

*The energy transition is often framed as a story about lithium, copper, and rare earths. But one of the most important materials in the entire battery supply chain receives far less attention: graphite. Today, nearly every lithium-ion battery anode is made primarily from graphite, making it the single largest component by volume in most electric vehicle batteries. As EV adoption accelerates and energy storage systems expand globally, battery demand for graphite is growing rapidly. The key constraint the market overlooks: more than 90% of the world's processing capacity remains concentrated in China. The result is a market defined not by geological scarcity, but by industrial concentration. A market susceptible to severe supply shocks.*

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## **1. Executive Summary**

Graphite is undergoing a structural demand transformation. Demand from EV growth and rapidly scaling energy storage systems is steadily increasing, eclipsing legacy industrial demand applications. The velocity, industrial security implications, and quality specifications of battery-grade graphite demand are reshaping supply chains, geopolitics and investment dynamics in the global graphite market.

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### **1.1 Core Thesis**

- Graphite sits at the center of lithium-ion battery architecture (anode material dominance).
- Demand growth is structurally tied to EV penetration and stationary energy storage.
- Supply of processed battery grade graphite remains geographically concentrated.
- Geopolitics & Western industrial policy is accelerating supply chain

diversification.

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### **1.2 Key Imbalances**

- Regional ore reserve vs processing production capacity
- Western demand vs domestic production capacity
- China's low production cost vs ROW production cost
- Legacy demand vs emerging growth drivers
- West's existing industrial graphite capacity vs non-existent battery-grade capacity
- ESG and permitting friction in new jurisdictions vs Industrial policy & mandates

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### 1.3 Investment Implications

- Graphite has entered a strategic tipping point. Battery demand is approaching parity with legacy industrial demand and is expected to become the dominant graphite consumption segment this decade. This has considerable near-term implications, particularly for Western market that lacks graphitization facilities; currently producing 5% of its current battery-grade graphite demand. Global annual graphite demand is expected to double over the coming decade to 10,000-12,000/kt with battery anode demand rising to 60% of total demand.
- Reimplementation of existing Chinese export controls (scheduled for Nov 2026) in addition to geopolitical event driven supply disruptions have the potential to create significant supply shocks in Western markets that would largely benefit ex-China processing facilities and vertically integrated producers.
- Western graphite market structure is evolving from Chinese driven surplus and price suppression to a market defined by regional structural deficits with substantial price premiums for ex-China graphite. This shift is driven by Industrial policy forces: low-carbon mandates and the likely confirmation of anti-dumping duties (93%) on imported graphite.

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## 2. Market Overview & Structure

Graphite is the most thermodynamically stable carbon. Carbon naturally prefers to manifest as graphite over diamond. While Graphite is non-metallic, it exhibits metallic-like properties: electrical & thermal conductivity, chemically inert, and stable at extreme temperatures. Graphite exists in two primary categories: natural and synthetic.

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### 2.1 Market Size & Segmentation

Currently, the market is estimated to be worth \$10 Billion annually. Natural graphite production is estimated at 1.6 million metric Tons, while annual synthetic graphite production is estimated at 3-3.5 million metric Tons. There are three primary categories of graphite and that satisfy demand in different market segments with various quality requirements.

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## **Natural graphite (flake, amorphous, vein)**

Natural graphite is mined from ore deposits in metamorphic rocks, in three primary categorizations: Flake, amorphous, and vein. Flake dominates with 87% of global production, followed by amorphous 12%, and vein .2%.

**Flake Graphite:** Most abundant and highest carbon content with two key subsegments: small flake (most abundant) used in industrial applications and large flake (scarce) that is used in specialized applications (premium).

Flake graphite represents the most strategically significant segment of the market due to its role as primary feedstock for spherical graphite used in lithium-ion battery anodes.

Key uses: Batteries, refractories, and lubricants

**Amorphous Graphite:** Lowest quality – poorly formed microcrystals -Key uses: Seals, brake linings, low-end refractories (not suitable - batteries)

**Vein Graphite:** aka “lump” is the rarest-most valuable (99% carbon content) -Key uses: High purity applications – crucibles and electrodes (premium)

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## **Synthetic graphite**

Offers higher purity, consistency, and conductivity than natural forms.

-Key uses: Electrodes (steel making), nuclear reactors, high-end batteries.

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## **Spherical graphite (battery-grade)**

A refined, processed form of natural flake graphite with two distinct subsegments:

Uncoated (lower quality) used in general less demanding battery applications and coated (higher quality) - specialized use cases like EV batteries (price premium)

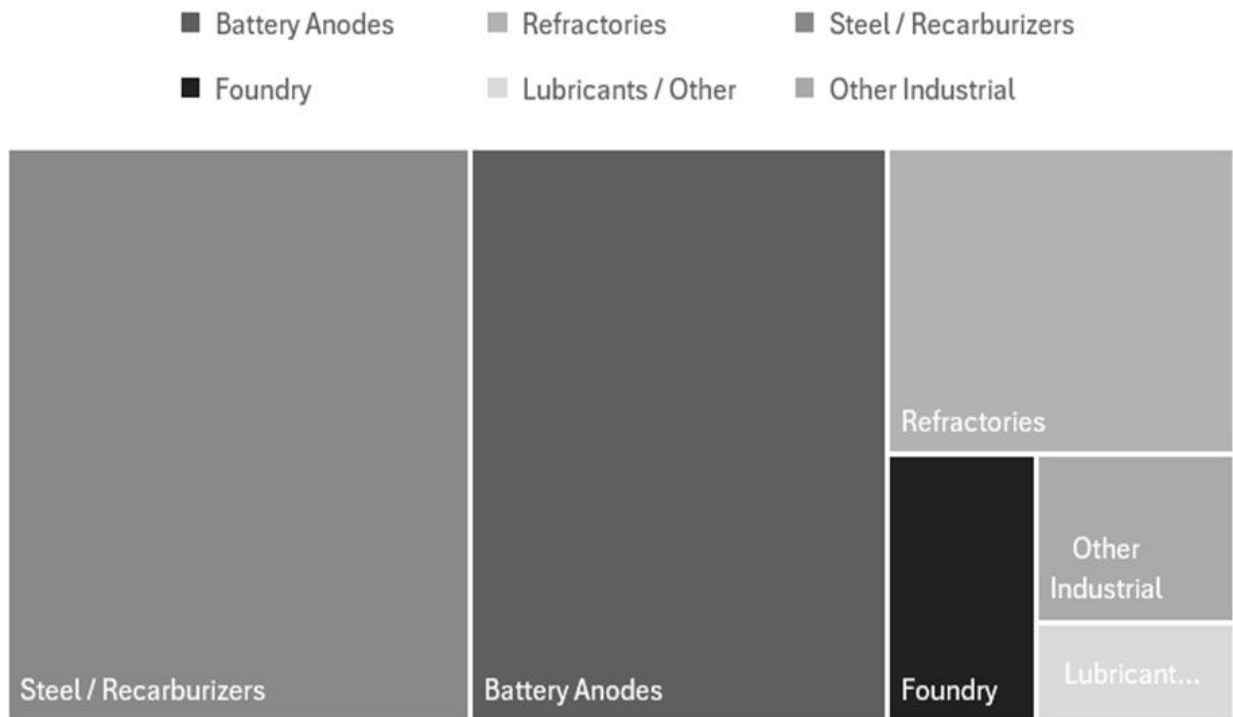
– Key uses: Anode material for applications in lithium-ion batteries.

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## 2.2 End-Use Breakdown

Total annual demand for natural (35%) and synthetic (65%) is approximately 5,000 kt. The majority of current demand is in industrial applications. Battery-grade graphite demand is emerging as the fastest growing segment, fueled by the energy transition and carbon reduction initiatives. Battery demand is projected to grow at a double digit CAGR through 2035 to eclipse legacy demand and comprise 60% of total demand by 2035.

### Graphite Demand by Sector



Source: BMI

Oculus Research

## 2.3 Trade Flows

Flows of natural and synthetic Graphite are comprised of natural ore (flake, amorphous, vein), refined/purified graphite (from natural), and synthetic graphite.

- **China:**

Mining: Controls est. 70-80% of natural graphite ore production (85% flake, 15% amorphous)

Refining/ spherical processing: China Controls 90-95% of battery-grade refined graphite - dominates refining and spherization with a 75% cost advantage. Vast refining capabilities. China imports 10-15% of global natural ore, supplementing domestic ore production to meet its processing capacity.

- **Mozambique:**

Mining: Contributes approx. 13% of natural ore production with major projects in development.

Refining: Exports majority of ore (flake) to China for refining, small percentage to US/EU

- **Madagascar:**

Mining: Contributes approx. 5% but growing rapidly with major projects in development.

Refining: Currently exporting majority of production to China – US/EU exports increasing.

- **US, EU, Japan:** Largely import reliant for natural graphite ore, and processed natural/synthetic graphite.

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### 3. Demand Analysis — Structural Drivers & Elasticity

Macroeconomic, Technological, and policy trends are key drivers in the graphite market. The market is currently being reshaped from legacy demand- traditional industrial applications, toward high-growth clean energy sectors. EV battery demand is currently 20-30% of total demand, but it is the fastest growing segment with energy storage subsegment growing 40%+ CAGR. Total battery demand is expected to drive the majority of incremental demand over the next decade.

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#### 3.1 Traditional Industrial Demand

Industrial applications account for the majority of graphite consumption today but exhibit relatively modest growth rates tied to global manufacturing and steel production.

- **Steel/Recarburisers:** Graphite is used for its carbon content in alloys

Type: Synthetic (Graphitized)

Market share: 35-37%

Growth Drivers: Global transition to “green steel” and the expansion of Electric Arc Furnace (EAF) capacity.

- **Refractories:** Graphite is used to line furnaces, ladles, and vessels to contain molten metal.

Type: Natural high purity Flake preferred

Market share: 22%

Growth Drivers: Steel and metallurgy industry growth – global manufacturing

- **Foundries:** casting technologies for automotive and aerospace industries.

Type: Amorphous and flake often in combination

Market share: 6-8%

Growth drivers: Automotive and machinery sectors

- **Lubricants:** Graphite’s layered structure provides dry lubricant in high temp/vacuum environments used in greases, oils, and automotive parts

Type: Amorphous graphite is most common (cost-effective)

Market Share: Estimated at 5% of total production

Growth Drivers: Manufacturing, consumer applications, and industrial demand

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### 3.2 Emerging Demand – Growth Drivers

- **EV anodes:** Graphite accounts for 90-95% of anodes by weight, enabling high conductivity stability, and the ability to intercalate lithium ions efficiently in EV batteries.

Type: Spherical graphite (processed from flake) and synthetic graphite (preferred)

Market share: Estimated at 30% of total demand

Growth drivers: EV adoption, Subsidies for green mobility and emissions targets.

- **Consumer electronics:** Graphite anodes are used in lithium-ion batteries in smartphones, laptops, and wearables providing high energy density, low self-discharge, and stability

Type: synthetic preferred due to its consistency in smaller-scale batteries.

Market share: consumer electronics 10% of production

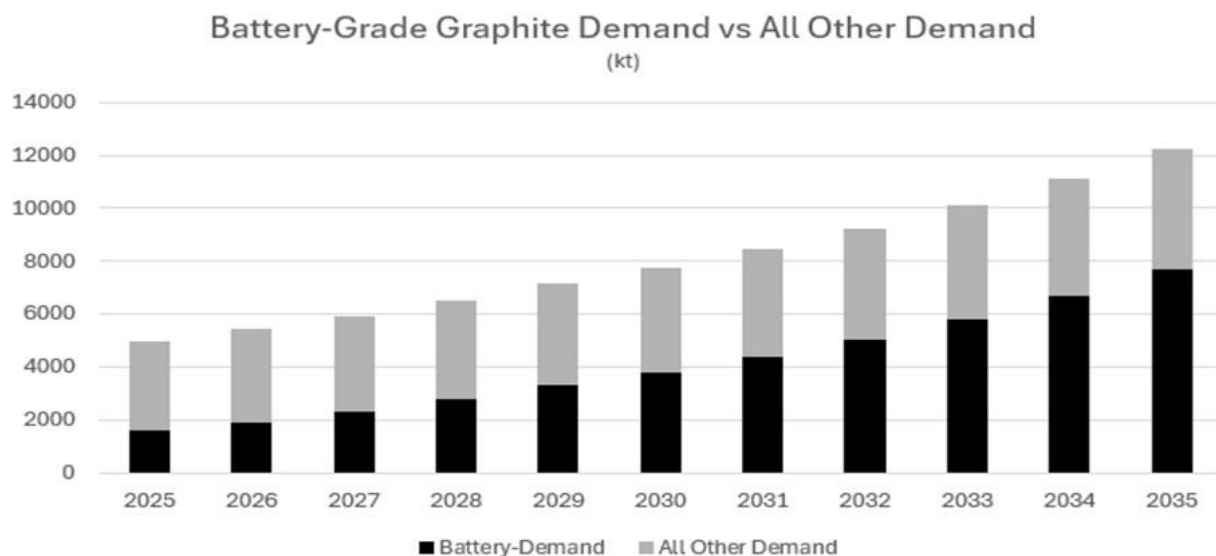
Growth drivers: Steady growth from portable electronics but slower than EV demand.

- **Battery Energy Storage Systems:** Graphite is used in stationary energy storage battery systems to support electrical grids.

Type: combination of synthetic graphite and spherical natural graphite with increasing preference for synthetic.

Market share: 5-8%

Growth Drivers: Fastest growing segment (40-50% in 2025), driven by urgent need to integrate intermittent renewable energy. This growth is backed by favorable government policies and mandates.



Source: BMI, IEA

Oculus Research

Battery demand is projected to grow significantly faster than traditional industrial applications. While industrial consumption continues to expand gradually, battery-grade graphite demand accelerates rapidly due to electric vehicle adoption and scaling of energy storage systems. As a result, battery applications are expected to represent more than 60% of total graphite demand by 2035.

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### 3.3 EV Penetration & Battery Intensity

EV penetration continues to accelerate graphite demand in lithium battery anodes. EV sales and penetration have reached a structural inflection point, with policy, cost parity, and Chinese supply chain dominance fueling adoption beyond previous projections.

- Global EV Penetration: Sales in 2025 reached est. 23 million units (30% YoY growth)

Share by Region: China 60%, EU 25%, US 11%, Emerging markets 20-30%

- Battery Intensity: Stable at 60-80 kWh (mass-market vehicles), 90-120 kWh (SUVs)

Efficiency improvements have slowed kWh per vehicle growth

Demand continues to rise rapidly due to volume growth

- Graphite Intensity per kWh: Graphite remains 95% of all LIB anodes.

Global weighted Avg: .88-.95 kg per kWh

Intensity has stabilized as silicon blends (5-10%) offset pure graphite req.

Silicon-blended anodes est. to reduce graphite to ~.80-.85 kg/kWh by 2030

NMC Chemistries: .85 kg/kWh (pure graphite anode baseline)

LFP Chemistries: .96 kg/kWh (40-45% of global market)

- Graphite demand per EV (kg per vehicle)

EV batteries contain significantly more graphite by weight than any other single material – roughly double required lithium per battery.

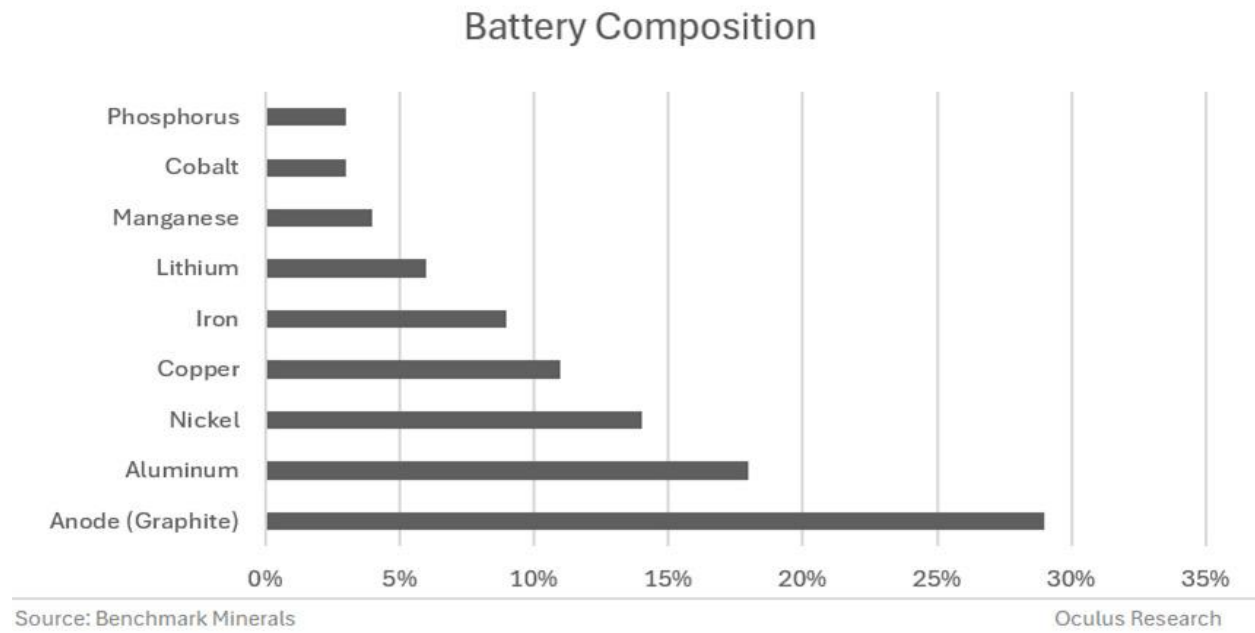
Typical range: 50-100 Kg battery grade (spherical/purified) per vehicle,

Mass market Avg: 55-70 kg (60-80 kWh)

Premium segment: 80-110 kg (90-120 kWh)

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## Anode Share vs Cathode Metals



Anode (graphite) mass exceeds the combined mass of all cathode's active metals in most battery designs. Even if lithium chemistry shifts, graphite remains dominant in most configurations. Cathode metals include cobalt, nickel, manganese, iron, and aluminum, often arranged as complex oxides.

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### 3.4 Stationary Storage Optionality

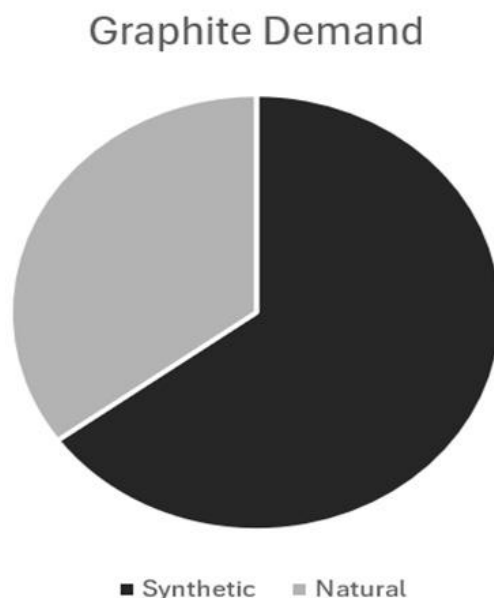
Stationary storage applications are emerging growth segment in graphite demand, particularly in LFP (lithium-iron-phosphate) batteries and grid-scale deployments.

- LFP chemistry expansion: Heavily reliant on graphite anodes. Expansion into stationary uses accelerating demand.
- Grid storage growth scenarios: Net-zero targets storage capacity of 680 GWh by 2030 – 15x increase from current levels.
- Long-duration storage implications: Long-duration storage heightens graphite intensity. Volume requirements for grid-scale storage escalate supply risks – increasing emphasis on diversification of supply chains.

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### 3.5 Synthetic vs Natural Demand

The graphite market is undergoing a structural shift, with synthetic graphite growing dominance in high-performance applications due to its consistency and purity. Natural graphite growth is fueled by cost-sensitive and environmentally focused sectors.



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Source: Mordor Intelligence

Oculus Research

- **Synthetic Graphite:**

Accounts for est. 60-70% of total market share driven by LIB anodes, electrodes, and refractories that require stable, high-purity graphite.

- **Natural Graphite:**

Primary demand is driven by industrial applications with less stringent purity requirements. Demand growth (est. 15-20% CAGR) in batteries anode segment is growing - driven by purification improvements- closing the gap between synthetic quality. Carbon emissions targets are expected to fuel natural graphite's share of total demand due to synthetic's high carbon footprint.

• **Blends:** (synthetic/natural): Emerging trend (batteries), balancing performance and costs.

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### 3.6 Elasticity & Substitution

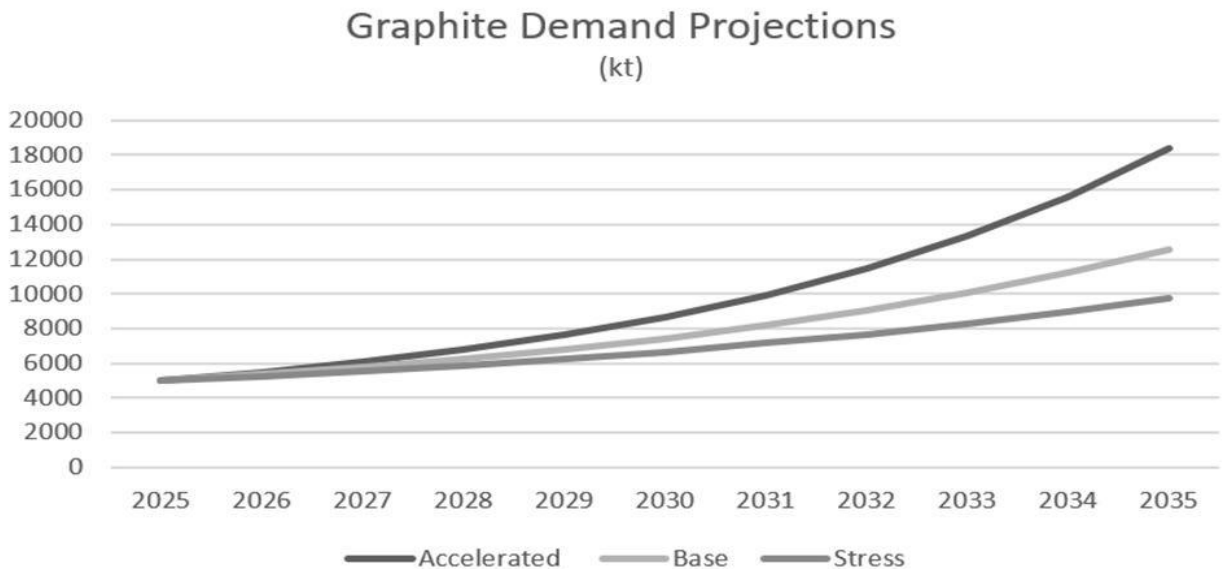
Key substitution risk is in displacement from silicon anodes – promising higher energy density but face expansion and cycling challenges leading to blended adoption – not outright replacement.

- Silicon anode blending trends: Silicon anode blending trends: Blended Anodes comprised of 5-10% silicon prevail – boosting capacity and enhancing range.
- Graphite displacement probability: Current probability is sub 20% due to silicon’s 60-80% Coulombic efficiency and manufacturing scale issues. Blends are currently limited to 10-20% graphite substitution.
- Realistic penetration timelines: Blended silicon anodes are currently entering mass production – projected to capture 5-15% market share by 2030.

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### 3.7 Demand Projections

Demand projections are constructed using a bottom-up framework incorporating electric vehicle adoption trajectories, energy storage segment growth, battery capacity trends, graphite intensity per kilowatt-hour, and baseline industrial demand growth. Scenario variation reflects differing assumptions regarding EV penetration rates, energy storage system demand, battery chemistry composition, and industrial production growth.



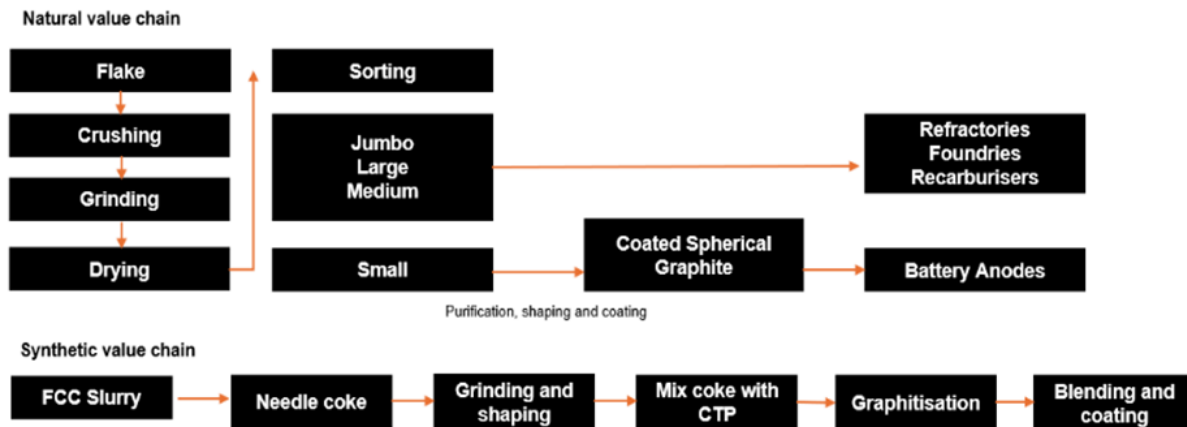
### Key Variables:

- EV production/Global sales trajectory
  - Graphite kg per EV (battery chemistry)
  - Energy Grid demand growth (energy storage)
  - Industrial demand (Economic factors)
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## 4. Supply Analysis — Elasticity & Constraint Mapping

Graphite supply is largely controlled by China, who dominates natural ore production, global ore processing, and synthetic graphite production. While new, geographically diversified ore production is emerging, it remains dependent on China for processing and refinement. Long lead times, capital and energy intensity subdue new ex-China processing capacity.

### Supply Chain



Source: OIES

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### 4.1 Primary Natural Graphite Production

· **Cost Curves:** China dominates with low sustaining costs (USD 257/t) - Natural graphite concentrates avg USD 400-600/t. Emerging producers (Africa) have higher AISC but competitive in premium grades/segment.

- **Country-level concentration:** Concentrated in China (80%) and Africa with Madagascar, Mozambique, and Tanzania largely accounting for remaining (20%)
- **Reserve vs production mismatch:** Global reserves stand at and est. 300 Mt

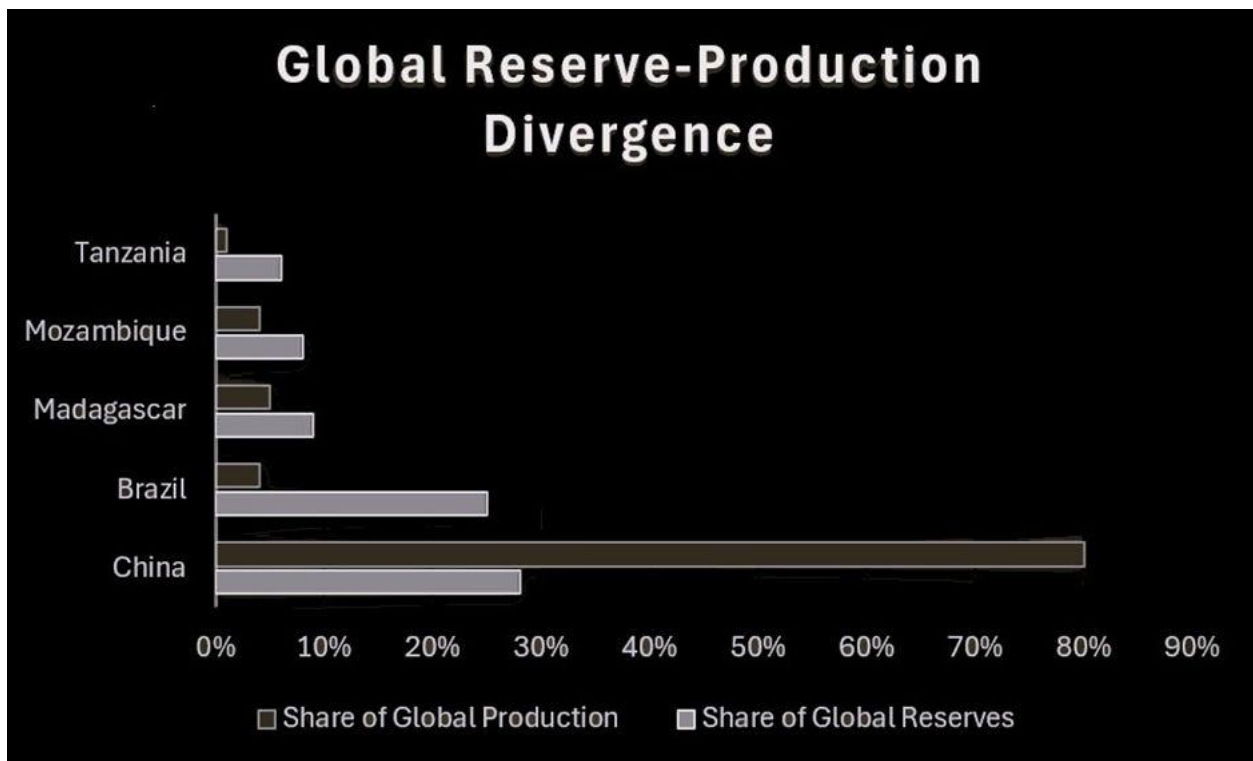
China 28% reserves- production 80%

Brazil 25% reserves - production 4%

Madagascar 9% reserves, production 7-13%

Mozambique 8 % reserves, production 5%

Tanzania 6% reserves, productions 1-2%



- **Political risk exposure: High** Supply is concentrated in two regions exposing the supply chain to considerable geopolitical shocks.

China: Export controls

Africa: Political instability (Mozambique insurgency)

· **Policy implications:** Sustainability and diversification policies (EU/US) incentivize increasing natural graphite production. Tariffs on Chinese imports create premiums for ex-China supply. Both act as potential benefits for natural graphite and ex-China natural graphite producers/miners.

· **Carbon intensity:** Low (significantly less than synthetic). 5-10 kg CO<sub>2</sub> eq./kg (mining/purification)

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## 4.2 Synthetic Graphite Production

- **Cost curves:** Production costs avg 35-40% higher than natural refinement due to energy intensity/raw materials (needle coke). Regional cost curve divergence: - China OPEX USD 3,000-5000/t. Ex-China OPEX USD 7,000-10,000/t
  - **Country-level concentration:** Overwhelmingly dominated by China (95%)
  - **Political risk exposure: Very High** – Supply controlled by China.
  - **Policy implications:** Decarbonization mandates could cut synthetic graphite's footprint by est. 50%
  - **Carbon intensity:** High – 20-41 kg CO<sub>2</sub>-eq./kg due to high-temp graphitization consuming 6,500 kWh/t and fossil-based feedstocks. Plant-specific variations significantly lower (7-13 kg CO<sub>2</sub>-eq./kg)
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### Synthetic Production Considerations:

- **Petroleum coke feedstock Sensitivity:** High - Petroleum needle coke is 70-80% of battery-grade synthetic graphite. China/US control key supply.
  - **Energy cost sensitivity:** High – processing is energy intensive. China dominates synthetic production due in part to lower energy costs (subsidies).
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## 4.3 Processed Graphite Bottleneck

This segment of the supply and the supply chain is overwhelmingly concentrated in China, leaving the supply chain susceptible to significant disruption.

- Spherical graphite refining concentration (LIB grade -primary demand growth driver)

China controls 85-90% of spherical graphite refining capacity

China controls 95% of synthetic graphite production capacity

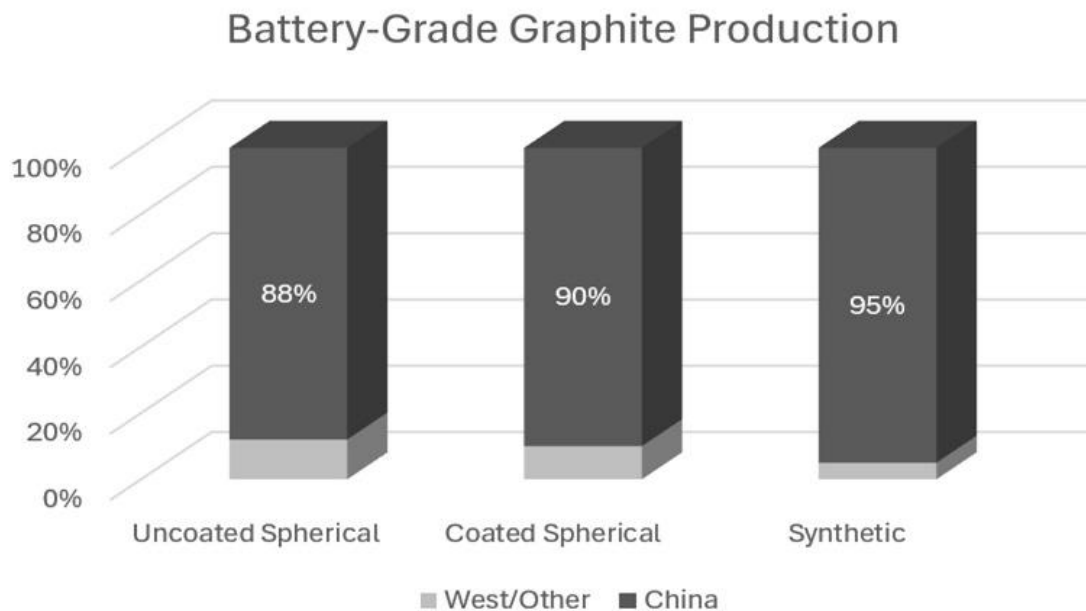
Indonesia recently contributed to 20-25% of US battery-grade graphite imports as Chinese companies diversify regional processing capacity to circumvent tariffs and geopolitical tensions.

(As of October 2025, China’s Ministry of Commerce (MOFCOM) implemented new rules that directly affect overseas manufacturing hubs like Indonesia)

- Capex requirements for Western replication

Purification 99.95% purity demands spheronization/milling.

EU/US capex approx. USD 20,000-50,000/tpa capacity.



Source: Benchmark Minerals Intelligence

Oculus Research

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#### 4.4 Project Pipeline & Permitting Risk

The West is focused on expanding the existing supply chain to diversify away from China dominance and reliance with emphasis on spherical graphite, processing facilities, and vertically integrated production/producers.

- New Western projects

Graphite One: Graphite Creek mine in Alaska, Processing plant in Ohio

Nouveau Monde: Mine and Battery materials refining plant (Canada)

Upgrades to existing mines and processing in Australia and Mozambique.

- Timeline realism

Historically, new developments hit 5+ year (avg) delays from feasibility to production

- Capex intensity

Refining capacity drives 60-70% of capex far exceeding that of mining. Graphite One's (US) processing facility accounts for approx. 78% of its est. \$5 billion CAPEX.

· Environmental constraints

ESG scrutiny increases delays and extends timelines due to complications with water use, tailings, etc.

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## 5. Cost Curve & Margin Sensitivity

### 5.1 Global Cost Curve (Natural & Synthetic)

Natural graphite has a lower baseline cost (USD 500-1,000/t) because of mining simplicity over synthetic graphite (USD 3,000-20,000/t) due to synthetic's energy intensive processing requirements. Synthetic graphite and high-grade natural graphite carry a premium due to their purity and demand in specialized applications like anodes.

- **Low-cost Jurisdictions**

**China** –Lowest – exerts pressure on ex-China producers with higher AISC Flake FOB set at \$830/t, Spherical Graphite (99.95%) FOB \$2,000/t avg

**Madagascar/Mozambique** emerging producers but 20-30% pricier vs China

**Indonesia** is emerging as significant low-cost graphite processor , specifically for battery anodes, due to massive investments from Chinese companies aiming to bypass U.S. trade restrictions.

- **High-Cost Jurisdictions**

Ex-China producers' costs avg double the costs of China. Western producers face many challenges: High operating costs and capital intensity, energy costs, long qualification timelines, technological expertise scarcity, in addition to environmental and regulatory standards compliance burdens.

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## **5.2 Energy Sensitivity Modeling**

Synthetic graphite exhibits heightened sensitivity to energy inputs due to electricity/graphitization comprising 60% of OPEX. While Natural graphite is less sensitive, spheronization (refining) adds 20-30% power reliance. Ex-China producers have heightened sensitivity to energy volatility vs subsidized producers in China.

### **Synthetic Graphite Cost response to:**

- **Natural gas**

Minor – 5-10% of costs but indirect impact via oil correlation.

- **Electricity**

10% increase would result in 15-20% cost increase in production in China (primary producer)

- **Oil**

Petroleum Coke Sensitivity (synthetic) - Approx 40% of synthetic production costs. 10% change in Oil = 4-5% change in production cost.

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## **5.3 Pricing Regime History**

The graphite market is relatively stable due to China's dominance and ability to adjust output to match demand. For this reason, the market has not experienced acute shortages like lithium in recent years. While the market has ranged from well to over supplied, forecasts indicate modest firming in 2026 due in part to U.S. tariffs on Chinese anodes driving a shift toward ex-Chinese supply.

- **Historical Graphite Price Stability:**

2020-2021: (Covid Recovery) Demand briefly dipped 5-10% due to industrial slowdowns but quickly recovered in part to EV production rebounds.

2022-2023:( EV demand surge) Supply expansions in China (20-30%) absorbed increased demand keeping volatility low.

2024-2025: (Oversupply lows) Weak steel/refractory demand countered battery segment growth leading to a surplus – 1.5-1.8 M t. Fla

Early 2026: (Modest Firming) prices are resilient, with regional divergences.

- **Current Graphite prices:**

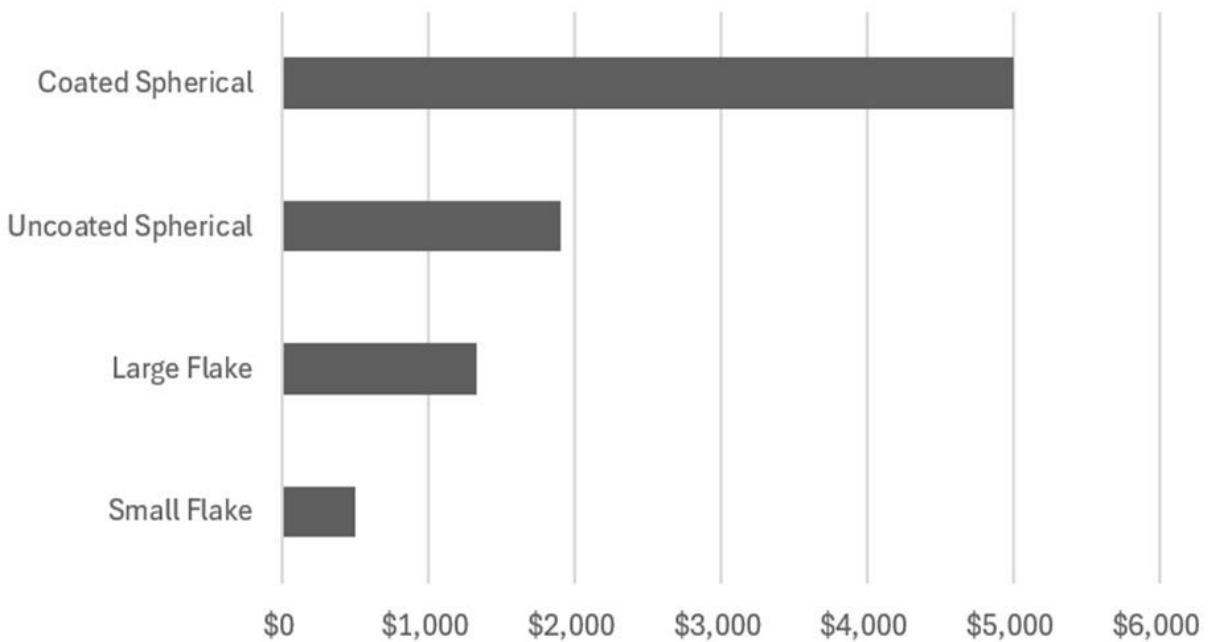
Small Flake: USD 400-550/t

Large Flake: USD 1,250-1,400/t

Uncoated Spherical: USD 1,800-2,000

Coated Spherical: USD 3,000-7,000

## Graphite Mesh Type & Grade Benchmarks



Source: Benchmark Mineral Intelligence

Oculus Research

(Prices per region vary. Over-supply from China pushes averages down. Future Western qualified supply of coated spherical is often modeled at USD 10,000 avg.)

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## 5.4 Inventory & Market Positioning

Currently, the market is characterized by oversupply with elevated levels of inventory. Recent policy driven trends have increased stockpiling by OEMs by 20-30%, supporting a firmer supply-demand balance.

### Visible Inventory

- Visible inventories in the graphite market are limited and fragmented with no centralized exchange-traded stockpiles. The market is primarily traded via bilateral contracts – not futures markets rendering 70-80% of global volumes unobservable. This dynamic contributes to graphite’s price stability – as off-exchange stockpiles absorb demand fluctuations without public signaling.
- China, who holds the bulk of producer inventories carries surpluses of 3-6 months of forward to demand. Mozambique and Madagascar report lower stockpiles.
- EV and battery OEMs exhibit cautious, forward-looking inventory strategies in 2026, prioritizing supply security amid tariffs/diversification mandates- maintaining 1-3 months of production.

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## 5.5 Structural reasons for relative price suppression

- Supply Elasticity: Graphite’s mature supply chain allows for rapid capacity scaling.
- Demand Diversification: Currently, EV demand (highest growth) segment is only 20-30% of demand. Industrial demand weakness counters spikes in the lithium-ion-battery segment.
- Geopolitical: Geopolitical risk is concentrated in Chinese Supply, which, until recently, has offered stability to the market. In contrast, fragmented supply chains (lithium) are prone to a wider range of geopolitical risks and subsequent supply shocks.
- Trade Barriers: Tariffs/export controls create premiums but encourage dumping (China) suppressing global averages.
- Cost Advantages: China’s substantial cost advantage deters investment further fueling China’s dominance and supply control/pricing power.

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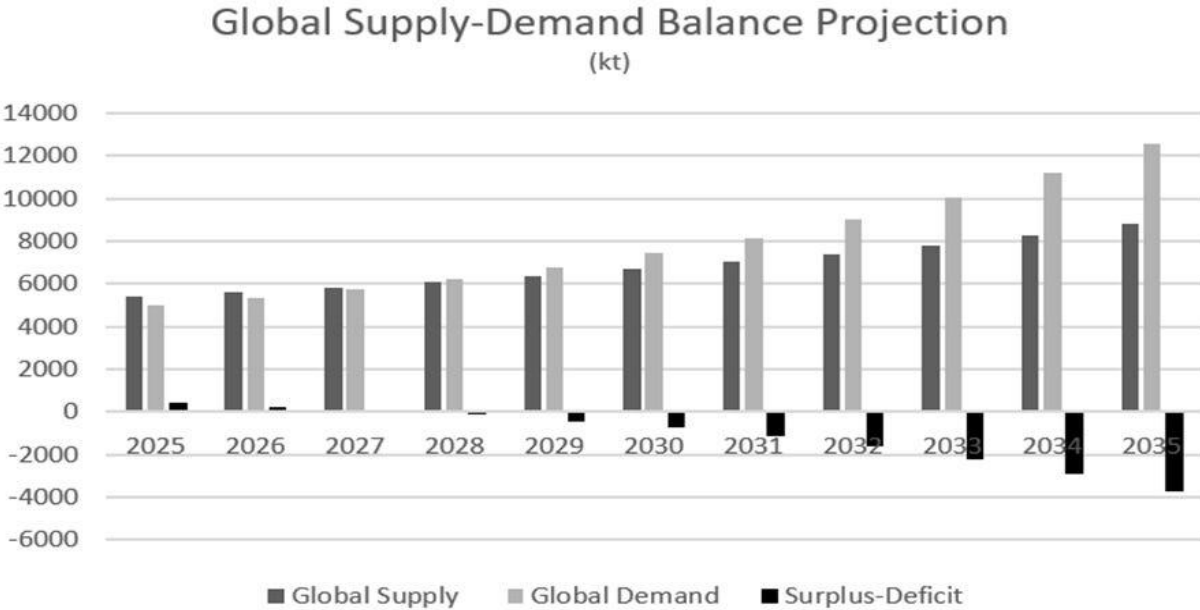
## 6. Market Balance & Scenario Outlook

In the mid-term, the global graphite market is well supplied. The global balance is projected to firm coming into 2030, leading to potential deficits in the outer years when legacy industrial demand segments are eclipsed by emerging battery anode demand.

While current global supply-demand balance remains positive, the current Western supply-demand balance is in a significant deficit. This deficit is projected to persist despite significant growth in domestic production capacity over the next decade.

Regional supply-demand dynamics render the Western market susceptible to significant supply shocks.

### 6.1 Global Graphite Supply-Demand Balance (Base Case)



Source: BMI, IEA

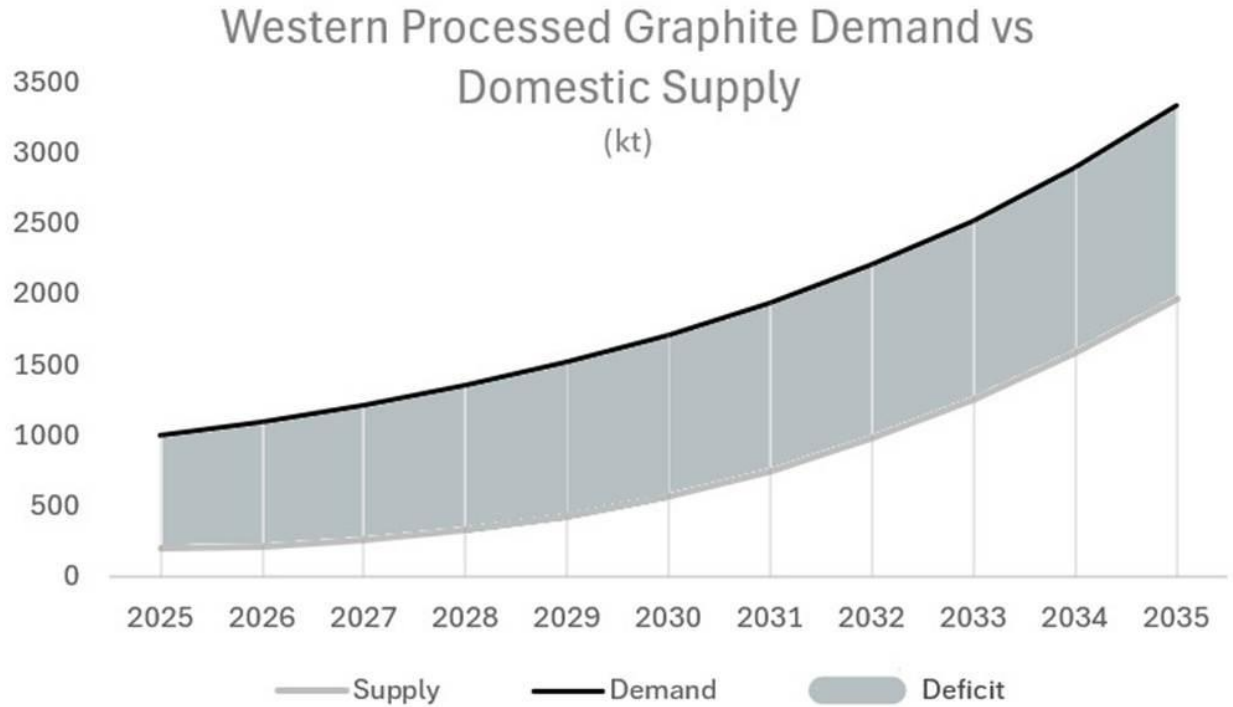
Oculus Research

#### Assumptions:

In the mid-term supply is elastic. China currently holds excess capacity and can ramp up production to meet growing demand. In the outer years, incremental demand will outpace existing capacity and new production capacity timelines. While the projected total global graphite demand CAGR is 9% (BMI), our model incorporates a steadily increasing CAGR as Battery-Anode demand's CAGR (20%) increases in weight of total CAGR calculations.

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## 6.2 Western Graphite Supply-Demand Balance



Sources: BMI, IEA, USGS

Oculus Research

### Assumptions:

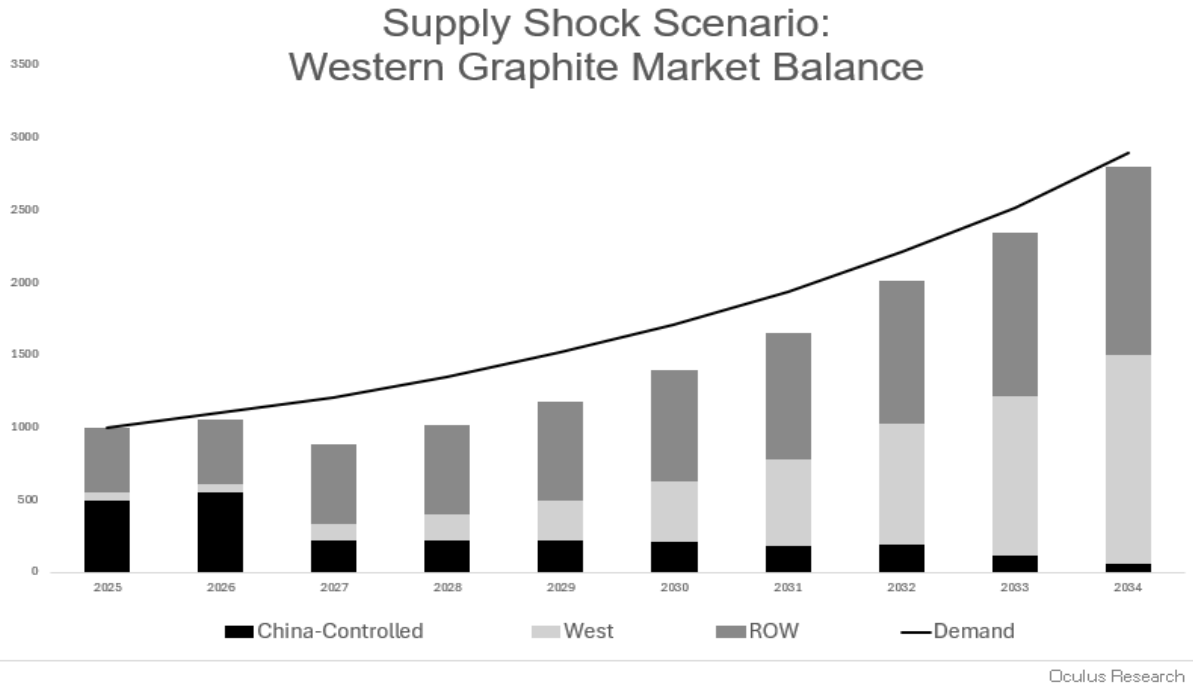
Prevailing models project a Global 9% CAGR for total graphite demand. Western graphite demand, however, is projected to be significantly higher than the global average through 2035, specifically in processed battery-grade demand.

Western Supply growth is modeled based on announced project pipelines and planned processing capacity expansions from emerging ex-China graphite producers. Capacity additions are incorporated according to publicly disclosed development timelines and expected commissioning dates.

The supply-demand balance is projected to remain in a deficit despite significant investment and increases in domestic production.

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### 6.3. SUPPLY SHOCK SCENARIO



#### Assumptions:

This scenario models a supply disruption in 2027.

China, and Chinese controlled companies currently control 50%+ of Western battery-grade graphite imports. This scenario models a 60% decline in Chinese and Chinese controlled exports (including Indonesia's 25%) of battery-grade graphite to Western markets due to export licensing restrictions (scheduled to be reimposed - Nov 2026).

Western supply (announced capacity expansions) begins to close the supply-demand gap in the outer years.

Demand follows accelerated electrification scenario.

## 7. Geopolitical & Policy Overlay

The geopolitical and policy landscape for graphite is being reshaped by escalating US-China trade tensions and subsequent diversification mandates in the West. Graphite's emerging importance in EVs and energy storage are fueling diversification imperatives. China's control of refined and processed graphite poses a significant risk to the global supply chain.

### 7.1 China

- Export controls have been intensifying since 2023 and signal the potential for long-term restrictions and supply disruptions.
- China's REE controls provide a blueprint for graphite supply risks. In addition to domestic export licenses/restrictions, China affected extraterritorial licenses for products containing Chinese REE or using Chinese technology.
- In 2024 China began Graphite export licensing requirements targeting defense application demand and dual-use items (civilian/military applications). China suspended restrictions until November 2026. Reimplementation of the graphite restrictions could restrict 35-50% of U.S. imports.
- China placed restrictions on Japan, targeting Japanese firms- reducing dual-use exports by 25-50%
- Major Chinese producers like BTR have begun shifting exports to plants in Indonesia to circumvent U.S. trade restrictions, explaining the massive growth in Indonesian import shares (20-25% of US battery-grade graphite imports).

(As of October 2025, China's Ministry of Commerce (MOFCOM) implemented new rules that directly affect overseas manufacturing hubs like Indonesia)

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### 7.2 US / EU Policy

- U.S. imposed a preliminary anti-dumping duty (93.5%) on Chinese battery-grade graphite in July 2025. Currently, importers are posting cash deposits on the duties that will convert to payments if the ICT (U.S. International Trade Commission) affirms the measure. Affirmation would lock in the measure for a minimum of 5 years and create a structural premium for battery-grade graphite in the U.S.
- EU enacted anti-dumping duties on Chinese graphite electrode systems ranging from 25.5%-74.9. In 2026 the EU's Carbon Border Adjustment Mechanism will begin

enacting “climate tariffs”: charging importers based on the carbon intensity of goods. Implementation will increase the cost of China’s synthetic graphite due to its energy-intensive processing.

- U.S. IRA is beginning to require that 60-80% of battery minerals sourced from U.S. or FTA partners by 2026-2027.
- Impending FEOC exemptions expiries has shifted OEM behavior toward stockpiling (20-30% YoY increase).
- Graphite is on the USGS’s critical mineral list (100% import reliant) and EU’s CRMA list (strategic raw material for batteries).
- U.S.’s recent “Project Vault” includes graphite. EU’s “Resource EU Plan” is funding 47 projects, including a graphite project in Ukraine. U.S. has implemented tax credits and BIL grants to incentivize investment in domestic production.

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### **7.3 Strategic Stockpiling**

Strategic stockpiling of graphite could distort markets, repeating the effect it had on copper in (2025-2026) in which U.S. accumulation drove prices to USD 13,000/t.) turning copper’s 2025 surplus into a deficit. Graphite’s concentration risk (China) could exacerbate volatility if a similar stockpiling effort repeats in graphite.

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## **8. Risk Framework**

### **8.1 Downside Risks:**

- EV demand slowdown: Each 10% reduction in EV demand = approx. 5-8% battery-grade graphite demand. Macroeconomic headwinds (consumer affordability pressures) represent downside risk to EV sales projections.
- Silicon substitution acceleration: Acceleration of silicon-graphite composite anodes could reduce graphite intensity per kWh reducing demand.
- Synthetic oversupply: China oversupply could continue to pressure prices downward and delay ex-China project economics.
- Policy reversal: Reversal of export restrictions (China) and easing of tariffs (US) could slow diversification efforts resulting in continued reliance on Chinese supply and pricing power.

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## 8.2 Upside Risks

- China export restrictions: Reinstatement of export licensing/controls (suspended for U.S. until Nov 2026) poses a significant supply disruption and upside trigger – potentially restricting 30-50% of global battery grade graphite supply flows.
- If the preliminary anti-dumping duties of 93.5% on Chinese battery-grade graphite (active anode material) are confirmed by US International Trade Commission (expected in March 2026) would lock in a structural premium in the U.S. market.
- Energy shock impacting synthetic: A spike in energy costs would significantly raise synthetic production costs favoring natural and widening its premium.
- Faster-than-expected EV adoption: Each 5 million EVs adds approx. 250-500 kt graphite demand. Policy boosts (subsidies/mandates) and consumer demand shifts could accelerate EV demand.
- Refining bottleneck persistence: Western project hurdles could prolong import reliance and amplify disruption risk.

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## 9. Strategic Conclusion

Global graphite reserves are abundant. Unlike lithium, nickel, or cobalt, graphite is not geologically scarce. From a resource perspective, the market faces little risk of depletion or structural ore shortages.

The strategic constraint lies downstream.

Graphite supply is limited not by mining capacity, but by the industrial processes required to transform raw material into engineered graphite suitable for battery anodes and specialized applications. These processes—particularly spherical graphite purification, shaping, and coating—are capital intensive, energy intensive, and technically complex.

Today this capability remains overwhelmingly concentrated in China.

While new mining projects can bring additional graphite ore to market, the midstream conversion infrastructure required to produce battery-grade material develops far more slowly. Refining facilities require significant capital investment, long development

timelines, and specialized technical expertise that Chinese producers have accumulated over decades.

Synthetic graphite reinforces this concentration. The high-temperature graphitization process requires substantial electricity inputs and petroleum-derived feedstocks, areas where Chinese producers benefit from both scale and subsidized energy costs.

As a result, the global graphite market is characterized by abundant resources but highly concentrated industrial capacity.

Under normal conditions, this concentration allows Chinese supply to expand relatively elastically, anchoring prices and limiting the likelihood of sustained shortages driven purely by demand growth.

However, the increasing politicization of critical mineral supply chains introduces a new dimension of risk. Export restrictions, supply chain localization policies, and geopolitical tensions could expose the market to episodic disruptions in engineered graphite supply.

In this context, graphite's strategic importance is not defined by geological scarcity but by its role as a critical industrial bottleneck within the electrification supply chain.

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## **9.2 Positioning Implications**

The graphite market currently sits at the intersection of two competing structural forces: accelerating battery demand and highly concentrated processing capacity. While global graphite reserves are abundant, the supply chain remains overwhelmingly dependent on Chinese spherical graphite processing, creating a structural bottleneck within the battery materials ecosystem.

Under baseline conditions, this concentration acts as a stabilizing force, allowing Chinese producers to expand output and moderate price spikes as demand increases. However, the same concentration introduces a potential policy-driven dislocation scenario, particularly as Western governments accelerate supply chain localization efforts and trade tensions with China persist.

For investors, this dynamic suggests that graphite exposure may function less as a traditional scarcity-driven commodity thesis and more as a geopolitical supply chain positioning trade. The primary opportunity emerges not from global graphite availability, but from the limited scale and slow development timeline of non-Chinese anode processing capacity.

Companies capable of delivering integrated mine-to-anode supply chains within Western jurisdictions may capture disproportionate strategic value should export restrictions tighten or policy drive battery manufacturers accelerate supplier diversification.

Positioning should focus on processing capability, jurisdictional alignment, and downstream integration, rather than purely on graphite resource scale.

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### **9.3 Key monitoring indicators:**

- Expansion timelines for Western spherical graphite processing facilities
- Chinese export license policy and enforcement trends
- Final determination of ITC of U.S. anti-dumping duties on Chinese supply
- Energy price shocks
- Adoption rates of Silicon anode blends and graphite percentage changes