From Captive Coal to Green Nickel: Securing Indonesia's Future Competitiveness

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Muyi Yang, Biqing Yang, Dinita Setyawati

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About

Nickel is critical for batteries, electric vehicles (EVs), and other clean technologies, yet most of Indonesia's rapidly expanding nickel processing industry still relies on captive coal. While this boom supports the global clean energy transition, it also risks deepening Indonesia's coal dependence — undermining national climate goals and eroding long-term competitiveness in increasingly climate-sensitive markets. This report examines whether Indonesia can align its nickel ambitions with decarbonisation and long-term prosperity – and what role different stakeholders can play in supporting this alignment.

Executive summary

The scale and roots of captive coal reliance. Driven by energy-intensive demand from nickel processing, Indonesia's captive coal capacity already exceeds 15 GW in 2024. If current trends continue, capacity could more than double to over 32 GW by 2031 — nearly the size of Germany's entire coal power fleet.

Indonesia's dependence on captive coal power stems from a mix of resource nationalism, downstreaming strategies, and structural constraints on renewable deployment, all of which made coal the most attractive option for powering nickel processing. While a range of solutions exists – from improving efficiency through industrial clustering to integrating renewables into industrial parks and deploying hybrid systems – their effectiveness has been limited by policy, planning, and governance challenges.

Future pathways. Indonesia's nickel industry faces two diverging options: Green Opportunism, which prioritises immediate gains while locking in coal dependence; or Green Developmentalism, which treats decarbonisation as a lever for future competitiveness, aligning nickel expansion with renewables, efficiency, and industrial clustering to secure Indonesia's long-term role in global EV and battery supply chains.

Encouraging signs: Indonesia has launched the Nickel Industry Decarbonisation Roadmap; stakeholders from think tanks to development agencies are mapping transition pathways; industry players are piloting renewable integration; and debates around "green nickel" as a premium product are gaining traction. Together, these reflect a growing recognition that downstream growth must be made compatible with long-term sustainability, and a range of technical

solutions and policy instruments have already been proposed to support this shift.

Strategic commitment is critical for real progress. Turning this momentum into meaningful outcomes is far from straightforward. Decarbonising Indonesia's nickel processing sector requires delivering renewable energy at scale in remote smelter regions with weak grids, while also balancing short-term industrial expansion with long-term transition goals. It also demands overcoming entrenched coal interests, strengthening governance capacity, and improving coordination across central agencies and local authorities. Only a strong and sustained strategic commitment can overcome these obstacles and translate ambition into lasting progress.

Fostering such a commitment: Suggested actions

01 **Shift the narrative**
Think tanks and research institutes: Develop studies framing decarbonisation as central to future competitiveness; convene dialogues to socialise this view; provide evidence through modelling and analysis of socio-economic and trade benefits.

02 **Reinforce the framing**
External partners: Integrate "green nickel" into regional dialogues, trade talks, and cooperation platforms; support its positioning as a premium product in international markets.

03 **Lead adoption & branding**
Industrial players: Publicly endorse green nickel as a competitive advantage; take the lead in branding Indonesia's low-carbon nickel in trade fairs, supply chain dialogues, and investor forums.

04 **Signal national priority**
Public agencies: Embed "green nickel" in strategies, regulations, and planning; ensure consistent narratives across agencies; provide durable signals to mobilise the whole economy.

The role of China. Indonesia's nickel transition will test whether resource-based industrialisation can be aligned with climate goals and future prosperity. As Indonesia's key partner, China can help tip the balance. In practice, Chinese stakeholders could explore:

01 **Evidence & narrative**

Co-develop park-level transition plans (e.g., Morowali, Weda Bay) comparing captive-to-clean pathways and quantifying co-benefits; consider establishing a China–Indonesia Green Nickel Observatory to benchmark plant emissions and track buyer rules (battery passports, CBAM-style), turning "green nickel" into a competitiveness case.

02 **Regional rulebook**

Champion "green minerals" tracks in BRI/RCEP and test mini-lateral cooperation (e.g., Australia–China–Indonesia) to pair China's tech scale with regional strengths in standards, permitting, ESG assurance and co-financing – so principles become bankable, interoperable rules.

03 **Bankable demand & finance**

Encourage Chinese cathode/EV buyers to sign offtake MOUs indexed to declining emissions intensity with third-party verification; consider offering transition-linked credit/insurance to reward verified intensity cuts and fund park-level clean energy solutions and grid upgrades.

04 **Capability & implementation**

Provide technical help to operationalise derivative regulations (declining targets for captive coal) and design ETS Phase II for captive power with robust MRV; run grid-integration clinics for weak systems (Sulawesi/Halmahera); co-develop supplier and workforce training for solar/BESS O&M, digital EMS, MRV and safety.

While full answers will require deeper work across trade, regulation, and diplomacy, the direction is clear: the fossil-fuelled model is losing viability as

markets demand cleaner supply chains and climate risks drive up costs. The pragmatic next step is to prove the economics – pick one industrial park, deliver a 200–500 MW solar-plus-storage pilot, pair it with an intensity-indexed offtake, and use that success to scale. Better to shape the new market now than pay more to defend the old one later.

Chapter 1

Introduction

Indonesia's nickel sector faces a paradox. On the one hand, nickel is a critical mineral for the clean energy transition, essential for batteries and electric vehicles (EVs). On the other hand, most of Indonesia's fast-growing nickel processing industry is powered by captive coal plants, entrenching one of the most carbon-intensive forms of industrialisation in the world.

This report explores that paradox. It asks: can Indonesia's nickel transition be aligned with its climate goals and long-term prosperity? And what role can different stakeholders — from domestic policymakers to international partners, and especially China as Indonesia's most important partner in the nickel sector — play in shifting the trajectory?

The report is structured as follows:

Chapter 2 quantifies the scale of Indonesia's reliance on captive coal power.

Chapter 3, drawing on expert insights (see Appendix for details on the consultation process), examines the historical and structural roots of this reliance. It also unpacks the current barriers – policy gaps, planning inefficiencies, and implementation challenges – that make the transition to cleaner production difficult.

Chapter 4 contrasts two possible transition pathways: green opportunism, which locks in coal dependence, and green developmentalism, which uses decarbonisation as a lever for competitiveness. While many technical solutions and policy instruments have already been proposed, the chapter emphasises

that strong strategic commitment is essential for translating them into real progress. It also outlines actions stakeholders can take to help foster such commitment.

Chapter 5 outlines practical roles for Chinese stakeholders in supporting Indonesia's shift to cleaner nickel – building the evidence base, embedding "green minerals" in regional rules, creating bankable demand signals, and strengthening implementation capacity.

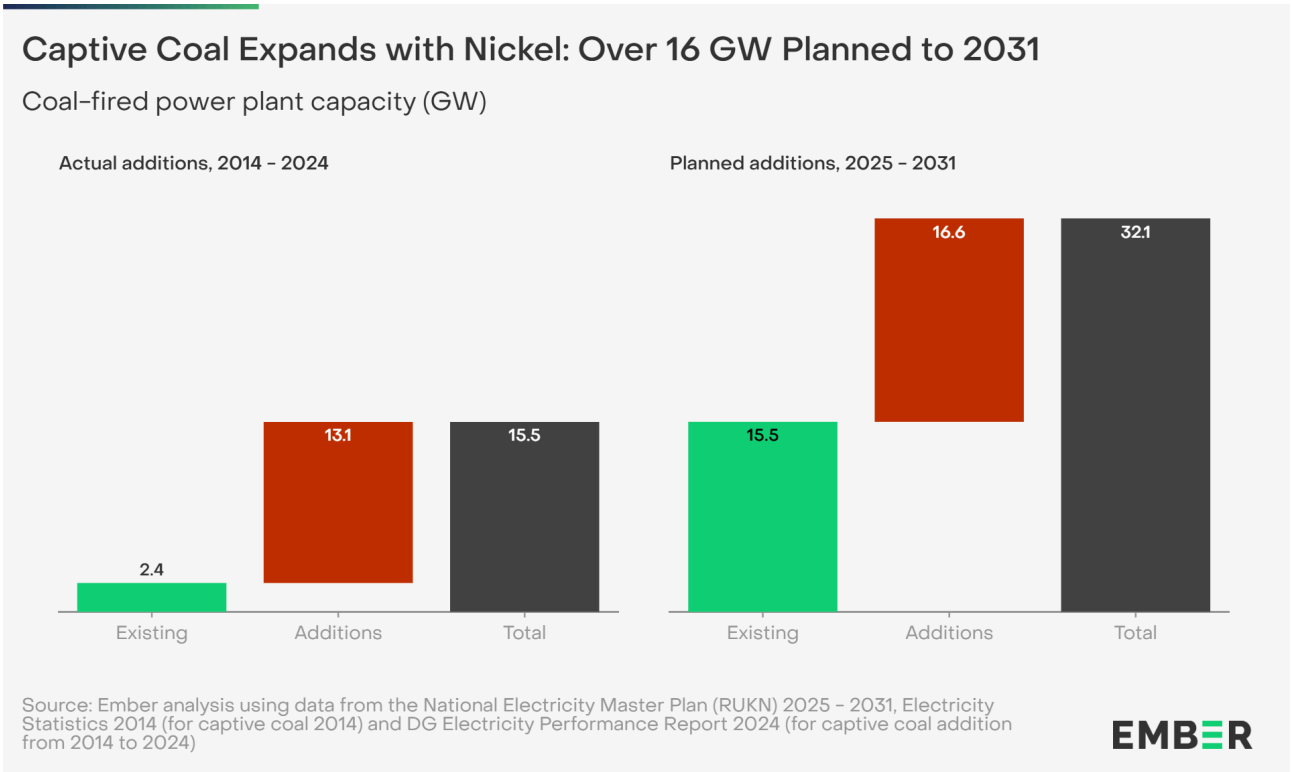
Chapter 2

Captive coal power in Indonesia's nickel sector: scale of the challenge

Captive coal power – dedicated coal-fired power plants built by industries to power factories, industrial parks, or mining operations – often operates outside regulatory oversight, sidestepping efficiency standards and emissions regulations. Indonesia's industrial sector, particularly mineral processing, has long relied on localised captive coal power to meet surging energy demand. Since 2015, this dependence has deepened dramatically: roughly 80% of Indonesia's captive coal capacity was built after 2014, with much of this growth concentrated in North Maluku and Sulawesi (Zhu et al., 2023).

By 2024. Indonesia operated 15.5 GW of captive coal capacity, with more than 65% serving smelters. Even more alarmingly, another 5 GW is already in the pipeline for smelter use by 2026, pointing to continued rapid expansion (Coordinating Ministry of Maritime and Investment Affairs, 2024).

Looking further ahead, the National Electricity Master Plan (RUKN) compounds this trajectory, anticipating over 16 GW of additional captive coal capacity by 2031 to support mineral processing – even as it also projects a substantial rise in renewable energy (Setiawan, 2025). If realised, Indonesia's captive coal capacity would more than double within seven years, surpassing 32 GW. To put this scale into perspective, 32.1 GW of captive coal would be almost equivalent to the entire coal fleet of Germany (32.3 GW in 2024). It would also surpass the total coal capacity of Vietnam (27.2 GW in 2024), Southeast Asia's second-largest coal generator.



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Chapter 3

Why captive coal exists: historical roots and transition challenges

Drawing on consultations with experts, supplemented by literature and statistics, this chapter examines the historical roots of Indonesia's reliance on captive coal power in nickel processing (Section 3.1), as well as the current barriers to reducing this reliance (Section 3.2).

3.1 Historical evolution: From resource nationalism to captive coal

3.1.1 The downstream turn in Indonesia's resource nationalism

Indonesia's push to process nickel at home reflects a broader shift towards resource nationalism — using its mineral wealth to build domestic industries rather than relying on raw exports. For many years, Indonesia followed a liberal model dominated by foreign mining firms, supported by pro-investment policies. However, the commodity boom of 2003–2011 prompted the country — as in many

other resource-rich nations — to adopt restrictive trade measures to capture greater value from its mineral wealth (Warburton, 2024).

The 2009 Mining Law (Law No. 4/2009 on Mineral and Coal Mining) cemented this strategic shift by mandating domestic mineral processing. Subsequent policies – including the Masterplan for Acceleration and Expansion of Economic Development 2011-2025 (MP3EI), the Industry Law (No.3/2014), and the Amendment to the Mining Law (Law No.2/2025) – further reinforced this framework through non-tariff measures and fiscal incentives such as VAT exemptions, export duty waivers, income tax holidays, and reduced mining loyalties. These measures specifically targeted downstream mineral sector development, with the aim of transitioning Indonesia towards value-added production while reducing dependence on raw commodity exports (Warburton, 2019).

The nickel export ban became the centrepiece of this strategy (Terauds, 2017). Exports of high-grade ore (≥1.7% nickel content) were prohibited from 2014, while low-grade ore (<1.7%) was initially permitted. A temporary relaxation in 2017 allowed limited exports under specific conditions, such as commitments to build smelters (Warburton, 2017). Soon after, the government advanced its schedule and imposed a comprehensive ban on all raw nickel ore exports effective January 1, 2020, regardless of grade. From that point onwards, only processed products such as ferronickel, nickel pig iron (NPI), and later mixed hydroxide precipitate (MHP) have been eligible for export.

The global electric vehicle (EV) boom gave new momentum to Indonesia's downstream ambitions. Policymakers sought to position the country as a hub for lithium-ion battery production (Mance, 2024). Two major legal reforms in 2020 reinforced this path: the Amendment to the Mining Law (Law No. 3/2020), which extended mining rights and reaffirmed domestic processing requirements, and the Omnibus Law on Job Creation (Law No. 11/2020), which consolidated more than seventy regulations, streamlined land acquisition and permitting, and introduced generous tax incentives for designated strategic projects, including high-value nickel refining(Warburton, 2024).

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3.1.2 Nickel investment boom, led by China

The downstream strategy successfully attracted significant investment in nickel refining, with Chinese companies playing the leading role. By late 2021, Indonesia had its first HPAL smelter online. By the end of 2023, Chinese firms — led by Tsingshan Holding Group and Jiangsu Delong Nickel Industry — accounted for about three-quarters of the country's smelting capacity (Mining Technology, 2025), producing more than 85 percent of battery-grade nickel (Zhang, 2024).

Experts noted that this expansion was not only the result of policy incentives. Indonesia's domestic nickel ore prices, below international levels during the 2020–2022 price surge, created additional incentives to Chinese firms to expand locally. At the same time, China's role reflected its structural dependence on Indonesian ore. Before the 2014 export ban, Indonesia supplied about half of China's nickel ore imports (SMM, 2019). Several experts emphasised that this strong market dependence helps explain why downstream strategy has been effective in nickel but far less so in other minerals.

The 2023 bauxite export ban has so far attracted limited investment, largely because Indonesia does not enjoy the same degree of global leverage. This contrast, experts argued, illustrates that the effectiveness of resource nationalism depends not only on policy design but also on a country's market share and strategic positioning within global supply chains.

3.1.3 Captive coal behind downstreaming

Yet the success of nickel downstreaming has come with a significant cost. The rapid proliferation of smelters has been accompanied by a parallel expansion of captive coal power plants, which now provide most of the electricity for nickel processing.

Experts noted that this reliance reflects both resource availability and system constraints. Indonesia has abundant domestic coal reserves and well-established logistics networks, making coal the most reliable option. Coal plants also have the advantage of being built within just a few years and can provide stable power needed for energy-intensive smelting.

Many smelters are sited in resource-rich coastal areas of Sulawesi and Halmahera where local electricity demand is thin; a single smelter's load can dwarf the surrounding grid. Because PLN's planning cycle takes years to register such site-specific demand – and grid reinforcements may take even longer – waiting for the national grid is often incompatible with project timelines.

Developers therefore often turn to captive plants under PPU (private power utility) licences to secure firm power quickly.

By contrast, renewable energy faces significant constraints in meeting the scale and reliability required for nickel processing. Many smelters are located in remote areas across Sulawesi and Halmahera, where the national grid is weak. Experts suggested that, in principle, industrial development could be strategically located closer to renewable resources, but in practice this is constrained by geography, infrastructure, and land availability.

In Sulawesi, experts observed that hydropower and wind are less viable, given low water resources and low wind speeds in certain areas. Solar power holds greater potential but faces land acquisition challenges, as much of the land is classified as protected forest or already used for mining. In addition, deploying solar on a large scale would affect the land of peasants and Indigenous peoples, raising concerns about livelihoods and biodiversity.

Another key barrier is the long lead time for renewable projects, particularly hydropower. One expert explained that a coal-fired power plant can be built in two to three years, whereas a hydropower project often takes up to ten years once permitting, land acquisition, and supporting infrastructure such as roads in remote areas are factored in.

3.2 Difficulties in aligning downstreaming with decarbonisation goals

The above-noted barriers to deploying renewable energy at the scale required for nickel processing are real and significant, but they are not unique to Indonesia. Many countries face similar challenges: renewables can be intermittent, land-intensive, and slower to develop compared to coal. Yet there remain viable solutions for promoting greener mineral processing – such as improving efficiency through industrial clustering, integrating renewables directly into industrial parks, and developing systems that combine multiple energy sources.

The critical factor is whether policies, planning, and implementation are designed to unlock these solutions. So far, substantial gaps in these areas have limited progress.

Barriers to reducing the reliance on captive coal

Policy	Carbon neutrality targets not fully integrated into sector policies
	PR 112/2022 & MEMR 10/2025: phased coal exit but exemptions for smelter-linked coal
	Green Finance Taxonomy classifies coal used for critical minerals as "transition finance"
Planning	Limited coordination between energy and industrial planning agencies
	Site planning limits effective infrastructure sharing
Implementation	Coal interests influence policy
	Capacity gaps in central agencies
	Challenges in coordination between central and local authorities

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3.2.1 Policy gaps

Several experts highlighted that Indonesia's carbon neutrality pledge has not yet been fully integrated into its resource sector policies. While the government has set ambitious transition targets, in practice the downstreaming agenda – especially in nickel – continues to rely heavily on captive coal power.

Indonesia's main policy framework for energy transition rests on Presidential Regulation (PR) No. 112/2022, later supplemented by Ministry Regulation No. 10/2025 on the Electricity Transition Roadmap. Together, these policy documents set out a phased retirement of coal-fired power plants, conditional on international support, and reaffirm a moratorium on new conventional coal power. However, they also carve out exemptions for captive coal plants classified

as National Strategic Projects, widely understood to include smelter-linked power stations in the nickel sector.

These regulations further require new coal plants to achieve a 35% reduction in emissions by 2030 relative to the 2021 baseline average and mandate a full coal phase-out by 2050. Experts noted, however, that implementation remains unclear – from how the 35% reduction will be calculated, to how compliance will be monitored and enforced, to what pathways will guide the eventual phase-out of captive coal.

In addition, the Green Finance Taxonomy, introduced as an update to the 2022 sustainable finance guidebook, classifies coal power as a "transitional" investment when it supplies the mining or processing of minerals deemed critical to the energy transition, such as nickel. This classification allows banks and investors to continue financing coal projects for smelters under the label of "transition finance." Several experts expressed concern that this risks legitimising new coal investment and, in doing so, weakening incentives for renewable energy deployment in industrial operations.

3.2.2 Planning issues

Apart from these policy gaps, significant planning challenges remain in aligning decarbonisation goals with industrial development. At the macro level, one expert familiar with Indonesia's planning process observed that, while renewable energy sources can often be identified for industrial parks, their effective deployment requires better coordination between energy development and industrial planning. According to this expert, such coordination is often complicated by the shared responsibilities for planning and approval across multiple public agencies, particularly the Ministry of Energy and Mineral Resources (MEMR) and the Ministry of Industry (MoI).

The recent establishment of the National Downstreaming and Energy Security Task Force under Presidential Decree No. 1/2025 — bringing together central agencies responsible for industry, energy, finance, and planning, alongside

state-owned enterprises — may represent a step towards improving coordination between energy and industrial planning. However, critical questions remain. To what extent does the Task Force have the capacity and political will to enforce alignment across ministries? And with its overarching goals framed primarily around downstreaming and energy security, will its work ultimately prioritise keeping smelters powered – thereby perpetuating reliance on coal – over advancing decarbonisation?

At the micro level, planning issues emerge within industrial parks themselves. One expert explained that when multiple plants operate in an industrial area, each industrial consumer typically relies on its own captive power plant rather than sharing energy infrastructure. A key reason is regulatory: most captive power operators hold own-use licenses, which are easy to obtain but restrict electricity generation to self-consumption. These licenses do not permit operators to supply power to other users, even when shared arrangements could reduce duplication and enable more efficient use of renewable energy.

3.2.2 Implementation challenges

Even with strong policies and ambitious targets on paper, experts noted that significant questions remain about how Indonesia can effectively implement its energy transition within the context of nickel downstreaming. Three areas, in particular, were highlighted: the influence of coal interests, the governing capacity of central agencies, and the balance of responsibility between central and local authorities.

Indonesia's coal sector has long been politically influential, benefiting from subsidies and established supply chains. This raises the question of how far coal interests will shape the interpretation and implementation of transition policies in nickel processing. For example, will measures such as "transition finance" be used primarily to legitimise continued investment in coal, rather than to accelerate a genuine shift to clean energy? Can regulatory enforcement overcome the political and economic weight of the coal industry, or will coal's entrenched position continue to slow the transition?

A second concern relates to the governing capacity of central agencies. Do they have the financial resources, technical expertise, and institutional authority to translate policy frameworks and planning documents into real progress on the ground? Or will capacity gaps limit their ability to guide and enforce a coherent transition pathway? Experts also pointed out that mandates are often fragmented across ministries, and a lack of coordination may further hinder implementation.

Finally, there is the question of how responsibilities are shared between central agencies and local authorities. Central agencies often require active support from local governments to translate national policy into action on the ground. While mining approvals are now centralised under the 2020 Mining Law amendment, local authorities still play important roles in enabling nickel processing projects, particularly through land-use planning, construction and environmental permits, and managing relations with local communities. This raises a series of questions: To what extent can national agencies secure cooperation from local governments? And do local authorities have the technical and institutional capacity to assume their allocated responsibilities?

Chapter 4

Strategic choices for Indonesia's nickel transition: pathways and actions

Drawing on expert insights, the previous chapter traced the roots of Indonesia's reliance on captive coal power, showing how resource nationalism, downstreaming strategies, and structural constraints on renewable deployment combined to make coal the most attractive option for powering nickel processing — leading to today's reliance on captive coal power.

Nevertheless, this dependence is not set in stone. A range of solutions for reducing it exists, from improving efficiency through industrial clustering, to integrating renewables directly into industrial parks, to deploying hybrid systems that combine multiple energy sources. Yet their effectiveness has so far been limited by policy, planning, and governance challenges, as discussed in the previous section.

At the same time, the broader context is shifting. International market pressures, rapid technological advances, and evolving domestic policies are reshaping the

landscape of possibilities for cleaner industrialisation. Meanwhile, domestic economic headwinds – including slower-than-expected GDP growth and weak household consumption – together with rising trade pressures, are placing greater demands on public resources to address short-term challenges. This risks diverting attention and funding away from longer-term decarbonisation priorities.

Against this backdrop, Indonesia now faces a set of strategic choices that will determine the trajectory of its nickel transition. This chapter explores those choices (Section 4.1) and outlines suggested actions (Section 4.2) for different stakeholders, aimed at better aligning Indonesia's downstream industrial ambitions with long-term environmental sustainability and socio-economic prosperity.

4.1 Indonesia's nickel at a crossroads: Green Opportunism or Green Developmentalism?

Indonesia's nickel sector stands at a critical juncture. For decades, climate action in developing Asia was framed as a trade-off – an environmental imperative demanding economic sacrifice. The prevailing narrative of "climate sobriety" emphasised restraint over economic growth (Balzani, 2019), fostering reluctance among policymakers in Asia's fast-growing economies. Many feared stringent climate goals would stifle poverty alleviation and economic progress, particularly in resource-reliant economies like Indonesia. This hesitancy was further exacerbated by the "free-rider" problem: countries deferred action, expecting others would assume the costs of decarbonisation, weakening collective momentum (Leo & Singh, 2022).

At its core, this stalemate reflects an ethical paradox: How can developing nations reconcile their legitimate aspirations for prosperity with the reality of finite planetary boundaries? Politically, resolving this challenge is fraught. People across the Global South demand higher living standards, not austerity. Yet

clinging to the “grow first, clean up later” model — once pursued by Western and East Asian economies — now risks climate catastrophe.

The booming global clean energy market has transformed this calculus. Between 2020 and 2024, investment in renewable energy, grid infrastructure, electrified heating, and electric vehicles (EVs) more than doubled, surpassing $2 trillion (Bloomberg NEF, 2025). This surge has catalysed a paradigm shift: climate action is no longer seen as a constraint but as an engine of development. For Indonesia, the opportunity is clear. Holding nearly half of the world’s nickel reserves, the country is strategically positioned to develop high-value battery materials and build an integrated EV supply chain.

Against this backdrop, two possible pathways lie ahead.

The first pathway, **green opportunism**, builds on the country’s vast nickel reserves and fast-growing downstream sector to capture immediate economic gains while leaving the structure of the industry — and its coal-heavy power base — largely intact. Smelters and refineries would continue to rely on captive coal plants, supported by regulatory exemptions that favour coal as the fastest and most scalable source of energy.

In the short term, this approach may deliver rapid industrial growth and new battery manufacturing capacity. Some countries and investors may even tolerate or overlook environmental concerns in pursuit of geopolitical advantages, energy security, or near-term economic priorities.

Yet the risks are substantial. By locking in carbon-intensive development, Indonesia could undermine its decarbonisation goals, face reputational costs, and lose long-term competitiveness in increasingly climate-sensitive markets. With mechanisms like the EU’s Carbon Border Adjustment Mechanism and the forthcoming EU battery passport set to discourage high-emissions products, EVs and batteries using coal-powered nickel may find themselves excluded from premium markets.

The second pathway, **green developmentalism**, treats decarbonisation not as a constraint but as a lever for building future-oriented industrial competitiveness. Here, industrial expansion would be deliberately aligned with energy transition goals, embedding a phased reduction of captive coal into downstream planning and prioritising the integration of clean energy and energy efficiency solutions. These measures would include developing captive renewable projects linked to industrial parks, investing in grid reinforcement to deliver clean power more reliably, and promoting infrastructure sharing to reduce costs and improve efficiency.

This pathway would position Indonesia to benefit from the growing climate sensitivity of global supply chains. With international buyers, particularly in the EV and battery sectors, increasingly demanding transparency and low-carbon production, the transition to green nickel would secure a long-term competitive edge.

Deploying renewable-based captive systems for industrial parks would also create domestic markets for clean technologies, providing a critical hedge against external volatility that could otherwise derail the country's booming clean tech manufacturing sectors, such as solar panel production. This could help set in motion a positive feedback loop: early gains in clean manufacturing and job creation would strengthen domestic constituencies in support of the broader energy transition, gradually weakening the political influence of entrenched coal interests. When people experience the benefits first-hand, they are far more likely to trust in – and commit to – its transformative potential.

4.2 From pathways to progress: Securing strategic commitment

As outlined in the previous section, Indonesia's nickel industry faces two diverging pathways: green opportunism, which prioritises immediate gains while locking in coal dependence, and green developmentalism, which aligns industrial growth with long-term decarbonisation and competitiveness.

Encouragingly, there are signs that Indonesia is beginning to move in the direction of green developmentalism. In 2025, the government launched the Indonesian Nickel Industry Decarbonisation Roadmap, which targets an 81% reduction in sectoral emissions by 2045. A key element of this roadmap is reducing reliance on captive coal power through a combination of efficiency improvements, fuel switching, and accelerated deployment of renewable energy (WRI Indonesia, 2025).

In parallel, multiple stakeholders – from international development agencies to think tanks and research institutes – have produced studies exploring transition pathways, financial incentives, and regulatory changes needed to promote cleaner nickel processing. Meanwhile, some industry players have begun piloting renewable integration projects, and public debates around "green nickel" as a premium product in global supply chains are gaining traction.

Taken together, these trends suggest an emerging recognition that downstream growth must be made compatible with long-term sustainability. Yet, despite this progress, significant challenges remain. Decarbonising Indonesia's nickel processing sector is not straightforward. It requires ensuring that renewable energy is available at the right scale and cost in the regions where nickel smelters are concentrated – often remote areas with weak grids and difficult geography. Equally, it involves managing the complex tasks of balancing short-term industrial expansion with long-term transition goals, addressing the entrenched influence of coal interests, strengthening governance capacity, and improving coordination between central agencies and local authorities.

This complexity underscores the need for a strong and sustained strategic commitment. Many technical solutions and policy recommendations have already been articulated in existing studies and initiatives. What is often missing, however, is the political commitment to pursue them consistently.

Building this commitment means recognising that energy transition and decarbonisation — of which nickel processing is a crucial component — are not

merely environmental imperatives. They represent a strategic pivot to reimagine Indonesia's development model: aligning socio-economic progress with long-term sustainability and securing industrial competitiveness in an increasingly climate-sensitive global economy. Viewed in this way, immediate challenges should be seen as hurdles to be overcome in pursuit of higher goals, rather than as excuses for delay – or worse, inaction.

Fostering a strategic commitment to Indonesia's nickel transition

Roles and actions across research, industry, government and partners

Stakeholder	Suggested actions
Think Tanks & Research	• Frame decarbonisation as industrial competitiveness
	• Shift narrative: from "environmental cost" to "future competitiveness"
	• Model decarbonisation pathways to provide evidence for the narrative shift
External Partners	• Integrate green nickel into trade & development agendas
	• Support premium positioning in global markets
	• Facilitate exchanges with countries pursuing low-carbon transition
External Partners	• Endorse green development publicly
	• Promote low-carbon nickel in supply chains & trade forums
	• Attract investors & secure contracts
Public Agencies	• Embed green nickel into regulations & planning
	• Enforce emissions targets (ETS)
	• Strengthen cross-agency coordination
	• Align ecosystem behind decarbonisation goals

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But building such commitment requires a coalition of actors to shift narratives, embed clear targets, and mobilise resources. Suggested actions to help foster such commitment are:

- **Think tanks and research institutes**: Develop and publish studies that frame nickel decarbonisation as a foundation for Indonesia's future industrial competitiveness and economic resilience, highlighting its links to job creation, industrial upgrading, and long-term sustainable development. To reinforce these messages, convene dialogues with government and industry to help shift the narrative from "environmental cost" to "future competitiveness."

  These efforts must be grounded in solid evidence, which requires conducting modelling studies on decarbonisation pathways for nickel processing under different policy scenarios. By quantifying socio-economic co-benefits such as employment, regional development, and reduced trade risks, such studies can provide the credibility needed to inform government planning and shape investor dialogues.

- **External partners (international donors, development banks, partnering countries)**: Reinforce the strategic framing of nickel decarbonisation as a pathway to long-term competitiveness by integrating it into regional dialogues, trade discussions, and development cooperation agendas. Support Indonesian policymakers and industry leaders in positioning "green nickel" as a premium product in international markets – for instance, by linking it to free trade agreements on green products. Facilitate high-level exchanges with other countries undertaking similar transitions to build confidence that decarbonisation is not an environmental concession, but a strategic investment in future competitiveness.

- **Industrial players (nickel, batteries, EV and related sectors):** Publicly endorse a green developmental pathway, positioning "green nickel" not as an environmental compliance cost but as a competitive advantage for Indonesia's downstream industries. Industrial players can also take the lead in international branding, promoting Indonesia's commitment to

low-carbon production in trade fairs, supply chain dialogues, and investment forums.

In doing so, they reinforce the perception of Indonesian nickel as "future-proof," helping to attract new investors, secure long-term contracts, and strengthen Indonesia's reputation as a reliable supplier in increasingly climate-sensitive markets.

- **Public agencies**: They could anchor "green nickel" as a pillar of future competitiveness and hard-wire it into regulation, planning, and investment rules. Concretely, issue derivative regulations to operationalise the Presidential Regulations – requiring captive coal operators to meet declining emissions targets – and launch Phase II of the ETS to cover captive power with enforceable compliance.

  Do this alongside stronger cross-agency coordination so narratives and rules are consistent, giving investors and international partners confidence that a cleaner industrial base is a long-term, credible priority. In turn, the whole ecosystem – from state-owned enterprises to private investors – can align behind the goal.

Chapter 5

Supporting indonesia's sustainable nickel transition: the role of china

Indonesia's choices and commitment will ultimately determine the trajectory of its nickel sector. Given the scale of Chinese participation in this industry and its connected supply chains, Chinese stakeholders can play an important role in shaping what is possible — both by sharing lessons from their own experience and by helping to lower barriers to Indonesia's shift towards greener development.

5.1 China's transition experience: From fossil dependence to clean competitiveness

China's own experience with climate action and energy transition offers a useful point of reference. Its rapid industrial rise was initially powered by fossil energy, but by the 2010s the mounting costs – import dependence, pollution, and record emissions – prompted a fundamental rethinking of its growth model.

Oil import dependence has exceeded 70% since the mid-2010s, and about 40% of gas is imported, exposing China to supply and price risks. In response,

policymakers doubled down on domestic coal as a short-term solution to energy security — a logic captured in the well-worn phrase "rich in coal, short of oil, and low in gas."

Yet even coal is increasingly constrained. By the end of 2021, China's proved coal reserves were estimated at 208 billion tonnes (Yan, 2023), while annual consumption reached 4.9 billion tonnes in 2024 (Yan, 2025). So even assuming full extractability, current reserves might only last another 30 to 40 years at current rates of use. Although advances in mining technology may extend this horizon, relying on coal as the backbone of long-term energy security entails significant uncertainty.

Meanwhile, the environmental and social costs of fossil-fuelled growth became undeniable. Despite decades of efforts to improve energy efficiency and control pollution, hazardous smog, degraded ecosystems, and record emissions revealed the limits of conventional measures. These environmental issues have also triggered widespread social concern, further reinforcing the urgency for change.

It was in this context that China embarked on a more fundamental transformation. The energy transition was no longer seen as a rhetorical gesture or incremental adjustment, but as a critical lever for redefining development itself. Decarbonisation was reframed not as a constraint, but as a driver of international competitiveness, industrial upgrading, and long-term economic resilience.

The vision is now institutionalised in the "1+N" framework: a high-level roadmap for peaking emissions before 2030 and achieving carbon neutrality before 2060, supported by sectoral and regional action plans. Through this framework, climate goals have been systematically embedded into planning, regulation, and investment across the economy, mobilising state-owned enterprises, private companies, and financial institutions alike to capture value from the clean energy transition.

For Indonesia, the lesson lies not in replicating China's pathway, but in considering its underlying logic: a fossil-fuelled growth model has diminishing returns, while building future-oriented competitiveness depends on making a decisive pivot towards a clean economy.

5.2 Practical avenues to explore

Indonesia's nickel transition will be a defining test of whether resource-based industrialisation in the 21st century can be aligned with climate goals and future prosperity. As Indonesia's most important partner in this sector, China can help tip the balance. The ideas below are not prescriptions; they are feasibility questions and pilot-ready avenues Chinese stakeholders could consider or investigate with Indonesian counterparts.

Coal to competitiveness

Practical avenues for China in supporting Indonesia's sustainable nickel transition

	Practical avenues
Prove: Make "Green Nickel" Competitive	Co-develop park-level transition plans
	Compare captive-to-clean options
	Quantify co-benefits
	Establish a China–Indonesia Green Nickel Observatory
Pull: Shape the market with rules and demand	Embed green nickel in regional cooperation frameworks
	Reaffirm details of the "no new overseas coal" commitment
	Condition finance on renewables-first storage-ready projects
	Explore mini-lateral cooperation on standards & ESG
	Use offtake MOUs & transition-linked finance tied to verified emission cuts
Partner: Build capacity to deliver	Provide technical assistance to operationalise mandates
	Design ETS Phase II for captive power
	Run grid-integration clinics
	Co-develop supplier & workforce training

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5.2.1 Prove: make “green nickel” a competitiveness case

Chinese think tanks and research institutes: Co-develop park-level transition plans with Indonesian partners for hubs such as Morowali and Weda Bay, comparing captive-to-clean options (e.g., solar + BESS microgrids, hybridising existing captive coal as interim backup, staged grid reinforcement) and quantifying co-benefits (jobs, export-risk mitigation, financing costs).

In parallel, consider establishing a China–Indonesia Green Nickel Observatory to benchmark plant-level emissions intensity and track buyer requirements (battery passports, CBAM-type rules), issuing concise briefs for policymakers and industry.

Together, these actions provide the evidence and market signals needed to position “green nickel” as a strategic lever for future competitiveness – opening premium markets, securing long-term offtake, lowering capital costs, and de-risking downstream development.

5.2.2 Pull: shape the market with rules and demand

Chinese public agencies: Weave green nickel into the regional rulebook by championing dedicated “green minerals” tracks in regional cooperation frameworks, helping to mainstream the idea that green development underpins future competitiveness. For example, could major regional initiatives such as the Regional Comprehensive Economic Partnership (RCEP) be mobilised to support a sustainable nickel transition through a free trade clause for green nickel products?

Consider publicly reaffirm that China’s “no new overseas coal” commitment explicitly includes captive coal for industrial parks and smelters; reflect this in “going-out” guidance and green-finance taxonomies, and condition official

finance/insurance on renewables-first, storage-ready projects with verifiable intensity-reduction pathways.

Explore mini-lateral cooperation (e.g., Australia–China–Indonesia) that pairs China's manufacturing scale with regional strengths in standards, permitting, ESG assurance, and co-financing – turning principles into bankable, interoperable rules. Key questions include: While China brings the "hard" technological know-how, the "soft" institutional architecture – rules, standards, and incentives – also needs to be built to guide industry behaviour. Can other regional economies contribute to this regard? For example, could Australia, with its expertise in sustainable mining and high standards, help strengthen this partnership and support the development of regional rules for change?

Chinese buyers/off takers & finance enablers: Consider signing offtake MOUs indexed to declining emissions intensity with third-party verification to anchor investment. In parallel, consider offering transition-linked credit/insurance that rewards verified intensity reductions and supports park-level clean energy solutions.

5.2.3 Partner: build the capability to deliver

Cross-stakeholder technical assistance to operationalise existing mandates (derivative regulations with declining emissions-intensity targets for captive coal) and to design ETS Phase II covering captive power with robust MRV (measurement, reporting and verification). Run targeted grid-integration clinics for Sulawesi/Halmahera (storage dispatch, weak-grid operations, industrial demand response). Co-develop supplier and workforce training programmes (O&M for solar plus battery, MRV, safety) to localise capability along a lower-carbon nickel/battery supply chain.

5.3 Why act now?

While a fossil-fuelled growth model may still deliver short-term gains, it is rapidly becoming unsustainable – economically and environmentally. Global markets

are turning more climate-sensitive, with investors, trading partners, and consumers demanding lower-carbon products and tightening restrictions on high-emissions supply chains. At the same time, intensifying climate risks – from extreme heat and wildfires to floods and droughts – are driving up adaptation and recovery costs, straining public finances and stretching already limited resources.

The choice is whether to wait until these pressures become overwhelming, or pivot proactively and capture first-mover gains. A near-term proof point is within reach: pick one park, launch one 200–500 MW solar-plus-battery storage pilot, and lock in one intensity-indexed offtake. Prove it once – then scale.

This playbook also aligns with China's push for net-zero industrial parks. If even a single nickel hub is rebuilt as an integrated clean-power ecosystem – pairing solar-plus-storage with electrified processes and co-locating upstream battery materials, cell production, and EV assembly – it could serve as a China-branded flagship: evidence that China is leading, not lagging, on climate action. More importantly, it would set a clear regional benchmark on emissions intensity, transparency, and cost that others can follow and improve upon.

References

Balzani, V. (2019). Saving the planet and the human society: renewable energy, circular economy, sobriety. Substantia, 3, 9–15.

Bloomberg NEF. (2025). Energy Transition Investment Trends 2025. https://about.bnef.com/energy-transition-investment/

Coordinating Ministry of Maritime and Investment Affairs. (2024). Clean energy transition in Indonesia captive power sector. https://jetp-id.org/news/jetp-kicks-off-captive-power-study-for-cipp-update-2024

Leo, U., & Singh, N. (2022). Why the planet needs legally binding obligations to limit climate-mitigation "free-riders." https://www.weforum.org/stories/2022/06/incentives-free-rider-problem-climate-change-mitigation/

Mance, A. (2024). Nickel Nationalism: Resource Downstreaming and the Attainment of Golden Indonesia 2045. https://www.internationalaffairs.org.au/australianoutlook/nickel-nationalism-resource-downstreaming-and-the-attainment-of-golden-indonesia-2045/

Mining Technology. (2025). China's control over 75% of Indonesia's nickel capacity raises concerns.

https://www.mining-technology.com/news/chinas-indonesias-nickel-capacity/?cf-view

Setiawan, D. (2025). Captive coal expansion plan could undermine Indonesia's climate goals. https://ember-energy.org/latest-insights/captive-coal-expansion-plan-could-undermine-indonesias-climate-goals/

SMM. (2019). Advanced Indonesia export ban threatens China's nickel ore, NPI shortage in 2020. https://news.metal.com/newscontent/100967996/Advanced-Indonesia-export-ban-threatens-China/

Terauds, K. (2017). Using trade policy to drive value addition: Lessons from Indonesia's ban on nickel exports. https://unctad.org/system/files/non-official-document/suc2017d8_en.pdf

Warburton, E. (2017). The life and death of Indonesia's mineral export ban. https://www.insideindonesia.org/editions/edition-130-oct-dec-2017-2/the-life-and-death-of-indonesia-s-mineral-export-ban

Warburton, E. (2019). A new developmentalism in Indonesia? . In H. Hill & S. D. Negara (Eds.), The Indonesian economy in transition: Policy challenges in the Jokowi era and beyond (pp. 34–56). Yusof Ishak Institute.

Warburton, E. (2024). Nationalist enclaves: Industrialising the critical mineral boom in Indonesia. The Extractive Industries and Society, 20, 101564. https://doi.org/10.1016/j.exis.2024.101564

WRI Indonesia. (2025, June 12). Kementerian PPN/Bappenas dan WRI Indonesia Memastikan Integrasi Dekarbonisasi Industri Nikel untuk Pembangunan Rendah Karbon.

https://wri-indonesia.org/id/berita/kementerian-ppnbappenas-dan-wri-indonesia-memastikan-integrasi-dekarbonisasi-industri-nikel

Yan, Z. (2023, September 8). **煤炭开采对环境的影响可以减小**. China Energy News. https://paper.people.com.cn/zgnyb/html/2023-09/08/content_26016932.htm

Yan, Z. (2025, February 28). **从煤炭供需变化浅谈2025年煤价走势**. Coal Market Research Report. https://m.bjx.com.cn/mnews/20250228/1429697.shtml#:~:text=%E6%8D%AE%E4%B8%AD%E5%9B%BD%E7%85%A4%E7%82%AD%E5%B7%A5%E4%B8%9A%E5%8D%8F%E4%BC%9A,%E5%90%A8%E4%BB%A5%E4%B8%8A%E7%9A%84%E5%B9%B3%E5%8F%B0%E6%9C%9F%E3%80%82

Zhang, M. (2024). Strategic realignments: Indonesia's strategic shift in the EV supply chain—What are the ramifications for Australia? https://www.internationalaffairs.org.au/australianoutlook/strategic-realignments-indonesias-strategic-shift-in-the-ev-supply-chain-what-are-the-ramifications-for-australia/

Zhu, M., Lou, Z., Cui, R., Cheng, X., Li, S., Li, D., Tumiwa, F., Arinaldo, D., Li, W., & Hultman, N. (2023). Decarbonizing captive coal power plants in Indonesia and implications for Chinese stakeholders: Trends, challenges and opportunities. https://spp.umd.edu/research-impact/publications/decarbonizing-captive-coal-power-plants-indonesia-and-implications

Appendix A

Approach to collecting expert insights

The Chapter 3 of the report draws on two rounds of expert consultations conducted in March-April 2025 and June 2025.

The first round combined online and in-person discussions with 10 experts from think tanks, research institutes, multilateral organisations, and the energy industry. Consultations were semi-structured and exploratory, designed to facilitate open conversation rather than prescriptive responses. Guiding questions centred on three broad themes: 1) barriers to deploying renewable energy in nickel processing; 2) factors underpinning coal's attractiveness in the sector; and 3) options for cleaner energy integration, and why they remain difficult to implement.

The second round, held in June, built on this feedback, refining and deepening the analysis. During this process, a summary report synthesising the discussions was shared with 18 experts, including some participants from the first round, to validate interpretations and gather additional insights. This process also provided a degree of peer review and triangulation, helping ensure that findings reflected expert perspectives.

To supplement these insights, the research also incorporated a review of relevant literature and statistical data, enriching the discussion and situating expert views within a broader body of evidence.

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Photo

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