

# STATUS OF THE INVERTER INDUSTRY 2019

## Market & Technology Report - June 2019

*Motor drive still powers the inverter market, with EV/HEV positively impacting overall market dynamics.*

### WHAT'S NEW

- In-depth market dynamics analysis, by segment: EV/HEV, rail, photovoltaics, wind, grid, charging infrastructure, motor drives, and UPS
- Market forecast updates for the different segments
- Inverter-related supply chain synergies in between different segments
- Update of full supply chain dynamics for the different segments, including supply chain movement trends
- Mergers & acquisitions at inverter/system level
- Power stack business model
- Harsh environments for inverters
- Wide band-gap inverter - trends update

### REPORT KEY FEATURES

- Motor drive continues to be the inverter market's largest segment, with about the 50% of the market in \$ M
- In terms of excellence, EV/HEV will be the driving market for power electronics for the next several years. Many investments and efforts to develop high-quality, high performance inverters are underway
- The number of public and private EV charging points is growing rapidly. Many players from different business areas are entering the charging business.
- Ample HVDC lines are being deployed to connect electricity generation sites with regions that have high energy demand
- PV installations keep increasing annually, even though subsidies in China (the world's largest PV installer) decreased in 2018
- Over the last three years we have seen many big mergers & acquisitions for the purpose of gaining more share of a single business, or to diversify business

### THE INVERTER MARKET: AN ELECTRIFICATION-DRIVEN DOMAIN

Electrical power-conversion optimization is driven by different factors: for example, electrification trends in transportation, CO<sub>2</sub> emission reduction goals, the development of clean electricity sources, and industrialization. The power inverter market follows the big megatrends, and so one could directly link these different markets' growth with the inverter market's dynamics.

For a simpler understanding of inverter dynamics, Yole Développement (Yole) differentiates between two business types: transport (EV/HEV and rail) and energy (wind, photovoltaics (PV), electricity grid, and charging infrastructure) segments, which are often linked to big projects dependent on subsidies and political/governmental decisions; and industrial segments (UPS and motor drives), which are less volatile and more linked to electrification. Let's explore these market drivers in a bit more detail for different applications...

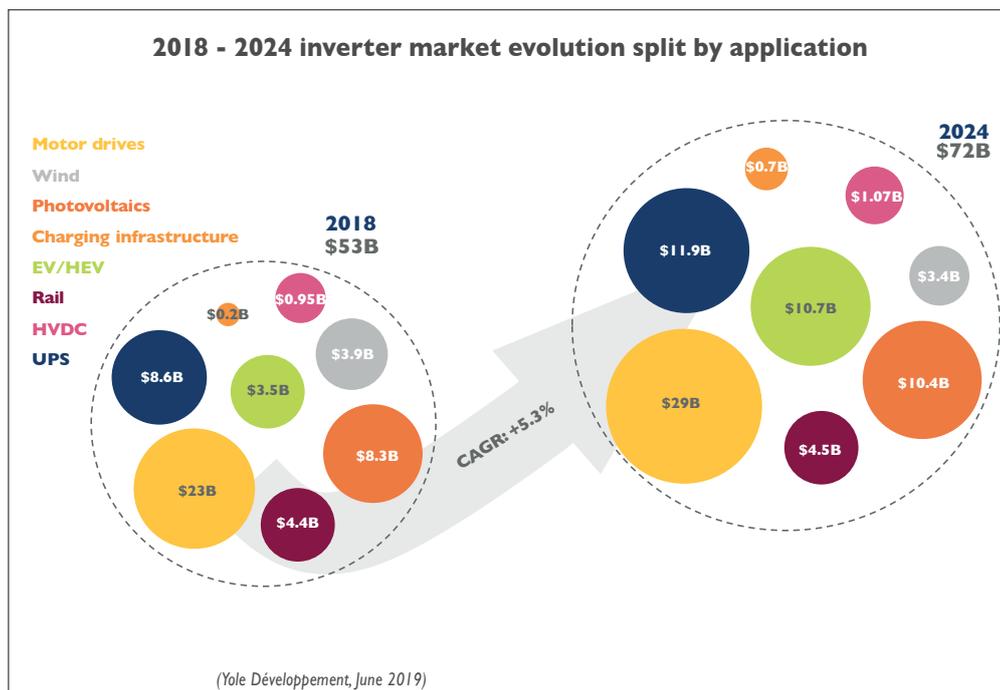
In the EV/HEV market's case, tough CO<sub>2</sub> targets are pushing automotive OEMs towards high electrification levels in their new vehicle fleets. This market is expected to be the main driver for new technology developments, and many supply chain movements are expected over the next few years. Indeed, the inverter market for EV/HEV is expected grow at an impressive CAGR<sub>2018-2024</sub> of 20.7%, despite constantly changing subventions. On the other hand, the rail market is slowly increasing despite it is a very volatile market, depending

directly on government subsidies that might change over a short period.

In the energy segment, clean energy sources continue to be championed worldwide. PV installations keep increasing every year (CAGR for the inverter PV market is 3.8%), even if subsidies in China, the world's largest PV installer, decreased in 2018. The wind market is expected to remain almost steady over the next several years, in number of GWs installed. Meanwhile, the grid segment must continue being deployed, since the world requires more and more energy to be transported efficiently. The EV/HEV charging infrastructure is growing briskly to anticipate rapid EV market growth, and Yole expects that the inverter market for charging infrastructure will grow at a CAGR<sub>2018-2014</sub> of 20.5%.

Finally, the industrial market depends on the inverter business's leader: motor drives. Millions of inverters for compressors, pumps, and other motors were installed during the last few years, and this trend will continue in the future, reaching a motor drive inverter market of \$29B by 2024. Another growing industrial inverter market is the UPS business, resulting in a growth of 5.6% from 2018-2024.

*In this report, Yole summarizes the different power electronics trends driving various applications, as well as the main boosters associated with each application.*



## A DIVERSIFYING SUPPLY CHAIN IN POWER ELECTRONICS

The key players have decided not to miss out on opportunities in the growing power electronics market. Indeed, over the last three years we have seen many big mergers & acquisitions in order to gain more share of a single business (i.e., ABB sold its power Grid division to Hitachi), or to diversify business.

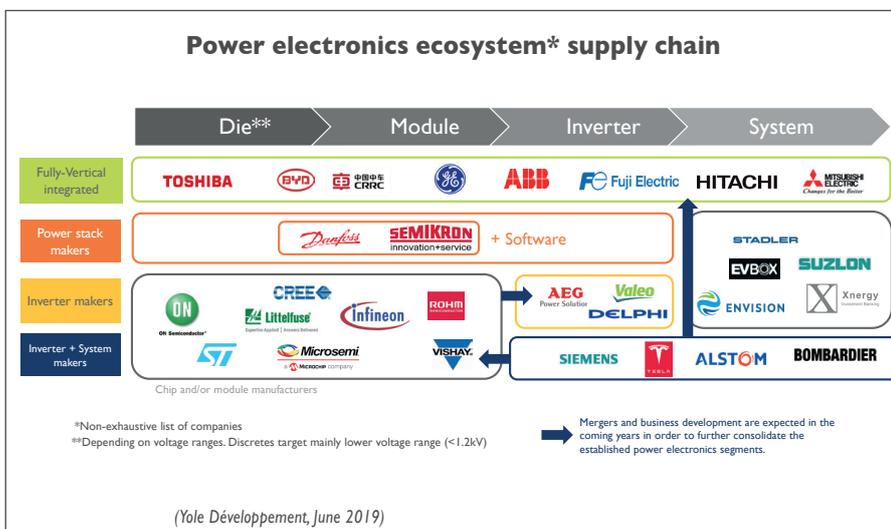
For instance, we have seen players racing to gain more market share in the wind segment: examples include the Siemens/Gamesa merger in 2017, and the Nordex/Acciona power merger in 2016. The same strategy was attempted by Siemens and Alstom in the rail segment, intended to create the biggest force in the EU and gain strength against a strong CRRC. However, the European Commission stopped the

merger at the beginning of 2019 in order to avoid a rail monopoly in Europe. Other mergers are expected in the coming years in order to further consolidate the established power electronics segments.

On the other hand, the business diversification of a single company is becoming more and more pronounced thanks to the EV segment push, where today the main differentiation in a car is not the ICE motor anymore but the electronics behind it. Thus, close development of the power module from the inverter is preferred as a means of capturing all the benefits and achieving better performance. The same is true of other products such as passives and current sensors: the more integrated they are in the business model, the higher the company's profit. In fact, Yole's analysts observe a trend towards vertical integration not just from the big Tier I's like Continental and Bosch (building up their own power modules), but also from OEMs like BYD and Toyota, which are present across the entire power electronics supply chain.

Over the last year, we have also perceived the entrance of players from different business areas into the new, appealing charging infrastructure segment. As this application is directly linked from energy and source electricity to grid for energy transport, and from EV for charging points need/deployment to industrial for inverter implementation, players from all of these segments are today involved in charging infrastructure development.

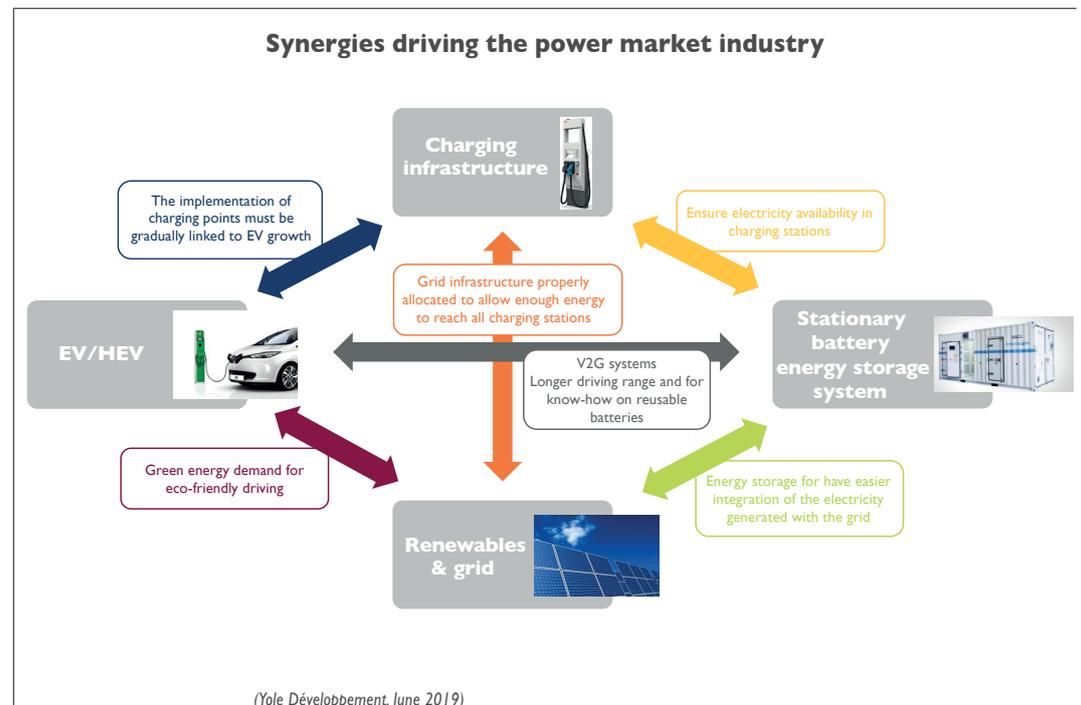
*In this report, Yole offers a supply chain status and forecast for different segments, ensuring that readers do not miss what is happening at inverter level, and understand what to be aware of in the coming years.*



## EV/HEV POSITIVELY IMPACTS OVERALL MARKET DYNAMICS

As already stated, today's global power electronics market is clearly driven by the EV/HEV market.

Indeed, the needs of fleet deployment have many repercussions on other segments. One of the more



obvious is the charging infrastructure segment: the implementation of charging points must be gradually linked to EV growth, enough to sustain electric car deployment but not too big where it might negatively impact the charging segment.

Another growing segment with EV/HEV is renewables, originating from the green energy demand for eco-friendly driving. Also, the grid infrastructure must be properly allocated to allow enough energy to reach all charging stations, including those located far from cities, including highways and rural towns.

Finally, the battery market will also be forced to grow with the need for millions of units for EV, pushing for the technological development of higher-voltage batteries for a longer driving range and for know-how on reusable batteries. Battery energy storage systems will be widely deployed, enabling easier integration of EV/HEV chargers with the electricity grid.

*All of these topics are discussed in this report, in which Yole emphasizes the synergies between different markets.*



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**REPORT OBJECTIVES**

- Provide an overview of the main applications for inverters and its market value
- Identify the key drivers that will shape the future market
- Understand the dynamics of each market segment and the synergies between them
- Deliver an overview of the power inverter supply chain (devices, modules, inverters, and system level)
- Offer an overview of inverter/system leaders, by segment
- Analyze the shifting of business models, synergies with other industries, and opportunities for newcomers in the inverter segment
- Furnish an analysis of each inverter technology trend, by application

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