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Why Energy Now Sits at the Center of the **High-Tech Economy**

Part II of the 12-part GeoTechNexus series. The digital economy has outgrown the old fiction that compute can be separated from power. This installment shows how energy moved from cost line to strategic constraint, why power electronics are the hidden enabler, and how geopolitics now operates inside the high-tech system rather than around it.

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Turning Signals Into Solutions

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Power, Energy & the High-Tech Economy · Part II

COVERAGE

ENERGY & GEOPOLITICS

ELECTRONICS

Why Energy Now Sits at the Center of the **High-Tech Economy**

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TOP TAKEAWAYS

- Energy has moved from a cost line to a strategic constraint — global data-centre electricity use was 300–380 TWh in 2023, with AI-related demand projected at 200–400 TWh by 2030.
- Compute can no longer be separated from power: fabs, AI clusters, and telecom networks are now sited around grid capacity, not the other way around.
- Power electronics — silicon, IGBTs, MOSFETs, SiC, GaN, modules, PMICs — are the hidden enabler that makes scaled compute and electrification possible.
- Concentration in power-device manufacturing, packaging, substrates, and specialty materials creates chokepoint risk on par with leading-edge logic.
- Geopolitics has moved inside the system: subsidies, export controls, investment screening, and critical-mineral measures now shape commercial decisions in energy and electronics.

Abstract

The digital economy has outgrown the old fiction that compute can be separated from power. Part II of the GeoTechNexus series on power, energy, and the high-tech economy argues that energy has moved from cost line to strategic constraint, that power electronics are the hidden enabler of every electrified and digital workload, and that geopolitics is no longer external to the high-tech system — it now operates within it.

Opening Argument

For much of the digital era, strategy in electronics and information technology was framed around design leadership, scale, software, intellectual property, and low-cost globalized production. Energy was essential, but it was usually assumed to be available, routinized, and politically neutral. That assumption has now broken down.

What has changed is not merely that high-tech industries consume more electricity than before, though they do. It is that the relationship between energy and technological capability has become tighter, more visible, and more politically consequential. Semiconductor fabs, AI data centres, cloud campuses, telecom networks, battery plants, and digitally controlled industrial systems now sit on top of increasingly stressed power systems, contested supply chains, and strategic materials flows that are no longer insulated from geopolitics.

Analysis

From Cost Line to Strategic Constraint

For years, energy was treated as a cost to be managed rather than a strategic condition to be secured. A fab's electricity bill mattered, but it did not usually dominate public discussion of semiconductor strategy. A data center's power contract was important, but it rarely carried the same analytical weight as processor performance, storage growth, or cloud-market share. That hierarchy is changing because power is no longer simply an input into high-tech production; it is increasingly a limiting factor in whether expansion can occur at all.

A broad review of recent studies estimated global data-centre electricity use at 300–380 TWh in 2023, excluding crypto, with AI-related data-center electricity demand projected in a plausible range of 200–400 TWh by 2030. The same research notes that the electricity use of the four largest data-centre operators more than tripled between 2018 and 2023. These figures matter not simply because they are large, but because they show that marginal gains in compute are now tied to large increases in electrical and thermal requirements.

This turns infrastructure adequacy into a competitive issue. A country or region can attract advanced chipmaking or cloud investment only if it can provide dependable, expandable, and politically credible power at scale. In this sense, the next phase of the high-tech economy will be determined not only by who designs better systems, but by those able to keep systems energized without crippling cost, bottlenecks, or social backlash.

The strategic significance of energy is also evident in the widening gap between nominal digital growth and physical infrastructure reality. Digital systems appear weightless in public imagination, but their growth rests on energy-intensive facilities, cooling systems, ultra-pure manufacturing environments, backup power architecture, and increasingly dense electrical interconnections. The more artificial intelligence and automation spread, the less plausible it becomes to describe the high-tech economy as immaterial. It is becoming more materially demanding at precisely the moment many policymakers still speak as if software alone drives the future.

> **PULL QUOTE**
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> The firms and states that continue to treat energy as a background utility may discover that the real constraint on ambition is not access to ideas, but access to stable electrons.

This is why energy is moving from the finance department to the boardroom. It now shapes site selection, capex timing, supplier relationships, permitting risk, community opposition, industrial policy, and national security planning. The firms and states that continue to treat energy as a background utility may discover that the real constraint on ambition is not access to ideas, but access to stable electrons.

Power Electronics as the Hidden Enabler

If electricity is the indispensable fuel of the high-tech economy, power electronics are the systems that make that fuel usable. Yet public and policy attention continues to focus disproportionately on compute devices, especially advanced logic chips and AI accelerators, while the components that convert, regulate, manage, and protect electrical power remain analytically underexamined. This imbalance obscures a central truth: compute cannot scale without power conversion, conditioning, and control.

Power electronics encompass the devices and systems that manage electrical energy across applications and voltage levels, including silicon-based power semiconductors, insulated-gate bipolar transistors, MOSFETs, silicon carbide devices, gallium nitride devices, modules, converters, inverters, rectifiers, and power-management ICs. Their role is not decorative or marginal. They determine how efficiently energy moves from grid to facility, from facility to server rack, from battery to drivetrain, and from generation source to industrial load. In an age of dense computing and electrification, these functions are determinants of system viability.

This is why the importance of power electronics now reaches across the entire high-tech landscape. In semiconductor fabs, power-conditioning and backup systems are fundamental to process stability, yield protection, and equipment integrity. In data centers, power conversion and uninterrupted power systems determine how effectively operators can manage dense computational loads and avoid downtime. In telecom networks — especially 5G, fiber backbones, and edge infrastructure — power-management equipment underpins resilience and service continuity. In electric mobility, renewable integration, and industrial automation, the need for more efficient switching and lower losses is driving demand for wide-bandgap devices such as silicon carbide and gallium nitride.

> **GEOTECHNEXUS VIEW**
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> Power semiconductors are not peripheral suppliers to the digital economy. They are among the actors making that economy scalable.

The critical point is that power electronics increasingly mediate the relationship between energy supply and digital performance. As electricity becomes more expensive, contested, or constrained, efficiency is no longer just a commercial advantage; it becomes a strategic necessity. Small improvements in conversion losses, thermal behavior, and power density can produce large effects when multiplied across data-center fleets, telecom rollouts, vehicle platforms, and industrial installations. Under these conditions, the companies that design and manufacture power semiconductors are not peripheral suppliers to the digital economy. They are among the actors making that economy scalable.

There is also a geopolitical dimension to this hidden layer. Concentration in manufacturing capacity, packaging capabilities, substrates, and specialized materials means that power electronics can become chokepoints just as logic chips have. As industrial strategies broaden beyond leading-edge processors toward full-stack techno-industrial resilience, power semiconductors are becoming more visible to policymakers, trade authorities, and national planners. This attention is overdue.

Geopolitics as Operating System

Energy and electronics now form a single strategic field because both are increasingly governed by the same political logic. Questions once treated separately — where to mine, where to refine, where to fabricate, where to build data centers, where to place cable landings, where to source grid equipment, and where to allow foreign investment — are now being folded into a common framework of national security, resilience, and strategic autonomy. The result is that geopolitics no longer merely affects the high-tech economy from the outside. It operates within the system itself.

Economic nationalism is central to this shift. States are intervening more aggressively through subsidies, local-content rules, export controls, investment screening, reshoring incentives, and strategic procurement. The objective is not simply to capture more value, but to reduce dependence on politically risky suppliers and to secure control over key layers of the energy-technology stack. This is visible in efforts to localize semiconductor production, lock in access to critical minerals, expand grid capacity for industrial use, and tie energy planning more closely to technology policy.

China's use of export controls on strategically important minerals, alongside restrictions involving gallium and germanium and newer measures on additional minerals in 2025, illustrates how upstream concentration can be converted into geopolitical leverage. Whether such restrictions create lasting supply denial or trigger price spikes and diversification, they expose a structural reality: modern electronics, power systems, and advanced manufacturing remain vulnerable to concentrated control over refining and processing.

The geopolitical stakes are further amplified by the uneven geography of energy itself. States with abundant hydrocarbons, expanding nuclear fleets, large renewable buildouts, or the fiscal capacity to subsidize grid expansion are positioned differently from those facing persistent power shortages, regulatory incoherence, or public resistance to energy infrastructure. This is one reason the competitive map of the high-tech economy is widening beyond a narrow Atlantic frame. The Gulf is seeking to convert energy abundance into data and connectivity relevance. India is trying to marry infrastructure expansion with manufacturing ambition. Southeast Asia and parts of Latin America are emerging as alternative production and resource zones. Africa remains more central to future mineral and infrastructure politics than conventional technology narratives often admit.

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What emerges from these shifts is a more fragmented but also more explicit political economy of technology. The era when supply chains could be organized around efficiency is giving way to one in which resilience, redundancy, sovereignty, and political trust increasingly shape commercial decisions. This does not mean globalization is ending. It means interdependence is being renegotiated under harder political conditions. In that environment, energy is not a side issue within the high-tech world. It is one of the main arenas through which power, advantage, and vulnerability are now expressed.

Key Conclusions

Part II therefore establishes the central premise of the report. Energy sits at the center of the high-tech economy because the sector's growth now depends on physical systems that are capital-intensive, politically exposed, geographically uneven, and increasingly strategic. Once power became a limiting factor in compute, manufacturing, and connectivity, it also became a geopolitical issue. The chapters that follow build on that premise by examining how generation, distribution, devices, materials, firms, and states are being reorganized around the struggle to control the energy foundations of technological power.

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