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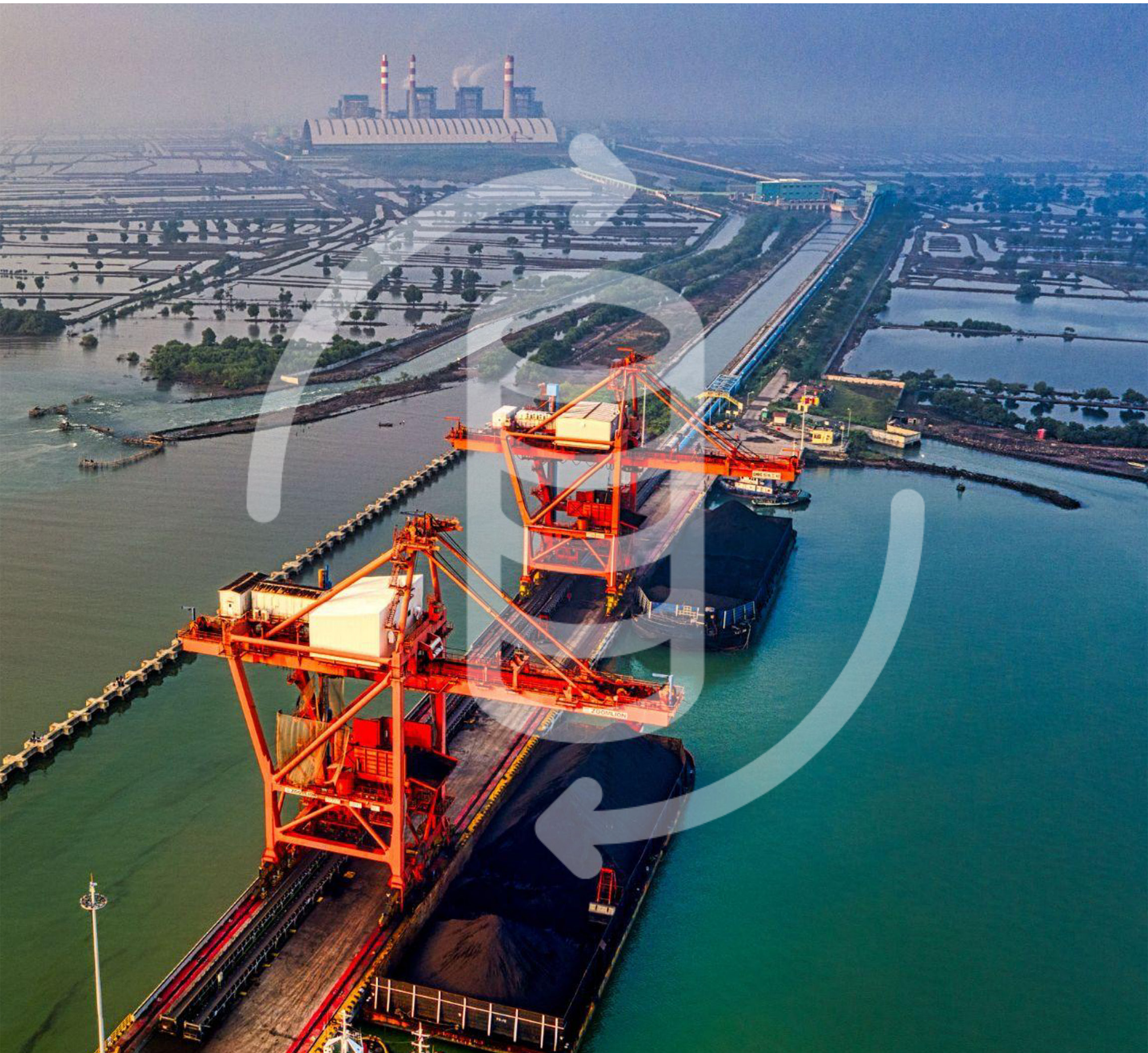

FINANCING INDONESIA'S GREEN INDUSTRIALIZATION:
SYSTEM PATHWAYS, STRUCTURAL DIAGNOSIS, AND TAILORED SOLUTIONS

Ana Maria Camelo Vega

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Table of Contents

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Executive Summary

The Financing Problem

Indonesia produced 2.2 million metric tons of nickel in 2024, roughly 60% of global mine production, and has built an industrial strategy around processing that resource domestically. That strategy has so far been powered by captive coal: operational and planned captive capacity is approaching 31 GW by early 2026, concentrated in the high-pressure acid leaching (HPAL) facilities that produce battery-grade nickel.

Indonesia's energy transition requires roughly USD 140 billion annually through 2050. The difficulty is allocation, not volume. Only around 3% of private financial sector investment is climate-aligned, while roughly 66% of tracked power sector financing continues to flow to coal, including the captive coal serving nickel processing. Existing instruments, contracts, and lending relationships can quickly underwrite a captive coal plant; they cannot yet underwrite the alternative on comparable terms or timelines.

As part of the *Indonesia's Green Industrialization* project, this report diagnoses the misallocation, sets out the instruments that would correct it, and identifies which institutions should deploy them and in what sequence. Companion publications include a policy concept note on the mining–energy–industry feedback loop, a report on the circular economy (CE) in Indonesia's nickel sector, and a project appendix on the country's mineral and energy landscape.

Two Pathways for Green Industrialization

The report proposes how to finance two mutually reinforcing pathways to Indonesia's green industrialization, each calling for different instruments and sitting at different points in the financing pipeline. The **mining–energy–industry feedback loop** is the more financeable of the two today. The assets are physical, contracting templates exist, and predictable demand from nickel mining and processing and downstream manufacturing can serve as long-term anchor offtake for newly built utility-scale renewable energy, turning what would otherwise be speculative supply-side investment into infrastructure backed by creditworthy buyers. The binding constraint is deployment at scale. The analysis concentrates on the multi-user, park-level configuration, the most complex to finance and the most consequential, since solving it opens both the energy supply and the industrial expansion that depends on it.

The **circular economy** operates on a different cash flow logic, with returns tied to avoided costs, material recovery, and compliance-driven value, and a distributed benefit profile that conventional project finance is not designed to capture. It also sits earlier in the pipeline. Process circularity is a near-term proposition whose constraints are park-level coordination and price signals, not capital availability; product circularity is a medium-term one, dependent on binding extended producer responsibility (EPR) requirements, recycled content mandates, and domestic electric vehicle (EV) volumes that do not yet exist.

Why Capital Flows to Captive Coal

Four constraints, running from the cost of capital through to contract design, keep reproducing this outcome.

- **A structural cost-of-capital premium.** The weighted average cost of capital for utility-scale solar in Indonesia was 9.4% in 2024, against 5.0% to 6.5% in advanced economies. That premium raises the levelized cost of solar by 34% and wind by 29%, but coal by only 10% and gas by 11%. The differential falls on technologies whose lifetime costs are dominated by upfront capital. Land procurement and permitting, particularly in Java, inflate the cost of equity before debt structuring begins.

- **A financing asymmetry.** Captive coal is financed on the industrial sponsor's balance sheet through five-year facilities and established lending relationships that absorb currency and refinancing risk within the sponsor's portfolio. Renewable independent power producers (IPPs) are financed on project terms: power purchase agreements (PPAs) of 15 years or longer, often hard-currency debt, and risk mitigation instruments designed for long tenors, with no sponsor balance sheet to fall back on.
- **A price stack and contracting architecture built for coal and for single counterparties.** The sustainable finance taxonomy classifies certain captive coal plants serving nickel processing as transition-supporting, the Domestic Market Obligation caps domestic coal prices, and the state electricity company's (*Perusahaan Listrik Negara*, PLN) tariff caps sit below the level at which renewable projects clear project finance return thresholds. The hybrid configurations the feedback loop requires, serving anchor users, park tenants, and potentially the grid, fit no existing licensing category. With no standardized industrial PPA and no aggregation model for shared transmission, each facility comes to market as a separate transaction with its own counterparty, and the economies of scale that aggregation would deliver never materialize.
- **A missing regulatory foundation for circularity.** Indonesia's battery waste framework assigns procedural responsibilities but imposes no binding take-back obligations, collection targets, or producer-financed systems, so recycling capital expenditure cannot be underwritten against voluntary feedstock. The value chain is also export-oriented, so most Indonesian material will reach the end of life outside any collection system Indonesia can enforce.

Financing Instruments and Recommendations

Blended finance, guarantees, PPAs, and EPR underperform when they are sized to country envelopes, calibrated to general uncertainty, or negotiated as bespoke single-counterparty arrangements. They perform when they are scoped to the specific risk blocking a specific transaction. That means disaggregating the blanket country premium into its currency, offtake, liquidity, construction, and regulatory components, and allocating each to the balance sheet best equipped to absorb it. Midstream borrowers in the battery value chain report sustainability-linked facilities offering two to three basis points of pricing benefit against substantial framework and reporting requirements, a mismatch symptomatic of instruments calibrated to labels rather than to risks.

- **Layer catalytic capital against first-mover risk.** On projects with no local precedent, lenders price novelty and coordination complexity into the senior margin, and subordination is what absorbs it. For integrated renewable systems serving industrial users, the capital stack can combine concessional subordinated debt or first-loss equity covering 20% to 30% of project cost at 2% to 4% returns, private senior debt at market rates for 50% to 60%, and industrial PPAs providing the revenue stream. Concessionality has to reach the project level; JETP allocations that stop at the sovereign balance sheet do not lower a developer's cost of capital.
- **Use credit enhancement and guarantees as connectors between risk and capital.** PT SMI provides credit enhancement and subordinated capital, while the Indonesia Infrastructure Guarantee Fund holds the guarantee mandate, which applies where PLN or a government agency sits in the transaction. Ministry of Finance (MoF) Regulation 5/2025 already permits guarantees on PLN renewable purchases. Since both are subject to state audit and must stay conservative, donor or philanthropic first-loss capital is likely to be necessary for projects that fall outside commercial risk appetites.
- **Anchor standardized PPAs in credible industrial offtakers.** MIND ID's position as the state mining holding company, and its linkage to the downstreaming strategy, make it a strong

signaling counterparty. A MIND ID–linked PPA could establish a market reference point for pricing and contract design.

- **Treat shared-use infrastructure as a financeable asset class.** Place shared transmission, interconnection, and other common-use assets in dedicated special purpose vehicles (SPVs) with long-term take-or-pay service agreements, standardize cost-sharing and connection templates, and plan transmission as backbone infrastructure serving multiple zones and users. Public land procurement and lease arrangements for utility-scale solar and wind, on the model already used in the railway sector, would remove one of the largest identifiable components of the equity premium at source.
- **Put the circular economy's regulatory foundation in place before deploying instruments.** Binding collection and recycled content targets with real enforcement capacity come first. First-mover transactions follow: pilot recycling facilities anchored by minimum offtake agreements at benchmark-linked pricing, with minimum volume guarantees covering the ramp-up period. Scaling instruments come last, including portfolio aggregation across facilities and dedicated circular credit lines on the model of Intesa Sanpaolo's EUR 6 billion facility.

The Appendix maps these recommendations institution by institution across both pathways.

A Sequenced Three-Phase Approach

The instruments are known, and the diagnosis is reasonably clear. The open question is which institution holds the mandate and the capacity to act, and in what order. Both pathways move through the same three phases, though the work inside each differs.

Phase 1: macro planning and regulatory alignment. The objective is a bankable pipeline, not a policy document: energy, industrial, spatial, and mineral plans aligned so that infrastructure leads industrial siting; pricing and contracting frameworks closed; circular economy foundations laid; and concessional capital redirected from sovereign channel loans toward project-level grants and project preparation facilities. The phase ends when transactions no longer require bespoke regulatory clearance. *Led by the Ministry of National Development Planning (Badan Perencanaan Pembangunan Nasional, BAPPENAS), the Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral, ESDM), the Ministry of Environment, the Ministry of Finance, the Financial Services Authority of Indonesia (Otoritas Jasa Keuangan, OJK), PLN, and the JETP Secretariat.*

Phase 2: risk and asset intermediation. The objective is to close the first transactions that have no precedent, so that subsequent deals can be priced on track record. Danantara's consolidation of approximately USD 900 billion in state enterprise assets changes the institutional picture; the division of labor that makes sense pairs its balance-sheet scale with PT SMI's project appraisal and structuring capability. The Sulawesi and Maluku corridors are the natural geographic anchors. The phase ends when a replicable template exists for the multi-user park configuration, and at least one EPR-anchored recycling facility has closed with a minimum offtake structure. *Led by PT SMI, MIND ID, industrial park operators, DFIs and export credit agencies (ECAs), and the JETP Secretariat.*

Phase 3: commercial maturation and bank underwriting. The objective is to convert the demonstrated template into an asset class. Standardized structures reduce per-transaction diligence costs enough for commercial banks to syndicate alongside DFIs; refinancing converts first-mover facilities into longer-tenor infrastructure bonds priced on performance; and circularity and climate metrics become part of core underwriting. The phase succeeds when private capital is the marginal financier. *Led by commercial banks, institutional and impact investors, and dedicated circular credit facilities.*

The phases overlap. Individual first-mover transactions can close ahead of full Phase 1 clarity, and doing so can help force the regulatory fixes that follow, but they cannot be priced on precedent or replicated at scale until that clarity is in place. Sequencing also separates the two pathways. The feedback loop is ready for Phase 2 work in select corridors while planning continues elsewhere; the circular economy needs Phase 1 substantially complete first. Treating both as ready for the same instruments at the same moment produces misallocation in both directions.

Unresolved Tensions

Two tensions remain. The first is between speed and integration: captive coal is being locked in now, while the planning architecture that would make multi-user renewable configurations bankable takes time and politically difficult coordination to assemble. The workable response is to pursue first-mover transactions that demonstrate viable structures while the architecture catches up, accepting higher structuring costs and more subordinated capital on early deals.

The second is between domestic ambition and external dependency. European Union (EU) recycled content mandates determine the price and scale of demand for recycled materials; the bulk of domestically produced nickel and batteries reaches the end of life outside Indonesia's collection system; and DFI risk pricing, JETP allocation, and foreign currency lending conditions are calibrated against country risk that no national policy can reprice unilaterally. Part of the response is to build domestic foundations that hold across external scenarios. The other part is regional: an ASEAN-level (Association of Southeast Asian Nations) approach broadens the credible buyer base for renewable PPAs beyond a single national grid and makes backbone infrastructure financeable at scales no individual country can underwrite alone.

List of Acronyms and Abbreviations

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
ASEAN	Association of Southeast Asian Nations
BAPPENAS	Ministry of National Development Planning (*Badan Perencanaan Pembangunan Nasional*)
CAPEX	capital expenditure
COD	commercial operation date
DFI	development finance institution
DMO	Domestic Market Obligation
ECA	export credit agency
EPR	extended producer responsibility
ESDM	Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral*)
ESG	environmental, social, and governance
EU	European Union
EV	electric vehicle
FX	foreign exchange
GREM	Geothermal Resource Risk Mitigation (facility)
HPAL	High-Pressure Acid Leaching
IDR	Indonesian Rupiah
IEA	International Energy Agency
IFC	International Finance Corporation
IIGF	Indonesia Infrastructure Guarantee Fund
INDEF	Institute for Development of Economics and Finance
IPP	independent power producer
IRENA	International Renewable Energy Agency
JETP	Just Energy Transition Partnership
KPI	key performance indicator
LCOE	levelized cost of electricity
LCOS	levelized cost of storage
LFP	Lithium Iron Phosphate
MDB	multilateral development bank
MIND ID	Mining Industry Indonesia (State Mining Holding Company)
MoF	Ministry of Finance
OJK	Financial Services Authority of Indonesia (*Otoritas Jasa Keuangan*)
PLN	State Electricity Company (*Perusahaan Listrik Negara*)
PPA	Power Purchase Agreement
PPP	public–private partnership
PRO	producer responsibility organization
PT SMI	PT Sarana Multi Infrastruktur
RUPTL	Electricity Supply Business Plan (*Rencana Usaha Penyediaan Tenaga Listrik*)
SOE	state-owned enterprise
SPV	special purpose vehicle
USD	United States Dollar
WACC	weighted average cost of capital

Introduction

Indonesia produced 2.2 million metric tons of nickel in 2024, roughly 60% of global mine production, and holds an estimated 55 million metric tons in reserves.[1] Building on this resource base, the country has pursued an industrial strategy focused on downstreaming (*hilirisasi*), expanding domestic processing and manufacturing to capture more value along the supply chain and to establish the industrial foundations for a circular mineral economy.[2]

The strategy has to balance rapid economic growth against the urgent mandates of the energy transition and resource efficiency.[3] At its center sits a financing dilemma: can the large, predictable electricity demand of nickel processing serve as an anchor for utility-scale clean energy? Currently, the existing financing architecture favors a captive coal configuration as the primary option. The question is urgent: energy-intensive industrial expansion and climate commitments are on a collision course.[4,5]

The capital numbers give a sense of scale. Indonesia's energy transition requires roughly USD 140 billion annually through 2050, with the bulk of this funding concentrated in power generation, grids, and storage.[6] Private finance remains deeply misaligned with decarbonization and circularity needs: only around 3% of private financial sector investment is climate-aligned, while roughly 66% of tracked power sector financing continues to flow to coal, including captive coal serving nickel processing parks.[7]

Complementing companion analyses on the mining–energy–industry feedback loop[8] and the circular economy[9] in Indonesia's nickel value chain, this report focuses on how to finance these two mutually reinforcing pathways to Indonesia's green industrialization, each calling for different instruments and strategies.[10]

The mining–energy–industry feedback loop is the larger and more urgent of the two pathways, and the more financeable today: the underlying assets are physical, the contracting templates already exist, and the binding constraints are about deployment at scale rather than design from scratch. Predictable demand from nickel mining and processing and downstream manufacturing can serve as a long-term anchor offtake for utility-scale renewable energy, turning what would otherwise be speculative supply-side investment into infrastructure backed by creditworthy buyers.

Whether capital flows at scale depends on the offtake architecture: which counterparty signs the power purchase agreement (PPA), how volumes ramp, how risk is priced, and how the contracts sequence with the underlying industrial build-out.[11] This report tackles the multi-user, park-level configuration: the most complex to finance, and the most consequential, because solving it opens up both the energy supply and the industrial expansion that depends on it. Other configurations, such as single-user captive and direct mine-site solutions, are possible and covered in the companion analysis.[12]

The circular economy pathway operates on a different logic, with returns tied to avoided costs, efficiency gains, material recovery, and compliance-driven value.[13] This shifts the cash flow profile away from concentrated, long-dated revenues toward distributed and, often, non-monetized benefits that conventional project finance is not designed to capture.[14] The constraints, the instruments, and the roles of private and public stakeholders differ. It also sits earlier in the financing pipeline: the regulatory foundation is incomplete, feedstock is not yet at scale, and most enabling conditions still need to be built before the instruments described in this report can do their work.[15]

The report closes with the central recommendation: a sequenced three-phase pathway for redirecting capital, anchored in the institutional mandates of relevant stakeholders. Phase 1 aligns the planning and regulatory architecture so that bankable pipelines exist from the outset. Phase 2 deploys targeted, structured financing instruments to close first-mover transactions that have no precedent today. Phase 3 hands the pipeline over to commercial banks and capital markets once a track record has made circularity and renewable metrics part of core underwriting. Each phase specifies who acts, with what instrument, against which risk.

1. The Mining–Energy–Industry Feedback Loop: Why finance flows the wrong way and how to redirect it

The mining–energy–industry feedback loop reframes energy demand from nickel mining and processing and downstream manufacturing as a driver of renewable power deployment.

Mining development also creates opportunities for downstream manufacturing linked to clean energy supply chains. Nickel is an important input for battery cathodes today, even as the industry's gradual shift toward lithium iron phosphate (LFP) chemistries creates uncertainty over the timeframes considered in this report.[16] Near- to medium-term deployment pathways still rely heavily on nickel, which is enough to make the window economically significant. Indonesia can boost its mining sector and advance its manufacturing industry by developing local battery technologies.[17] As further explained in the companion report, this creates a self-reinforcing loop of industrial growth.[18]

By early 2026, Indonesia's operational and planned captive coal capacity is approaching 31 GW, already comparable to the total coal fleets of some advanced economies.[19] The expansion is concentrated in high-pressure acid leaching (HPAL) facilities for battery-grade nickel, which have grown from zero to seven in Indonesia since 2021, with a further 14 under construction or permitted.[20] Energy policy explains part of that shift; the way these projects are financed explains the rest. In many of Indonesia's nickel and aluminum developments, captive generation is funded as part of overall industrial capital expenditure, drawing on corporate balance sheets and existing credit lines.[21]

This financing structure creates two problems, depending on whether capacity already exists or is yet to be built.

For existing facilities, the barriers to switching are largely economic and structural. Coal plants operating on amortized capital benefit from subsidized feedstock through the Domestic Market Obligation (DMO) and entrenched financing relationships that make carbon-intensive options easier to replicate than renewable ones.[22] Even as renewables become cost-competitive over their lifetimes, the economics of retrofitting or replacing coal-fired equipment remain unfavorable without stronger regulatory or commercial pressure.

For new capacity decisions, the same financing channels reproduce the same outcome. Developers default to captive coal because corporate balance-sheet finance is faster to mobilize, contracting templates are familiar, and the project finance architecture required for utility-scale renewables imposes longer lead times and higher transaction costs, even when lifetime economics favor clean alternatives.[23] New industrial clusters, therefore, risk being locked into high-carbon assets from inception, hindering Indonesia's decarbonization.

Renewable energy could address both cases. Captive on-site renewable generation built directly by the industrial user is a meaningful improvement on captive coal, where viable, and Indonesia's self-use license category can support it.[24] Multi-user park-level configurations involving utility-scale solar, grid interconnection, or battery storage are the harder case and the higher-leverage one: they require long-term PPAs, complex multi-lender arrangements, and shared-use infrastructure at a scale that no single industrial user can finance on its own.[25] This section focuses on the latter.

1.1 *Cost of Capital and System Transition Costs*

1.1.1 The Challenge

Indonesia's cost of capital for renewable energy is structurally higher than in advanced economies, and the burden falls on renewables in ways that captive coal escapes. [26] Three forces compound: a measurable capital premium, the macro drivers that produce it, and a financing asymmetry that determines who bears it.

First, the capital premium shows up directly in project economics.[27] Indonesia's weighted average cost of capital (WACC) for utility-scale solar was 9.4% in 2024, compared with 5.0% to 6.5% in advanced economies.[28] A higher cost of capital increases the levelized cost of solar by 34% and wind by 29%, compared to only 10% for coal and 11% for gas.[29] The differential falls disproportionately on technologies whose lifetime costs are dominated by upfront capital, and renewables sit at the high-impact end of that distribution.

Second, the macro drivers. Five structural conditions in Indonesia's capital environment produce the premium. These include the *sovereign risk premiums* that automatically inflate interest rates on any project meant to last for decades; *currency mismatch*, where projects earn Indonesian Rupiah (IDR) revenues but often require hard-currency debt; *shallow domestic capital markets* with limited long-tenor lending capacity; and *system integration costs* (firming, storage, transmission, grid stabilization) that the headline levelized cost of electricity (LCOE) does not capture but that project finance must absorb. A system-level LCOE (sometimes called a levelized cost of storage, LCOS) provides a more accurate basis for comparison.[30] A fifth driver operates at the equity layer: *land procurement and permitting costs,* especially in Java, inflate the cost of equity for utility-scale solar and wind before debt structuring even begins, and were identified as among the largest identifiable components of the premium.[31]

These conditions raise the cost of capital for all capital-intensive investments. Addressing the policy tilt toward coal, while necessary, will not close this gap on its own. The structural differential must be addressed directly through the risk-disaggregation and risk-transfer mechanisms described in the next section.

Third, the financing asymmetry. Coal economics are dominated by recurring fuel costs and are less sensitive to financing terms. The same financing environment produces very different outcomes for renewables, because the two technologies are financed through fundamentally different pathways.

On one hand, captive coal is financed on the industrial sponsor's balance sheet through 5-year term facilities and established lending relationships, absorbing foreign exchange (FX) and refinancing risk within the sponsor's portfolio.[32] On the other hand, renewable IPPs are financed on project finance terms, requiring 15-year or longer PPAs, often hard-currency debt, and risk-mitigation instruments designed for long tenors, without a sponsor balance sheet to absorb FX or refinancing risk.

The captive pathway fits existing industrial lending practice. Renewable alternatives require a more complex financing architecture, even when their long-run economics are stronger.

1.1.2 The Solution

Mitigating the high cost of capital requires disaggregating the blanket risk premium and allocating each component to the balance sheet best equipped to absorb it.[33]

First, disaggregate risk through specialized instruments. Rather than treating uncertainty as a single undifferentiated penalty, developers can break it down. The risk profile of an Indonesian asset is rarely uniform; it is a composite of specific exposures, such as currency fluctuations, offtake variability, liquidity conditions, and climate-related disruptions, each moving on its own timeline and sitting with different actors. Lumping them into a generic macro-penalty misprices the real liability. Scaling transactions requires moving away from an aggregate view of country or project risk and instead mapping the exact points of failure within a specific business model, exposing the precise friction points that deter commercial capital.

Second, deploy catalytic capital against specific risks, not as generic credit enhancement. The distinction that matters is between catalytic instruments that target a specific, identifiable risk and actually block a transaction, and instruments layered on as generic credit enhancement.[34] The implication for Indonesia is that the value of concessional and catalytic capital depends on whether it is deployed against specific risks blocking specific transactions, rather than on the amount allocated to the country in aggregate.[35]

Midstream borrowers in the battery value chain report that sustainability-linked facilities have offered pricing benefits of only two to three basis points, against substantial additional framework, reporting, and standard operating procedure requirements, most of which are aimed at greening upstream operations the borrower does not control. The mismatch is symptomatic of instruments calibrated to labels rather than to the risks that block transactions. Catalytic deployment should instead be assessed against three forms of additionality: financial (whether public participation crowds in private capital), impact (environmental and social outcomes), and ecosystem (how a participant's involvement shapes the market's development).

For the feedback loop pathway, two catalytic structures fit. The first is a layered capital structure with explicit risk pricing per tranche.[36] A workable structure for integrated renewable systems serving industrial users could combine concessional subordinated debt or first-loss equity covering 20 to 30% of the project cost at 2 to 4% returns, private senior debt at market rates for 50 to 60% of the project cost, and PPAs from industrial users that provide the revenue stream.[37]

Concessional capital absorbs losses first, lowering the cost of capital for industrial users without requiring public finance to cover the full project cost. This matters most for first-mover projects, where lenders price novelty and coordination complexity rather than underlying asset quality.[38] Once structures are proven, subsequent projects require less subordination, and the demonstration effect is as valuable as the immediate impact of financing. For this to work, concessional capital must reach the project level. The Just Energy Transition Partnership (JETP)'s allocation pattern has often left concessional benefits on the sovereign balance sheet rather than passing them through to IPPs developing renewable projects, thereby blunting the catalytic effect. A second failure mode compounds the first: deployment has been fragmented and slow because heavy and divergent safeguard and reporting requirements are pushed down onto implementing institutions and their clients, creating a mismatch between donor compliance expectations and project-level capacity.[39]

This sequential layering of public and concessional mechanisms works as a de-risking funnel: at each stage of development, a distinct risk is targeted and absorbed, until the project is commercially bankable (Figure 1).

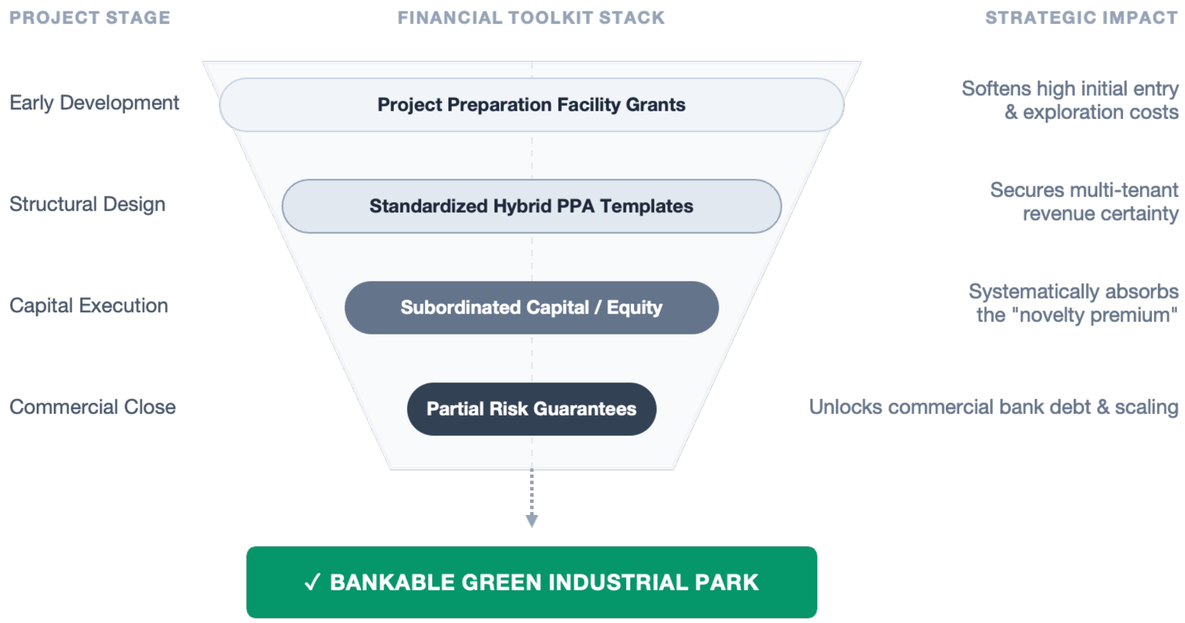


Figure 1. The de-risking funnel

Source: Author's elaboration.

The second catalytic approach includes deploying guarantees as connectors between risk and capital.[40] As with blended finance in general, guarantees work best when they target specific, identifiable risks that lenders cannot price, rather than serving as generic credit enhancements that reduce the overall probability of default.[41]

PT Sarana Multi Infrastruktur (PT SMI) is well placed to play this role. As a state-owned infrastructure financing company under the Ministry of Finance, PT SMI has a mandate to de-risk infrastructure projects for private participation and to provide longer tenors than those offered by commercial banks.[42] An important institutional distinction applies here: PT SMI provides credit enhancement, including first-loss instruments, subordinated debt, and blended donor grants, designed to prevent default and improve bankability, whereas guarantees proper are the mandate of the Indonesia Infrastructure Guarantee Fund (IIGF), which is triggered only after a default occurs.

IIGF's guarantee window is anchored in public–private partnership (PPP) structures and government-side counterparty risk, including contracting-agency obligations and state-owned enterprise (SOE) direct lending, so the combined structure applies most directly when PLN or a government agency is involved in the transaction.[43] Deployed together, PT SMI credit enhancement and IIGF guarantees can cover payment risk, construction completion risk, or regulatory risk for industrial renewable projects, addressing specific concerns rather than eliminating all risk. PT SMI's own precedents are citable: in the geothermal sector, a reimbursable grant structured with the World Bank (the Geothermal Resource Risk Mitigation facility, GREM) forgives up to 50% of the state-funded portion of the loan if exploration fails to find steam and the license is relinquished, a template for absorbing early-stage risk that no commercial lender will price.[44] As a state-owned enterprise subject to state audit, however, PT SMI must remain conservative on risk appetite; its capacity to act as a first mover depends on donor or philanthropic first-loss capital that shares the risk.

The leverage effect is significant. A guarantee covering 20–30% of a project's debt exposure can enable a commercial bank to provide the remaining senior debt on terms it would otherwise refuse, multiplying the impact of concessional support.[45] The guarantee fee replaces a higher-risk premium applied across the entire loan and reshapes investor behavior: covered risks are priced through the fee, while the investor prices residual exposure based on the actual remaining risk rather than applying a conservative blanket premium to all uncertainties.[46]

The land and permitting component of the equity premium can also be addressed directly through public land facilitation. In the railway sector, the government procures land and leases it to the state-owned operator; an analogous model for utility-scale solar and wind sites would lower developers' equity requirements and remove one of the largest identifiable components of the cost-of-capital premium at its source.

1.2 Pricing, Contracting, and Aggregation Barriers

1.2.1 The Challenge

Beyond the cost of capital, renewable energy in Indonesia is held back by three reinforcing features of the policy and market environment: a price stack that favors coal across regulation, subsidy, and procurement; a contracting architecture built around single counterparties; and the absence of a mature aggregation model for shared-use infrastructure.

First, the price stack. Three policy and procurement mechanisms tilt the economics toward coal: a national taxonomy, the DMO, and PLN feed-in tariff caps.

Indonesia's updated sustainable finance taxonomy classifies certain captive coal plants linked to nickel processing as transition-supporting (amber), keeping coal financeable under a transition framing rather than treating it as incompatible with decarbonization.[47]

The DMO caps the price of coal sold to domestic power plants, keeping coal-fired electricity artificially cheap.[48] Renewable projects must compete against this subsidized baseline. Tariff benchmarking has historically linked renewable electricity prices to average generation costs heavily influenced by subsidized coal.

PLN caps renewable electricity prices at levels that neither satisfy private developers' return requirements nor PLN's own procurement economics.[49] Raising caps risks pushing industrial users toward captive generation, creating a structural trap: renewables cannot achieve project-finance prices, while higher prices undermine the demand that justifies infrastructure investment.[50]

Pertamina's dominant position in Indonesia's industrial and marine fuel markets limits competition, while evolving fuel pricing and quota policies have contributed to policy uncertainty across the energy sector. Together with continued support for coal through domestic pricing mechanisms, these factors weaken investment confidence in renewable energy projects.[51]

Second, the contracting mismatch. Existing contracting categories are designed for single-counterparty configurations, whereas the feedback loop requires aggregated, multi-user systems. Start with PLN, which functions as a regulated monopsony for grid sales, locked into long-term take-or-pay contracts with existing coal plants, constraining new renewable procurement regardless of commercial merit.[52]

PPAs with PLN shift significant development and connection risks to developers that international practice typically allocates to offtakers.[53] There is no standardized industrial PPA framework; each contract is negotiated from first principles, covering price, volume, payment security, and termination, thereby raising transaction costs.

The regulatory framework distinguishes between self-use captive systems and public-supply generation, but many industrial renewable configurations needed for the feedback loop are hybrids that serve anchor users, park tenants, and potentially the grid.[54] These do not fit existing categories, creating licensing uncertainty, unclear grid access rights, and ambiguity about surplus power sales.

Self-use licenses have lighter planning requirements than public supply licenses, which is an advantage for captive configurations.[55]

Third, the aggregation gap. Shared-use infrastructure has no natural home for financing, and the financing template for multi-user systems has not yet been established.

The transmission backbone remains on PLN's balance sheet, linking expansion capacity to PLN's financial position and planning cycles.[56] When transmission investment lags industrial expansion, developers face uncertain grid connection timelines and default to captive solutions. Indonesian officials have acknowledged that existing transmission lines are not designed to accommodate renewable power from where it can be built; technical analysis of nickel decarbonization identifies transmission as a low-return asset that requires government guarantees and co-investment to become financeable.[57]

It also means there is no aggregation model. Indonesia is moving toward shared-use arrangements, including power wheeling and joint transmission utilization, but these mechanisms are still in a policy and regulatory transition phase rather than an established financing template.[58] Projects are still largely structured as single-user captive systems or PLN-centered IPPs.[59] That keeps demand, contracts, and risk fragmented across multiple facilities.[60] Lenders face multiple smaller transactions with separate counterparties rather than a single aggregated transaction with shared-use infrastructure, standardized contracts, and stronger economies of scale.

1.2.2 The Solution

Resolving these barriers requires action at three levels: removing the price distortions that subsidize coal, building contracting templates that fit the configurations actually needed, and creating financing structures for shared assets that no single user can fund alone. The first is a policy reform agenda; the second and third are the financing architecture solutions this report develops in detail below.

Reforming the pricing stack requires direct regulatory intervention to correct entrenched policy distortions. The priority is to remove the amber classification for new captive coal facilities serving nickel processing, so that the sustainable finance taxonomy no longer provides institutional legitimacy to fossil fuel financing within the critical mineral value chain. Policymakers must phase down the DMO price advantages that insulate captive coal, so fossil generation has to compete at undistorted prices.

PLN's feed-in tariff caps need restructuring so that industrial renewable PPAs can clear project finance return thresholds without pushing operators back toward captive coal. Tiered pricing, or industrial tariffs decoupled from residential cross-subsidies, is the practical route.

Standardized PPAs should be anchored in credible industrial offtakers. Renewable generation, storage, and interconnection linked to nickel mining and processing and to industrial park loads will not scale unless lenders can underwrite stable revenues over periods long enough to match infrastructure asset lives.

Long-term offtake agreements are the foundation.[61] These contracts commit industrial users to purchase specified volumes of electricity at agreed prices over 15 to 20 years, structured as take-or-pay obligations or baseload commitments, with volume flexibility within defined bands.[62] Pricing can be fixed, inflation-indexed, or structured with ceiling and floor arrangements that share commodity price risk between generator and offtaker.[63]

Stronger anchor offtakers raise the credit quality behind the PPA. In Indonesia, MIND ID's role as the state mining holding company and its close linkage to the government's downstreaming strategy make it a particularly strong signaling counterparty.[64] A MIND ID–linked PPA, for instance, could establish a market reference point for pricing and contract design while signaling policy commitment to lenders.

Recent regulatory movement supports this direction: the Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral*, ESDM) build–own–operate framework has improved PPA bankability by allowing share transfers to lenders before commercial operation date (COD), though key commercial terms remain open and uncertain, and the Ministry of Finance (MoF) Regulation No. 5/2025 now permits government guarantees on PLN renewable purchases through the Indonesia Infrastructure Guarantee Fund (IIGF), an existing hook for the payment-security structures recommended here.[65]

Contracting structures should align payment obligations with actual production profiles and phased demand growth rather than assuming flat offtake from day one.[66] Flexibility on contracted volumes, delivery timelines, and ramp-up schedules reduces early-stage performance risk while preserving the revenue certainty lenders require.

Third, shared-use infrastructure as a financeable asset class. The companion feedback loop report frames the strategic case for these assets: what to build, where, and why, including diversification across minerals, system capacity investments in transmission and battery manufacturing, and strategic siting of industrial parks near renewable resources.[67]

This section addresses the financing structure that lets those investments close.

Shared transmission, interconnection, and other common-use energy assets should be structured through dedicated special purpose vehicles (SPVs) to make them financeable on project terms. Rather than treating these assets as ancillary costs to be absorbed by a single tenant, the SPV creates a ring-fenced entity with a defined asset base, clear governance, and a long-term take-or-pay revenue model anchored to contracted users. This allows costs to be transparently allocated across beneficiaries and supports predictable cash flows (Figure 2).[68]

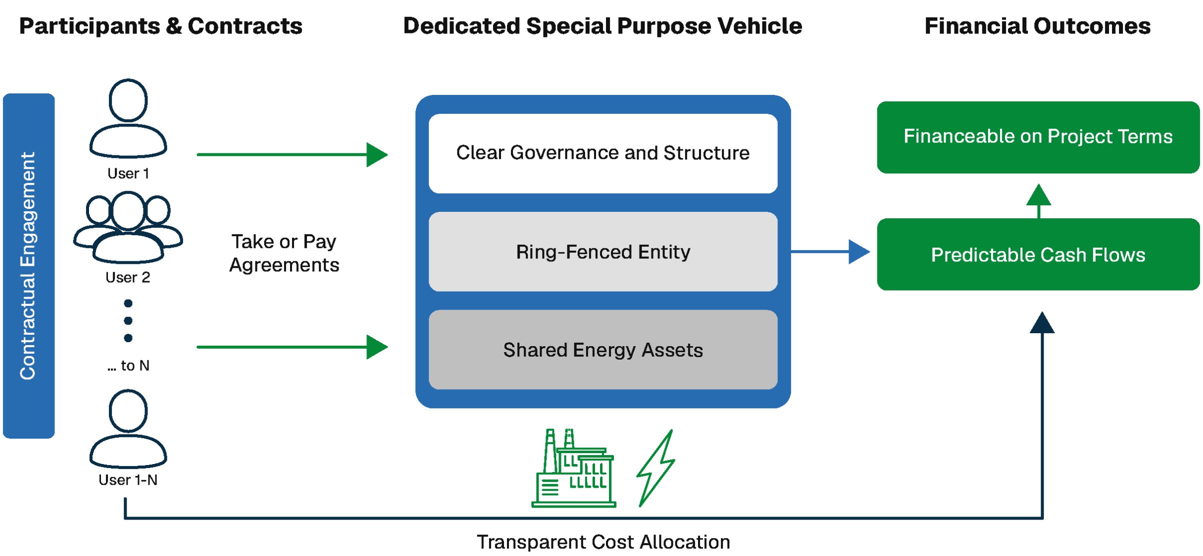


Figure 2. How an SPV works for shared-use infrastructure

Source: Author's elaboration.

That structure improves bankability because lenders can underwrite a discrete project with identifiable, contractually secured revenues, rather than relying on the balance sheet and demand profile of a single industrial facility to finance infrastructure serving multiple users.[69] The SPV can be capitalized by the park operator, anchor users, and other strategic investors, and then raise debt against long-term service agreements that lock in payment obligations and reduce revenue uncertainty.[70] This approach can lower coordination risk, avoid fragmented or enclave-style infrastructure development, and strengthen the investment case by aggregating demand across users. It also provides a platform for future capacity additions, as infrastructure can be designed and expanded in line with the park's growing demand rather than being constrained by a single off-taker's needs.

Standardization matters just as much. As long as every shared-use infrastructure deal remains bespoke, transaction costs stay high, legal complexity multiplies, and timelines become too slow for the pace of industrial expansion. Standardized templates for offtake commitments, cost-sharing formulas, connection terms, upgrade rules, and payment enforcement reduce that friction by narrowing the scope of negotiation and making risk allocation more legible to all parties.[71] That matters especially for investors, who need contractual structures they can diligence quickly and compare across projects.

Finally, Indonesia's archipelago geography creates acute transmission challenges: renewable resources are often distant from industrial demand centers, requiring major grid reinforcement and, in some cases, subsea interconnections.[72] A regional approach treats transmission as backbone infrastructure that serves multiple zones and users, rather than as a cost attached to individual industrial sites.[73] The financing logic improves when infrastructure is planned for shared use from the outset, when investment can be sequenced as different zones develop, and when cost allocation accounts for these timing differences so that early users are not penalized for infrastructure that will eventually serve multiple parties.

The same structuring challenge arises in discussions of Southeast Asian regional interconnection, where renewable resources, demand growth, and industrial load are unevenly distributed across the Member States of the Association of Southeast Asian Nations (ASEAN).[74] Indonesia's domestic transmission and industrial decarbonization requirements fit within this broader regional context. Planning for interconnection systems and financing mechanisms that support cross-border renewables-based energy supply, shared transmission investment, and risk-sharing for backbone infrastructure serves Indonesia's interests while contributing to regional solutions. Domestic cases like Sulawesi, where grid expansion can be coordinated with industrial growth, become part of a larger case for how regional infrastructure makes the energy transition more financeable across Southeast Asia.

Finally, the financing agenda must go further downstream. The diagnosis in this section is deliberately centered on power supply to mining, processing, and industrial parks, but much of Indonesia's green industrial ambition sits further downstream, in precursor, cathode, cell, and vehicle manufacturing, where PPA- and offtaker-style parameters do not apply and where a borrower cannot force compliance on an upstream it does not own. Green financing potential also varies along the chain: mineral processing may remain hard to abate, while midstream nodes such as auto assembly require far less power and are correspondingly easier to decarbonize. Financing instruments and policy support should therefore be specific about which segment of the value chain they address rather than treating "green industrialization" as a single financing problem.

For these segments, the near-term tools are market-side rather than contractual: financial disclosure that shows a project's contribution beyond carbon, to output, employment, and the wider economy,[75] helps banks that underwrite on 10- to 25-year relationship horizons see green projects as feasible and profitable, and better governance of use of proceeds raises the credibility of labeled instruments whose pricing benefit is otherwise too small to justify their overhead. See Appendix Table A.1 for the full sequencing of enabling conditions, first-mover transactions, and scaling instruments across the feedback loop pathway.

2. Circular Economy Pathways: A market that has not yet formed

Circularity matters to the core economics of green industrialization. Tailings reprocessing, where the technical and economic feasibility for nickel is still being established, can recover minerals left behind in initial extraction; industrial symbiosis can turn one facility's waste into another's input; and water recycling reduces both operational costs and exposure to physical resource constraints. Together, these practices keep material value within domestic supply chains, insulating downstream expansion from external supply shocks and lowering the net resource intensity of industrial growth.[76]

Circular performance increasingly shapes how international capital markets price risk. As global environmental standards tighten, mining and processing operations with weak waste management face greater regulatory, legal, and social exposure. This performance deficiency directly feeds into the financing terms across the entire battery and electric vehicle (EV) value chain, affecting downstream capital costs just as severely as upstream mining operations.

The circular economy pathway divides into two forms: process circularity and product circularity.[77] Process circularity focuses on internal or adjacent industrial operations, such as optimizing material flows, water reuse, and industrial symbiosis within a localized cluster. Product circularity, by contrast, focuses on the product's external life cycle, requiring the reclamation, sorting, and recycling of post-consumer goods, such as end-of-life batteries, once they leave the production system. The financing implications differ substantially across these two forms of circularity (Table 1).[78]

Table 1. Process vs product circularity: two financing logics

Dimension	Process circularity	Product circularity
What it covers	Industrial symbiosis, tailings reprocessing, water and energy reuse, byproduct valorization within and around existing operations.	Battery collection, recycling, and recovery of nickel, cobalt, and lithium back into the cathode supply chain.
Value proposition	Avoided costs and efficiency gains (lower input, waste, water, energy bills) plus reduced regulatory and social exposure.	New revenue stream from recovered material sales, plus compliance-driven contractual revenue once EPR and recycled-content rules bind.
Cash flow profile	Non-monetized cost savings on the firm's P&L; difficult to isolate as a project revenue stream.	Volatile commodity-linked revenues plus regulatory-linked premia; ramps slowly with waste volumes.
Financing instruments	Shared-asset special purpose vehicles (SPVs) at park level, dedicated circular credit lines (e.g. Intesa Sanpaolo model), multi-firm service agreements.	Portfolio aggregation vehicles, blended finance for demonstration plants, minimum volume guarantees, compliance-linked offtake.
Readiness in Indonesia	Near-term. Constraint is park-level coordination and price signals (water, emissions), not capital availability.	Medium-term. Requires binding EPR, recycled-content mandates, and meaningful domestic electric vehicle (EV) consumption before feedstock and revenues become bankable.

Source: Author's elaboration.

Financing circularity is structurally harder than financing linear projects. Conventional project finance is designed for standalone assets with clear boundaries and linear inputs; circular projects depend on system performance, with feedstock supplied by other firms, demand absorbed by other firms, and infrastructure shared across operators.[79] A bankruptcy or failure at one node can cut off the feedstock or demand underlying another facility's circular investment. Project economics are also highly sensitive to commodity price volatility: without revenue stabilization mechanisms, recovered materials compete directly with low-cost virgin supplies, undermining the case for secondary recovery.[80]

Several factors outside the financing architecture shape what circular economy investments need to withstand, even though they do not determine the underlying financing logic. Battery chemistries are evolving rapidly, and recycling economics depend on the material composition of the waste stream for which a facility was designed; if that mix shifts, utilization and recovery assumptions deteriorate.[81] Process technology choice carries its own tradeoff: more flexible technologies handle a wider range of battery inputs but recover less value unless additional processing is added; more specialized technologies recover more material at higher quality but are sensitive to feedstock composition and harder to operate consistently.

2.1 The Missing Foundation for Circular Investment

2.1.1 The Challenge

Indonesia has a partial regulatory foundation for battery waste management, but not yet a financeable one.[82] The current framework assigns responsibilities for handling, transport, and processing through the Ministry of Environment and Forestry regulation, but remains largely procedural. It does not create the conditions investors need: binding take-back obligations, collection targets, recycling targets, producer-financed systems, or a producer responsibility architecture that can guarantee feedstock flows and payments over time.[83]

Commercial recycling facilities need predictable feedstock to underwrite capital expenditure. Without operational EPR, feedstock depends on voluntary returns or short-term price signals.[84] Indonesia's current battery end-of-life management remains tethered to hazardous waste permitting. While essential for environmental safety, this mechanism does not incentivize high collection rates, stimulate the development of predictable secondary markets for recovered materials, or allocate upstream costs to producers.[85]

Battery waste volumes in Indonesia remain insufficient to support large-scale recycling financing. EV adoption is growing, but from a relatively low base, especially compared to Indonesia's long-term policy targets.[86] Indonesia's nickel and battery value chain is overwhelmingly structured around export-oriented downstream production.[87] The bulk of that output, and the nickel and battery materials embedded in it, will reach end-of-life outside Indonesia, beyond the reach of any domestic collection system or producer responsibility framework Indonesia can enforce. Reverse logistics back to Indonesian recyclers from foreign end-markets is not a workable near-term pathway, and the financing case for domestic recycling capacity should not be built on it.

2.1.2 The Solution

The near-term priority is getting the regulatory foundation right. Indonesia's current framework assigns procedural responsibilities for handling battery waste but imposes no binding obligations on producers. Moving to regulations that define specific collection targets, recycled content requirements, and penalties for non-compliance would change that. The detailed regulatory architecture, including EPR design, producer ownership models, and digital passport sequencing, is set out in the companion circular economy report.[88] The focus here is on the financing implication: without binding obligations, recycling CAPEX cannot be underwritten because feedstock flows remain voluntary.

Regulation creates the demand signal; contracts make it bankable. Once a credible compliance framework is in place, built on binding collection and recycled content targets, traceability, and enforcement capacity, commercial structures that are currently unsustainable become viable.[89] These enabling conditions pave the way for first-mover transactions, specifically pilot recycling facilities anchored by a minimum offtake agreement in which manufacturers commit to defined volumes at benchmark-linked pricing over tenors that match facility debt. At this initial stage, blended finance structures are deployed alongside these offtakes to absorb early-stage technology and volume risk.

In parallel, battery manufacturers and downstream players must begin establishing the demand signals and feedstock guarantees required to underpin future infrastructure. This includes upfront investment in domestic collection systems, material traceability networks, and reverse logistics across international supply chains. Downstream actors should organize into Producer Responsibility Organizations (PROs), which, once the EPR framework is operational, can serve as market anchors for long-term offtake agreements, securing predictable feedstock flows and reducing revenue uncertainty.

Multi-party offtake agreements linking recyclers, cathode producers, and end-product manufacturers can further strengthen revenue certainty, though they represent a medium-term target rather than a near-term instrument due to the negotiation capacity and mature relationships they require.[90] Scaling instruments come last, shifting the market toward portfolio aggregation across multiple facilities, dedicated circular credit lines, and structured finance vehicles that can attract institutional capital once a proven track record is established. See Appendix Table A.2 for the full sequencing of enabling conditions, first-mover transactions, and scaling instruments across the circular economy pathway.

2.2 Coordination and Cost Allocation

2.2.1 The Challenge

Circular economy financing is often constrained by coordination problems across the value chain.

For product circularity, materials reach end-of-life dispersed across many locations rather than within co-located industrial settings, and the route back to a recycler runs through collection points, transporters, sorters, and intermediaries whose obligations and economics rarely align without policy direction.[91] Cost allocation across the producer, PRO, collector, and recycler chain is contested, particularly without enforceable EPR, and quality standards for recovered material remain unsettled enough that downstream cathode producers and end-product manufacturers discount what they will commit to in offtake terms.

Individual recycling facilities consequently operate at sub-bankable scale and cannot underwrite CAPEX on their own feedstock pipeline. No natural intermediary exists to aggregate volumes across multiple recyclers, broker multi-party offtake agreements, or standardize cost-sharing among producers. Each recycling project therefore becomes a one-off transaction with uncertain feedstock and revenue volatility, which most lenders are reluctant to finance at commercial terms.

For process circularity, a waste stream must first be recognized as a usable input. Upstream processes may need to adjust to produce material of consistent quality, while downstream users may need retrofits to absorb it. Offtake agreements must be secured, and questions regarding standards, liability, and insurance must still be resolved. Financing depends on all these pieces falling into place at once, yet industrial park governance rarely provides such coordination.

Most firms operate independently and share little information. Park operators focus on land, utilities, and basic services rather than cross-firm transaction development.[92] No natural intermediary exists to identify opportunities, broker agreements, standardize cost-sharing, or coordinate investment in shared assets. Each project becomes a bespoke negotiation, which most lenders are reluctant to finance. Evaluated on a standalone basis, facilities face feedstock uncertainty, technology risk, and a limited operating track record, which result in conservative pricing or no transaction at all.[93]

2.2.2 The Solution

The fragmentation in circular value chains is, at the bottom, a problem of cost allocation and multi-party coordination, and the fix is to move from isolated plant-level upgrades to shared, bankable structures. Three solutions do that work: bankable project structures for shared assets; catalytic public finance and volume guarantees that absorb early-stage coordination and technology risk; and aggregation of standalone projects into portfolio vehicles.

First, process circularity should be treated as shared-use infrastructure rather than isolated upgrades inside individual plants. Because shared systems require a centralized legal and commercial framework to execute contracts, collect payments, and allocate costs, the absence of this architecture reduces potential projects to inefficient, one-off negotiations that rarely close. While process circularity relies on physical assets shared across a finite set of co-located firms, product circularity achieves bankability through a different mechanism: an EPR-anchored minimum offtake structure, strengthened by portfolio aggregation across multiple recyclers. [94]

A practical solution is to place the shared asset in a dedicated entity that signs long-term service agreements with participating firms. The specific legal structure matters less than the contracts.[95] What matters is that volumes, pricing formulas, and responsibility for upgrades or expansion are clearly defined. When those terms are explicit, a circularity opportunity can be translated into predictable cash flows that lenders can evaluate.[96]

A dedicated circular credit facility with clear eligibility criteria could take circular lending to scale.[97] Intesa Sanpaolo shows how a lender can put this into practice: it created a dedicated EUR 6 billion credit facility for circular economy–aligned companies and projects, developed circular eligibility criteria and KPIs as part of the credit process, and offered favorable credit terms that reduced the cost of capital.[98] This is useful here because shared process circularity projects often fail at the last mile of underwriting, even when the economics are credible.

Second, catalytic public finance and credit enhancement carry the early stage of the circular pathway. Blended finance structures designed for circular economy demonstration projects can mobilize private investment, as they have in the feedback loop context.

Public support for research and early deployment matters most for nickel circularity, where uncertainty remains around how battery chemistries will evolve and how efficiently valuable materials can be recovered from waste streams, including tailings, slag, and end-of-life batteries.[99] Demonstrating recovery processes at a commercial scale through public finance reduces technology risk and creates the conditions for private investors to finance recycling capacity.

Minimum volume guarantees can address the timing mismatch between upfront infrastructure investment and the gradual development of waste streams.[100] Under this structure, a guarantor commits to compensating the recycler if waste volumes fall below an agreed-upon threshold during the ramp-up period, thereby stabilizing revenue until feedstock reaches sufficient scale.

Banks should also formalize dedicated circular economy credit policies. Directing credit exposure toward circular projects strengthens portfolio resilience over the medium- to long-term and signals institutional commitment to the sector.[101]

Third, circular economy assets in Indonesia's nickel value chain should not be financed individually. The priority should be to aggregate multiple assets into a portfolio vehicle, diversify risk, and produce a cash flow profile that is more bankable than any single project.

Repayment structures should be designed around how circular economy revenues are actually generated, rather than imported from standard project finance. This applies most directly to end-of-life recycling revenues, where commodity price exposure and volume uncertainty are highest; the same logic carries over to process circularity revenues (sales of recovered water, reprocessed by-product material, or recovered heat), where volumes and prices are also variable but generally less so.[102] Given that revenues fluctuate, debt service profiles should reflect this, with repayment linked to actual revenues or to phased schedules during ramp-up, rather than to fixed amortization that creates unnecessary stress in early operating years.

Downstream manufacturers should also play a more explicit role in financing once extended producer responsibility or recycled content requirements create enforceable obligations.[103] EPR alone, however, does not push manufacturers to design products for easier disassembly and material recovery; recovery tends to remain an afterthought. Pairing EPR with design-for-recovery standards or eco-modulated fees (lower fees for products that meet recyclability criteria and higher fees for those that do not) makes recovery a primary design objective and ultimately reduces recycling costs. Long-term offtake agreements or advance purchase commitments from producers subject to compliance obligations would strengthen revenue visibility and reduce reliance on balance-sheet lending in the project's early years.

Over the medium term, policy should be designed to finance recycling infrastructure with compliance-linked cash flows rather than volatile recovered-material revenues. That would reduce commodity price exposure at the infrastructure level and materially improve bankability as producer responsibility systems mature. Without aggregation, circular economy finance stays stuck in transactions that are too small, too bespoke, and too uncertain to attract capital at scale.

3. A Three-Phase Approach

If the instruments are known and the diagnosis is clear, the gap is less about what to do and more about which institution has the mandate and capacity to do it, and in what order. The barriers diagnosed in this report do yield to sequencing. Capital does not flow because risks are bundled, planning is fragmented, and no institution sits in a position to absorb the first-mover premium.

The three phases below assign that work, in order, to the institutions best able to do it. Each phase has a defined set of lead institutions, an objective, and the end state required by the next phase. The same three phases apply to both the feedback loop and the circular economy, but the work within each phase differs: the feedback loop is largely ready for first-mover transactions, whereas the circular economy still needs Phase 1 foundations before it can reach the same point. For the institution-by-institution mapping of instruments and recommendations across both pathways, see the Appendix.

3.1 Phase 1: Macro Planning and Regulatory Alignment

In Phase 1, the lead institutions include the Ministry of National Development Planning (BAPPENAS), the Ministry of Energy and Mineral Resources (ESDM), the Ministry of Environment, the Ministry of Finance (MoF), the Financial Services Authority (OJK), the State Electricity Company (PLN), and the Just Energy Transition Partnership (JETP) Secretariat.

The objective is to create a bankable pipeline, not a policy document.

Phase 1 is where the planning architecture, the contracting templates, and the regulatory scaffolding catch up with what lenders need to underwrite. The work runs in four parallel tracks: aligning the energy, industrial, spatial, and mineral plans so that infrastructure leads industrial siting; closing the pricing and contracting frameworks so that transactions no longer require bespoke regulatory clearance; building the foundations for investment in the circular economy; and redirecting concessional capital from sovereign-channel loans toward project-level grants and project preparation facilities. Each track is led by a different ministry, but the coordination problem is the binding constraint, which is why the list of lead institutions begins with planning and budget agencies rather than financial ones.

Phase 1 ends when the pipeline exists on paper with credible counterparties, standardized contracts, and a regulatory environment that no longer requires bespoke clearance for each transaction.

3.2 Phase 2: Risk and Asset Intermediation

The lead institutions include PT Sarana Multi Infrastruktur (PT SMI), Mining Industry Indonesia (MIND ID), industrial park operators, development finance institutions (DFIs) such as the Asian Development Bank (ADB), the International Finance Corporation (IFC), the World Bank Group, and the Asian Infrastructure Investment Bank (AIIB), export credit agencies (ECAs), and the JETP Secretariat.

The objective is to close the first deals with no precedent, so that subsequent transactions can be priced on a track record.

Phase 2 is where the institutional architecture takes shape. National development finance institutions absorb structuring risk through project-level guarantees and subordinated capital. State-linked industrial anchors with investment-grade credit quality sign long-term offtake agreements at scale, which both finance the first integrated systems and establish the reference pricing that subsequent contracts can build on. Industrial park operators evolve from land-and-utilities providers into coordination intermediaries that aggregate multi-tenant demand and shared circularity assets into financeable transactions. DFIs and ECAs disaggregate the risk bundle so that each component is priced by the party best able to absorb it, and extend tenors to match the asset's life. JETP concessional capital flows directly to subordinated tranches at the project level, which is where its catalytic value is created.

Two institutional realities condition this phase. First, the state-linked institutions expected to play the first-mover role operate within a highly risk-averse public financial environment. Although major Indonesian SOEs benefit from strong expectations of government support, state-owned financial institutions are subject to public sector audit and accountability frameworks that create powerful incentives to avoid losses on individual transactions.[104] These institutional incentives suggest that donor- or philanthropic-funded first-loss capital will likely be necessary if Phase 2 is expected to finance projects beyond existing commercial risk appetites. Second, the establishment of Danantara, which has been created to consolidate approximately USD 900 billion in SOE assets, fundamentally changes the institutional landscape.[105] Rather than duplicating existing development finance institutions such as PT SMI, Phase 2 should explicitly leverage Danantara's balance-sheet scale while relying on PT SMI's established project appraisal and transaction-structuring capabilities.[106]

The natural geographic anchors are the Sulawesi and Maluku industrial corridors, where nickel processing, captive coal expansion, and multi-user park configurations all concentrate. On the circular economy side, the parallel work is closing the first EPR-anchored recycling facility with a minimum offtake structure: the regulatory foundation laid in Phase 1 is what makes that financing structure possible.

Phase 2 ends when a replicable transaction template exists for the multi-user, park-level configuration in at least one industrial corridor, and when at least one EPR-anchored recycling facility has closed with a minimum offtake structure.

3.3 Phase 3: Commercial Maturation and Bank Underwriting

Lead institutions include domestic and international commercial banks, institutional and impact investors, and dedicated circular credit facilities. The objective is to convert the demonstrated template into an asset class.

Phase 3 is where the work shifts from structuring to underwriting at scale. The standardized deal structures established in Phase 2 reduce per-transaction diligence costs to the point that commercial banks can syndicate alongside DFIs without having to rebuild each deal from scratch. Refinancing pathways activate once projects have accumulated an operating track record, converting first-mover bank facilities into longer-tenor infrastructure bonds whose pricing reflects performance rather than novelty. Impact and sustainability-linked investors take intermediate tranches; dedicated circular credit facilities carry process and product circularity at output-linked terms; and climate and circularity risk metrics are embedded into core underwriting rather than treated as add-on screens.

Phase 3 succeeds when private capital is the marginal financier, and concessional support shifts from carrying transactions to catalyzing the next frontier (new minerals, new chemistries, regional infrastructure) (Figure 3).

PHASE 1 Macro Planning & Regulatory Alignment

BAPPENAS

BARRIER: Fragmented planning timelines

SOLUTION: Establish cross-ministry coordination vehicle to align energy grid capacity expansion with downstream industrial growth.

INSTRUMENTS: Project Prep Facility Grants

ESDM

BARRIER: RUPTL electricity policy misalignment

SOLUTION: Integrate industrial zoning laws directly with national utility power procurement and long-term resource allocations.

INSTRUMENTS: Standardized Hybrid PPAs

JETP / INT'L ACTORS

BARRIER: Sovereign loan bottlenecks

SOLUTION: Pivot away from strict sovereign lending to provide flexible first-loss project equity accessible to private developers.

INSTRUMENTS: Blended Finance Facility Stacks

PHASE 2 Risk Subordination & Asset Intermediation

PT SMI

BARRIER: First-mover transaction novelty premium

SOLUTION: Systematically absorb structural premiums; act as local transaction incubator and co-developer to standardize structures.

INSTRUMENTS: Partial Risk & Credit Guarantees

DFIs & ECAs

BARRIER: Commercial debt tenor constraints

SOLUTION: Extend early maturities to match long-term industrial cycles; embed guaranteed post-COD refinancing windows.

INSTRUMENTS: Subordinated & Mezzanine Debt

INDUSTRIAL PARK OPERATORS

BARRIER: Bespoke, uncoordinated tenant risk

SOLUTION: Aggregate multi-tenant clean power baseline demand into ring-fenced utility and process circularity off-take vehicles.

INSTRUMENTS: Special Purpose Vehicles (SPVs)

PHASE 3 Commercial Maturation & Bank Underwriting

PRIVATE / IMPACT INVESTORS

BARRIER: Bespoke asset risk-return profiles

SOLUTION: Deploy target impact and ESG mandates to absorb diversified secondary market asset tranches using standardized tracking rules.

INSTRUMENTS: Credit-Enhanced Project Bonds

COMMERCIAL BANKS

BARRIER: Green asset technical underwriting gaps

SOLUTION: Move beyond add-on screens; anchor circular and renewable supply-chain parameters directly into standard credit underwriting guidelines.

INSTRUMENTS: Subordinated & Mezzanine Debt

TARGET OUTCOME

Unified Capital Allocation Pipeline

Reforms evolve the national transition architecture from bespoke, sovereign-reliant debt stacks to standardized, liquid, and commercial-scale green private markets.

✓ ALIGNED SYSTEM PLANNING TRANSFORMS SECTOR INVESTMENTS FROM BESPOKE TO REPLICABLE

Figure 3. Cross-cutting structural solutions matrix

Source: Author's elaboration.

3.4 Why Sequencing Matters

The phases are interdependent. Individual first-mover transactions can close ahead of full Phase 1 clarity, and doing so can help force the regulatory fixes that follow; but they cannot be priced on precedent or replicated at scale until that clarity is in place. Phase 3 commercial uptake cannot happen without Phase 2 precedent. Skipping forward produces what Indonesia has now: blended-finance demonstration deals that do not replicate, concessional capital sitting at the sovereign level rather than reaching projects, and a private financial sector that remains 97% unaligned with the transition.

The sequencing also resolves a tension that Indonesia's transition planning has not yet addressed directly. The feedback loop pathway is ready for Phase 2 work in select industrial corridors, particularly Sulawesi and Maluku, where Phase 1 foundations are most advanced, while planning work continues elsewhere; the circular economy pathway still needs Phase 1 to be substantially completed before its first-mover transactions can close. Treating both as ready for the same financing instruments at the same moment produces misallocation in both directions. Staging the work inside each phase, rather than treating the pathways as identical, aligns the response to where each pathway actually sits.

Finally, the phases are not exclusive. Phase 1 work continues into Phases 2 and 3 because planning and regulatory architecture is never finished. What changes across phases is the binding constraint and the institution best placed to address it. Phase 1 is constrained by political coordination and led by the state; Phase 2 is constrained by transaction novelty and led by public-purpose financial institutions; Phase 3 is constrained by underwriting capacity and led by commercial markets. Each phase is built deliberately and, where possible, in parallel; the recommendation is not to wait for one to finish before starting the next.

Conclusion

Indonesia's commitment to green industrialization is clear; whether it will be delivered is a different question. The constraint is not the absence of capital or of instruments. It is that the financing system, as currently configured, directs long-lived industrial demand to the fastest available answer (captive coal) rather than the cost-effective, sustainable one (utility-scale renewables anchored to aggregated industrial offtake), and treats circular economy investments as too small, too uncertain, and too bespoke to underwrite at scale. Both outcomes are produced by the same underlying logic: risks are bundled rather than disaggregated, contracts are negotiated from first principles rather than templated, and no institution bears the first-mover premium.

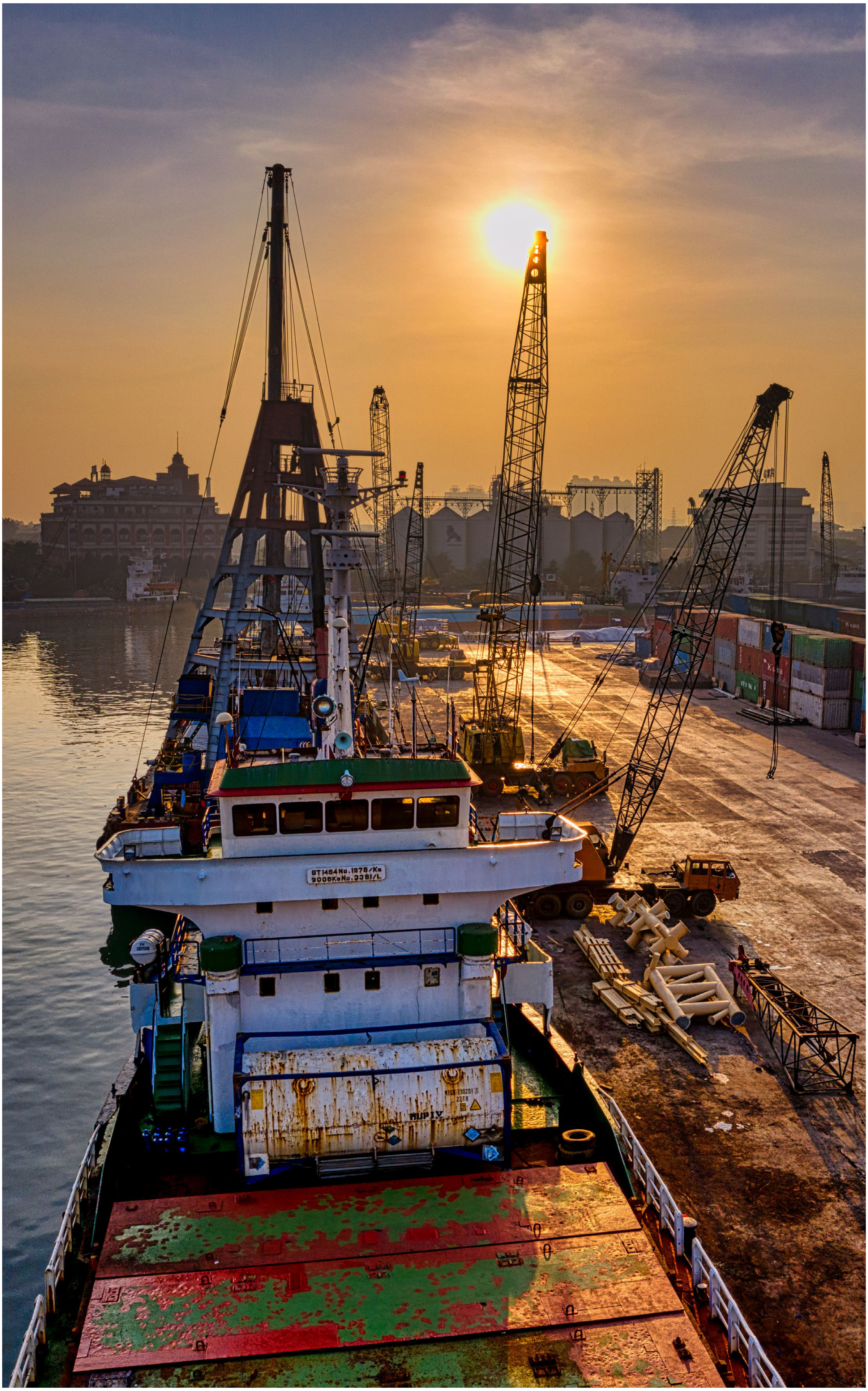
The instruments that resolve this are not the ones most often discussed at the country-envelope level. Blended finance does not crowd in private capital when it is sized to a national allocation rather than scoped to a specific risk, blocking a specific transaction. Guarantees do not lower the cost of capital when they cover general uncertainty rather than discrete exposures that the lender cannot otherwise price. PPAs cannot aggregate demand, since each is negotiated from scratch. And EPR will not anchor feedstock flows as long as its targets stay procedural. The diagnosis across both pathways converges on one point: *financing instruments work when they are matched to the actual constraint, and they fail when they are calibrated to look broadly applicable rather than locally effective.*

Two tensions remain unresolved.

The first is between speed and integration: industrial expansion is underway, and captive coal is being locked in, but the planning architecture that would make multi-user renewable configurations bankable takes time and politically difficult coordination to assemble. The workable response is to pursue first-mover transactions that demonstrate viable structures while the architecture catches up, accepting higher structuring costs and more subordinated capital on early deals.

The second concerns domestic ambition and external dependency, with regional integration the least developed response. Indonesia's pathway is significantly shaped by factors outside its control: EU recycled content mandates determine the price and scale of demand for recycled material; the bulk of domestically produced nickel and batteries reach end-of-life outside Indonesian collection reach; and DFI risk pricing, JETP allocation, and foreign-currency lending conditions are calibrated against country risk that no single national policy can reprice unilaterally.

Part of the response is to build domestic foundations (collection systems, traceability infrastructure, and producer responsibility frameworks) that are robust across external scenarios. The other part is regional. An ASEAN-level approach broadens the credible buyer base for renewable PPAs beyond a single national grid, secures the supply chain against single-country concentration, and makes backbone infrastructure (cross-border transmission, shared standards, regional traceability) financeable at scales no individual country can underwrite alone. Indonesia's position in nickel and battery value chains gives it standing to help set that regional architecture rather than receive it; the alternative is to remain a price-taker on standards set elsewhere. A regional supply chain that circulates value is workable even when final assembly is elsewhere: batteries finished in Vietnam or China and re-imported into Indonesia still anchor demand for Indonesian materials, and economic partnership agreements already in force provide the framework, provided the value circulates within a managed ASEAN perimeter rather than leaking out of it.



Appendix – Recommendations by Stakeholder

Ana M. Camelo Vega, Hans Wibisono Sutikno

Appendix Tables A.1 (feedback loop) and A.2 (circular economy) cover stakeholders whose financing roles are specific to a single pathway. Appendix Table A.3 covers stakeholders whose roles span both pathways, including the JETP partnership and international actors, export credit agencies (grouped with DFIs), and private and impact investors, as well as cross-cutting barriers. The three tables are intended to be read together.

Table A.1. Feedback loop: financing roles and recommendations by stakeholder

Sequencing	Stakeholder	Financing Role	Key Recommendations	Instruments & Mechanisms
Phase 1: Enabling conditions	Indonesian Government (BAPPENAS, ESDM, MoF/ OJK)	Integrated planning and enabling policy architecture	• Align energy (the Electricity Supply Business Plan (*Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL)), industrial, and spatial planning around bankable project pipelines with explicit infrastructure sequencing and investment timing • Phase out DMO coal price advantages for industrial captive power to remove the subsidized baseline against which renewables compete • Revise sustainable finance taxonomy to exclude new captive coal for nickel from transition-compatible (amber) classification • Establish regulatory framework for hybrid energy configurations (self-use + grid + third-party) with standardized licensing categories	• Policy-based guarantees (PT SMI, World Bank) • DMO reform/carbon pricing signal • Regulatory reform roadmap tied to JETP milestones
	PLN (Offtake role)	Grid offtaker and PPA counterparty	• Revise PPA risk allocation to shift development and connection risks to offtaker, in line with international norms (land acquisition, grid access, regulatory delays currently borne by developers) • Develop standardized industrial PPA templates with defined price, volume, payment security, and termination terms to replace bespoke contract negotiation • Enable power wheeling and shared-use transmission frameworks for multi-user renewable systems	• Standardized PPA templates • Long-term take-or-pay offtake with PLN payment guarantee • Shared-use transmission regulatory framework

Sequencing	Stakeholder	Financing Role	Key Recommendations	Instruments & Mechanisms
Phase 2: First-mover transactions	PLN (Transmission role)	Transmission infrastructure and grid expansion	• Accelerate transmission investment in Sulawesi and Maluku industrial corridors through dedicated SPVs with ring-fenced revenue models and explicit cost allocation across users • Plan grid expansion as shared backbone infrastructure serving multiple industrial zones—not as cost attached to individual sites • Sequence investment so early users are not penalized for infrastructure that will eventually serve multiple parties	• Dedicated transmission SPVs (ring-fenced revenue model) • Multi-user cost allocation frameworks • Regional interconnection co-financing
	MIND ID (State mining holding company)	Anchor offtaker and market signal provider	• Sign anchor PPAs (15–20 years, take-or-pay) using MIND ID credit quality to establish market reference pricing for industrial renewables and signal policy commitment to lenders • Coordinate multi-tenant demand aggregation across industrial parks to reach financeable project scale • Pilot first-mover renewable projects in Sulawesi/Maluku to create replicable financing templates for subsequent transactions	• MIND ID-backed long-term PPAs (15–20 years, take-or-pay) • Multi-buyer aggregated offtake through park management entities • Subordinated equity in demonstration projects
	PT SMI (Infrastructure financing facility)	Targeted risk absorber and credit-enhancement provider (with IIGF guarantees)	• Deploy targeted credit enhancement (first-loss instruments, subordinated debt, blended donor grants) against discrete, identifiable risks—payment risk, construction completion risk, or regulatory risk—and coordinate with the Indonesia Infrastructure Guarantee Fund (IIGF), whose separate mandate covers guarantees proper • Co-invest as subordinated equity in first-mover projects to absorb the novelty premium that lenders price into unprecedented structures; once precedent is established, subsequent projects require less subordination • Develop standardized guarantee products for shared transmission and park-level energy SPVs	• Credit enhancement (first-loss, subordinated debt, blended donor grants) covering ~20–30% of debt exposure, enabling commercial bank senior debt on remainder; IIGF guarantees for default risk • Subordinated equity in first-mover projects • Guarantee fee replacing blanket risk premium
	DFIs, multilateral development banks (MDBs) & ECAs (ADB, IFC, World Bank Group, AIIB, Japan Bank for International Cooperation (JBIC))	Concessional capital provider and risk disaggregator	• Provide long-tenor concessional debt directly to IPPs and private developers—not only through sovereign channels where it cannot reach project-level finance • Deploy currency risk disaggregation instruments (swaps, FX guarantees, hybrid local/foreign currency structures) to lower hard-currency debt costs • Design layered blended finance stacks for integrated renewable systems: concessional first-loss (20–30% of project cost at 2–4% return) + private senior debt (50–60%) + industrial PPA revenue stream • Support demonstration transactions in Sulawesi to create replicable templates	• Currency swaps / FX hedging (TCX-type) • Layered blended finance (concessional + commercial tranches) • Policy-based guarantees for regulatory risk • Technical assistance for project preparation
	Industrial Park Operators & Developers	Demand aggregator and shared-use infrastructure organizer	• Establish park-level energy management entities to aggregate multi-tenant demand and sign consolidated offtake—enabling investments unviable for individual tenants • Structure shared transmission, storage, and balancing assets as dedicated SPVs with transparent cost-allocation and long-term service agreements • Align permitting and licensing for hybrid renewable configurations within parks to remove regulatory ambiguity	• Park-management SPVs for shared energy infrastructure • Multi-buyer PPAs with tenant co-investment • Standardized connection and cost-sharing contracts

Sequencing	Stakeholder	Financing Role	Key Recommendations	Instruments & Mechanisms
Phase 3: Scaling & replication	Commercial Banks (Domestic and international)	Senior debt provider and refinancing channel	• Build internal capacity to assess clean energy project finance structures in Indonesia—addressing the information and capacity gap that contributes to higher perceived risk • Participate in syndicated lending alongside DFIs using standardized deal structures to reduce per-transaction due diligence costs • Support refinancing pathways: projects financed initially with 7-year bank debt can extend to 15-year infrastructure bonds once an operational track record reduces risk • Strengthen use-of-proceeds governance and impact reporting on green and sustainability-linked issuance, and adopt financial disclosure showing contributions beyond carbon (jobs, GDP, wider economic effects) to widen the investor base	• Syndicated project finance with DFI participation • Green bonds / sustainability-linked instruments • Infrastructure debt refinancing post-COD

Table A.2. Circular economy: financing roles and recommendations by stakeholder

Sequencing	Stakeholder	Financing Role	Key Recommendations	Instruments & Mechanisms
Phase 1: Enabling conditions	Indonesian Government (Ministry of Environment, Ministry of Industry, Ministry of Finance)	Regulatory foundation for circular investment	• Implement binding Extended Producer Responsibility regulations with: collection targets, minimum recycled content requirements, financial penalties for non-compliance, and a producer responsibility organization architecture (EU Battery Regulation as design reference) • Clarify waste classification for secondary materials (slag, tailings, sulfuric acid by-products) so that transport, storage, and reuse are legally feasible without excessive liability • Establish traceability mandate for downstreaming products to support compliance with export market requirements and build domestic data infrastructure	• EPR regulations with enforceable, time-bound targets • Waste classification reform for secondary materials • Traceability infrastructure mandate
	Industry (Battery manufacturers & downstream sector)	Demand signal and feedstock guarantor	• Invest in domestic collection systems, material traceability infrastructure, and reverse logistics arrangements across foreign export markets—recognizing that end-of-life recovery depends on systems beyond Indonesia's borders • Build producer responsibility organizations capable of guaranteeing feedstock flows and payments over time to recycling facilities • Once EPR is operational: secure long-term offtake agreements for recycled nickel, cobalt, and lithium at benchmark-linked pricing over tenors matching recycling-facility debt	• Producer responsibility organization (operational unit) • Research and development (R&D) and collection infrastructure investment • Long-term offtake agreements for recycled materials

Sequencing	Stakeholder	Financing Role	Key Recommendations	Instruments & Mechanisms
Phase 2: First-mover transactions	DFIs & MDBs (ADB, IFC, World Bank Group, AIIB)	Early-stage risk absorber and R&D funder	• Fund public R&D on tailings processing and battery recycling technologies where public investment at commercial scale lowered the risk bar for private deployment • Provide minimum volume guarantees for recycling facilities to bridge the timing mismatch between upfront capital expenditure and the gradual development of EV waste streams • Structure blended finance vehicles for circularity demonstration projects: first-loss equity or concessional debt from public finance (20–30%), enabling private senior debt at market rates	• Multi-year R&D fund • Volume guarantees (3–4 year ramp-up window) • Blended finance vehicle (20–30% first-loss from public finance) • Technical assistance for EPR regulatory design (2–3 years)
	Industrial Park Operators & Developers (Nickel processors & park managers)	Coordination intermediary for process circularity	• Act as the missing transaction arranger: identify cross-firm symbiosis opportunities (shared sulfuric acid systems, slag valorization, waste heat recovery) that individual tenants cannot coordinate alone • Place shared process circularity assets in dedicated entities with long-term service agreements—volumes, pricing formulas, and upgrade responsibilities clearly defined so lenders can evaluate predictable cash flows • Aggregate multi-tenant waste streams to create viable offtake scale for recycling facilities	• Dedicated entities for shared process circularity • Long-term service agreements with participating firms • Aggregated multi-tenant waste management operations
Phase 3: Scaling & replication	Commercial Banks (Domestic and international)	Circular credit provider	• Develop dedicated circular economy credit facilities with standardized eligibility criteria and circularity KPIs integrated into credit processes—Intesa Sanpaolo's EUR 6 billion circular credit facility as operational reference • Structure repayment linked to actual recycling output or phased schedules during ramp-up, rather than fixed amortization that creates unnecessary stress in early operating years • Embed circularity risk metrics in internal risk analysis frameworks to build institutional capacity for the sector	• Circular credit facilities with output-linked repayment • Sustainability-linked bonds with circular economy performance targets • Internal circular economy risk assessment capabilities

Table A.3. Cross-cutting barriers: financing roles and recommendations by stakeholder

Sequencing	Stakeholder	Financing Role	**Key Recommendations**	**Instruments & Mechanisms**
Phase 1: Enabling conditions	Indonesian Government (BAPPENAS)	Fragmented planning—energy, industrial, and spatial plans operate on separate timelines with different assumptions, producing pipeline uncertainty rather than bankable project sequences	• Establish cross-ministry coordination vehicle (PLN, ESDM, MoF, BAPPENAS, JETP) for green industrial park pipelines—aligning expansion plans with regional infrastructure sequencing and investment timing • Orient planning toward financing outcomes: sequencing, cost-sharing arrangements, and risk allocations that make projects bankable, not just policy-coherent • Provide dedicated institutional support for pilot projects that demonstrate integrated planning across feedback loop and circular economy pathways	• Project preparation facility grants • Programmatic policy-based loans
	Indonesian Government (ESDM)	Planning misalignment—RUPTL energy planning not integrated with BAPPENAS regional development or Ministry of Industry industrial policy on shared-use infrastructure and implementation timing	• Integrate RUPTL energy planning with regional development and industrial policy around shared-use infrastructure, enabling environment, and implementation timing • Create regulatory framework and standardized PPA templates for hybrid industrial-renewable arrangements (serving anchor users, park tenants, and grid simultaneously) with defined cost-sharing and payment enforcement	• Regulatory reform of PPA / licensing framework • Standardized hybrid PPA contracting templates
	JETP Partnership & International Actors (IEA, IRENA)	Capital access asymmetry—JETP committed an initial USD 20 billion package of public and private finance at its launch at the 2022 G20 Bali Summit. However, the vast majority is structured through market-rate and non-concessional loans rather than grants; furthermore, what concessional finance is available is heavily structured as sovereign lending, which limits the Indonesian government's ability to safely leverage private sector capital across both pathways.	• Redirect JETP finance toward subordinated and first-loss tranches accessible to private IPPs—closing the gap between sovereign-channeled concessional finance and project-level needs • Expand JETP scope to include shared industrial park infrastructure and circular economy enabling investments beyond the power sector	• JETP financing restructured for direct IPP access • Expanded scope: industrial park + circular economy infrastructure

Sequencing	Stakeholder	Financing Role	**Key Recommendations**	**Instruments & Mechanisms**
Phase 2: First-mover transactions	PT SMI (Infrastructure financing facility)	First-mover gap—initial integrated park projects face pricing based on limited precedent; no entity systematically absorbs the novelty premium that lenders price into unprecedented structures	• Act as first-mover de-risking vehicle: provide subordinated capital for initial integrated park projects combining aggregated renewable procurement and shared transmission—the demonstration effect is as valuable as the immediate financing impact • Leverage Danantara's balance-sheet scale for these transactions while relying on PT SMI's established project appraisal and transaction-structuring capabilities, rather than duplicating existing development finance institutions[107] • Coordinate with planning, environment, and industry ministries to align pipeline development with broader industrial planning • Serve as financial structuring advisor and arranger early in project development—ensuring bankability is designed in from inception, not retrofitted	• Credit enhancement (first-loss, subordinated debt) coordinated with IIGF guarantees • Subordinated capital for demonstration projects • Multi-sector investment platforms
	DFIs & ECAs (ADB, IFC, World Bank Group, AIIB, JBIC)	Tenor mismatch—infrastructure asset lives require 30+ year horizons but financing structured on short terms; annual debt service can exceed cash flow in early years even when lifetime economics are sound	• Extend debt tenors to align with infrastructure asset lives—development loans should generally be structured for 30+ years given the long period required for successful economic development • Structure refinancing pathways: projects initially financed with 7-year bank debt can extend maturity once 3–4 years of operational track record reduces perceived risk and improves debt service coverage • Redirect JETP concessional finance toward subordinated and first-loss tranches accessible to private IPPs—bridging the gap between where concessional finance sits (sovereign) and where it needs to land (project-level)	• First-loss equity or mezzanine debt • Refinancing facilities post-commissioning • JETP restructured for direct IPP access
	Industrial Park Operators & Developers	Missing coordination intermediary—tenants operate independently with no mechanism to identify cross-firm opportunities, broker agreements, standardize cost-sharing, or coordinate investment in shared assets across either pathway	• Evolve from land/utilities providers into active coordination intermediaries: organize multi-buyer PPAs for the feedback loop and cross-firm symbiosis for circular economy simultaneously • Bundle industrial demand (smelters, processing plants) with dedicated renewable energy + grid + utilities infrastructure to create integrated, financeable configurations • Structure all shared assets (energy, transmission, waste management, process circularity) through dedicated entities with transparent cost-allocation—making each a discrete project with identifiable cash flows	• Park-management SPVs (energy and circularity) • Monitoring and coordination infrastructure • Standardized multi-tenant service agreements

Sequencing	Stakeholder	Financing Role	**Key Recommendations**	**Instruments & Mechanisms**
Phase 3: Scaling & replication	Private / Impact Investors	System-level value vs. project-level finance—configurations that reduce system risk are penalized when disaggregated into standalone projects for conventional project finance evaluation	• Target impact-oriented and sustainability-linked mandates to absorb intermediate risk (mezzanine position) while DFI first-loss tranches enable commercial senior debt • Participate in blended finance structures covering both feedback loop (integrated RE) and circular economy (recycling, process circularity) investments • Build internal risk models tailored to RE, storage, circularity, and industrial park configurations—conventional project finance templates systematically misprice these	• Credit-enhanced project bonds • Green bond refinancing • Mezzanine capital at moderate returns
	Commercial Banks (Domestic and international)	Capacity gap—only ~3% of private financial sector investment is climate-aligned; domestic banks face information and capacity gaps on clean energy project performance and risk-return profiles	• Develop in-house expertise on clean energy and circular economy project finance through partnerships with DFIs and participation in syndicated structures • Integrate climate and circularity risk metrics into standard credit assessment processes—not as add-on ESG screens but as core underwriting criteria • Once demonstration projects establish track records: scale participation through standardized deal structures that reduce per-transaction costs	• Syndicated project finance with DFI co-lending • Standardized credit assessment frameworks • Portfolio refinancing instruments

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Columbia Climate School
Columbia Center on Sustainable Investment

Columbia Center on Sustainable Investment

475 Riverside Drive, Suite 504. New York, NY 10115

ccsi.columbia.edu