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SiC for the rest of us

From EVs to AI Data Centers, Silicon Carbide Powers the Path to Sustainability

Silicon carbide (SiC), once seen primarily as a disruptor in the electric vehicle (EV) market, is rapidly gaining ground in a new frontier: artificial intelligence (AI) data centers and the broader green energy transition. While the early 2020s were defined by SiC's rise in EV powertrains and charging systems, the mid-2020s are showing an inflection point, one where the demand for high-efficiency, high-density power devices is coming from hyperscale data centers, edge computing, and renewable energy infrastructure.

AI's Energy Hunger Spurs New Demand

AI's explosive growth is pushing infrastructure to its physical and electrical limits. Training large language models (LLMs) and running inference workloads across millions of servers requires vast amounts of energy. According to the International Energy Agency (IEA), global electricity demand from data centers, cryptocurrencies, and AI could more than double by 2026, reaching over **1,000 terawatt-hours**, roughly equivalent to Japan's total electricity consumption.

The challenge for hyperscale data centers and edge facilities is clear: deliver more compute power without overwhelming grid capacity or thermal management systems. That's where SiC's unique characteristics come into play.

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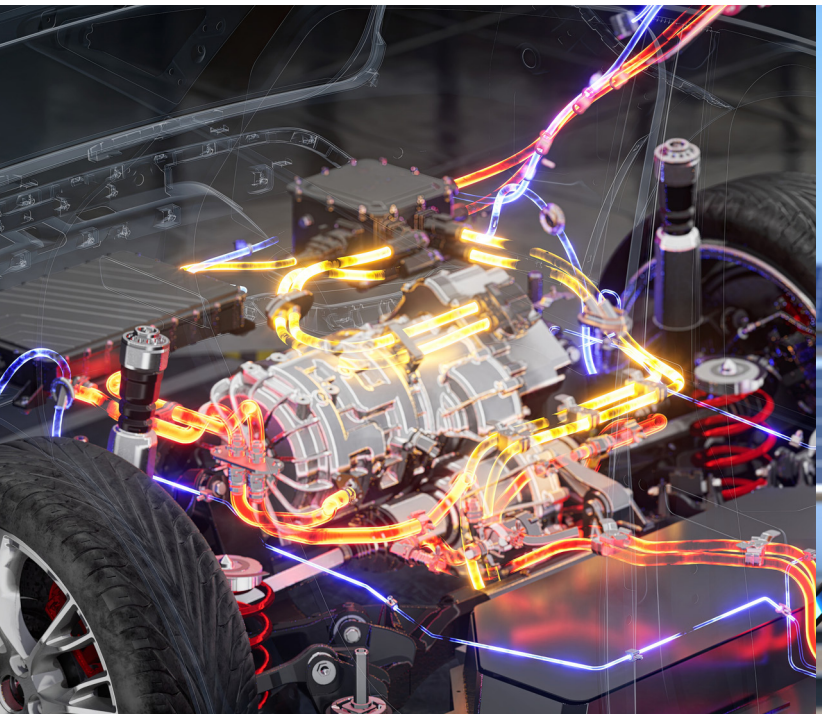
Compared to traditional silicon (Si) devices, SiC offers:

- **Higher breakdown voltage**
- **Faster switching speeds**
- **Lower conduction and switching losses**
- **Superior thermal conductivity**

These traits enable the development of compact, high-efficiency power conversion systems that waste less energy and generate less heat, both critical for modern data centers aiming to improve power usage effectiveness (PUE) and reduce operational costs.

EVs Plateau, But the Energy Transition Marches On

SiC's early momentum was driven by vehicle electrification, especially as automakers like Tesla, BYD, and Lucid Motors raced to optimize inverter and onboard charger efficiency. However, the EV market has entered a period of stabilization and regional variability. North American EV sales, for instance, slowed in early 2025, with Tesla reporting a double-digit drop in quarterly deliveries. Meanwhile, China and Europe continue to see solid growth, bolstered by government incentives and expanded charging networks.



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While EVs remain an important long-term application, the broader **"electrification of everything"** movement, including industrial automation, energy storage systems, smart grid equipment, and renewable generation, is creating new, high-value opportunities for SiC adoption.

In particular, **bidirectional DC-DC converters**, **solar inverters**, and **solid-state circuit breakers** are leveraging SiC's ruggedness and efficiency to improve energy conversion in constrained environments. These systems are especially important for microgrids, **vehicle-to-grid (V2G)** deployments, and **distributed energy resources (DERs)**, all of which play a role in decarbonizing global power systems.

Data Center Power Systems: A Perfect Match for SiC

Hyperscale operators such as Google, Microsoft, Amazon, and Meta are not just deploying more data centers, they're rethinking their power architectures. Traditional silicon-based power components struggle to keep up with increasing energy densities and strict efficiency standards. According to Yole Group's 2024 Power Electronics report, SiC-based power devices are expected to grow at a **CAGR of over 30%** through 2030, driven largely by computing and renewable energy applications.

SiC is already being deployed in:

- AC-DC and DC-DC converters in power supply units (PSUs)
- Uninterruptible power supplies (UPS)
- Power factor correction (PFC) circuits
- Battery energy storage systems paired with solar or wind farms
- Cooling pump motor drives

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Because of SiC's higher temperature tolerance and switching speed, system designers can reduce the size of heat sinks, inductors, and capacitors, leading to lighter, more compact, and more energy-efficient designs.

Industry Collaboration Unlocks Scalable SiC Solutions

To meet the growing demand from AI data centers, renewable energy systems, and electrified infrastructure, manufacturers of silicon carbide devices are rapidly scaling production capacity and forming strategic collaborations across the ecosystem. These partnerships between device makers and system integrators are focused on co-developing power solutions that are more efficient, compact, and thermally robust, tailored for applications where energy density and reliability are non-negotiable.

Collaborative efforts are particularly focused on optimizing both hardware and software to enable faster time to market and simplify design complexity. Integrated solutions that combine high-efficiency SiC devices with supporting firmware and application-specific reference designs help accelerate adoption across mission-critical markets.

Demand is especially strong in edge computing, high-performance data centers, EV charging infrastructure, industrial automation, and renewable energy systems, all of which require advanced power conversion under tight spatial and thermal constraints. By aligning roadmaps between semiconductor suppliers and system developers, the industry is ensuring that next-generation SiC technologies are ready to address rapidly evolving performance requirements.

These collaborative models are also helping standardize SiC deployment across a wider range of platforms, providing OEMs with validated, scalable building blocks for high-efficiency power systems. As applications continue to demand smaller, smarter, and more energy-dense solutions, joint development efforts are becoming a key enabler of SiC's expansion into new markets.

CoolCAD Electronics: Engineering the Next Wave of SiC Innovation

As demand accelerates for advanced SiC-based systems, innovative companies like **CoolCAD Electronics** are stepping up to bridge the gap between semiconductor performance and real-world reliability. Specializing in custom SiC device design, thermal modeling, and ruggedized circuit protection, CoolCAD is helping system developers harness the full potential of wide-bandgap semiconductors.

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From gate driver optimization to high-temperature circuit protection and modeling tools that simulate extreme thermal and electrical environments, CoolCAD brings deep domain expertise to the table, enabling faster development cycles and more resilient power architectures.

Whether you're designing for hyperscale AI workloads or grid-connected energy systems, CoolCAD offers simulation, prototyping, and custom SiC circuit solutions that ensure your systems perform under pressure, and thrive in the field.

Supply Chain Expansion and Localization

Another factor accelerating the adoption of silicon carbide (SiC) is the increasing focus on supply chain resiliency and regionalized semiconductor manufacturing. As global tensions and material shortages continue to disrupt critical supply chains, there is mounting pressure to secure more localized and stable sources for next-generation semiconductor materials, including wide-bandgap technologies like SiC.

Major government initiatives around the world—such as national semiconductor investment programs in the United States, Europe, and Asia, have designated SiC as a strategic priority for enabling energy-efficient electronics, electric transportation, and advanced computing. These efforts are supporting the development and expansion of fabrication facilities dedicated to SiC materials and devices.

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New foundries and capacity expansions are coming online across multiple regions, strengthening the global SiC ecosystem. This wave of investment is helping to stabilize pricing, improve material availability, and foster closer integration between manufacturing and end-use applications. As a result, SiC technology is becoming more accessible to a broader range of industries, supporting its growth across automotive, industrial, energy, and data center markets.

The Bottom Line: SiC's Role in a Smarter, Greener Future

SiC is no longer just about building better cars, it's about enabling a smarter, cleaner, and more energy-resilient world. As power demand grows exponentially from AI workloads, renewable generation, and electrified infrastructure, the need for higher-performing power semiconductors becomes a cornerstone of sustainability.

Whether in the heart of an AI inference server or on the edge of a wind-powered microgrid, SiC's role is clear: transform how power is managed, saved, and distributed. And in doing so, it may well be the material that powers both the digital revolution and the green transition, simultaneously.

Ready to accelerate your SiC-powered roadmap? Visit www.coolcadelectronics.com to explore CoolCAD's SiC capabilities, request a consultation, or collaborate on your next-generation power project.

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About CoolCAD

CoolCAD Electronics is a leader in the development and fabrication of SiC-based power devices and high-temperature semiconductor electronics for aerospace, automotive, defense, geothermal development, green energy production, industrial furnace control, water purification, and oil and gas extraction. The CoolCAD team possesses a unique combination of expertise in electronics, semiconductor physics, fabrication, and design. They also excel at integrated and board-level circuit development and manufacturing. They have published 100s of research papers in professional scientific and engineering journals, and have multiple patents on their key discoveries in the area of wide bandgap SiC electronics.

To learn more about CoolCAD visit **coolcadelectronics.com**