WHITE PAPER

Securing Europe's Energy Transition

The Strategic Role of Graphite

BATTERY RESILIENCE STARTS UPSTREAM

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ECGA
European Advanced Carbon and Graphite Materials Association

Securing Europe’s Energy Transition
The Strategic Role of Graphite

Electrification is at the heart of the European Union's strategy to decarbonise its economy and strengthen industrial resilience. Batteries are the key enabling technology for decarbonising transport, integrating renewable energy into the grid and enhancing Europe's industrial competitiveness. At the core of every lithium-ion battery lies graphite, the dominant anode material that makes energy storage possible.

As Europe expands its battery manufacturing capacity, securing reliable supplies of graphite is becoming increasingly important. Yet the graphite value chain remains highly concentrated outside Europe, particularly in processing and active anode material production, creating strategic risks for Europe's energy transition, industrial competitiveness and economic security.

Europe has the resources, industrial expertise and emerging projects needed to strengthen its position. This white paper examines the key supply-chain vulnerabilities, explains why graphite is strategically important, identifies Europe's existing strengths and proposes policy actions to support a resilient and competitive European graphite value chain.

Supply Chain Realities

Despite its strategic importance to the battery value chain, **Europe remains highly dependent on imports** across almost every stage of the graphite supply chain. While the EU has set ambitious targets for electrification and clean-tech manufacturing under the Net-Zero Industry Act, these objectives will significantly increase demand for battery materials, including graphite. However, domestic capabilities in graphite production, processing and active anode material manufacturing remain limited.

This dependence is particularly pronounced in relation to China, which dominates the global supply of graphite. According to the International Energy Agency's Global Critical Minerals Outlook 2026, China accounted for 94% of global battery-grade graphite production in 2025 and supplied virtually all recent growth in battery-grade graphite capacity. **Supply chain vulnerabilities** are concentrated not only at the mining stage but also across the processing and manufacturing activities required to transform graphite into battery-ready materials. Europe is also reliant on imports of several critical carbonaceous feedstocks used in synthetic graphite production, including petroleum coke, needle coke and pitch.

While some production capacity exists within Europe, supply remains concentrated and vulnerable to disruption. The challenge is therefore not only securing access to graphite itself, but also developing the industrial capabilities required to convert it into battery-grade materials. Strengthening the resilience of the European battery value chain therefore requires investment across the full graphite ecosystem, including feedstocks, processing, active anode material production and recycling.

The vulnerability of graphite supply chains has become increasingly apparent as **governments adopt more interventionist industrial and trade policies**. China's dominant position in the market allows for it to selectively tighten or loosen access to materials and technologies that European producers cannot yet source elsewhere. Since 2020, China's Ministry of Commerce (MOFCOM) has ceased approving export licences for the export of artificial graphite products, without issuing a formal decision or providing any explanation.

China's 2023 export control measures on certain natural and synthetic graphite products demonstrated how concentration in processing capacity can create strategic dependencies for downstream industries. At the same time, other major economies are deploying subsidies, trade measures and industrial policies to secure strategic supply chains.

Competition for investment in graphite and battery materials is also intensifying. North America and Asia are attracting projects through grants, tax incentives and preferential financing, while countries such as India and Indonesia are expanding their ambitions in battery materials and downstream processing. Europe therefore faces the **dual challenge of reducing strategic dependencies while remaining globally competitive.**

A key weakness lies in the midstream segment of the value chain. While discussions often focus on access to graphite resources, Europe's largest gap is in the processing steps required to convert graphite into battery-ready anode materials. Purification, spheronisation, coating and graphitisation are technologically complex, capital-intensive activities that account for a significant share of value creation and remain heavily concentrated outside Europe. The Critical Raw Materials Act itself recognises processing as a strategic vulnerability by establishing a benchmark that at least 40% of the EU's annual consumption of strategic raw materials should be processed within the Union by 2030. Without greater investment in these stages, Europe's battery industry will remain dependent on imports even if additional graphite resources become available.

The EU Energy Transition: A Battery-Driven Transformation

The European Union has made electrification a central pillar of its strategy to decarbonise transport, integrate renewable energy and strengthen industrial competitiveness. Through initiatives such as the Electrification Action Plan, the EU has recognised accelerated electrification as a key enabler of affordable energy, industrial competitiveness and decarbonisation. This direction, together with the Clean Industrial Deal and the Net-Zero Industry Act, places batteries at the heart of Europe's energy, industrial and security objectives.

Batteries are essential not only for electric mobility, but also for energy storage, defence applications and digital infrastructure. Their performance and competitiveness depend on secure access to battery materials, among which graphite plays a unique role. The EU's ambitions to expand domestic battery manufacturing and reduce strategic dependencies therefore require **secure and diversified supplies of graphite**. Strengthening the entire graphite value chain, from mining and processing to active anode material production and recycling, is essential for Europe's economic security, industrial resilience and technological sovereignty. Given Europe's continued reliance on imports and graphite's critical role in batteries, the material should remain a central focus of European industrial, raw materials and battery policies, as recognised in the Critical Raw Materials Act.

Why Graphite Matters

Graphite is a cornerstone of the lithium-ion battery value chain. As the primary anode material in virtually all commercially available lithium-ion batteries, it is essential for electric mobility, energy storage and a wide range of clean technologies. There is currently no commercially viable substitute capable of replacing graphite at scale in battery anodes, and graphite remains the largest mineral component of a typical lithium-ion battery by weight.

Both natural and synthetic graphite are required to support a secure and competitive battery value chain. They are often combined in battery anodes to achieve the desired balance of performance, durability and cost. Natural graphite often offers cost advantages, while the relative environmental footprint of natural and synthetic graphite depends on factors such as production processes, energy sources and supply-chain configurations. Synthetic graphite provides the consistency, purity and performance characteristics required for demanding applications. Although battery producers frequently use blends of natural and synthetic graphite, recent market developments have seen synthetic graphite play an increasingly important role in anode production and account for most growth in battery-grade graphite supply, particularly in China and in high-performance applications. These trends reinforce the need for reliable access to both natural and synthetic graphite, as each contributes distinct and complementary properties that are essential for battery performance, supply security and market resilience.

As battery manufacturing expands worldwide, **demand for graphite is expected to increase significantly**. The IEA projects global demand to rise from 5.8 million tonnes in 2025 to almost 11 million tonnes by 2040, driven primarily by batteries for electric vehicles and energy storage. Securing sufficient graphite supply will therefore be critical to supporting Europe's battery ambitions and avoiding future supply bottlenecks.

Reflecting its **economic importance and supply risk**, the EU has designated graphite as a Critical Raw Material and battery-grade graphite as a Strategic Raw Material under the Critical Raw Materials Act. Beyond its indispensable role in batteries, graphite has also been identified by NATO as one of its 12 defence-critical raw materials, underlining its importance for Europe's security and defence industrial base. Graphite is furthermore used in aerospace and advanced manufacturing applications.

Strengths of the European Graphite Industry

Despite the challenges facing the graphite supply chain, **Europe possesses a number of important strengths** that provide a solid foundation for developing a resilient and competitive battery-grade graphite industry. These strengths span the entire value chain, from natural graphite resources and synthetic graphite production to advanced manufacturing expertise, innovation capabilities, recycling infrastructure and sustainability leadership.

Europe possesses natural graphite resources, with significant deposits identified in countries such as Sweden, Finland, Norway, Greenland, Romania and the Czech Republic. Several projects are advancing through exploration, permitting and development, demonstrating Europe's potential to become a meaningful supplier of natural graphite to the battery sector while reducing import dependence and supporting local processing and anode material production.

Europe also has an **established industrial base for synthetic graphite production**. Battery-grade synthetic graphite is already produced in France, Norway and Switzerland, while companies in Italy and Spain are exploring expansion into battery anode materials. In parallel, **Europe is emerging as a hub for bio-based and renewable carbon materials**, creating a diversified supply base that can complement conventional graphite production.

A major European asset is its **long-standing expertise** in carbon and graphite materials, graphitisation, high-temperature processing, carbon chemistry and materials engineering. This industrial know-how provides a strong foundation for competitive anode material production and represents a strategic capability that is difficult to replicate.

Europe is also well positioned to lead in **sustainable graphite production**. New mining, processing and anode material projects are being developed under some of the world's highest environmental standards and increasingly benefit from low-carbon electricity. As a result, European producers can offer lower-carbon and responsibly sourced graphite, in line with growing customer demand.

Innovation is another key advantage. European companies and research organisations are developing next-generation anode technologies, advanced purification processes, alternative feedstocks, recycling technologies, bio-based carbon materials and hard-carbon anodes. These innovations can improve performance, reduce environmental impacts and strengthen industrial competitiveness.

The region further benefits from a **well-developed circular economy ecosystem**. Europe hosts an extensive network of battery collection, recycling and waste-management companies, while several ECGA members are investing in technologies to recover, purify and reintegrate graphite into battery production. ECGA is actively involved in advancing these efforts through its participation in European research and innovation projects focused on graphite recycling and circularity. Research initiatives such as **LIFE GRAPHIREC** and **BASTILLE** in which ECGA contributes as a project partner, are helping to establish future secondary graphite supply streams.

Beyond sustainability, **domestic production offers important strategic advantages**. Manufacturing graphite and anode materials within the European Union reduces exposure to geopolitical tensions, trade restrictions and supply chain disruptions. It gives battery manufacturers greater visibility over their supply chains and strengthens Europe's ability to manage future supply risks.

Finally, **proximity** to Europe's expanding battery manufacturing base creates important competitive advantages. Shorter supply chains reduce transport costs, lead times and emissions, while facilitating supplier qualification, technical cooperation and integrated planning with gigafactories.

Taken together, Europe's resource base, industrial expertise, innovation capacity and circular economy capabilities provide the foundations for a distinct graphite value chain model. Rather than competing solely on cost, Europe can differentiate itself through sustainability, lower-carbon production, shorter supply chains, high environmental standards and greater material circularity. These characteristics can become a significant competitive advantage as battery manufacturers increasingly prioritise resilient and responsible sourcing.

Policy Recommendations

Securing Europe's graphite supply chain requires a policy framework that addresses the competitive distortions affecting the global graphite market, enables competitive production in Europe and supports the development of future sources of supply. The following three priorities should form the basis of a European strategy for graphite and active anode materials.

1. Levelling the Playing Field for European Graphite Production

European graphite and active anode material producers face intense competition from production outside Europe that often benefits from industrial subsidies, preferential financing, lower energy costs and other forms of state support. To develop a resilient European graphite value chain, the EU must address these distortions and create conditions that allow European projects to become bankable and commercially viable.

Mandatory European content requirements: The Industrial Accelerator Act should introduce gradually increasing Made-in-Europe requirements for active anode materials used in strategic sectors such as electric vehicles and energy storage systems. For battery-grade graphite and active anode materials, European origin should be determined primarily on the basis of substantial transformation and value creation within the EU/EFTA rather than the origin of all upstream feedstocks.

Price-support and market-creation mechanisms: The EU should establish dedicated price-support mechanisms for graphite projects recognised as Strategic Projects under the Critical Raw Materials Act. Such instruments could be coordinated through the future Critical Raw Materials Centre and designed to reduce revenue uncertainty, improve bankability and counter the effects of state-supported production outside Europe. Green premium mechanisms and carbon-related support schemes should also be considered where they help bridge the competitiveness gap faced by European production.

Stronger financing support for industrialisation: Financing support should extend beyond project construction and address the full industrialisation cycle. It should be available not only for new greenfield and first-of-a-kind facilities, but also for the scale-up, debottlenecking, expansion, conversion and repurposing of existing European carbon and graphite assets. New graphite and active anode material facilities typically require lengthy customer qualification, validation and scale-up phases before reaching stable commercial operation. The EU should therefore deploy the full financing toolbox, including grants, loans, guarantees, equity instruments, blended finance and risk-sharing mechanisms, while also covering the upfront CAPEX gap and temporary OPEX, ramp-up and customer-qualification costs where appropriate.

Diversify supply through strategic partnerships: While circularity will become increasingly important, Europe will continue to require primary supply. Strategic partnerships with trusted third countries should therefore support diversified sourcing while contributing to European processing, refining and anode material manufacturing capabilities.

Strategic market intelligence: The Critical Raw Materials Centre should strengthen monitoring of graphite supply chains, including processing capacity, export restrictions, industrial subsidies and other market distortions. Better market intelligence would support investment decisions and help identify emerging supply risks.

2. Enabling Competitive Operating Conditions in Europe

Reducing strategic dependencies will require more than financial support. Europe must offer framework conditions that enable graphite production and processing to compete globally.

Faster permitting and regulatory predictability: Strategic graphite mining, processing and anode material projects should benefit from streamlined permitting procedures, one-stop-shop authorisation processes and binding timelines. Regulatory frameworks governing chemicals, waste, batteries and critical raw materials should be aligned to support investment and industrial development.

Competitive energy access: Graphitisation is among the most energy-intensive processes in the battery value chain and electricity costs are a key determinant of competitiveness. Graphite projects should receive priority access to grid connections, low-carbon electricity and long-term power-price solutions, including renewable power purchase agreements.

Addressing structural cost disadvantages: European producers face competition from regions benefiting from significantly lower energy prices and extensive industrial support. Targeted energy compensation measures, Carbon Contracts for Difference and other competitiveness instruments should therefore be available for strategically important graphite processing and active anode material facilities.

Strategic feedstocks and processing capacity: Policy support should extend to critical carbonaceous feedstocks, including petroleum coke, needle coke, pitch and other suitable carbon precursors. At the same time, Europe should prioritise investment in processing, graphitisation and active anode material manufacturing, where much of the value creation, technological know-how and strategic importance of the graphite value chain resides. These industrial transformation activities should be recognised as strategic European capabilities in their own right, including where carbonaceous feedstocks are sourced from trusted third countries.

3. Establish Europe as a Global Leader in Circular Graphite

Recycled graphite is likely to become one of the most sought-after battery materials over the coming decade. Europe has the opportunity to become a leader in this area, building on its advanced recycling ecosystem, environmental standards and battery policy framework.

Create demand for recycled graphite: The Circular Economy Act should introduce strong incentives for the use of recycled materials in battery production, including graphite. Recycled-content requirements should create genuine demand for recovered and purified graphite while remaining technically achievable for industry.

Accelerate graphite recycling and closed-loop value chains: Support should be directed towards technologies that enable the recovery, purification and upgrading of graphite from end-of-life batteries. Particular attention should be given to technologies capable of reintroducing recovered graphite into active anode material production.

Prevent the loss of strategic resources: Europe should ensure that valuable battery materials remain within the European value chain. Measures under the Circular Economy Act should discourage the export of black mass and other strategic battery waste streams where such exports undermine Europe's ability to develop domestic recycling and battery-material production capacities.

IN SHORT

Europe's Battery Transition in Numbers

- 🔋 100% zero-emission new cars by 2035: Electrification is the EU's primary pathway for decarbonising road transport.
- ⚡ 600+ GWh battery manufacturing capacity planned by 2030: Europe is investing heavily in a domestic battery industry.
- 🏭 Batteries designated a strategic net-zero technology under the Net-Zero Industry Act.
- 🌍 Battery supply chains are now a strategic issue, linking industrial competitiveness, energy security and economic resilience.

Graphite at a Glance

- ⚡ Primary anode material in virtually all lithium-ion batteries.
- ⚖️ Largest mineral component by weight in a typical lithium-ion battery.
- 📈 Global graphite demand projected to approach 11 million tonnes by 2040.
- 🇪🇺 Critical Raw Material and Strategic Raw Material (battery-grade graphite) under the CRMA.

Graphite Supply Chain: Key Realities

- 🌏 China dominates graphite processing and active anode material production.
- 🏭 Europe's largest vulnerability lies in midstream processing and anode materials, not resource availability alone.
- 📜 Export controls, industrial policy and subsidies are reshaping global supply chains.
- 🔗 Battery security depends on the entire value chain, from feedstocks to active anode materials.

Europe's Competitive Advantages

- 🧑‍🔬 Decades of expertise in carbon materials, graphitisation and high-temperature processing.
- 🏭 Existing synthetic graphite production and emerging battery-grade graphite projects.
- ♻️ A growing recycling ecosystem and strong circular-economy framework.
- 🌱 High environmental standards, low-carbon electricity and proximity to European gigafactories.

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