

INVESTMENT CHALLENGES FOR U.S. PROJECTS

Nickel, a linchpin in modern technology, is mined from ores like laterite and sulfide. After extraction, these ores are crushed, ground, and processed through magnetic separation and flotation to produce a nickel-rich concentrate. Smelting in flash furnaces yields a matte, which is further refined using pressure leach techniques and high-temperature refining to surpass 75% nickel content. The final purification, including electrorefining and the Mond process, results in nickel exceeding 99.98% purity. Essential for lithium-ion batteries in electric vehicles, nickel enables higher energy density and efficiency. It's also key in manufacturing durable alloys for renewable energy infrastructure. With the rise of EVs and sustainable power sources, recycling nickel from end-of-life products is vital for resource conservation and environmental sustainability, underpinning a stable, circular economy.

Applications requiring nickel.

China's Influence	Mining (%)	3.3%
	Processing (%)	35.0%
	Export Rules	
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 nickel processing.

Feedstock Scarcity	Major	Dependence on imports from politically sensitive areas like Indonesia and Russia, environmental constraints on new mining, and global competition hinder feedstock sourcing.
Competition for Labor	Major	Labor shortages are due to specialized skill needs, attractive alternatives, and geographical mismatches.
Need for Technical Expertise	Mild	Improvements in high-pressure acid leach (HPAL) techniques and refining electro-winning for pure nickel production must be aligned with existing infrastructure and new recycling efforts.
Immature Market	Minor	Cost competitiveness against global rivals, who benefit from significant economies of scale, is the primary market concern.
Lack of Price Competitiveness	Major	Price competitiveness in nickel is impacted by Indonesia and Russia's lower production costs and favorable regulatory environments.
Lack of Investor Interest	Mild	Investor caution stems from high start-up costs, competition from Indonesia and Russia, and demand fluctuations in steel and battery sectors.

Overview of nickel processing.

Upstream Material	Common Mid-Stream Technologies	Mid-Stream Product Outputs
nickel-containing ores	<ul style="list-style-type: none"> ▪Physical Beneficiation [crushing, grinding, screening, flotation, magnetic separation, gravity separation] ▪From Sulfide Ore: <ul style="list-style-type: none"> ○Hydrometallurgy and Pyrometallurgy [froth flotation, smelting, leaching, SX, electrowinning] ▪From Laterite Ore: <ul style="list-style-type: none"> ○Hydrometallurgy [high-pressure acid leaching, SX, electrowinning] ▪Electrometallurgy: Electrorefining 	High purity nickel metals, salts, and alloys