

With increased demand for nickel ore by new energy, how to ensure the minimum ecological loss?

By WEN Bo¹

Abstract: The development of new energy vehicles relies on long-range EV batteries. The increase of nickel content in batteries can achieve an increase in range. Indonesia has the world's largest nickel resource and annual production, and many of these nickel reserves are under tropical forests. Nickel mining poses a serious threat to rainforest ecosystems. Countries should recognize the resources from “urban mines”, and provide financial and policy incentive.

Key words: New energy vehicles, critical minerals, rain forests, nickel ore, urban mines

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Tropical forests are vulnerable to the environmental impacts of mining activities. Current and projected growth in the demand of critical minerals such as nickel poses a threat to the continued conservation of tropical rain forests. Mining-related deforestation destroys the carbon storage capacity of tropical forests, threatens key biodiversity areas, as well as the livelihoods of indigenous peoples and local communities. Moreover, the high density of wetlands and rivers in tropical areas increases the probability of pollution of water by toxic substances, such as the acids used to separate the metal content from the mined crude ore. The loss of forest cover and inadequate regulations of mining practices can also cause landslides that negatively affect local communities.

New energy vehicles trigger a surge in demand for nickel metal

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Chinese firm CATL and Ford Motor are joining hands to build a new lithium battery plant in Michigan, USA. As the world's leading battery manufacturer, CATL will help Ford boost its electric vehicle production and cut manufacturing costs. Based on the new U.S. regulation "Inflation Reduction Act", Ford can also get U.S. government subsidies for new energy vehicles, as well as considerable subsidies for U.S. domestic production and assembly of batteries. Consumers will also receive subsidies for purchasing electric vehicles that meet certain requirements.

The manufacturing and production of electric vehicle batteries requires not only leading technology, but also nickel and lithium ore resources. Nickel is an important mineral for batteries, electroplating and steel making. Nickel is needed for coin minting, electric vehicles, wind turbine manufacturing and nuclear power plant construction, and it is also used to make stainless steel alloys that are resistant to corrosion and extreme temperatures. With the development of new energy vehicles, the demand for high nickel ternary lithium batteries is becoming increasingly strong. The increase in the composition of nickel in ternary lithium batteries can increase the driving range of vehicles.

Both the U.S. and China lack nickel deposits, which makes the nickel supply chain of both countries only extend overseas. In order to prevent global warming, humans must transition from fossil fuels to renewable energy as quickly as possible, while ensuring that damage to nature, biodiversity, and humans must be kept to a minimum.

Ecological challenges in Indonesian nickel ores

With about 21 million tons of nickel resources, Indonesia holds the world's top rank in terms of nickel resources reserves and annual production, making it a hot spot for battery manufacturers and material companies.

Nickel, like palm oil, is the new gold. Nickel mining is a significant contributor to Indonesia's GDP. In 2020, Indonesia was the world's largest nickel producer producing approximately 800,000 metric tons, and home to the world's largest nickel deposit. According to data from the Central Statistics Agency of Indonesia, the mining and



quarrying sector, which includes nickel mining, contributed 10.21% to Indonesia's GDP in 2020. The industry has grown rapidly in Indonesia due to the increasing demand for electric vehicle batteries.

Nickel mining is located in North Sulawesi, where several large nickel mining companies operate. These are Vale Indonesia, the Brazilian mining giant Vale subsidiary, and PT ANTAM Tbk, a Indonesia state-owned mining company. Other significant Indonesian nickel mining industry players include Harita Group, Gag Nickel, and Indonesia Asahan Aluminium (Inalum). Although the scale is smaller than in North Sulawesi, some nickel mines exist in Tanah Papua, the island with a large intact contiguous forest in Indonesia, for nickel mining in Raja Ampat.

Papua has an enormous nickel deposit. The Weda Bay nickel deposit, owned by Eramet, a French mining company, and its Indonesian partner PT Weda Bay Nickel, contains over 9 million tons of nickel in estimation, making it one of the largest undeveloped nickel deposits in the world. Other smaller nickel deposits are also located on Gag Island, owned by Harita Group, an Indonesian mining company.

Since 2009, IUP (mining business licence) cannot be granted to foreign entity, but only local one. But IUI for smelter can be granted to foreign entity. So there are 2 permits on upstream and downstream on nickel production, IUP (mining only) and IUI is for smelter only. And IUI allows international or foreign stakeholders.

Most of the nickel reserve in Indonesia which is in eastern part of Indonesia is intact forest area, the remaining contiguous forest in Indonesia. Additionally, this region, including Sulawesi, North Mollucas, West Papua, is rather rich-biodiversity area.

In 2020, Indonesian President Joko Widodo announced a ban on outbound shipments of the metal ore, limiting exports to refined products. The nickel ban is a long sequence of policy process of Indonesia's downstreaming policy on minerals since 2009 based on Mineral and Coal Mining Law (Law No. 4/2009). This policy is not only to do



acquisition of foreign mining companies' Indonesia branch, but aimed to control both upstream and downstream of natural resources.

In the two years since, the value of Indonesia's nickel exports has soared from \$3 billion to \$30 billion and surpassed China as the top nickel producer by 2021. Jokowi's vision is not just to increase tax revenue and jobs, nor is it satisfied with making batteries. Rather, it is counting on Indonesia to become a major manufacturer of EVs.

High-pressure acid leaching (HPAL) technology can effectively refine nickel. However, HPAL is a costly and polluting wet process. Investors are betting on high nickel prices and low ore and labor costs, at the expense of large tropical rain forests and ecological damage, public benefits that are a lower priority for investors and the Indonesian government.

In addition to the destruction of rainforest by mining, the environmental degradation caused by nickel smelting is also manifested in the disposal of tailing. Nickel mine tailing contains other rare earth elements and pollutants, and the local tropical rainforest climate receives frequent rainfall, causing pollution outflows to seep into groundwater or the ocean. Local factories have also been exposed for numerous discharge violations in the disposal of nickel ore waste.

Before 2010, the Indonesian government had no restrictions on the export of raw nickel ore in order to encourage mineral development. After 2010, Indonesia tightened the export of raw ore, including nickel ore. In 2012, the Indonesian government enacted a regulation to provide for a plan to reduce the shareholding of foreign mining companies to domestic investors. In June 2020, 20% of Vale Indonesia's shares were acquired by Indonesia's state-owned mining holding company.

China's nickel resources and carbon neutral

China is a nickel-poor country, with about 4 million tons of nickel reserves, accounting for only 4.4% of the world. However, China is the first in global consumption, so its external dependence is very high.



In 1957, the first nickel mine in China was the discovery of the Lima River nickel mine in Huili, Sichuan. In the following year, Jinchuan Nickel Mine was discovered in Jinchang, Gansu Province, with the largest reserves in China, and Jinchang was thus named “Nickel Capital”. The output of nickel and platinum group metals of Jinchuan Group here used to account for more than 90% of the country’s output, and was the largest nickel and cobalt production base in China. Jinchuan Group, Qinghai Yellow River Mining, Xinjiang Xinxin Mining and other leading enterprises occupy half of the domestic nickel market. The development of nickel mines in these ecologically sensitive and fragile areas in the northwest does require effective ecological protection measures. Gansu, Qinghai and Xinjiang are the ones with huge potential for solar and wind energy, given their geographical and climatic advantages, mining enterprises with electricity to effectively use these renewable energy sources, can significantly reduce carbon emissions.

Nickel mining itself causes ecosystem damage, and the process of mining and smelting nickel is also energy intensive. The unit carbon emission of nickel products is in the range of 10-16 tons of carbon dioxide equivalent, second only to aluminum, which is the second highest carbon emission per unit product among non-ferrous metals. In the context of national requirements for carbon neutrality and carbon peaking, Chinese domestic nickel producers should start low-carbon transition as early as possible to reduce greenhouse gas emissions in the production process of nickel products.

For example, nickel-related companies can set short-, medium- and long-term emission reduction targets to reduce carbon emissions by improving installations and systems, building energy recovery devices, and reducing electricity consumption. One is to cooperate with the requirements of the double carbon target of the province where they are located, and then to increase production and reduce production costs by reducing the carbon emissions per unit of product.

The new EU battery regulation requires battery manufacturers of new energy vehicles to disclose the carbon footprint of the batteries they sell in the EU. This is an inevitable



challenge in terms of reducing carbon emissions in the nickel supply chain. ESG principals are also particularly important for Chinese firms and products aiming at US and EU markets.

In December 2022, the EU decided to impose a carbon border tax on some EU imports starting in 2026. The Carbon Border Adjustment Mechanism, known as the “green tariff”, will require non-EU companies to pay a carbon tax on some emissions-intensive products in order to reduce the difference between the carbon price in the country of origin and the EU.

Urban mines should not be neglected

Compared with natural mines, “urban mines”, often labeled as waste, are no less valuable for exploitation. Used appliances, computers, TV remote controls and batteries are rich in various rare metals that can be recycled. Among them, small electronic appliances are often discarded as garbage, polluting the environment.

A large number of appliances and electronic products are renewed and scrapped every day in China, with the vast majority concentrated in large and medium-sized cities. We should promote advanced recycling technology to develop “urban mines” instead of just opening up new sources in nature. It is a long-term solution for the supply of critical metals, resource security, and ecosystem protection.

Audi Motor Company recently partnered with battery recycling startup Redwood Materials to collect rechargeable batteries from everyday consumer devices, phones, hearing aids, electric toothbrushes and game controllers, as well as household lithium-ion batteries and larger electric vehicle battery recycling efforts.

On average, Redwood’s technology can recover more than 95 percent of the materials used in lithium-ion batteries, such as nickel, cobalt, copper, aluminum, lithium and graphite. These materials can then be returned directly to the supply chain to make batteries for new electric vehicles and energy storage products. The U.S. Department



of Energy has now provided a \$2 billion loan to help it expand its campus and scale up domestic battery cell production in the United States.

China's governmental investment should not only focus on domestic and foreign natural mines, "urban mines" should also be given policy and financial support. As China's nickel metal consumption increases, its secondary resources are actually accumulating, forming new "social" nickel mines. Although urban mines are not hard to find, it is often oblivious to them. In the history of commercial mining, companies have become accustomed to excavating and mining increasingly fewer mines at a higher environmental and social cost, and mining equipment manufacturers are naturally happy to see this happen.

There is a finite amount of nickel available on the planet, and one day nickel will face depletion, just like oil. Governments should work to reduce dependence on nickel by developing advantageous and convenient public transportation systems to reduce the pressure on the mineral materials needed to manufacture private cars.

Promoting the mining of urban mining resources requires the establishment of social collection channels and networks for relevant waste materials. The degree of perfection and scope of the network determines the stability of the raw material supply system of these companies, which requires management and policy support.



