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The Prospects of Indonesia's Nickel Boom Amidst a Systemic Challenge from Coal



Center for Energy
and Climate

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Executive summary

Indonesia is a country that is booming economically and demographically. This not only matters for regional political and energy security, but also increasingly, for the world's energy transitions, due to Indonesia's large metal reserves, as well as its equally important coal consumption in industry and for power generation.

Over the last 20 years, Indonesia's economy has been characterized by very dynamic growth, massive increases in its electricity demand, and coal consumption and exports. Hence, its greenhouse gas (GHG) emissions are on a steady growth trajectory, although the country has committed to lowering them by 32% (unconditional) or 41% (conditional) by 2030.

With its Organisation for Economic Cooperation and Development (OECD) membership application, occurring in the context of global energy transition requirements and geopolitical confrontations, Indonesia is today at a crossroads.

Indonesia has 42% of the world's nickel reserves, as well as substantial reserves of copper, gold, tin, and, notably, coal. This wealth in natural resources has given the mining industry crucial importance in Indonesia's economic growth and has recently taken an even more prominent place: Indonesia has managed to become the world's largest nickel producer within just a few years, as its share in global nickel extraction grew from 5% in 2015 to 50% in 2023. The country is also the world's third copper ore exporter.

Coal and energy transition minerals have progressively replaced oil and gas in Indonesian exports. Between 2011 and 2023, oil and gas exports fell by nearly two-thirds and their share in the national exports decreased from 20% to 6%. In 2023, export revenues from copper were larger than those of oil and equal to gas earnings.

Yet, having major mineral deposits and mining activities is no longer considered sufficient by the Indonesian government. So far, the mineral industry's growth has relied hugely on Chinese investments and on low-added-value activities, especially in pyrometallurgy processing. Diversification of trade partners and expansion into new, entire value chains is, therefore, a key objective for the Indonesian government.

Indonesia is seeking to boost trade with the United States (US), the European Union (EU) and even the Eurasian Economic Union. However, negotiations over respective agreements are currently encountering hurdles due to American legislation (the Inflation Reduction Act and Foreign

Entities of Concern status), which could seriously threaten Indonesian exports of battery mineral components to the US market while they also face hurdles to entering the EU due to environmental regulations.

The second part of Indonesia's strategy focuses on the development of new industrial segments of value chains: refining facilities, hydrometallurgical processing plants, battery factories, etc. To develop these activities, the Indonesian government is using two main tools: the divestment of foreign companies in local firms and export bans on crude ore exports. Such bans have been introduced for nickel in 2020 and for bauxite in 2023, while they are expected for copper in 2024 and perhaps even later for tin.

Indonesia is today also confronted with the negative repercussions of mining activities on its soil, including protests over the lack of safety in its mines and smelters, citizens' expropriations, the presence of indigenous tribes on mining sites, and, above all, damage to the environment.

Such damage also has its roots in the substantial amounts of energy used to feed smelters, which mostly rely on the use of coal. Decarbonizing Indonesia's economy has thus become a central challenge for the country, where the consequences of climate change are already palpable on the archipelago's soil, with extreme weather events and the sinking of the capital city – Jakarta – as sea levels rise.

To carry out the tremendous transformation towards net-zero emissions while ensuring steady and sustainable development, the country has signed a Just Energy Transition Partnership and prepared decarbonization scenarios within this framework. Key priorities in the coming years include renewable energy deployment, grid development and an early phase-out of coal.

Deploying renewable energy sources as well as large and resilient grids is made more difficult by the country's geography. The archipelago includes 17,000 islands, some of them being undeveloped, hard to access and far away from each other. Furthermore, the levelized costs of solar and wind power are currently high in Indonesia compared with other developing countries, while public subsidies for coal do not favor low carbon generation sources.

If the two first points are thus very challenging, the last one appears to be the hardest, considering the Indonesian economy's tremendous dependency on coal. Concerns are therefore rising about Indonesia's ability and even willingness to pursue a genuine, albeit differentiated decarbonization pathway.

There are also many questions regarding Indonesia's mineral trade strategy. New bans on crude ore exports are expected to come into force, while new mining and mineral processing operations are under

development across the archipelago, as quantities of nickel produced in the country are at historic highs.

This extraordinary increase in nickel production, concomitant with a global economic slowdown, has resulted in a sharp fall in nickel prices, with nickel losing half of its value between January 2023 and February 2024. As a result, many producers are finding themselves in danger, especially in Australia or New Caledonia.

While there could be a deliberate strategy to flood the markets and neutralize competition, notably by Chinese companies that control 75% of the global nickel supply (mainly from Indonesia but also from the Philippines), the country faces serious dilemmas. Indonesia's oil and gas production is diminishing, and it increasingly relies on nickel exports and higher nickel prices for its economic stability, with coal also remaining very important. Indonesia's resource nationalism and industrial strategy, which include attracting foreign investments, notably via its OECD membership pledge, require a credible pathway to reduce the carbon footprint of its electricity generation.

Among the pathways towards both decarbonization and the development of industrial battery value chains, three steps could be considered:

1. Deploying renewable energy sources, especially solar photovoltaic (PV) power and offshore wind farms, as well as progressively transferring subsidies from coal to renewable energy sources.
2. Developing a clean battery industry based on high environmental, social and governance (ESG) criteria and on the wealth of Indonesia's subsoil, which includes most of the metals used in battery manufacturing.
3. Protecting climate and biodiversity by favoring innovative solutions for mining waste management and upholding high ESG standards.

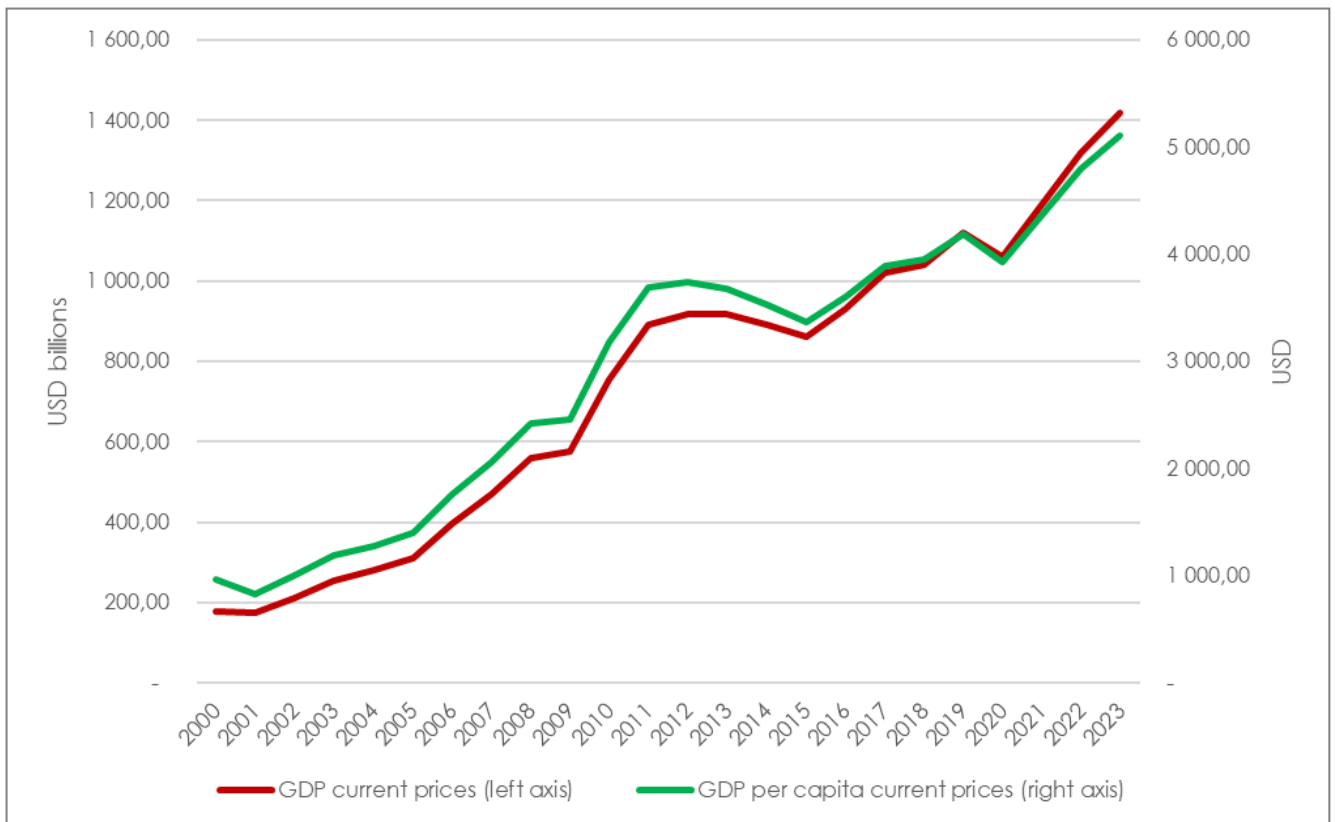
Table of contents

INTRODUCTION	7
INDONESIA: A MINERAL GIANT	11
INDONESIA'S MAIN OBJECTIVE: DIVERSIFICATION IN ALL ITS FORMS	16
China's omnipresence in Indonesia's mining industry	16
Developing new value chains	18
Developing links with new partners	22
THE CHALLENGES OF MINING	25
Clouds on the horizon	25
Solving the equation of Indonesia's energy transition	29
INDONESIA'S STRATEGY FOR THE EXPLOITATION OF MINERALS REMAINS HARD TO READ.....	36
Indonesia's strategy is not restricted to nickel.....	36
Indonesia's nickel ambitions: the biggest question mark	37

Introduction

Indonesia is a fast-growing economy that needs large infrastructural investment. Over the last decade, Indonesia has launched a series of large-scale projects, especially under President Joko Widodo's mandates: railway infrastructures, industrial facilities, or hydropower plants, with the 9 gigawatts (GW) Kayan Cascade Project, etc. This dam project, located on Kalimantan Island, is expected to supply electricity for President Widodo's main initiative – the creation of a new capital city called Nusantara. These development projects are crucial to ensure the continuation of Indonesia's fast economic development. The archipelago can indeed be considered an emerging country, with a gross domestic product (GDP) and a GDP per capita that have been respectively multiplied by 7 and 5 since 2000 (see Figure 1).

Figure 1. Indonesia's GDP and GDP per capita (2000-2023)

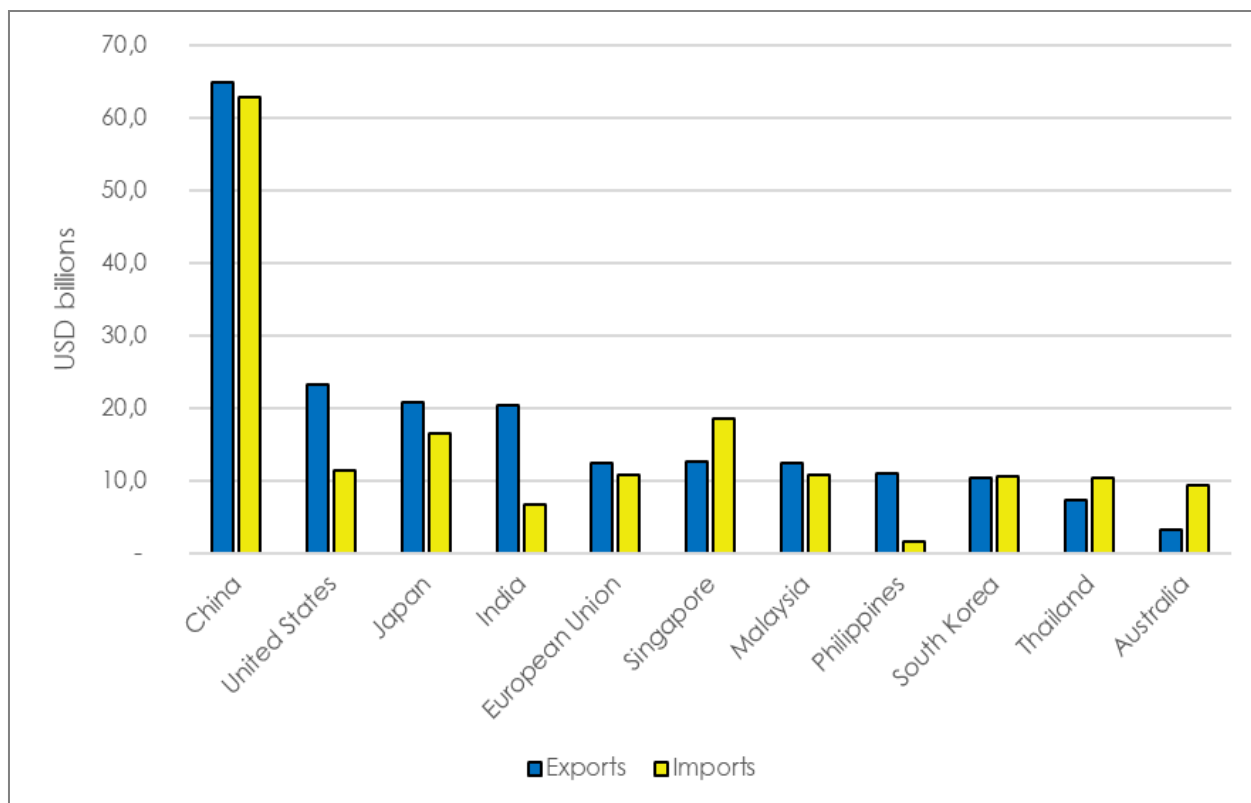


Source: Ifri, based on data from the International Monetary Fund (IMF).

The country is also characterized by a dynamic demography. Even if its population growth has started to slow down, especially in recent years, the country is still gaining around 1.5 million people each year. At the beginning of 2024, Indonesia's population was estimated at 279.8 million people¹ and is expected to reach 317 million by 2050.²

Indonesia has established strong economic links with international partners, especially with China. Its other main trade partners include the United States (US), Japan, the European Union (EU), as well as regional partners like Singapore and Malaysia (see Figure 2). The share of agricultural products – led by palm oil – in Indonesia's exports remains important, at 28.3% in 2021. Fuels and mining products account for a further 26.5%.³

Figure 2. Indonesia's main trade partners in 2023

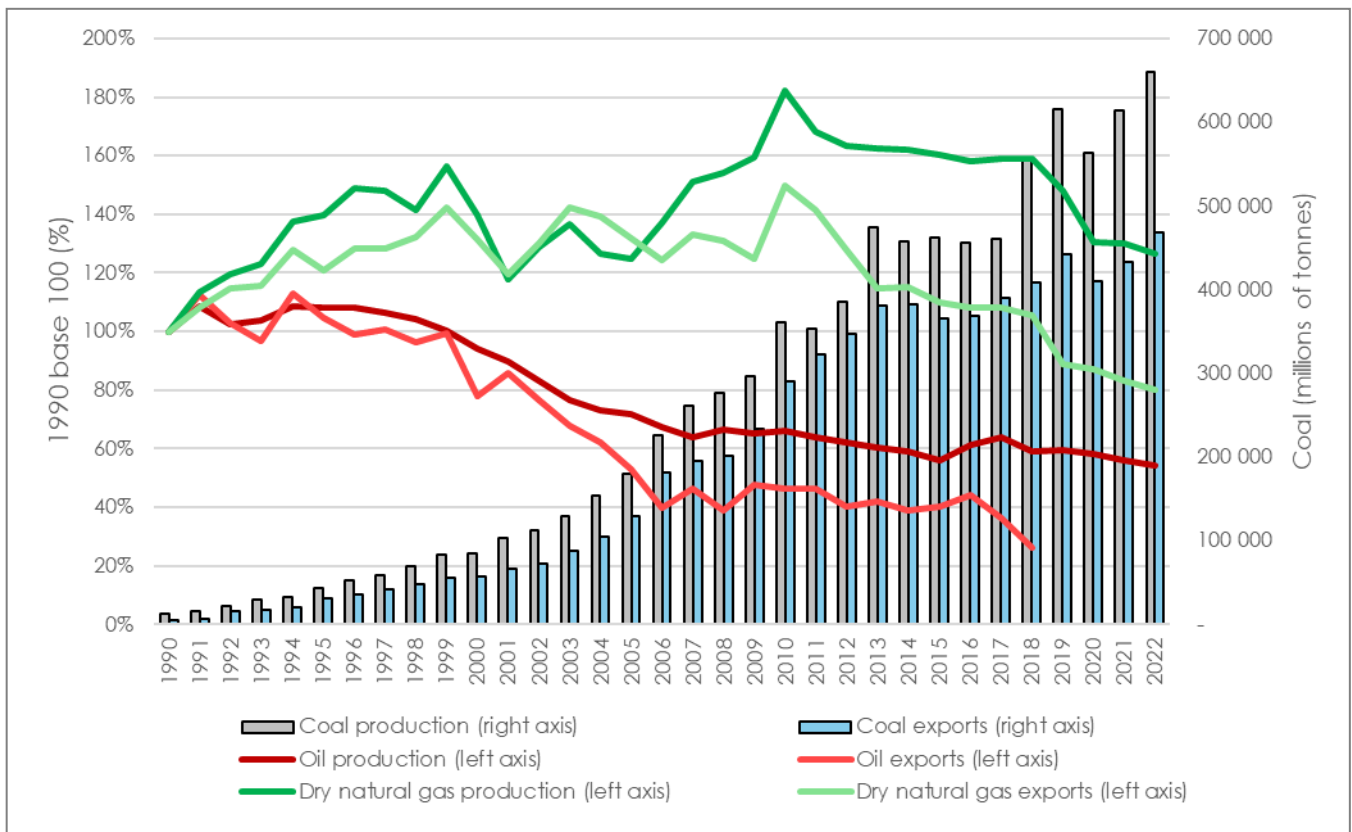


Source: Ifri, based on data from the Indonesian Ministry of Commerce, available at: <https://satudata.kemendag.go.id>.

1. Data from the United Nations Population Fund, available at: www.unfpa.org.
 2. "Projections par pays", Institut national d'études démographiques, available at: www.ined.fr.
 3. "Trade profiles", World Trade Organization, available at: www.wto.org.

Indonesia's economy has been reshaped over the last decades. At the beginning of the 1990s, oil and natural gas played a major role in the Indonesia's economic output. However, the importance of gas and above all oil has decreased significantly, in favor of the mining industry and especially coal, which is booming (see Figure 3).

Figure 3. Indonesia's oil, natural gas and coal production and exports (1990-2022)



Source: Ifri, based on data from the US Energy Information Administration, available at: www.eia.gov.

Nevertheless, while economic growth has been substantial, its benefits remain unequally spread across the archipelago. Indonesia's population and economic activity are mainly located in the Western part of the country, on the islands of Java and Sumatra. In 2022, they accounted for 77% of the country's population and 78% of its GDP.⁴ By contrast, Papua, the poorest region of Indonesia, represented only 1.83% of GDP.

4. Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023, National Energy Transition Task Force Working Group, November 21, 2023, p. 27, available at: <https://jetp-id.org>.

In 2022, Indonesia ranked only 112th globally in the Human Development Index.⁵ Continuing the archipelago's economic growth and improving the livelihood of Indonesian citizens will thus be the main task of the administration that will succeed Joko Widodo (publicly known as "Jokowi"), whose mandate ends in October 2024. Indonesia's citizens did indeed go to the polls in February 2024 for a general election that designated Prabowo Subianto as president, elected with 58.6% of the popular vote, even though his party only came third in the legislative polls.

To develop the national economy further, three fields are key: attracting investment into infrastructure; starting credibly to reduce the carbon footprint of the electricity sector; and managing the archipelago's subsoil resource development and the most crucial one – nickel ore.

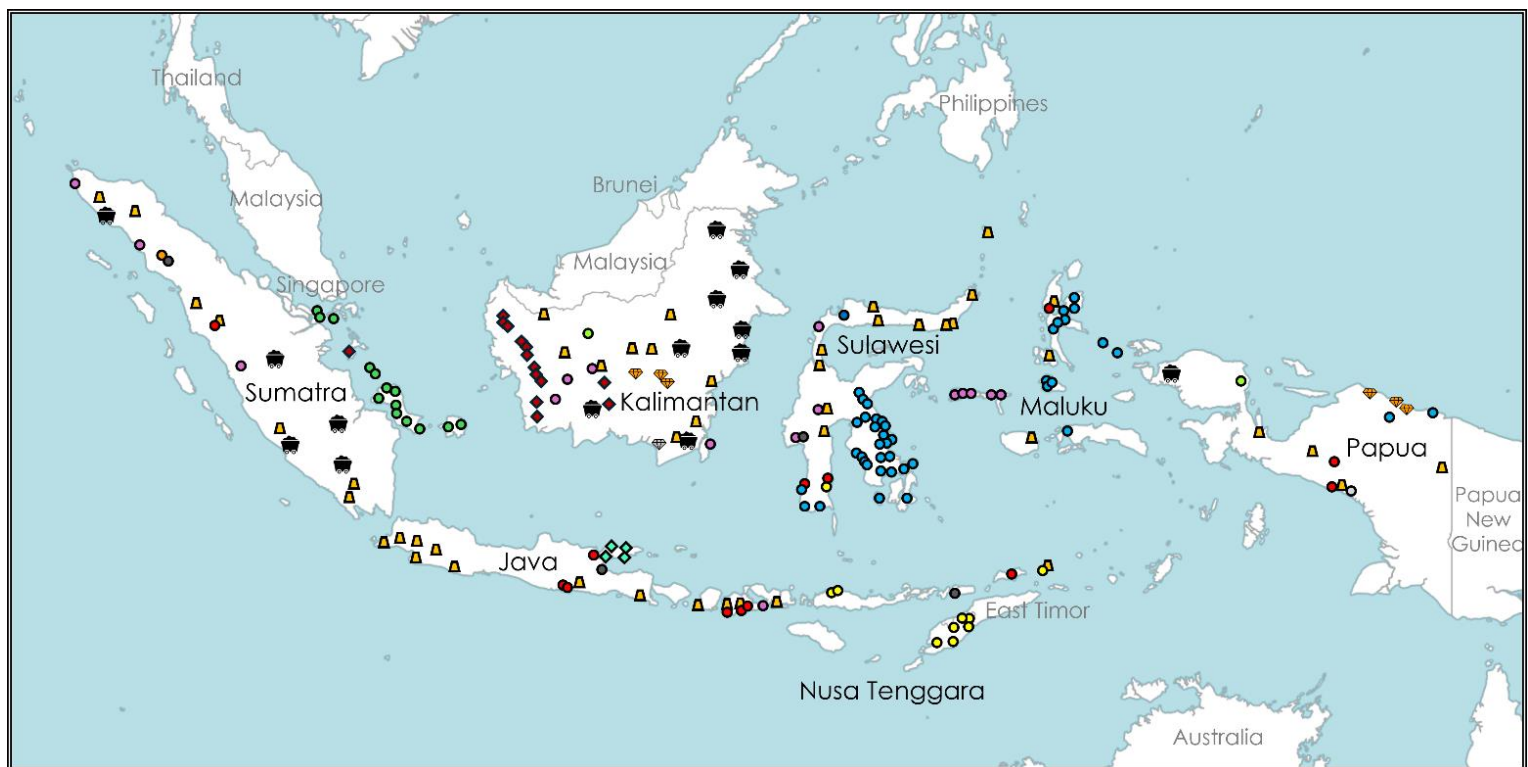
This paper intends to highlight and illustrate the importance acquired by the mining industry, especially for nickel ore, within the Indonesian economy. Beyond this first assessment, it aims to analyze the major challenges associated with the mining industry's development in the archipelago: diversification of trade partners and industrial processes; mining's environmental and social repercussions; the transformation of the electricity mix and decarbonization challenge. Lastly, it examines the prospects of the future development of mineral production.

5. *Human Development Report 2023/2024*, United Nations Development Program, 2024, available at: www.undp.org.

Indonesia: a mineral giant

Indonesia truly has a rich and diversified mineral subsoil. Its territory includes major mineral reserves of bauxite, manganese, gold, copper, tin, cobalt and, above all, nickel (see Figure 4). All these minerals are essential to the global energy transition: tin is largely used in electronics, and copper and aluminum are used in electrical circuits, while manganese, cobalt, and nickel are key to the production of batteries.

Figure 4. Primary commodities in Indonesia, based on mining concessions issued



Metals and metalloids

- Yellow circle: Manganese (^{25}Mn)
- Purple circle: Iron (^{26}Fe)
- Blue circle: Nickel (^{28}Ni)
- Red circle: Copper (^{29}Cu)
- Orange circle: Zinc (^{30}Zn)
- Grey circle: Silver (^{47}Ag)
- Green circle: Tin (^{50}Sn)
- Light green circle: Antimony (^{51}Sb)
- Yellow triangle: Gold (^{79}Au)
- Dark grey circle: Lead (^{82}Pb)

Gemstones

- Grey diamond: Diamond
- Orange diamond: Zircon

Other

- Red diamond: Bauxite
- Light blue diamond: Phosphate
- Black coal icon: Coal

Source: Ifri, based on data from the Ministry of Energy and Mineral Resources of Indonesia, available at: <https://momi.minerba.esdm.go.id>.

Indonesia is already taking advantage of this wealth, especially its nickel potential. With 1.8 million tonnes produced in 2023, the archipelago provides 50% of global nickel production and holds 42% of the world's reserves (see Table 1). Nickel extraction in the country was only 130,000 tonnes in 2015. In 2018, Indonesia overtook the Philippines as the world's biggest nickel producer with an annual domestic production of 600,000 tonnes, an output that has tripled by 2023, reaching 1,800,000 tonnes. To sum up, in 8 years, Indonesia's share in global nickel extraction grew from 5% to 50% in 2023.⁶ The country is also developing its other mineral production, with, for instance, cobalt extraction that was multiplied by eight between 2021 and 2023.

Table 1. Indonesia's mining production and reserves

Metal/product	Bauxite	Cobalt	Copper	Gold	Nickel	Tin
Estimated production in 2023 (tonnes)	20,000,000	17,000	840,000	110	1,800,000	52,000
Share of global production	5% ⁷	7%	4%	4%	50%	18%
Rank among world producers	6 th	2 nd	7 th	8 th	1 st	3 rd
Reserves as estimated in 2023 (tonnes)	1,000,000,000	500,000	24,000,000	2,600	55,000,000	800,000 ⁸
Share of global reserves	3%	5%	2%	4%	42%	19%

Source: Ifri, based on Mineral Commodity Summaries 2024, U.S. Geological Survey, U.S. Department of the Interior, January 31, 2024, available at: <https://pubs.usgs.gov>.

Note: "Indonesian production" refers to mine production.

This growth entails the development of large-scale mining parks spread all over the country, but most specifically on the islands of Sulawesi and Maluku for nickel (see Figure 5). The most emblematic of these mines is the Indonesian Morowali Industrial Park (IMIP), located on Sulawesi

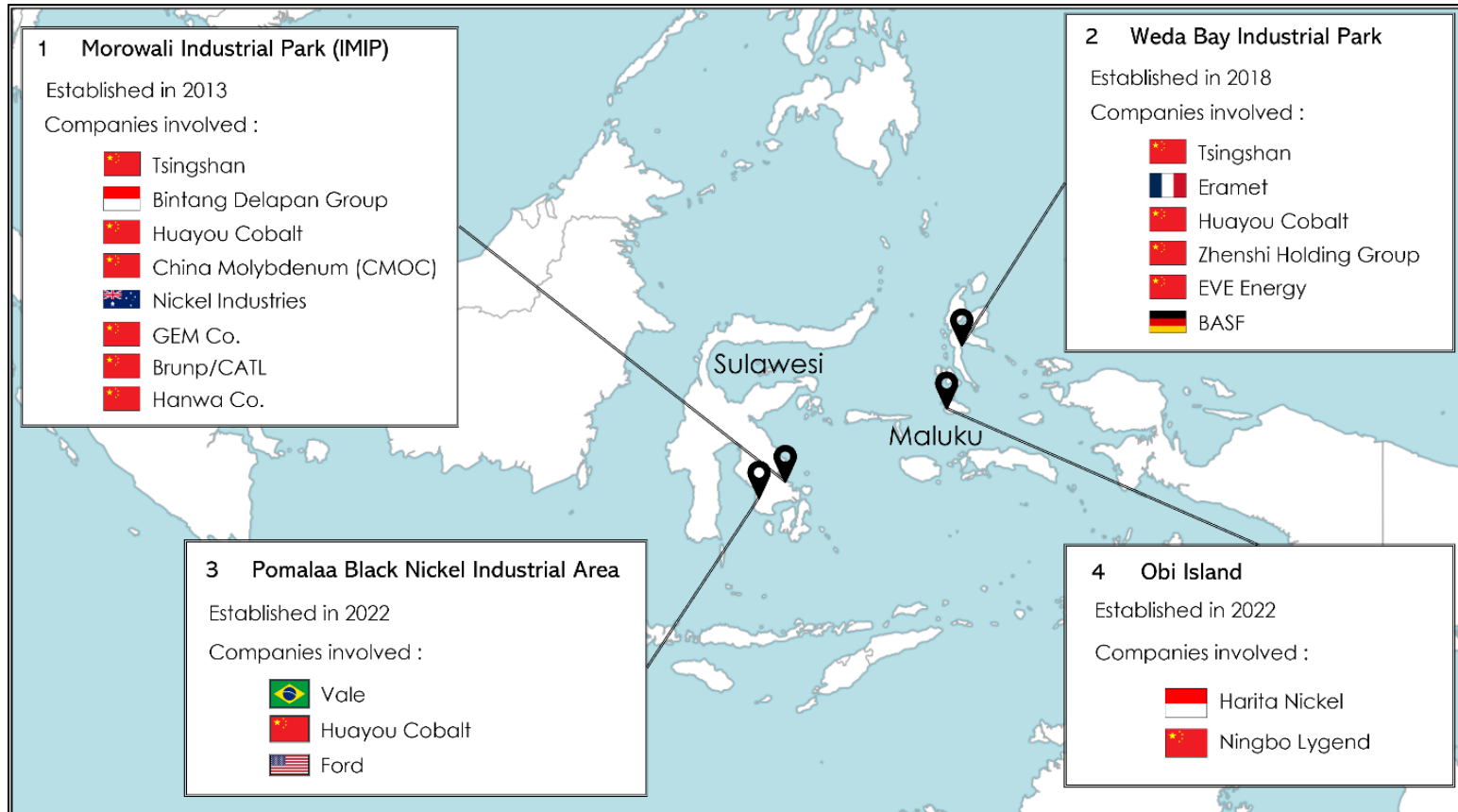
6. Mineral Commodity Summaries, U.S. Geological Survey, U.S. Department of the Interior, available at: www.usgs.gov.

7. The data presented in the Mineral Commodity Summaries 2024 excludes US bauxite production in the total global production of bauxite.

8. The estimates of Indonesian tin reserves are from the Mineral Commodity Summaries of 2023. Indonesian figures were "not available" in the 2024 Summaries.

Island, created in October 2013. In ten years, the former fishing town of Bahodopi has become a complete city, with a deepwater port and an airfield, hosting 66,000 workers employed by the park.⁹

Figure 5. Main nickel industrial parks in Indonesia

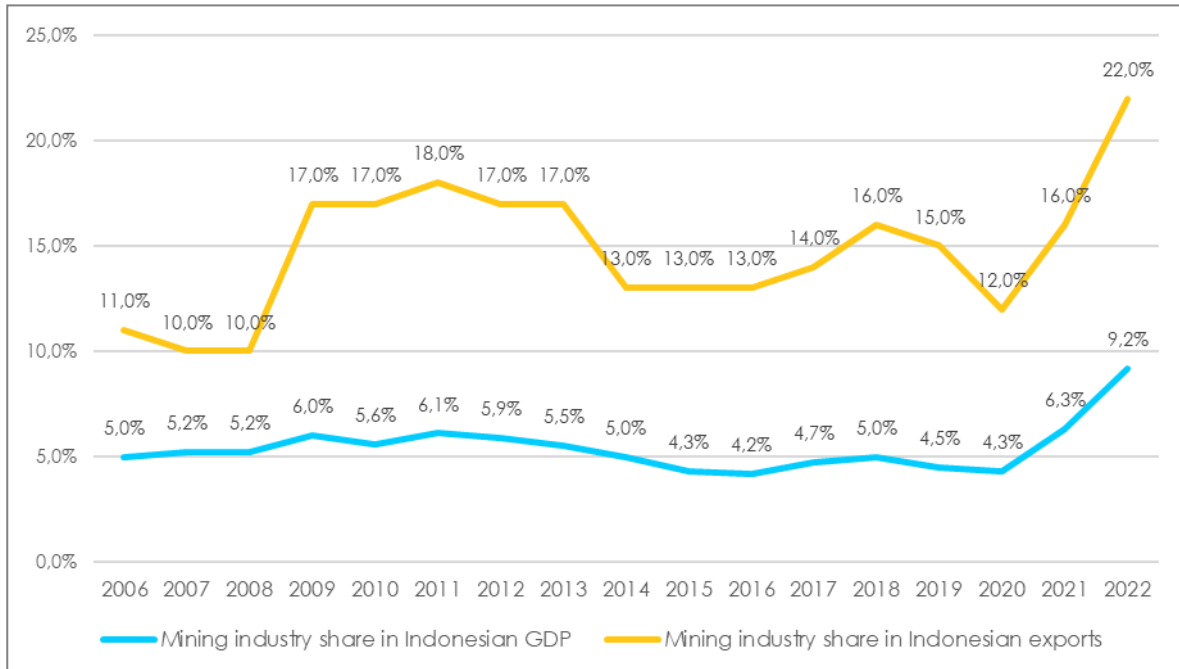


Source: Ifri, based on data from companies and on "The Nickel Pickle", MineralPrices.com, May 8, 2023, available at: <https://mineralprices.com>.

Over time, the mining industry has acquired a central role in the Indonesian economy, especially in recent years. Indeed, according to a report by PwC, its share in GDP grew from 4.3% in 2020 to 9.2% in 2022, while its share in exports increased from 12% to 22% in the same period (see Figure 6).

9. B. Pedroletti, "En Indonésie, ruée vers le nickel, or noir du futur", *Le Monde*, November 11, 2022.

Figure 6. Contribution of the mining industry to the Indonesian economy



Source: Ifri, based on data from PwC, "Mining in Indonesia. Investment, Taxation and Regulatory Guide", PwC, September 2023, 13th Edition, pp.17-18, available at: www.pwc.com.

As shown in Figure 7, copper generated USD 8 billion in export revenues for Indonesia in 2023, i.e., as much as gas and more than oil. According to the International Energy Agency (IEA), revenues from nickel, copper and tin production in Indonesia could be worth USD 40 billion in 2050.¹⁰ The benefits from minerals could be even higher should Indonesia's share in the global market increase or their prices become higher. Currently, copper and gold prices are increasing, and it could be the same for tin, whose market may tighten in the coming years.¹¹

However, Indonesia's mineral wealth does not rely only on energy transition metals. Coal plays a huge role in the archipelago's mining industry as well. As shown in Figure 4, some of the Indonesian islands hold major coal deposits, such as Sumatra and, above all, Kalimantan. The latter accounts for 90% of Indonesia's coal production, which represented 35% of East Kalimantan province's GDP in 2019.¹²

In 2023, 70% of Indonesian coal was exported, making Indonesia the top thermal coal exporter in the world, with 44% of global exports, followed by Australia (17%) and Russia (16%). In 2023, thermal coal exports from

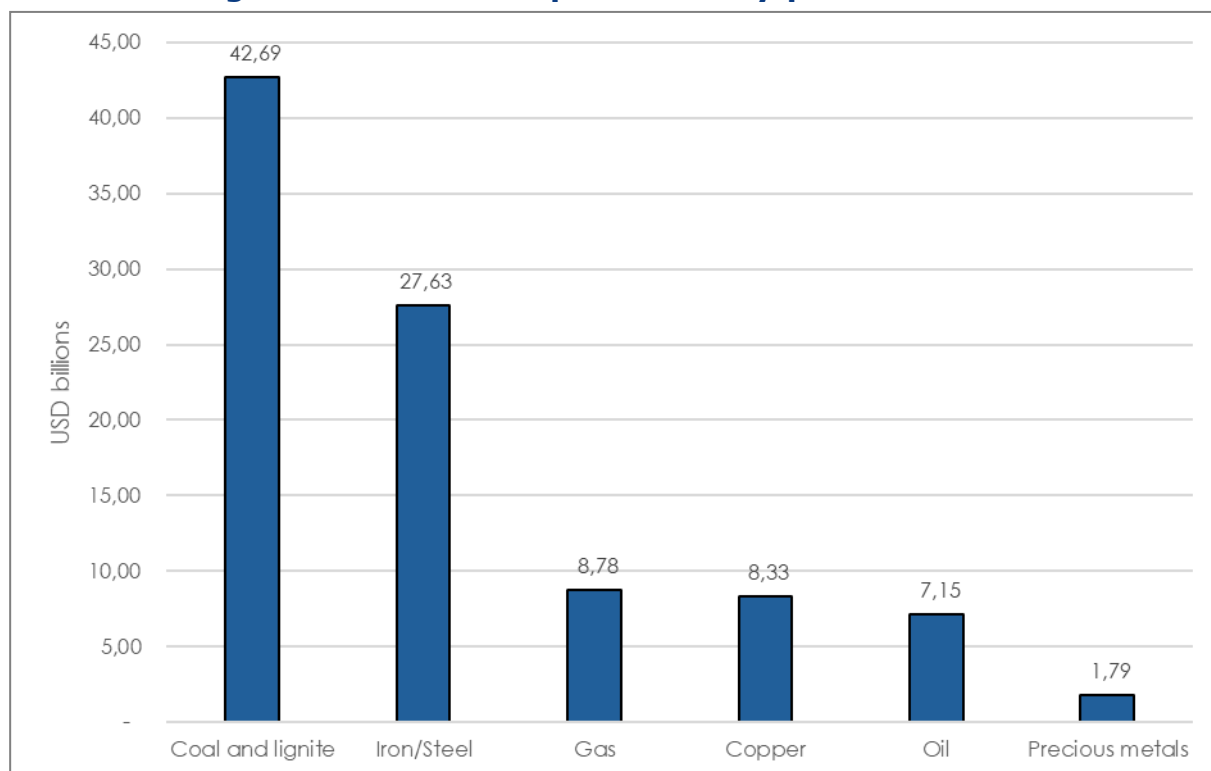
10. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", IEA, September 2022, p. 175, available at: <https://iea.blob.core.windows.net>.

11. Ibid., p. 174.

12. Ibid., p. 162.

Indonesia surpassed 500 million tonnes, a level never reached by any country before.¹³

Figure 7. Indonesia exports value by-product in 2023



Source: Ifri, based on data from the Central Bureau of Statistics of Indonesia, "Statistical Yearbook of Indonesia 2024", available at: www.bps.go.id.

13. "Coal 2023. Analysis and Forecast to 2026," IEA, December 2023, pp. 63-66.

Indonesia's main objective: diversification in all its forms

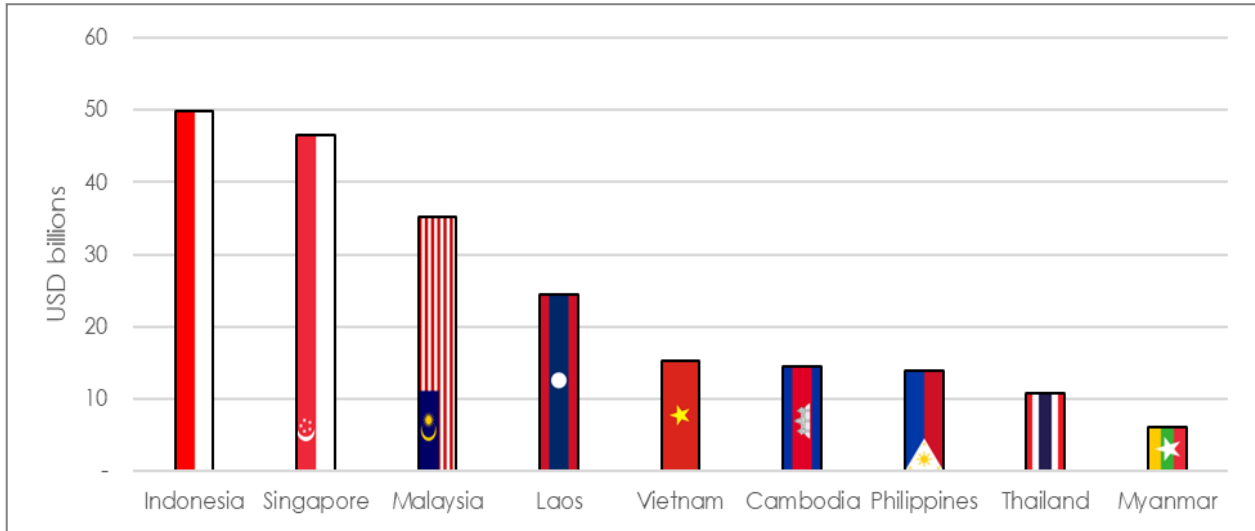
China's omnipresence in Indonesia's mining industry

If the mining industry has been an efficient way to develop Indonesia, its growth has so far relied substantially on Chinese investments. Since 2013, China's Belt and Road Initiative has played an important role in the archipelago's economy. China has, for instance, built the high-speed train line that connects Jakarta to Bandung on Java Island, a line which was inaugurated by Jokowi and Xi Jinping on October 2, 2023. Many other projects have been awarded to Chinese firms, such as the hydropower plant of Kayan Cascade. China is looking to develop even stronger links with Indonesia, which could be a way to expand its influence in the Indo-Pacific region. In July 2023, during the visit of President Jokowi to China, President Xi Jinping expressed China's willingness to "build high-level strategic mutual trust" between the two countries and to implement a regular dialogue between their Defense and Foreign Affairs ministers.¹⁴

The Middle Kingdom's huge presence in Indonesia is illustrated by the Chinese foreign direct investments (FDI) operated in the ASEAN countries over the last decade. Between 2013 and 2022, China invested USD 220 billion in the ten countries of the ASEAN, with around USD 50 billion (23%) in Indonesia (see Figure 8). Figure 9 indicates that these investments were not made at a perfectly regular pace. After a very active period, Chinese foreign direct investment (FDI) in the Association of Southeast Asian Nations (ASEAN) countries and the Indonesian archipelago declined within the context of the Covid-19 crisis. After reaching their lowest level in ten years, Beijing's FDI in the ASEAN then increased once again and are currently approaching the levels they had before the health crisis.

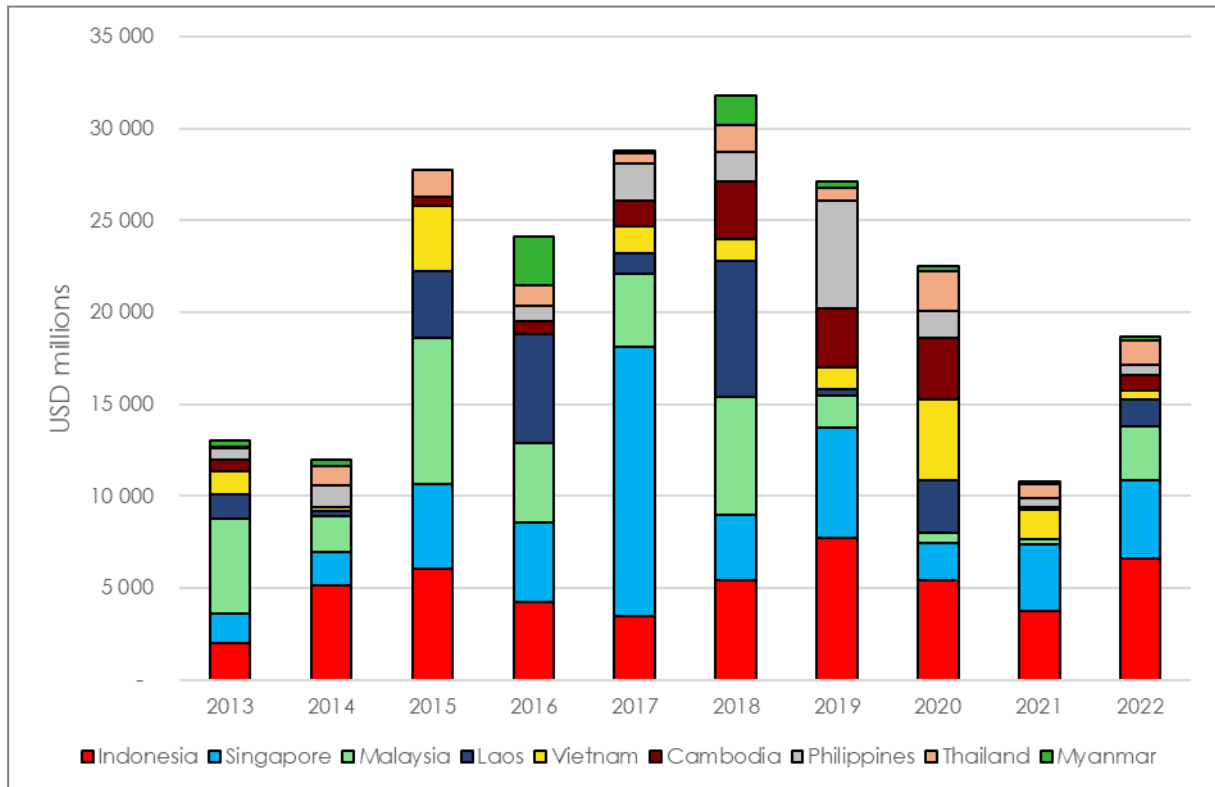
14. "Xi Jinping Meets with Indonesian President Joko Widodo", Ministry of Foreign Affairs of the People's Republic of China, July 27, 2023, available at: www.fmprc.gov.cn.

Figure 8. Chinese investments in ASEAN countries between 2013 and 2022



Source: Ifri, based on data from ASEAN X Macro, China's Belt & Road: "Small But Beautiful", Report from the Malaysian bank Maybank, March 17, 2023, p. 5, available at: www.maybank.com.

Figure 9. Chinese investments in ASEAN countries evolution over time (2013-2022)



Source: Ifri, based on data from ASEAN X Macro, China's Belt & Road: "Small But Beautiful", op. cit.

As mentioned above, the mining sector is no exception to the rule. At least one Chinese company is represented in the four main nickel parks of the archipelago (see Figure 5). The Tsingshan Holding Group, the world leader in the steel industry, played a central role in the creation of IMIP and Weda Bay industrial park, through the establishment of joint ventures, giving it a highly dominant position in the production of Indonesian nickel ore.

This huge Chinese presence has raised issues within the Indonesian mining sector, especially in the case of IMIP. First of all, the park houses a large number of Chinese workers, which has become controversial. Indeed, according to a *Le Monde* investigation, companies must pay a tax of USD 100 to the local government for each Chinese worker they employ. Officially, IMIP includes no more than 10% of Chinese employees, and its head of office explained that there were only 5,000 of them. Yet, according to Indonesian workers' associations, this number is highly understated. A former Indonesian trade unionist even explained that Chinese workers were “hidden in the forest during official inspections.” In Kendari, another park in Sulawesi, tensions were also present between Indonesian and Chinese miners, the latter being accused, among other things, of trafficking in identity cards.¹⁵ China's popularity seems to have decreased since the early Indonesian participation in the Belt and Road Initiative in 2013. According to a poll conducted by the Australian Lowy Institute, 54% of Indonesians considered that China's growth had been good for Indonesia in 2011, while they were only 43% in 2021. Similarly, 50% of the archipelago's inhabitants thought that Indonesia should join with other countries to limit China's influence in 2011, compared with 60% in 2021.¹⁶

Developing new value chains

If foreign investments have been a way to develop the national economy, they have for a long time consisted almost exclusively of seeking to export raw materials. This phenomenon manifested from 1596 onwards, with the arrival of Dutch colonists in the archipelago, who first searched for cloves (native of Maluku) and later for oil deposits. Such high-scale hydrocarbon deposits led to the invasion of the Dutch colony by the Japanese army during the Second World War, demonstrating the same willingness to exploit natural resources. Between 1967 and 1998, the Suharto dictatorship widely opened the gates of Indonesia to foreign investors, especially American firms. At the end of the 2000s, with the end of Suharto's regime, Indonesia's policy on foreign investment shifted to a more protectionist one, especially concerning mining. In trying to avoid a form of “Dutch disease” or the “resource curse” of raw material rent phenomena, new heads of states have implemented laws with two main objectives:

15. B. Pedroletti, “En Indonésie, ruée vers le nickel, or noir du futur”, *op. cit.*

16. “Indonesia Poll 2021”, Lowy Institute, available at: <https://interactives.lowyinstitute.org>.

- Developing investments in downstream mining industries, especially in transformation facilities (smelters and refineries), to keep added value within the archipelago.
- Reinforcing local companies' weight in the mining sector, mostly through a process of disengaging foreign firms.¹⁷

The Indonesian strategy has aimed to create and develop local mining industries, including extraction and transformation, to boost living standards significantly. To this end, Indonesian governments have adopted several mining laws. The first vector of this strategy relies on foreign companies' divestment. In 2010, the Indonesian Ministry of Energy and Mineral Resources mandated foreign companies to sell a 20% stake in their local mining firms to Indonesian shareholders after five years of operation. In 2012, a new mining text was announced, obliging foreign companies to sell 51% of their shares after ten years of exploitation.

This led to a confrontation between President Jokowi – elected in 2014 – and the American mining firm Freeport-McMoRan, which was operating the copper, gold and silver mine of Grasberg in Papua. In 2017, a deal was finally concluded in which Freeport would sell 51% of its shares and open local foundries, and in exchange, it would receive an extension of its exploitation permit.¹⁸

The second vector of the Indonesian strategy is based on raw material export bans. The first ban on nickel ore exports was formulated in 2014, but pressure from mining companies forced the government to withdraw its project. The ban was re-established in 2017, in a reduced way, and eventually strengthened in 2020. Through these bans, the Indonesian government intended to put pressure on foreign companies, giving them no choice but to develop refining firms and facilities inside the archipelago. Otherwise, they would no longer be able to exploit the mineral wealth of Indonesia's subsoil. As mentioned above, such a ban was introduced for nickel but was also set on bauxite exports in June 2023.

A similar ban is planned for copper and is expected to be set in June 2024, raising concerns among mining companies. On March 28, 2024, the chief executive officer (CEO) and the Chairman of the Board of Freeport-McMoran met President Jokowi in Jakarta to ask for the ban to be delayed. Tony Wenas, Freeport-McMoran's CEO, explained that with such a decision, "state revenues will drop by around USD 2 billion."¹⁹ According to

17. B. Courmont, "Le difficile contrôle des exploitations minières en Indonésie", *Géoéconomie*, Choiseul Institute, No. 75, March 2015, pp. 93-108.

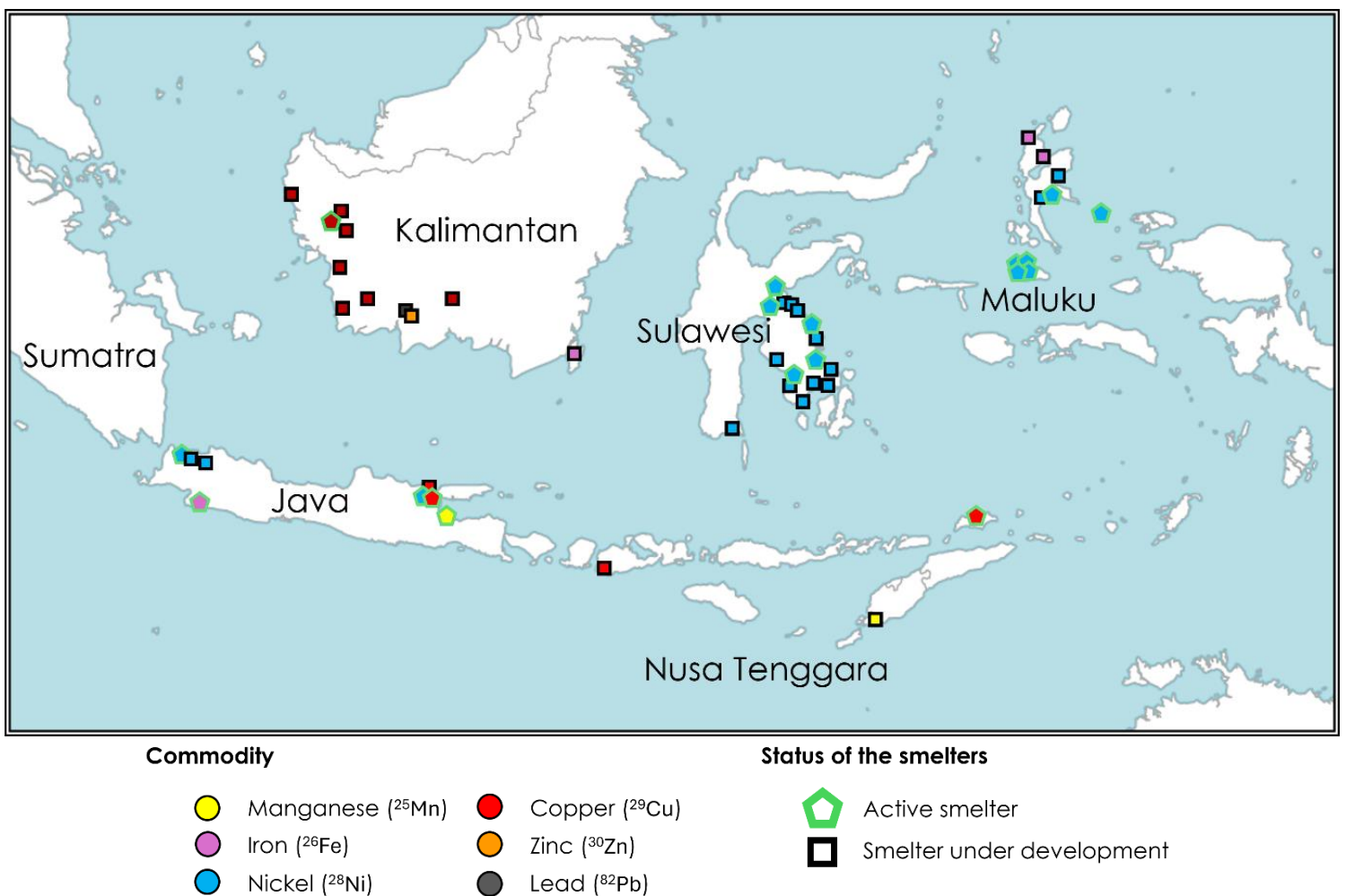
18. B. Pedroletti, "En Indonésie, ruée vers le nickel, or noir du futur", *op. cit.*

19. "Freeport Warns Copper Export Ban Could Cost Indonesia US\$2 Billion in Lost Revenue", *The Business Times*, March 28, 2024.

some sources, including the IEA, Indonesia is thinking about establishing a ban on tin exports as well.²⁰

This strategy seems to have been successful, considering the current presence and development of smelters across the archipelago (see Figure 10). Once again, the major importance of nickel is illustrated by the huge number of smelters in Sulawesi and North Maluku, as well as by the fact that nickel concerns 82% of the current existing smelters (see Table 2).

Figure 10. Distribution of existing Indonesian smelters and projects under development across the archipelago



Source: Ifri, based on data from the Ministry of Energy and Mineral Resources of Indonesia, available at: <https://momi.minerba.esdm.go.id>.

Note: Figure 10 and Table 2 are based on the data presented on the website of the Indonesian Ministry of Energy and Mineral Resources within an interactive map, which is consequently not dated. It is thus difficult to know if the data in question are regularly updated and so precisely accurate. The distinction between smelters "under development" or "active" and the data presented must, therefore, be interpreted in an indicative approach rather than as a precise inventory of the properties of Indonesian smelters.

20. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", *op. cit.*, p. 174.

Table 2. Number and capacities of smelters in Indonesia

Commodity	Number of active smelters	Output capacity for active smelters (tonnes per year)	Number of smelters under development	Output capacity for smelters under development (tonnes per year)
Nickel	14	3,045,810	16	2,522,263
Bauxite	1	300,000	9	10,986,000
Copper	2	325,000	2	722,000
Iron	1	36,367	3	3,903,245
Manganese	1	16,186	1	40,379
Lead	0	0	1	22,924
Zinc	0	0	1	29,319
Total	19	3,723,363	33	18,226,130

Source: Ifri, based on data from the Ministry of Energy and Mineral Resources of Indonesia, available at: <https://momi.minerba.esdm.go.id>.

However, for Indonesia, the objective is today no longer only to lower raw materials exports and to develop local smelting plants. Henceforth, the aim is also to develop a specific type of refinery capacity in the archipelago.

Nickel itself cannot be found in the ground and extracted: nickel ore contains nickel atoms combined with other elements, such as oxygen (nickel oxide) and other minerals. Refinery processes are required to increase the quantity of nickel atoms. Nickel products thus obtained are then divided into two categories: class I and class II. Products containing more than 99.98% nickel are considered to belong to class I, while those containing less nickel than this threshold belong to class II.

Two processes can be used to refine nickel ore: pyrometallurgy and hydrometallurgy. Pyrometallurgy, using a method called “rotary kiln-electric furnace” (RKEF), leads to the production of ferronickel (class II), which contains a low quantity of nickel and is mainly used to produce stainless steel. Hydrometallurgy, using a method called “high-pressure acid leaching” (HPAL), leads to a final product that is more highly concentrated in nickel (class I). This product is used especially in producing cathodes and

nickel sulphate for batteries, particularly electric vehicle batteries. Today, around 70% of the nickel produced around the world is used for stainless steel, while 11% is used for battery manufacturing.²¹

Nickel made through hydrometallurgy produces more added value than ferronickel, but a major share of Indonesian smelters was built to conduct pyrometallurgy. Therefore, Indonesian officials are trying to develop HPAL facilities, the first being constructed in 2021, by the Chinese firm Lygend Resources & Technology, in Obi Island (North Maluku).²² Since January 2022, HPAL is also being operated in IMIP.²³ The Indonesian government is also supporting the establishment of electric vehicle battery factories, such as the one planned in Karawang on Java Island, which is expected to produce 30 million battery cells in 2024.²⁴

Developing links with new partners

The diversification of Indonesia's mining sector also relies on the search for new partners. As explained above, China has been the most important provider of FDI in the archipelago's mining industry, and the Middle Kingdom was importing huge quantities of Indonesian nickel ore before the export ban of 2020. Therefore, Indonesia is not trying to completely turn away from China but to continue its foreign policy, described as "free and active". New partners could be emerging countries, as suggested by negotiations currently carried out with the Eurasian Economic Union,²⁵ but also with the US and the EU.

In May 2022, President Jokowi made a five-day visit to the US, during which he met President Biden as well as Elon Musk, Tesla's CEO, with the aim of supporting the establishment of an electric vehicle factory in Indonesia.²⁶ In its National Energy Grand Strategy, the Indonesian government has indeed committed the country to have 2 million electric vehicles (EVs) and 13 million electric motorbikes by 2030. This would correspond to, respectively, about 9% and 12% of the respective stocks in 2030, compared to well under 0.1% in 2021. To support the development of EV batteries inside the archipelago, Jakarta has also supported the creation of the Indonesia Battery Corporation, a partnership gathering four state-

21. "Coal 2023. Analysis and forecast to 2026", *op. cit.*, p. 34.

22. L. Guoping and D. Jia, "Chinese Nickel Miners in Indonesia Face Threat from Falling Prices", *Nikkei Asia*, December 5, 2023.

23. H. Fisher and B. Grossl, "Overcoming Mining Waste Issues Will Be Key to Indonesia's Nickel Ambitions", *Benchmark Mineral Intelligence*, July 7, 2023.

24. "President Jokowi Inspects Electric Vehicle Battery Factory in Karawang", Cabinet Secretariat of the Republic of Indonesia, September 14, 2023, available at: <https://setkab.go.id>.

25. "EAEU and Indonesia Held Third Round of Negotiations on Free Trade Agreement", *Eurasian Economic Union*, December 15, 2023, available at: <https://eec.eaeunion.org>.

26. "Indonesia's Jokowi Meets Tesla's Musk After Nickel Talks", *Reuters*, May 15, 2022.

owned companies: Pertamina, Perusahaan Listrik Negara (PLN, the national electricity company), Mind.Id., and ANTAM.²⁷

In November 2023, President Jokowi and President Biden met again to discuss a potential mineral partnership, according to Reuters.²⁸ However, negotiations between the two countries remain difficult. It is not yet clear enough if batteries containing components extracted or manufactured in Indonesia will be able to benefit from Biden's Inflation Reduction Act (IRA) tax credit program. In the field of EVs, this program mainly relies on a tax credit of USD 7,000 for the purchase of an electric vehicle in the US, with eligibility based on the provenance of the materials used. This tax credit is divided into two parts, each of them amounting to USD 3,500. Part 1 relies on battery components, for which 40% must come from North America. Part 2 is based on the critical raw materials used, with 40% needing to come from the US or a country with which the US has a free trade agreement (FTA). The two thresholds will progressively be increased in the years ahead.²⁹ For Indonesia, it, therefore, appears crucial to sign an FTA with the US.³⁰

Nonetheless, this FTA could still be insufficient. The US also targets what it calls "Foreign Entities of Concern" (FEOC). In December 2023, the US Department of Energy proposed guidance describing these FEOCs as entities "owned by, controlled by, or subject to the jurisdiction or direction of a government of a foreign country that is a covered nation", namely China, Russia, Iran, and North Korea.³¹ As explained in Section 30D of the US Internal Revenue Code, after December 31, 2023, any electric vehicle whose battery components were "manufactured or assembled by a FEOC" will not be able to benefit from the IRA tax credit part 1. Moreover, after December 31, 2024, any electric vehicle whose battery contains critical minerals that were "extracted, processed or recycled by a FEOC" will not be able to benefit from the IRA tax credit part 2.³² So far, it remains uncertain whether all the Chinese companies involved in Indonesia would be considered FEOC and whether the joint ventures created with other companies will be considered FEOC as well. However, such a situation could be a hammer blow to Indonesia, as well as to foreign companies that have developed joint ventures with Chinese firms in Indonesia (Vale, Eramet, Ford, etc.). The US will likely maintain a certain ambiguity on who

27. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", *op. cit.*, p. 43.

28. T. Hunnicutt and S. Holland, "Biden Meets with Indonesia President Ahead of Xi Summit", Reuters, November 14, 2023.

29. 10% will be added each year until 2027. At that time, the two thresholds will be 80% and will be maintained at this level.

30. A. Mehdi and T. Moerenhout, "The IRA and the US Battery Supply Chain: One Year On", Center on Global Energy Policy, Columbia School of International and Public Affairs, September 20, 2023.

31. "Interpretation of Foreign Entity of Concern", *Federal Register. The Daily Journal of the United States Government*, December 1, 2023, available at: www.federalregister.gov.

32. US Internal Revenue Code, Title 26, §30D, available at: www.govinfo.gov.

will be considered as FEOC and act on a case-by-case basis to keep its supply chains functioning in areas where it is the most dependent.

The US has also shown its disappointment about the increasing links between China and Indonesia, especially since the US had invested significantly to reinforce Indonesian cost guard defense capacities. These investments were undertaken to protect the northern parts of the archipelago from incursions by Chinese surveillance boats, especially around Natuna Islands.

In the case of the EU, an FTA has been under negotiation since 2016, and negotiations are unlikely to end successfully in a short time. Indonesia's export ban on nickel was denounced by the EU in 2021, which brought this case to the World Trade Organisation. Moreover, the EU's regulation on deforestation (EUDR) has impacted Indonesia's exports: five of the seven products targeted by the EUDR are among Indonesia's usual export products (palm oil, coffee, cacao, wood and caoutchouc). Indonesia's global diversification strategy is thus encountering setbacks.

The challenges of mining

Clouds on the horizon

Work and safety conditions

Locally, Indonesia's mining sector is raising issues as well. First, miners' working conditions are often criticized, and accidents are frequent. In December 2023, a major incident happened in IMIP: an explosion occurred in a smelter, killing 10 Indonesian and 8 Chinese workers, and injuring 30 more. This incident caused an outcry in the country, especially since workers were not wearing fireproof clothing, according to the Indonesian newspaper *Koran Tempo*, even though they were in close contact with molten materials. The newspaper also explained that the smelter included no emergency exit and that safety managers from China did not speak Indonesian. Three days later, hundreds of workers protested for better work and safety conditions near IMIP.³³

Chinese workers are also subject to harsh working conditions, as denounced by the NGO China Labor Watch, in a study of November 2022. The report presents a document from IMIP, listing the rules and fines to which Chinese workers are subject within the park, such as CNY1,000 (USD137) for "sleeping during work at construction sites," or CNY10,000 (USD1,371) for "leaving factories or working areas without permission".³⁴

Expropriations and the concerns of indigenous tribes

Large-scale industrial projects also lead to the expropriation of local people. In Rempang Island, in the western part of Indonesia, the expulsion of around 1,000 inhabitants is planned as part of the development of a Chinese giga-factory called "Rampang Eco-City." On 8 September 2023, Rempang island citizens protested against this situation and got support from NGOs and even national newspapers, such as *The Jakarta Post*.³⁵ This question is highly problematic in the country since the archipelago has numerous indigenous communities, especially in Maluku, Sulawesi, or Papua. Indeed, these areas are often very wild and hard to access, with

33. "Les travailleurs du nickel en Indonésie dénoncent leurs conditions de travail", *L'Usine Nouvelle*, December 27, 2023.

34. "Trapped: The Belt and Road Initiative's Chinese Workers", China Labour Watch, November 2022, pp. 159-161, available at: <https://chinalabor.wpenginepowered.com>.

35. B. Pedroletti, "Indonésie : l'îlot de Rempang résiste aux ambitions chinoises", op. cit.

steep mountains and some territories or islands that have been isolated for centuries. Deforestation to establish mines is threatening indigenous peoples' ways of life.

In Maluku, another project is raising concerns at the already giant nickel production site of Weda Bay. Since 2018, the development of Weda Bay Industrial Park has led to substantial transformations in local landscapes, as illustrated by Figure 11. An initiative led by the French firm Eramet and Germany's BASF, called "Sonic Bay", plans to build a new nickel refinery in the area, raising concerns among NGOs and environmentalists.³⁶ Indeed, an indigenous tribe lives there: the Hongana Manyawa, which is one of the last Indonesian tribes of hunter-gatherers, with an estimated 3,000 members. In October 2023, an employee from a forestry company, moving into the forest with his bulldozer, filmed his encounter with two members of this tribe and posted it on social networks. These two tribesmen belong to the "uncontacted" part of the tribe, which avoids any contact with the outside world, and their records are extremely rare. It is only the third known video showing these men, and the fact that this encounter occurred highlights the expansion of industrial activities in wild natural areas.³⁷

Figure 11. Weda Bay area in 2018 (top) and 2024 (bottom)



36. P. Mouterde, "Un projet du groupe minier français Eramet en Indonésie inquiète les associations", *Le Monde*, March 2, 2024.

37. T. Chaigne, "Indonésie : une vidéo rare montre des autochtones 'non-contactés' face à un bulldozer, une rencontre 'traumatisante'", *France 24*, November 20, 2023.



Source: Sentinel Hub EO Browser, Sentinel 2, available at: <https://apps.sentinel-hub.com>.

Note: The top satellite image is dated May 1, 2018, and the bottom one is February 4, 2024.

Environmental repercussions

Finally, mining's environmental damage is publicly known, especially through the release of chemicals or the use of coal to produce electricity in the case of Indonesia. Waste management is crucial, and nickel companies are working on methods to alleviate the environmental impact of their activities, such as dry stack tailings or the use of iron waste to produce stainless steel. Yet, while environmental standards are theoretically controlled by local and federal governments, it appears that their action is delayed due to several factors, including the important number of operators mining in the same area, corruption and illegal operations.³⁸ Mining tailings runoff into the sea and change the color of water from blue to brown, blocking the sunlight at the surface and preventing it from reaching coral reefs and their marine biodiversity. Yet, Indonesia is known worldwide for its coral ecosystems.

On the other hand, the development of mining industrial parks has also been a way to allow improvements in the livelihood of local citizens, providing access to electricity, treated water and education. The provision of nutritious food and vitamins has also been facilitated due to the new commercial routes opened, resulting in a decrease in infant mortality.

38. H. Fisher and B. Grossl, "Overcoming Mining Waste Issues Will Be Key to Indonesia's Nickel Ambitions", *op. cit.*

Another major source of pollution from the mining industry is its energy-intensive character. As explained above, Indonesia uses coal to power its economy and its electricity system based on its huge reserves. However, as anywhere else in the world, such use of coal is not without repercussions on the climate, and these consequences are already visible in the case of Indonesia. Indeed, according to a study from the World Bank and the Asian Development Bank, Indonesia is ranked among the top three countries most exposed to climate change and is the 5th country with the largest population living in lower-elevation coastal zones.³⁹ Jakarta, the capital city, is slowly sinking under the sea level, and frequent floods are occurring.

If these floods have always existed, their occurrences have increased strongly. Furthermore, with the rising sea levels, the water flooding Jakarta is often no longer made of freshwater but also contains salt water as the sea invades the city. This happened in 2007, when 1.5 meters of salt water flooded into the Northern neighborhoods, leading to the death of 76 people.⁴⁰ Today, the Northern parts of Jakarta only resist floods by the sea due to the construction of a coastal wall in 2002, a wall that nonetheless did not prevent the flood of 2007. Extreme weather events are increasing: floods, as mentioned above, but also cyclones, sea storms or heatwaves. The monsoon patterns are changing strongly. Shorter wet seasons are henceforth the norm in the Western part of the archipelago, while tremendous rainfalls engender more landslides, especially in areas of steep mountains and hills, such as Sulawesi and Maluku.⁴¹

Jakarta's air is also heavily polluted. In September 2023, the city was forced to reduce the production of one of its coal power plants due to CO₂ emissions and the high degree of pollution within the capital.⁴² In 2021, around 150,000 people died prematurely from exposure to ambient air pollution in Indonesia and 100,000 from breathing polluted indoor air.⁴³ While Indonesia had the 5th highest GDP per capita in the ASEAN in 2022, the country was only in 8th place (of 10) concerning life expectancy, ahead only of Laos and Myanmar (see Table 3).

39. "Climate Risk Profile: Indonesia", The World Bank Group and Asian Development Bank, 2021, available at: www.adb.org.

40. O. Sevin, "L'aménagement sans cesse repoussé de la baie de Jakarta", Bulletin de l'association de géographes français, Vol. 98, No. 1, 2021, pp. 118-136, available at : <http://journals.openedition.org>.

41. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia", *op. cit.*, pp. 49-50.

42. "Asphyxiée par la pollution, l'Indonésie réduit la production d'une de ses centrales à charbon", *La Tribune*, September 6, 2023.

43. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", *op. cit.*, p. 203.

Table 3. A comparison between GDP per capita and life expectancy for ASEAN members

Country	GDP per capita in 2022 (thousand USD)	Rank among ASEAN countries	Women's life expectancy in 2022 (age)	Men's life expectancy in 2022 (age)	Rank among ASEAN countries
Singapore	82.81	1 st	85.2	80.7	1 st
Brunei Darussalam	37.85	2 nd	78.3	74.5	2 nd
Malaysia	12.47	3 rd	75.8	71.3	4 th
Thailand	7.07	4 th	80.7	73.6	3 rd
Indonesia	4.8	5 th	73.8	69.9	8 th
Vietnam	4.09	6 th	76.4	71.1	6 th
Philippines	3.62	7 th	77.5	71.3	5 th
Laos	2.05	8 th	69	66	9 th
Cambodia	1.8	9 th	75.5	71.2	7 th
Myanmar	1.23	10 th	71.3	62.8	10 th

Source: Ifri, based on data from the IMF and the ASEAN, available at: <https://asean.org>.

Note: For the life expectancy rate, the ranking is based on an average between women and men.

Solving the equation of Indonesia's energy transition

Poor environmental performance could be an obstacle to Indonesia's trade with the EU and, to a lesser extent, with the US. In its Enhanced Nationally Determined Contribution (NDC), Indonesia has pledged to reduce its greenhouse gas (GHG) emissions by 32% (unconditional) and 43% (conditional) by 2030, relative to a business-as-usual baseline.⁴⁴ Within the scope of its national strategies, the country has committed to reaching carbon neutrality by 2060. Indonesia also signed a "Just Energy Transition Partnership" (JETP) with Western countries at the end of 2022 during the

44. Enhanced Nationally Determined Contribution, Republic of Indonesia, 2022, available at: <https://unfccc.int>. "Unconditional" refers to the target reachable by Indonesia without foreign support, while "conditional" refers to the target reachable with foreign support.

G20 summit in Bali.⁴⁵ Following this signature, a Comprehensive Investment and Policy Plan (CIPP) was prepared and published in November 2023 by the National Energy Transition Task Force Working Group. The plan aims to allow Indonesia to reach net zero emissions for its power sector by 2050 and selects several areas as the main objectives and actions to carry out the related ambitious transformation:

- The deployment of various renewable energy sources, including the development of a diversified supply chain in this field.
- The construction of strong electricity grids and transmission lines throughout the archipelago.
- Early coal-fired power plant retirement and the management of a coal phase-out.⁴⁶

Reshaping the electricity mix: from 87% fossil fuels to renewables

To reduce Indonesia's GHG emissions, the CIPP intends first to transform Indonesia's electricity system. Overall, electricity generation and installed capacity must increase strongly. Generation is expected to grow from 308.2 TWh in 2022 to 1,482 TWh in 2050, while the installed capacity needs to increase from 63 GW to 519 GW within the same time frame.⁴⁷

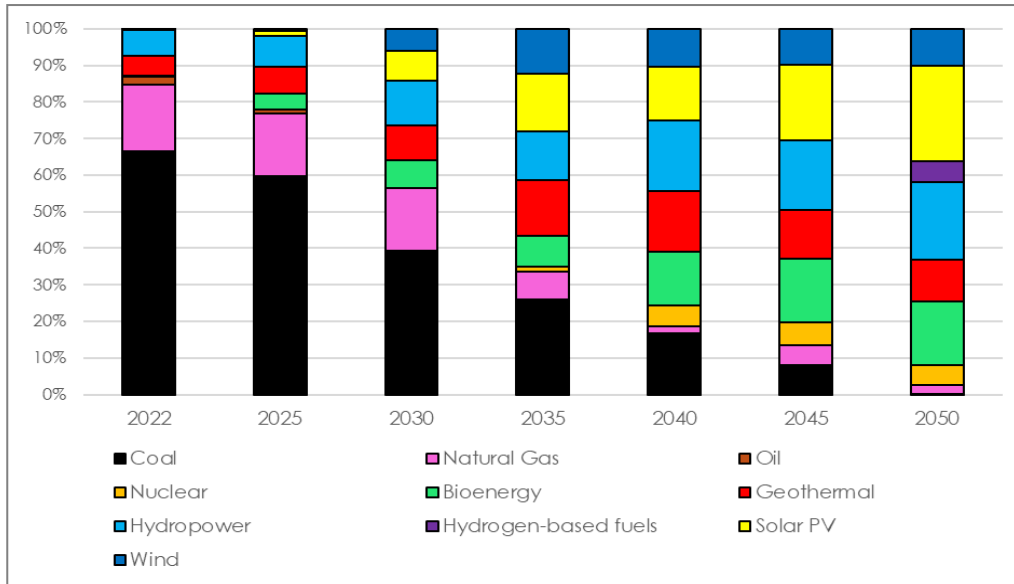
Alongside increasing the electricity generation and installed capacity in the country, the other major challenge will be to transform the electricity mix, which currently relies heavily on fossil fuels. According to the data from the CIPP, 87% of electricity generation in the country relied on fossil fuels in 2022, with 67% coming from coal (see Figures 12 and 13). Renewables accounted for 13% of the power generated, mainly from hydropower (7.3%) and geothermal power (5.4%). The agenda presented by the CIPP thus looks audacious. Developing an electricity mix made of 92% of renewables and only 2.6% of fossil fuels in 2050 appears to be a very ambitious target.

45. These countries are members of the International Partners Group (IPG), and in the case of the Indonesian JETP bring together the US, Japan, Canada, Denmark, the EU, France, Germany, Italy, Norway and the United Kingdom. The agreement is expected to mobilize USD 20 billion in public and private investments to support a just energy transition in Indonesia. Such an agreement was also signed with South Africa in 2021 and Senegal in 2023.

46. *Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023*, *op. cit.*, p. 74.

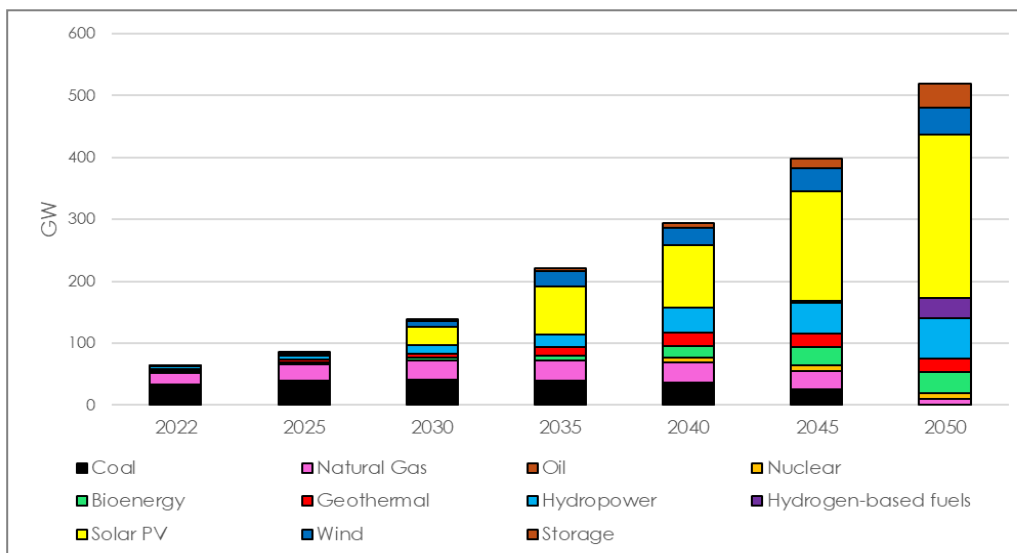
47. *Ibid.*, p. 45.

Figure 12. Power generation trend according to the CIPP pathway



Source: Ifri, based on data from Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023, op. cit., p. 45, available at: <https://jetp-id.org>.

Figure 13. Installed capacity trend according to the CIPP pathway



Source: Ifri, based on data from the Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023, op. cit., available at: <https://jetp-id.org>.

To succeed in such a transformation, solar photovoltaic (PV) power will play a key role, expected to account for 26% of electricity generation by 2050 and more than 50% of the installed capacity. Among other renewables, the development of hydropower and bioenergy will be essential as well, accounting for 21% and 17.5% of the generation by 2050, respectively. For their part, onshore and offshore wind are planned to account for 10% of the generation and 44 GW of installed capacity by then.

Indonesia indeed has major potential to develop more renewable energy sources. According to the IEA, 1,500 GW of utility-scale solar PV could be installed in Indonesia as well as 500 GW of onshore wind power. Hydropower and geothermal potentials are respectively estimated at 70 GW and 24-40 GW.⁴⁸ Nevertheless, the levelized costs of energy (LCOE) for utility-scale solar PV and onshore wind in Indonesia remain relatively high in comparison with other emerging countries, such as Brazil, South Africa, and India.⁴⁹

Furthermore, while the archipelago as a whole truly has important potential for solar and wind power, this potential is not equally shared between the different islands. More than three-quarters of the 1,500 GW solar PV potential is indeed concentrated in Sumatra and Kalimantan (82%), while Java-Bali and Sulawesi account for only 7.2% of this potential. It is similar for wind power, with 59% for Sumatra and Kalimantan and only 18.4% for Java-Bali and Sulawesi. Yet, by 2030, more than 70% of the Indonesian electricity demand is set to come from Java-Bali, and the energy-intensive nickel smelters of Sulawesi, currently coal-powered, are likely to need imports from other regions in the future if they are to use clean electricity. Indeed, according to the IEA, Java-Bali is expected to import 350 TWh of electricity annually by 2050, coming from the other islands of the country (Sumatra, Kalimantan, Maluku, etc.).⁵⁰

Establishing a dense and resilient grid in an archipelago of 17,000 islands

A key obstacle, however, is that currently, none of Indonesia's major islands are connected with each other. Indonesia does not have one electricity system, but 52. This situation is due to Indonesia's geography, with the difficulty of connecting the 17,000 islands of the archipelago, spread over tremendous distances. The northwestern point of Indonesia, in Sumatra, and its southeastern point, in Papua, are 5,300 km apart: i.e., the distance between New York City and Brest (on the tip of Brittany in France) on the other side of the Atlantic Ocean. To interconnect the Indonesian islands and allow the electricity trade expected as part of the decarbonation path, the IEA estimates that the installed capacity of the inter-regional electricity grids in Indonesia should be around 70 GW by 2050.⁵¹ A first connection is expected to be operational in 2029 between Java and Sumatra, using high voltage direct current (HVDC) technology. According to the CIPP, since this HVDC project will be the first of its kind in Indonesia, and to avoid technical implementation shortcomings, "it will be crucial for PLN to

48. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", op. cit., p. 183.

49. Ibid., p. 195.

50. Ibid., pp. 182-189.

51. Ibid., p.188.

engage well-experienced international firms, especially a utility abroad that has experience in the successful design, construction, and operation of HVDC facilities.”⁵²

However, the weaknesses of the archipelago's grid do not concern only inter-regional connections. A lot needs to be done inside the different Indonesian regions as well. As of today, the country's transmission grid is mainly made up of 150 kilovolts (kV) lines, with a limited number of 275 kV and 500 kV lines, concentrated in Java-Bali and Sumatra. Once again, Indonesia's geography is a major challenge for the construction of strong networks. Some of the archipelago's islands, such as Sulawesi or Maluku, have slender and winding profiles, entailing the development of long transmission lines. Such backbone networks are more vulnerable than networks designed in a “spider-web model” since a single line is responsible for almost all of the electricity system's proper functioning. Some islands with more circular profiles, like Kalimantan, are, for their part, covered by highly dense forests or steep relief areas, making the deployment of long transmission lines difficult as well. Finally, extreme weather events, which are more frequent with climate change, have huge impacts on the energy infrastructure and on grids. Tropical cyclones damaged the transmission lines in 2019 and 2021; heavy rainfall or flooding may lead to the shutdown of power plants, while heatwaves can result in blackouts due to a high peak of electricity demand, as happened on Lombok Island in 2019.⁵³

To further develop and strengthen the national electricity grid, the CIPP focuses on five main projects (see Figure 14):

- The Sumatra backbone and Sumatra-Batam-Bintan interconnection (500 kV and 275 kV);
- The Java-Sumatra HVDC Interconnector;
- The Sulawesi backbone (275 kV);
- The Northeast Kalimantan backbone (500 kV);
- Grid modernization and digitalization with Smart Grid technologies.⁵⁴

In its report, the CIPP estimates the required annual investments for the development of an efficient and resilient grid by 2050 to be USD 3 billion annually, with cumulative investments reaching USD 50 billion by 2040.⁵⁵

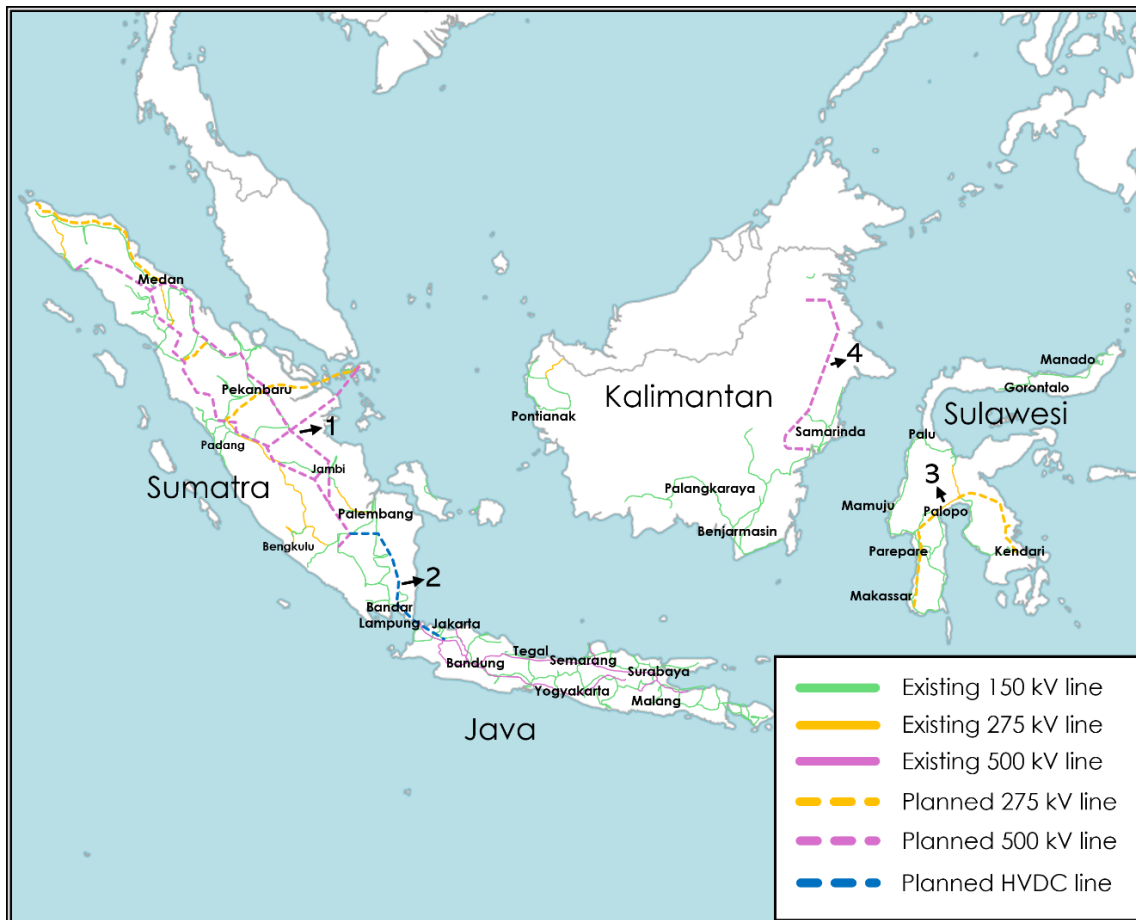
52. *Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023*, op. cit., p. 83.

53. “An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report”, op. cit., p. 49.

54. *Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023*, op. cit., pp. 77-83.

55. *Ibid.*, p. 74.

Figure 14. Electricity grids in Western Indonesia in 2023



Source: Ifri, based on data from Just Energy Transition Partnership Indonesia. Comprehensive Investment and Policy Plan 2023, *op. cit.*, pp. 79-82, available at: <https://jetp-id.org>.

The possibilities for phasing out coal

According to the CIPP, the last stage of Indonesia's decarbonization relies on a coal phase-out, with the early retirement of coal-fired power plants. This part appears to be the most difficult.

Indeed, as mentioned above, the role of coal in the Indonesian economy is central. In its Coal Transition Exposure Index, measuring the degree of dependence on coal in national economies, the IEA gave Indonesia a score of 5.76, putting it at the top of its ranking.⁵⁶ In 2022, the country accounted for 49% of ASEAN's coal consumption while representing only 41% of the bloc's population.⁵⁷ The electricity generation through coal is favored by a domestic market obligation policy, according to which domestic coal miners must supply 25% of their annual production to PLN. Furthermore, this coal is sold at USD 70 per tonne, which is well

56. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", *op. cit.*, pp. 159-160.

57. "Coal 2023. Analysis and Forecast to 2026", *op. cit.*, p. 33.

below current international prices.⁵⁸ Therefore, current electricity tariffs do not support wind and solar and are incentives to generate power through fossil fuels, especially coal.

Jakarta's recent decisions raise questions about its willingness to decarbonize its economy, as well as about the realism of this policy. Indeed, according to Reuters, on February 20, 2024, Indonesia launched a revised "taxonomy", also called the green investment rulebook.⁵⁹ This rulebook categorizes investments made in Indonesia using a traffic light system:

- Green: investments considered aligned with efforts to meet Indonesia's decarbonization goals.
- Yellow: investments in sectors considered to support the transition to a low-carbon economy.
- Red: investments in sectors that are considered harming the environment.

Investments in coal-fired power plants are classified in the yellow category as long as they meet certain criteria (being built before 2031, shut down by 2050 and reducing their GHG emissions by 35% within ten years of operation). This analysis relies on the fact that the energy produced through the coal plants will be used to extract and transform critical minerals, which will then contribute to the energy transition. In its Coal Report of 2023, the IEA also identifies five new coal mining export projects in Indonesia.⁶⁰ It should, therefore, be noted that these projects are less numerous than the ones developed in Canada (12) or Australia (23), for instance.

Nevertheless, one can legitimately wonder about the realism of the decarbonization pathway presented and the willingness to convert it into actions. As the IEA has put it: "Despite Indonesia's aims to transition to clean energy and reduce coal usage, underlined by the USD 20 billion package in the Just Energy Transition Package (JETP), it is about to construct multiple coal-fired power facilities tailored for industrial purposes. These captive coal plants, whose primary objective is to feed nickel, cobalt and aluminum smelters, account for 13 GW of the total 18 GW in the pipeline".⁶¹

58. "An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Agency Special Report", op. cit., p. 45.

59. "Indonesia's New Green Investment Rulebook Includes Coal Power Plants", Reuters, February 20, 2024.

60. "Coal 2023. Analysis and Forecast to 2026", op. cit., pp. 120-123.

61. Ibid., p. 33.

Indonesia's strategy for the exploitation of minerals remains hard to read

Alongside the difficult task of transforming its energy mix, Indonesia faces another challenge on its horizon, namely the definition of its mining and metallurgical strategy in a world where the metals present in the archipelago's subsoil are becoming more important every day.

While Indonesia has a major asset with its nickel resources, the country also intends to develop or reinforce the production of other minerals, with the development of numerous mines and smelters designed for aluminum, manganese or cobalt.

Indonesia's strategy is not restricted to nickel

As with nickel, minerals containing cobalt do not contain only cobalt atoms. These atoms are indeed mixed with a lot of other elements. Nonetheless, while nickel is the 5th most common element on earth, with around 75 to 80 grams per tonne (g/t) of Earth's crust, cobalt is a scarcer element, with only around 23 to 25 g/t. Cobalt is thus almost always never extracted as a primary product in a mine and is generally a by-product of copper or nickel mining. Therefore, while 73% of the world's cobalt was extracted from copper mines in the Democratic Republic of Congo (DRC) in 2023, this situation could change if the cobalt present in Indonesia's nickel deposits were to be refined.⁶²

To do this, Indonesia needs to develop HPAL smelters on its territory, which were recently built to transform nickel ore (as explained above). The use of these refinery plants has enabled Indonesia to increase its cobalt production as well, making it the second largest producer in the world (even if far below the DRC), although Indonesian production was almost non-existent in 2020. According to forecasts, the proportion of cobalt mined as a by-product of nickel extraction could grow from 25% across the world in 2023 to 41% in 2030,⁶³ especially due to new supplies coming from

62. It is important to note that this decrease in the share of the DRC in global cobalt extraction results from an increase in production outside of the DRC, not from a reduction in the DRC's cobalt output.

63. "Two-fifths of Cobalt Could Come from Nickel Mines by 2030", Benchmark Mineral Intelligence, September 15, 2023.

Indonesia. According to the Cobalt Institute, Indonesia has the potential to multiply its 2022 cobalt production (9,600 tonnes) tenfold by 2030.

Indeed, the use of HPAL on Indonesian nickel ores leads to the formation of mixed hydroxide precipitate (MHP), which mainly contains nickel but also cobalt and manganese hydroxides. This MHP thus holds all the elements used to produce the cathodes (one of the two electrodes) of NMC batteries. These batteries, indeed, take their name from the fact that their cathodes are made of nickel, manganese and cobalt. Their chemistry has evolved, using less cobalt and manganese than before: roughly 25% of EV batteries manufactured today use the NMC technology, with a proportion of around 70%-20% of nickel, 20%-10% of manganese and 10% of cobalt.⁶⁴ These shares correspond to the output shares of the MHP produced in Indonesia. This could, therefore, constitute a major advantage for Indonesian mineral production compared to that in the DRC, with all three elements (nickel, manganese and cobalt) gathered in the same place. By exploiting this strength, Indonesia could develop a strong cathode industry.

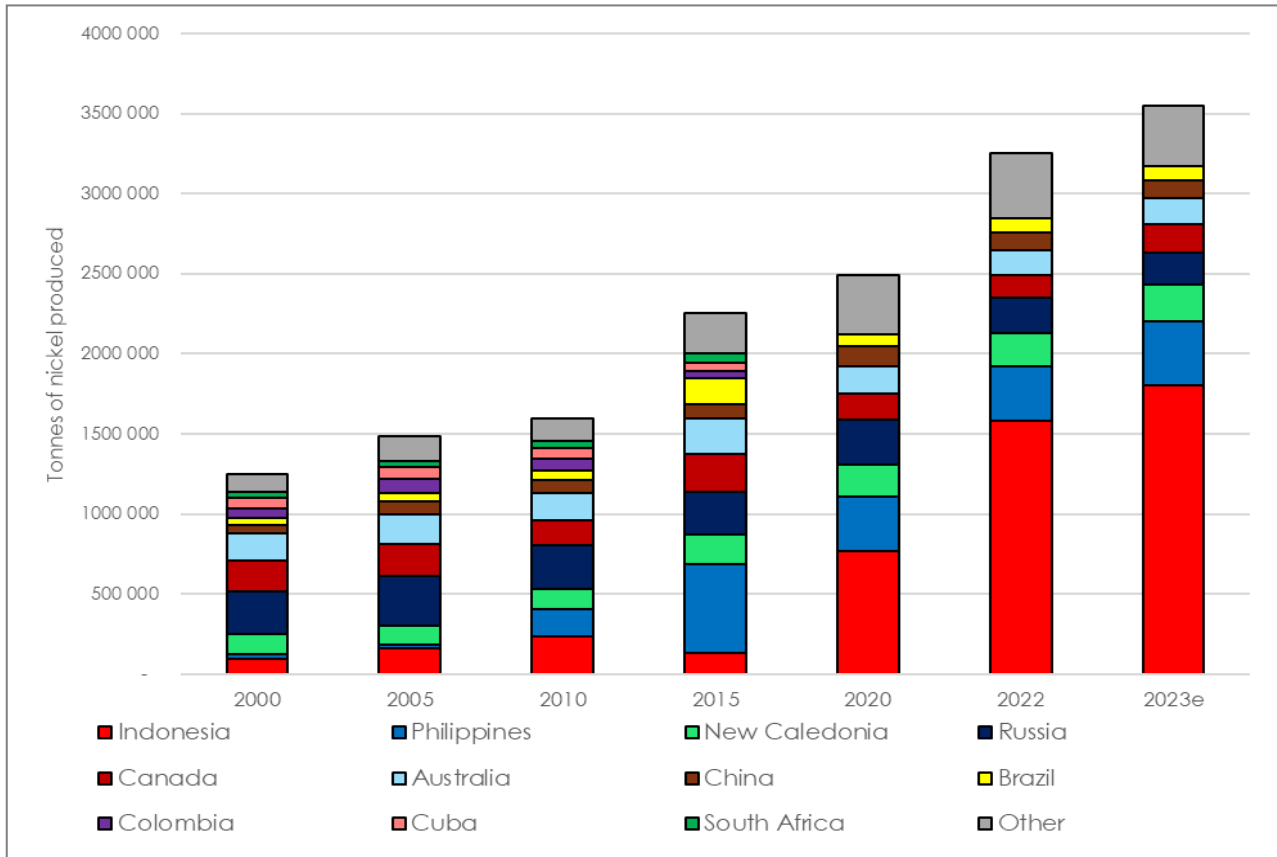
Alongside cobalt, Indonesia is also developing an important number of smelters designed to refine bauxite, copper or zinc, as shown in Figure 10 and Table 2 above. Will there be a surge in Indonesia's production of these metals as well?

Indonesia's nickel ambitions: the biggest question mark

Nickel output has already seen a surge. Since 2021, Indonesia has strongly increased its nickel production, reaching levels no country had ever achieved in the past (see Figure 15). In 2023, the Indonesian nickel mine production was estimated at 1,800,000 tonnes (up 73% compared to 2021), covering half of global production. This production increase has led to falling nickel prices.

64. "Critical Minerals Market Review 2023", IEA, December 2023, p.38, <https://iea.blob.core.windows.net>. During the past 7 years, the chemistry of NMC batteries has evolved, from NMC 333, also called NMC 111 (33% Ni, 33% Mn, 33% Co), to NMC 532 (50% Ni, 30% Mn, 20% Co) or NMC 622 (60% Ni, 20% Mn, 20% Co), and eventually to NMC 721 (70% Ni, 20% Mn, 10% Co) or NMC 811 (80% Ni, 10% Mn, 10% Co).

Figure 15. Global nickel production (2000-2023)



Source: Mineral Commodity Summaries. *op. cit.*, available at: <https://pubs.usgs.gov>.

Since January 2023, these prices have fallen sharply, the “devil’s metal” losing half of its value. For several nickel producers, and especially for western producers (Canadian, Australian, New Caledonian, etc.), low nickel prices are highly problematic since they are subject to higher environmental standards and, therefore, costs. Furthermore, these costs cannot be compensated by keeping prices higher since the nickel price is regulated by the London Metal Exchange (LME). Australian and New Caledonian nickel industries are thus facing major difficulties. Several Australian nickel mines and smelters have been shut down since the beginning of the year, and the Australian government, urged by its mining companies, has called on the LME to rethink its nickel assessments, working, for instance, on a “clean nickel” price, with higher environmental, social and governance (ESG) standards. Australia has been backed by the US on this point.⁶⁵

65. M. Cranston, “London Exchange Rejects Bid to Have ‘Green’ Nickel Recognised”, *Australian Financial Review*, March 6, 2023.

Yet, so far, this request has not been successful. At the beginning of March 2024, the LME rejected the Australian proposition, stating that a market for “green nickel” was “not yet large enough to support vibrant trading” and that “further industry consensus and agreed industry standards will be needed in order to provide the data necessary for consumers to be able to make fully informed purchasing decisions.”⁶⁶

The bad consequences of falling prices are not restricted to Australia. About 1,200 km to the East, mines in Neo-Caledonia are also encountering severe difficulties. The three mining companies of the French archipelago are going through a very tough period, leading Paris to design a so-called “Pacte Nickel” deal. Aiming to rescue the nickel industry, the agreement involves the French State, the Neo-Caledonian government, and the nickel companies. It provides, among other things, permission for crude ore export and a ten-year investment program from France to provide clean energy to the companies. The latter will have to convert their smelters to hydrometallurgy processes, and their supply will primarily go to the European market.⁶⁷ The deal has not, however, yet been voted on by the Neo-Caledonian Congress.

Maintaining high production levels to keep nickel prices low could be a deliberate strategy on the part of Indonesia and/or some of the nickel companies established in the archipelago. “We don’t see any reason why we should not expand production of nickel for battery materials”, Septian Hario Seto, Indonesian deputy coordinating minister for investment and mining, stated on April 1.⁶⁸ According to forecasts, Indonesian production is likely to continue its growth until 2030, reaching 4 million tonnes at that point, and will account for almost 70% of global nickel production by 2035.⁶⁹ Could Indonesia develop a similar strategy to that of the Organisation of the Petroleum Exporting Countries (OPEC) in 2014? Keeping its production high, Indonesia could indeed try to flood the market and stifle Western producers, making them go bankrupt.

Even if the country already controls a large share of the world’s nickel supply, its government has indeed already shown its willingness to create a “cartel” that would control global supplies of this battery metal.⁷⁰ Yet this could also be a dangerous game. Low nickel prices are an issue for Indonesia as well. Indeed, an important correlation exists between the

66. “Discovering the Low Carbon Premium for the Nickel Market”, London Metal Exchange, March 5, 2024.

67. S. Riahi, M. Noukouan and F. Tromeur, “Que contient le pacte sur le nickel calédonien en attente de signature ?”, *La 1^{ère}*, March 20, 2024.

68. A. Anantha Lakshmi, “Indonesia to Accelerate Nickel Production Despite Low Prices”, *The Financial Times*, March 28, 2024.

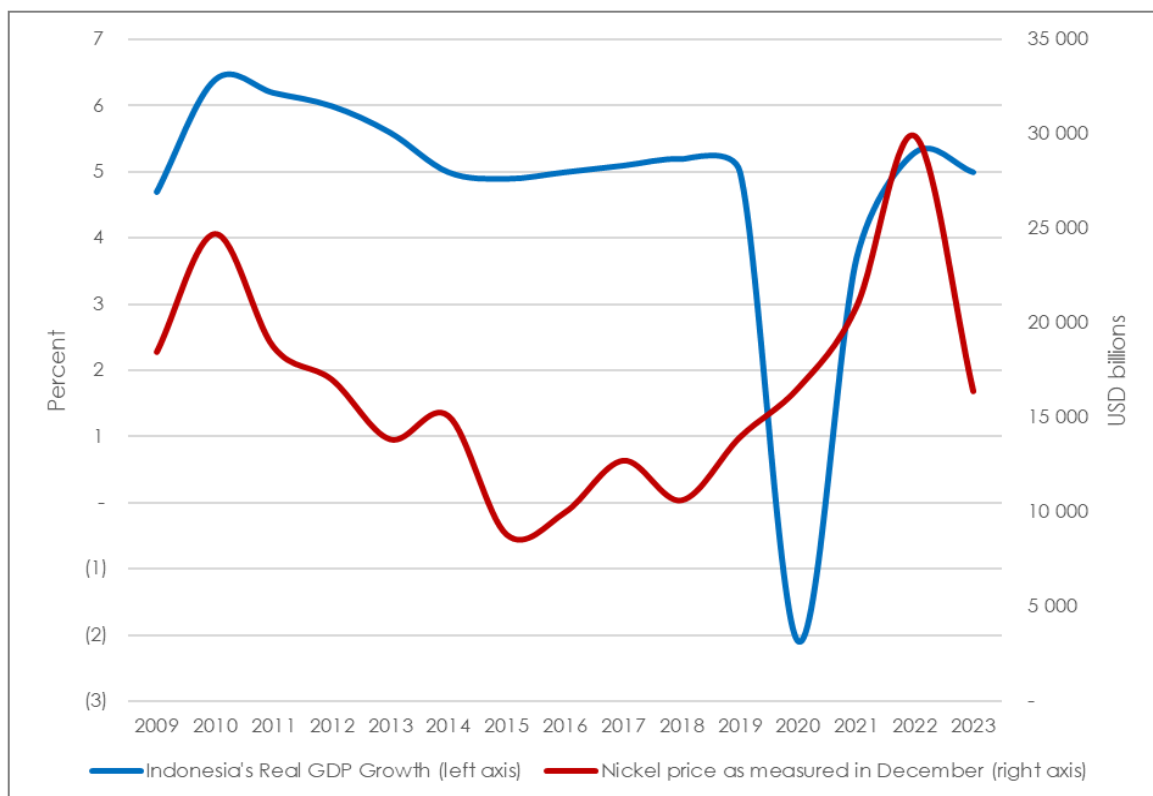
69. “Struggling Nickel Miners Press for Alternative Pricing Mechanisms”, Benchmark Mineral Intelligence, February 27, 2024.

70. É. Goetz, “L’Indonésie réfléchit à créer une Opep des métaux pour batteries”, *Les Échos*, November 3, 2022.

nickel price and Indonesia's GDP growth (see Figure 16). In 2011, a big decrease in nickel prices was concomitant with a slowdown in Indonesian economic growth. In the same way, Indonesia's last period of economic growth (2016-2023) occurred in the context of increasing nickel prices, and in 2023, growth started to slow down as well.⁷¹

The overall nickel market is forecast to be in oversupply until 2027, but specifically regarding nickel sulfate (used to produce batteries), a supply deficit is set to occur from 2025 onwards and could make prices increase. Nonetheless, such a supply deficit will depend on how the EV industry and EV sales develop around the world.⁷²

Figure 16. Correlation between nickel price and Indonesian GDP growth



Source: Ifri based on data from the IMF and Trading Economics, available at: <https://tradingeconomics.com>.

71. Since March 2024, the price of nickel has started to increase again, mainly due to the announcement of sanctions on Russian metals from the US and the United Kingdom. This announcement has resulted in a rise in copper, aluminum and nickel prices. However, this growth in prices is likely to be circumstantial, particularly if new nickel surpluses continue to come from other parts of the world, such as Indonesia.

72. Forecast presented by Benchmark Mineral Intelligence on a webinar: "Sustainable Nickel Prices: A New Benchmark for the Industry", April 18, 2024.

Furthermore, Jakarta's strategy of developing battery factories inside the archipelago could become a weakness. It seems that export markets will be harder to penetrate. As explained above, it is rather uncertain if batteries containing Indonesian minerals will be eligible for IRA tax credits. Furthermore, should an FTA not be signed eventually between the US and Indonesia, then US EV battery producers could try to prioritize the development of lithium iron phosphate batteries (LFP) that contain minerals for which they are less dependent or for which they are dependent on countries much more closely allied to the US (Australia, Canada, Chile, etc.).⁷³ At the same time, the EU is raising its environmental, social and governance norms and working on a battery passport, while China's strength in the electric vehicle industry is blatant.

Getting into Western markets could become an increasingly arduous task for Indonesian batteries if their manufacturing ESG standards are not revised, especially with regard to electricity generation.

Advancing towards both decarbonization and the development of a battery industry could include the following steps:

1. Boosting the development of renewable energy sources:

- Deploying renewables, especially solar PV, for mines and smelters to reduce the use of coal, for instance, through incentives.
- Developing offshore wind farms, particularly in the Java and Banda seas as well as in the Karimata straight. This could be done through the construction of hybrid networks, powering several islands of the archipelago and thus reducing the need for extensive submarine transmission interconnections. These networks are indeed called "hybrid" since they combine generation and transmission assets, thus optimizing investments.
- Transferring electricity incentives from coal to renewables in order to make their LCOE decrease.

2. Developing a sustainable battery industry:

- Fostering working and security conditions for miners and metallurgists.
- Developing ESG standards for mines and smelters and correlating the exploitation of the country's subsoil with respect to these norms, for instance, relying on a system of export bans.

73. LFP batteries nonetheless present several weaknesses: lower energy density, poor cold weather performance or poor economics of recycling due to low value of recovered material, which leads to landfilling.

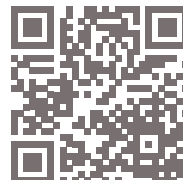
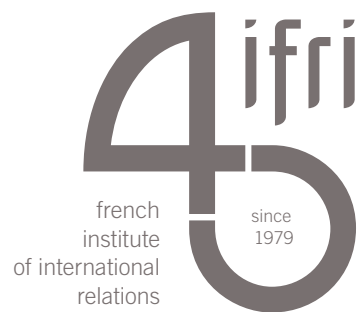
Such a system has been put in place to force industrials to build smelters and has shown its strength. Foreign investors did not flee the country; rather the opposite. Indonesia currently holds such a stranglehold on nickel that it will be hard to operate in the future without the country, whether or not it applies high ESG standards.

- Developing a “green cathode industry”, exploiting the fact that all three NMC components are present in Indonesia at the same place. This would mean lower logistical costs for cathode producers, as well as less GHG emissions from shipping. Furthermore, Indonesia does not only hold reserves of these three metals but also of copper, aluminum, iron, and phosphate and is even prospecting for graphite deposits.⁷⁴ These minerals could create a crucial comparative advantage for the development of an Indonesian battery industry, even maybe an EV industry.

3. Protecting climate and biodiversity:

- Favoring innovative solutions for waste management, especially the reforestation of former mining zones or the deployment of solar panels in these areas.
- Establishing a national independent commission in charge of assessing and upholding ESG criteria, as well as security standards and indigenous tribes' rights. To avoid local corruption, it would be preferable that this commission operates nationally, with members not living in the areas they are assessing, in order to limit local political influences on its work.

74. “Indonesian REE, Lithium, And Graphite Potency”, Indonesia Geological Agency, Ministry of Energy and Mineral Resources, August 3, 2023, available at: <https://geologi.esdm.go.id>.



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