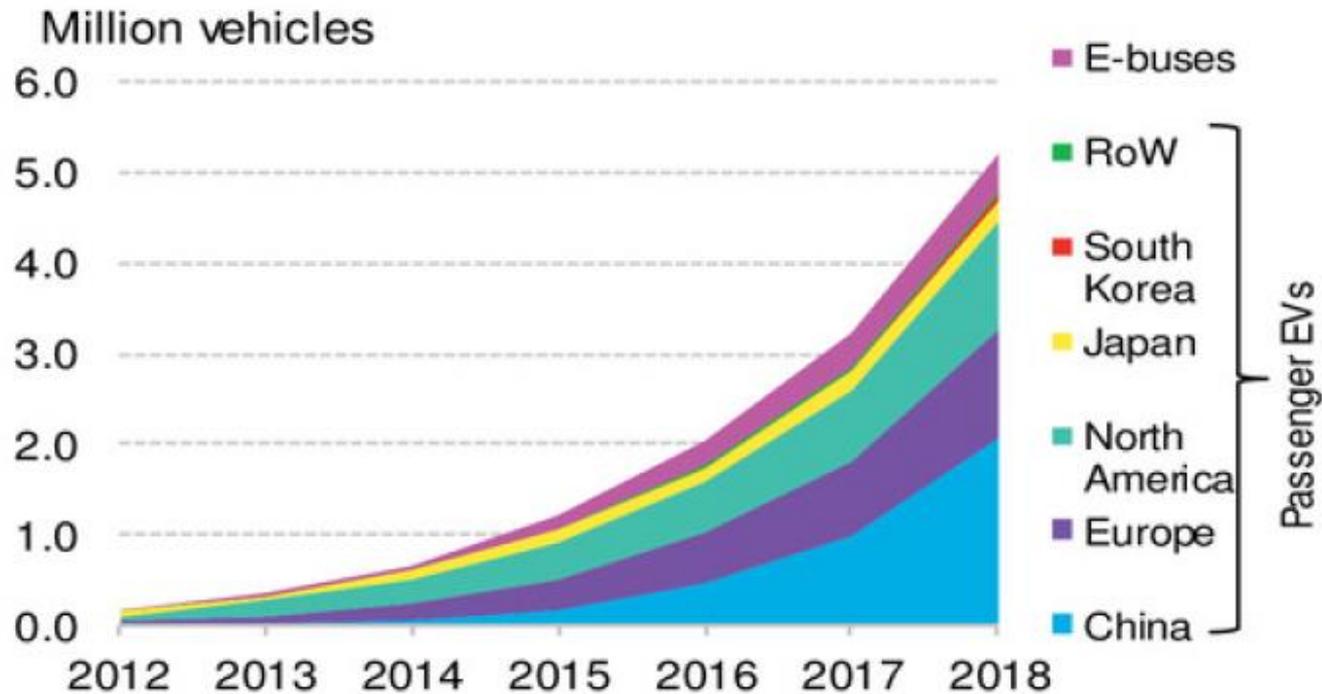


# Outline

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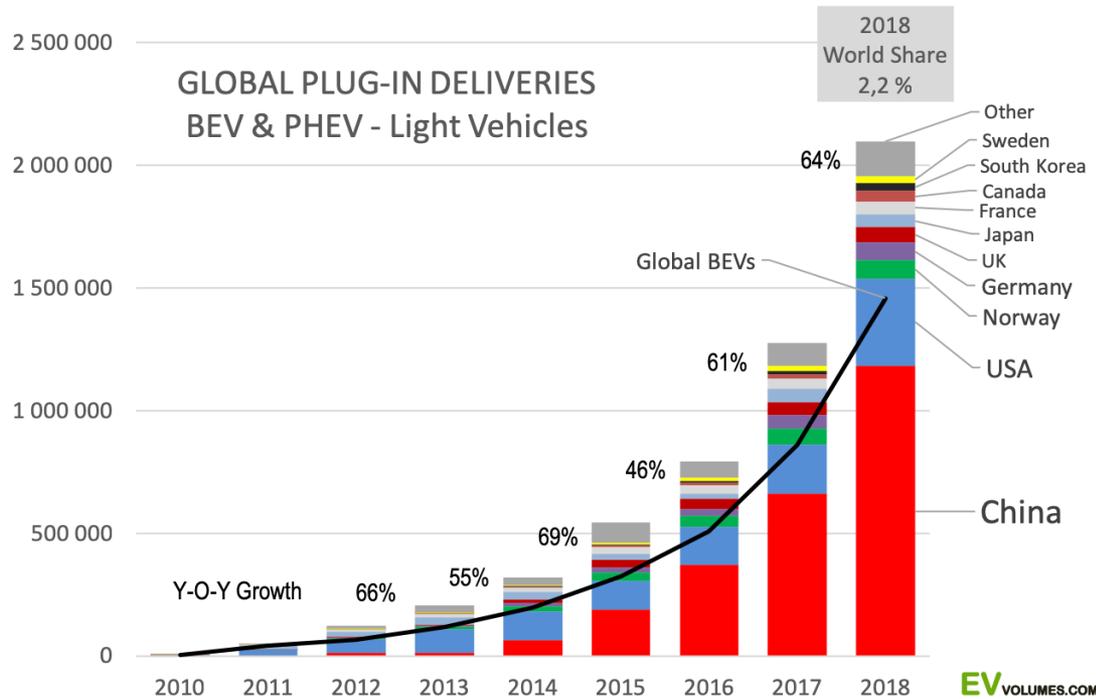
- ▶ Size of the battery market today and moving forward
- ▶ Global market share distribution
- ▶ Which companies and which products?
- ▶ Projections from various sources
- ▶ Cost parity
- ▶ Peak internal combustion engine vehicle sales?
- ▶ Technology timeframe
- ▶ Final thoughts

# Cumulative Global EV Sales by Region



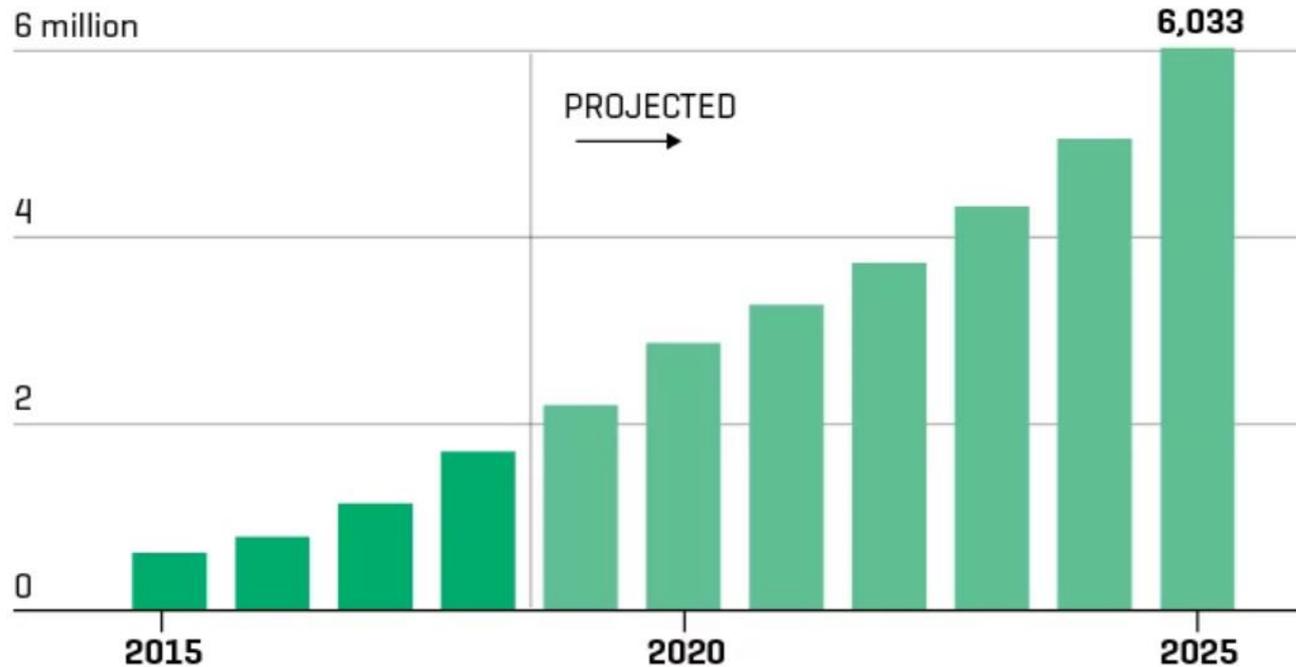
- ▶ The Chinese government's incentives have been successful
- ▶ Justifies why more battery factories are being built in China
- ▶ More than 50% of the market is outside of China

# Global EV Sales



- ▶ Y-O-Y Growth has averaged 60% for the last six years
- ▶ China, Europe and USA stood for 93 % of global sales in 2018
- ▶ Business is kept local

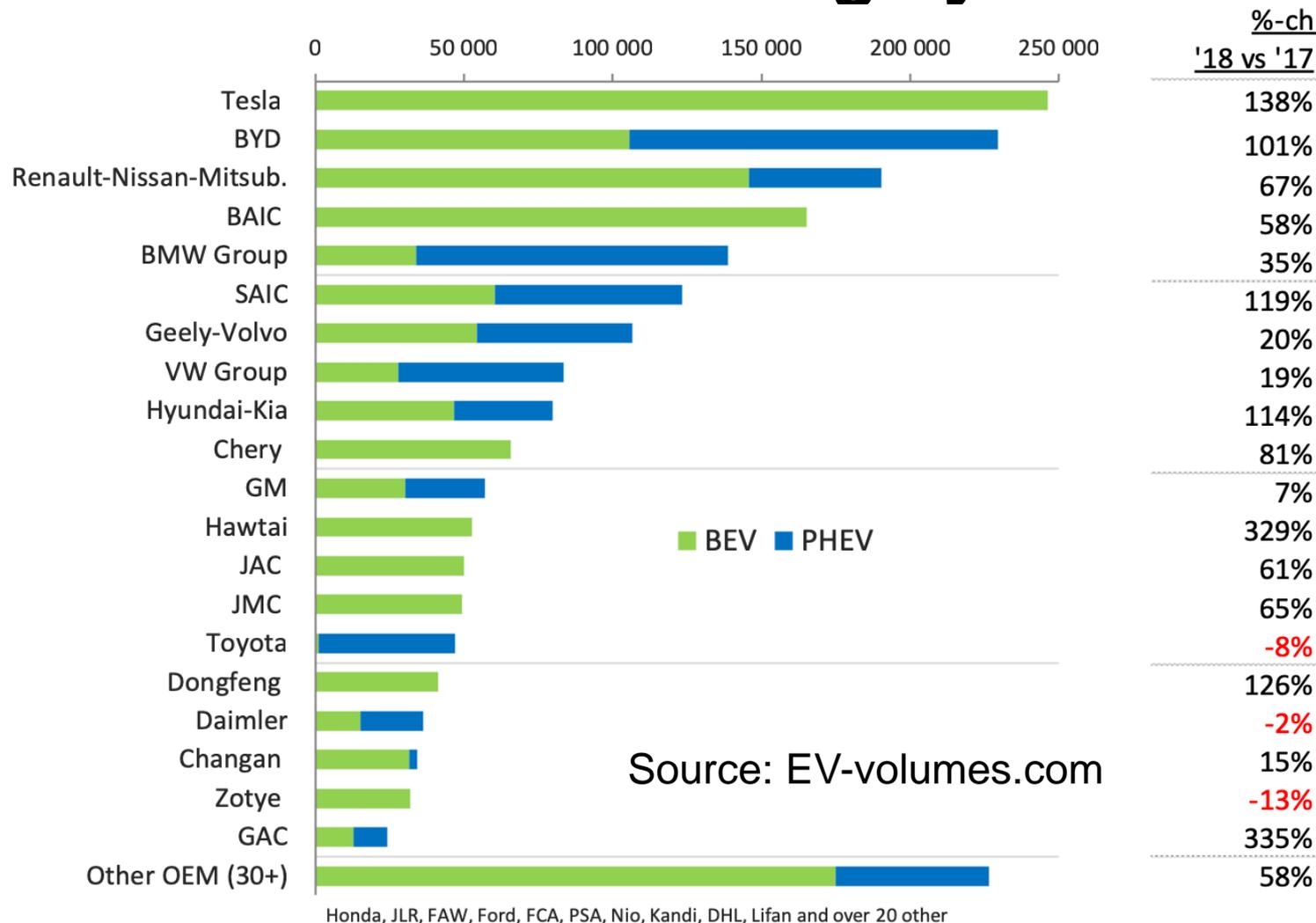
# Projected Global EV Sales



Source:  
Wood  
Mackenzie

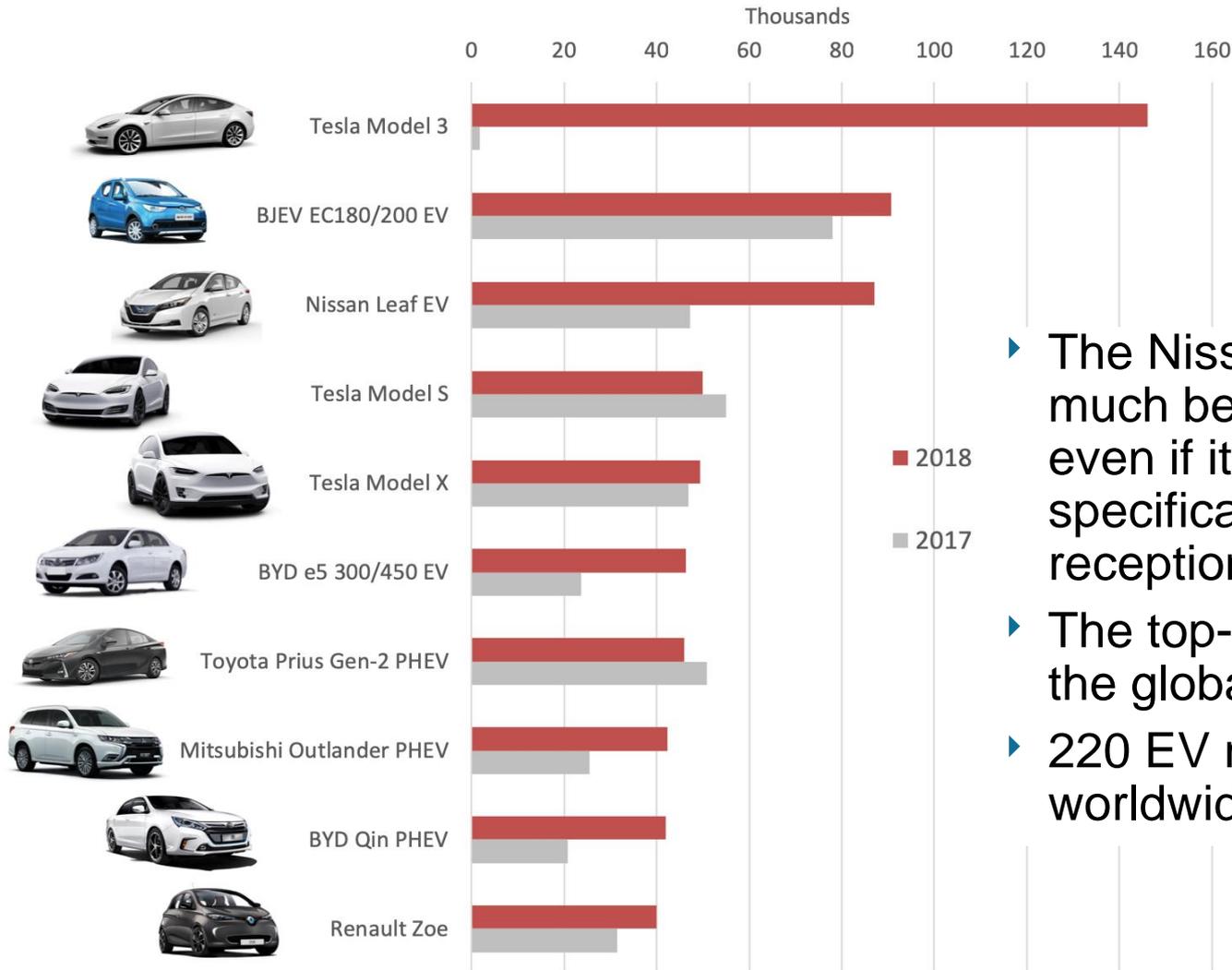
- ▶ Market value will jump to \$41 billion in 2024, from \$13 billion in 2017

# Global EV Sales Ranking by OEM Group



- ▶ Few signs of sector consolidation, yet
- ▶ The number of players keeps growing, every month

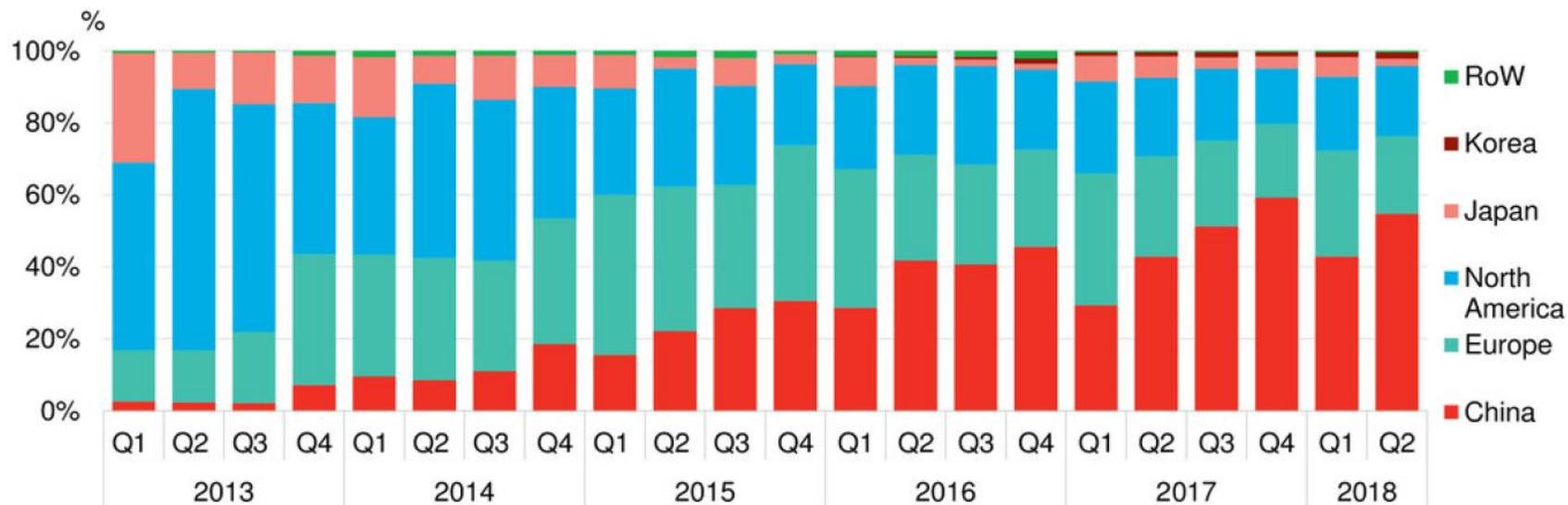
# Global Top 10 EV Models



- ▶ The Nissan Leaf Gen-2 did much better than average, even if its battery specification got a lukewarm reception
- ▶ The top-10 stood for 30 % of the global volume in 2018
- ▶ 220 EV models were sold worldwide in 2018

Picture Credits: WattEV2Buy

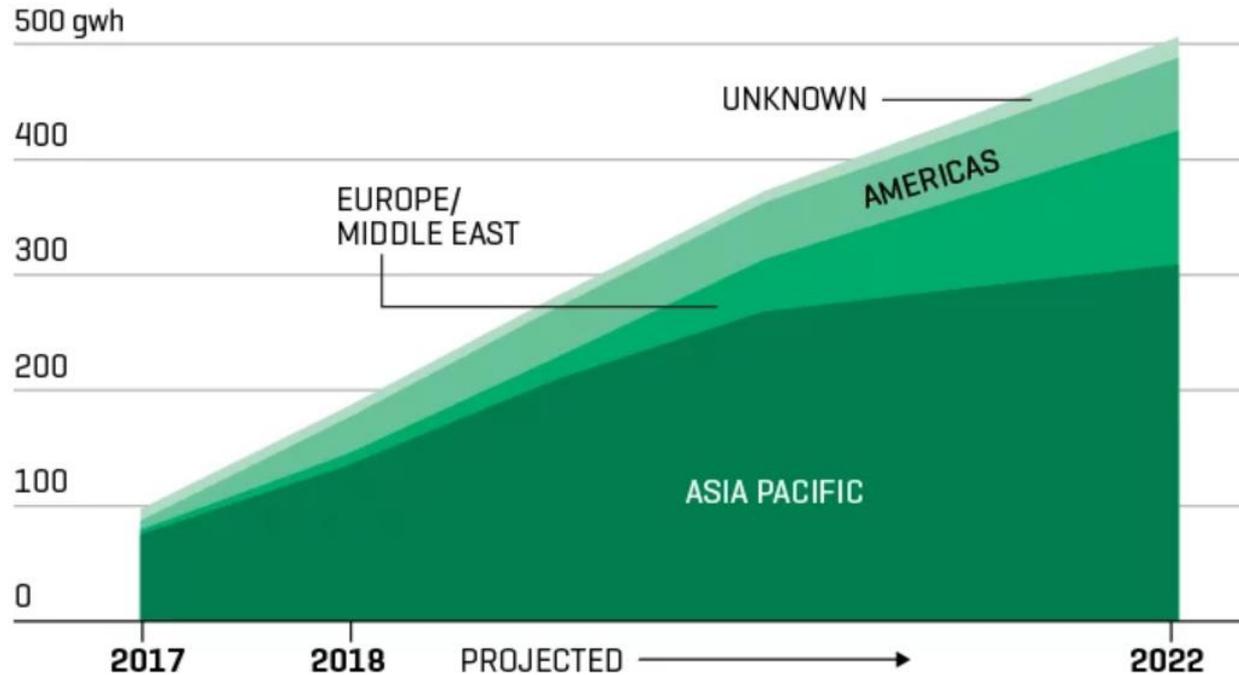
# Regional contribution towards total EV sales



Source: Bloomberg NEF, MarkLines, vehicle registration agencies, EV Sales Blog. Note: Click [here](#) for underlying data.

- ▶ Market share for China in the 2013 to 2018 timeframe has increased from less than 5% to greater than 50%

# Projected Battery-Manufacturing Capacity for EV and Grid



Source:  
Wood  
Mackenzie

- ▶ Europe's share of global cell production is expected to grow from 6 percent to 35 percent over an eight-year period

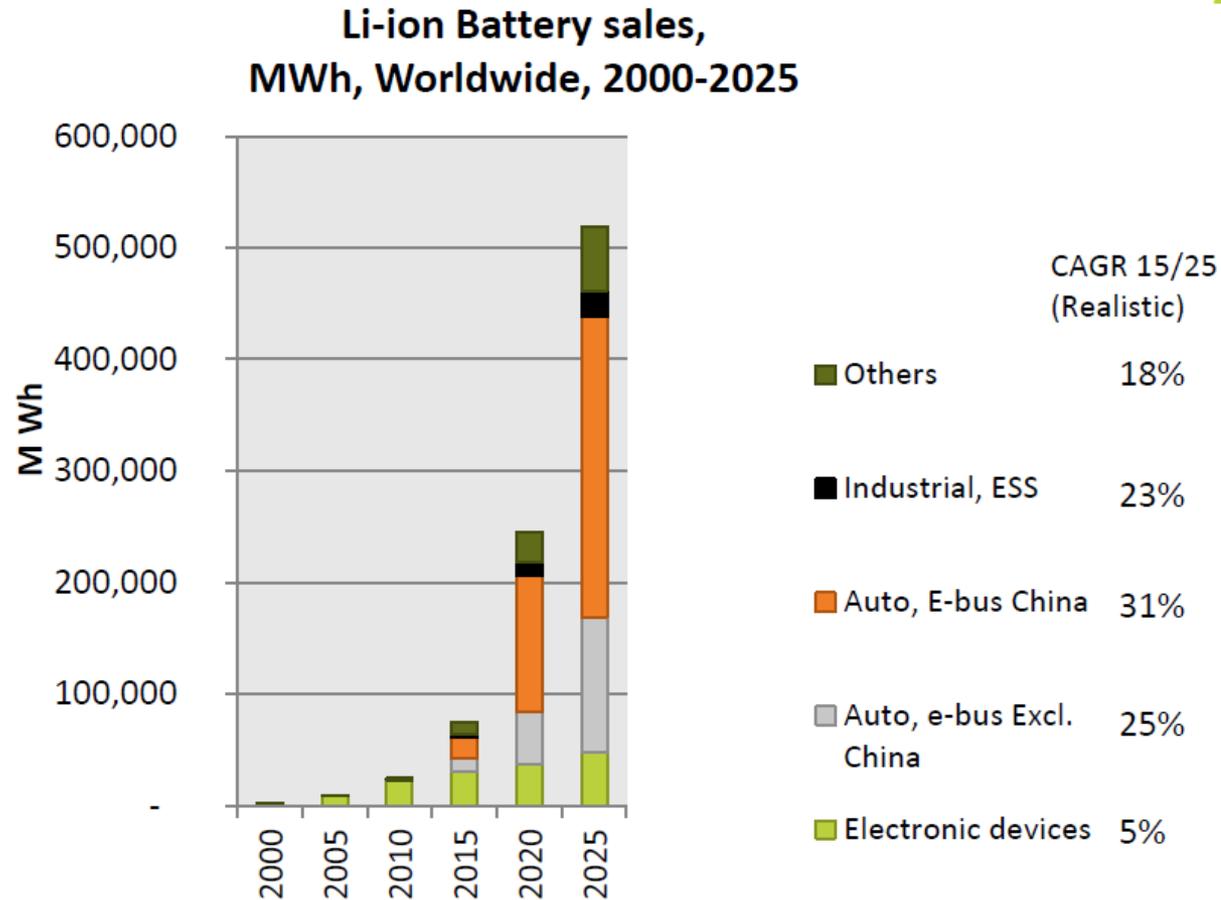
# Optimistic Forecast by Benchmark Mineral Intelligence

Region	Capacity (GWh, 2018)	Capacity (GWh, 2023)	Capacity (GWh, 2028)
China	134.5	405	631
Europe	19.6	93.5	207
North America	20.9	81	148
Other	0	0	5
Asia (excl China)	45.5	78.5	111.5
Grand Total	220.5	658	1,102.5

<https://www.visualcapitalist.com/battery-megafactory-forecast-1-twh-capacity-2028/>  
<https://www.benchmarkminerals.com/>

- ▶ The Europe, Middle East and Africa (EMEA) region will account for almost 228 gigawatt-hours of lithium-ion cell manufacturing capacity a year by 2026 (Woods Mackenzie)
- ▶ Total of around 649 gigawatt-hours worldwide in 2026 (Woods Mackenzie)

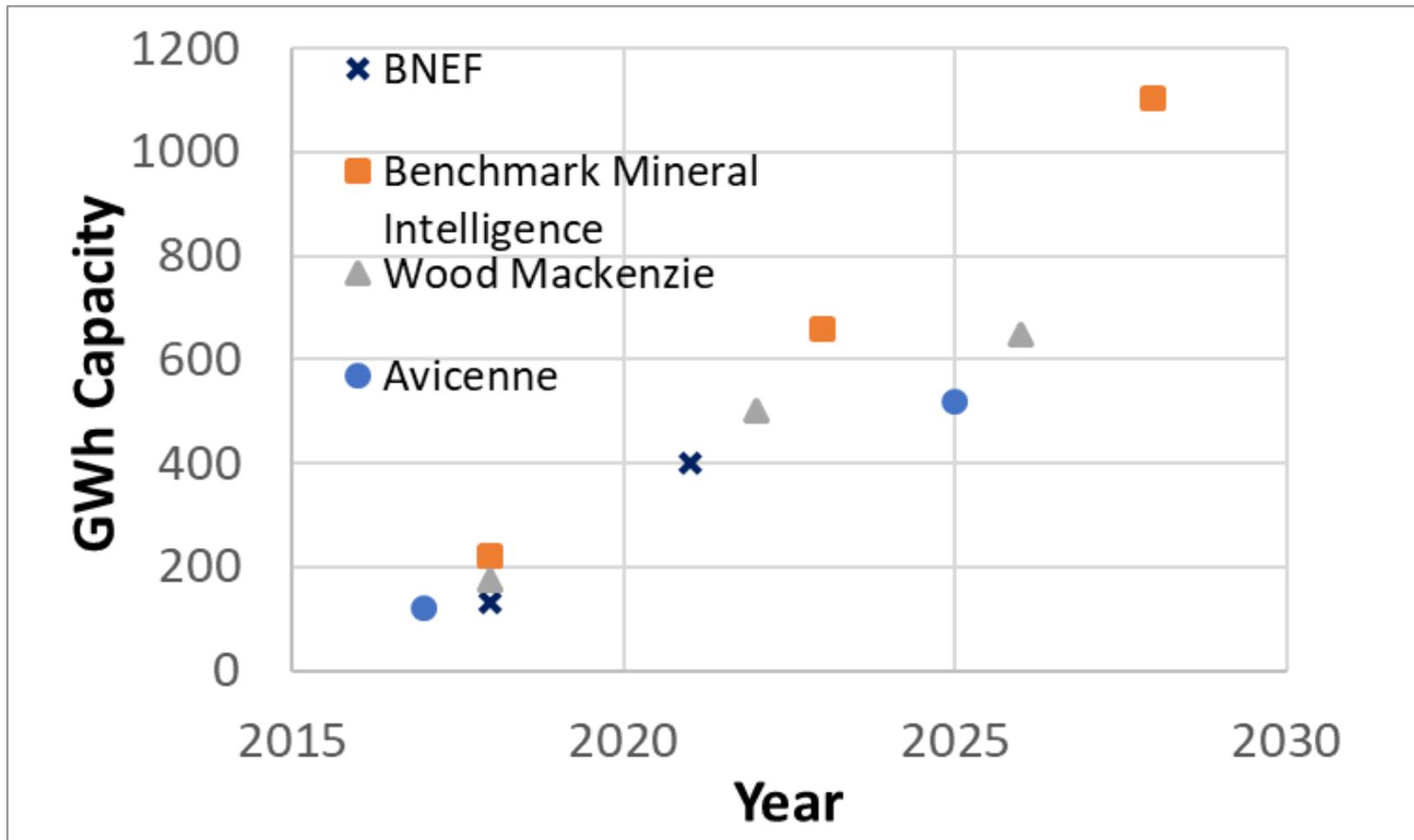
# From 120 GWh in 2017 to 520 GWh in 2025



Others: medical devices, power tools, gardening tools, e-bikes...

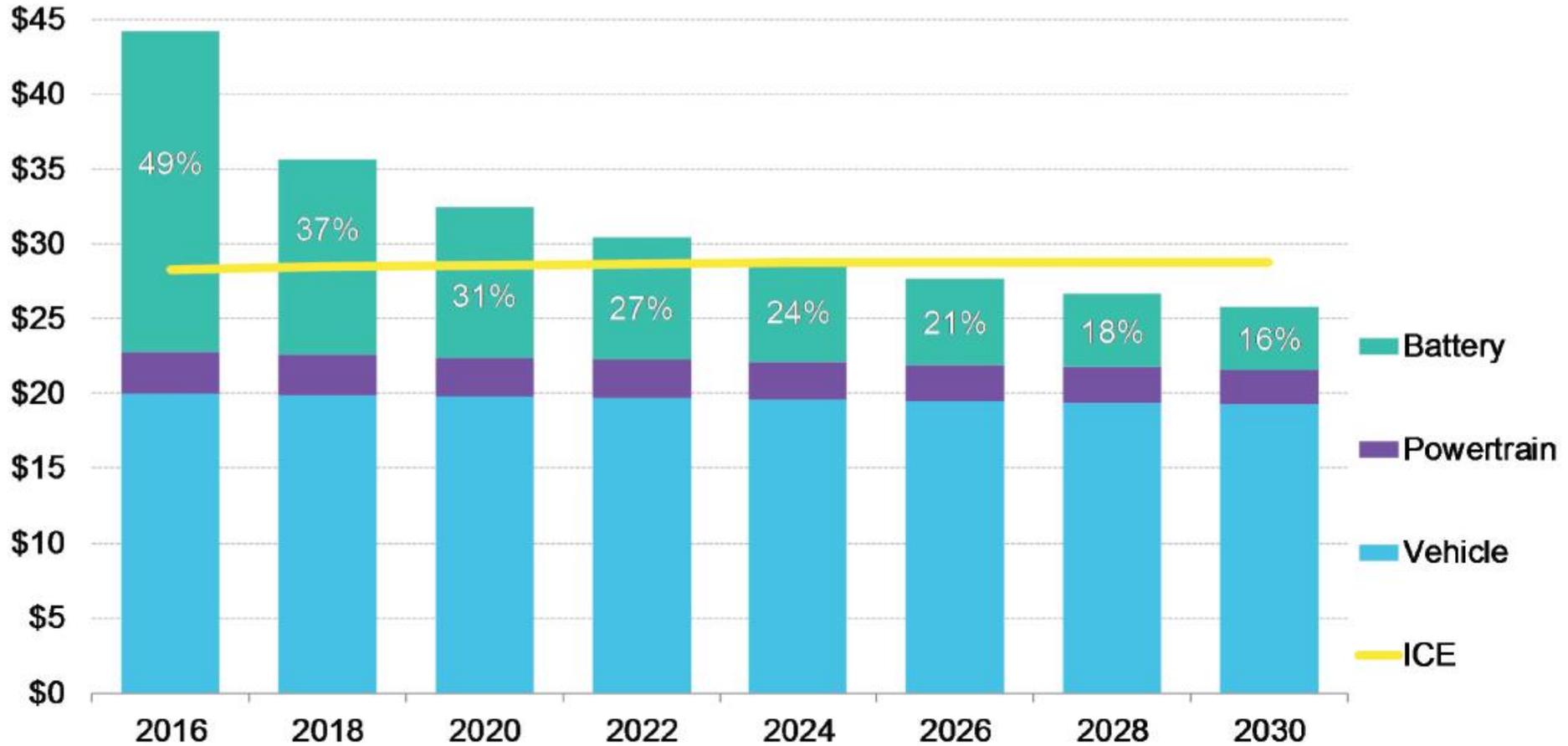
Source: AVICENNE Energy 2018

# GWh Capacity Projection Comparisons



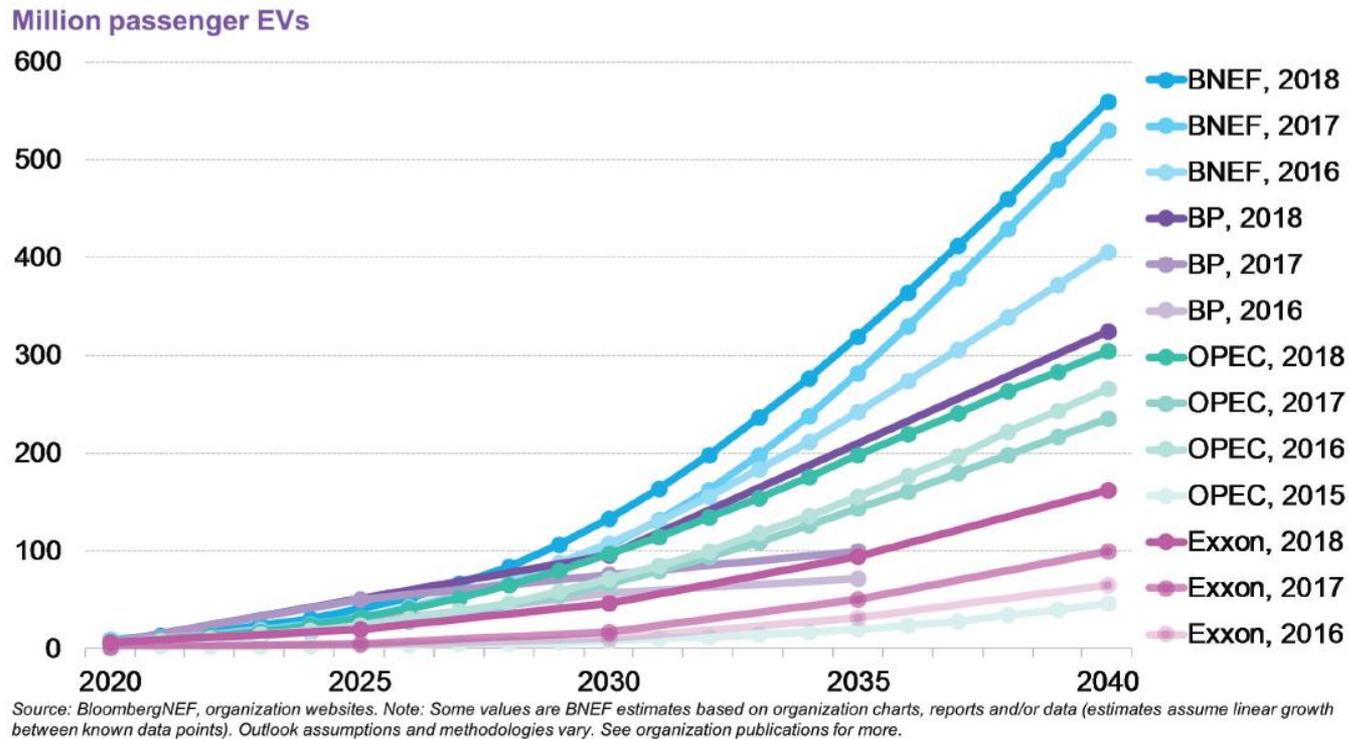
# EVs will begin to achieve up-front cost parity in the mid-2020s

U.S. medium BEV price breakdown (2016 thousand \$)



Source: BloombergNEF. Note: Values in 2016 dollars.

# Cumulative EV sales Estimates by Various Groups



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BloombergNEF

- ▶ With BNEF estimate of 30 million vehicles annually by 2028 with 60 kWh battery packs, the total plant capacity needs to be 1.8 TWh, while optimistic projections are 1.1 TWh
- ▶ AlixPartners, a British consulting service, says it expects electric car sales to grow by 1.5 million in 2019, reaching about 1.6 percent of the global market

# Was 2018 the peak for internal combustion vehicles sales?

- ▶ Factors at play:
  - International trade war among the U.S., China, and Europe
  - Tighter consumer credit in China
  - Troubled Brexit negotiations
  - Tighter European restrictions on carbon-dioxide emissions (Financial Times)
- ▶ Evercore ISI, Accenture, and Jato Dynamics expect a structural downturn in 2019, based on slower sales in the second half of 2018 (Financial Times)
- ▶ Conversely, global internal combustion engine (ICE) market is expected to exhibit a CAGR of 4.9% from 2018 to 2025 (Grand View Research, 2018)

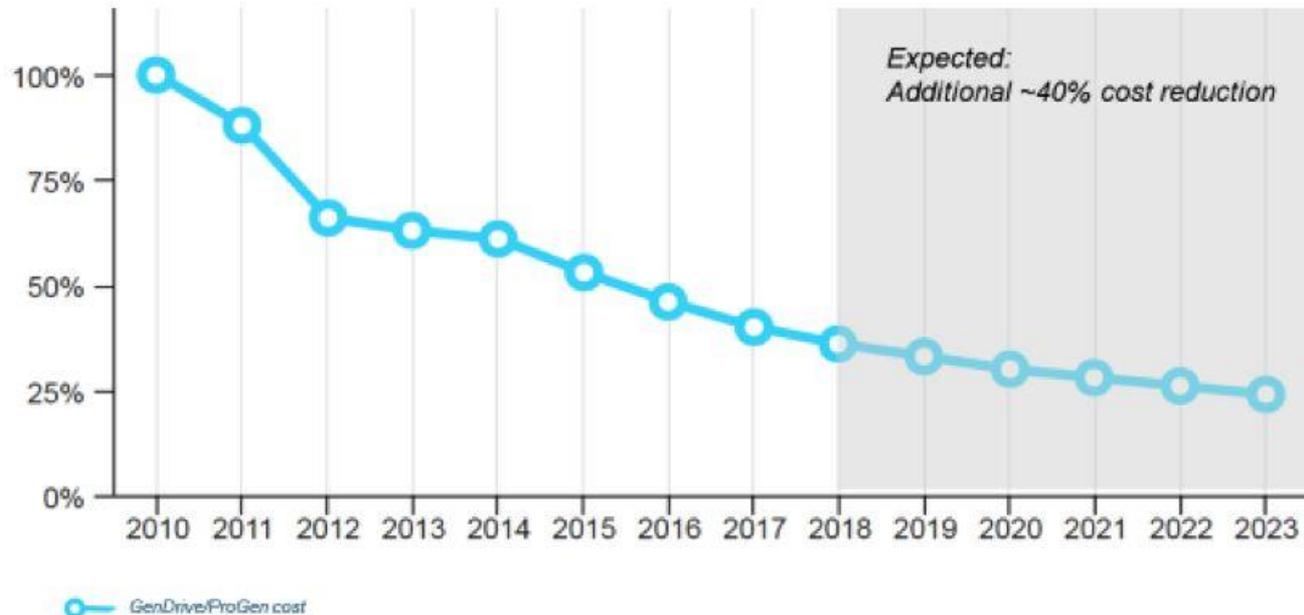


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Recent array of advanced technologies, including low temperature combustion engines and hybrid systems, have helped the industry gain traction, a trend expected to elevate industry growth over the forecast period

# Other competing (or complimentary) technology: FCEV

Clear and Dramatic Reduction in Cost



- ▶ The global fuel cell electric vehicle (FCEV) stock reached 11,200 units at the end of 2018, with sales of around 4 000 in that year (80% more than in 2017).



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ENERGY

INFORMATION FOR GROWTH  
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Automotive Batteries  
Market Dynamics 2017-2026

THE BATTERY SHOW  
NORTH AMERICA 2018

September 12<sup>th</sup>, 2018  
Novi, MI

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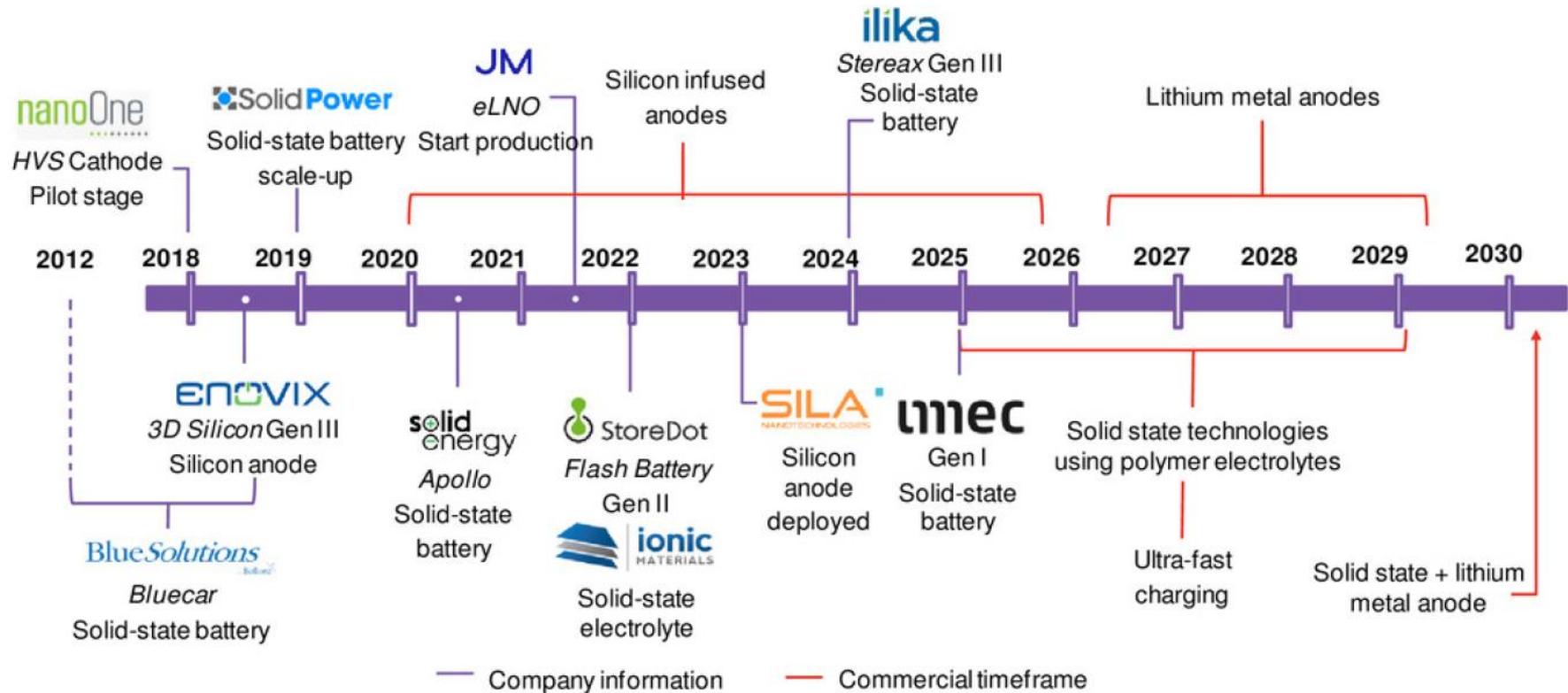
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# TIME TO MARKET FOR NEW MATERIALS IN LIB INDUSTRY



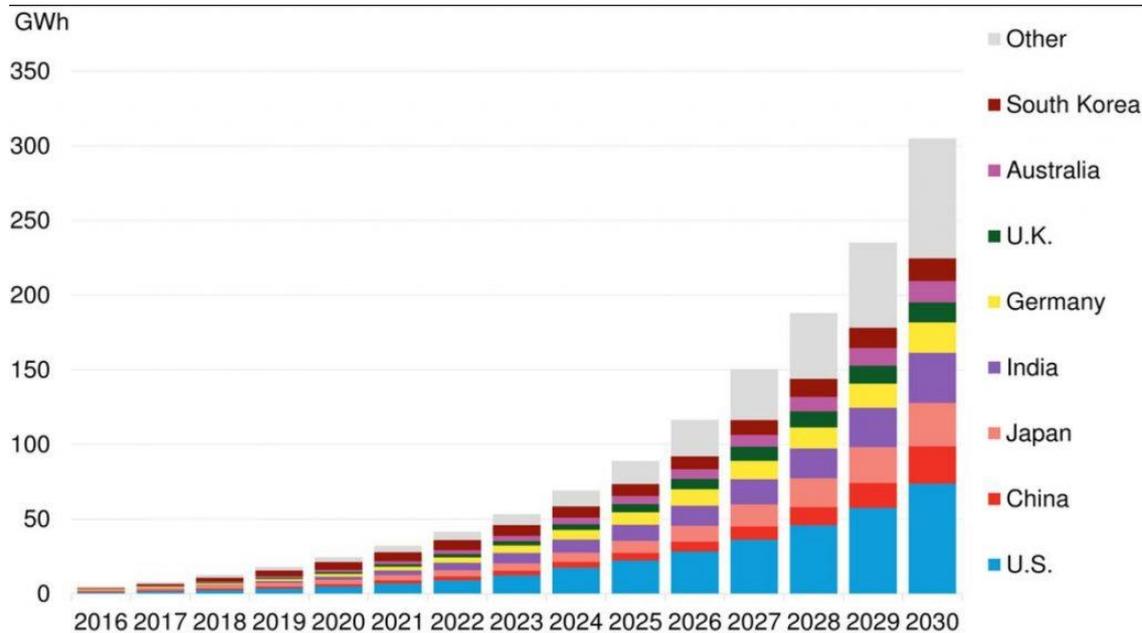
- ⌚ The research and development in this industry is very long and time consuming.
- ⌚ Time to market to commercialize a new material is long. Remember that the first Li-ion battery was launched by Sony in 1991 with LCO cathode, graphite,  $\text{LiPF}_6$  electrolyte & polyolefin membrane. It was 20 years ago.
- ⌚ LTO was invented by Matsushita in 1993 (22 years ago)
- ⌚ Lithium iron phosphate was invented in 1995 (20 years ago).
- ⌚ So, it takes between 10 & 20 years to commercialize a new material in the battery industry.

# BNEF Technology Timeframe



Source: Bloomberg NEF and company interviews

# Stationary Energy Storage – not for awhile



- ▶ With BNEF estimate of 30 million vehicles annually by 2028 with 60 kWh battery packs, the total plant capacity needs to be 1.8 TWh, while projections are 1.1 TWh – now add 40 GWh more with Stationary Energy Storage
- ▶ The global energy storage market will grow to a cumulative 942GW/2,857GWh by 2040, attracting \$620 billion in investment over the next 22 years (BNEF)

# Final Thoughts

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- ▶ Clearly, battery manufacturing capacity is increasing in sync with a large market pull – there is room for new manufacturing processes
- ▶ Not clear that ICE vehicles have reached sales peak
- ▶ EV cost parity is now a matter of when and not if
- ▶ The technology rich lithium battery roadmap includes lithium metal anodes
- ▶ Growing lithium battery markets include:
  - UPS, Telecom, Forklift, Medical, Residential ESS, Grid ESS, hoverboard, and drones:
  - CAGR > 10% in the next 15 years [Avicenne Energy]
- ▶ ESS market could be much more important if the price of LIB at the system level is under 150 \$/kWh [Avicenne Energy]