

The Development and Emission Reduction Path of Indonesia's Nickel Industrial Parks



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THE RAPID DEVELOPMENT OF NICKEL INDUSTRIAL PARKS IN INDONESIA

Nickel, as an important alloying element, has traditionally been widely used in the production of stainless steel and other corrosion-resistant alloys. With the continuous innovation in clean energy technologies, the application of nickel in new energy battery manufacturing is becoming increasingly prevalent, making it an indispensable key material in the fields of electric vehicles and energy storage. According to a report by the International Finance Corporation (IFC) of the World Bank, to achieve global net-zero emissions targets, the annual supply of nickel needs to increase by 208% by 2050 compared to 2020 [1]. Due to the significant influence of nickel production and supply on the global energy transition and the future dynamics of the energy sector, key industrial nations—such as the United States, the European Union, Canada, Australia, and China—consider nickel a crucial mineral resource and assign it considerable strategic importance.

The global nickel ore resources exceed 350 million tons and are highly concentrated in a few countries. Data from the USGS in 2024 indicates that Indonesia holds the top position worldwide for proven nickel reserves, accounting for 42% of the total global supply, well ahead of Australia (18%) and Brazil (12%)[2]. Notably, while Indonesia is the largest country in terms of nickel ore resources, it did not secure its place as the leading producer globally until after 2017 (Figure 1). Statistical data indicates that global nickel production reached approximately 3.6 million tons in 2023, representing a notable increase of 10.1% compared to the previous year. Of this total, Indonesia contributed a significant 50%, with its production rising by 13.9% from 2022 [3]. The remarkable advancement of Indonesia in both nickel resources and the associated industrial chain can be primarily attributed to effective industrial policies and considerable investments from Chinese companies. In recent years, Indonesia has made substantial strides in utilizing its nickel ore resources to foster the development of downstream industries, particularly in steel production and new energy battery manufacturing. The rapid growth of these

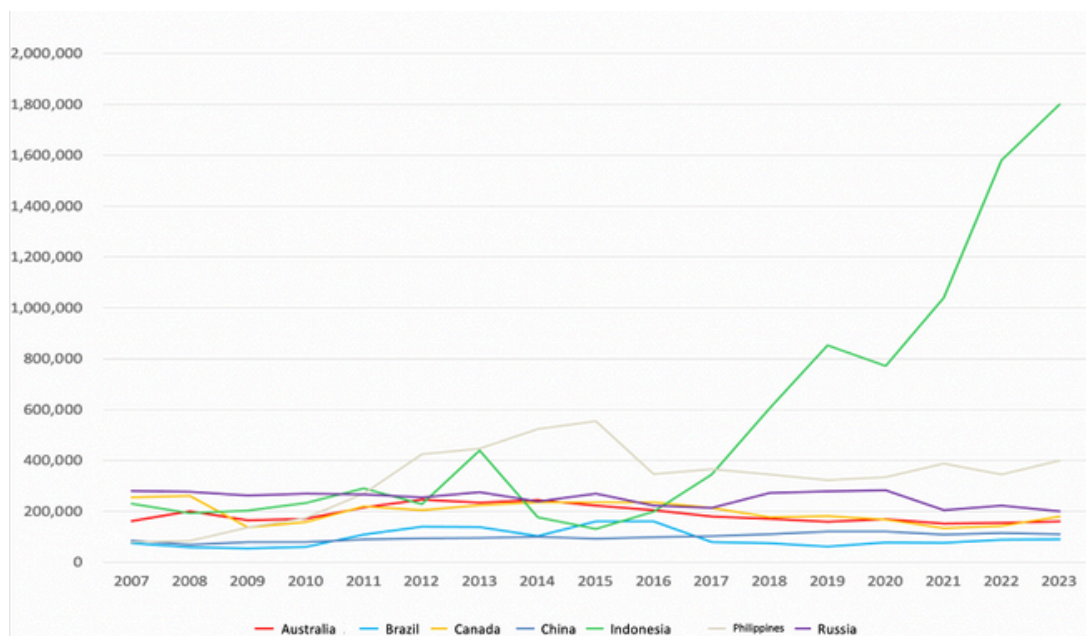


Figure 1: Nickel Production (in tons) of Major Nickel Producing Countries from 2007 to 2023. Source: USGS (Compiled and illustrated by IIGF, CUFE).

downstream sectors has subsequently stimulated expansion in the mining industry, thereby establishing a constructive cycle of "resources + industry." The share of the mining sector in Indonesia's GDP increased significantly from 4.3% in 2020 to 9.2% in 2022 [4]. Concurrently, in 2021, Indonesia surpassed India to secure its position as the world's second-largest producer of steel, following China.

The Indonesian government has demonstrated a far-sighted strategic vision in promoting domestic industrial development, particularly in guiding foreign investment and managing policies in the mining and related industries. In 2009, former President Susilo Bambang Yudhoyono, who served as the Minister of Energy and Mineral Resources, enacted the Mining Law, which prohibited the export of raw minerals starting in 2014 and encouraged foreign enterprises to invest in local downstream processing facilities. After President Joko Widodo took office in 2014, a series of policies aimed at encouraging foreign investment were introduced, with the government maintaining a focus on long-term goals such as job creation, enhancing the value-added of strategic industries, and promoting economic diversification. In terms of easing foreign investment restrictions, the Indonesian government removed the foreign ownership limit for mining companies in 2021, creating a more accommodating environment for foreign entry into the Indonesian mining market. Another significant reform initiative is the Omnibus Law on Job Creation, which aims to enhance Indonesia's market competitiveness by reducing corporate taxes, reforming labor laws, and improving administrative efficiency.

The accelerated growth of Indonesia's nickel mining sector and its associated downstream industry chain has been significantly supported by continuous investments from Chinese enterprises.

By 2023, foreign investment in Indonesia's metals industry had soared to approximately \$53.3 billion, with a substantial portion directed towards nickel mining-related activities. In the last decade alone, Chinese investments have exceeded \$14 billion, underscoring their critical role in the development of Indonesia's nickel industry chain [5]. Chinese enterprises, such as the Tsingshan Holding Group, began their involvement in nickel mining development in Indonesia as early as 2009. They have continuously adjusted their corporate strategies in line with Indonesia's progressive industrial policies to build clusters of downstream industry chains, ultimately establishing large industrial parks represented by the Morowali Industrial Park (IMIP) and the Weda Bay Industrial Park (IWIP). The Central Sulawesi and North Maluku provinces, where these parks are located, have become the fastest-growing regions in Indonesia, with growth rates of 11.91% and 20.49% in 2023, significantly surpassing the national average of 5.05% [6]. The successful experiences of IMIP and IWIP have also attracted a multitude of Chinese companies eager to invest in Indonesia's nickel industry chain, including Delong Steel, Lygend Resources, and Zhejiang Huayou Cobalt.

ISSUES AND CHALLENGES IN THE DEVELOPMENT OF NICKEL INDUSTRIAL PARKS AND FUTURE OUTLOOK

However, the rapid growth of the mining industry and its related sectors inevitably brings numerous environmental and social governance challenges. In the model where large industrial parks serve as the primary engines of economic development, a key challenge for Indonesia in the next phase of its economic growth will be how to incorporate environmental and social sustainability goals while maintaining high-speed growth. From a micro-level perspective concerning the regions surrounding these parks, our field research indicates that the

socio-economic structure around IMIP and IWIP is undergoing fundamental changes. The local community has rapidly expanded from a traditional village of fewer than 10,000 households to a medium-sized town with nearly 300,000 residents, with the primary sources of income shifting from agriculture and fisheries to commerce and services. At the same time, the rapid urbanization driven by large industrial parks naturally gives rise to various public governance challenges, such as traffic, waste management, education, healthcare, and the lack of essential public services like water and electricity. Given the governance gaps arising from the swift and significant transformations in local communities, the way in which Chinese enterprises establish their responsibilities and take on appropriate roles will be crucial for the sustainable development of these communities throughout the urbanization process.

From the standpoint of Indonesia's national development, the focus on heavy industrial growth—particularly in mining, steel production, and new energy battery manufacturing—presents significant challenges to the country's low-carbon development strategy. In 2022, Indonesia submitted its latest Nationally Determined Contributions (NDC) in accordance with the Paris Agreement, committing to an unconditional emissions reduction of 31.89% by 2030, with the potential to increase this target to 43.2% under specific conditions. The government has outlined a plan to achieve peak carbon emissions by 2030 and reach net-zero emissions by 2060. Additionally, the National Energy Policy Framework (KEN), approved by the People's Consultative Assembly of Indonesia in 2014, established the legal framework for energy structure, aiming for a renewable energy share of at least 23% by 2025 and at least 31% by 2050. However, as of 2023, renewable energy accounted for only 13.1% of Indonesia's total electricity generation, indicating substantial challenges in achieving these imminent goals [7].

Regions in Indonesia rich in nickel resources, such as Sulawesi Island and the Maluku Islands, face challenges due to their remote geographical locations and historically low electricity demand prior to the establishment of industrial parks. As a result, the electricity infrastructure on these islands is relatively underdeveloped, with low grid coverage and unstable operations. Consequently, most nickel industrial parks rely on captive power plants for their electricity supply. Indonesia's abundant coal resources have led the majority of these captive power plants to opt for coal-fired generation. Currently, there are 117 operational captive coal-fired power plants (Captive CFPP) in Indonesia, with a total installed capacity of 10.8 GW, and an additional 14.4 GW planned [8]. These captive coal-fired power plants (CFPP) contributed to a 21%

increase in Indonesia's carbon emissions in 2022 [9], making it challenging for the country to meet its climate commitments. Indonesia urgently needs to find a strategic balance and developmental pathway between rapid industrialization and carbon emission control. To avoid pursuing climate goals at the expense of economic growth, the Indonesian government's current coal phase-out and new energy development targets do not include captive CFPPs within industrial parks. For instance, the Presidential Regulation No. 112/2022 announced in 2022 states that Indonesia will no longer construct grid-connected coal-fired power plants, but captive CFPPs are exempt from this ban.

Despite the Indonesian government's current leniency regarding CFPPs, there remains no assurance that carbon constraint policies will not be imposed on industrial parks in the future. Indonesia is presently undergoing a significant political transition, introducing a level of uncertainty concerning the trajectory of CFPPs. The newly elected President Prabowo has articulated his commitment to sustaining economic growth, targeting an ambitious 8% GDP increase within the next two to three years. The further maturation of the nickel industry chain is anticipated to play a pivotal role in driving this economic expansion; however, the potential for the new administration to reevaluate the climate implications of CFPPs associated with industrial parks should not be dismissed.

ASSESSMENT OF THE FEASIBILITY AND RECOMMENDATIONS FOR THE TRANSITION AWAY FROM COAL IN INDONESIA'S NICKEL INDUSTRIAL PARKS

The transition away from CFPPs within Indonesia's industrial parks necessitates substantial technical, financial, and policy interventions. It is impractical for enterprises to independently navigate the complexities of this transition within the confines of the parks. Technologically, the nickel industrial parks in Indonesia primarily encompass two production chains: stainless steel and battery manufacturing, with the decarbonization of stainless steel production proving particularly challenging. Current technological alternatives, including carbon capture and hydrogen-based steelmaking, have yet to achieve commercial viability at a large scale. Moreover, enhancing renewable energy generation, such as solar photovoltaic power, to mitigate carbon emissions presents significant land acquisition challenges, particularly as many industrial parks are situated in tropical forest regions. The establishment of large-scale ground-mounted solar facilities could adversely affect local biodiversity and the surrounding environment. Additionally, the intermittent nature of renewable energy sources may not sufficiently meet the high and continuous electricity demands characteristic of industrial operations, thereby preventing a complete

transition away from fossil fuel-based power generation at this juncture. Presently, the primary industrial parks are formulating renewable energy development plans aimed at achieving a generation capacity that constitutes approximately 10% to 20% of existing thermal power capacity, a figure that aligns with the national renewable energy installation ratio in Indonesia.

In the long term, the successful decommissioning of CFPPs will depend on the ongoing enhancement and fortification of the surrounding electrical infrastructure. It is imperative for both central and local governments in Indonesia to prioritize the development of power planning and grid infrastructure in regions abundant in nickel resources. Presently, the Indonesian government has proposed the construction of a 275 kV transmission backbone project in Central and South Sulawesi, which aims to create a green transmission and transformation corridor linking Central, South, and Southeast Sulawesi. This initiative is projected to require an investment of approximately \$930 million and is slated to begin construction in 2024. The establishment of this green corridor is expected to unlock the potential for developing the rich hydropower resources in Central Sulawesi, as evidenced by the inclusion of eleven hydropower projects in the national Electricity Supply Business Plan (RUPTL) for 2021–2030, amounting to a total installed capacity of 1 GW and anticipated operational status by 2030. Furthermore, the RUPTL encompasses a 130 MW wind power project alongside a designated share of solar, geothermal, and biomass energy generation initiatives. Conversely, in the Maluku Islands—where CFPPs are concentrated—the RUPTL currently lacks comparable plans for grid infrastructure development. Existing proposals focus solely on hydropower development in Papua Province, with plans to supply electricity to North Maluku Province across the sea. This approach is insufficient to facilitate the reintegration of CFPPs in North Maluku into the broader grid or to support their gradual decommissioning.

A substantial financing gap poses the primary challenge to implementing Indonesia's planned energy projects. To mitigate this, Indonesia entered into the Just Energy Transition Partnership (JETP) with key Western nations at the G20 Leaders' Summit in Bali in November 2022. The JETP initiative seeks to mobilize \$21.6 billion in both public and private investments to facilitate Indonesia's shift toward low-carbon energy. Following this, in February 2023, the Indonesian government established the JETP Secretariat within the Ministry of Energy and Mineral Resources. The Secretariat subsequently introduced the Comprehensive Investment and Policy Plan (CIPP), a strategic framework designed to guide Indonesia's low-carbon energy transition. The alignment between the CIPP and RUPTL has established these



Figure 2: Planned Diagram of the Central and Southern Sulawesi Transmission Backbone Project

Source: Just Energy Transition Partnership/Comprehensive Investment and Policy Plan (JETP-CIPP), 2023.

frameworks as crucial components in shaping Indonesia's future national power strategy. However, the effectiveness of the JETP in driving modernization of power infrastructure in nickel-rich regions—and in supporting the reintegration or phased decommissioning of captive power plants—largely hinges on the capacity and commitment of local governments and PLN (Perusahaan Listrik Negara) regional branches to implement these initiatives. Indonesia's administrative structure is notably centralized, limiting local governments' influence in power planning and project selection processes. Additionally, as tax revenues from large industrial projects are primarily allocated to the central government, local authorities have minimal incentive to back project execution. This distinctive central-local government dynamic may thus present obstacles to the rapid development of large-scale energy infrastructure.

In discussions with the IIGF, CUFÉ research team, the JETP Secretariat expressed that, although CFPPs are not yet included in the CIPP, efforts are underway to incorporate them into a cohesive strategy by December 2024. This initiative is intended to support industrial development while adhering to emission reduction goals. In light of this policy ambiguity, Chinese enterprises are encouraged to proactively prepare for potential carbon-related regulations affecting nickel industrial zones and CFPPs. Some Chinese companies have already commenced carbon assessments and accounting within these zones,

aiming to pinpoint emission sources, gather relevant data, and evaluate viable carbon reduction technologies. For various international firms operating within these zones, acquiring green certification for energy usage and emissions in accordance with ESG frameworks is increasingly becoming a necessary requirement. Many of these companies have launched small-scale pilot initiatives, including the installation of rooftop solar panels and the implementation of biomass co-generation systems that combine palm kernel and coal. Furthermore, they have proposed large-scale wind and solar energy projects in the adjacent areas to enhance low-carbon development in these zones. However, the Indonesian government's support for renewable energy projects remains inadequate, with insufficient subsidies and weak policy frameworks, leading to elevated costs for substantial investments in new energy initiatives.

The industrial structures, production capacities, and future developmental strategies of nickel industrial parks in Indonesia exhibit considerable diversity, reflecting variations in their natural environments and community development challenges. Consequently, promoting the creation of bottom-up emission reduction strategies by businesses within these parks, grounded in comprehensive carbon assessments, is likely to yield more efficient and tailored results. It is essential for the Indonesian government to refrain from imposing uniform, top-down emission reduction policies, such as setting mandatory quotas for renewable energy installations or establishing timelines for the decommissioning of coal-fired power plants. Instead, the government should focus on implementing relative constraint targets, like carbon intensity metrics, which would encourage companies to identify and adopt emission reduction approaches that align with the specific characteristics and needs of each park. Considering the significant technical difficulties and high costs associated with deep decarbonization and the attainment of net-zero emissions in nickel industrial parks, it is essential to explore the possibility of allowing enterprises in these parks to engage in Indonesia's carbon trading market [i] and green electricity trading system [ii]. Such involvement would enable these companies to utilize market mechanisms to partially offset their emissions. It is imperative for these enterprises to conduct comprehensive carbon assessments within the parks during the relevant policy period and to publicly disclose pertinent carbon emission data. Additionally, they should communicate their carbon reduction targets and strategies to address any misconceptions or concerns from external stakeholders regarding nickel industrial parks and CFPPs.

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[i] In 2023, Indonesia launched the government-supported carbon exchange, Indonesia Carbon Exchange (IDX Carbon), operated by the Indonesia Stock Exchange. The exchange currently includes various markets: an emissions market, a negotiated market, a conventional market, and a non-conventional market. The primary trading carbon units are the Approved Emission Limit Commitment (PTBAE-PU) and the Greenhouse Gas Emission Reduction Certificates (SPE-GRK).

[ii] In 2020, Indonesia initiated a Renewable Energy Certificate (REC) trading market, through which Masmindo Dwi Area (MDA), an Indonesian gold mining company, achieved its goal of 100% green electricity by purchasing RECs issued by the state-owned electricity company, PLN.

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