# From Reliance to Resilience Securing Europe's Eco-Friendly Graphite Supply

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## SECURING EUROPE'S GRAPHITE AGENDA

- 1. Graphite's critical role
- 2. Europe's dependency and the geopolitical risks
- 3. Environmental challenges of traditional graphite production
- 4. Innovative solutions for sustainable and reliable graphite supply





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**Business** | China and Europe

### Why is China blocking graphite exports to Sweden?

Its motive may be more commercial than political

Fastmarkets



Market welcomes addition of synthetic graphite to EC's Critical **Raw Materials Act** 

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# **CARBON IN CONTRAST**



# **LITHIUM-ION BATTERIES**



## **FUEL CELLS**



## **ELECTRIC ARC FURNACE STEELMAKING**





# A LOOMING GLOBAL SUPPLY DEFICIT



Figure 1: Graphite demand / supply showing market deficit beginning 2025E Source: Macquarie Research (March 2023)

#### 🗾 Dem. Repub. Congo 📕 Chile 🔛 China 🔚 Indonesia 📕 Japan 📕 Peru 👘 Russia 👘 Other countries Mining 23% (56 kt) Cobalt 65% (157 kt) 24% (5,311 kt) 40% (9,050 kt) Copper 82% (1,320 kt) 17% (268 kt) Graphite 18% (34 kt) 24% (46 kt) Lithium Rare earth elements 39% (28 kt) 61% (44 kt) 43% (1,470 kt) 52% (1,787 kt) Nickel Processing 21% (47 kt) 77% (172 kt) Cobalt



Processing includes refining copper, cobalt, nickel and rare earth elements, production of lithium chemicals and production of battery-grade graphite products.

Chart: James Goldie, 360info • Source: International Energy Agency • Get the data • Embed • Download image • Created with Datawrapper

### **Biggest suppliers of each critical mineral in 2023**

## **GAME OF GRAPHITE**

- Dec 2023: New Chinese export permits required
- Dec 2023: EU added graphite to the Critical Raw Materials Act (CRMA)
  - Extraction: At least 10% of the EU's annual consumption
  - Processing: At least 40% of the EU's annual consumption
  - Recycling: At least 15% of the EU's annual consumption
- Jan 2024: US IRA policy introduced Foreign Entity of Concern: Chinese graphite disqualified for EV credits
- June 2024: US announced 25% tariff on Chinese graphite with start 2026
- Dec 2024: North American graphite miners petitioned the U.S. government to impose tariffs as high as 920%
- Dec 2024: NATO releases list of the 12 defence-critical raw materials, including Graphite
- Dec 2024: Swedish Inspectorate of Strategic Products stopped a €1.4 bn anode material plant by Chinese company Putailai
- March 2025: Japan announced 95.2% duty on China graphite electrodes

### **RISING COSTS, RISING RISKS**

- Surging Demand: EAF to grow from ~28% to ~42% of global steel production by 2040.
- Feedstock Bottleneck: needle coke is derived from oil/coal byproducts.
- Declining Supply Base: EU refining capacity to shrink by 0.5 million barrels/day by 2030; heavy residue processing in decline, reducing petcoke output.
- Competing Demand: Global needle coke demand forecast to more than double by 2040, reaching ~3.9 million tonnes, driven by batteries overtaking electrodes after 2030.
- Environmental Limits: New needle coke/electrode plants require 2–5+ years and face high ESG barriers; existing facilities risk shutdown under stricter EU emission rules.

# **A MASSIVE SOURCE OF EMISSION**

On average: 17 kg CO<sub>2</sub> emissions for every kg graphite produced

#### Natural graphite



**Carbon Intensity** 

Tonnes of CO2 eq. per tonne of uncoated graphite material Average global warming potential (GWP) for Chinese production

On average, today's synthetic anode production process has a **higher carbon intensity** relative to natural anode, due to the use of coal-based electricity in the graphitisation process. **Diversification of production** to new regions with **more clean energy generation** is narrowing this gap and changing the **cost and sustainability dynamics** that have historically defined the market.

Source: Benchmark Mineral Intelligence



# **CO<sub>2</sub> EMISSIONS FROM GRAPHITE**



# **PRICE IMPACT**

#### EU Carbon Price to Crank Up After Brief Dip

Looming supply cuts could see allowances more than double to €146/t this decade, before hitting €194/t in 2035

🖊 Historical 🖉 BNEF's 2H 2023 base case 🧪 BNEF's 1H 2024 base case



#### **Pricing:**

- Synthetic graphite price: € 4 000
- CO2 per kg graphite: 3.67
- ETS price: €150
- Total price: €4 550

#### Impact on total price:

- Est +20% bio-graphite: €5 500
  - $\rightarrow$  €4 increase per ton steel
  - $\rightarrow$  €0.4 increase per car

# CAN RECYCLING FILL THE GAP?

- EU's Critical Raw Materials Act (CRMA) require higher recycled content (25% of synthetic graphite by 2030).
- Steel electrodes: Only ~3–10% of electrode graphite is currently recyclable.
- **Battery Anode**: Impurities and mixed chemistries make it difficult to ensure quality and reuse graphite in high-performance applications.
- High Energy Demand: Purification and re-graphitization (~3,000°C) drive up energy use and costs.
- Low-End Use Cases: Recycled graphite is mostly used as recarburizer or in non-electrode applications.
- GHG Emissions: Recycled graphite produces 0.5–9.8 kg CO<sub>2</sub>e/kg





- Patent-pending technology developed over more than a decade of research at the Royal Institute of Technology (KTH) in Stockholm, Sweden.
- Fossil-free, bio-based graphite produced from commercially available biocarbon.
- Innovative CO<sub>2</sub>-neutral production: reduces energy consumption by 75% and acid usage by 98%.



Biomass: 8 tons Softwood residuals (saw dust, chips and wood shavings) from sawmills



Biochar: ~2 tons C-fix: 90%+ Volatile Matters: <3% Ash Content: <1.5%





Bio-graphite: ~1 ton Proven performance for batteries and EAF electrodes.

# Thank you

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