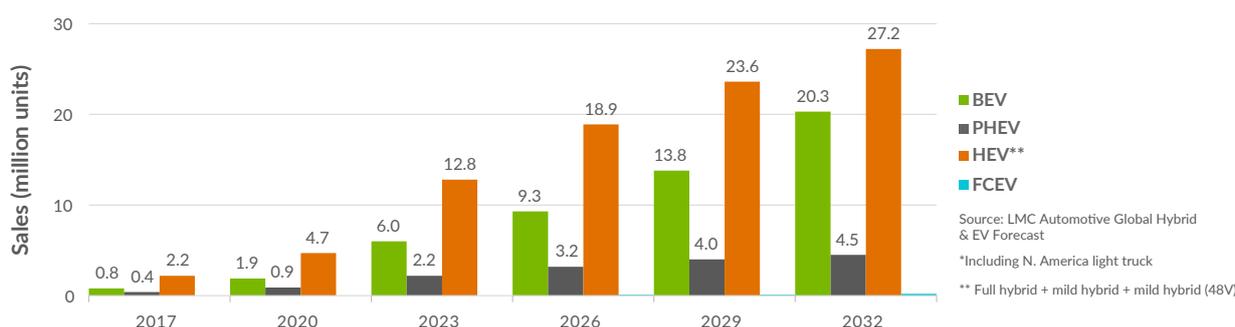


Electrification – Automotive Sector Impact Report

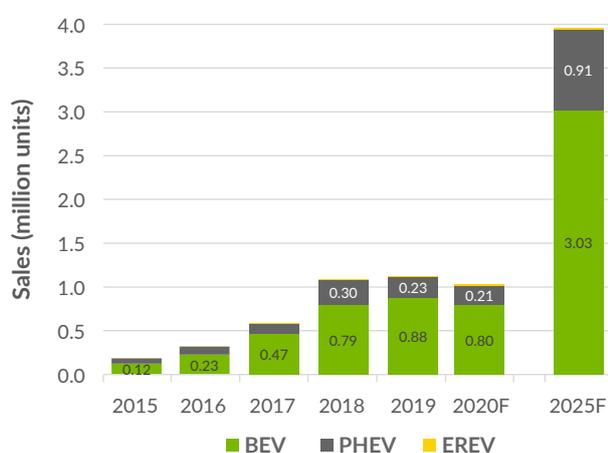
20 October 2020

Global Personal Vehicle Outlook* by xEV Technology Type



- By the early part of the next decade, LMCA expects that more than half of global sales of Passenger Cars (including North American Light Trucks) will be electrified in one way or another. Individual markets and regions may move at very different speeds, with Europe and China expected to be amongst the electrification leaders. The outcome for the US depends very much on the direction of political will.
- In order to comply with climate change mitigation efforts, we expect the BEV segment to be the fastest growing over this period, although our current forecast does not place the industry on track to achieve global net-zero CO₂ emissions from the fleet by 2050. More decisive action to limit sales of ICE vehicles would be necessary in our opinion.
- Plug-in hybrids will play an increasing role in the medium term, but their long-term prospects may be limited by doubts over in-use CO₂ performance and by technical advances in the pure electric segment, rendering PHEVs less necessary, but still relatively expensive.

China NEV Outlook

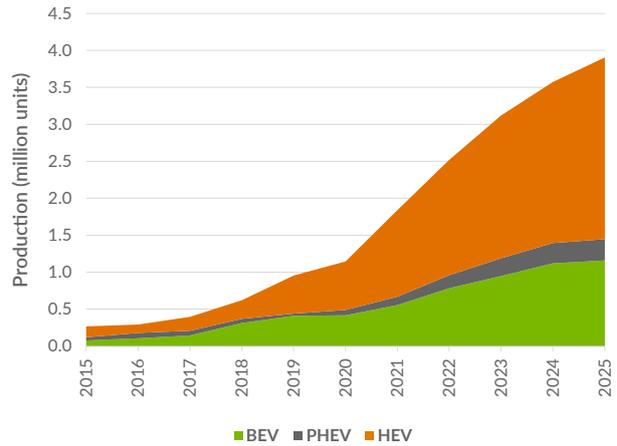


- Consisting primarily of BEVs and PHEVs, China's New Energy Vehicle (NEV) market has been in decline since mid-2019, and is only recently showing signs of recovery.
- Recent renewal of the government NEV subsidy until 2022 and the accompanying mandated production targets will ensure that the NEV segment prospers, but the days of any type of electric vehicle being viable are probably over.
- More stringent technical requirements plus a move to improve the fuel efficiency of the non-NEV segment are designed to ensure that China's electrification industry remains globally competitive, and that air quality and fuel efficiency targets have a reasonable chance of being met.
- We envisage a growth path for NEVs, but with other routes to meeting targets (including hybrid vehicles) now being available, we see the powertrain forecast mix skewed a little away from BEVs, with more opportunity for advanced ICE, including hybrid.



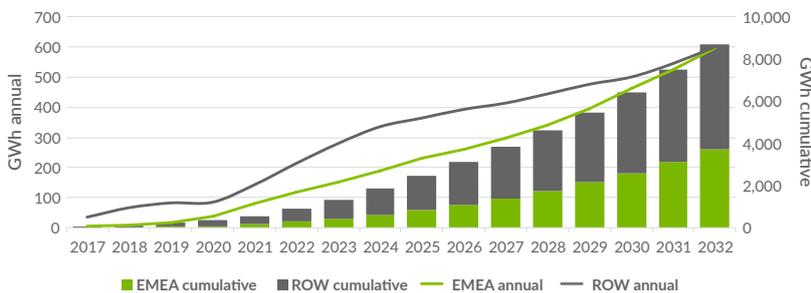
North American Electrified Light Vehicle Production

- In North America, BEV production significantly outpaces regional sales as Tesla continues to expand sales into other global markets. These export volumes will diminish in the coming years as the company expands its global production footprint.
- A lawsuit has been posed by many states against the new fuel economy legislation (SAFE) instituted earlier this year. Success in the court could cause a return to Obama-era annual improvements, while failure would cause a lowering of our EV outlook. Of note is California’s inability to mandate its own CO₂ or ZEV requirements under the new national SAFE regulations.
- If Joe Biden is elected president in November, it is likely that he will try to replace the new SAFE regulations as part of a plan to reduce the US impact on climate change.
- Sustained incentives (in the short to medium term) and continued investment into the charging infrastructure will continue to support BEV/ PHEV sales in spite of the reduced fuel economy requirements.



“BEV production significantly outpaces regional sales as Tesla continues to expand sales into other global markets.”

Global xEV Battery Demand Outlook



“Our analysis indicates the need for up to 1.4 TWh (terawatt hour) of battery production capacity by the early part of the next decade.”

- As demand for ‘strong’ electrified vehicles (BEVs and PHEVs) increases significantly, battery production capacity will need to keep pace. Our analysis, based on LMCA’s forecast of plug-in vehicle demand growth, indicates the need for up to 1.4 TWh (terawatt hour) of battery production capacity globally by the early part of the next decade. Currently, less than 50 GWh is needed.
- Europe, currently heavily dependent on non-domestic suppliers, is racing to become self-sufficient in battery production. We see the need for at least 25 battery gigafactories in the region by 2025, assuming a typical output of 24 GWh per plant. This is a huge investment, but a parallel can be drawn with engine production plants; there are currently 60 such plants active in the region, all of which will become obsolete in the long term, making space available for newer technologies.
- The destination for the output of battery plants will increasingly be the BEV segment. At present, this accounts for around 70%, with the remainder going to PHEV and other lower power hybrids. By 2032, we expect that the BEV segment will be demanding 90% of the output from global battery plants.

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