

INVESTMENT CHALLENGES FOR U.S. PROJECTS

Graphite, essential in various industries, is obtained both naturally from ore deposits and synthetically from amorphous carbon sources like petroleum coke. Natural graphite undergoes flotation for purification, while synthetic graphite is produced through high-temperature treatment, yielding a pure, consistent material. Valued for its conductivity and thermal resistance, graphite is used in electrodes, refractories, and lithium-ion battery anodes, enhancing energy storage and charge efficiency. With the rise in electric vehicles and electronics, sustainable sourcing of natural graphite and advanced production of synthetic variants are crucial to meet increasing demands while minimizing environmental impacts.

Applications requiring graphite.

China's Influence	Mining (%)	65.4%
	Processing (%)	92.0%
	Export Rules	Restricted
Electric Vehicles (incl. batteries)		✓
Aerospace		
Defense Technologies		✓
Mobile Electronics (incl. batteries)		✓
Satellites/Space (incl. batteries)		✓
Robotics (incl. batteries)		✓
Wind Turbines		
Solar Panels		
Nuclear Power		
Energy Storage		✓
Grid Infrastructure		
LED Lighting		

Risks to establishing domestic graphite processing.

Feedstock Scarcity	Mild	Heavy reliance on imports, particularly from China, and the growing demand competition limits availability of domestic feedstock for processing.
Competition for Labor	Major	Labor availability issues arise from niche skill scarcity, superior options in competing industries, and remote operational areas.
Need for Technical Expertise	Mild	Scaling complexity is due to advancing separation of flake graphite because of its layered structure, purification for battery-grade quality, and developing efficient recycling from lithium-ion batteries.
Immature Market	Major	Volatile and opaque pricing, lack of domestic commercial and technical counter-parties, high costs due to underdeveloped economies of scale, all constrain industry development.
Lack of Price Competitiveness	Major	Price competitiveness in graphite is compromised by China's dominance and economies of scale, which leverages extensive mining and low regulatory costs
Lack of Investor Interest	Major	Investor caution is driven by high capital needs, competition from China, demand volatility, and market opacity.

Overview of graphite processing.

Upstream Material	Common Mid-Stream Technologies	Mid-Stream Product Outputs
Natural graphite-containing ore	<ul style="list-style-type: none"> Physical Beneficiation [crushing, milling, flotation] Pyrometallurgy and Hydrometallurgy [thermal and chemical purification] Shaping and Sizing [milling, spheroidization] Surface Coating 	Higher-purity shaped graphite or graphene
Petroleum coke, coal tar pitch, and other high-carbon materials	<ul style="list-style-type: none"> Physical Beneficiation [mixing raw materials] Pyrometallurgy [carbonization, graphitization] Shaping and Sizing (milling, spheroidization) Secondary Treatments, if needed [oxidation, surface functionalization] Pyrometallurgy and Hydrometallurgy [thermal and chemical purification] Machining and further shaping Surface Coating 	Synthetic graphite