Meta-analysis on the Market Development of Electrified Vehicles

© [M] PEM, RWTH Aachen |
xiaoliange | stock.adobe.com

Government regulations in particular are promoting electric mobility. A meta-analysis on electrified vehicles market development shows the impact this will have on the international automotive industry and the urgent need for action. The PEM of RWTH Aachen University expects especially the supplier industry for battery cells to develop into a competitive market.

The electrified powertrain system plays a fundamental role in achieving the CO₂ targets. While global new passenger car registrations declined for the second year in a row in 2019 [1], the number of new registrations of electrified vehicles (xEVs) is still growing. In the European region alone, growth of 45 % was observed compared to the previous year [1]. Even during the Coronavirus pandemic, xEV sales continued to grow in 2020 [2]. The crucial question is how the market will develop in the future.

Based on studies of annual new registrations of various types of powertrains, a forecast can be derived as well as the resulting effects on the supplier industry. These results are elementary for the future strategic product and production design of all companies involved

in the value chain, and they give a unique opportunity to address this growing market.

MARKET DEVELOPMENT UP TO 2030

A meta-analysis was carried out as the basis for forecasting the development of the automotive market up to 2030. For this purpose, three scenarios for the development of electric mobility were formed: optimistic, moderate and pessimistic. Over 700 individual forecasts from more than 80 studies were considered. The powertrains are divided in ascending degrees of electrification into Internal Combustion Engine-powered Vehicles (ICEVs), full or mild Hybrid Electric Vehicles (HEVs/MHEVs), Plug-in Hybrid Electric Vehicles without and

with range extenders (PHEVs/REEVs), Battery-electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs). Light duty vehicles which include passenger cars and light commercial vehicles are considered in this study. In addition, both a global and continental (Europe, USA and China) view of the most important markets is taken.

Based on the meta-analysis, an examination of the implications for the supplier industry is conducted. Assuming a theoretical continuation of the trend of weak market development between 2010 and 2019, a market share of 93.2 % for ICEVs can be predicted in 2030. However, due to the global promotion of electric mobility, a strong market growth of xEVs in the coming years [3] is more likely. The results of the meta-analysis underline this trend and show a signifi-

AUTHORS

Prof. Dr.-Ing. Achim Kampker
is Head of the Chair of
Production Engineering of
E-Mobility Components
(PEM) of RWTH Aachen
University (Germany).

Christian Offermanns, M. Sc.
is Senior Engineer of the Chair of
Production Engineering of
E-Mobility Components
(PEM) of RWTH Aachen
University (Germany).

Dr.-Ing. Heiner Heimes
is Senior Chief Engineer of the Chair
of Production Engineering of
E-Mobility Components
(PEM) of RWTH Aachen
University (Germany).

Patrick Bi, B. Sc.
is Master Student at the Chair of
Production Engineering of
E-Mobility Components
(PEM) of RWTH Aachen
University (Germany).

cantly faster increase in xEVs over the next ten years.

HEV/MHEV AS A TRANSITIONAL SOLUTION

Accordingly, 54.3 % of all vehicles will already be electrified globally in 2030 instead of 6.8 % if the trend continues, **FIGURE 1**. HEVs/MHEVs will account for the largest share of xEVs, followed by BEVs and PHEVs/REEVs. The latter two powertrains show stronger growth from 2025 onwards so that a larger share of BEV can be assumed if growth continues beyond 2030. HEVs/MHEVs serve as a transitional solution between ICEVs and BEVs.

In addition to political regulations, the main reasons for the increasing growth of electrified vehicles are decreasing Total Cost of Ownership (TCO) as well

as higher energy densities of batteries, which enable a higher range [4]. For OEMs however, the trend of electric mobility also poses some challenges. Two examples are the increased investments due to the introduction of new electrified models and the reduced employee requirement of about 30 % compared to conventional vehicles [5]. By using hybrid vehicles, a more systematic and slower transition of technologies and the associated know-how within the automotive companies is possible.

STRONG DEVELOPMENT OF ELECTRIFIED DRIVES

A similar development can be observed in Europe. The total share of all xEV will even be slightly higher in 2030 at 59.5 %, **FIGURE 2**. The strong development of electrified powertrains in

Europe is favored in particular by strict CO₂ regulations. A limit of 95 g CO₂/km per fleet applies. In comparison, the values in Japan (105 g CO₂/km), China (117 g CO₂/km) and the USA (121 g CO₂/km) are higher [6]. In addition to EU regulations, there are individual countries that are planning an absolute ban on the sale of ICEVs to further promote electric mobility. Norway is considered a pioneer of electric mobility in Europe and is planning a sales ban from 2025, Ireland, the Netherlands and Slovenia from 2030, and France and the UK from 2040 [7].

Based on the studies, ICEVs will continue to dominate the US automotive market in 2030 with a share of 56.4 %, **FIGURE 3**. The weaker development of electrified vehicles can be explained by the long distances between cities, the preference for larger vehicles

FIGURE 1 Forecasted development of global annual new vehicle registrations of ICEVs and xEVs (© RWTH Aachen University)

FIGURE 2 Forecasted development of annual new vehicle registrations of ICEVs and xEVs in Europe (© RWTH Aachen University)

FIGURE 3 Forecasted development of annual new vehicle registrations of ICEVs and xEVs in the USA (© RWTH Aachen University)

(especially SUVs) and the low fuel prices [8].

CHINA AS A PIONEER OF ELECTRIC MOBILITY

China is considered a global pioneer of electric mobility. This is also reflected in the forecast for 2030 with a total share of xEVs in new registrations of 60 %, **FIGURE 4**. In contrast to the other regions considered, BEVs are the leading alternative to ICEVs in 2030. In China, the greater development of electrified vehicles is favored by lower electricity costs and, at the same time, higher fuel prices, so that the TCO of xEVs is lower compared to that of ICEVs

[8]. Moreover, New Energy Vehicles (PHEV, BEV, and FCEV) have been promoted with the help of a national subsidy program for a decade [9]. As a result, the market share of New Energy Vehicles is expected to exceed 50 % by 2035 [10]. Additionally, more restrictions on the sale of ICEVs are planned in China in the future – especially in major cities – to further promote the development of electric mobility [11].

Overall, the meta-analysis shows a strong increase in demand for electrified vehicles in all regions. This also results in higher demand for the necessary components such as battery cells and electric motors. In all three scenarios, global demand for battery cell capacity grows by about ten times between 2020 and

2030. This increase can be justified not only by the strong rise in demand for electrified vehicles, but also by the average increase in battery capacity per BEV. In 2030, 87 % of the total capacity demand is attributable to BEVs.

BATTERY CELL SUPPLY

For the supply of battery cells, the production plans of more than 100 different suppliers and OEMs with 170 different production sites – 118 of which are located in China – up to 2030 were examined. Europe's share of global production is currently still very low and leads to underproduction, but the construction of numerous production sites is planned for the coming years. How-

FIGURE 4 Forecasted development of annual new vehicle registrations of ICEVs and xEVs in China (© RWTH Aachen University)

ever, it has been shown that the construction of a plant can be delayed or even fail [12]. Since such potential announcements on future plants can burst, for example due to unresolved financing issues, this creates uncertainty about the development of the supply.

Assuming that the number of vehicles produced in Europe has been 8.3 % higher on average than the number of new vehicles registered over the last ten years and that this trend continues, this results in a slightly increased demand for battery cell capacity. When comparing this demand in the optimistic scenario and the supply of firmly planned plants in Europe, it is

expected that demand can be met from 2025, **FIGURE 5**. According to the forecast, however, underproduction may occur again from 2027. **FIGURE 5** also shows the development of supply if both the firmly planned and the potentially announced plants can be realized. In this case, an oversupply of about 175 GWh can arise in 2030, which can be used to equip an additional 3.5 million BEVs with an average battery size of 50 kWh.

INDEPENDENCE FROM CELL MANUFACTURERS

With high demand and low supply, it can be very advantageous for OEMs to

invest in their own production. On the one hand, this would reduce their dependence on cell manufacturers and strengthen their know-how in one of the key components. On the other hand, it would generate high investment costs. Tesla, for example, has decided to establish its own battery cell production in Grünheide near Berlin (Germany) [13]. Since the construction and commissioning of such a battery production facility takes a certain amount of time, it is already imperative to address this issue today.

A competitive market is emerging for battery cell manufacturers, particularly due to the predicted oversupply in the

FIGURE 5 Supply and demand of battery cells in the optimistic scenario (Europe) (© RWTH Aachen University)

FIGURE 6 Global demand for cathode active material in optimistic, moderate and pessimistic scenarios (© RWTH Aachen University)

second half of this decade, which may make the expansion of already established battery cell manufacturers more likely than the entry of new market players. The rising global demand for battery cells also has an impact on material requirements. Here, the active material in the cathode plays the most important role. The chemical composition of the cathode is subject to many changes due to new technologies.

RIISING DEMAND FOR RAW MATERIALS

Today, NCA (Nickel Cobalt Aluminum) and NMC (Nickel Manganese Cobalt) are predominantly used, and LFP (Lithium Iron Phosphate) cells are also produced for the Chinese market. For NMC cells, the proportions of the individual raw materials can vary. There is a trend toward higher nickel contents (for example NMC 811) in favor of higher energy density and less dependence on cobalt. **FIGURE 6** shows the resulting demand for the main materials in the cathode for all three scenarios.

In addition to the increasing relative share of nickel in battery cells and the strong increase in absolute material demand between 2020 and 2030, a significant difference between the scenarios can also be seen. Nevertheless, a shortage of resources is not assumed for raw materials in the future [14].

Global demand for electric motors increases more than fourfold in all sce-

narios. Unlike battery cells, the production of electric motors is already frequently carried out by OEMs or direct existing suppliers themselves and can be flexibly adapted to demand.

SUMMARY

Overall, all regions show a significant increase in demand for xEVs in the coming years. Except for the USA, the share of ICEVs will be less than 50 % in 2030. While HEVs/MHEVs and PHEVs/REEVs in Europe and HEVs/MHEVs and BEVs in the USA, respectively, are the dominant alternatives to ICEVs in 2030, China shows a particularly strong development of BEVs. This underpins China's pioneering position in vehicle electrification.

Government regulations represent the elementary instrument in the development of electric mobility for all regions. For OEMs, the change means a shift in production and development. For the supplier industry, a competitive market is expected in the next ten years, especially for battery cell manufacturers. Competitive unique selling propositions such as high energy density as well as longer battery cell lifetime through developments in cell chemistry and low-cost production can tip the balance for or against a successful market entry.

REFERENCES

- [1] Verband der Automobilindustrie: Analysen zur Automobilkonjunktur 2019. Berlin, 2020, p. 3, p. 22

- [2] Verband der Automobilindustrie: Jahresbericht 2020. Die Automobilindustrie in Daten und Fakten. Berlin, 2020, p. 125

- [3] International Energy Agency: Entering the decade of electric drive? Global EV Outlook 2020. Paris, pp. 91 ff.

- [4] RBC Capital Markets: RBC Electric Vehicle Forecast Through 2050 & Primer. New York, 2018, p. 9

- [5] HSBC: Disruptive Technologies. Carmakers versus new entrants. London, 2018, p. 5

- [6] Verband der Automobilindustrie: CO₂-Regulierung bei Pkw und leichten Nutzfahrzeugen. Berlin, 2020

- [7] International Energy Agency: Towards cross-modal electrification. Global EV Outlook 2018. Paris, p. 36

- [8] Boston Consulting Group: Who Will Drive EVs to the Tipping Point? Boston, 2020, p. 5, p. 6

- [9] International Council on Clean Transportation: China announced 2020-2022 subsidies for new energy vehicles. Wilmington, 2020

- [10] China SAR: Energy-saving and New Energy Vehicle Technology Roadmap 2.0. Hongkong, 2020

- [11] International Energy Agency: Scaling-up the transition to electric mobility. Global EV Outlook 2019. Paris, p. 125

- [12] Schneider, L.; Janczural, S.: Muss die Batterieproduktion in Deutschland neu gedacht werden? Online: <https://www.ingenieur.de/technik/fachbereiche/e-mobilitaet/batterieproduktion-kehrt-im-grossen-stil-deutschland-zurueck>, aufgerufen: 7. Februar 2021

- [13] Germany Trade & Invest: Germany Welcomes Tesla Gigafactory to Berlin-Brandenburg Location. Bonn, 2019

- [14] Fraunhofer ISI: Batterien für Elektroautos: Faktencheck und Handlungsbedarf. Karlsruhe, 2020, p. 12 f.

THANKS

The authors would like to thank Philipp Heinzelmann and Constantin von Salis-Soglio, whose work results were significantly incorporated into this meta-analysis, for their support.

Get a Grip on Success

For those who want to reach new heights, only the best will do. With **adhesion**, the international trade magazine for industrial adhesives and sealing technology, you will benefit from valuable insider knowledge, practical information and the latest trends and technologies. Get access to the industry's largest knowledge pool – essential for gaining competitive advantage. Try our comprehensive service: four issues per year available as print and digital editions, website and newsletters, now optimized for mobile devices. As a subscriber, you also gain access to our comprehensive online archive with all contributions since 2003, plus the “Adhesives Technology Compendium” - the reference book for adhesives practitioners.

For more information:
www.my-specialized-knowledge.com/adhesion

adhesion ADHESIVES +
SEALANTS