

GREEN ENERGY MINERAL: KEY FACTS

Nickel

US CRITICAL MINERAL?

Not yet, but under review for inclusion

MAIN USES IN GREEN ENERGY TECHNOLOGY



Solar



Wind



Energy storage



Geothermal

KEY DEVELOPMENT ISSUES IN MINING



Environment



Governance



Conflict



Land tenure



Leveraging minerals for economic growth (local/national)

DEMAND PROJECTIONS

Nickel is a widely used base metal. About two-thirds of global production ends up in stainless steel thanks to nickel's anti-corrosive properties. For this reason, China is the world's largest consumer of nickel, given its central role in steel production. Nickel is also used in other steel alloys employed in various applications including geothermal plants and wind turbines. However, the bulk of nickel demand from renewables stems from its central role in lithium-ion batteries, forming part of the nickel-manganese-cobalt (NMC) cathode chemistry. By 2050, each year renewable energy manufacturers will use 2,268,000 tons of nickel, or 99% above 2018 global production levels (Hund et al., 2020). Overall nickel demand is set to triple by 2050.

PRODUCTION/RESERVES



Source: OECD

Indonesia was the largest producer of nickel in 2020, with 760,000 tons or 30% of world production. The second largest producer was the **Philippines** with 320,000 tons and the third **Russia** with 280,000 tons. The fourth largest producer is **New Caledonia**, a French overseas territory. Globally there are over 300 million tons of known reserves, not including nickel found on the ocean floor in manganese crusts.

Nickel is classified per its ore and final use. Class I nickel is the purest (above 99.8%) used in applications like batteries and historically is derived from sulfide deposits. Class II nickel is less than 99.8% used in the steel industry and is historically derived from lateritic deposits. Most ores are lateritic. Smelting lateritic ores and refining nickel to Class I requires a complex metallurgical process.

The price per ton of nickel is closely tracked by the LME and has ranged from \$9,594 to \$14,000 between 2016 and 2020. Despite some industry projections of oversupply, nickel has rallied to a record high of \$18,611 per ton in early 2021.

MINING IN USAID-PRESENCE COUNTRIES

The top two producers in the world are **Indonesia** and the **Philippines**, accounting for half of all 2020 production. Both are USAID-presence countries. Other significant producers with USAID presence in decreasing order of 2020 production area **Brazil, Cuba**, and the **Dominican Republic**. Smaller and emerging USAID-presence producers are **Albania, Burma, Colombia, Côte d'Ivoire, Guatemala, Kosovo, Madagascar, Papua New Guinea, South Africa, Zambia**, and

Zimbabwe. Some of the emerging projects have the potential to become major. The Ambatovy project in Madagascar, for example, jointly owned by Japanese Sumitomo Corporation and Korean Resources Corporation, is projected to become the world’s largest lateritic nickel mine.¹

MAJOR INDUSTRIAL COMPANIES	ARTISANAL AND SMALL-SCALE MINING (ASM)
<p>Brazil-based Vale is the world’s largest producer, with mines in Brazil, Canada, Indonesia, and New Caledonia (France), as well as refineries in China, South Korea, Japan, the UK, and Taiwan. Norilsk Nickel is Russia’s top nickel miner and Jinchuan Group is China’s top miner. Switzerland-based Glencore and Australia BHP are also in the top five (NS Energy, 2020b).</p>	<p>None</p>

ISSUES IN USAID-PRESENCE COUNTRIES

Nickel mining poses environmental risks. Processing lateritic deposits, like those that dominate in Southeast Asia and Africa, requires high-pressure acid leaching and deep-sea tailings disposal in order to process to battery-grade purity. This is a particularly important public policy issue in **Indonesia** pitting miners/smelters against environmental activists who are concerned about the effects on the high-value marine ecosystems (Morse, 2020a). As the world’s top producer, Indonesia’s environmental management is under increasing international scrutiny. Processing lateritic deposits to battery grade nickel also requires intense energy usage (Morse, 2021). Environment is also a major issue in the **Philippines**. The country banned new nickel mining projects for nine years under pressure from activists before announcing a reversal in April 2021 in a bid to increase revenues (Crus, 2021).

Environmental concerns can create tensions with surrounding communities. In **Papua New Guinea** (limited presence), a Chinese-owned company spilled toxic waste into the sea in 2019 (Burton & Daly, 2019). The issue has caused tensions with local communities who sued the company in 2020 (Morse, 2020b). In **Guatemala**, similarly, investigative journalists and activists have denounced environmental degradation and human rights violations of indigenous people (Garside, 2020).

Opportunities and challenges around local processing is another issue in Indonesia. Starting in January 2020, Indonesia banned the export of unprocessed nickel ore in order to incentivize local smelting by smelters in three industrial parks. Most smelters in the parks will produce ferronickel or “nickel pig iron” which is semi-processed and used in the steel industry.

Corruption and other governance issues are also a concern, including the ways in which Chinese nickel mining companies in **Burma** have facilitated the military junta’s recent crackdown on protests (Daly & Zhang, 2021). In **Zimbabwe**, similarly, activists have scrutinized the purchase of the country’s top nickel mine by a presidential advisor (Ndlovu, 2019).

MINE DEVELOPMENT AND SUPPLY CHAIN DYNAMICS

Nickel is a more complex supply chain than other base metals like copper due to different deposits and processing techniques depending on end use. As sulfide deposits decrease against increasing overall demand, the environmental impacts of more complex lateritic deposit processing will increase. Several frontier nickel mining projects have taken significant losses due to these complexities. The increasing scrutiny over these practices in Southeast Asia in particular is an important factor.

The overall nickel sector is characterized by likely oversupply with prices at historic highs due to speculation around the energy transition as well as post-COVID recovery expectations. The price is expected to decrease as the market takes into account supply. Nickel prices are also set to become increasingly decoupled from China as the country is reportedly become self-sufficient with regards to its metal nickel needs (Hu, 2020).

ORGANIZATIONS AND INDUSTRY GROUPS

The **Nickel Institute** is an industry group consisting of primary nickel producers from around the world (Nickel Institute, n.d.). The **International Nickel Study Group (INSG)** is an intergovernmental organization producing studies and data on the sector.

¹ See the Ambatovy project page <https://ambatovy.com/ang/>