

Critical minerals & green industrialization: Lessons from Indonesia

Riandy Laksono

CSIS Indonesia

RIETI-ANU Symposium on Remaking Supply Chain, Tokyo

8 October 2026



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STRATEGIC AND
INTERNATIONAL
STUDIES

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- 3 Challenges of green industrialization for global south
- 4 Way forward

Introduction

Leveraging critical minerals to pursue green industrialization



"Green" industrial policy, not so green?

- Mineral-rich developing countries increasingly see their critical minerals sector as a tool for advancing green industrialization:
 - leverage mineral deposit to strengthen position in the emerging clean-tech (& advanced-tech) manufacturing supply chain, and
 - build sustained (green) industrial capability (break THE curse).
- Indonesia is the poster boy → policy intervention + Chinese investment in nickel processing boosted local GDP (Warburton, 2024), and manufacturing jobs (Bosker et al., 2025).
- But what is often missing here is prioritization. Government may not be able to attain all objectives at once.
 - Mineral downstreaming vs EV investment
 - Local value-addition vs reducing strategic vulnerabilities
 - Smelter vs protecting local environment
- **My central argument:** there is more ambition than the actual space to do (green) industrialization given today's trade landscape. A more realistic approach is needed!

Indonesia's nickel policy and some results

The evolution of Indonesia's nickel policy: tighter state control



From nickel ore to downstream products: a policy mix

Early Downstreaming Phase

Domestic Processing Mandate	Processing obligation	UU 4/2009
Nickel Ore Export Ban	Export restriction	PP 1/2014 → Permen ESDM 11/2019
Tax Holiday	Tax / investment incentive	PMK 130/2020

Battery Minerals

Mineral Benchmark Price	Price Regulation	Kepmen 363/2026
*Royalty	Fiscal / Resource rent	PP 19/2025 → Permen ESDM 11/2019
Exp Tax on Low-Grade Nickel ore	Fiscal	Draft → expected timeline 2027

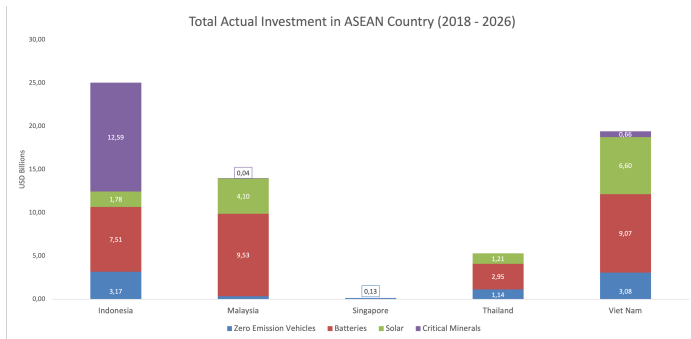
Electric Vehicles

**BEV Development	LCR for EV & Tax Incentive for Imported Component	Perpres 79/2023
VAT Cut for EV Purchase	Fiscal	PMK No. 12/2025
OEM Investment	Investment incentive	Permeninves/BKPM No. 1/2024

***Royalty:** Different rates based on processing technology. Higher-grade ore (saprolite) incurs a **14%–19%** progressive rate. Low-grade ore (limonite) receives a flat **2.00%** incentive to support the green industry.

****The local content requirement** has been postponed until 2026, and it will only be increased to 60% in 2027

Investment in clean technology is still lacking



Source: Rhodium database

Note: actual investment (foreign & direct)

- Indonesia has a mixed result. Investment comes into some clean-tech sector, but not as much as one would have hoped given the abundance of nickel (see battery and EV investment).
- Investment is still dominated by mineral processing, which is more energy-intensive and capital-intensive.
- Yet, most nickel processing capacity serves steel industry via RKEF processing, instead of clean-tech supply chain: only ~8% uses HPAL process to produce battery-grade intermediates (for smelters active by 2025).

Investment in clean technology is still lacking (2)

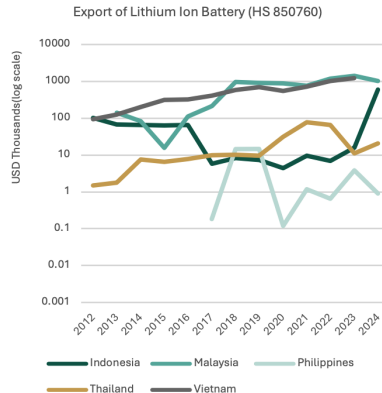
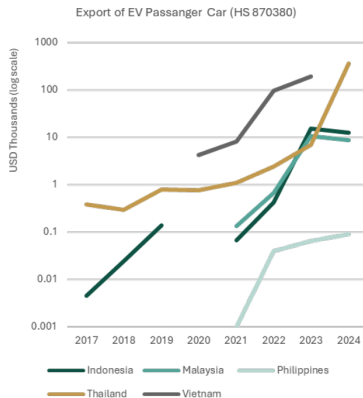


- Vietnam moved straight away to EV assembly, while Indonesia too focused on mineral processing. Big chunk of EV investment, esp from China, doesn't use nickel-based technology
- Indonesia is also late in attracting battery investment, while Malaysia emerge as the main destination.
- The stringent LCR and nickel focus are understandable but they do not help foster the necessary capabilities for clean-tech industrialization, at least at the current rate.

Source: Rhodium database

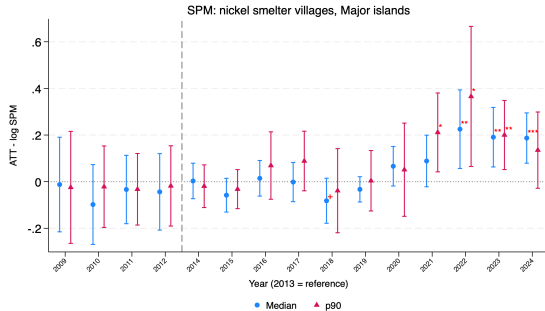
Indonesia's nickel-focused policy packages does not seem to be very effective in stimulating broader clean-tech industrialization and capability

Indonesia's export of EV and battery has started to pick up the pace but remain relatively lagged behind other powerhouses in the region (which are not endowed with critical minerals)

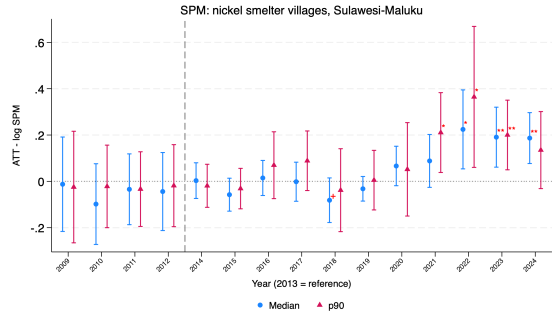


Environmental cost of downstreaming push: water quality (SPM) worsens following export ban

Impact is consistently larger during the second export ban (post-2020).



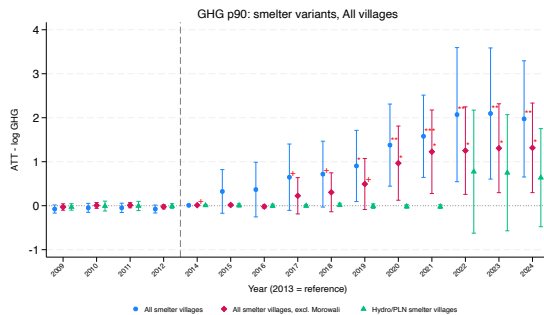
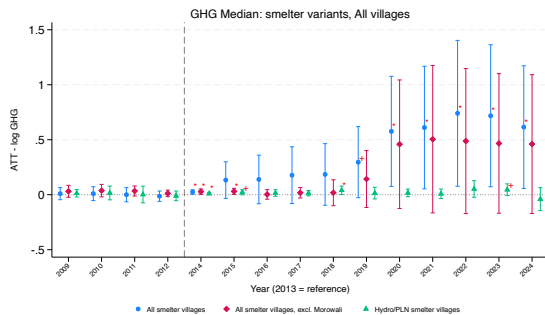
Major islands



Sulawesi-Maluku

Environmental cost of downstreaming push: air quality (greenhouse gasses/GHG) worsens following export ban

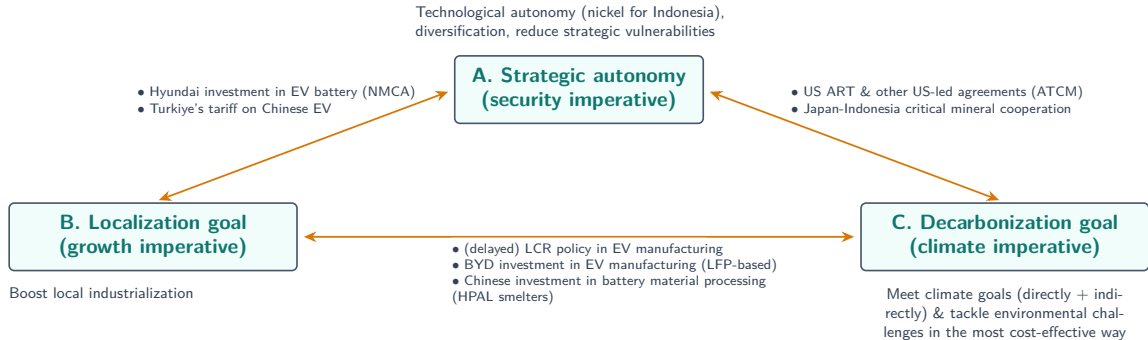
Air pollution is substantially lower when smelters use cleaner source of energy! Majority of smelters has their own (captive) coal-fired power plant



Challenges of green industrialization for global south

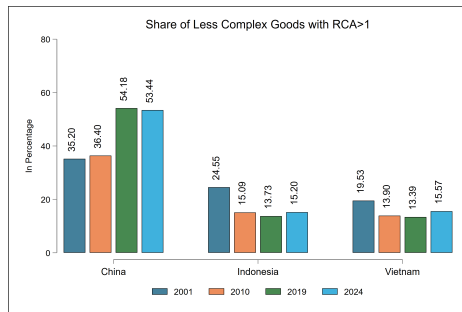
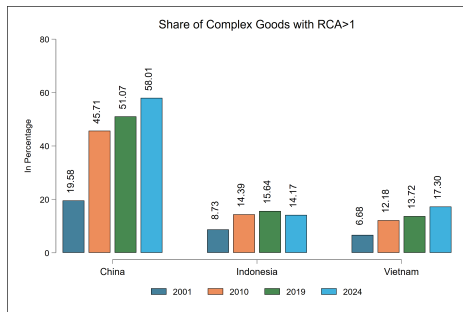
The impossible trinity (trilemma) in green industrial policy (GIP)

Inherent trade-offs make it difficult for government to attain all objectives at once!



The pathway for export-oriented (green) industrialization is narrower

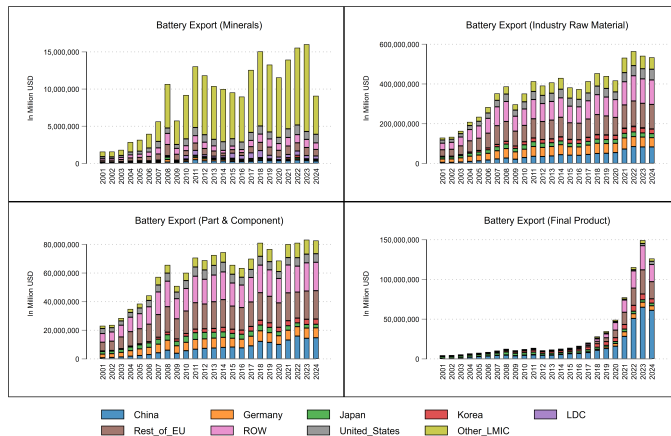
China's Capability in Green Products



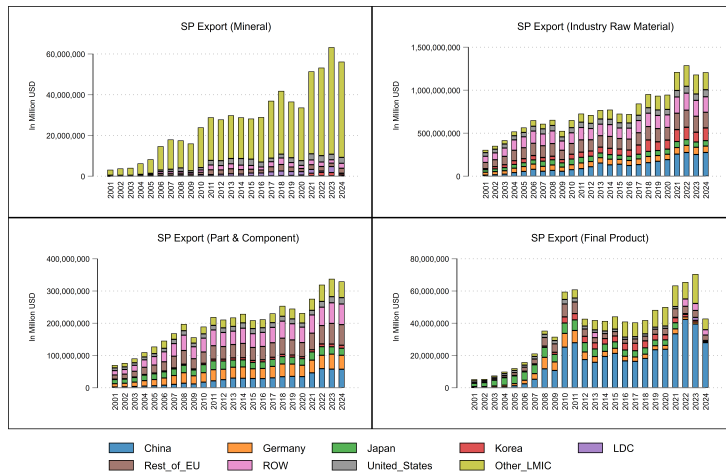
- **Shrinking market access:** Advanced countries are increasingly turning inward, reflected in rising trade-related environmental measures (e.g. CBAM, EUDR, battery passport, etc.).
- **Trade securitization:** Critical minerals and strategic technologies face increasing security-driven trade policies (ATCM, US ART, IRA).
- **China's dominance:** China's dominance in green products may narrow development space for latecomer.

China's Battery Export, various supply chain stages

In batteries and solar panel, China's position is strong in almost all supply chain segment, except for minerals. Will the boom in clean tech repeat similar pattern of resource curse?



China's Solar PV Export, various supply chain stages



Way forward

A more viable green industrialization framework

(Short Term) Openness to Trade and Investment 01

- Attract LCT production by leveraging foreign technology and global supply chain reallocation.

(Long Term) Targeted Industrial Intervention 02

- Build absorptive capacity through R&D incentives and strategic FDI to move into higher-value LCT segments.



06 International & Regional Coordination and Policy Space

- Expand policy space w/ coordination
- A more ambitious energy transition plan at the region to boost regional demand for clean-tech

05 Market Failures and Policy Instruments

- Match policy instruments to specific market failures, recognizing trade-offs among multiple objectives.

Domestic Renewable Energy Demand as a Driver 03

- Boost domestic demand in renewable energy to scale-up clean-tech manufacturing as export markets become harder to penetrate.

04 Regulatory and Institutional Framework

- Align industrial policy with decarbonization while preserving competitiveness and avoiding narrow strategies.

Thank you!



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Riandy Laksono

riandy.laksono@csis.or.id

Appendix

Appendix : Supply Chain Mineral RKEF & HPAL

