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The myths surrounding Indonesia's Nickel Revolution: Fact or fiction?

The Western press is rife with negative headlines targeting the surge of Indonesia's nickel industry. We delve into whether these headlines hold any truth, or are they designed to protect incumbent operators at the expense of Indonesia's growth? Is this another example of rich countries using 'green policies' to dominate less wealthy nations? Is Indonesia's nickel mining truly as dirty as media portrays it to be? Let's find out.

"If you're not careful, the newspapers will have you hating the people who are being oppressed, and loving the people who are doing the oppressing."

- Malcolm X

Emerging Trends Report
Q2 2024

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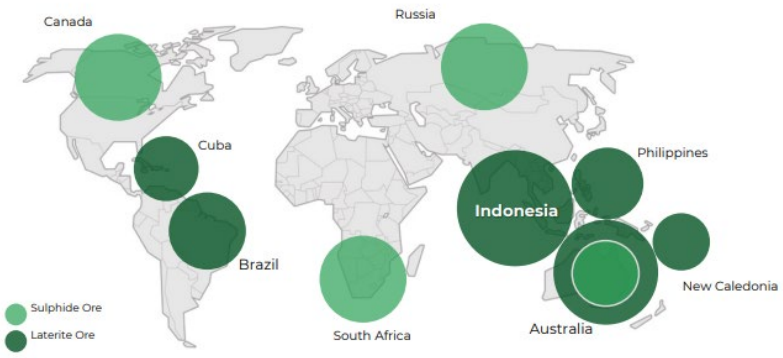
A nickel powerhouse under the microscope

As Indonesia rises in the global nickel market, its strategic reserves and geographic advantages position it as a centre of the electric vehicle (EV) industry. By pioneering the development of an entire EV supply chain—from mines to EVs—Indonesia is embarking on an unprecedented initiative towards sustainable energy.

Despite this, its rising stature has not escaped scrutiny given its cost advantage, particularly from competitors in Western nations. For perspective, Australia's nickel breakeven cost is estimated at around $20,000 per ton[1], New Caledonia's is $24,000 per ton[2] and Indonesia's is the lowest – by far - at $12,000 per ton. Indonesia's huge cost advantage introduces a challenge to competing nations given the massive boom in energy demand. Legacy producers find themselves unable to compete on price and now challenge the sustainability of Indonesian mining operations, casting its practices in a negative light.

Indonesia has one of the largest laterite ore deposits in the world

Geographical locations of nickel deposits based on minerals



Source: Nickel Institute

Contrary to these portrayals, Indonesia has taken a proactive stance in the last decade on embracing advanced technologies such as High-Pressure Acid Leach (HPAL), implementing stringent environmental regulations, and innovating greener waste management solutions.[3] This comprehensive examination aims to address these concerns, highlight Indonesia's progress - which often goes unrecognized - and showcase its transformative role in the future of nickel production.

Mining mechanics for battery materials: limonite is the no brainer way to go

The extraction of nickel for battery materials can be achieved through three different nickel deposits: Limonite (low-grade laterite ore) using HPAL (high pressure acid leach), Saprolite (a higher-grade laterite ore) using RKEF (rotary kiln electric furnace), and sulphide (highest grade ore) using smelting. Each of these deposits is processed by separate methods that follow a distinct process flow and have varying carbon emissions levels.

Among the three downstream processing of nickel, the extraction of nickel through the Limonite using the HPAL process possesses an absolute advantage for battery-making. The cost-effective and carbon footprint advantage of HPAL roots on its (1) hydrometallurgy nature which is a chemical-intensive process instead of a heat and energy process (pyrometallurgy) and (2) refining the ore directly to the required metal grade. This compares to the conventional approach of sulphide ore processing that requires additional refining or downgrading with the pyrometallurgical process (read: energy and heat intensive) of its already processed high-grade nickel.

HPAL plant at Morowali industrial park

Stacked mixed hydroxide precipitate (MHP)

As a nickel deposit, limonite ores stand out among various nickel ores because it already contains the required nickel, cobalt, and manganese, which are among the critical and valuable minerals required to make battery materials.

The MHP (mixed hydroxide precipitate) product, a processed limonite output that has gone through HPAL, contains a mix of about 77% Nickel, 7% Cobalt, and 15% Manganese, producing a near perfect ratio of 8:1:1. This composition is optimal for producing NMC (nickel, manganese, cobalt) 811 batteries, the current flagship choice for EV cars due to its high energy density and capacity. Compared to Sulphides and Saprolite, nickel matte though higher in nickel grade comes with the trade-off of lower cobalt levels and zero manganese, necessitating the use of expensive additives to get to that ideal 8:1:1 ratio.

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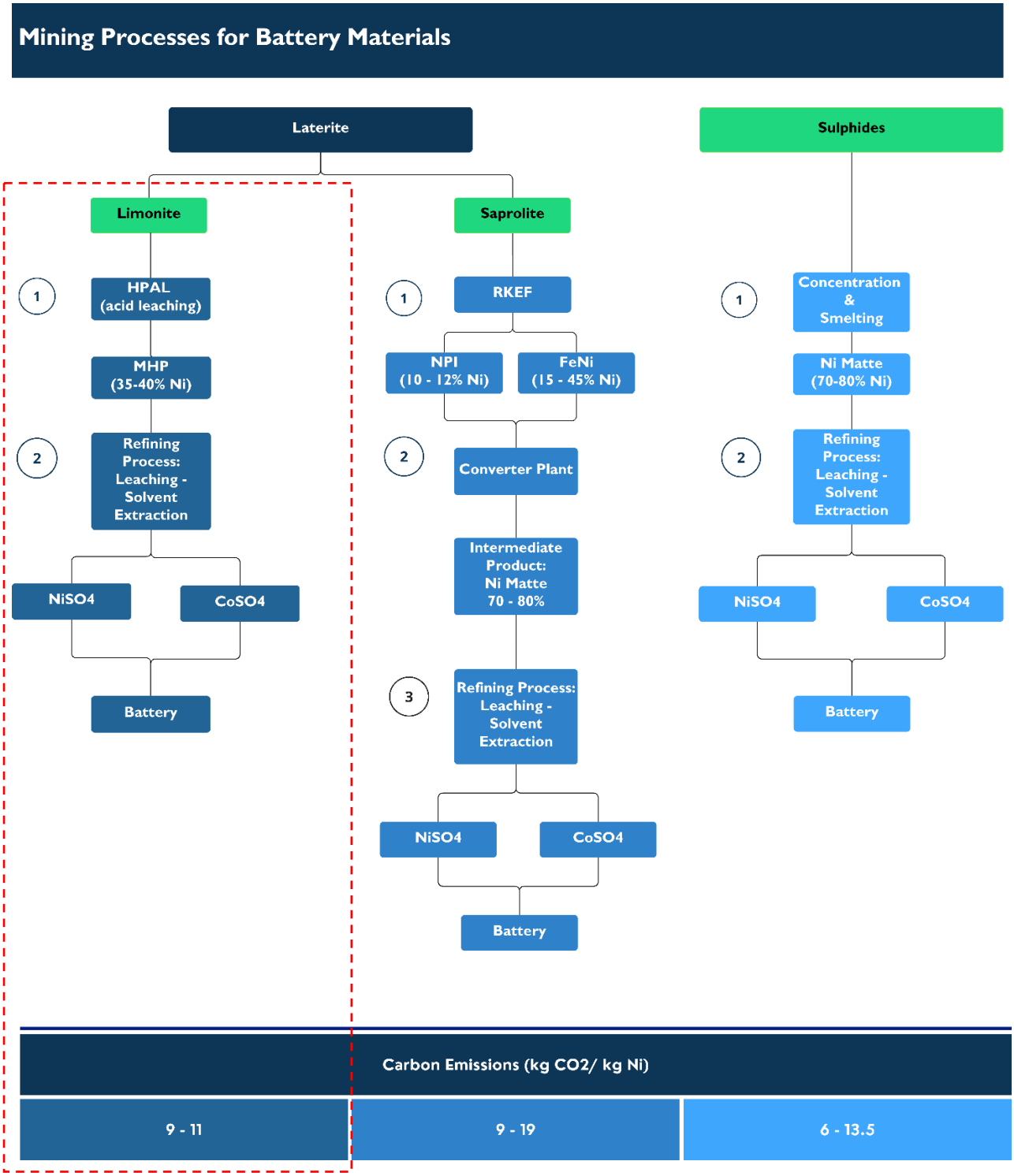
Laterite Ore mining through HPAL is less carbon intensive than other methods

Breakdown of limonite, saprolite, and sulphide ore mining



Source: Coordinating Ministry of Maritime Affairs and Investment Republic of Indonesia, Benchmark Minerals, Roskill, Roland Berger (2023)

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Nickel mining utilizes both deep underground mining and open pit mining

Sulphide ore mines are mostly underground, while Laterite ore mines are mostly open pit

1. Limonite (low-grade laterite) extraction:
   Limonite is a variety of laterite ore characterized by its low nickel content, typically below 1.7%. Laterite ore deposits form as large tabular bodies near the surface with Limonite being a layer found on top and extracted through open pit mining. The extraction process for nickel begins with the HPAL or acid leaching of limonite, which yields MHP containing 35-40% nickel. This intermediate product undergoes a refining process involving leaching and solvent extraction to produce nickel sulfate ($NiSO_4$) and cobalt sulfate ($CoSO_4$), which are then used in battery production. The carbon emissions for this method range from 9 to 11 kg CO_2 per kg of nickel, making it the least carbon-intensive option among the three. Indonesia has an abundance of limonite ores and stands to lead in greener initiatives with this method.

2. Saprolite (higher-grade laterite) extraction:
   Saprolite is a type of laterite ore that has a higher nickel content, typically containing more than 1.7% nickel. The Saprolite layer is located under the Limonite layer within the Laterite ore that is close to the surface also making them suitable for open-pit mining. In this extraction method, saprolite undergoes an RKEF process, resulting in nickel pig iron (NPI). These products are converted into nickel matte (70% nickel grade) in a converter plant. The intermediate nickel matte is then refined through leaching and solvent extraction to produce $NiSO_4$ (about 22% nickel grade) and $CoSO_4$ for battery production. Having to re-refine an already high-grade product to a lower grade not only is inefficient but takes up a lot more energy too. This method has the highest carbon emissions, ranging from 9 to 19 kg CO_2 per kg of nickel

3. Sulphide (highest grade ore) extraction:
   Sulphide is a type of ore that contains a high concentration of nickel, which can reach up to 20%. These ores are typically extracted from deep underground, though some deposits have been mined using open-pit methods in the initial phases. This extraction method involves the concentration and smelting of sulphide ores to produce nickel matte containing 70-80% nickel. The nickel matte undergoes a refining process involving leaching and solvent extraction to yield $NiSO_4$ and $CoSO_4$, which are used in battery production. The carbon emissions for this method range from 6 to 13.5 kg CO_2 per kg of nickel, rendering it the second highest in carbon emissions and energy intensity. This high energy usage is a result of its energy-intensive process and converting high-grade nickel matte (70-80% nickel) to a lower grade, making the process inefficient.

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Limonite deposits used to be pretty useless for battery production until modern HPAL technology came along. Now, Indonesian limonite nickel miners have a significant edge, both in cost and environmental efficiency. With plenty of limonite ore available - full of nickel, cobalt and manganese - Indonesia is perfectly poised to capitalize on the HPAL process.

The HPAL edge: faster, cleaner, cheaper

Indonesia, utilizing new HPAL technology developed by leading Chinese metals companies has cemented itself as a leader in nickel-based battery material production, producing over 50% of the world's nickel in 2023. This shift challenges traditional nickel producers like BHP Billiton and Glencore, who rely on older, more expensive methods to produce high-purity class 1 nickel, which then requires additional processing for battery use. By eliminating energy-intensive smelting, HPAL reduces energy consumption and emissions, making it a cost-effective and eco-friendly solution.

Indonesian MHP to displace other Ni Intermediates

MHP-to-sulfate is the most cost-effective way to produce nickel sulfate

Nickel Sulfate Unit Economics	Nickel Sulfate (NiSo4) Feedstock			
US$ per ton Ni	MHP	Battery Scrap	Matte	Briquette
Production share in China	**A 48.0%**	**12.0%**	**16.0%**	**B 20.0%**
Standalone NiSo4 refinery				
Cost				
Feedstock	11,770	13,452	13,079	16,349
Processing	3,350	1,250	3,050	650
Recycling loss	353	202	523	164
NiSo4 production cost	**15,473**	**14,904**	**16,653**	**17,163**
Refinery margin	**231**	**800**	**C (949)**	**(1,459)**
X-to-sulfate				
Cost to produce feedstock	9,011	N/A	11,443	N/A
Feedstock margin	3,112	N/A	2,159	N/A
X-to-sulfate margin	**A 3,343**	N/A	**1,211**	N/A

Selling price assumption		
Ni MHP	11,770	$ per ton Ni
Ni Matte	13,079	$ per ton Ni
Nickel Sulfate	15,704	$ per ton Ni
Nickel LME	16,349	$ per ton Ni

Note:
1. Production share is based on SMM's data of China's nickel sulfate production, June 2022.
2. Battery scrap price is estimated by pro-rata of SMM's June 2022 reference to Nickel Briquette.
3. In standalone NiSo4 refinery, feedstock & recycling loss are arrived from selling price assumption.
4. We applied the latest available pricing on 21 February 2024
5. Matte assumes Tsingshan's process.

A MHP to sulfate has the lowest cost, but only makes sense if it is vertically integrated.

B Currently, Matte and briquette to sulfate are out of the cost-curve. Their higher cost is structural and to be displaced by MHP.

C There is a spread of c.US$ 3,270 between Ni Matte and LME grade metal. Ni Matte remains arbitrable for LME deliverables such as Ni plating or Ni briquette.

Source: Heyokha Research, SMM

Chinese metal and metallurgical companies, including Zhejiang Huayou Cobalt (SHA: 603799), China Metallurgical Corporation (SHA: 601618), and Lygend Resources and Technology (HKG: 2245), invested billions to make HPAL technology reliable, affordable, and scalable, even in remote areas of the Philippines and Papua New Guinea. This innovation has revolutionized nickel production economics. Today, Indonesia can utilize its vast laterite ore resources to produce battery-grade nickel material, MHP, directly.

Chinese innovation and investment

In recent years, Chinese companies have led the way in refining and implementing HPAL technology on a large scale. Tsingshan Steel funded the development of the Morowali (IMIP), Konawe (IKIP) and Weda Bay (IWIP) parks that have become the main centers of Indonesia's nickel production. Companies like Zhejiang Huayou Cobalt and Lygend Resources and Technology have also invested heavily in HPAL projects, leveraging the country's rich laterite nickel reserves.

Indonesia's re-industrialization is attracting massive investments

Overview of Indonesia's four commodity industrial parks

Note: Morawali IMIP has increased in size to 5,500 Hectares as of 2024
Source: Heyokha Research

For instance, Zhejiang Huayou Cobalt has partnered with PT Vale Indonesia (IDX: INCO) to construct several HPAL plants, including major facilities in Pomalaa with capacity to produce 120 ktpa (kilo tons per annum) of nickel and Sorowako with capacity to produce 60 ktpa nickel. These projects aim to produce large quantities of MHP for use in EV batteries, highlighting the strategic importance of HPAL technology in the global push for electric mobility.

Lygend Resources and Technology, in collaboration with Harita Nickel (IDX: NCKL), has successfully commissioned the first HPAL plant on Obi Island, Indonesia. This USD 1.1 billion plant with a capacity of 65 ktpa marked a significant milestone in the industry, overcoming substantial logistical and environmental challenges to produce nickel and cobalt hydroxide for the global market.

Meanwhile, PT Merdeka Battery Materials (IDX: MBMA) holds a significant stake in Indonesia's IKIP, which includes the SCM nickel mine. This mine spans 21,000 hectares and holds 13.8 million tons of nickel ore, making it the largest single nickel deposit outside of Russia. In addition, MBMA has partnered with GEM (SHE: 002340) to develop an HPAL plant with a nameplate capacity of 30 ktpa of MHP. There is also a potential plan to build additional facilities with even larger capacities of 120 ktpa, possibly collaborating with CATL (SHE: 300750) and Zhejiang Huayou Cobalt.

Future plans are in talks to focus on establishing a circular nickel economy that covers everything from mining to EV battery production to recycling. This strategy includes utilizing the SCM mine's saprolite ore deposits via RKEF. The reason is straightforward: the initial capital expenditure for HPAL is considerably higher than for RKEF, and RKEF offers additional nickel products such as NPI and nickel matte, good for diversification. While HPAL has a lower cash cost, it also incurs higher depreciation costs, among other expenses.

MBMA's strategy of majority ownership at each stage showcases a remarkable level of vertical integration especially with stellar partnerships alongside Zhejiang Huayou Cobalt, GEM, and Tsinghan Steel. This, coupled with its access to abundant laterite ore and the use of advanced HPAL technology, poses a substantial challenge to traditional mining companies struggling to compete.

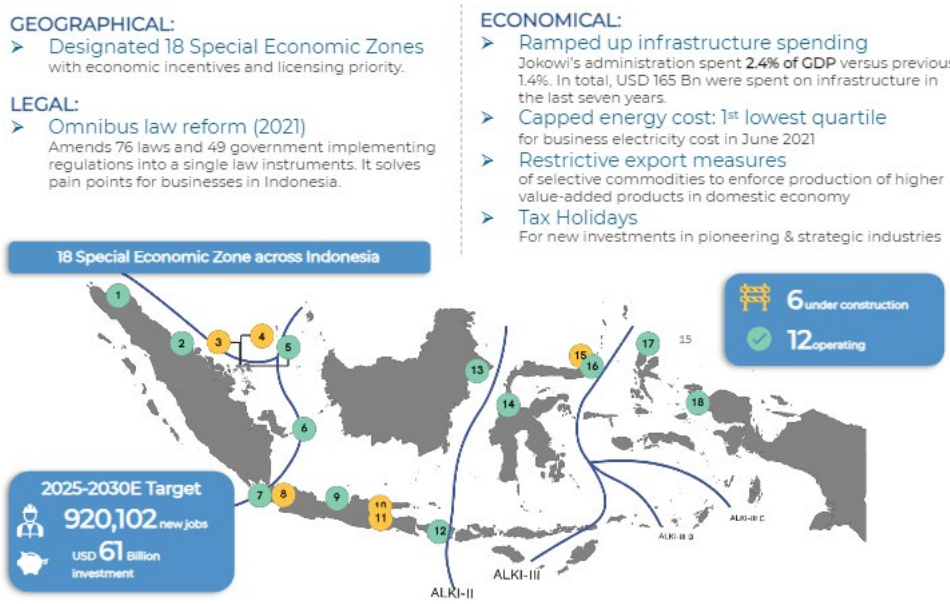
Nickel's new frontier: from ore to EV batteries

Combined with lower input costs, from labour to energy and Indonesia's unique capability for vertical integration, Western mining and EV companies that are standalones - outside the vertical supply chain - simply cannot compete economically. Nickel, particularly from Indonesia's laterite ores which has a near-perfect ratio of nickel, cobalt, and manganese for NCM 811 batteries is vital for the EV battery supply chain. The value chain extends from ore extraction to refining and ultimately to EV production.

Indonesia's abundant laterite ores place it in pole position, especially as global EV manufacturers increase demand for nickel. The government's strategic ban in 2014 on exporting raw ores has ensured that processing takes place domestically, creating a more integrated value chain. Pro-growth policies such as this, along with pro-investment policies such as tax relief on related foreign direct investment (FDI), have spurred the development of industrial parks within Special Economic Zones (SEZs). These zones have transformed into nickel powerhouses, featuring not only mining operations but also facilities for the production of EV batteries.

Government initiatives are driving re-industrialization

Overview of geographical, legal, and economical initiatives in Indonesia

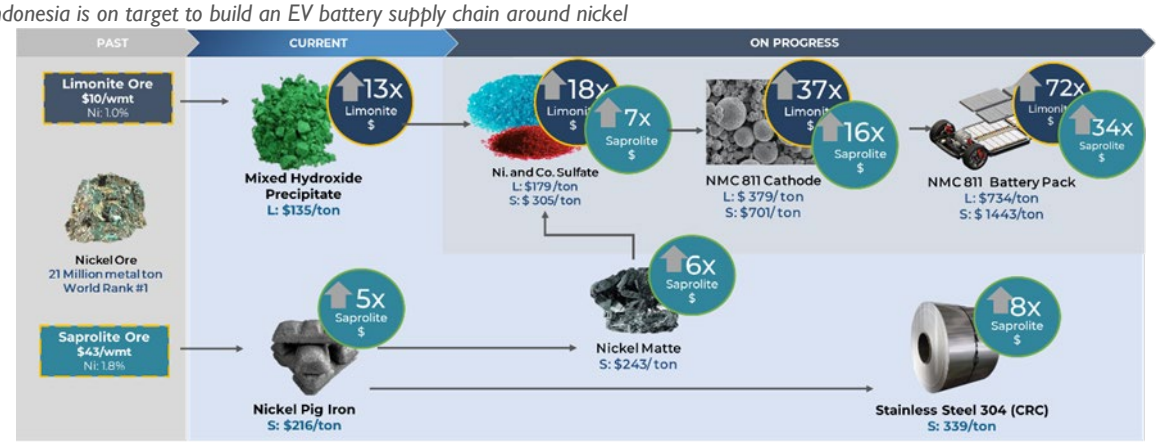


Source: Heyokha Research

In July 2024, Indonesia opened its first EV battery plant in Karawang, West Java, a joint venture between Indonesia Battery Corporation, Hyundai Motor, and LG Energy Solution.[4] It is a USD 1.1 billion investment and has the capacity to produce 150,000 EV batteries per year. Their upcoming USD 2 billion second phase adds a further 20 GW capacity. In addition, this facility is integrated into Hyundai's EV factory with a capacity to produce 50,000 EVs pa for the Indonesian market.

Value-add of onshoring limonite and saprolite downstreaming can yield ~34-72x its raw ore value

Indonesia is on target to build an EV battery supply chain around nickel



Source: Heyokha Research, CRU, USGS, and various sources

"I'd just like to re-emphasize, any mining companies out there, please mine more nickel"

- Elon Musk (July 2020) -

"It's quite likely that my company will invest in Indonesia"

- Elon Musk (May 2024) -

Debunking criticisms: technological and environmental realities

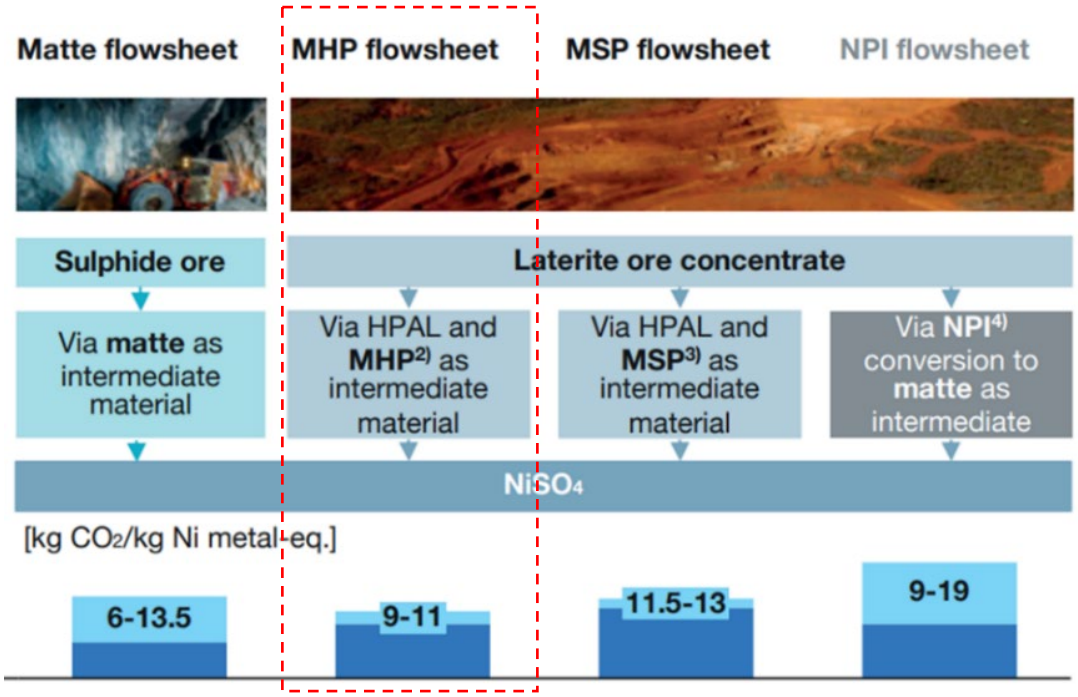
- ***Criticism: Indonesia's nickel extraction methods are excessively carbon-intensive due to the intensive use of coal***

Rebuttal:

While many operations rely on coal, Indonesia is actively investing in cleaner production methods like HPAL, which has considerably reduced carbon emissions compared to traditional methods such as RKEF.

HPAL technology extracts nickel from laterite ores using high-pressure, high-temperature sulfuric acid. This method reduces carbon emissions and produces MHP, a precursor for battery-grade nickel, representing a significant improvement over traditional sulphide ore processing. HPAL simplifies production, lowers energy consumption, and mitigates environmental impacts, meeting the rising demand for nickel in electric vehicle batteries. Additionally, HPAL processes recycle steam byproducts, enhancing efficiency.

Producing nickel sulfate from MHP (HPAL process) has the lowest carbon emissions



Source: Benchmark Minerals, Roskill, Roland Berger (2023)

Beyond HPAL, Indonesia is also exploring a blend of renewable energy sources to power mining operations, further enhancing sustainability. The government has stated that it will not issue new smelter permits unless renewable energy is used to a certain degree.[5] This evolution in nickel production technology underscores the industry's commitment to sustainability and efficiency, aligning with global trends towards greener and more cost-effective manufacturing processes.

In practical terms, Indonesian mines using HPAL can produce one ton of nickel equivalent for roughly US$12,000 (US $10,000 when the cobalt credit is considered), while traditional sulphide ore and smelting methods used in countries like Australia and New Caledonia cost up to twice as much.

- ***Criticism: Indonesia's nickel mining causes deforestation due to open pit mining***

Rebuttal:

The expansion of mining operations has historically led to habitat destruction and significant ecological impact. However, recent efforts by Indonesian mining companies and the government have focused on sustainable mining practices. Rehabilitation programs now aim to restore and replant mined areas. For example, PT Vale Indonesia has successfully rehabilitated former nickel mining land covering 10,000 hectares in South Sulawesi,[6] transforming it back into forest and establishing a nursery capable of producing 700,000 endemic plant seeds annually.[7]

- ***Criticism: Indonesia has poor mining waste management due to dumping tailings into the sea***

Rebuttal:

HPAL technology has significantly enhanced waste management practices in Indonesia's nickel industry, setting new standards for environmental responsibility. The HPAL process generates tailings, which are primarily composed of iron and magnesium residues with about 35% moisture. These are treated and dry stacked to meet local government standards before later being backfilled. At that point the ground is lined with black plastic polymer membranes, and the tailings are rehabilitated with grass and shrubs.[8]

Managing nickel processing waste as dry tailings rather than wet tailings offers considerable environmental benefits, as dry tailings are more stable, less risky for the environment, and use less water. Furthermore, due to the tailings' high iron content, Indonesian nickel producers are investigating multiple strategies for reusing these materials in stainless steel or construction projects. This approach also supports a circular economy by repurposing waste in other industrial applications.[9]

Indonesian nickel companies, e.g. Harita Nickel, also show commitment to waste management and environmental protection by employing third-party assessors. Their dry stack tailing storage facilities undergo regular evaluations to meet industry standards, while water and sea monitoring within their operations ensures compliance with the Environmental Protection and Management Law and the Wastewater Standards for Nickel Mining Law.

Tightening government oversight in banning deep sea tailings disposal and international partnerships promoting sustainable practices further highlight Indonesia's commitment to improved waste management, reducing carbon emissions, optimizing energy use, and minimizing the overall carbon footprint in the nickel industry.[10]

Debunking criticisms: economic and regulatory realities

- ***Criticism: Indonesia's nickel industry abuses labor and has substandard working practices***

Rebuttal:

Companies are increasingly investing in safer working environments and improving wages.

During our field visit to the Morowali Industrial Park in March 2024, workers reported that their salaries ranged from IDR 6 to 8 million (US$ 387 to 516), with a median salary between IDR 10 to 15 million (US$ 645 to 967). This is significantly higher compared to the minimum wage in Jakarta (IDR 4.9 million or US$ 316) and Makassar (IDR 3.6 million or US$ 232).[11]

Government initiatives, coupled with pressure from international stakeholders, have led to more consistent adherence to labour laws and improved working conditions.

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A look inside Morowali Industrial Park

- ***Criticism: Indonesia's nickel is less 'green' and should be traded at a discount to 'green' nickel***

Rebuttal:

There is no premium pricing for 'green' nickel, it is just the market price.

Australian and Canadian producers have attempted to market their nickel as environmentally friendly and therefore deserving of a 'green premium'. Despite this, the market is hesitant to pay significantly more (read: not even one cent more!) for such products, and there is debate about how much 'greener' it really is, given that they're still producing class 1 nickel and then converting it back to lower-grade nickel battery material grade nickel. Also, most manufacturers prioritize affordability and sourcing reliability over environmental labels, which prevents legacy producers from charging a premium thereby leading to increased concerns of never-ending losses at their mining operations.

Instead, Indonesia's increasing adoption of HPAL technology means its nickel is not only cheaper but also increasingly environmentally friendly. Based on our findings, the HPAL technology using MHP as an intermediate produces near perfect NMC 811 batteries, the best choice for EV cars due to its high energy density and capacity. Other methods do not achieve as precise a ratio of these minerals and must use additives to compensate, often by incorporating additional cobalt from less sustainable sources, such as the DRC.

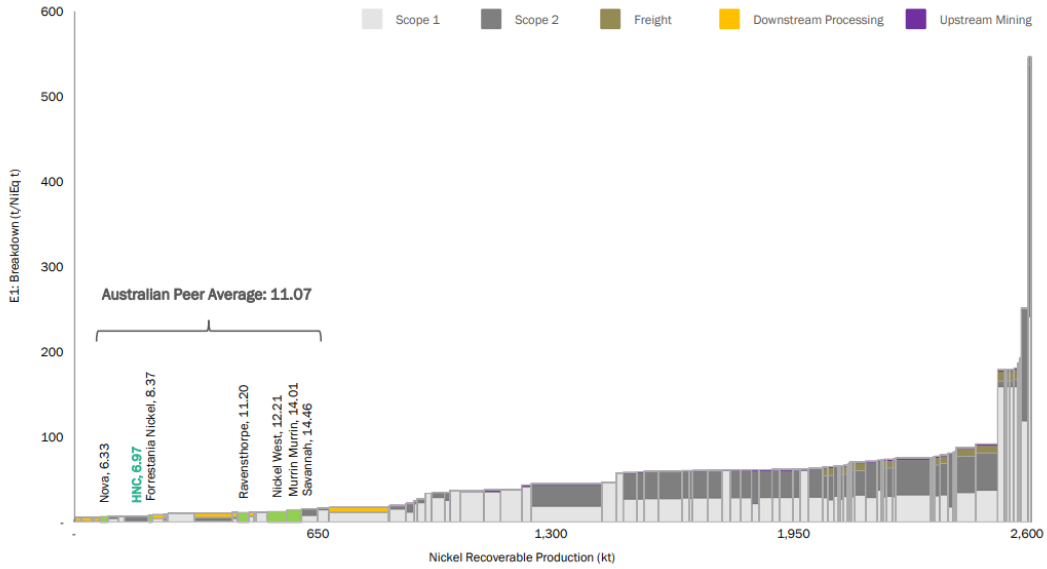
Using Indonesian nickel is becoming more widely accepted as not only Chinese car and battery companies have invested locally, but also American (Ford and Jeep), Korean (Hyundai, KIA and LG), and European (Fiat and Peugeot) companies have followed suit. Not only have local investments been increasing, but there has also been a focus on investing directly in HPAL plants. Ford Motors (NYSE: F) for instance has signed an investment agreement with PT Vale Indonesia and China's Zhejian's Huayou Cobalt to build a HPAL processing plant in Sulawesi.[12] This is just the beginning.

"Mineral resources of this nation, such as iron and nickel are important components in batteries that will mobilise millions of EV globally"

- Euisun Chung, Hyundai Motor Group Executive Chair (July 2024) -

Simply put, if there was demand for 'greener' nickel, there would be a premium for it. Yet there is not. Furthermore, if not for the new nickel supply from Indonesia, nickel prices would likely be much higher than now, as they were in 2022, slowing the adoption of EVs globally and undercutting the entire idea of a premium for a like-for-like product.

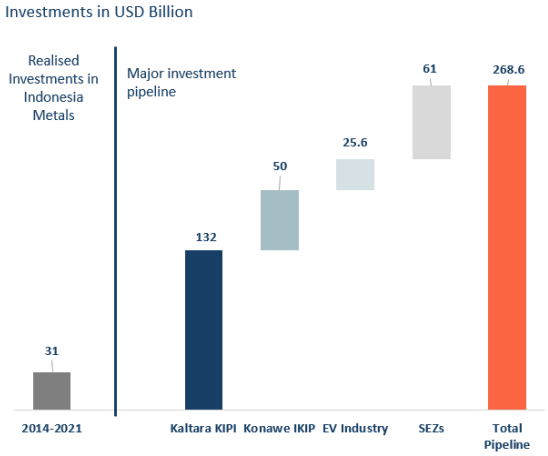
The Indonesian Huayou Nickel Cobalt (HNC) HPAL project is one of the lowest carbon emitting nickel processors globally compared to its Australian peers (6.97 < 11.07 average tonnes of CO2 per tonne of nickel)



Source: Nickel Industries, Company Filings, Skarn Associates

Indonesia draws investments from world class companies validating its green practices

Realized and pipeline foreign investments



More than ***USD 25 Billion*** investments are committed for EV industry

	Hyundai, LG Energy Solution, IBC (Karawang, West Java province)	➢ Size : USD 9.8 Bn ➢ Project: EV battery factory, 150 Ktpa Nickel Sulfate, precursor and cathode factory
	CATL & IBC (North Moluccas province)	➢ Size: USD 6.7 Bn ➢ Project: EV battery
	Foxconn, IBC, Indika, Gogoro (Batang, East Java province)	➢ Size: USD 8 Bn ➢ Project: Factory for battery cells, cathode precursor, and telecommunication spare parts
	Vale & Ford Motors & Stellantis (Pomalaa, Southeast Sulawesi province)	➢ Size: USD 4.5 Bn ➢ Project: HPAL 120 Ktpa, to downstream
	Tesla **BYD**	➢ Eyeing an industrial complex for its new EV factory

**Note: IBC is a consortium of Indonesia SOEs for battery industry.*
Source: Company filings, various sources.

Source: Heyokha Research

- ***Criticism: Indonesia's regulations are less stringent***

Rebuttal:

Implementing nickel traceability and partnering with the best-in-class global companies ensures world class standards will be met.

The Indonesian government is catching up – implementing comprehensive environmental regulations that require companies to conduct impact assessments, manage waste responsibly, and reduce emissions[13]. These changes align Indonesia's regulations with international standards and improve environmental practices across the mining sector. Mining minister Arifin Tasrim has announced an initiative to track the ores from mines to buyers within their online system SIMBARA (Risk-Based Mineral and Coal Information System) to allow nickel traceability for more responsible monitoring of transparency and compliance.

Investments made by Western companies over the past 18 months clearly demonstrate Indonesia's commitment to global ESG standards. These companies, including Ford, are not just securing their nickel supply through these investments; they are also ensuring they have a voice in shaping the ESG practices of their partners. By doing so, they align their operations with ethical, environmental, and governance criteria, influencing positive change in the industry.

"Ford can help ensure that the nickel that we use in electric vehicle batteries is mined, produced within the same ESG standards as part of our business around the world"
- Christopher Smith, Ford's Chief Government Affairs Officer (March 2023) -

Striking it rich: Indonesia's nickel boom fuels economic and community growth

The nickel industry is stimulating economic growth in Indonesia. The ban on raw ore exports, coupled with the focus on local processing, has led to significant foreign direct investment, initially from Chinese companies and now from around the world. This influx of capital has generated employment opportunities, particularly in mining hubs like Morowali on the island of Sulawesi, improving infrastructure and boosting local economies. Additionally, technology transfer from international partners enhances the skills of the local workforce. Last but certainly not least, the rise in export revenues from higher-value nickel production has almost single-handedly reversed Indonesia's long-standing chronic current account deficit, transforming it into a surplus.

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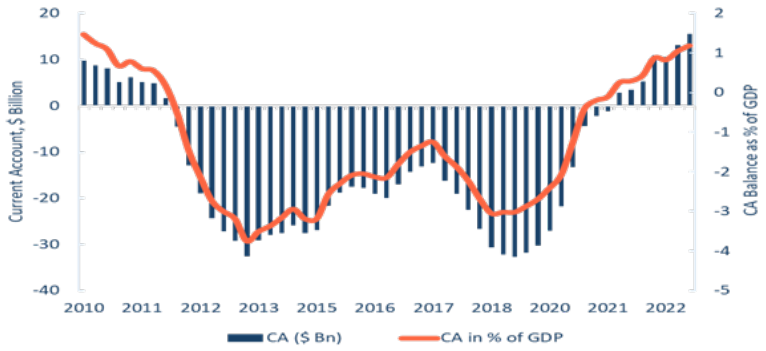
Structural improvement in current account

Nickel exports added c.$8 Bn quarterly surplus to current account

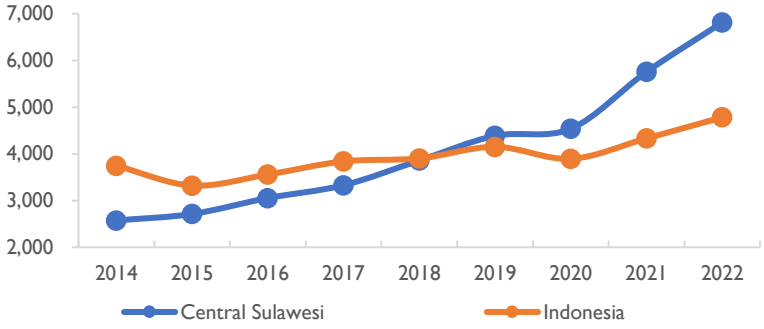


Source: Bloomberg

Beyond mining operations, many nickel companies are engaged in community development programs. These initiatives focus on improving infrastructure, healthcare, education, and social welfare. The programs have enhanced the quality of life for the local population, leading to poverty alleviation in rural areas.

Wealth creation in Sulawesi is increasing

Central Sulawesi province GDP per Capita vs Indonesia's (US$)



Source: Government data

Conclusion: Indonesia's nickel revolution

Indonesia is not merely responding to the global demand for nickel; it is actively shaping the market through innovative practices and sustainable advancements. Through utilization of cobalt and manganese rich limonite nickel ore, investments in cleaner technologies like HPAL, increasing the use of renewable energy and the adoption of stricter environmental regulations, Indonesia is emerging as a leader in sustainable nickel production. While criticisms from Western competitors continue, Indonesia is proving that its strategic approach to nickel mining can align economic growth with environmental responsibility. Indonesia has become a stabilizing force that ensures economical and scalable battery materials, proving that economic development and environmental responsibility can indeed coexist and thrive together to achieve global energy transition targets and net zero goals.

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