

EV/HEV is driving power electronics innovations¹

OUTLINES:

- Vehicle electrification is transforming the global automotive industry.
- Stronger vehicle electrification means more power electronics content, resulting in a reshaping of the supply chain.
- A prosperous EV/HEV market is driving power semiconductor device growth.
- The EV/HEV industry features diverse technology approaches.
- TechDay powered by Yole Group of companies: EV/HEV Cost vs. Performance Trade-off: A Battle on Multiple Fronts For Power Electronics (Feb. 18 – Stuttgart, Germany) – [Register today!](#)

“The EV/HEV² race has begun”, affirms **Milan Rosina, PhD Principal Analyst, Power & Wireless and Batteries at Yole Développement (Yole)**. “The Transition period towards full vehicle electrification is entering into its next phase, with important vehicle electrification strategic plans announced by conventional automotive players and focus on stronger vehicle electrification”.

And **Hong Lin, PhD Principal Analyst, Compound Semiconductor** at Yole adds: “Indeed market figures look promising. In 2018, 1.32 million BEV³ were purchased, along with 0.75 million PHEV⁴ - compared to 0.78 million units and 0.41 million units in 2017, respectively. This equates to year-over-year growth of 68% and 84%, respectively. Moreover, sales of other hybrid cars have also increased”.

Under this dynamic ecosystem, the power electronics sector is pushing to adapt and propose innovative products. Objectives are clearly to answer to the specific needs coming from EV/HEV makers and make sure, for the power electronics companies, to be part of this attractive growth. They are so working on the miniaturization of the components, circuits and system design and are developing new solutions to integrate several systems in one system (e-axle, integration of DC-DC converter with a battery, etc.). Of course, WBG⁵ technologies are

¹ Extracted from : Power Electronics for Electric & Hybrid Electric Vehicles, Yole Développement, 2020

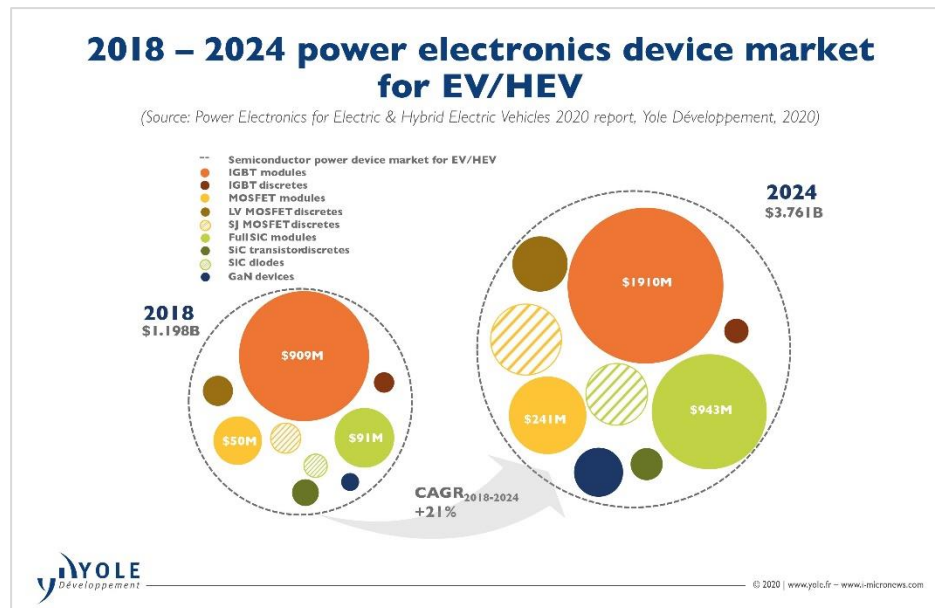
² EV/HEV : Electric Vehicle / Hybrid Electronic Vehicle

³ BEV : Battery Electric Vehicles

⁴ PHEV : Plug-in Hybrid Electric Vehicles

⁵ WBG : Wide Band Gap

part of the technology roadmap, especially SiC⁶ power devices. “There is no doubting the technical benefits of using WBG instead of Si based technology for different inverters and converters for EV/HEV”, explains Hong Lin from Yole. “R&D programs and technical developments have shown positive results, including reduction in size and weight and efficiency improvements for both SiC and GaN. WBG adoption is not just a technical choice but a strategic decision for Tier 1s and OEMs...”



Driven by the prosperous EV/HEV market, the power electronics devices market should have a bright future, confirm Yole’s analysts. The company announces a market value exceeding US\$3.7 billion in 2024, with 21% CAGR⁷ between 2018 and 2024. IGBT⁸ modules represent the largest market, which is expected to double in five years. SiC power modules will also grow fast, with a 2018 - 2024 CAGR of 48%.

Yole’s power electronic analysts release the **Power Electronics for Electric & Hybrid Electric Vehicles report**. This technology & market analysis marks another step forward in the understanding of the EV/HEV adoption and its impact on the power electronics industry. Analysts are daily developing an impressive expertise dedicated to these sectors. By combining market and technical knowledge with numerous interactions with car makers and technology developers, Yole proposes today a detailed vision of the EV/HEV industry evolution. This report explores EV/HEV market dynamics and explains how different power electronics market segments evolve.

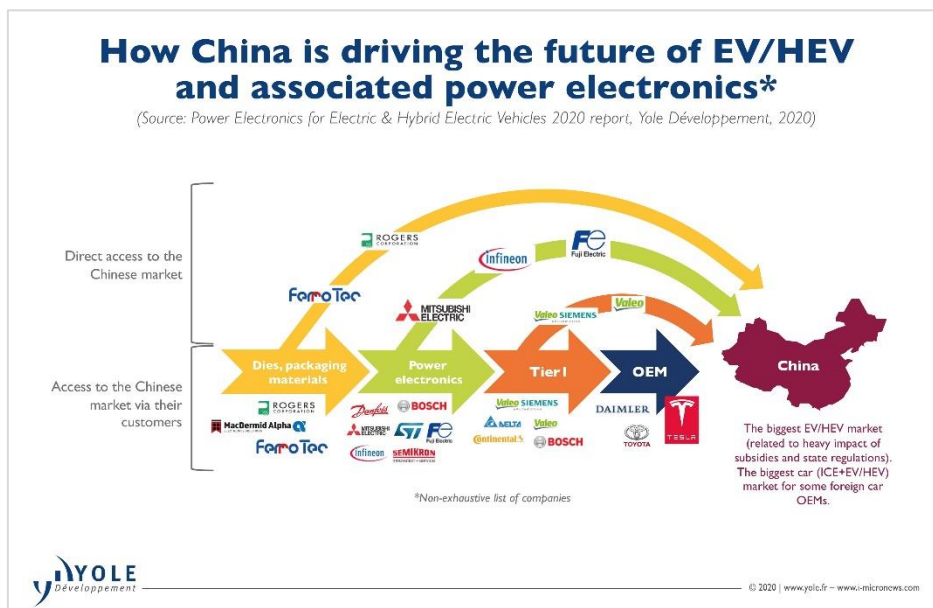
⁶ SiC : Silicon Carbide

⁷ CAGR : Compound Annual Growth Rate

⁸ IGBT : Insulated Gate Bipolar Transistor

In this attractive context, it is not easy at all. Therefore a rapidly growing market like EV/HEV brings plenty of opportunities and also many challenges, all across the supply chain. Regarding EV/HEVs, conventional ICE⁹ vehicle manufacturers are now at the same starting line and competing with newcomers like Tesla, which was the #1 BEV¹⁰ vendor in 2018. ICE automakers must invest significant effort to balance EV/HEV development with their existing ICE activities during a “transition period” - the length of which is hard to determine because of rapidly-changing incentive mechanisms and evolving customer needs.

Within the EV/HEV supply chain, Tier I companies are particularly exposed to different challenges, such as revenue decrease for ICE-related products. To compensate, Tier I's are increasing their efforts in EV/HEV-related products. However, OEMs are becoming more and more intrusive, particularly in main inverters, with the objective of controlling the key EV/HEV elements. Established semiconductor device suppliers are in a similar situation, on the one hand facing the entrance of some Tier I's in the device market, and addressing challengers from the emergence of WBG devices on the other.



The Power Electronics for Electric & Hybrid Electric Vehicles report emphasizes that the transformation of the automotive supply chain is ongoing. According to Milan Rosina and Hong Lin from Yole, most of questionings is coming from China, the biggest market for electric cars.

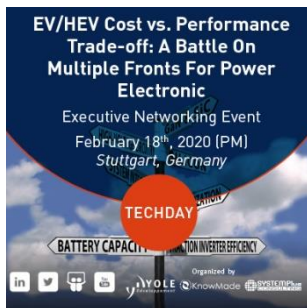
So far, there are two different ways for suppliers to access the Chinese market: either directly (by producing in China or selling to Chinese integrators) or via their customers that sell to

⁹ ICE : Internal Combustion Engine
¹⁰ BEV : Battery Electric Vehicle

Chinese integrators. For EV/ HEV components, China has different levels of technology and independency.

Regarding battery, China has top suppliers like CATL and BYD. However, the majority of IGBT power modules used in Chinese cars are still manufactured outside of China, which is not a sustainable solution for the Chinese industry and particularly for China's government. The trend towards increasing the share of "Chinese-made" products is clear, and some companies have started working to build a local supply chain. For example, BYD built its own IGBT product line and is developing SiC MOSFET¹¹s.

With this new report, Yole's analyst's deliver a detailed vision of supply-chain and changes. They identify business opportunities and highlight the next steps of development.



Yole Group of Companies including System Plus Consulting, Knowmade and Yole Développement will provide a complete overview of the ecosystem and technologies being pushed by the EV segment, including amongst others power device packaging, batteries and new semiconductor materials during a dedicated EV/HEV Techday. This event will take place in Stuttgart, on February 18th, 2019.

It is a great opportunity to meet professionals from different segments, from material and equipment suppliers to power electronic device manufacturer, as well as system integrators, car makers.... During this EV/HEV TechDay, you will get the opportunity to discuss challenges, opportunities and timelines for this growing market. Register right now on i-Micronews.com! Yole's power electronics & compound semiconductor team announces an impressive agenda in 2020. Analysts will present their results and exchange with leading companies all year long, during a selection of key conferences & trade shows. Make sure to save the date right now:

- NEPCON 2020 (Feb. 15-17 – Tokyo, Japan) – Booth #W10-9
- APEC 2020 (March 15-19 – New Orleans, USA)

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¹¹ MOSFET : Metal Oxide Semiconductor Field Effect Transistor

About the report

Power Electronics for Electric & Hybrid Electric Vehicles

Stronger vehicle electrification means more power electronics content, resulting in a reshaping of the supply chain. - Performed by Yole Développement

Companies cited

Ankai, Aptiv, Audi, BAIC, BMW, BMW-Brilliance, BorgWarner, Bosch, Broad-Ocean, Brusa, BYD, CATL, Continental, CRRC, Daimler, Dana, Daihatsu, Danfoss, Delphi, Delta Electronics, Denso, Eberspächer, FAW, FCA, Ford, Fuji Electric, Geely, GKN, GM, Hella, Hitachi, Honda, Huayu, Hyundai, Infineon, Isuzu, JAC, Jaguar Land Rover, Kia, LG Chem, Macmic, Mahle, Mahindra, Mazda, Megmeet, Mitsubishi Electric, Mitsubishi Motors, Nichicon, Nidec, Nissan, Panasonic, Porsche, Proterra, PSA, Renault, Ricardo, SAIC, Samsung SDI, Scania, Schaeffler, Shinry, Siemens-Valeo, Solaris, Starpower, Tesla, Subaru, Tata Motors, Toshiba, Toyota, UAES, Valeo, Volkswagen, Volvo, Yutong and many more...

Authors

Milan Rosina, PhD, is a Principal Analyst, Power & Wireless / Batteries, at Yole Développement (Yole), within the Power & Wireless division. He is engaged in the development of the market, technology and strategic analyses dedicated to innovative materials, devices and systems. His main areas of interest are EV/HEV, renewable energy, power electronic packaging and batteries. Milan has 20 years of scientific, industrial and managerial experience involving equipment and process development, due diligence, technology, and market surveys in the fields of renewable energies, EV/HEV, energy storage, batteries, power electronics, thermal management, and innovative materials and devices. He received his PhD degree from Grenoble Institute of Technology (Grenoble INP) in France. Milan Rosina previously worked for the Institute of Electrical Engineering in Slovakia, Centrotherm in Germany, Fraunhofer IWS in Germany, CEA LETI in France, and utility company ENGIE in France.

Hong Lin, PhD, is a Principal Analyst, Compound Semiconductors at Yole Développement (Yole). Since 2013, Hong has been involved in analyzing the compound semiconductor market with dedicated technical, strategic, market and financial analyses. Hong interacts on a daily basis with leading SiC companies, from wafer suppliers to device manufacturers, as well as equipment suppliers and end users, to understand the added value of this technology, its ability to penetrate the markets and its adoption by the end-users. Prior to Yole, she worked as an R&D Engineer at Newstep Technologies. Dr Hong Lin holds a PhD in physics and chemistry of materials from the University of Pierre & Marie Curie (Paris VI, France).

About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis.

With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide covering MEMS & Sensors - Imaging - Medical Technologies - Compound Semiconductors - RF Electronics – Solid State Lighting - Displays - Photonics - Power Electronics - Batteries & Energy Management - Advanced Packaging - Semiconductor Manufacturing - Software & Computing - Memory and more...

The market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business... [More](#)

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