

AEER 2025 YEAR-END REPORT

DECARBONIZATION OF THE NICKEL INDUSTRY: EMISSIONS FROM CAPTIVE COAL-FIRED POWER PLANTS, HPAL EXPANSION, AND THE SUPPLY CHAIN DUE DILIGENCE AGENDA



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**Emissions from Captive Coal-Fired Power Plants, HPAL Expansion,
and the Supply Chain Due Diligence Agenda**

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Decarbonization of the Nickel Industry:

Emissions from Captive Coal-Fired Power Plants, HPAL Expansion, and the Supply Chain
Due Diligence Agenda

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About Action for Ecology and People's Emancipation - Aksi Ekologi dan Emansipasi Rakyat (AEER)

AEER is an Indonesian environmental organization founded in 2017, dedicated to addressing ecological and social justice issues, particularly those exacerbated by unsustainable industrial practices. AEER's mission is to rescue communities impacted by environmental degradation and promote policies that support sustainability. The organization actively campaigns to reduce the country's dependence on fossil fuels, particularly coal, while encouraging a transition to low-carbon energy alternatives. This commitment is reflected in its target to help reduce Indonesia's carbon emissions by 446 million tons of CO₂ in the energy sector by 2060.

The organization collaborates with local and international partners, including community groups, government agencies, and other NGOs, to conduct research and advocacy campaigns. AEER's activities are particularly important in the context of Indonesia's growing nickel industry, which, while playing a crucial role in the global transition to electric vehicles, also poses significant environmental and social challenges. By raising awareness, producing detailed research reports, and engaging in policy dialogue, AEER seeks to mitigate the negative impacts of mining and other industrial activities. The organization also emphasizes the importance of biodiversity conservation and the protection of vital ecosystems, working to ensure that economic development does not compromise environmental integrity.

LIST OF CONTENT

EXECUTIVE SUMMARY	5
CHAPTER 1. INTRODUCTION	1
CHAPTER 2. PROGRAM AND POLICY ANALYSIS	3
2.1 Industrial Decarbonization Policy Framework	3
2.2 Roadmap and Decarbonization Program	5
CHAPTER 3. THE DEVELOPMENT OF THE NICKEL INDUSTRY	7
3.1 Production Trend and Industrial Expansion	7
3.2 Nickel Industry for Battery Raw Materials	9
3.3 HPAL Technology and Tailing Matter	11
3.4 Main Actors and Their Origin Countries	17
CHAPTER 4. CARBON EMISSIONS AND INDUSTRIAL IMPACTS	21
4.1 Carbon Emissions from Nickel Industry	21
CHAPTER 5. STRUCTURAL PROBLEMS OF INDUSTRIAL DECARBONIZATION	25
5.1 Dependency on Fossil Energy	25
5.2 Underutilization of Renewable Energy	27
CHAPTER 6. CONCLUSION	31
6.1 Summary of Findings	31
6.2 Future Policy Direction	32

HPAL, IWIP, Central Halmahera, North Maluku,
Processing Low Grade Ore to Battery.
Photo Source: Garry Lotulung.



EXECUTIVE SUMMARY

Data shows that:

1. Massive production of refined nickel has positioned Indonesia as the world's leading refined nickel producer, triggering a surplus that drives down prices. Nickel Pig Iron (NPI) production was projected to reach 1.76 million tons in 2025 and is forecast to hit 1.97 million tons in 2026. Nickel Pig Iron (NPI) conversion to nickel matte was estimated to reach 294,000 tons in 2025, and is expected to increase to 347,000 tons in 2026. Meanwhile, Mixed Hydroxide Precipitate (MHP) production was projected to reach 399,000 tons in 2025 and rise to 543,000 tons in 2026.
2. The years 2025 and 2026 are marked by the fast expansion of High Pressure Acid Leaching (HPAL) projects, which will double the HPAL production capacity. In 2025, eight operational HPAL projects have a total capacity of 491,000 tons of nickel production in MHP annually. Additional four projects will start operating this year, doubling the production capacity to 840,000 tons of nickel in MHP. Indonesia becomes the location of world's biggest HPAL projects.
3. In 2025, Indonesia's nickel processing industry produced between 92.8 million tons of carbon dioxide (CO₂) and 224.36 million tons of CO₂. Nickel processing is an energy-intensive industry, and thus carbon-intensive as well.
4. Captive coal-fired Steam Power Plant (PLTU) is the pillar behind the rapid growth of the nickel industry in Indonesia. There are 72 units of captive coal-fired PLTU with an installed capacity of 15,405 MW built in the nickel industrial parks in Central Sulawesi, Southeast Sulawesi, and North Maluku. The installed capacity of PLTUs will still increase due to the government's regulation that allows new development of coal-fired PLTUs, as long as it is part of the National Strategic Project (PSN) on nickel downstreaming.

Therefore, the government should:

1. Limit the nickel mining quota and simultaneously halt the nickel industrial expansion where the government stops issuing the Industrial Business License (IUI) for new nickel processing projects.
2. Curb the rate of emissions from the coal-fired PLTUs and shift to clean energy by not issuing new licenses for the coal-fired PLTU projects in nickel industrial parks, despite the existence of Government Regulation (PP) No. 112/2022 that allows such projects.
3. Decarbonize captive coal-fired PLTUs in industrial parks by accelerating the gradual phase-out of captive PLTUs in nickel-based industrial parks. The operational lifespan of nickel industrial captive PLTU should be moved forward to 2034, with the requirement for the industry to develop renewable energy sources and integrate nickel-based industrial parks to State Electricity Company (PLN)'s on-grid system, creating an opportunity for energy mix.



PLTU in IWIP, Lelilef Sawai, Central Halmahera, North Maluku.
Photo Source: Garry Lotulung.

CHAPTER 1. INTRODUCTION

Demands for electric vehicle battery as part of the energy transition keep increasing. It is expected to reach more than 3 terawatt-hours (TWh) in 2030, rising from around 1 TWh in 2024. Even though electric cars are the main reason for battery demands, other types of transportation are projected to earn their market shares. In particular, electric truck contribution to the electric vehicle battery demands climbs up threefold, rising from just below 3% in 2024 to more than 8% in 2030.¹

Nickel is one of the critical minerals that are needed in electric vehicle batteries. Electric vehicle batteries with nickel-cobalt-manganese (NCM) lithium composition are still widely used in the United States of America and Europe. In contrast, the lithium-iron-phosphate (LFP) composition is more widely used in China, the world's largest electric vehicle market. China absorbed 64.70% of the market share by selling 17 million electric vehicles in 2024.²

Indonesia is the leading nickel producer globally, thus, taking a crucial role in the world's electric vehicle supply chain. With 55 million tons or 42.30% of nickel reserves out of total global reserves, Indonesia mines 2.2 million tons of nickel or 59.45% of the global total mining in 2024. This number rises significantly from 130,000 tons or around 5.70% of the global total mining in 2015.³

¹ International Energy Agency. 2025. "Global EV Outlook 2025: Expanding sales in diverse markets." Page, 135. Accessible at: <https://iea.blob.core.windows.net/assets/7ea38b60-3033-42a6-9589-71134f4229f4/GlobalEVOutlook2025.pdf>. [Accessed on 26 December 2025].

² *Ibid*

³ USGS. 2025. "Nickel Statistics and Information." Accessible at: <https://www.usgs.gov/centers/national-minerals-information-center/nickel-statistics-and-information>. [Accessed on 26 December 2025].

This significant increase in nickel mining is driven by the nickel downstream program within the last 10 years in Central Sulawesi, North Maluku, Southeast Sulawesi, and South Sulawesi. These provinces have rapidly developed into centers of processing industry that produce NPI, raw material for the stainless steel industry that also grows integrally there. Additionally, Central Sulawesi and North Maluku specifically produce nickel matte and mixed hydroxide precipitate or MHP as well, the raw materials for electric vehicle batteries.

Nickel processing is an energy-intensive industry. The nickel-based industrial parks in Central Sulawesi, North Maluku, and Southeast Sulawesi are fully dependent on the coal-fired PLTUs. In 2025, captive coal-fired PLTUs were built with an installed capacity of 15,405 MW, making the nickel-based industrial parks carbon-intensive areas. The decarbonization paradox is that the nickel processing industry for the raw materials of electric vehicle batteries still relies on the electricity supply from the coal-fired PLTUs.

The International Energy Agency (IEA) estimated that the world's CO₂ emissions reached 37.5 Gton in 2024. The contribution of carbon emission from the coal-fired PLTUs and industrial processing reached 15.6 Gton of CO₂ or around 41.58% of that year's total emission. The coal consumption in Southeast Asia, as the third biggest coal consumers in the world, increased almost 8% in 2024. This increase is largely driven by Indonesia, where the usage by the metallurgical industry, especially nickel processing, is the main contributor.⁴

Indonesia is targeting to meet Net Zero Emission (NZE) by 2026. Many policies have been enacted, and the most significant one is Presidential Regulation Number 112 of 2022 on the Acceleration of Renewable Energy Development for Electricity Provision as the groundwork of decarbonization. Sadly, there is no indication of the implementation of decarbonization in the nickel industry. One of the reasons is that Presidential Regulation No 112/2022 issued the development of coal-fired PLTUs for value-added industries designated as National Strategic Project (PSN).

⁴ International Energy Agency. 2025. *Global Energy Review 2025*. Accessible at: <https://iea.blob.core.windows.net/assets/5b169aa1-bc88-4c96-b828-aaa50406ba80/GlobalEnergyReview2025.pdf>. [Accessed on 27 December 2025]

2.1 Industrial Decarbonization Policy Framework

Industrial decarbonization refers to the efforts in reducing industrial carbon emission by adopting technologies that rely on environmentally friendly power plants and production processes.

Indonesia is targeting to meet the NZE by 2060. Several policies have been enacted to meet that target. Law Number 59 of 2024 on the National Long-Term Development Plan (RPJPN) 2025-2045 has stipulated the vision of Golden Indonesia 2045, measured by one of the targets, which is to reduce greenhouse gas emissions intensity to zero emissions. The energy transition time framework is specified, especially related to the coal-fired PLTU operations. Phase 1 (2025-2029) is the implementation of Carbon Capture and Storage (CCS)/Carbon Capture Utilization and Storage (CCUS) and limitation on coal-fired PLTU development; Phase 2 (2030-2034) is the implementation of coal-fired PLTU retirement; Phase 3 (2035-2039) is the continuation of coal-fired PLTU retirement; Phase 4 (2040-2045) is the expansion of coal-fired PLTU retirement.

Government Regulation Number 40 of 2025 on National Energy Policy serves as the key guideline for Indonesia's energy development until 2060. The scope of the energy transition program includes: "the restriction of new coal-fired power plants development, referring to the national energy security and the fulfillment of the greenhouse gas emission reduction in Energy Sector, as stipulated by the laws."⁵

The National Government is responsible for the development of the National Electricity Master Plan (RUKN). RUKN projects that in 2060, new and renewable energy will account for 73.6% of the energy mix, while fossil energy plus carbon capture and storage (CCS) represents around 26.4%. Decision of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number

⁵ Refer to Article 42 paragraph (2) letter f of Government Regulation Number 40 of 2025 on National Energy Policy.

85.K/TL.01/MEM.L/2025 on National Electricity Master Plan stated that CO₂ emissions in 2025 are estimated around 435 million tons and will still increase to around 598 million tons of CO₂ in 2037. CO₂ emissions are rising mainly due to the growing number of coal-fired PLTUs for mineral downstream industry and value-added natural resource industry in the areas outside PT PLN grids' reach.⁶

Electricity Supply Business Plan (RUPTL) is a ten-year electricity development plan in PLN's Business Area. RUPTL is derived from the RUKN. RUPTL includes demand projections, expansion plans, electricity production forecasts, fuel needs, and projects that will be developed by PLN and the Independent Power Producer (IPP) investors. RUPTL is reviewed annually and the latest one is for 2025 – 2034 period.

One of the captive PLTUs in IWIP, Weda, Central Halmahera, North Maluku.
Photo Source: Greenpeace / Reza Rahmandito.



⁶ Ministry of Energy and Mineral Resources. 2025. *National Electricity Master Plan*. Jakarta: Ministry of Energy and Mineral Resources.

2.2 Roadmap and Decarbonization Program

Presidential Regulation Number 112 of 2022 on Acceleration of Renewable Energy Development for Electricity Provision is intended to accelerate the renewable energy development for electricity supply. This regulation requires prioritizing renewable energy resources and prohibiting the development of new coal-fired PLTUs, with some exceptions. Among them, coal-fired PLTU development is permitted if it contributes to the increase of value-added natural resources or if the coal-fired PLTUs are included in the national strategic project (PSN). Operational coal-fired PLTUs should also reduce their greenhouse gas emission to at least 35% within 10 years since starting operation, and are only permitted to operate until 2050.⁷

Minister of Energy and Mineral Resources Regulation Number 12 of 2023 on Utilization of Biomass Fuel as a Co-Firing Fuel in Steam Power Plants specify the usage guidelines of biomass fuel as a co-firing component in coal-fired PLTUs. This regulation is intended to accelerate the target of national renewable energy mixes and reduce greenhouse gas emissions. The regulation also defines the technical standard provisions, monitoring mechanisms and procedures, and transition provisions to ensure an effective biomass integration to the operating coal-fired PLTU system. Biomass co-firing implementer also includes electricity supply business license holders for their own interests.⁸

However, the usage of wood biomass as the coal-fired PLTU co-firing energy resource could potentially trigger deforestation in Indonesia. Relying on the Energy Plantation Forest (*Hutan Tanaman Energi/HTE*) and the Industrial Plantation Forest (*Hutan Tanaman Industri/HTI*) as biomass raw material provider may lead to deforestation. The 2025-2034 RUPTL mentions the existing energy forest potential of up to 49,578 hectares which can produce 991,560 tons of wood, in addition to expansion potential as wide as 27.2 million hectares that will produce 544.4 million tons of wood as the potential biomass supply.⁹

⁷ Article 3 paragraph 4 letter b of Presidential Regulation of the Republic of Indonesia Number 112 of 2022 on Acceleration of Renewable Energy Development for Electricity Provision.

⁸ Minister of Energy and Mineral Resources Regulation Number 12 of 2023 on Utilization of Biomass Fuel as a Co-Firing Fuel in Steam Power Plants.

⁹ PLN.2025. *Electricity Supply Business Plan (RUPTL) 2025 - 2034*. Jakarta: PLN. Page,III-25.

Minister of Energy and Mineral Resources Regulation Number 10 of 2025 on Energy Transition Roadmap for Power Sector acts as a guideline to reduce dependency on fossil fuel and to achieve national commitment toward sustainable development and zero emission of greenhouse gas. However, Article 6 paragraph 2 emphasizes the exclusion of coal-fired PLTU development as stated in Presidential Regulation 112/2022.¹⁰

Thus, Presidential Regulation 112/2022 becomes an obstacle in the transition to environmentally friendly power plants. As a project that produces added value and holds the status of National Strategic Project (PSN), there is no obligation for the nickel industries to transition from dependency on the coal-fired PLTUs to the new and renewable energy (NRE) power plants. The industrial decarbonization roadmap for nickel processing is voluntary.



One of PLTU in IMIP, Morowali, Central Sulawesi.
Photo Source: AEER Documentation.

¹⁰ Minister of Energy and Mineral Resources Regulation Number 10 of 2025 on Energy Transition Roadmap for Power Sector.

CHAPTER 3. THE DEVELOPMENT OF THE NICKEL INDUSTRY

3.1 Production Trend and Industrial Expansion

International Nickel Study Group (INSG) estimates the global refined nickel production to reach 3,810,000 tons in 2025, and to increase to 4,085,000 tons in 2026. Meanwhile, the global refined nickel consumption is projected to reach 3,601,000 tons in 2025 and rise to 3,824,000 tons in 2026. The nickel market is projected to record a surplus of 209,000 tons in 2025 and 261,000 tons in 2026,¹¹ which drove down London Metal Exchange (LME) nickel prices to their lowest rate of USD 14,125 per ton in the 16 December 2025 trading session.¹²

The surplus was mainly fueled by the massive production in Indonesia, the biggest refined nickel producer in the global nickel supply chain, which contributes more than half of the global production. This is due to the rapid growth of the nickel smelting industry in various nickel-based industrial parks. Nickel Pig Iron (NPI) production was projected to reach 1.76 million tons in 2025 and is forecast to hit 1.97 million tons in 2026. NPI conversion to nickel matte was estimated to reach 294,000 tons in 2025, and is expected to increase to 347,000 tons in 2026.¹³ Meanwhile, MHP production was projected to reach 399,000 tons in 2025 and rise to 543,000 tons in 2026.¹⁴

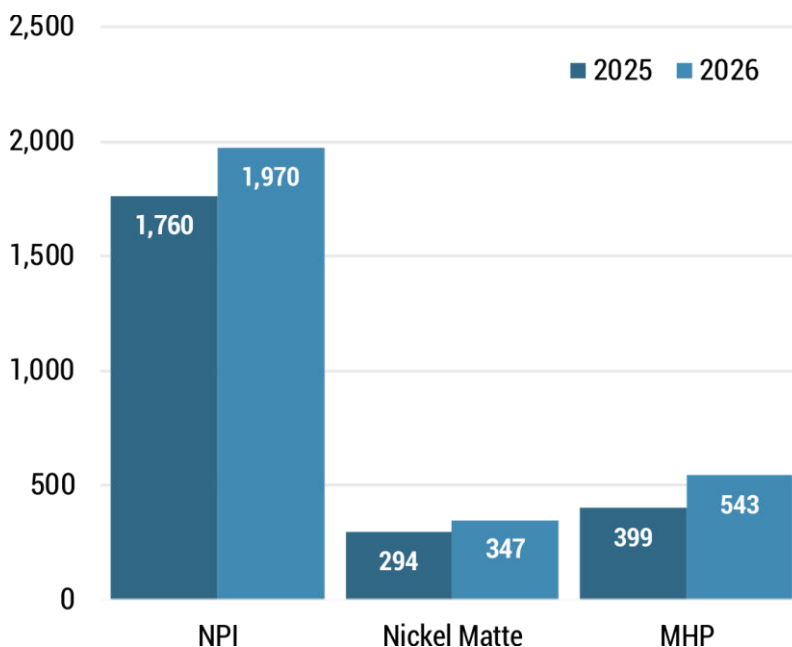
¹¹ INSG. 2025. "Nickel Market Observations for 2025 and 2026." *Press Release*, 7 October. Accessible at: https://insg.org/wp-content/uploads/2025/10/pressrel_INSG-Press-Release-October_2025-nd782v78.pdf. [Accessed on 26 December 2025].

¹² LME. 2025. "LME Nickel Official Prices Graph." Accessible at: <https://www.lme.com/en/Metals/Non-ferrous/LME-Nickel#Price+graphs>. [Accessed on 6 January 2026].

¹³ Nornickel. 2025. "Quintessentially Nickel". Accessible at: https://nornik-upload.storage.yandexcloud.net/iblock/b88/b885707084c99b8c0a60aecd4f19ab5/2025_12_15-Quintessentially-Nickel.pdf. [Accessed on 26 December 2025].

¹⁴ *Ibid*, page 17.

Chart 1. Refined Nickel Production in Indonesia (in thousands tons)



Source: Nornickel.

In the global supply chain, Indonesia's refined nickel products are exported mainly to China. These products will then be processed further as stainless steel or an electric vehicle's battery component. Up to the third quarter of 2025, Indonesia has exported 1,047,000 tons of NPI, 306,000 tons of MHP, and 129,000 tons of nickel matte, in addition to nickel sulfate and class-1 nickel.¹⁵

Some NPI products are used as a cheap raw material alternative for stainless steel production in industrial parks that are integrated with the NPI smelters in Indonesia. Stainless steel series-300 production in Indonesia is expected to reach 5,193,000 tons in 2025 (equivalent to 407,000 tons of nickel demands) and is projected to reach 6,666,000 tons in 2026 (equivalent to 486,000 tons of nickel consumption).¹⁶ Stainless steel products are exported primarily to China.

¹⁵ *Ibid*, page 13.

¹⁶ *Ibid*, page 6.

3.2 Nickel Industry for Battery Raw Materials

The transition towards clean energy to end reliance on fossil energy is underway. Electric vehicle batteries are now an alternative to decarbonize the transportation sector. As a critical mineral for global electric vehicle battery demand, nickel consumption has now reached 15%, with stainless steel still being the highest nickel consumer, absorbing 65%.¹⁷

As the biggest nickel producer in the world, the growing nickel industries in Indonesia are using the technologies that produce intermediate nickel products which then will be converted to nickel sulfate, the material of electric vehicle batteries. The RKEF (Rotary-Kiln Electric Furnace) technology is used to convert NPI into nickel matte, other than the OESBF (Oxygen Enriched Side Blowing Furnace) technology, which produces nickel matte directly. Meanwhile, the HPAL (High Pressure Acid Leaching) technology is used to produce MHP. Nickel matte and MHP are used to produce nickel sulfate, which is then processed into pCAM (Precursor Cathode Active Material).¹⁸ In the global supply chain, nickel production for electric vehicle batteries is geographically concentrated in Indonesia, especially for the upstream activities (mining) and midstream activities (refining).

However, the electric vehicle battery supply chain is also concentrated geographically according to the production of battery cells and their components. China contributed 80% of global battery cell production in 2024, while the remaining 20% were produced by the United States of America, the European Union, Korea, and Japan. The production of lithium-ion battery manufacturing equipment is also concentrated, with China, Korea, and Japan as the market leaders. China also monopolizes the production of battery components by supplying almost 85% of cathode active material, NMC and LFP, and more than 90% of anode active material, especially graphite. Other than China, only Korea and Japan have a large enough capacity to produce cathode components.¹⁹

¹⁷ Nor Nickel. 2025. Annual Report 2024. Accessible at: https://nomik-upload.storage.yandexcloud.net/iblock/f92/f9210a4b4425bd885e24df90f8c38f01/2024_annual_report_pjsc_mmc_norilsk_nickel.pdf. [Accessed on 4 January 2026].

¹⁸ Arianto Sangadji, Linda Dewi Rahayu, Pradnya Paramarini. 2025. *Clean Cars, Dirty Nickel: The Indonesia-China-Germany Nickel Supply Chain for EV Batteries*. Berlin: Rosa-Luxemburg-Stiftung. Accessible at: https://www.rosalux.de/fileadmin/rls_uploads/pdfs/Studien/Onl-Studie_X-25_Lieferkette_Nickel.pdf. [Accessed on 27 December 2025].

¹⁹ IEA, *Global EV Outlook 2025*, page, 146.

Nickel-cobalt-manganese (NMC) batteries for electric vehicles are fiercely competing with lithium-iron-phosphate (LFP) batteries. Each battery has its own strengths and weaknesses. LFP is known for its safety, almost 30% cheaper per kilowatt, and has the capability to reach 100% of charging. It is increasingly used in energy storage and electric vehicles. NMC has higher energy density for long-range applications or to be operated in cold climates, where the LFP technology is usually less effective. It is also more costly, and the main components are nickel and cobalt. However, nowadays LFP batteries offer adequate performance levels for most electric vehicle applications. Thus, its lower cost is the main advantage for car manufacturers targeting the mass market. NMC plays a critical role in the industry that needs a huge amount of energy, such as luxurious electric cars and portable devices.²⁰



²⁰ Solomon Evro et al. 2024. "Navigating battery choices: A comparative study of lithium iron phosphate and nickel manganese cobalt battery technologies". *Future Batteries* 4: 1-18. <https://doi.org/10.1016/j.fub.2024.100007>

3.3 HPAL Technology and Tailing Matter

HPAL was first introduced around 70 years ago and has since expanded widely to meet the battery demand for nickel-based vehicles. How HPAL works is simple: add sulfuric acid and increase the temperature to fully dissolve the ores. Neutralize the excess acid, remove unwanted metals, and recover the desired metals.²¹ This HPAL technology was first introduced in Moa Bay, Cuba, in the late 1950s. During the 1999-2014 period, there were only 10 HPAL projects operating around the world.²²

In Indonesia, HPAL technology is rapidly advancing. This technology was first used to process limonite ore into MHP by PT Halmahera Persada Lygend, which was operating in Obi Island in 2021. Within five years, other HPAL projects grew rapidly. In 2025, there were eight operating HPAL projects in total, with more expected in 2026 and 2027 (see TABLE 1). Those 8 operational HPAL projects have a total production capacity of 491,000 tons of nickel in MHP annually. Another 4 projects will start operating this year, doubling the production capacity to 840,000 tons of nickel in MHP. Indonesia becomes the world's biggest HPAL project location.

The main issue is that those HPAL projects depend on fossil energy to a large extent. Currently operational projects are heavily dependent on the coal-fired PLTUs, while the upcoming ones will rely on the energy supply from the Gas Power Plant (*Pembangkit Listrik Tenaga Gas/PLTG*).

Other than its reliance on a huge electricity resource, the most crucial aspect of HPAL technology is the tailing volume or the toxic waste produced after mining those precious metals. Producing 1 ton of nickel will extract 150 - 200 tons of tailings.²³ The operational HPAL projects, with 491,000 tons of nickel production capacity in MHP, are estimated to produce 73.65 – 98.20 million tons of tailings annually. In 2026, with a total of 840,000 tons of nickel production capacity in MHP from the new projects, the tailing volume produced will increase to 126 - 168 million tons.

²¹ Lyle Tritten. 2025. "Nickel Industry – Part 3: Processing Nickel Laterite, High Pressure Acid Leaching." <https://nickelinstitute.org/en/blog/2025/march/nickel-industry-part-3-processing-nickel-laterites-high-pressure-acid-leaching>. [Accessed on 7 January 2026].

²² Jack Gabb. 2018. "HPAL: Upping the Pressure." Accessible at: <https://gigametals.com/site/assets/files/4861/2018-03-19-hpal.pdf>. [Accessed on 26 December 2025].

²³ Zhen-fang Zhang et al. 2025. "Nickel extraction from nickel laterites: Processes, resources, environment and cost". *China Geology* 8:187-213.

There are 3 ways to remove the tailings, which are the tailing dam, deep-sea disposal, and dry stacking storage. Operational HPAL projects in Indonesia are using the dry-stack tailings method. The word “dry-stack” is considered incorrect because even these “dry” tailings still contain 15-20% of water. A more appropriate term for this method is “filtered tailings”.²⁴

Nonetheless, the implementation of the dry-stack method in humid climate locations with heavy rainfall, such as Sulawesi and North Maluku, poses high environmental and biodiversity risks. Slurry tailings that contain 30-35% of water and are kept in dry-stack tailings will turn into sludge when hit by heavy rainfall. After exposure to rainfall, the slurry tailings, which at first appear dry, become wet and undergo oxidation and heavy metal leaching. When the rain falls through the tailings, heavy metals and other elements can be carried into the surrounding soil and water bodies.²⁵

The same risks also apply in the earthquake-prone areas. Morowali, where IMIP is operating, is part of the Matano active fault and is often struck by damaging earthquakes. Similarly, Obi Island, a branch of the Sorong fault, is often struck by destructive earthquakes. Earthquakes often hit Central Halmahera as well, which is part of the Sorong fault.

The most alarming factor is the heavy rainfall and potential seismic activity that may trigger tailings facility failure, possibly releasing millions of tons of tailings. This is what happened to the tailings facility owned by PT HYNC in Morowali in March 2025. The dry-stack tailings facility of PT HYNC was not designed to withstand high rainfall. Thus, it collapsed due to flooding on 16 March 2025. The flood hit Labota village and IMIP, risking exposure to tailings containing heavy metal for 341 families or 1,092 people of Labota Village, including workers.²⁶

A worse case happened on 21 March 2025, when the dry-stack tailings facility of PT QMB New Energy Materials collapsed. As a result, four workers of PT Morowali Investasi Konstruksi Indonesia (MIKI) were buried. Three of them (Irfan Tandil, Akbar, and Demianus) passed away while one worker survived. PT MIKI is a contractor company of PT QMB.²⁷ The incident forced PT QMB to stop all production activities in March 2025 and reduce its production volume in the upcoming months.

²⁴ Steven H. Emerman. 2024. “A letter to Callum Russel and Sophie Grig”. March 14.

²⁵ Steven H. Emerman. 2023. “Evaluation of the Filtered Tailings Storage Facility in the Updated Proposal for the Savannah Lithium Barroso Mine, Northern Portugal.” Report prepared at the request of Associações Unidos em Defesa de Covas do Barroso e Povo e Natureza do Barroso, Revised on April 13.

²⁶ Yayasan Tanah Merdeka (YTM). 2025. “About Occupational Accidents in Tailing Facilities at PT Indonesia Morowali Industrial Park”. Press Release, 23 March.

²⁷ *Ibid*

The failure of dry-stack tailings in Fatufia shows that tailings that are filtered and stored above ground at a high elevation with a poor drainage system, and inadequate risk modelling cannot withstand heavy rainfall and seismic activities. In Fatufia, a landslide happened after days of rain, but the satellite imagery showed that the land might have been damaged long before. It is not an isolated miscalculation. But a gap in systemic design that endangers the entire community.²⁸

Table 1. Companies Owning HPAL Facilities in Indonesia

Location	Ni production capacity in MHP (ton)/year	Tailing production (ton)/year	Source of electricity	Production start year	Shareholding
PT Halmahera Persada Lygend					
Obi Island	55,000	8,250,000 to 11,000,000	PLTU	2021	PT Trimegah Bangun Persada (45.10%), Lygend Resources & Technology Co Ltd (29.53%), and Kang Xuan Pte Ltd (25.36%). ²⁹
PT Huayue Nickel Cobalt					
IMIP	80,000	12,000,000 to 16,000,000	PLTU	2022	Huaqing Nickel & Cobalt Co Ltd (57%), W-Source Holding Ltd (30%), Nickel Industries (10%), Huaqing Hualong Consulting Co Ltd (2%), and Long Sincere Holding Ltd (1%). ³⁰
PT QMB New Energy Materials					
IMIP	96,000	14,000,000 to 19,200,000	PLTU	2022	Jingmen GEM Co Ltd (28%), New Horizon International Holding Ltd (21%), IMIP (10%), Brunp Recycling - CATL (10%), EcoPro Co Ltd (9%), and Hanwa Co Ltd (8%), Yibin Libode New Materials Co Ltd (8%), and GEM Hongkong International Co Ltd (6%). ³¹

²⁸ Geoengineer. 2025. "When Dams Fail: The Growing Crisis of Tailings Management". *Geoengineer*, May 2. Accessible at: <https://www.geoengineer.org/news/when-dams-fail-the-growing-crisis-of-tailings-management>. [Accessed on 3 January 2026].

²⁹ Ministry of Law. 2025. *Profil Perusahaan PT Halmahera Persada Lygend AHU-0060835.AH.01.02. Tahun 2025*. Jakarta: Ministry of Law.

³⁰ Ministry of Law. 2025. *Profil Perusahaan PT Huayue Nickel Cobalt (AHU-AH.01.09-0183459)*. Jakarta: Ministry of Law.

³¹ Ministry of Law. 2025. *Profil Perusahaan PT QMB New Energy Materials (AHU-AH.01.09-0101637)*. Jakarta: Ministry of Law.

Location	Ni production capacity in MHP (ton)/year	Tailing production (ton)/year	Source of electricity	Production start year	Shareholding
PT Obi Nickel Cobalt					
Obi Island	65,000	9,750,000 to 13,000,000	PLTU	2024	Lygend New Power (Hongkong Limited) (60%) and PT Trimegah Bangun Persada (40%). ³²
PT Huafei Nickel Cobalt					
IWIP	120,000	18,000,000 to 24,000,000	PLTU	2024	Huayou International Cobalt (Hongkong Co Ltd) (51%), Glaucous International Pte Ltd (30%), Eva Asia Co Ltd (17%), and Lindo Investment Pte Ltd (2%). ³³
PT ESG New Energy Material					
IMIP	30,000	4,500,000 to 6,000,000	PLTU	2025	PT Merdeka Industri Anantha (60%), GEM Hongkong International Co Ltd (14%), EcoPro (10%), Y&K (HK) Internasional Holding Ltd (7%), Eversong Internasional Investment Pte Ltd (5%), Internasional Mining (Hongkong) Technology Ltd (2.8%) H&K Internasional Investment Holdings Ltd (1.2%). ³⁴
PT Meiming New Energy Material					
IMIP	25,000	3,750,000 to 5,000,000	PLTU	2025	GEM (Wuxi) Energy Material Co Ltd (54%), Merdeka Energi Utama (12.5%), H&K Internasional Investment Holdings Ltd (10.5%), Cahaya Jaya Investment Pte Ltd (10%), EcoPro Co Ltd (9%), Green Engineering Technology (Jingmen) Partnership (3%), and GEM Hongkong International Co Ltd (1%). ³⁵

³² Ministry of Law.2025. Profil Perusahaan PT Obi Nickel Cobalt. AHU-AH.01.09-0302702. Jakarta: Ministry of Law.

³³ Ministry of Law. 2025. Profil Perusahaan PT Huafei Nickel Cobalt.AHU-AH.01.09-0303810. Jakarta: Ministry of Law.

³⁴ Ministry of Law.2025. *Profil Perusahaan PT ESG New Energy Material* (AHU-AH.01.09-0342266). Jakarta: Ministry of Law.

³⁵ Ministry of Law.2024. *Profil Perusahaan PT Meiming New Energy Material* (AHU-AH.01.09-0277437). Jakarta: Ministry of Law.

Location	Ni production capacity in MHP (ton)/year	Tailing production (ton)/year	Source of electricity	Production start year	Shareholding
PT Green Eco Nickel					
IMIP	20,000	3,000,000 to 4,000,000	PLTU	2025	EcoPro (38%), New Horizon International Holding Ltd (23.2%), H&K International Investment Holdings Ltd (16%), Darrow International Pte Ltd (10%), GEM Hongkong International Co Ltd (5.8%), Speed (HK) International Engineering Ltd (5%), and Green Engineering Technology Partnership (2%). ³⁶
PT Excelsior Nickel Cobalt					
IMIP	72,000	10,800,000 to 14,400,000	PLTU	2026	Sanghai Decent (46%), Nickel Industries (44%), Sphere Corp (10%). ³⁷
PT Blue Sparkling Energy					
IWIP	67,000	10,050,000 to 13,400,000	PLTU	2026	PT Tanito Harum Nikel (51%) and Tanjung Development Investment Pte Ltd (49%). ³⁸
PT Kolaka Nickel Indonesia					
IPIP	120,000	18,000,000 to 24,000,000	PLTG	2026	Huaqi (Singapore) Pte Ltd (85.71%), Ford Motor Company (8.49%), and PT Vale Indonesia (5.78%). ³⁹
PT Sulawesi Nickel Cobalt					
IMIP	90,000	13,500,000 to 18,000,000	PLTU	2026	Merdeka Energi Baru (50.1%), Constant Resource Pte Ltd (28.93%), Strive Investment Capital Pte Ltd (19.96%), and Kingdo Internasional Pte Ltd (1%). ⁴⁰

³⁶ Ministry of Law. 2025. *Profil Perusahaan PT Green Eco Nickel (AHU-AH.01.09-0337608)*. Jakarta: Ministry of Law.

³⁷ Nickel Industries. 2025. Annual Report 2024; James Thornhill. 2026. "SpaceX supplier buys into \$3.6b Nickel Industries project". *Finansial Review*, January 2. Accessible at: <https://www.afr.com/companies/mining/spacex-supplier-buys-into-3-6b-nickel-industries-project-20260102-p5nr6o>. [Accessed on 3 January 2026].

³⁸ Ministry of Law. 2025. *Profil Perusahaan PT Blue Sparkling Energy*. AHU-AH.01.09-0303559. Jakarta: Ministry of Law.

³⁹ Ministry of Law. 2024. *Profil Perusahaan PT Kolaka Nickel Indonesia*. AHU-AH.01.03-0224714. Jakarta: Ministry of Law.

⁴⁰ Ministry of Law. 2025. *Profil Perusahaan PT Sulawesi Nickel Cobalt (AHU-AH.01.09-0218041)*. Jakarta: Ministry of Law.

Location	Ni production capacity in MHP (ton)/year	Tailing production (ton)/year	Source of electricity	Production start year	Shareholding
PT Bahudopi Nickel Smelting Indonesia					
IGIP	66,000	9,900,000 to 13,200,000	PLTG	2027	GEM Hongkong International Co Ltd (55.12%), Vale Indonesia (26.52%), and EcoPro Co Ltd (18.34%). ⁴¹
PT Huali Nickel Indonesia					
IHIP	60,000	9,000,000 to 12,000,000	PLTG	2027	Hua Qun (Hongkong) Ltd (53%) and Hua Bin (Hongkong) Ltd (47%). ⁴²
PT Chongseng New Energy					
IMIP	60,000	9,000,000 to 12,000,000	PLTU	-	Tsingshan
Total	1,026,000	153,900,000 to 205,200,000			



Wanxiang Nickel Indonesia Smelter at Bahomotete, East Bungku, Morowali, Central Sulawesi
Photo Source: Jawa Pos / Muhamad Ali.

⁴¹ Ministry of Law. 2025. *Profil Perusahaan PT Bahudopi Nickel Smelting Indonesia (AHU-AH.01.03-0250846)*. Jakarta: Ministry of Law.

⁴² Ministry of Law. 2024. *Profil Perusahaan PT Huali Nickel Indonesia*. AHU-AH.01.09-0254555. Jakarta: Ministry of Law.

3.4 Main Actors and Their Origin Countries

Capital investment in HPAL projects has been rapidly growing in the last 5 years. Chinese companies are the leading capital force, who dominates capital investment and technology. Companies based in South Korea, Australia, and Indonesia also take part in some HPAL projects (see TABLE 1). The estimated investment value of all HPAL projects is around USD 21.9 billion.

The most prominent actor is Zhejiang Huayou Cobalt Co Ltd, a giant Chinese company operating in the new energy sector. Huayou controls 57% of the shares in PT Huayue Nickel Cobalt (HYNC) in IMIP, 51% of the shares in PT Huafei Nickel Cobalt (HFNC) in IWIP, 85.71% of the shares in PT Kolaka Nickel Indonesia (KNI) in Indonesia Pomalaa Industrial Park (IPIP), and controls 100% of the shares in PT Huali Nickel Indonesia in PT Indonesia Huali Industrial Park (IHIP). Huayou Cobalt through Huacai (Hongkong) Ltd holds 35% of the shares in PT Wana Kencana Mineral, a nickel mining company with a concession area of 24,700 hectares in East Halmahera and Central Halmahera.

GEM Co Ltd is a Chinese company, leading the production of battery materials for new energy. GEM directly controls 28% of the shares in PT QMB, and via New Horizon International Holding Ltd, it holds 21% of the shares. GEM Hongkong International Co Ltd also holds 6% of the shares, allowing GEM to control 55% of the shares in PT QMB. GEM via GEM (Wuxi) Energy Material Co Ltd also owns 54% of the shares in PT Meiming New Energy Material and via GEM Hongkong International Co Ltd controls 55.12% of the shares in PT Bahudopi Nickel Smelting Indonesia (BNSI). GEM via GEM Hongkong Internasional Co Ltd also owns 14% of the shares in PT ESG New Energy Material and 5.8% of the shares in PT Green Eco Nickel.

Lygend Resources & Technology Co Ltd is a Chinese company operating in the entire nickel supply chain. This company owns 29.53% of the shares in PT Halmahera Persada Lygend (HPL) and via its subsidiary, Kang Xuan Pte Ltd, controls 25.36% of the shares in PT HPL, allowing Lygend to control 55% of the shares in HPL. Lygend also holds 60% of the shares in PT Obi Nickel Cobalt (ONC).

EcoPro is a global company from South Korea that supplies NCM battery cathode. This company aggressively expands by investing USD 477.6 million in several HPAL projects in Morowali.⁴³ EcoPro owns 38% of the shares in PT Green Eco Nickel, 9% of the shares in PT QMB, 10% of the shares in PT ESG New Energy Material, 9% of the shares in PT Meiming Energy Material, and 18.34% of the shares in PT BNSI.

Tsingshan is a giant stainless steel company from China. Tsingshan is widely known for its integrated nickel mining business with facilities for intermediate nickel processing and stainless steel in IMIP, producing highly competitive stainless steel products in the global market. Tsingshan owns 40% of the shares in IWIP. The company, via its subsidiary, Sanghai Decent, holds 56% of the shares in PT ENC and via PT IMIP holds 10% of the shares in PT QMB. Tsingshan also owns 51.2% of the shares in PT Weda Bay Nickel that controls 45,045 hectares of nickel mine in Central Halmahera and East Halmahera.

Nickel Industries is a company based in Sydney, Australia. It has facilities for the mining and integrated nickel processing industry in IMIP and IWIP. Nickel Industries holds 10% of the shares in HPAL projects managed by PT HYNC in Morowali. The company has 44% of the shares in PT ENC as well.

Harita Group is an Indonesian company pioneering the use of HPAL technology in the processing industry. This group, through PT Trimegah Bangun Persada Tbk, holds 45.10% of the shares in PT HPL and 40% of the shares in PT ONC.

PT Merdeka Battery Materials Tbk is an Indonesian company that is actively involved in the HPAL-based nickel processing industry. The company, through PT Merdeka Industri Anantha, owns 60% of the shares in PT ESG New Energy Material and, through PT Merdeka Energi Baru, owns 50.1% of the shares in PT Sulawesi Nickel Cobalt (SLNC). Merdeka, also via PT Merdeka Energi Utama, holds 12.5% of the shares in PT Meiming New Energy Material. These companies obtain their limonite nickel supply from PT Sulawesi Cahaya Mineral (SCM), which has a concession area of 21,100 hectares in Rوتا, Konawe. PT SCM is a joint venture between Merdeka Battery Materials and Tsingshan Group. Merdeka Battery Materials, via its subsidiary PT Merdeka Industri Mineral, controls 51% of the shares in PT SCM, while Tsingshan holds the 49%.

⁴³ Lee Gyu-lee. 2025. "EcoPro to launch high-voltage mid-nickel cathodes production". *The Korea Times*, Nov 26. Accessible at: <https://www.koreatimes.co.kr/business/companies/20251126/ecopro-to-launch-high-voltage-mid-nickel-cathodes-production>. [Accessed on 27 December 2025].

PT Vale Indonesia is a major player in the nickel sector, producing nickel matte in Sorowako, South Sulawesi, and is currently expanding to HPAL technology. The company controls 5.78% of the shares in PT KNI and 18.34% of shares in PT BNSI. Vale becomes the main supplier of limonite nickel ores for PT KNI, extracted from its concession area of 20,286 hectares in Pomalaa Block. In Morowali, Vale supplies limonite ores for PT BNSI, extracted from a concession area of 22,699 hectares in Bahudopi.

PT Harum Energy is a national company that also operates in the mining and nickel processing industry sectors. Harum, through PT Tanito Harum Nickel, controls 51% of the shares in PT Blue Sparkling Energi, while Tanjung Development Investment Pte Ltd holds 49%. PT Tanito Harum Nickel also owns 51% of the shares in PT Position, a company with a nickel mining concession area of 4,017 hectares in East Halmahera.

The PLTU currently being built by Harita Nickel, Obi Island, South Halmahera, North Maluku.
Photo Source: Kompas / Raditya Helabumi.



PLTU in Indonesia Huabao Industrial Park (IHIP), Morowali Central Sulawesi.
Photo Source: AEER Documentation.



CHAPTER 4. CARBON EMISSIONS AND INDUSTRIAL IMPACTS

4.1 Carbon Emissions from Nickel Industry

The nickel industry requires a huge amount of electricity supply. Building nickel industrial parks in areas with poor electricity infrastructures due to the absence of PLN pushes the companies to build captive coal-fired PLTUs. These coal-fired PLTUs are the cheapest source of power while also contributing the largest carbon emissions among other power plants. The emissions from coal-fired PLTUs is approximately 800 – 1200 kgCO₂e/MWh, depending on the technology used. Other than CO₂, some primary emissions generated from coal combustion are, among others: sulfur dioxide (SO₂), which causes acid rain and respiratory diseases; Nitrogen oxides (NOX), which results in smog and respiratory diseases; Particulate Matter (PM2.5), which contributes to smog, respiratory diseases, and lung diseases.

Coal-fired PLTUs have become the backbone of the rapid growth of the nickel industry for the past 10 years due to their participation in National Strategic Projects (PSN) for mineral resource downstreaming. Today, many nickel industrial parks in Indonesia operate coal-fired PLTUs with an installed capacity of 15,405 MW (see TABLE 2). The number equals 38.5% of the total PLTUs operated by PLN and IPP, which was 40 gigawatt in 2024.⁴⁴

⁴⁴ PLN. 2025. *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025-2034*. Jakarta: PLN. Page, IV-1.

Table 2. Captive PLTUs of Nickel Industry in Indonesia

Industrial Parks and Companies	Location	MW
Indonesia Morowali Industrial Park (IMIP)	Morowali	5,440
Indonesia Weda Bay Industrial Park (IWIP)	Central Halmahera	4,540
Virtue Dragon Nickel Industrial Park (VDNIP)	Konawe	2,370
Obi Island Industrial Park	South Halmahera	1,630
Gunbuster Nickel Industry	North Morowali	945
Indonesia Huabao Industrial Park (IHIP)	Morowali	350
Wanxiang Nickel Indonesia	Morowali	130
Total		15,405

Source: GEM

IMIP is an industrial park with the largest captive coal-fired PLTU, with an installed capacity of 5,440 MW. PT Sulawesi Mining Investment (SMI) initially built two units of coal-fired PLTUs, integrated with RKEF smelter with a capacity of 150 MW and started its operation in 2015. Between 2016 and 2020, PT Indonesia Guang Ching Nickel and Stainless Steel Industry (GCNS) built two PLTU units with a capacity of 300 MW, PT Indonesia Tsingshan Stainless Steel (ITSS) built four PLTU units with a total capacity of 1,400 MW, and Indonesia Morowali Power Co built a unit with a capacity of 250 MW. All companies are affiliated with Tsingshan Group, except for GCNS, which is a subsidiary of Guangxin Holding.⁴⁵

In five years since 2021, the capacity of PLTUs built in IMIP has reached 3,360 MW. PT Walsin Nickel Industrial Indonesia and Eternal Tsingshan Group each operate one unit of PLTU with a capacity of 350 MW, and PT Hua Chin Aluminum Indonesia operates a unit of PLTU with a capacity of 380 MW. PT Zhao Hui Nickel and Indonesia Wanjia Ferro Nickel Co Ltd each operate one unit of PLTU with a capacity of 380 MW, and PT Sulawesi Mining Investment operates four PLTU units, each with a capacity of 380 MW. The PLTUs operated by Zhao Hui Nickel, Wanjia Ferro Nickel, and PT Sulawesi Mining Investment utilize supercritical technology.⁴⁶ Supercritical technology has been considered 30% more efficient for coal consumption.⁴⁷

⁴⁵ Gem. "Sulawesi Mining Power Station." Accessible at: https://www.gem.wiki/Sulawesi_Mining_power_station. [Accessed on 26 December 2025].

⁴⁶ Gem. "Sulawesi Labota Power Station". Accessible at: https://www.gem.wiki/Sulawesi_Labota_power_station. [Accessed on 26 December 2025]

⁴⁷ Irwandy Arif. 2022. *Era Baru Batubara Indonesia*. Jakarta: Penerbit Gramedia Pustaka Utama. Page, 594-5.

The installed capacity of coal-fired PLTUs in IMIP is estimated to be approaching 7,000 MW with the addition of 1,520 MW constructed in January 2024.⁴⁸ The installed capacity of captive PLTUs in IMIP is significantly larger than the existing capacity of all power plants owned by PLN and IPP in Sulawesi, which is approximately 3,628.75 MW.⁴⁹

IWIP becomes the powerhouse that operates 14 units of coal-fired PLTU with total installed capacity of 4,540 MW. IWIP provides six power plant units with a capacity of 2,150 MW. PT Yashi Indonesia Investment, PT Youshan Nickel Indonesia, PT Libai Indonesia Metal, PT Huayue Nickel Cobalt, and PT Huake Nickel Indonesia individually operate a unit of PLTU with a total capacity of 1,250 MW. On the other hand, PT Sunny Metal Industry operates a unit of PLTU with a capacity of 380 MW and PT Angel Nickel Industry operates two PLTU units with a total capacity of 760 MW.⁵⁰ All PLTUs in IWIP use supercritical technology. Among the companies providing and operating the PLTUs, there is PT Huayue Nickel Cobalt (HYNC) – most likely PT Huafei Nickel Cobalt – that operates unit 5 of PLTU with a capacity of 250 MW, supplying electricity for its HPAL plants.⁵¹

Coal-fired PLTUs are also the backbone of the nickel industry in Obi Island Industrial Park. PT Halmahera Persada Lygend operates eight coal-fired PLTU units with a capacity of 810 MW. On the other hand, PT Obi Nickel Cobalt operates four PLTU units with a capacity of 760 MW. There are twelve operational PLTU units with an installed capacity of 1,570 MW.⁵²

In Virtue Dragon Nickel Industry Park (VDNIP), the PLTU's installed capacity reached 2,370 MW. PT Virtue Dragon Nickel Industry, an NPI manufacturer, operates eight power plant units with a total capacity of 530 MW. PT Obsidian Stainless Steel, a stainless steel manufacturer, operates ten power plant units with an installed capacity of 1,840 MW.⁵³

⁴⁸ Anonymous. 2024. "Melihat Langsung Hilirisasi Produk Nikel di Kawasan PT IMIP, Morowali". *Kumparan* 22 January. Accessible at: <https://kumparan.com/kumparanbisnis/melihat-langsung-hilirisasi-produk-nikel-di-kawasan-pt-imip-morowali-2215p7IIUoK/2>. [Accessed on 26 December 2025].

⁴⁹ PLN. 2025. *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025-2034*. Jakarta: PLN.

⁵⁰ Gem. "Weda Bay Power Station". Accessible at: https://www.gem.wiki/Weda_Bay_power_station. [Accessed on 26 December 2025].

⁵¹ Gem, "Weda Bay Power Station".

⁵² GEM. "PT Halmahera Persada Lygend Nickel Smelter power station." Accessible at: https://www.gem.wiki/PT_Halmahera_Persada_Lygend_Nickel_Smelter_power_station. [Accessed on 26 December 2025].

⁵³ Gem. "Delong Nickel Phase I Power Station". Accessible at: https://www.gem.wiki/Delong_Nickel_Phase_I_power_station. [Accessed on 26 December 2025]; Gem. "Delong Nickel Phase II Power Station". Accessible at: https://www.gem.wiki/Delong_Nickel_Phase_II_power_station. [Accessed on 26 December 2025].

There are three industrial parks and a nickel industry, each with their own coal-fired PLTUs with a capacity below 1 GW. Firstly, PT Gunbuster Nickel Industry (GNI) operates seven coal-fired PLTU units with an installed capacity of 945 MW.⁵⁴ Secondly, Indonesia Huabao Industrial Park (IHIP) operates three coal-fired PLTU units with an installed capacity of 350 MW.⁵⁵ Lastly, PT Wanxiang Steel Indonesia operates two coal-fired PLTU units with a capacity of 130 MW.⁵⁶



Captive PLTU's on IMIP, Morowali, Central Sulawesi.
Photo Source: indonesiaibusinesspost.com.

- ⁵⁴ Gem. "Delong Nickel Phase III Power Station". Accessible at: https://www.gem.wiki/Delong_Nickel_Phase_III_power_station. [Accessed on 26 December 2025].
- ⁵⁵ Gem. "PT IHIP Power Station". Accessible at: https://www.gem.wiki/PT_IHIP_power_station. [Accessed on 26 December 2025].
- ⁵⁶ Gem. "Wanxiang Nickel Indonesia Power Station." Accessible at: https://www.gem.wiki/Wanxiang_Nickel_Indonesia_power_station. [Accessed on 26 December 2025].

CHAPTER 5. STRUCTURAL PROBLEMS OF INDUSTRIAL DECARBONIZATION

5.1 Dependency on Fossil Energy

Nickel production is a process that results in a huge amount of carbon emissions as it relies on fossil energy. RKEF technology uses nickel ore smelting at around 1500°C,⁵⁷ while HPAL technology relies on dissolution under a high pressure at around 250°C.⁵⁸ While both require a large amount of energy, RKEF technology produces more emissions than HPAL technology. According to IEA, producing 1 ton MHP with HPAL technology will generate 18-33 tons of CO₂ emissions, depending on the power generation technology.⁵⁹ As for RKEF technology, producing NPI or Ferronickel will generate 40-120 tons of CO₂ emissions per ton nickel, depending on the power generation technology.⁶⁰ With the same technology, converting NPI into nickel matte produces 62 tons of CO₂ emissions per ton nickel.⁶¹

In 2025, the nickel processing industry in Indonesia produced between 92.8 million tons of CO₂ and 224.36 million tons of CO₂. In detail, NPI production was estimated to have produced 70.40 million to 211.2 million tons of CO₂. As for MHP production, it generated emissions from 7.18 million to 13.16 million tons of CO₂. The conversion of nickel matte from NPI was projected to have produced around 18.22 million tons of CO₂.

⁵⁷ Lyle Trytten. 2024. Nickel Industry – Part 2 – Processing Nickel Laterites and Smelting. Accessible at: <https://nickelinstitute.org/en/blog/2024/august/nickel-industry-part-2-processing-nickel-laterites-and-smelting>. [Accessed on 6 January 2026].

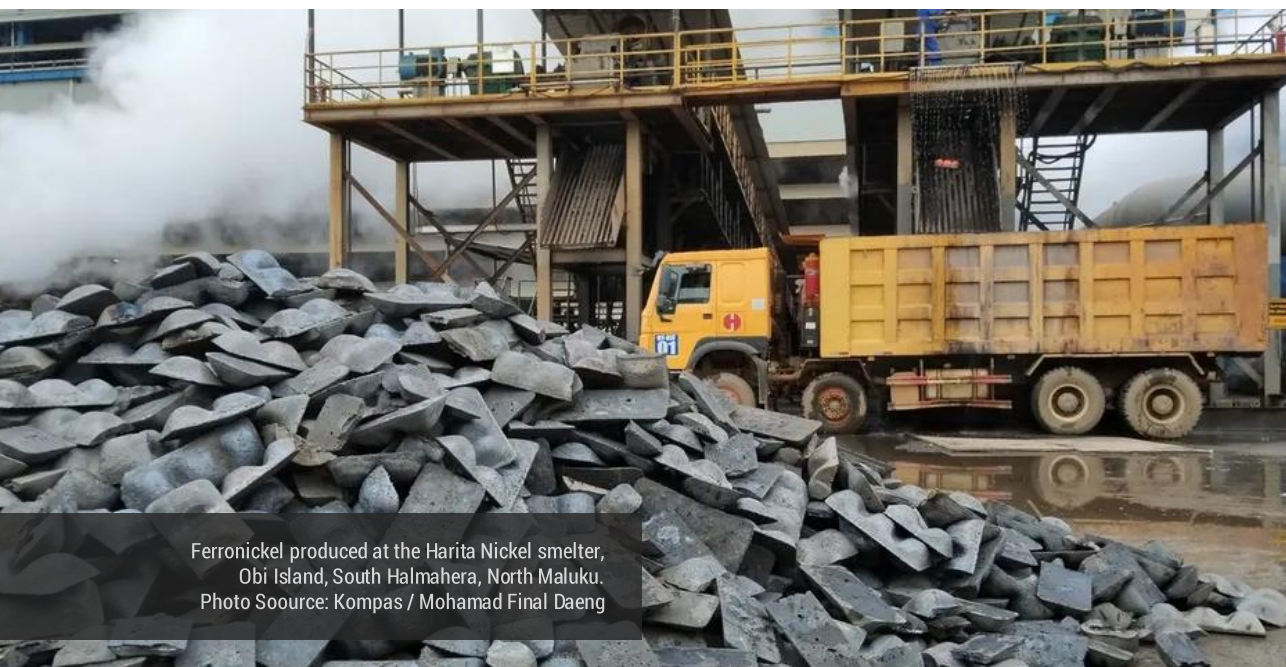
⁵⁸ Lyle Trytten. 2025. "Nickel Industry-Part 3 Processing Nickel Laterite, High Pressure Acid Leaching.". Accessible at: <https://nickelinstitute.org/en/blog/2025/march/nickel-industry-part-3-processing-nickel-laterites-high-pressure-acid-leaching>. [Accessed on 6 January 2026].

⁵⁹ IEA. 2022. The Role of Critical Minerals in Clean Energy Transitions. Accessible at: <https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>. [Accessed on 3 January 2026].

⁶⁰ R. Basuhi et al. 2024. "Clean energy demand must secure sustainable nickel supply". *Joule B*, 2960-2973.

⁶¹ IEA, The Role of Critical Minerals in Clean Energy Transitions.

Some nickel processing companies in Indonesia reported higher intensity of emissions. HPAL facilities of PT QMB New Energi Materials generated 37.5 tons of CO₂ emissions per ton nickel.⁶² This figure has far exceeded the emissions of HPAL projects, as specified by IEA. RKEF facilities producing NPI owned by PT Merdeka Battery Materials generated 56.9 tons of CO₂ emissions per ton nickel.⁶³ This amount nearly matched the emissions produced from converting NPI to nickel matte. RKEF projects producing NPI under Nickel Industries in IMIP and IWIP generated 64.65 tons of CO₂ emissions per ton nickel.⁶⁴ In contrast, PT Vale Indonesia produced lower emissions in its nickel matte production as it relies on three Hydro Power Plants (*Pembangkit Listrik Tenaga Air/PLTA*) with a capacity of 365 MW. Vale produced 30 tons of CO₂ emissions per ton nickel.⁶⁵



Ferronickel produced at the Harita Nickel smelter, Obi Island, South Halmahera, North Maluku.
Photo Source: Kompas / Mohamad Final Daeng

- ⁶² PT. QMB New Energy Materials. 2024. *Environmental, Social, and Governance (ESG) Report (2023)*. Accessible at: <https://www.gemindonesia.com/uploadfiles/2024/08/20240831111142137.pdf>. [Accessed on 3 January 2026].
- ⁶³ Merdeka Battery Materials. 2024. *Sustainability Report of 2024*. Accessible at: <https://assets.merdekabattery.com/dist/documents/PT%20Merdeka%20Battery%20Materials%20Tbk%20-%20Sustainability%20Report%202024.pdf>. [Accessed on 3 January 2026].
- ⁶⁴ Nickel Industries. 2024. *Sustainability Report 2023*. Accessible at: <https://nickelindustries.com/carbon/assets/0007e8/000006/NIC-2023-Sustainability-Report.pdf>. [Accessed on 3 January 2026].
- ⁶⁵ PT Vale Indonesia. 2025. *Laporan Keberlanjutan 2024*. Accessible at: <https://vale.com/documents/d/guest/laporan-keberlanjutan-sustainability-report-pt-vale-indonesia-tbk-2024-bahasa>. [Accessed on 3 January 2026].

5.2 Underutilization of Renewable Energy

Despite President Xi Jinping's statement in 2021 that China will no longer help build or fund any foreign coal-fired power plants, Chinese companies keep constructing PLTUs in nickel-based industrial parks. As the nickel downstreaming program in Indonesia reaches its 10th year, it reveals the poor commitment of those Chinese companies to build power plants based on renewable energy. In 2021, Tsingshan announced its plan to build solar and wind power plants with a capacity of 2 GW in IMIP and IWIP within 3 to 5 years with the objective of reaching zero carbon emissions in its production process.⁶⁶ However, after 5 years, no real action has been taken regarding the implementation of this plan.

For the past year, several companies committed to reducing their limited dependence on coal-fired PLTU have started to emerge. One of them is PT Dexin Steel Indonesia (DSI), which operates in IMIP. The company built a Solar Power Plant (*Pembangkit Listrik Tenaga Surya/PLTS*) with the capacity of 65.89 megawatt and its construction had reached 80% in October 2025.⁶⁷ Once operational, this PLTS with an investment value of USD 37,5 million is expected to reduce 100,000 tons of CO₂ per year.⁶⁸ PT DSI also uses the Combined Cycle Gas Turbine to reduce approximately 2.4 million tons of CO₂ emission and save up to 980,000 tons of coal consumption per year. This Combined Cycle Gas Turbine with a capacity of 350 MW is an installation used to convert thermal energy from smelter furnace combustion into electricity.⁶⁹

IWIP is reported to be developing a green energy project worth USD 2 billion dollars. The project includes the construction of a Solar Power Plant (PLTS) with a capacity of 2,000 MW and a Wind Power Plant (*Pembangkit Listrik Tenaga Bayu/PLTB*) with a capacity of 500 MW.⁷⁰ Nonetheless, there is no time frame for the project's commencement.

⁶⁶ Anu Bhambhani. 2021. "Chinese Steel Producer Wants Solar & Wind In Indonesia". Taiyang News March 15. Accessible at: <https://taiyangnews.info/business/chinese-steel-producer-wants-solar-wind-in-indonesia>. [Accessed on 5 January 2026].

⁶⁷ Anonymous. 2025. "IMIP Dorong Transisi Energi Bersih, Sejumlah Tenant Terapkan Teknologi Rendah Emisi". Narasita, 20 December. Accessible at: <https://narasita.com/baca/imip-dorong-transisi-energi-bersih-sejumlah-tenant-terapkan-teknologi-rendah-emisi/>. [Accessed on 28 December 2025].

⁶⁸ Tang Shihua. 2024. "China's Yonker Pens USD38 Million Solar Power Deal for Indonesian Steel Mill". Yicai, March 19. Accessible at: <https://www.yicai.com/news/chinas-yonker-secures-usd38-million-deal-to-build-operate-pv-facilities-for-steel-mill-in-indonesia>. [Accessed on 6 January 2026].

⁶⁹ Klaster, Edisi No. 18. November 2024

⁷⁰ Bambang P. Jatmiko. 2025. IWIP Percepat Transisi Energi Lewat Proyek PLTS dan PLTB di Weda Bay. *Kompas*, 16 November. Accessible at:

Harita Nickel has also started developing PLTS, targeting up to 30% reduction in carbon emissions by 2030. One of them has a capacity of 5.26 MW and is still being tested at employee dormitories. The company is also building PLTS in the facilities of PT Halmahera Persada Lygend, PT Obi Nickel Cobalt, and in a Nickel Sulfate manufacture, as well as 20.96 MW in the area of PT Halmahera Jaya Feronikel. Harita aimed to start the operation of the PLTS with 40 MW capacity by the end of 2025.⁷¹

As for new projects, Indonesia Pomalaa Industrial Park (IPIP), an industrial park dominated by Huayou Cobalt, planned to build power plants with a capacity of 4,100 MW in 2030. The power plants to be constructed include Gas Power Plants (PLTG) with 2,000 MW capacity, PLTA with 1,600 MW capacity, and PLTS with 500 MW capacity.⁷² The first project in IPIP is an HPAL project of PT Kolaka Nikel Indonesia (KNI) with a capacity of 120,000 tons of nickel in MHP. The energy is supplied by PLTG. While gas produces lower carbon emissions compared to coal and crude oil, the use of PLTG still signifies the poor commitment to decarbonization or even the practice of “green washing.”

The same thing can be found in an HPAL collaboration project between GEM, Vale, and EcoPro in Indonesia Green Industrial Park (IGIP) area in Sambalagi. The project conducted by PT Bahudopi Nickel Smelting Indonesia (BNSI) is also planned to rely on electricity supply from PLTG. Despite using fossil energy from PLTG, Vale claimed that the project is designed for net zero emission.⁷³

The lack of decarbonization efforts in the nickel industry is driven not only by Indonesian government policy via Presidential Decree No. 112/2022, but also due to technical obstacles, i.e. limited power and transmission network, of PLN to supply electricity to industrial parks. A feasible medium-term solution is integrating nickel-based industrial parks to PLN's on-grid system. According to the Accelerated Renewable Energy Development (ARED) scenario mentioned in the 2025-2034 RUPTL, the planned power plant development up to 2034 amounts to 10,422 MW in

<https://lestari.kompas.com/read/2025/11/16/165924186/iwip-percepat-transisi-energi-lewat-proyek-plts-dan-pltb-di-weda-bay>. [Accessed on 28 December 2025].

⁷¹ Harita Nickel. 2025. Laporan Keberlanjutan 2024. Accessible at: https://tbpnickel.com/files/sustainability_assets/Laporan%20Keberlanjutan%20Harita%20Nickel%202024.pdf. [Accessed on 5 January 2026].

⁷² Huayou Cobalt. ND. *Company Profile: Indonesia Pomalaa Industry Park*. Huayou Cobalt; Huayou Cobalt. 2025. “Huayou Indonesia IPIP Park: Building a New Benchmark for Global Lithium Battery Industry and Jointly Creating A Green Future”. Press Release, April 22. Accessible at: <https://www.huayou.com/en/news/press-release/310>. [Accessed on 5 January 2026]

⁷³ Vale Indonesia. 2025. Press Release February 26. Accessible at: [https://vale.com/documents/d/quest/2025-2-26-pt-vale-indonesia-4q-2024-results-release-english#:~:text=The%20Morowali%20mining%20development%20project,investment%20of%20US\\$1.4%20billion](https://vale.com/documents/d/quest/2025-2-26-pt-vale-indonesia-4q-2024-results-release-english#:~:text=The%20Morowali%20mining%20development%20project,investment%20of%20US$1.4%20billion). [Accessed on 6 January 2026].

Sulawesi and 934 MW in North Maluku. These figures remain far below the operating coal-fired PLTU capacity in nickel-based industrial parks, but at least they help create an energy mix within those industrial parks.

A key issue for PLN is the lack of an interconnection system in Sulawesi. Sulawesi's interconnection is possible through linking the systems in southern Sulawesi (Sulbagsel) and northern Sulawesi (Sulbagut) via SUTT 150 kV Tambu – Bangkir (Central Sulawesi). The 2025-2034 RUPTL specifies that power supplied by SUTT 150 kV Tambu – Bangkir is relatively low, at only approximately 4.8 MW, making the benefits of interconnection not commensurate with the required investment. The 180 kilometers interconnection of Tambu – Bangkir will be technically and financially viable once the transmission load reaches 43.6 MW. According to the 2025-2034 RUPTL, the status of Tambu – Bangkir transmission network construction is currently planned for 2028. Further studies are required to determine the appropriate timeline for constructing this Sulawesi interconnection system.⁷⁴

However, considering that the locations of nickel industry are in Central Sulawesi, Southeast Sulawesi, and South Sulawesi, which are relatively connected to PLN's transmission network in southern Sulawesi (Sulbagsel), energy mix in industrial parks becomes feasible with the available potential supply from NRE power plants with a capacity of 6,048 MW. The 2025-2034 RUPTL states that the development plan of PLTA in Sulbagsel with a capacity of 1,700 MW in Central Sulawesi, 1,800 MW in West Sulawesi, and 465 MW in South Sulawesi may supply electricity to high voltage customers (*Konsumen Tegangan Tinggi/KTT*) in nickel industrial parks.⁷⁵ Nevertheless, the construction of PLTAs may trigger serious human rights issues, such as forced displacement. Other energy source according to the 2025-2034 RUPTL include the development plans for Solar Power Plants (PLTS) + Battery Energy Storage System (BESS) with a capacity of 1,153 MW and Wind Power Plants (PLTB) + BESS with a capacity of 930 MW in South Sulawesi.⁷⁶

⁷⁴ PLN, *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025-2034*. Page, C-34.

⁷⁵ PLN, *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025-2034*.

⁷⁶ PLN, *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025-2024*.

Nickel processing plant owned by Harita Nickel Group
on Obi Island, South Halmahera, North Maluku,
Photo Source: Kompas / Raditya Helabumi.



6.1 Summary of Findings

Indonesia has become the world's top producer of refined nickel, accounting for more than half of the global production. This follows the result of the rapid growth of the nickel smelting industry in many nickel-based industrial parks. The production of Nickel Pig Iron (NPI) was projected to achieve 1.76 million tons by 2025 and is expected to reach 1.97 million tons in 2026. The conversion of NPI to nickel matte was estimated to reach 294,000 tons by 2025 and will increase to 347,000 tons in 2026. The production of MHP was projected to reach 399,000 tons in 2025 and will increase to 543,000 tons in 2026.

In 2025, the nickel processing industry in Indonesia produced between 92.8 million tons to 224.36 million tons of CO₂. In detail, NPI production was estimated to have produced 70.40 million to 211.2 million tons of CO₂. As for MHP production, it generated emissions from 7.18 million to 13.16 million tons and the conversion of nickel matte from NPI was projected to have produced around 18.22 million tons of CO₂.

HPAL projects have been rapidly expanding for the past five years with eight operational HPAL projects with a total production capacity of 491,000 tons of nickel in MHP per year. This year, four projects will start to operate, nearly doubling the production capacity to 840,000 tons of nickel in MHP. Indonesia becomes the location for largest HPAL projects in the world.

This swift progress of the nickel industry is driven by coal-fired PLTUs, which have served as the backbone of the nickel industry's rapid growth for the last 10 years. Today, many nickel industrial parks in Indonesia operate coal-fired PLTUs with installed capacity of 15,405 MW. This figure is equivalent to 38.5% of the total PLTUs operated by PLN and IPP, which covers 40 gigawatts in 2024.

Companies' commitment to decoupling from coal-fired PLTUs is very limited. Only a few have begun transitioning to clean energy with a severely limited capacity, while new HPAL projects remain heavily reliant on PLTGs, a fossil energy source.

6.2 Future Policy Direction

1. The government needs to limit nickel mining quota while simultaneously halt the expansion of the nickel industry, specifically by no longer issuing Industrial Business License (IUI) for any new nickel processing projects.
2. To curb the rate of emissions from coal-based PLTUs and to transition toward clean energy, the government should not issue any new license for coal-fired PLTU projects in nickel industrial parks, despite the provisions of PP No. 112/2022 that allows such projects.
3. Targeting decarbonization for captive coal PLTUs in industrial parks by accelerating the gradual phase-out of captive PLTUs in nickel-based industrial parks. The lifespan of captive PLTUs in the nickel industry should be shortened to 2034, with the mandate for the industry to develop renewable energy sources and integrate nickel-based industrial parks into PLN's on-grid system, creating an opportunity for energy mix.



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