

Power electronics market to grow at 10% CAGR to over \$65bn by 2036

Wide-bandgap semiconductors are supporting higher-voltage operation and new power architectures across data centers, EVs and renewables, notes IDTechEx.

OEMs across power electronics applications are demanding increased efficiency and power density for power electronics components, while also insisting on solid reliability and device miniaturization. To enable this, wide-bandgap (WBG) semiconductors silicon carbide (SiC) and gallium nitride (GaN) are being adopted across the power electronics market. These WBG power semiconductors support higher-voltage operation and new power architectures across data centers, electric vehicles (EVs) and renewables.

Driven largely by the demand for use EVs and data centers, the power electronics market will rise rapidly, at a 10% compound annual growth rate (CAGR) over the next decade, to more than US\$65bn by 2036, forecasts IDTechEx in its new report 'Power Electronics Market 2026-2036: Data Centers, Electric Vehicles, and Renewables'.

The report tracks innovation trends across the power electronics market, which are being pushed by OEMs across the data-center, electric vehicle, and renewable energy industries, among others. Data centers, electric vehicles and renewables power electronics operate at significantly different power ratings and across a wide range of different environmental conditions. The demands and cost considerations for each are also vastly different. As a result, power electronics innovation developments across each industry differ considerably.

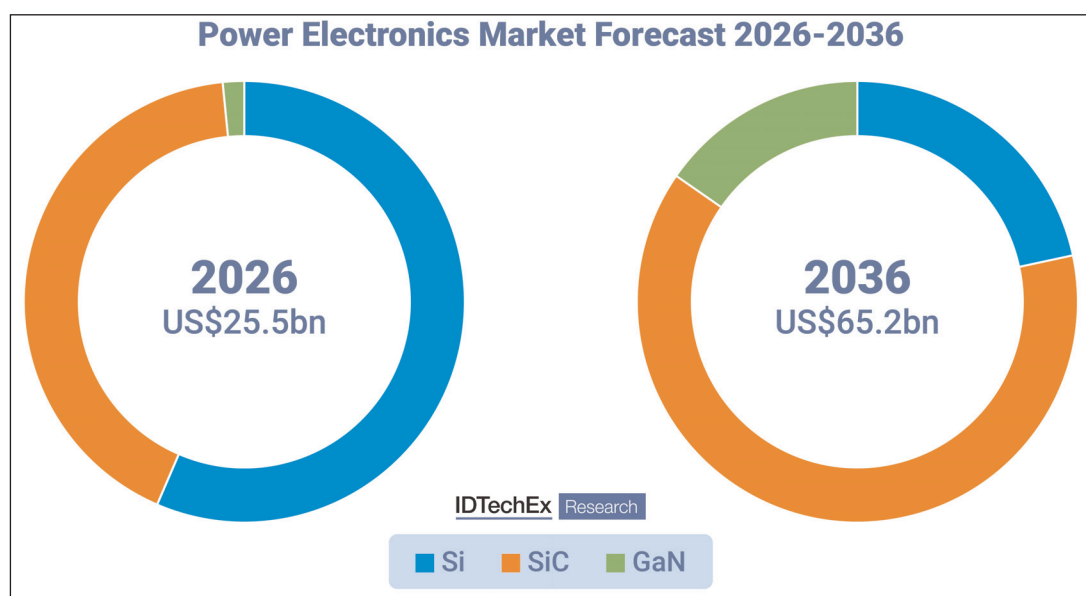
By understanding the innovation demands for power electronics across applications, IDTechEx says that it provides clarity on the power electronics market as a whole, predicting overall megatrends and wider barriers to adoption.

Electric vehicles: SiC to dominate; GaN will take more time to consolidate

While silicon IGBTs have remained the dominant power device of choice for the past 20 years of traction inverters, alongside other silicon power devices for the onboard charger and DC-DC converter, wide-bandgap technologies such as SiC MOSFETs occupy a significant and growing portion of the EV power electronics market.

IDTechEx predicts that SiC MOSFETs will form the majority of the EV traction inverter market by 2036, as well as the majority of the onboard charger and DC-DC converter market. The high-temperature operation, faster switching speeds, and smaller form factor lead to improved efficiency, as well as weight and volume savings that ultimately support increased range and EV performance.

GaN has significant potential in EVs, but the development of automotive GaN depends on proof of its long-term reliability in an EV environment, as well as its ability to operate at high voltages for 800V EV power architectures.



SiC will take the majority share of the power electronics industry by 2036, with significant uptake of GaN power electronics over the next ten years.

Data centers: wide-bandgap enables shift to 800VDC power architecture

The data-center industry has transformed since the widespread adoption of AI in 2023. AI models are becoming increasingly complex and require larger computational power for training. This has resulted in the rapid development of new generations of AI chips, which draw higher levels of power. The AI data-center power electronics industry must adapt to support future generations of AI training.

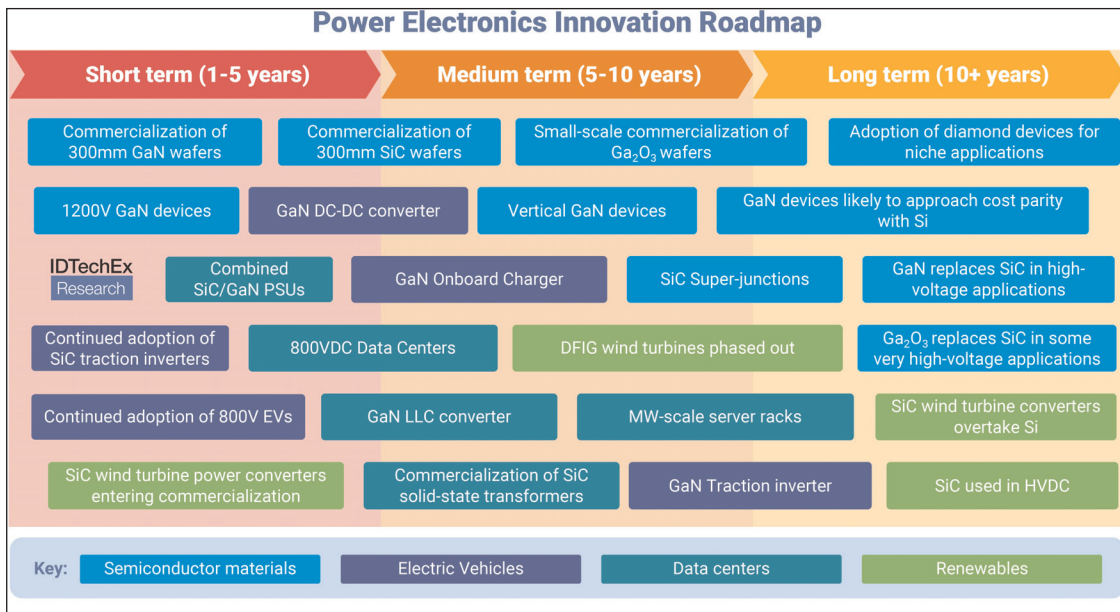
Wide-bandgap semiconductors are expected to become more prevalent in power supply units (PSUs) for data centers, as well as for point-of-load power conversion. The increased switching frequency and breakdown voltage of SiC and GaN enable more powerful and efficient power conversion devices in smaller form factors, while still maintaining the necessary reliability for AI training and inference. IDTechEx's report includes a 10-year forecast of silicon, SiC and GaN in data centers, predicting considerable uptake of GaN over the next ten years, especially for PSU and point-of-load power conversion.

At the same time, data-center power architecture will undergo a paradigm shift in the coming years, moving from AC power delivery to an 800VDC (HVDC) data-center power architecture. This transition is expected to simplify data-center power electronics, reducing the number of power conversion stages and points of failure. At the same time, this will increase overall data-center efficiency and enable the 1MW rack expected by the end of the decade.

The report includes a 10-year data-center power architecture forecast; IDTechEx expects that 800VDC will become the dominant power architecture for new AI data centers over the forecast period. IDTechEx compares the data-center power electronics market with the EV power electronics market, identifying key cross-overs and shared innovations between the two.

Wind energy: silicon's proven reliability slow the adoption of wide-bandgap technology

While comprising a relatively small segment of the overall power electronics market, power electronics for



Short-, medium-, and long-term roadmap of technology innovations in semiconductor materials for silicon, WBG and UWBG, as well as innovations in electric vehicles, data centers, and renewable energy.

wind energy represents an important contrast to the EV and data-center industries. With even higher power ratings, more challenging conditions (extreme temperature fluctuations, high humidity, and salt spray) and significant costs in the case of failure, the wind power electronics industry has been hesitant to adopt newer wide-bandgap power electronics innovations, opting instead for the long-proven reliability of silicon technology.

Tracking partnerships between wind OEMs and SiC suppliers, and through conversations with players such as Hitachi Energy, IDTechEx has produced a 10-year forecast of silicon and SiC demand for wind power converters, forecasting a steady adoption of SiC in the wind power electronics industry over the next ten years. The adoption of SiC in the wind industry represents a shift in wide-bandgap technology; its long-term reliability has been sufficiently proven in harsh environments to extend its range of applications into renewable energy.

From the sterilized environment of an AI data center, where strong demand for increased power density to train next-generation AI models is driving investment in power electronics innovation, to wind turbine power converters, where strong cost pressure and reliability considerations are paramount, power electronics innovations look very different across industries. With applications so different and yet so inter-related, a cross-industry approach must be taken to understand how innovations in one field affect others. The report is said to provide the analysis of semiconductor materials and application innovations required to fully understand the power electronics industry as a whole. ■

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