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Arianto Sangadji, Linda Dewi Rahayu, Pradnya Paramarini

CLEAN CARS, DIRTY NICKEL

The Indonesia-China-Germany Nickel Supply Chain for EV Batteries

ARIANTO SANGADJI holds a Ph.D. in Political Economy from York University, Canada. He has published numerous academic works and reports related to the mining industry and actively writes from a geopolitical economy perspective to advocate for a responsible mining industry.

LINDA DEWI RAHAYU is a lawyer and public policy analyst who is dedicated to defending human rights and social justice. Through critical law thinking, she has extensive experience in analyzing policies and advocating complex cases related to structural and social justice.

PRADNYA PARAMARINI holds a Master's degree in Natural Resource Management and is passionate about developing community-focused strategies that promote environmental sustainability. She enjoys engaging with local stakeholders to identify challenges and create practical, problem-solving solutions.

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CONTENT

EXECUTIVE SUMMARY

Nickel plays a critical role in the green transition as it is one of essential feedstocks for lithium-ion batteries that power electric vehicles (EVs). As Indonesia mines more than half of global nickel today and manufactures approximately two-fifths of the world's processed nickel, the archipelago has contributed to the global green transition in the energy and transportation sectors. Processed nickel refers to nickel metal, chemicals, and other products that are utilised by industrial consumers, including battery makers and car manufacturers.

This study aims to map the supply chain of battery-grade nickel for EVs, ranging from the production of mined nickel, refined nickel, cathode materials, and EV batteries. The study focuses on specific nickel mining and smelting companies belonging or related to Huayou Cobalt Co., Ltd., operating in Indonesia, and their links to battery manufacturer CATL and German automakers.

This report highlights environmental and human rights violations in the Indonesian nickel industry, such that the battery makers and automakers are at risk of being linked to those violations. German EV makers whose nickel likely arrives from Indonesia have a duty to prevent environmental and human rights violations within their nickel supply chain as stipulated by the Germany Supply Chain Due Diligence Act, the EU Corporate Sustainability Due Diligence Directive, and the EU Battery Regulation. This report's review and analysis is based on laws applicable in Indonesia, Germany, and the EU.

Figure 1. A coal-fired power plant at IWIP

credit: Anto Sangadji, 2024

KEY TAKEAWAYS

1. Nickel plays a key role in the green energy transition as it as a pivotal feedstock for lithium-ion batteries that power electric vehicles;
2. Nickel is mainly mined, smelted, refined, and exported from Indonesia to China for further processing for nickel powered batteries;
3. Nickel powered batteries are mostly manufactured in China for leading global electric vehicle manufacturers including Volkswagen, BMW, Mercedes-Benz, and Tesla;
4. Feedback from several actors reveals that it is very hard to trace nickel supply chains completely because, among other things, contracts among parties in the nickel supply chain involve in non-disclosure agreements. However, there are enough reports and information available that make clear the connections between automobile makers and the mining sites in Indonesia;
5. Battery-grade nickel production in Indonesia comes with high environmental costs including deforestation and air and water pollution;
6. Battery-grade nickel production in Indonesia entails human right violations including land theft, the displacement of indigenous peoples, and intense labour exploitation.

RECOMMENDATIONS

The Government of Indonesia:

The government needs specific policies to reduce the risks of environmental and human rights violations related to nickel mining, smelting, and refining operations. Such policies must:

1. Prevent nickel mining projects operating in no-go zones including areas where indigenous peoples reside in voluntary isolation;
2. Ensure nickel mining companies respect indigenous peoples' rights (including the mandatory right to free, prior, and informed consent), and establish effective and accessible grievance mechanisms;
3. Stop the new construction of coal-fired power plants in the nickel-based industries and develop a time-bound plan to power operations using renewable energy;
4. Provide tax incentives for smelting and refining companies that phase out coal power plants and transfer to solar and wind power;
5. Require that the Ministry of Environment implement improved practices to ensure harmful heavy metals are not discharged into surrounding freshwater and seawater;
6. Implement labour rights according the national law and the conventions of the International Labour Organization (ILO), including freedom of association, fair compensation, and limited working hours;
7. Use the high carbon stock and high conservation value approaches to determine legitimate zones and no-go zones for nickel mining operations;
8. Require that nickel mining and processing companies publish on their website, and in relevant reports, details on the extent of deforestation, tailing management, and hazard classification.

GERMAN AUTOMAKERS

German automakers must:

1. Ensure nickel supply is not sourced from mining projects operating in no-go zones including areas where indigenous peoples live in voluntary isolation;
2. Require that the upstream chain of nickel suppliers respect indigenous peoples' rights and conduct FPIC, adopt and implement social and environmental safeguards, and establish effective and accessible grievance mechanisms, and support such suppliers in doing so;
3. Reduce CO_2-emissions in battery production by obliging the upstream supply chain of nickel to treat pollution based on the best available technologies;
4. Require that the upstream chain of nickel suppliers to enshrine freedom of association, freedom from forced labour, and freedom from discrimination, and the right to a safe and healthy working environment, and support such suppliers in doing so;
5. Require that the upstream chain of nickel suppliers implement adequate safety regulations for workers to prevent death and injury, as well as fair compensation, and support such suppliers in doing so;
6. Require that the upstream chain of nickel suppliers undertake due diligence aligned with the German Supply Chain Due Diligence Act (SCDDA), the EU Corporate Sustainability Due Diligence Directive (CSDDD), and the EU Battery Regulation (BATT2), and support such suppliers in doing so;
7. Publish analysis of identified human rights and environmental risks on their websites, and describe preventive measures taken and the impact analysis of such measures.
8. Identify human rights violations and environmental degradation to determine appropriate remedies for affected communities.
9. Establish a functioning grievance mechanism for affected communities, accompanying civil society, and trade unions.

ACRONYMS USED

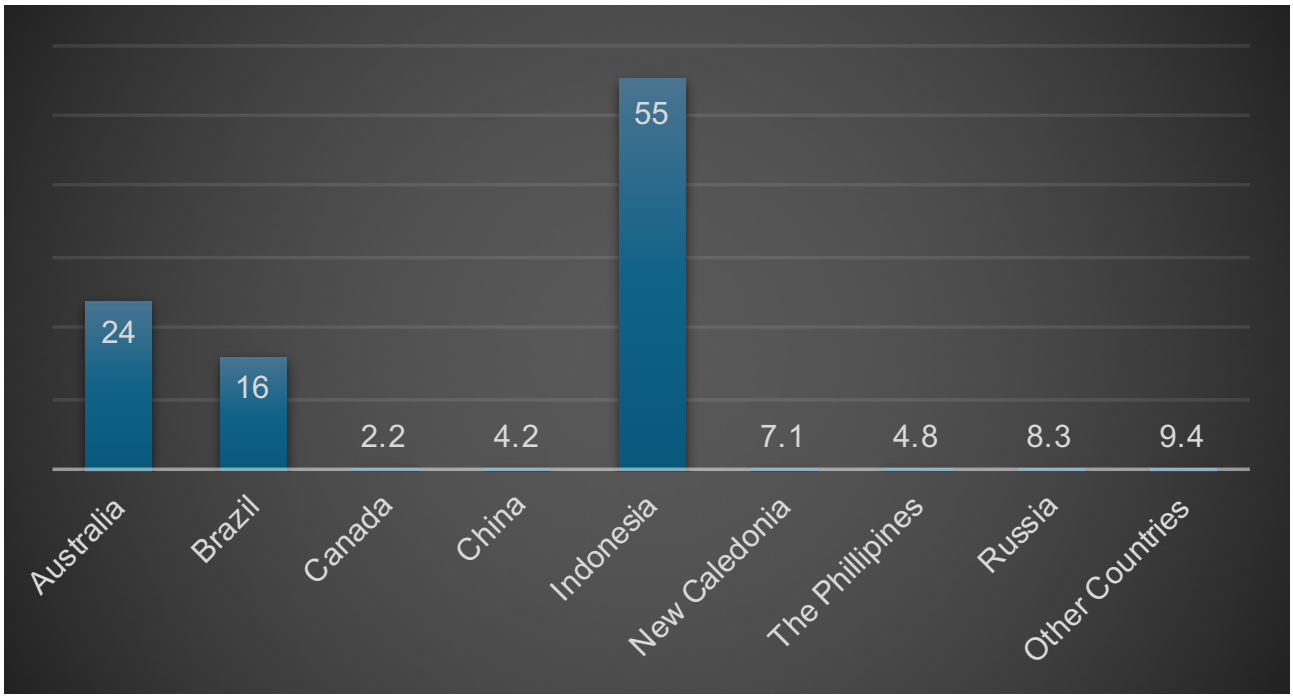
BATT2	EU Battery Regulation 2023
CAM	Cathode Active Materials
CATL	Contemporary Amperex Technology Co. Limited
CSDDD	EU Corporate Sustainability Due Diligence Directive
EV	Electric vehicle
GW	Gigawatt
HPAL	High-pressure acid leaching
LFP	Lithium iron phosphate
MHP	Mixed hydroxide precipitate
MW	Megawatt
NMC	Nickel manganese and cobalt
NPI	Nickel pig iron
OESBF	Oxygen enriched side blown furnace
pCAM	Precursor cathode active materials
RKEF	Rotary-kiln electric furnace
SCDDA	Supply Chain Due Diligence Act
t/y	Tons per year

I. OVERVIEW

Nickel exists naturally as either sulfide deposits (such as those found in Australia, Canada, and Russia) or laterite deposits (such as those found in Cuba, Indonesia, New Caledonia, and the Philippines). While sulfide ores derive from volcanic or hydrothermal processes, laterite ores are formed near the Earth's surface, typically in tropical climates. Global nickel reserves are estimated to contain 350 million tons of nickel, of which 54 percent is laterite and 35 percent is sulfilde.[1] The laterite can only be extracted using open-pit mining, as they are in large deposits in the upper layer of the earth's crust, while for sulfide ores, both underground mining and open pit mining are commonly employed.[2]

Global nickel reserves are projected to be 130 million tons as of 2023. Indonesia has the largest nickel reserves in the world, accounting for about 42.30 percent (Figure 2).

Figure 2. Global nickel reserves as of 2023 (in million of tons)



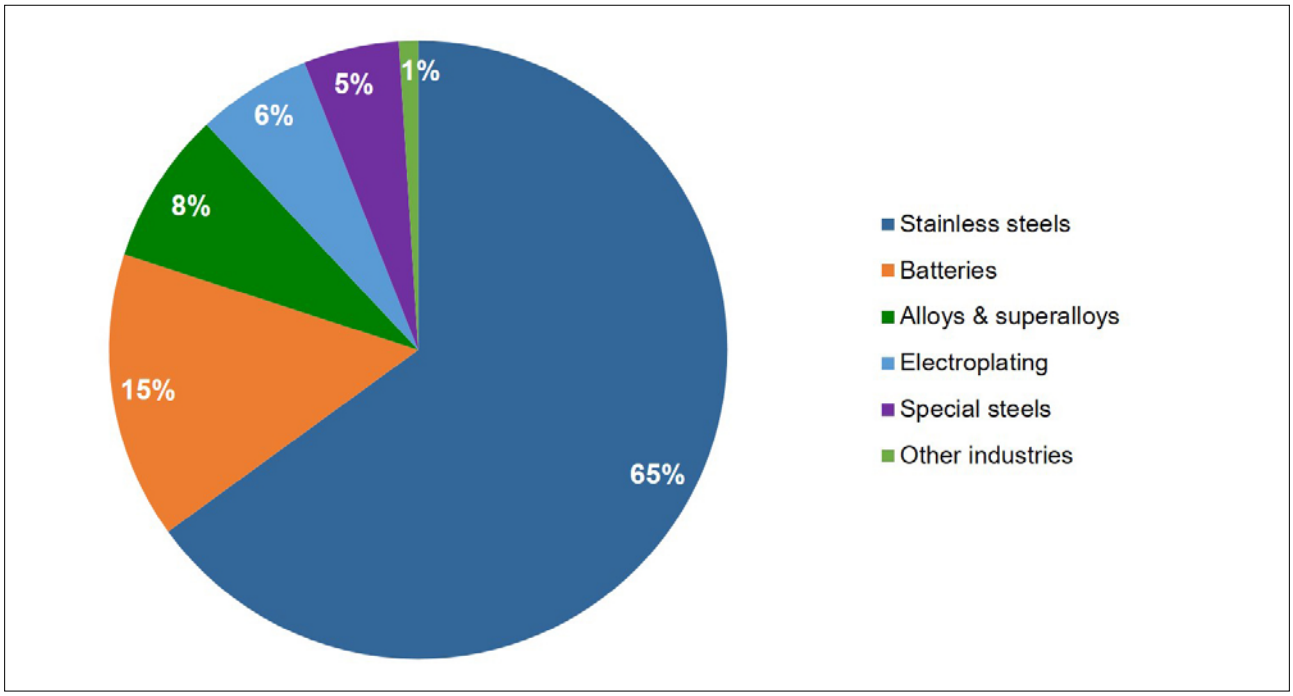
Source: USGS

Nickel is used as a raw material to produce other derivative commodities. To do so, it must be converted into intermediate products that subsequently undergo further processing before they become finished products, such as stainless steels, electric vehicle (EV) batteries, and nickel-based alloys. Global nickel consumption is led by nickel-based commodities such as stainless steels, batteries, alloys and superalloys, electroplating, special steels, and others (Figure 3).

At present, the growing global demand of nickel is associated with switching to clean sources of energy, mainly in the mobility sector, to tackle the climate crisis. Nickel consumption for batteries has significantly increased due to the rapid expansion of global EV industries. EV battery demand for nickel reached 320,000 tons in 2023, compared to 50,000 tons in 2018.[3] In addition, nickel is one of the critical materials that can be advantageous for clean energy technologies such as wind and hydroelectic power generation. Turbines for wind and hydro largely consist of nickel-containing stainless steel, which is highly resistant to corrosion.[4]

1 USGS. 2024. "Mineral Commodity Summaries", 2024, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-nickel.pdf.
2 Gavin M. Mudd, "Global Trends and Environmental Issues in Nickel Mining: Sulfides Versus Laterites", *Ore Geology Reviews,* 38(1–2), 2010: 9-26.
3 IEA. 2023. "Overall Supply and Demand of Nickel for Batteries by Sector, 2016–2022", https://www.iea.org/data-and-statistics/charts/overall-supply-and-demand-of-nickel-for-batteries-by-sector-2016-2022; IEA. 2024. *Global EV Outlook 2024: Moving Towards Increased Affordability,* https://iea.blob.core.windows.net/assets/a9e3544b-0b12-4e15-b407-65f5c8ce1b5f/GlobalEVOutlook2024.pdf.
4 Nickel Institute, "Wind and Water: Nickel in Clean Energy", 2021, https://nickelinstitute.org/en/blog/2021%E5%B9%B4/september/wind-and-water-nickel-in-clean-energy/.

Figure 3. Percentage of nickel consumption by industry in 2023



Source: Nornickel[5]

Global nickel production is distributed among different countries, and this distribution is changing all the time. In terms of mine output, Indonesia and The Philippines accounted for a combined 61.11 percent of global production in 2023, increasing from 9.28 percent in 2000. In contrast, the global percentage share of the two major producers — Russia and Canada — decreased from 37.31 percent in 2000 to 10.55 percent in 2023.[6] Historically, the global processing of nickel has mostly taken place in western or industrialized countries. In 1994, 819,000 metric tons was processed in four countries (Canada, Russia, Japan and Australia), which accounted for 56.89 percent of total world production — Indonesia's share was only 0.70 percent[7]. In 2023, the archipelago accounted for 41 percent of global production.[8]

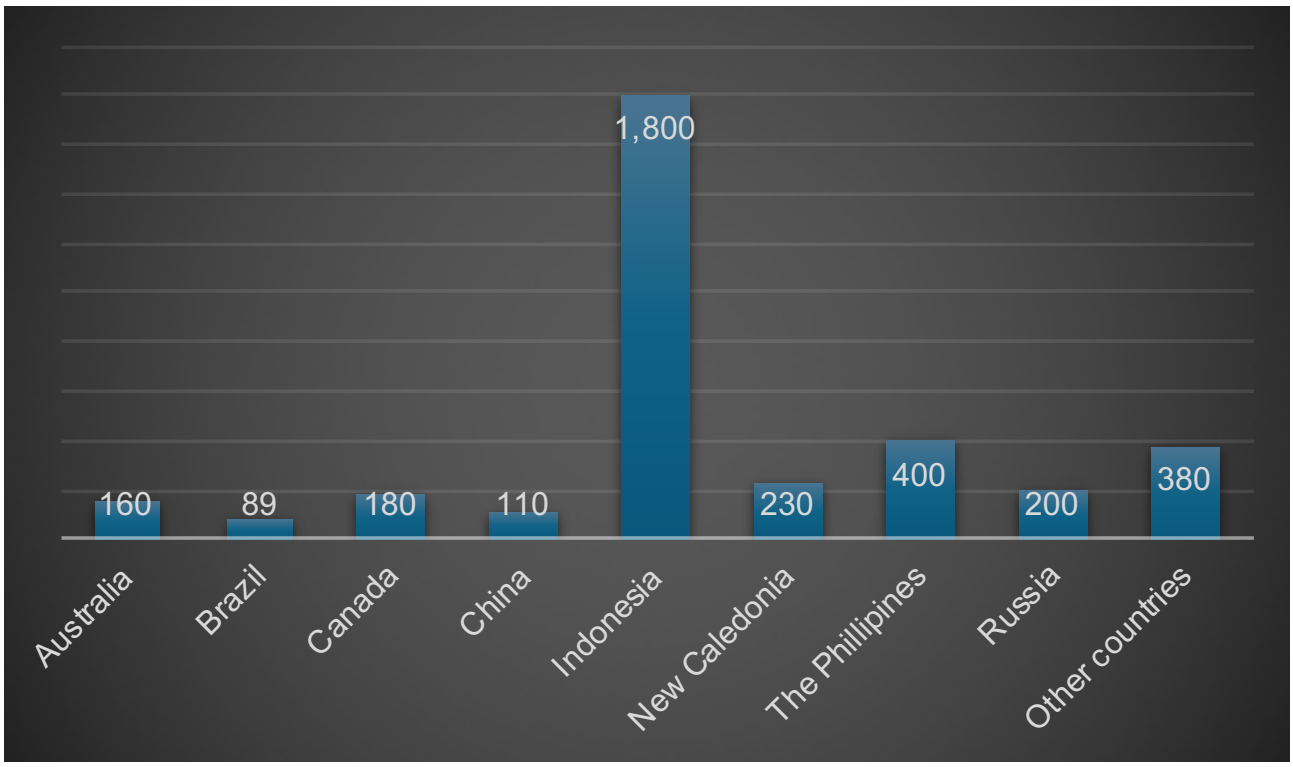
Indonesia's advantage in processed nickel is only in the upstream part of the value chain and is profoundly reliant on the part of the nickel industries value chain that is controlled by China. The archipelago has immediately emerged as a global nickel hub after a massive inflow of large-scale foreign direct investment, primarily from China under the umbrella of its Belt and Road initiative. From 2014 to 2023, the total value of China-led FDI inflow into metal-based industries, nickel-oriented industrial parks, and nickel mines in Central Sulawesi, Southeast Sulawesi, and North Maluku reached USD 44.1 billion.[9] By offshoring capital to the country with a rich nickel deposit and low mining and smelting operations costs, Chinese firms could pump out super profits.

Figure 4. Nickel laterite

credit: Anto Sangadji, 2024

5 Nornickel. *Annual Report 2023*, 2024.
6 USGS. "Nickel Statistics and Information", https://www.usgs.gov/centers/national-minerals-information-center/nickel-statistics-and-information.
7 Peter H. Kuck, "Nickel", 1995, https://d9-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/mineral-pubs/nickel/500495.pdf.
8 SMM, "Key Takeaway from SMM 2023 Indonesia Nickel and Cobalt Industry Chain Conference: INSG Shares Insights on 2023 Global Nickel Market Outlook and Sees Supply Surplus". SMM, May 31 2023,
9 BKPM, "Realisasi Investasi", https://www.bkpm.go.id/id/info/realisasi-investasi.

Figure 5. Global nickel mine production by country in 2023 (in thousands of tons)



Source: USGS

Top automakers such as Ford Motors, Tesla, and Volkswagen are attempting to secure nickel supplies by partnering with nickel mining and processing companies in Indonesia. Ford has teamed up with PT Vale Indonesia and Huayou Cobalt Co. Ltd to build a high-pressure acid leaching (HPAL) facility in Indonesia with an annual production capacity of 120,000 tons of mixed hydroxide precipitate (MHP). Volkswagen states that it sources nickel and cobalt from Indonesia and is interested in investing in battery-grade nickel projects in Sulawesi.[10] With factories across the globe including in Germany, Tesla signed an agreement with Huayou to purchase nickel from China's processing companies and recently reported that it sources nickel from Indonesia. Major global manufacturers of EV batteries have directly invested in upstream nickel projects in Indonesia. CATL has invested in existing nickel mining and processing projects for battery-grade nickel in Central Sulawesi and North Maluku. SK On has participated in an HPAL project in the Indonesia Morowali Industrial Park, the largest nickel-based industrial estate in the archipelago. BASF, a German-based maker of precursor cathode active materials, recently cancelled a joint nickel project with Eramet in Indonesia Weda Bay Industrial Park, the second largest nickel-oriented industrial park in the country. However, the company is still attempting to secure the supply of critical raw materials including nickel from Indonesia.[11]

However, the environmental damage caused by nickel production is enormous. The rapid expansion of nickel mines leads to large-scale deforestation of uplands and soil degradation through topsoil removal, the excavation of overburden, and the construction of roads and other infrastructures. All nickel mining companies hold concessions that overlap with tropical forests. Open-pit mining has been a major cause of massive deforestation in Indonesia's nickel regions. According to Mighty Earth, deforestation from nickel mining operations in the country has reached 75,000 hectares.[12] Previously, *Tempo* — a prominent Indonesian news magazine — reported that around 500,000 hectares of forests in Southeast Sulawesi and Central Sulawesi, Indonesia's major nickel-producing provinces, were deforested in the period from 2011 to 2020.[13] It devastates land, vegetation, and living organisms. Nickel mines also cause floods in the wet season and cause

10 Volkswagen Group, "Responsible Raw Materials Report 2023", 2024, https://uploads.vw-mms.de/system/production/documents/cws/002/716/file_en/d4d4bc8b2aea8ace68435605a99ef6e9a9bbf973/2023_Volkswagen_Group_Responsible_Raw_Materials_Report_1.pdf?1719555968.
11 Tesla, 2023 *Impact Report,* 2024, https://www.tesla.com/ns_videos/2023-tesla-impact-report.pdf.
12 Mighty Earth. 2024. *From Forest to Electric Vehicles*, 2024, https://mightyearth.org/wp-content/uploads/2024/05/FromForeststoEVs.pdf.
13 Erwan Hermawan, "Tentakel Tambang Nikel", *Tempo,* January 31– February 6, 2022.

land disputes and the displacement of indigenous people.[14] Nickel processing is carbon-intensive, as the processing facilities are almost always generated by coal-fired power plants with an installed capacity of over 10 gigawatts (GW). It also benefits from the massive exploitation of cheap labour with poor working conditions. The country's nickel industry is thus mainly associated with environmental and human rights abuses.[15] Global North countries and international institutions have increasingly expressed concerns about environmental and human rights issues related to the supply chain of critical materials including nickel and cobalt. Some policies on standards for the responsible sourcing of critical materials have been issued and implemented in recent years. Germany passed the Supply Chain Due Diligence Act (SCDDA), or the Supply Chain Act, that requires German as well as foreign companies with German branches to respect human right and environmental regulations throughout their global supply chains. The Act defines the supply chain as "all steps in Germany and abroad that are necessary to produce the products and provide the services, starting from the extraction of the raw materials to the delivery to the end customer …".[16] This definition implies that the Act can be applied to the global supply chain of nickel in which Germany-based companies are involved. The Supply Chain Act, which came into effect on January 1, 2023 impacts companies with 1,000 workers or more.

In addition, the European Union (EU) recently issued the Corporate Sustainability Due Diligence Directive 2024/1760 (CSDDD), which became effective on July 25, 2024. It calls for EU-based companies and their "chain of activities" to take respect human rights and environmental regulation. The chain of activities refers to "[the] activities of a company's upstream business partners related to the production of goods or the provision of services by the company, including the design, extraction, sourcing, manufacture, transport, storage and supply of raw materials, products or parts of the products and development of the product or the service …". The CSDDD thus requires all companies across the globe including nickel mining and processing firms that are part of EU-companies' chain of activities to conduct due diligence processes in order to ensure that their operations do not involve human rights violations or environmental degradation.[17] Furthermore, in 2023 the EU Battery Regulation 2023/1542 (BATT2), entered into force. The BATT2 stipulates corporate due diligence obligations for the supply chains of raw materials such as cobalt, natural graphite, lithium, and nickel required for batteries, as well as for their chemical compounds.[18] In this regard, all three pieces of legislation (the SCDDA, the CSDDD and the BATT2) contain specific environmental and human rights requirements for critical minerals suppliers. In this respect, they could require that nickel mining and processing companies in Indonesia improve their environmental and human rights practices.

14 Survival International. "The Uncontacted People being Sacrificed for Electric Car Batteries." Available: https://www.survivalinternational.org/tribes/honganamanyawa.

15 Arianto Sangadji et al., *Road to Ruin,* 2019, https://www.rosalux.de/fileadmin/rls_uploads/pdfs/engl/Nickel_Study_FINAL.pdf; Muhammad Rushdi, *Fast and Furious for Future,* 2021, https://www.rosalux.de/fileadmin/images/publikationen/Studien/Fast_and_Furious_for_Future.pdf.

16 "The Act on Corporate Due Diligence Obligations in Supply Chains [English Translation]", https://www.bmas.de/SharedDocs/Downloads/DE/Internationales/act-corporate-due-diligence-obligations-supply-chains.pdf?__blob=publicationFile&v=3.

17 Official Journal of The European Union, *Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on Corporate Sustainability Due Diligence and Amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859,* 2024, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401760.

18 Official Journal of the European Union, *Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 Concerning Batteries and Waste Batteries, Amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and Repealing Directive 2006/66/EC,* 2023, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1542.

II. METHODOLOGY

To keep focus and to keep this study manageable considering the resource and time constraints, we chose nickel mining and smelting companies belonging or related to Huayou Cobalt Co., Ltd., operating in Indonesia, as the main source of our empirical investigation. The reason is that this group plays an increasingly important role in nickel investment in Indonesia and it dominates the processing of battery-grade nickel in the archipelago (see Appendix 1). It is also a key player in supplying battery chemical materials for EV battery makers and EV automakers. The company thus controls the link between the global supply chains and Indonesia's nickel.

We study various literatures, including primary and secondary materials. The primary materials include national and international human rights laws and regulations. We also analyse the use Human Rights Due Diligence (HRDD) as part of business practices, which apply where supply chains of electric car companies operate in Germany. As we mainly employ descriptive statistics as a supplement to qualitative analysis, these primary materials consist of official statistics, corporate reports (annual reports, ESG reports, etc.), NGO reports, and news articles. We conducted in-depth and semi-structured interviews with key informants. In employing informal and interactive methods with open ended questions, we explore the complex experiences and emotions of individual respondents including members of communities affected by mining and smelting operations and workers and unions. We also interviewed scholars and NGO activists.

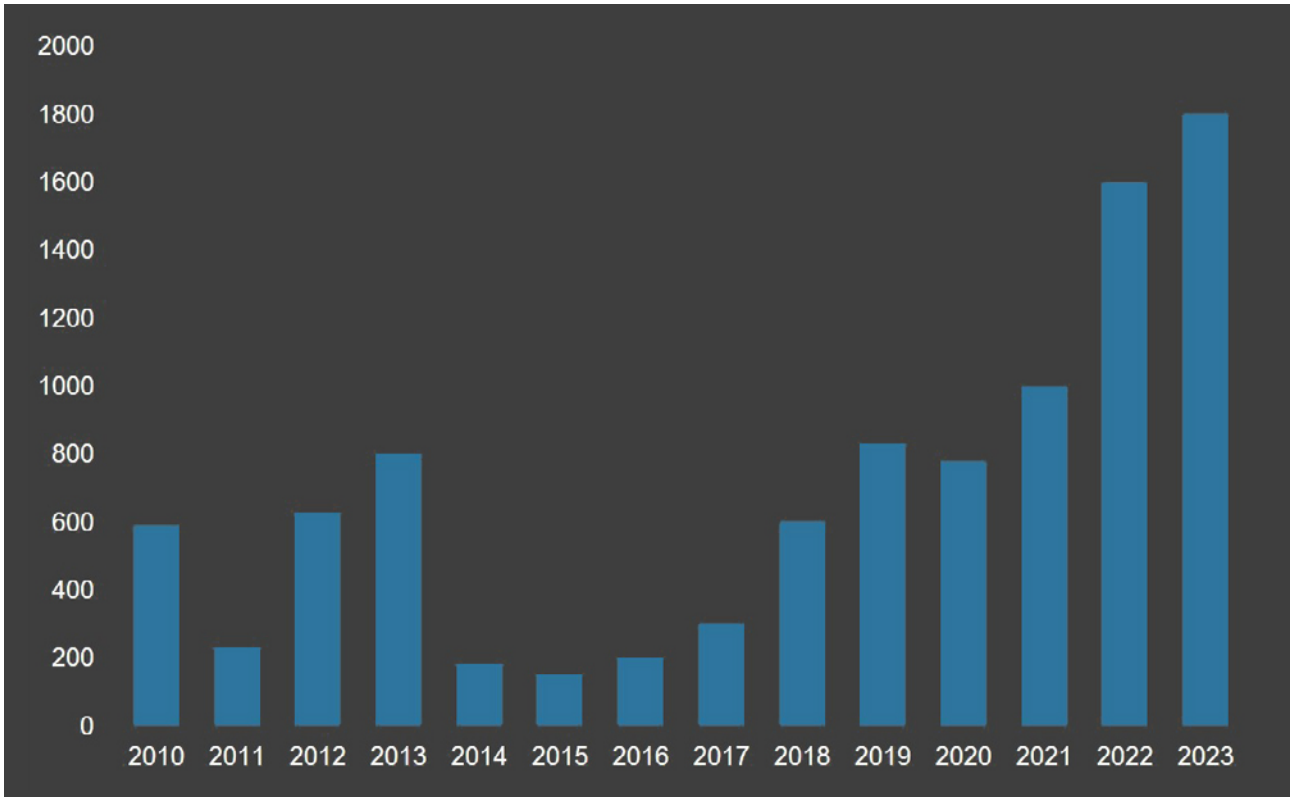
The data collected from written documents and interviews were analysed using qualitative and quantitative tools. This study employs law-based reasoning which uses environment and human rights norms to interpret the facts of this study. This permits the research findings to be scrutinised within the framework of the SCDDA/the CSDDD/the BATT2.

III. CURRENT DEVELOPMENTS IN NICKEL MINING AND PROCESSING OPERATIONS IN INDONESIA

1. NICKEL MINES

We have recently seen a large volume of nickel ore being mined by Indonesia's miners. Indonesia is home to about 55 million tons of nickel reserves, or 42 percent of global reserves, and in 2023 its mining output reached 1.8 million tons of contained nickel, accounting for half of the world mine production. By contrast, in 2010, its output was 564,000 tons, or only 14.59 percent of the global mine output.[19] The massive production of nickel mines, as shown by Figure 6, has been driven by the growing demands of in-country nickel processing since 2015. Since that time, demand for nickel ores was initially mostly driven by growing nickel pig iron (NPI) production in the country. It was then followed by demand for the domestic production of nickel matte and MHP.

Figure 6. Indonesia: Mine production, 2010–2023 (in thousands of tons)



Source: USGS

The explosion of nickel ore production results from the government's restriction on exports of unprocessed nickel as required by the Law on Mineral and Coal Mining (Law No. 4 of 2009). The law and its implementations have also compelled nickel mining companies to develop domestic processing facilities since 2014. The objective is to encourage nickel companies to invest in integrated mine and processing facilities. It thus brings added value to their exports.

Based on nickel mine operation data provided by the Government of Indonesia (GOI), there are 329 nickel mining companies operating in the country with a total concession of 836,000 hectares. The companies mostly mine across the provinces of Southeast Sulawesi, Central Sulawesi, South Sulawesi, and North Maluku.

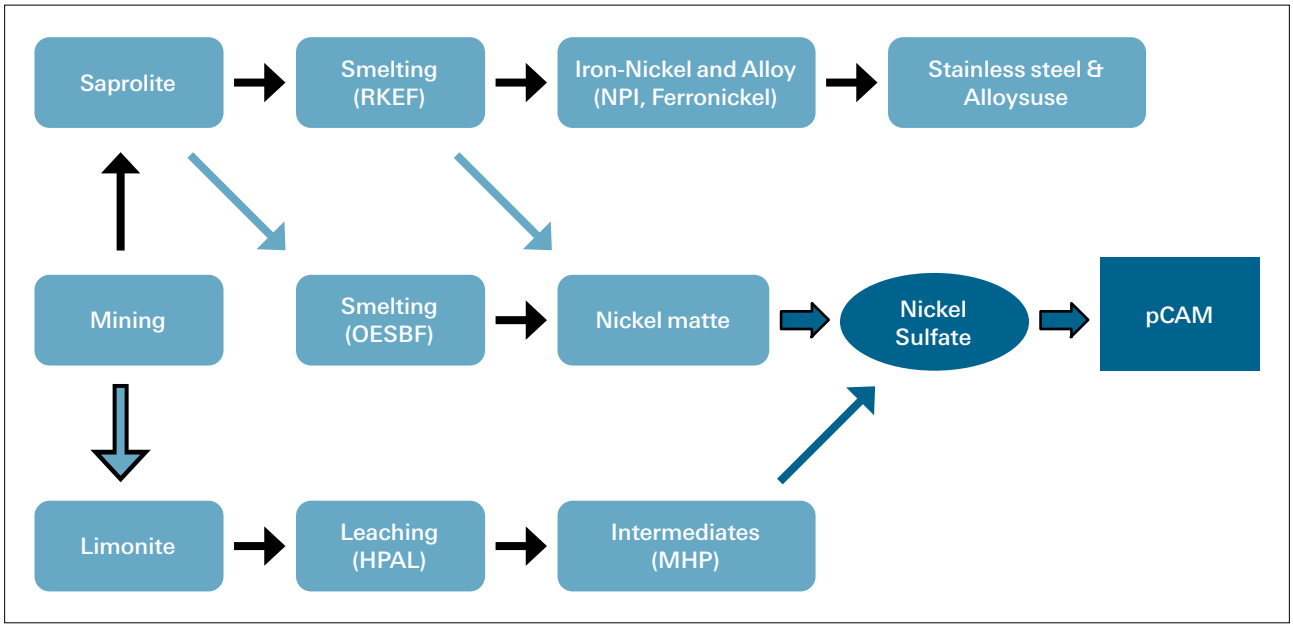
19 U.S. Geological Survey, Mineral commodity summaries 2024: U.S. Geological Survey, 2024, https://doi.org/10.3133/mcs2024.

Figure 7. Indonesia: Hub of nickel mining business licenses (MBLs) and China's investment in nickel-based industrial parks

2. THE VALUE CHAIN OF NICKEL PROCESSING ROUTES

At present, there are three technology routes for processing nickel laterite to intermediate products such as a low-grade nickel called nickel pig iron (NPI), nickel matte, and MHP in Indonesia. The routes include the use of a **rotary-kiln electric furnace** (RKEF), **high-pressure acid leaching** (HPAL), and the use of a **oxygen enriched side blown furnace** (OESBF). While NPI is a major raw material for producing stainless steels, MHP and nickel matte can be converted directly into nickel sulfate (NiSO4), which is generally used in making precursor cathode active materials (pCAM) for lithium-ion batteries (see Figure 8).

Figure 8: The value chains of nickel production and existing processing technologies in Indonesia

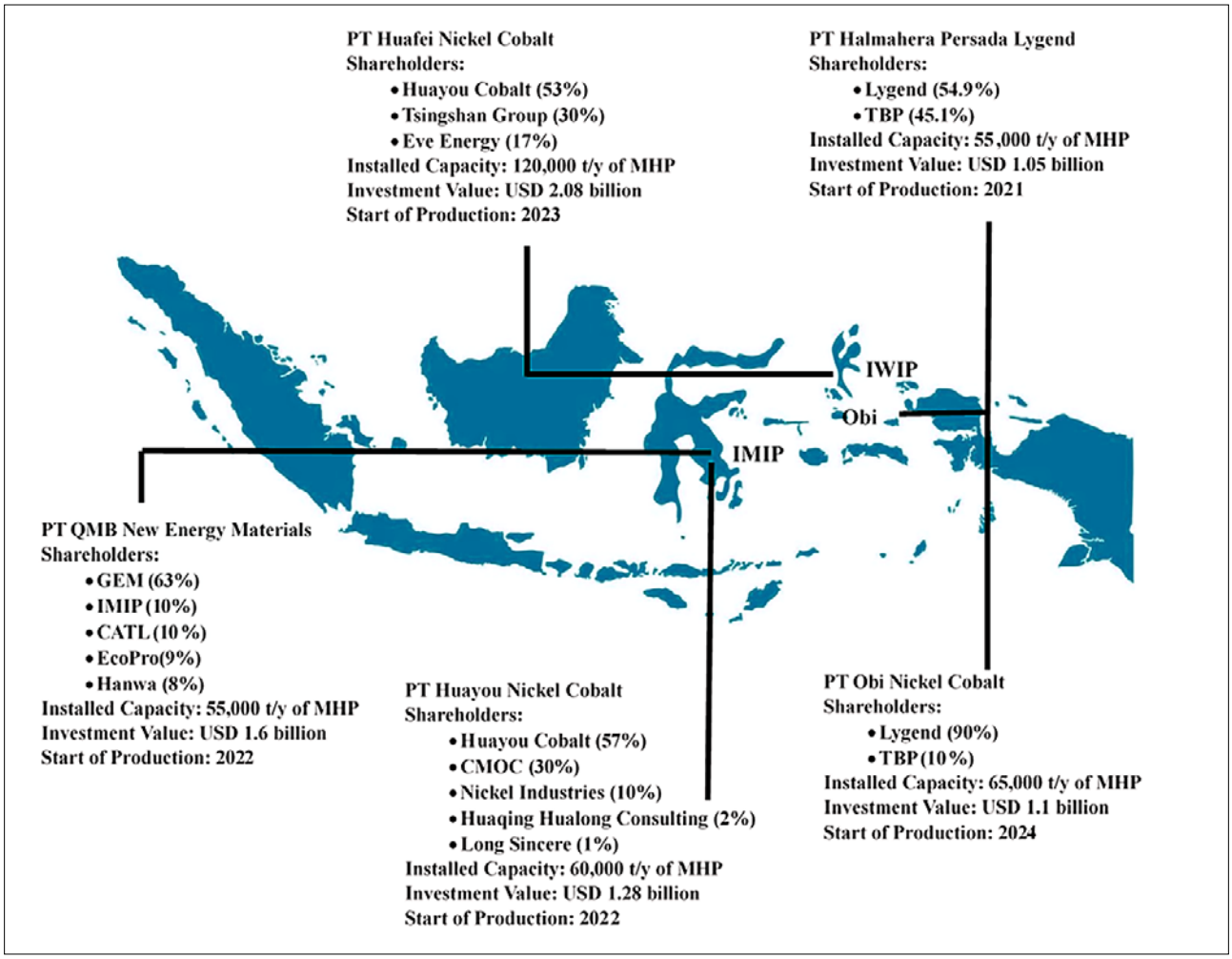


2.1. Mixed Hydroxide Precipitate and High-Pressure Acid Leaching

In the midst of growing global demand of primary nickel for new energy, Indonesia is becoming a global hub for the production of MHP, an ingredient for battery-grade nickel used for EVs. The total output of MHP projects in Indonesia is expected to reach 294,000 tons in 2024.[20]

Five companies have already produced MHP in the country. PT Halmahera Persada Lygend, located on Obi Island, North Maluku, commenced commercial production in 2021 with an output of 55,000 t/y. In 2022, PT Huayue Nickel Cobalt began operating a refining facility with an installed capacity of 60,000 t/y, and PT QMB New Energy Materials started operating a production facility with a manufacturing capacity of 55,000 t/y. Huayue Nickel Cobalt and QMB operate the HPAL plants in the Indonesia Morowali Industrial Park, Central Sulawesi; In 2023, PT Huafei Nickel Cobalt, located in the Indonesia Weda Bay Industrial Park, North Maluku, started operating a production facility with a production volume of 120,000 t/y, thus becoming the largest producer of battery-grade nickel in the country. This year, PT Obi Nickel Cobalt, located on Obi Island, began operating HPAL production lines with an output of 65,000 t/y of MHP.

Figure 9. HPAL facilities operating in Indonesia



Over the next few years, the output of MHP may rise to 457,000 t/y. This will result from the fact that several additional HPAL facilities are expected to become operational this year and next year. The projects include PT Excelsior Nickel Project, which will produce MHP with an installed capacity of 72,000 t/y and PT ESG New Energy Material with a potential capacity of 30,000 t/y of MHP. Excelsior Nickel Cobalt is 27.50 percent owned by Nickel Industries and 72.50 percent controlled by Tsingshan Group, while

20 Nornickel, "Quintessentially Nickel", 2024, https://nornickel.com/upload/iblock/d18/iz37fmx2a1srcecotbrgm1mixwtzvwfm/2024_05_30-Quintessentially-Ni.pdf.

ESG New Energy Material is 55 percent owned by the Merdeka Battery Materials Group and 45 percent owned by GEM. This ongoing project is scheduled to commence by the end of 2024.

Figure 10. Nickel smelter in Indonesia

credit: Anto Sangadji, 2021

Other projects are in the early phases of development. This includes PT Kolaka Nickel Indonesia, a joint venture between Huayou Cobalt (73.2 percent), Vale Indonesia (18.3 percent), and Ford Motors (8.5 percent). Located in Indonesia Pomalaa Industrial Park Pomalaa, Southeast Sulawesi, this HPAL project will produce MHP with an annual production capacity of 120,000 t/y. Another project is located in the Indonesia Weda Bay Industrial Park operated by PT Huashan Nickel Cobalt with an initial output of 120,000 t/y of MHP. The project is a joint venture between Huayou Cobalt (68 percent) and Huatuo International Development Pte. Ltd. (32 percent), a subsidiary of Glaucous. Another project is located in Malili, Southeast Sulawesi. It is run by PT Huali Nickel Indonesia, but is fully owned owned by Huayou, with a production capacity of 60,000 t/y. The Merdeka Group has an HPAL project in partnership with global players of material battery makers. In partnership with Ningbo Brunp Conatemporarry Amperex Co., Ltd., the group has developed an HPAL project with an installed capacity of 60,000 t/y of MHP. The plant will be built in the Indonesia Konawe Industrial Park in Konawe regency, Southeast Sulawesi. Merdeka and Brunp will hold a 66 percent and a 34 percent equity, respectively.

In addition to the production of MHP, there is also production of nickel sulfate. HPL has already operated its production facility on Obi Island with an output capacity of 240,000 t/y. ENC will produce 72,000 tons of nickel sulfate by the end of this year. In July 2023, Huayou announced a plan to build a nickel sulfate project in the Indonesia Weda Bay Industrial Park. The project will be run by PT Huaxiang Refining Indonesia. Huaxiang is a joint company between Huayou Group, Strive Investment Capital, and Lindo Investment, with the companies holding a 49 percent stake, a 49 percent stake, and a 2 percent stake, respectively. The project is projected to produce 50,000 t/y of nickel sulfate. It seems the project will source MHP as feedstock for nickel sulfate from Huayou's HPAL projects in Indonesia.

2.2. Nickel Matte and the Rotary-Kiln Electric Furnace (RKEF) Process

Historically, the first Indonesia's nickel matte producer is PT Vale Indonesia (formerly PT Inco Indonesia), which is recently owned by Vale Canada, Sumitomo Metal, and the Government of Indonesia. It was the first company in the country to use RKEF technology, beginning in the mid-1970s. In 2023, the company produced approximately 76,000 tons of nickel matte in Sorowako, South Sulawesi, and exported the processed nickel to Japan and Canada.[21]

The recent development of China-driven investment in battery-grade nickel production is turning

21 PT Vale Indonesia, *Annual Report 2023,* Jakarta: PT Vale Indonesia, 2024.

Indonesia into a major player in global nickel matte production. At present, the production of nickel matte by the RKEF technology appears to be on the rise. In the Indonesia Weda Bay Industrial Park, PT Huake Nickel Indonesia, which is controlled by Huayou (70 percent) and Tsingshan Group (30 percent), has a facility with production capacity of 50,000 t/y of nickel matte. PT Debonair Nickel Indonesia, a subsidiary of CNGR Advance Materials, runs a RKEF plant located in the Indonesia Weda Bay Industrial Park, with a production capacity of 27,500 t/y of nickel matte. It has been in operation since January 2023. CNGR — via PT Nadesico Nickel Industry, a joint venture between CNGR and Delong Nickel Industry — also has a RKEF project located in the Gunbuster Nickel Industry in North Morowali, Central Sulawesi. The project is planned to have 8-production lines with a production capacity of 80,000 t/y of low-nickel matte. The project's first production line began operating in January 2024.

Figure 11. Nickel matte facilities operating in Indonesia

As mentioned earlier, nickel matte can be converted from NPI, in 2021, Tsingshan Group announced to produce nickel matte converted from NPI using a RKEF procedure. The first nickel matte conversion was produced by PT Hengjaya Nickel Industries, which is controlled by Nickel Industries and Tsingshan Group. In 2023, Hengjaya Nickel Industries produced over 20,500 tons of nickel matte. Another RKEF project to convert NPI into nickel matte has also operated in Indonesia Morowali Industrial Park. This RKEF with a production capacity of 50,000 t/y of nickel matte is now run by PT Huaneng Metal Industry, which is jointly controlled by Merdeka Group (60 percent) and Tsingshan Group (40 percent).

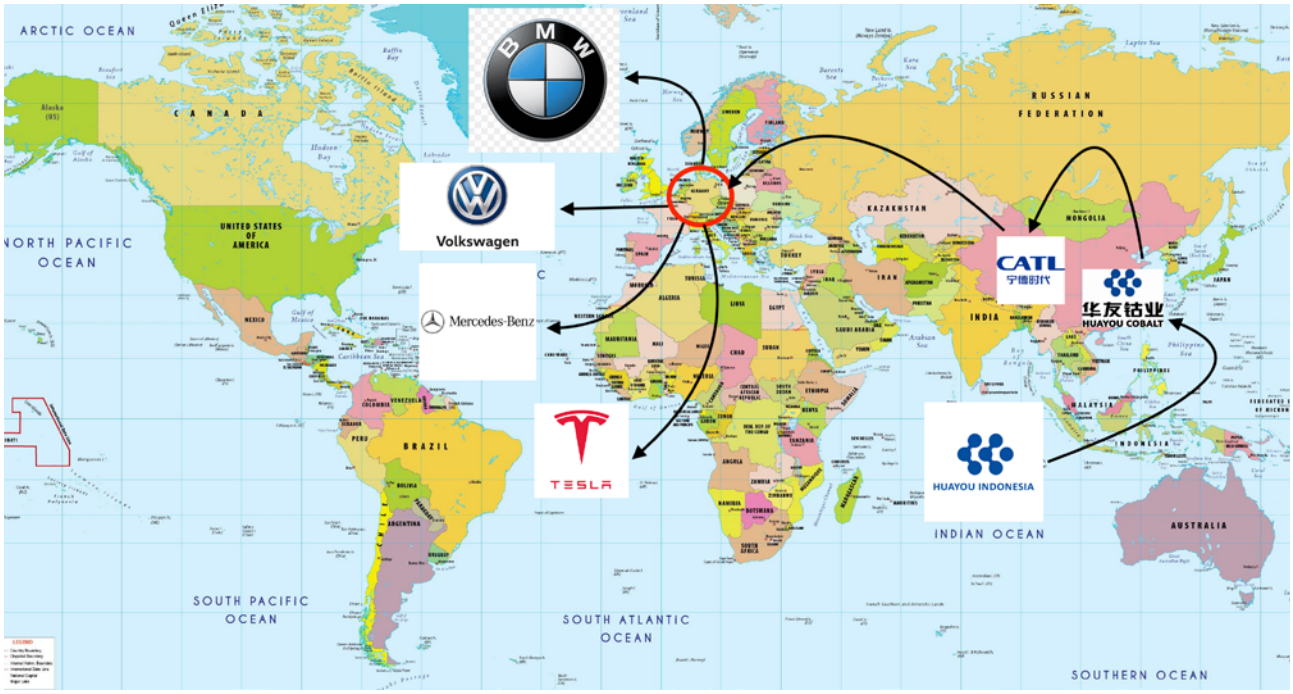
2.3. Nickel Matte and the Oxygen-Enriched Side-Blown Furnace Process

CNGR is one of the prominent investors in the nickel processing industry in Indonesia, starting in 2021. On 25 October 2022, CNGR started operating its first overseas OESBF to produce nickel matte. Located in the Indonesia Morowali Industrial Park, of a total of 6 planed production lines with an overall annual potential capacity of 30,000 tons of nickel matte, 2 production lines are currently in operation, with an output of 10,000 t/y. This project is run by PT Zhong Tsing New Energy, which is controlled by CNGR (70 percent) and Rigqueza (30 percent), registered in Singapore.

IV. THE INDONESIA–CHINA–GERMANY NICKEL SUPPLY CHAIN FOR EV BATTERIES

Simply put, the EV battery supply chain is a complex network that involves multiple phases, from mining, smelting/refining, and manufacturing. Indonesia's nickel industry is part of a complex supply chain for EV batteries that include extraction, intermediate processing, further chemical processing, and battery manufacturing. Indonesian nickel companies mostly participate in mining and are only partially involved in processing. Chinese companies such as Huayou Cobalt and CATL dominate the nickel supply chain through their effective control over nickel smelting, refining, and battery-containing nickel manufacturing. They are also somewhat engaged in nickel mining. German automakers such as Volkswagen, BMW, and Mercedes-Benz are competing in the global shift from the manufacture internal engine combustion vehicles to the manufacture of electric vehicles. The companies are striking deals with China-based battery containing nickel manufacturers to avoid raw materials shortages.

Figure 12. Map of Indonesia–China–Germany supply chain of nickel-based batteries for Evs



Map source: https://maps-germany-de.com/maps-germany-in-world/germany-on-world-map#google_vignette.

1. UPSTREAM: EXTRACTION OF NICKEL ORES

Mining such as nickel laterite mining is mainly defined as the process of extracting raw materials from the subsoil. Hundreds of companies mine laterite ores across provinces-rich nickel in Indonesia. Among them the following four companies are part of battery-grade nickel supply chain.

One of the prominent nickel companies involved in nickel mining is PT Weda Bay Nickel. Located in Central Halmahera and East Halmahera, the company holds 45,065 hectares of nickel concession, which is one the world's largest nickel mines. The Singapore-based Strand Minerals controls 90 percent of the Weda Bay nickel stakes, while PT Aneka Tambang, an Indonesian state-owned enterprise, holds a 10 percent stake. Strand is 55 percent owned by China's Tsingshan and 45 percent owned by French company Eramet.[22]

The company officially discloses that it has already mined 2,000 hectares. In 2023, the company mined 36.3 million tons of nickel ores, an increase of over 40 percent from 2022. It has delivered the ores to

22 Eramet, *2022 Integrated Report,* 2023, https://www.eramet.com/wp-content/uploads/2023/04/2023-04-19-Eramet-2022_Integrated_Report.pdf.

processing companies including RKEF and HPAL projects in the Indonesia Weda Bay Industrial Park since 2019.[23] It implies that the company has also supplied ores to projects related to battery-grade nickel-cobalt including Huayou Cobalt subsidiaries in the park. In 2022, for instance, Huayou stated that Weda Bay Nickel is a major supplier of nickel ores for Huake Nickel Indonesia.[24]

PT Wana Kencana Mineral is located in the regencies of East Halmahera and Central Halmahera in North Maluku province. It holds 24,700 hectares of nickel mine concession in those regencies, which is the second largest nickel mining concession area on the Island of Halmahera. Huayou Cobalt, via its subsidiary Huacai, has a 35 percent stake in Wana Kencana Mineral, while PT Baja Selatan Lintas Nusantara and PT Sejahtera Jaya Prima have a 40 percent and a 20 percent stake respectively. Nickel processing facilities belonging to Huayou Cobalt in the Indonesia Weda Bay Industrial Park source nickel from the Wana Kencana Mineral.

PT Sulawesi Cahaya Mineral is a mining company located in Konawe regency, Southeast Sulawesi province. The firm holds 21,100 hectares of mine concession in the regency and claims the concession area as one of the most nickel-rich deposits in the world. The mining company is jointly owned by Indonesia's Merdeka Group (51 percent) and the Tsingshan Group (49 percent) and is a part of the integrated mining and processing partnerships between the two companies. Sulawesi Cahaya Mineral is one of the major ore suppliers to Huayue Nickel Cobalt in the Indonesia Morowali Industrial Park.[25]

PT Hengjaya Mineralindo is located in Morowali regency, Central Sulawesi and holds 5,983 hectares of mine concession. This mining company is owned by Sydney-based Nickel Industries Limited (80 percent) and Wijoyo Family (20 percent) and is a part of Nickel Industries Limited and Tsingshan Group partnerships that control integrated mining and processing facilities in the Indonesia Morowali Industrial Park and the Indonesia Weda Bay Industrial Park. Hengjaya Mineralindo delivers limonite ores to the HPAL plant run by Huayue Nickel Cobalt.[26]

2. MIDSTREAM: PROCESSING BATTERY-GRADE NICKEL

Nickel processing is defined as the conversion of nickel ores into intermediate products such as NPI, nickel matte, and MHP.

As mentioned earlier, China's firms control Indonesia's nickel processing industries. One of the key players is Huayou Cobalt, which is mostly involved in the production of battery-grade nickel. To strengthen its strategic role in the global supply chains for EV batteries, starting in 2018 Huayou began to develop projects related to utilization of lateritic ore resources in Indonesia. In recent years, Huayou Cobalt has invested in HPAL and RKEF projects for producing battery-grade nickel and cobalt. It has also partnered with other global nickel processing firms, battery manufacturers, and automakers in the development of nickel and cobalt resources. The company is even directly involved in nickel mining.

At present, with a total investment of USD 6.3 billion,[27] Huayou Cobalt is the largest producer of battery-grade nickel in the archipelago. Its HPAL facilities in the country are able to produce 190,000 t/y of MHP. Its first HPAL project with an investment of USD 1.28 billion in the Indonesia Morowali Industrial Park, which is run by PT Huayue Nickel Cobalt, has a nameplate capacity of 70,000 t/y of MHP. The second HPAL project with a total investment of USD 2.1 billion in the Indonesia Weda Bay Industrial Park, run by PT Huafei Nickel Cobalt, has an installed production capacity of 120,000 t/y of MHP. The plant began producing in June 2023 and reached production output in March 2024.[28] These MHP are then transported to Huayou's production lines at various locations in China for converting into nickel and cobalt chemicals for EV batteries.[29]

In addition, Huayou has joined forces with some companies investing in new HPAL projects. Huayou has a joint project with Huatuo International Development Pte. Ltd., to develop an HPAL plant with an initial output of 120,000 t/y of MHP. Located in the Indonesia Weda Bay Industrial Park, the project is run by PT Huashan Nickel Cobalt. Huayou, Vale Indonesia, and Ford Motors have recently constructed an HPAL project in Pomalaa, Southeast Sulawesi. The company also signed an agreement with Vale Indonesia to cooperate in the construction of an HPAL project in Malili, South Sulawesi. Lastly, Huayou

23 Ibid.
24 Huayou Cobalt, *Introduction of Huayou Projects in Indonesia,* Zhejiang: Huayou Cobalt, 2023.
25 Arianto Sangadji, "HPAL dalam Industri Nikel: Tantangan Baru bagi Lingkungan di Indonesia", Jakarta: AEER, 2024.
26 Ibid.
27 CNN Indonesia, "Menteri Rosan Bawa Komitmen Investasi Rp120 Triliun dari Tiongkok", CNN Indonesia, December 23, 2024, https://www.cnnindonesia.com/ekonomi/20241223162012-97-1180330/menteri-rosan-bawa-komitmen-investasi-rp120-triliun-dari-tiongkok.
28 Reuters, "Chinese and other cobalt mines boosting output despite price slide", *Reuters,* December 6, 2023, https://www.reuters.com/markets/commodities/chinese-other-cobalt-mines-boosting-output-despite-price-slide-2023-12-06/.
29 Huayou Cobalt, "Tongxiang team, a modern factory built on an island!", *Press Release,* June 27, 2024, https://www.huayou.com/en/news/press-release/218.

signed a letter of intent for strategic cooperation with Germany-based Volkswagen and the Tsingshan Holding Group to plan the construction of a hydrometallurgy project in South Sulawesi.
Furthermore, Huayou also utilises RKEF technology to make battery-grade nickel. Its project, run by Huake Nickel Indonesia, reached the design capacity of 45,000 t/y of high-grade nickel matte.
At present, Huayou's combined outputs of nickel matte and MHP are 235,000 t/y, making the company as the largest player in producing battery-grade nickel in Indonesia.

3. DOWNSTREAM: EV BATTERIES AND MATERIALS MANUFACTURING

Manufacturing, such as materials and EV batteries manufacturing, is defined as the process of making manufactured products like precursor cathodes and EV batteries.
China is the leading producer of materials related to EV batteries and the batteries themselves. Huayou Cobalt and CATL are world-class companies that dominate the industries, especially in relation to nickel-rich materials and nickel-containing EV batteries.
China's Zhejiang Huayou Cobalt, founded in 2002, is listed on both the Shanghai Stock Exchange (SSE) and the SIX Swiss Exchange, and is a global player in the supply, manufacture, processing, and sale of new energy lithium-ion batteries and new cobalt materials. The company manufactures cathodes, which are commonly one of the most expensive parts of a battery. It makes cathodes called nickel manganese cobalt (NMC) for precursor cathode active materials (pCAM) which contain critical materials like nickel, manganese, and cobalt. The company then combines these manufactured materials with lithium hydroxide to produce NMC cathode active materials (CAM). Combined with anode, the latter is a key element for producing lithium-ion batteries. It also recycles batteries for reuse in the production of cathode. In 2022, Huayou manufactured 150,000 tons of pCAM and CAM.[30] In 2023, the company shipped 67,000 tons of lithium-ion battery cathode precursors and 53,000 tons of cathode materials.[31]

Table 1. Huayou Cobalt shareholders in 2023 (%)

Huayou Holding Group Co., Ltd.	15.22
Chen Xuehua	6.43
Hangzhou Youyou Enterprise Management Partnership (Limited Partnership)	4.38
Hong Kong Securities Clearing Co., Ltd.	4.15
China Construction Bank Corporation – Huaxia Energy Innovation Equity Securities Investment Fund	1.66
Citibank, National Association	1.45
Industrial and Commercial Bank of China	0.97
China Postal Savings Bank Co., Ltd.	0.67
CITIC Securities Company Limited	0.62
Agricultural Bank of China	0.62

Source: Huayou Cobalt[32]

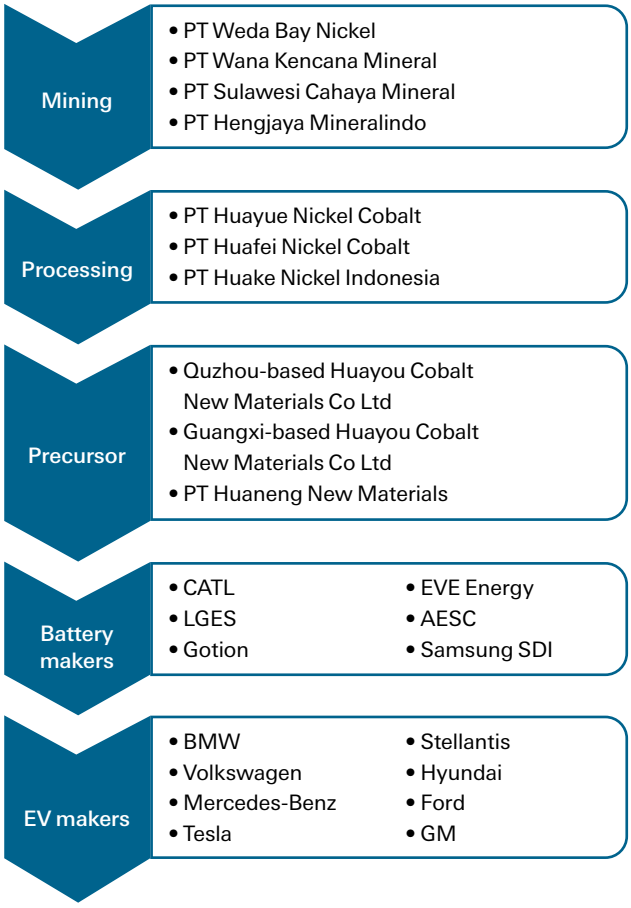
Huayou has several precursor plants. In China, it runs plants in Quzhou and Guangxi operated by Huayou Cobalt New Materials Co., Ltd. that produces nickel cathodes (electrodeposited technology, Ni99.96). In June 2024, the cathode brand "HUAYOU" was auspiciously registered as the delivery brand of a future standard contract on the Shanghai Futures Exchange.[33] Huayou Cobalt officially states that its factory operated by the Quzhou-based Huayou Cobalt New Materials Co., Ltd. sourced MHP from Huayue Nickel Cobalt in Morowali, while the factory run by the Guangxi-based Huayou Cobalt New Materials Co., Ltd. received nickel matte from PT Huake Nickel Indonesia.[34] Huayou Cobalt's first overseas precursor plant has been operating in Indonesia since October 2024. Located in the Indonesia Weda Bay Industrial

30 Huayou Cobalt, "Becoming a Global Leader of New Energy Li-ion Battery Materials", 2022, https://www.weare121.com/121mininginvestment-cape-town/wp-content/uploads/sites/25/2022/12/HUAYOU-Cobalt-Introduction.pdf.
31 Huayou Cobalt, *2023 Annual Report of Zhejiang Huayou Cobalt Co.Ltd.* Zhejiang: Huayou Cobalt.
32 Ibid.
33 Huayou Cobalt, "'HUAYOU' Brand Nickel Cathodes Successfully Registered Again", 2024, https://www.huayou.com/en/news/corporate-news/216.
34 Huayou Cobalt, *Nickel Supply Chain Due Diligence Management Report (2023),* 2024, https://www.huayou.com/Public/Uploads/uploadfile2/files/20241113/yingwenbanniegongyinglianjinzeguanlibaogao2023zuixin.pdf.

Park, the high-nickel ternary precursor material plant run by PT Huaneng New Materials has an installed production capacity of 50,000 t/y.[35]

Huayou officially reports that it delivers ternary precursors for the leading global battery brand companies. The company has mainly delivered high quantities of ternary precursors to China's Contemporary Amperex Technology Co. (CATL) and South Korea's LG Energy Solution (LGES), the world's top battery manufacturers. It has also provided the precursors for other battery makers such as Gotion, EVE Energy, AESC, and Samsung SDI. Huayou also claims that its products are used by global EV producers such as Tesla, BMW, Stellantis, Volkswagen, Mercedes-Benz, Hyundai, GM, and Ford.[36]

Figure 13. Huayou Cobalt Group and its nickel suppliers and customers



Source: Huayou Cobalt[37]

CATL is a company based in Ningde. Founded in 2011, the enterprise is listed on the Shenzhen Stock Exchange (SZSE) and manufactures battery material products such as lithium salt, precursors, and cathode materials. It also recycles metal materials including nickel, cobalt, manganese, lithium, phosphorus, and iron from waste batteries. The company is involved in upstream projects of critical materials such as lithium, nickel, cobalt, phosphorus for securing its battery manufacture supplies. The company runs its domestic manufacturing plants in dozens of locations across China and has overseas factories in Erfurt (Germany) and Debrecen (Hungary). CATL's nickel resources and materials businesses operate in China and in Indonesia.[38]

Table 2. CATL shareholders in 2023 (%)

Yu Qun Ceng	26.39
Zhen Hua Pei	7.32
Shi Lin Huang	3.00
China Asset Management Co., Ltd.	1.42
E Fund Management Co., Ltd.	1.35
Ningbo Meishan Baoshui Gangqu	1.34
Ping Li	1.29
Yong Yu	1.19
Honda Giken Industry China Investment Co., Ltd.	1.06
China Merchant Bank International Capital Mgmt Shenzhen Ltd.	1.04

Source: MarketScreener.[39]

CATL recently became the world's top EV battery manufacturer. CATL's EV batteries accounted for 36.8 percent (or 259.7 GWh) of global market share in 2023 (Figure 14), increasing from 36.2 percent (or 184.4 GWh) in 2022.[40] It manufactures and sells lithium-ion batteries including lithium iron phosphate (LFP) and lithium NMC. The latter is a type of cathode that is common in EV batteries today.

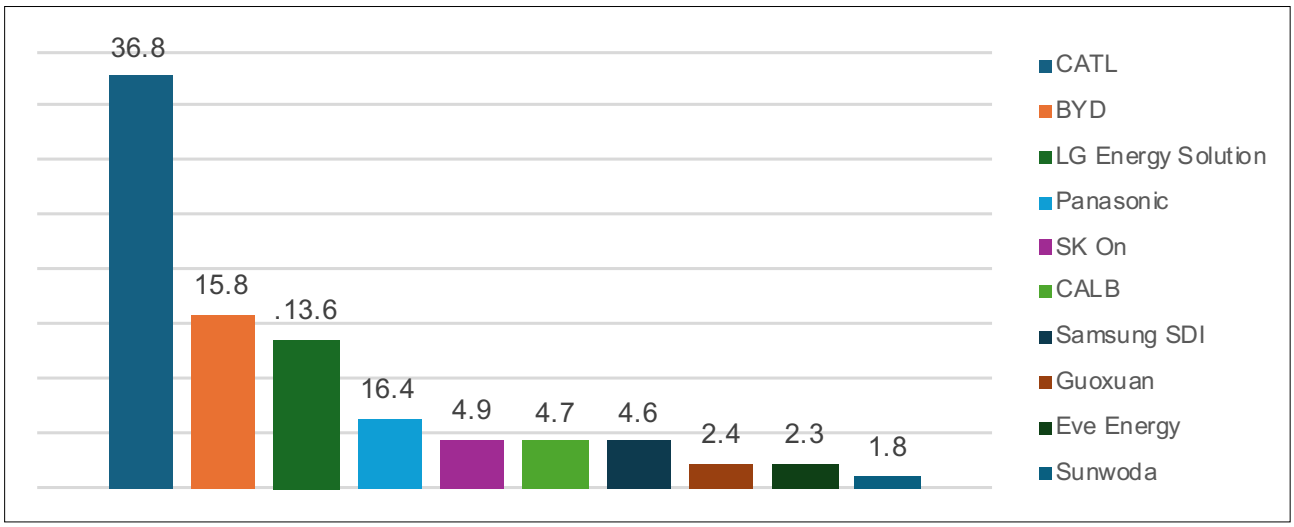
The first CATL plant erected outside of China that produces lithium-ion battery cells, including NCM batteries, opened in eastern Germany in 2022. It is the first large-scale battery manufacturing plant in Europe.

35 Huayou Cobalt, "Huayou Cobalt Completes its First Overseas Ternary Precursor Project and Successfully Begin Production", 2024, https://www.huayou.com/en/news/corporate-news/260.
36 Huayou Cobalt, *2023 Annual Report.*
37 Ibid.
38 CATL, *2023 Environmental, Social and Governance (ESG) Report,* 2024, https://www.catl.com/en/uploads/1/file/public/202404/20240417102933_uuiks9ljr8.pdf.
39 MarketScreener, "CATL (Contemporary Amperex Technology)", 2024, https://www.marketscreener.com/quote/stock/CATL-CONTEMPORARY-AMPEREX-44486738/company-shareholders/.
40 SNE, "Global electric vehicle battery usage to reach 705.5 GWh in January-December 2023, up 38.6% year-on-year", *Press Release.* February 7, 2024, https://www.sneresearch.com/kr/insight/release_view/220/page/0?s_cat=%7C&s_keyword=.

With a total investment of EUR 1.8 billion, the plant is expected to reach an annual production capacity of 14 GWh.[41] The company provides EV batteries to European automakers[42] and to leading global electric vehicle makers such as Tesla, Volkswagen, BMW, and Ford.[43] It has also been revealed that CATL supplies NCM for multiple types of Mercedes-Benz's electric cars.[44] Following its success in Germany, CATL is now attempting to control the European market in EV batteries with a massive investment around EUR 7.6 billion to build a 100 GWh battery factory in Debrecen, eastern Hungary. Production is planned to start in 2025.[45] As a key supplier to top EV makers, CATL obtains its nickel materials from several sources, including Huayou Cobalt. This implies that the processing of battery-grade nickel facilities in Indonesia belonging to Huayou subsidiaries such as Huafei Nickel Cobalt, Huayue Nickel Cobalt, and Huake Nickel Industry are part of the upstream sources of the battery-grade nickel supply chain for EVs. The upstream also includes nickel mining companies such as the Weda Bay Nickel and Wana Kencana Mineral that provide nickel ores for Huafei and Huake at Indonesia Weda Bay Industrial Park. It also includes Sulawesi Cahaya Mineral and the Hengjaya Mineralindo in Sulawesi that deliver ore to Huayue Nickel Cobalt.

Additionally, CATL is actively involved in projects related to nickel in Indonesia. Through its associate Brunp, it has a 10 percent stake in an HPAL project in the Indonesia Morowali Industrial Park run by PT QMB New Energy Materials since 2022. Its subsidiary Hong Kong CBL Limited has teamed up with the Indonesia state-owned company PT Aneka Tambang to develop an integrated battery ecosystem project ranging from mining to battery cell making since 2023. CATL's subsidiary CBL International Development formed a joint venture with the state-owned Indonesia Battery Corporation to build a battery cell factory in West Java, with a total investment of USD 1.2 billion. The project is estimated to produce batteries amounting to 15 gigawatts per annum.[46] CATL also has a 5 percent stake in PT Merdeka Copper Gold Tbk, a group that, together with the Tsingshan Group, controls an integrated mining, smelting, refining plant in Sulawesi. In sum, Indonesia is CATL's main source of battery-grade nickel for EVs.

Figure 14. Global market share (in %) of EV battery usage in 2023



Source: SNE Research[47]

41 CATL, "CATL's German Plant Receives Approval for Battery Cell Production", 2022, https://www.catl.com/en/news/921.html.
42 CATL, "CATL's German plant kicks off cell production", *The Investor,* August 14, 2022, https://m.theinvestor.co.kr/view.php?ud=20240814050641; Henry Sanderson, "China's Electric Vehicle Battery King". Time, September 29, 2022, https://time.com/6217992/china-electric-vehicle-catl/.
43 Anonymous, "Chinese firm CATL to supply lithium-ion batteries to Tesla", *Global Times,* June 28, 2021, https://www.globaltimes.cn/page/202106/1227312.shtml. Accessed 16 October 2024; Reuters, "CATL says to supply BMW with cylindrical cell from 2025". *Reuters,* May 27, 2022. Available: https://www.reuters.com/business/autos-transportation/catl-says-supply-bmw-with-cylindrical-cell-2025-2022-05-27/; CATL, "Carving Out a New Pattern, CATL Supplies batteries to Volkswagen ID.4", November 4, 2020, https://www.catl.com/en/news/641.html; Anonymous, "Volkswagen Plans to Gradually Adopt More CATL-Made Prismatic Batteries", https://en.pingwest.com/w/8416; Anonymous, "Mercedes-Benz expands battery supply partnership with CATL", 2022, https://group.mercedes-benz.com/innovation/digitalisation/industry-4-0/article-2.html#:~:text=Mercedes%2DBenz%20has%20chosen%20CATL,the%20end%20of%20the%20decade; SNE, "Global electric vehicle battery usage to reach 705.5 GWh in January-December 2023, up 38.6% year-on-year"; Sanderson, "China's Electric Vehicle Battery King".
44 The Investor, "[KH Explains] Are China-made batteries being fairly criticized for EV fires?", August 14, 2024, https://m.theinvestor.co.kr/view.php?ud=20240814050641.
45 Chen Weihua, "Building of battery factory on schedule". *China Daily,* May 10, 2024, https://epaper.chinadaily.com.cn/a/202405/10/WS663d7571a310df4030f5168b.html.
46 Mining.com, "Indonesia forms $1.2 billion battery venture with China's CATL", October 17, 2024, https://www.mining.com/web/indonesia-forms-1-2-billion-battery-venture-with-chinas-catl/.
47 SNE Research, "Press Release", 2024, https://www.sneresearch.com/en/insight/release_view/221/page/.

4. END USER: ELECTRIC VEHICLES

German automakers are shifting to the mass production of electric cars to combat the climate crisis. Companies such as Volkswagen, BMW, and Mercedes-Benz are among the world's leading electric vehicle manufacturers. Together, they delivered over 1.3 million electric cars in 2023. The automakers are striking deals with battery-grade nickel companies to secure raw materials supply. The automakers also attempt to reduce costs and protect supply by closely investing in mining and processing companies, or directly signing contract agreements with mining and processing companies. Even the German automakers were reportedly intending to invest billions of euros in both electric cars and electric vehicle batteries in Indonesia.[48]

Volkswagen Group is one of the global automakers and the largest automobile manufacturer in Europe. The company also produces electric vehicles of various types. It is one of the world's largest companies in selling electric vehicles, delivering 771,100 units in 2023, compared with 572,500 units in 2022.[49] Volkswagen accounted for 4.6 percent of global electric vehicles sales in 2023.[50]

Porsche Automobil Holding LC is Volkswagen's largest shareholder, with 55.3 percent of voting rights. The State of Lower Saxony and Qatar Holding have voting rights of 20.0 percent and 17 percent, respectively.

Table 3. Volkswagen shareholders in 2023 (in %)

Porsche Automobil Holding SE, Stuttgart	31.9
Foreign Institutional Investors	20.0
State of Lower Saxony, Hanover	11.8
Qatar Holding	10.0
Private shareholders	24.1

Source: Volkswagen.[51]

Volkswagen has factories in its home country and overseas. In Germany, the company's industrial base in Zwickau only produces electric vehicles and is the group's primary site electric vehicle production. With 10,350 permanent workers and and around EUR 1.2 billion of investment, the Zwickau factory produced 247,000 vehicles in 2023.[52] In 2022, its factory facilities in Emden transitioned into the mass production of electric vehicles in 2022. With 8,000 workers, the plant in Emden produced around 180,000 vehicles in 2023.[53] In 2022, the plant in Hanover started transitioning from producing internal combustion engine (ICE) cars to producing Evs. It is home to the ID. Buzz, an electric minivan. The Hannover plant produced 44,000 units of ID. Buzz in 2023. In Dresden, Volkswagen has plants that produce the ID.3 type of EV.[54] Volkswagen also has overseas operations producing EVs. In China, Volkswagen's Anting plant in Shanghai and its Foshan plant in Guangdong started producion in 2020, while in the US, the VW factory located in Chattanooga, Tennessee started producing the ID. 4 EV in 2022.

For the most part, Volkswagen purchases its EV batteries from the likes of CATL, LG Chem, and SK Innovation. Its ID series of electric vehicles mostly use lithium-nickel-manganese-cobalt-oxide (NMC) battery cells produced by CATL, LG Chem, and SK Innovation.[55]

In its *Responsible Raw Materials Report 2023*, Volkswagen stated that it did not directly source raw materials for batteries such as nickel and cobalt (by-product of nickel) from Indonesia. Instead, the company indirectly sources nickel and cobalt from multiple countries including Indonesia.[56] This implies that the company uses electric vehicle lithium-ion batteries containing nickel and cobalt through a network of companies that are involved in the upstream and downstream productions of raw materials. The report also declared that the Volkswagen subsidiary PowerCo was involved in purchase contracts for

48 Ruth Dea Juwita. 2024. "BMW eyeing EV investment in Indonesia, ministry says". Jakarta Post, 15 February. https://www.thejakartapost.com/business/2024/02/16/bmw-eyeing-ev-investment-in-indonesia-ministry-says.html.

49 Christoph Oemisch, "Volkswagen Group posts solid growth in deliveries in 2023 and strong increase in all-electric vehicles", *Press Release,* January 1, 2024, https://www.volkswagen-group.com/en/press-releases/volkswagen-group-posts-solid-growth-in-deliveries-in-2023-and-strong-increase-in-all-electric-vehicles-18057.

50 Trend Force, "BYD Set to Challenge Tesla for the Crown in EV Sales in 2024, Says TrendForce", February 20, 2024, https://www.trendforce.com/presscenter/news/20240220-12030.html.

51 Volkswagen Group, *Annual Report 2023;* Christoph Steitz and Victoria Waldersee, "Volkswagen law: German automaker's ownership structure explained", *Reuters,* October 29, 2024, https://www.reuters.com/business/aerospace-defense/volkswagen-law-unique-structure-behind-german-carmakers-labour-clash-2024-09-04/.

52 Volkswagen Newsroom, "Volkswagen Sachsen GmbH Zwickau Plant", *Media Information,* July 1, 2024, https://www.volkswagen-newsroom.com/en/volkswagen-sachsen-gmbh-zwickau-plant-5901.

53 Volkswagen Newsroom, "Volkswagen AG Emden plant", *Media Information,* November 20, 2024, https://www.volkswagen-newsroom.com/en/volkswagen-ag-emden-plant-5913.

54 Volkswagen Newsroom, "Volkswagen Sachsen GmbH Zwickau plant"; Volkswagen Newsroom, "Volkswagen's global production network for electric vehicles grows with the launch of a second German site in Emden", *Media Information,* May 20, 2022, https://www.volkswagen-newsroom.com/en/press-releases/volkswagens-global-production-network-for-electric-vehicles-grows-with-the-launch-of-a-second-german-site-in-emden-7976.

55 Anonymous, "Volkswagen MEB Battery Pack ID Family", *Battery Design,* February 5, 2023, https://www.batterydesign.net/volkswagen-meb-battery-pack-id-family/.

56 Volkswagen Group, *Responsible Raw Materials Report 2023,* 2024, https://uploads.vw-mms.de/system/production/documents/cws/002/716/file_en/d4d4bc8b2aea8ace68435605a99ef6e9a9bbf973/2023_Volkswagen_Group_Responsible_Raw_Materials_Report_1.pdf?1719555968.

battery-grade nickel and cobalt suppliers that will be operative in 2025.[57]

Volkswagen has begun taking action to secure access to nickel and cobalt for EV batteries. In March last year, the company publicly announced it would spend around EUR 15 billion on the production of battery and raw materials for EVs.[58] The planned projects seem to include the battery ecosystem related to nickel and cobalt as key raw materials in Indonesia, as claimed by Indonesian Investment Minister Bahlil Lahadalia after a meeting with Volkswagen in April 2023.[59] The project would be run by PowerCo.[60] It was also reported that on 21 March 2022, Volkswagen China entered into agreements with Huayou Cobalt and Tsingshan Holding Group to secure nickel and cobalt supplies for its China-based electric vehicle manufacturing. The first agreement was a Volkswagen-Huayou-Tsingshan joint venture to produce 120,000 t/y of nickel and 15,000 tons of cobalt in Indonesia. The second agreement was with Huayou for producing nickel and cobalt sulfates, and precursor and cathode materials.[61]

Following the German Supply Chain Due Diligence Act that entered into force on 1 January 2023, Volkswagen claimed to have developed a new approach for minimising human-rights, social, and environmental impacts throughout the length of the company's supply chain.[62]

Mercedes-Benz Group AG is one of the leading German automobile companies. In 2023, the Group employed around 166,000 workers and delivered around 2.04 million vehicles. Its fully electric vehicle sales were 11% of total sales and accounted for 2.6 percent of total global deliveries. Its plug-in hybrid electric vehicles (PHEV) accounted for 3.9 percent of global market. The group had a revenue of EUR 153.2 billion in 2023.[63]

Mercedes operates its electric car factories in numerous countries. In Germany, the company has plants in Sindelfingen, Bremen, and Rastatt, which employ 21,500 workers, 11,500 workers, and 6,100 workers, respectively. It also has plants in Kecskemet (Hungary), Beijing (China), and Tuscaloosa (US).

Mercedes-Benz manufactures electric cars using NMC batteries. They include the S 560 e plug-in hybrid, the G-Class, and the EQE model. It is already known as an automaker firm that uses lithium-ion battery cells with NMC 811 chemistry for electric vehicles. The firm makes this nickel-rich battery in its Hedelfingen plant.[64] It is also reported that Mercedes sources this battery from CATL.[65] The automaker has indeed partnered with CATL for delivering battery cells for the automaker's production sites of electric vehicles in Germany and Hungary.[66]

Table 4. Mercedes-Benz shareholders as of September 2024 (in %)

Chinese BAIC Group	9.98
Tenaciou3 Prospect Investment Limited	9.69
Kuwait Investment Authority	5.57
Institutional investors	37.65
Retail investors	28.06
Treasury shares	9.05

Source: Mecedes-Benz[67]

Bayerische Motoren Werke AG (BMW) is one of Germany's leading automakers. The Munich-based company manufactures motor vehicles across the globe including in Germany, the US, China, and Brazil among others. In 2023, BMW delivered a record of over 2.25 million vehicles. This includes fully elec-

57 Volkswagen Group, *Responsible Raw Materials Report 2023.*

58 Victoria Waldersee, "Volkswagen invests in batteries, raw materials in race for affordable EV", *Reuters,* March 14, 2023, https://www.reuters.com/business/autos-transportation/volkswagen-invest-180-bln-euros-five-year-plan-2023-03-14/.

59 Reuters, "Volkswagen to partner on Indonesia EV battery ecosystem-minister" *Reuters,* April 17, 2024, https://www.reuters.com/business/autos-transportation/volkswagen-partner-with-vale-ford-huayou-indonesia-ev-battery-ecosystem-minister-2023-04-17/.

60 Imanuddin Razak, "Volkswagen expressed interest in making investment in nickel ore processing in Indonesia. *Indonesia Business Post.* May 10, 2023, https://indonesiabusinesspost.com/risks-opportunities/volkswagen-expressed-interest-in-making-investment-in-nickel-ore-processing-in-indonesia/.

61 Brenda Goh and Dominique Patton, "Volkswagen unveils Asian ventures to secure e-battery materials supply", *Reuters,* March 21, 2022, https://www.reuters.com/business/autos-transportation/volkswagen-china-says-will-form-ventures-with-huayou-cobalt-tsingshan-group-2022-03-21/.

62 Volkswagen Group, *Sustainability Report 2023,* 2024, https://www.volkswagen-group.com/en/publications/more/group-sustainability-report-2023-2674.

63 Mercedes-Benz Group, "Sales Rise to 2,493,000 vehicles in 2023", 2024, https://group.mercedes-benz.com/company/news/sales-2023.html; Trend Force, "BYD Set to Challenge Tesla for the Crown in EV Sales in 2024, Says TrendForce", February 20, 2024, https://www.trendforce.com/presscenter/news/20240220-12030.html.

64 Mark Kane, "Mercedes Starts Production Of Battery Packs (108 kWh) For The New EQS", *InsideEVs,* March 24, 2021, https://insideevs.com/news/496439/mercedes-starts-production-battery-systems-eqs/.

65 AotBattery, "CATL NCM811 Battery Siege Strategy", https://www.aotbattery.com/new/CATL-NCM811-Battery-Siege-Strategy.html#:~:text=In%20addition%2C%20EQS%20will%20use,favor%20of%20more%20international%20OEMs.

66 Anonymous, "Mercedes-Benz expands battery supply partnership with CATL", 2022, https://group.mercedes-benz.com/innovation/digitalisation/industry-4-0/article-2.html#:~:text=Mercedes%2DBenz%20has%20chosen%20CATL,the%20end%20of%20the%20decade

67 Mercedes-Benz, "Overview of Mercedes-Benz Group AG Shareholders", 2024, https://group.mercedes-benz.com/investors/share/shareholder-structure/.

tric vehicles sales of nearly 330,600 units. Its PHEV accounted for 4.3 percent of the total global market.[68] BMW produces EVs in numerous countries. In Germany, the company operates plants in Leipzig, Munich, Dingolfing, and Regensburg, which employ 5,700, 7,800, 18,500, and 9,250 workers respectively. BMW also produces electric cars in Debrecen (Hungary) and Shenyang (China).

Table 5. BMW main shareholders as of December 2024 (in %)

Stefan Quandt	27.02
Susanne Klatten	21.90
Bayerische Motoren Werke AG	1.5
Amundi Asset Management SA	0.30
State Street Global Advisors Ltd.	0.13
Eurizon Capital SGR SpA	0.13
Bestinver Gestión SA SGIIC	0.11
Nordea Investment Management AB	0.09
AG2R LA MONDIALE Gestion d'actifs SA	0.08
Sjunde AP-fonden	0.07

Source: MarketScreener[69]

BMW electric vehicles use lithium-ion batteries in a variety of chemical compositions. One of the most commonly-used types is NMC that is known for its high energy density. BMW uses the most developed generation of NMC called NMC 811 batteries for some types of electric vehicles.[70] Since 2020, this type has been supplied by CATL.[71] The automaker also claimed it was the first customer of the CATL battery factory in Erfurt.[72] Like Mercedes-Benz, the fact that BMW sources NMC batteries from CATL means that the German giant is also a part of Indonesia's nickel supply chain. This claim emerges from the fact that CATL is deeply involved in diverse nickel projects in Indonesia, as explained earlier.

Tesla is a well-known American EVs maker. Tesla is one of the dominant global players in EV production. It makes a variety of electric cars, but also batteries related to the cars. In 2023, Tesla manufactured over 1.84 million vehicles, increasing from nearly 1.37 million units in 2022.[73] This multinational corporation manufactures EVs in the US, Germany, and China. Its Gigafactory Berlin-Brandenburg is its first automobile factory in Europe. Founded in 2022, at present this gigafactory employs around 12,000 workers, with a production output of 375,000 units in 2023.[74]

68 BMW Group, "A Successful 2023: BMW Group posts record sales, meets ambitious e-mobility growth targets", 2024, https://www.press.bmwgroup.com/global/article/detail/T0438999EN/a-successful-2023:-bmw-group-posts-record-sales-meets-ambitious-e-mobility-growth-targets?language=en#:~:text=With%20a%20total%20of%202%2C253%2C835,global%20premium%20segment%20last%20year; Trend Force, "BYD Set to Challenge Tesla for the Crown in EV Sales in 2024, Says TrendForce".

69 MarketScreener, "BMW AG", 2024, https://uk.marketscreener.com/quote/stock/BMW-AG-56358350/company-shareholders/.

70 Steven Paul. 2024. "Understanding BMW's Future: LFP Vs. NMC Batteries in Electric Vehicles", 2024, https://www.bmwblog.com/2024/10/18/bmw-lfp-vs-nmc-batteries-ev-performance-sustainability/; Green Car Congress, "BMW iX3 to introduce Gen5 BMW eDrive technology; NMC-811 batteries", 2019, https://www.greencarcongress.com/2019/12/bmw-ix3-to-introduce-gen5-bmw-edrive-technology-nmc-811-batteries.html#:~:text=BMW%20iX3%20to%20introduce%20Gen5%20BMW%20eDrive%20technology;%20NMC%2D811%20batteries,-19%20December%202019.

71 James Morris, "BMW Plans EV Battery Dominance With New Gen6 Cylindrical Cell", Forbes, September 10, 2022, https://www.forbes.com/sites/jamesmorris/2022/09/10/bmw-plans-ev-battery-dominance-with-new-gen6-cylindrical-cell/; Green Car Congress, "BMW iX3 gets a NCM 811 battery from CATL", PushEVs, 2020, https://pushevs.com/2020/07/15/bmw-ix3-gets-a-ncm-811-battery-from-catl/.

72 Saskia Graser, "BMW Group forges ahead with e-mobility and secures long-term battery cell needs – total order volume of more than 10 billion euros awarded", 2019, https://www.press.bmwgroup.com/global/article/detail/T0302864EN/bmw-group-forges-ahead-with-e-mobility-and-secures-long-term-battery-cell-needs-%E2%80%93-total-order-volume-of-more-than-10-billion-euros-awarded?language=en.

73 Tesla, 2023 *Annual Report*.

74 Reuters, "Tesla increases wages for staff at German gigafactory by 4%", *Reuters,* November 5, 2024, https://www.reuters.com/business/autos-transportation/tesla-increases-wages-german-gigafactory-by-4-2024-11-05/.

Table 6. Types of lithium-ion batteries for electric cars with high-grade nickel

EV makers	Type of EV	Type of batteries	Supplier
BMW	iX3	NMC 811	CATL
BMW	i4 eDrive40	NMC 811	CATL
BMW	i4 M50	NMC 811	CATL
Tesla	Model S	NCA 811	Panasonic
Tesla	Model X	NCA	Panasonic
Tesla	Model Y	NMC 811	LGES
Mercedes-Benz	eCitaro	NMC 333	Akasol
Mercedes-Benz	G-Class	NMC	CATL
Mercedes-Benz	S 560 e	NMC	
Mercedes-Benz	EQE	NMC 811	CATL
Volkswagen	ID.3; ID.4; ID.5	NCM 712	LGES
Volkswagen	e-Golf	NCM 333	
Volkswagen	Skoda Citigo-e iV	NCM 622	LG-Chem

Sources: BMW[75],[76]; Inside EVs[77];Autocar[78]; the Speed Journal[79]; Daimler truck[80] Anonymous[81]

Tesla mainly uses lithium-ion battery types such as NMC and LFP. Its longer-range cars use NMC batteries, while the standard range vehicles use LFP batteries. While LG Energy Solution supplies NMC batteries to Tesla, the company also directly sources nickel from Indonesia. Tesla recently reported that it sources 13 percent of its nickel from Indonesia, which is associated with Huayou's nickel processing facilities in Central Sulawesi and North Maluku as well as CNGR project in the Indonesia Morowali Industrial Park.[82]

75 https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/ir/downloads/en/2020/201028_BMW_iX3_Test_Days.pdf.
76 https://www.press.bmwgroup.com/canada/article/detail/T0334246EN/the-new-2022-bmw-i4-edrive40-and-i4-m50?language=en#:~:text=The%20high%2Dvoltage%20NMC%2D811,conventional%20manufacturing%20techniques%20are%20employed.
77 "What Batteries Are Tesla Using In Its Electric Cars?". https://insideevs.com/news/587455/batteries-tesla-using-electric-cars/.
78 Autocar. "Mercedes G-Class EV could get 400-mile range with new battery". https://www.autocar.co.uk/car-news/new-cars/mercedes-g-class-ev-could-get-400-mile-range-new-battery#:~:text=Revealed%20at%20the%202024%20Beijing,official%20range%20of%20292%20miles..
79 The Speed Journal. "New Plug-in Mercedes Hybrid S560e." https://www.thespeedjournal.com/mercedes-hybrid-s560e/#:~:text=the%20S%2DClass.-,The%20S560e%20has%20an%20approximate%20all%2Delectric%20range%20of%2025,at%20the%20time%20of%20launch.
80 Daimler Truck. "The New NMC4 Battery in the Mercedes Benz eCitaro." https://www.daimlertruck.com/en/newsroom/pressrelease/the-new-nmc4-battery-in-the-mercedes-benz-ecitaro-more-capacity-longer-service-life-52911254.
81 Anonymous.. "Volkswagen MEB Battery Pack ID Family".
82 Tesla, *2023 Impact Report.*

V. THE DARK SIDE OF THE NICKEL SUPPLY CHAIN

The upstream and midstream segments of the nickel-based EV battery supply chain in Indonesia have clearly led to environmental damage and human rights violations. While the upstream refers to the extraction of nickel as raw materials, the midstream involves the production of processed and refined nickel. The abuses include land theft, deforestation, pollution, the displacement of local people, and severe labour exploitation. Since the nickel supply chain includes mining companies, refiners, battery manufacturers, and EV makers, EV companies in the downstream must engage with their nickel suppliers to ensure responsible sourcing. In this respect, the German automakers that source nickel from Indonesia must take environmental and social responsibility based on human rights and sustainability principles beyond their corporate boundaries.

1. CASE STUDIES

PT Weda Bay Nickel is the largest nickel mining concession on Halmahera Island. Its operation has deforested Halmahera rainforest, with the amount of forest lost between 2020 and 2023 reaches 1,105.36 hectares.[83] The deforestation has a disastrous impact on the indigenous people called O'Hongana Manyawa (also referred to as Forest Tobelo or Tobelo Dalam) who live in the forest interior on Halmahera Island. While the forest has provided this native population with all of their needs including food, medicine, and spiritual and cultural practices, Weda Bay Nickel is linked to extensive deforestation of their customary forest. The rainforest is currently home to a population of roughly 300 to 500 people,[84] which has significantly dropped from around 3,000 over the last two decades.[85] The mass deforestation driven by nickel operations would therefore constitute genocide of the local indigenous peoples.

Since open-pit mining mostly takes place in the uplands, the Weda Bay Nickel operation generates downstream effects for rural populations whose agricultural and residential areas are in the lowlands. In the wet season, rivers flow across the landscape with brown alluvial sediment affecting the local population. Villages around the nickel industrial park in Weda Bay have experienced many major floods in recent years. A severe flood hit the villages of Woejerana, Woekob, Lelilef Waibulan, and Lukolamo in July 2024. The muddy flood paralyzed the activities of more than 6,500 residents, including nickel workers, and forced about 1,700 residents to leave their homes for safety shelters provided by local government.[86]

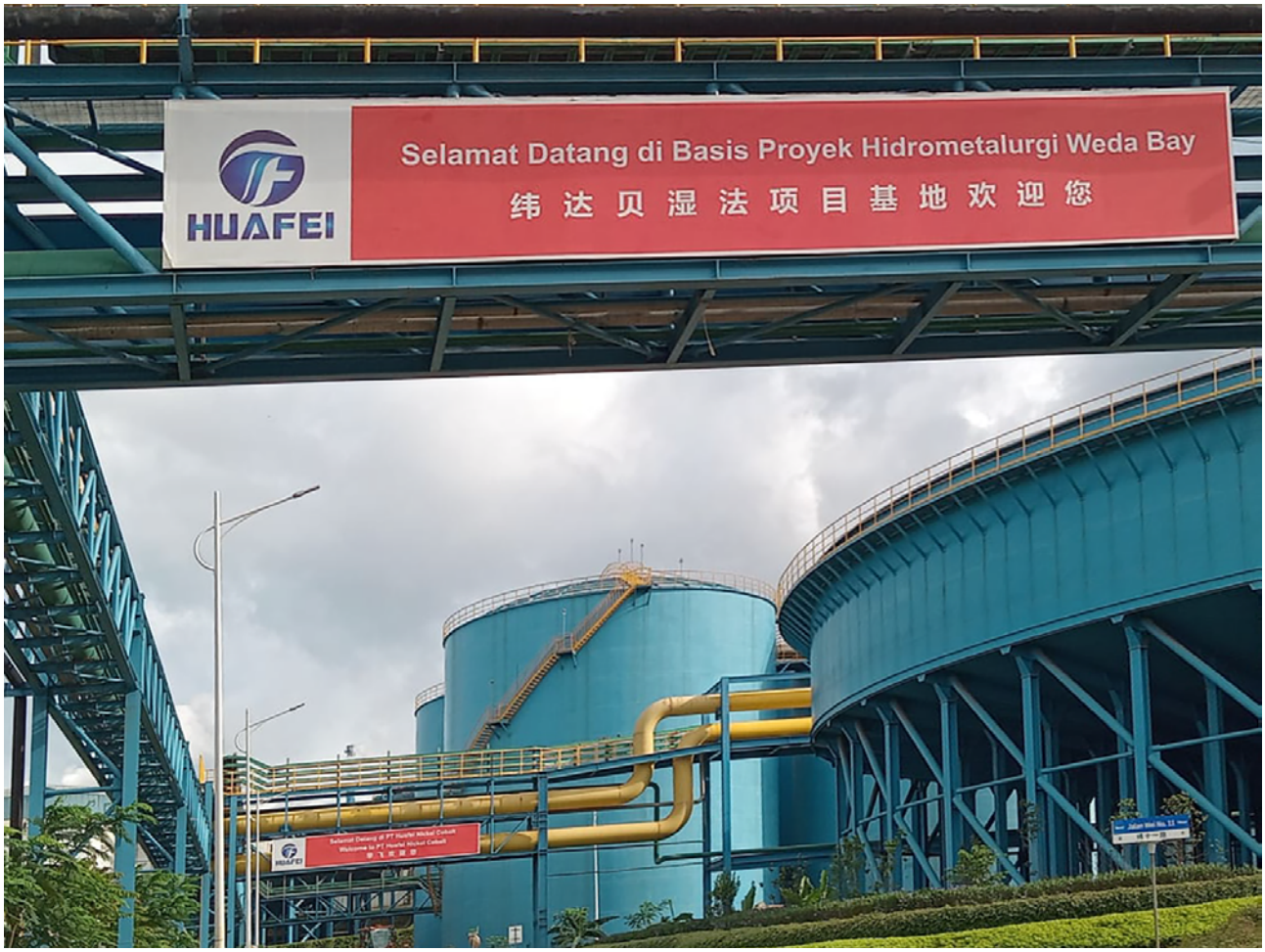
Another concern related to nickel mining operations associated with the Weda Bay Nickel is the pollution of coastal and marine ecosystems. In Weda Bay, nickel-related pollution has depleted fisheries. The local fisherfolk have been forced to go further afield because their traditional fishing grounds are contaminated by the muddy runoff and waste from nickel mining and smelting operations.[87] A local fisher Abdullah Saleh pointed out that the fishing areas near his house in Lelilef, usually cost him around IDR3 million (EUR 59.53) for one trip. However, if he has to fish further away, the cost can rise to a minimum of about IDR5 million (EUR 297.64).

> "I have been out of the sea for more than a year. So, I go fishing, but my gear is over there, in Patani, not here. Many people here still go fishing, toward Weda, straight toward Sagea, still (catching fish)... (here) you can catch fish too, but it's not satisfying. If it's just for food, it's okay; if it's for money, forget it... if they have to sell, then they have to fish far away... and for a long time. At a minimum, they have to be at the sea for two days."[88]

PT Wana Kencana Mineral is the second largest nickel mining concession on Halmahera Island. Mining in the forest area by the company caused more than 122 hectares of tree cover loss between 2020 and 2023,[89] thus contributing to the systemic displacement of O'Hongana Manyawa.[90] In the District of South Wasile, the East Halmahera Wana Kencana Mineral operation has recently appropriated the lands of the locals. It initially took the lands without fair compensation, leading to disputes that are still ongoing. The tension between Wana Kencana

83 Mighty Earth, *From Forest to Electric Vehicles*.
84 Conversation with Novenia Ambeua in Wasile, October 3, 2024.
85 Christopher R. Duncan, "Untangling Conversion: Religious Change and Identity among the Forest Tobelo of Indonesia", *Ethnology* 42(4), 2003: 307–22.
86 Malut Times, "Banjir di Wilayah Lingkar Tambang PT IWIP Tuai Kritik", *Malut Times,* July 25, 2024, https://maluttimes.com/2024/07/23/banjir-di-wilayah-lingkar-tambang-pt-iwip-tuai-kritik/; Purwanto Ngatmo, "Banjir 2 Meter Rendam Desa Lingkar PT IWIP, Kepala BPDB Halteng: Kami Hanya Bisa Nonton", 2024, https://www.klikhalmahera.com/maluku-utara/98213175388/banjir-2-meter-rendam-desa-lingkar-pt-iwip-kepala-bpdb-halteng-kami-hanya-bisa-nonton.
87 Conversation with Abdullah Saleh in Lelilef village, October 5, 2024.
88 Conversation with Abdullah Saleh.
89 Mighty Earth, *From Forest to Electric Vehicles*.
90 Conversation with Novenia Ambeua.

Figure 15. Huafei Nickel Cobalt in the Indonesia Weda Bay Industrial Park



credit: a worker, 2024

Mineral with the locals arose when customary lands were expropriated for mine operations without prior informed consent. Indigenous peoples and local communities, who plant cash crops and collect forest products, were forced off their lands without compensation. The company simply ignored the customary land claims. This generates village-based resistances.

A few months ago, hundreds of villagers in Jikomoi village and Waijoi village took direct action at the field office of Wana Kencana Mineral in Loleba village, South Wasile. Dozens of troops with small arms prevented the protesters from access to the company field office. Following the protest, seven villagers have been criminalised for fighting for their fundamental rights to the land. On 18 March 2024, the Special Crimes Directorate of North Maluku Police filed criminal charges against the villagers for obstructing the company's operations. The locals include Estepanus Djojong (aged 62), Septon Djojon alias Ton (aged 42), Keng Kamariba (aged 61), Lifas Gorango (aged 40), Paulus Lasa (aged 54), Rifo Bobala (aged 35), and Oscar Barera (aged 47).[91]

Wana Kencana Mineral and other nickel mining companies including Weda Bay Nickel generate widespread coastal pollution in Buli Bay. A recent report from an Indonesian NGO called Auriga indicated that Buli Bay has high mercury concentrations, ranging from 0.001 to 0.009 mg/L, which exceeds the national standard set by the Minister of the Environment's Decree No. 51 of 2004 (0.001 mg/L). Mercury contamination is suspected of being linked to the nickel mining operations surrounding Buli Bay, as mining waste is known to contribute to heavy metal release, including mercury and chromium. Additionally, it was found that fish commonly consumed by local communities, such as grouper, emperor, and bream, exhibited signs of necrosis, indicating heavy

91 Conversation with Keng Kamariba and Paulus Lasa in Waijoi, October 3, 2024; see also Anonymous, "Tolak Aktivitas Tambang PT Wana Kencana Mineral (WKM), 7 Warga Wasile Selatan Ditetapkan Sebagai Tersangka", *Radiosyallom.com,* April 1, 2024, https://radiosyallom.com/tolak-aktivitas-tambang-pt-wana-kencana-mineral-wkm-7-warga-wasile-selatan-ditetapkan-sebagai-tersangka/.

metal accumulation. If these fish are consumed by the locals, it poses a threat to their health.[92]

Industrial disputes in workplaces are widespead in nickel mining operations in Indonesia. They mainly emerge from unfair labour practises and demand for higher wages and better working conditions. If left unresolved due to the ignorant attitudes of company officers the disputes escalate and lead to threats and violence. This recently occurred in PT Five Star Indonesia, a mining contractor of Wana Kencana Mineral. A spontaneous protest against unfair labour practices turned violent. Indonesian police arrested four workers. They then faced an unfair trial, because they'd been denied access to lawyers. In July 2024, an Indonesian Court sentenced Melkianus Nabi, Rio Salasa, Stenly Laetemia, and Wiston Rahayan to 14 months in prison for their protests against Five Star Indonesia.[93] In addition, when workers organized strikes in response to the growing industrial disputes, the company pushed back, terminating the union leaders's contracts.[94]

PT Sulawesi Cahaya Mineral is one of the largest nickel mining firms in Indonesia. It has also been involved in environmental and human rights abuses. Almost 98 percent, or around 20,670 hectares, of its mine concession areas are classified as forest. Its operation thus causes deforestation. As Mighty Earth reported, between 2020 and 2023 forest loss linked to the firm reached 661.94 hectares.[95] Rapid deforestation will be exacerbated in the mine concession area following the construction of the Indonesia Konawe Industrial Park, a new nickel-based industrial park jointly controlled by the Merdeka Group and the Tsingshan Group. This results from the fact that in 2023 the Government of Indonesia already approved the clearance of about 3,854 hectares of forest inside Sulawesi Cahaya Mineral's concession area for the industrial park. Deforestation threatens biodiversity, and the mining operation has disrupted the habitat of anoa (Bubalus depressicornis), which is endemic to Sulawesi, and has been placed on the red list of endangered animals by the International Union for Conservation of Nature (IUCN).[96]

Sulawesi Cahaya Mineral's operation has generated land disputes with local communities who hold traditional land title. Mine operations are in an area called Mopute, which is part of the settlements of the To Laki people, an indigenous group in the region. Sulawesi Cahaya Mineral is conducting mining operations within a radius of approximately 2.5–3 kilometres in this area. Residents say the company plans to build solar panels and a waste disposal site in Mopute. The landowners have rejected this, occupied the area, and built settlements there, constructing about 200 houses and opening up agricultural land. Police arrested three residents at the end of 2022 on charges of entering the concession area of Sulawesi Cahaya Mineral. They were released after agreeing to dismantle their houses and leave the settlement, unable to endure the intimidation.[97]

PT Hengjaya Mineralindo is one of major nickel companies in Morowali and has a concession area of 5,983 hectares, of which 85.58 percent is forested. Deforestation is a major issue. It is estimated that around 1,800 hectares of forest have been or will potentially be lost in the Hengjaya Mineralindo operation area. This estimate is based on the issuance of the first Borrow-to-Use Forestry Permit covering 851 hectares in 2013 and the second Borrow-to-Use Forestry Permit covering 994 hectares in 2019.[98]

Hengjaya Mineralindo has a bad reputation with local residents. It had encroached on the lands owned by 30 locals in the village of Bete Bete, leading to land disputes over the years. Five villagers, including the head of the village, were arrested by police in 2021 as a result of unresolved disputes. In 2023, land disputes related to Hengjaya resulting from the dispossession of local communities' crops in the villages of Lafeu and Tandaoleo escalated. While 140 residents from both villages assert their ownership of the land, the companies claim the lands are part of its concession areas. On 22 and 23 December 2023, residents of both villages staged a protest demanding compensation for damaged crops and blockaded the hauling road to Hengjaya's jetty, halting nickel ore barging and shipping.[99]

PT Huafei Nickel Cobalt, PT Huayue Nickel Cobalt, and PT Huake Nickel Indonesia produce battery-grade nickel for clean energy. But they use dirty power plants to smelt and refine the nickel. Huafei and Huake operate their combined coal-fired captive powers of 500 megawatts, which are part of the existing 3,400 megawatts of coal-fired captive power plants in the Indonesia Weda Bay Industrial Park, while Huayue sources its electricity from a coal-fired power plant provided by the Indonesia Morowali Industrial Park. Pollution from the current operation of the power plants is responsible for the contamination

92 Auriga, *Status Kualitas Air dan Biota diperairan Teluk Buli Kabupaten Halmahera Timur,* Laporan Penelitian, 2024.
93 Interviewed with Melkianus Nabi and Rio Salasa in Soasio, October 6, 2024.
94 Conversation with Warles Paroco in Waijoi, October 3, 2024.
95 Mighty Earth, *From Forest to Electric Vehicles.*
96 Sangadji, HPAL dalam Industri Nikel.
97 Ibid.
98 Ibid.
99 Ibid.

of sulphur dioxide, nitrogen oxides, and undetectable particulates in areas surrounding the park. The plants are suspected of indirectly adversely impacting the local people's health. The coal-fired power plants emit visible smoke, which is concerning because the workers and residents living near the plants rarely have masks to protect themselves from inhaling the smoke. Moreover, there is no information on whether the power plants' emissions meet the quality parameters set out by Indonesia's Regulation of the Minister of Environment and Forestry No. P.15/2019, as this information has never been made public. Meanwhile, residents report suffering from respiratory diseases since the nickel smelting companies began operation.[100]

Huayue and Huafei opts for filtered tailings, a technology used to the treat mountains of toxic waste produced by the HPAL process. The technology involves dewatering, filtering, compacting, and storing waste in a stable and dry state. However, the use of this method in wet climates has drawn criticism. Morowali regency and Central Halmahera regency have high annual precipitation levels that increase the risk of runoff during the wet season and cause contaminated water supplies. In addition, the filtered tailings are also vulnerable to seismic activity. North Maluku is known for its intense seismic activity, with the US Geological Survey recording over 11,200 quakes over 122 years since 1900.[101] Meanwhile, Morowali is located on the Matano Fault and has frequently experienced severe earthquakes.[102] In this case, tailing storage facilities in the Indonesia Morowali Industrial Park and the Indonesia Weda Bay Industrial Park are vulnerable to failure in the event of intense earthquakes.

The processing contractor companies mostly employ temporary, outsourced workers. This type of worker has no guarantee of their legal labour rights being respected. In general, in the absence of a collective agreement, the temporary workers sign a labour contract for a certain working period. This contract scheme has become the most common type of labour agreement. There is legal uncertainty related to the work contract system. The workers are at risk at the end of their contracts, and are not provided with adequate welfare guarantees.

In our conversations with workers at PT Indosino Sukses Bersama, a contractor of Huafei Nickel Cobalt, we were told that the employer forces their workers to hand over their personal identity cards in order to keep their employees for a long time. This compulsory practice restricts the rights of workers to find a new job while still employed.[103]

It is also evident that contractor firms exploit the working class through the extension of normal working hours. Indonesia's Law Number 13 of 2003 concerning Manpower allows a maximum of 54 hours of work per week or 216 hours a month. In Huafei, our conversations with workers revealed that Indosino Sukses Besama employs workers for longer working hours. One payslip at the company indicated that the employee worked about 263.5 hours a month. The company thus employed workers for 47.5 hours longer than the working hours allowed by law.[104] Without being compensated by leave rights as regulated by law, workers do not have enough rest time. The work system forces them to continue working overtime without decent wages.

As poor working conditions lead to increased risks of workplace accidents, work-related incident in the nickel industry is a prominent issue in Indonesia. In the Indonesia Weda Bay Industrial Park, accidents happen frequently for a variety of reasons, but mainly due to unsafe working conditions. Unfortunately, many workplace accidents go unreported because workers may be subjected to disciplinary action from companies. But workers usually privately circulate information about accidents. On 20 August 2023, a logistics worker at the ISB was killed in a loader tire explosion in the Indonesia Weda Bay Industrial Park hauling site. The 37-year-old worker, Arirudin, was inflating the tire when it exploded, killing him.[105] An accident recently occurred with a contract worker at Huafei. On 19 November 2024, there was a hauling-related accident that killed a worker. The victim, a tailing dump truck driver, was crushed to death by the truck after he jumped off it. The accident was caused by a mechanical failure.[106] Indonesian workers at Huafei stated that many had experienced workplace accidents due to inadequate communication with their Chinese counterparts. The language barrier leads to misunderstandings.[107]

The Indonesia Morowali Industrial Park has a notoriously poor reputation regarding fatal workplace accidents, such as the fire and explosion at PT Indonesia Tsingshan Stainless Steel on 23 December 2023 that

100 Conversation with Abdullah Saleh.
101 Saaduddin et al, "Potential Tsunamis in North Maluku". Proceedings PIT IAGI 51th Makassar, October 25–27, 2022, https://www.iagi.or.id/web/digital/71/PITIAGI-22-P-Abs-156.pdf.
102 Sangadji, *HPAL dalam Industri Nikel.*
103 Conversation with a group of contractor workers at Huafei.
104 A Payslip at PT Indosino Maju Bersama.
105 Nurkholis Lamaau, "Karyawan PT IWIP di Halmahera Tengah Tewas Terkena Ledakan Ban Loader", *Detik.com,* August 21, 2023, https://www.detik.com/sulsel/berita/d-6887818/karyawan-pt-iwip-di-halmahera-tengah-tewas-terkena-ledakan-ban-loader.
106 Interview with a worker at Huafei, November 19, 2024.
107 Conversation with a group of contractor workers at Huafei.

Figure 16. A contract worker of Huafei died at the Indonesia Weda Bay Industrial Park hauling site on 19 November 2024

credit: a worker, 2024

killed 21 workers and injured 38 others. Many workplace accidents go unreported to the public because the company has no intention of disclosing them. Sources among workers at Huayue Nickel Cobalt insisted that at least two of their comrades had been killed in accidents in 2023 that were not made public. The first involved a worker driving a heavy-duty truck transporting cement for a construction project in the Indonesia Konawe Industrial Park. The second involved a Chinese worker who was in a traffic accident in Tangofa Village when the brakes on his vehicle failed while in it was motion. Huayue Nickel Cobalt never disclosed these incidents publicly and no mainstream media outlet reported them. The only information and photos were shared among workers through WhatsApp. In its 2023 Environment Social and Governance Report, Huayou Cobalt mentioned one work-related death in 2023 but did not specifically attribute it to Huayue Nickel Cobalt or its other subsidiaries. Workers acknowledged that there are many more workplace accidents that are unknown to the public, where workers sustained severe or minor injuries.[108]

2. BREAKING THE LAW

In the light of the above discussion, it must be stated that the mining and processing companies involved in battery-grade nickel production in Indonesia violate the Indonesian laws listed below, among others:

a. Law Number 5 of 1960 concerning Basic Agrarian Principles;
b. Law Number 39 of 1999 concerning Human Rights;
c. Law Number 21 of 2000 concerning Labor Unions;
d. Law Number 13 of 2003 concerning Manpower;
e. Law Number 11 of 2005 concerning the Ratification of the International Covenant on Economic, Social, and Cultural Rights;
f. Law Number 12 of 2005 concerning the Ratification of the International Covenant on Civil and Political Rights;
g. Law Number 32 of 2009 concerning Environmental Protection and Management.

Given the supply costs related to upstream and midstream nickel production, all actors in the nickel-based battery supply chain must be responsible

108 Sangadji, *HPAL dalam Industri Nikel.*

for their contribution to the harmful effects of nickel production, regardless of their role and position in the chain. As EVs are the major driver of nickel consumption, automakers should take responsibility in sourcing their nickel. In this respect, German automakers must step up to ensure the responsible sourcing of nickel by identifying, assessing, and mitigating environmental and human rights risks in their supply chain.

Such obligations emerge from the implementation of national and international regulations that require German companies to ensure that environmental and human rights impacts are investigated in their supply chain. Germany's SCDDA, the EU's CSDDD, and the EU's BATT2 clearly require that suppliers to comply with international human rights and environmental measures. Through the SCDDA, the CSDDD, and the BATT2, Germany and the EU could require that nickel mining and processing companies in Indonesia improve their environmental and human rights practices.

The SCDDA protects human rights and the environment in relation to particular legal standards in accordance with international conventions. The Supply Chain Act bans a range of business practices such as forced labour, all forms of slavery, withholding of an appropriate wage, harmful occupational health and safety practices, the restriction of freedom of association, the use of public or private security forces, the unlawful seizure of land, forests, and waters. The Act also prohibites the handling, collection, storage, and disposal of waste that poses a risk the environment.[109] Considering that the nickel mines, smelters, and refineries operating in Indonesia have violated international human rights and environmental benchmarks, due to poor occupational health and safety, long-working hours, low wage, union busting, widespread air, water, and land pollution, and the displacement of local people including indigenous people, the SCDDA must be consistently used by German automakers to ensure that they are not contributing to human rights violations and causing environmental degradation through their upstream and midstream nickel suppliers.

Similar consequences would eventuate from the implementation of regulations related to the European Union. The CSDDD obliges the EU automakers to assess and address the environmental and human rights impacts related to their upstream suppliers of nickel regardless of whether the violations occur within or outside the EU. In the course of widespread and systemic environment and human rights abuses in Indonesia's nickel mining and processing, the CSDDD can be a deterrent for abuses such as unhealthy and unsafe working conditions, rampant pollution, and the systematic dispossession of indigenous people from their ancestral lands.

The BATT2 due diligence requires EU-based companies and their suppliers to comply with environmental standards associated with air and water pollution, soil contamination, and biodiversity damage. It also prevents companies and suppliers from violating international human rights standards in the areas of occupational health and safety, forced labour, trade unions, and community life, including that of indigenous people. In this respect, the BATT2 can be applied to the EU-based automakers, which manufacture or source batteries containing nickel, to address environmental and human rights breaches in the upstream and midstream nickel supply chain as they have occurred in Indonesia's nickel industries.

In sum, in light of international environmental and human rights requirements, together the SCDDA, the CSDDD, and the BATT2 could strengthen environmental and human rights protections by requiring companies to assess, prevent, and address adverse ecological and social impacts within the entire global supply chain of battery-grade nickel for EVs. Such global supply chains include at least nickel mining and refining in Indonesia, the production of nickel containing EV batteries in China, and EV manufacturing in Germany.

109 "The Act on Corporate Due Diligence Obligations in Supply Chains [English Translation]", https://www.bmas.de/SharedDocs/Downloads/DE/Internationales/act-corporate-due-diligence-obligations-supply-chains.pdf?__blob=publicationFile&v=3.

VI. CONCLUSION

Nickel is one of the most ubiquitous metals in contemporary life. Once mainly used to produce stainless steels, the metal has recently become an essential part of green energy demand especially in the transition from internal combustion engine vehicles to rechargeable battery-based vehicles. The surge in lithium-ion battery production for electric vehicles has generated increased demand for nickel. More than half of the global nickel reserves are found in Indonesia, Southeast Asia's largest economy. More than half of the world's supply of mined nickel comes from four provinces: North Maluku, Central Sulawesi, Southeast Sulawesi, and South Sulawesi. In Indonesia, where more than two-fifths of the global processed nickel is produced, Chinese investors play a crucial role in industrial nickel development. The archipelago is thus a global hub of mined and refined nickel, representing the upstream stages of the nickel-based batteries supply chain for electric vehicles.

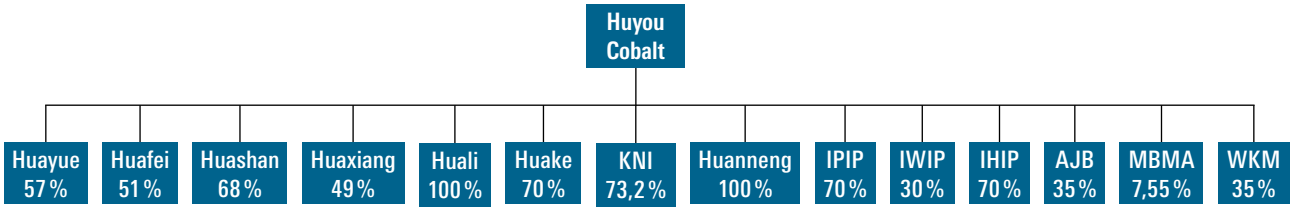
China is a global hub of the EV battery supply chain. As the nickel-based battery supply chain for EVs also involves the manufacture of EV batteries themselves, Chinese companies play a significant role in the global supply chain of nickel-based lithium ion batteries. Using refined nickel sourced from its subsidiaries in Indonesia, Zhejiang Huayou Cobalt produces nickel-rich cathodes and supplies the materials to CATL, the world's largest EV battery maker. This company manufactures nickel-based lithium-ion batteries and provides the batteries for top global automotive manufacturers including German automakers such as Volkswagen, BMW, and Mercedes-Benz.

However, the supply chain's reliance on nickel from Indonesia encounters risks associated with environmental damage and human rights violations. Deforestation and pollution are major environmental concerns for the nickel industry. Deforestation causes soil erosion, water pollution, and biodiversity loss. As the backbone of battery-grade nickel production, coal-fired power plants generate sulfur dioxide, nitrogen oxide, particulates, and other heavy metals that can have serious environmental and health effects. The upstream production of nickel in Indonesia also seriously violates human rights, due to issues such as land theft and the dispossession of indigenous peoples. It also represents an intense form of labour exploitation, with workers are forced to work for long hours and low wages in poor working conditions.

German automakers whose nickel also comes from Indonesia benefit from the above-mentioned environmental damage and human rights violations. In Germany, the environmental harms and human rights violations embodied in EVs are regulated by the SCDDA, the CSDDD, and the BATT2. As these laws and regulations extend German corporations' responsibility beyond their domestic operations to encompass their direct and indirect suppliers, German automakers must understand that they have a duty to protect against environmental and human rights violations within their nickel suppliers.

APPENDIX

Figure 17. Huayou Cobalt's stakes in nickel businesses in Indonesia



Note: % represents Huayou Cobalt's stake in the company

- Huyue refers to PT Huayue Nickel Cobalt
- Huafei refers to PT Huafei Nickel Cobalt
- Huashan refers to PT Huashan Nickel Cobalt
- Huaxiang refers to PT Huaxiang Refining Indonesia
- Huali refers to PT Huali Nickel Indonesia
- Huake refers to PT Huake Nickel Indonesia
- KNI refers to PT Kolaka Nickel Indonesia
- Huanneng refers to PT Huaneng New Material
- IPIP refers to Indonesia Pomalaa Industrial Park
- IWIP refers to Indonesia Weda Bay Industrial Park
- IHIP refers to Indonesia Huali Industrial Park
- AJB refers to PT Anugerah Jaya Buana
- MBMA refers to PT Merdeka Battery Materials
- WKM refers to PT Wana Kencana Mineral