

Insight Paper: Indonesia's Energy Transition Market — Minerals, Processing, Storage, and Renewable Generation (2025-2035)

I. THE ENERGY IMPERATIVE - Market fundamentals driving transition

- Explosive electricity demand growth (2-3x by 2035)
- Mineral leverage (21% global nickel reserves)
- Coal stranding risk and economic imperatives
- Regional leadership positioning

II. GOVERNMENT ACTION & POLICY FRAMEWORK - Multi-layered execution architecture

- **RUPTL 2025-2034:** 69.5 GW capacity target (42.6 GW renewable); USD 138 billion capex; 73% from private IPPs
- **JETP:** USD 21.6 billion mobilized; Energy Transition Mechanism (ETM) coal retirement pilots
- **Hilirisasi policy:** Mandatory mineral processing/EV battery localization
- **Grid modernization:** 47,758 km transmission network; Sumatra-Java HVDC interconnection

III. CRITICAL INSIGHTS - Actionable Opportunities by Sector

A. Solar Energy — The Low-Hanging Fruit

- **Current:** 717 MW installed (August 2024)
- **Target 2034:** 17.1 GW (24x growth required)
- **Key Projects:**
 - **Cirata Floating Solar Ph1** (145 MWac, operational Nov 2023, Masdar+PLN, USD 129M investment)
 - **Cirata Phase II** (500 MW additional, in development)
 - **Saguling Floating Solar** (92 MWp, under construction, JETP financed, COD Nov 2026)
 - **PLN Rooftop Quota 2024-2028:** 5.75 GW across 11 power systems

Actionable Entry Points: EPC contracts, equipment supply (inverters, monitoring), rooftop aggregators, green bond financing

B. Geothermal — High-Margin, Long-Duration Assets

- **Current:** 2.3 GW (world's 2nd largest)
- **Target 2034:** 9.3 GW (4x growth)
- **Flagship Projects:**
 - **Sarulla Geothermal (330 MW, operational)** — World's largest single-contract geothermal; consortium (Medco 27.5%, Itochu 25%, Kyushu Electric 25%, Ormat 12.75%); USD 1.17B project finance; 30-year PPA model proven
 - **Pertamina-PLN Joint Portfolio:** 19 geothermal projects generating 530 MW (development)
 - **5 New Concessions:** Tendered 2025; 300-500 MW potential; 2027-2029 COD
- **Actionable Entry:** Competitive tender participation, bottoming/repowering of existing fields (faster ROI), technology/drilling services, project finance roles (12-15% IRR typical)

C. Wind Energy — Frontier with Accelerating Momentum

- **Current:** 154 MW installed
- **Target 2034:** 7.2 GW onshore + offshore (50x+ growth)
- **Key Projects:**
 - **PLN Jakarta Wind** (597 MW, target COD 2025)
 - **Sukabumi Wind** (258 MW, UPC Renewables + Binaték, target COD 2025)
 - **Banten Wind** (200 MW, PLN, permitting stage, target 2025)
 - **Offshore Wind:** Floating offshore wind technology emerging for 50-200m depths; 10 regions identified with >5 m/s wind speeds
- **Policy Breakthrough (2025):** Local content requirement lowered to 15% (from 40%), unlocking international developer participation
- **Actionable Entry:** International IPP participation, component sourcing (nacelle, towers, foundations), wind farm development partnerships

D. Battery & Energy Storage — Enabling Renewable Integration

- **Installed BESS:** Minimal (~100 MW pilot)
- **Target 2034:** 10.3 GW (320 GWh distributed systems)
- **Landmark Projects:**
 - **Upper Cisokan Pumped Storage (1,040 MW)** — Indonesia's first pumped storage hydropower; World Bank USD 650M loan, AIIB USD 250M; USD 800M total cost; expected completion 2025-2026; enables Java-Bali grid stability
 - **HLI Green Power (Hyundai+LG):** 10 GWh operational July 2024 (Karawang, West Java); Phase 2 planned for 10 additional GWh (USD 1.7B investment); total Hyundai+LG ecosystem USD 9.8 billion

- **CATL Ecosystem:** USD 5.9 billion across 6 projects:
 - Karawang cell plant: 15 GWh/year (6.9 GWh by 2026, full capacity 2027+)
 - Halmahera nickel/cathode facilities (2027-2028 COD)

E. Bioenergy & Biogas — Agricultural Waste to Energy

- **PLN EPI + BEG + G7 Group Partnership:** 5 biomass plants; first COD 2026 (120,000 tonnes/year EFBs)
- **Pertamina-ReNikola Biogas:** 40 compressed biomethane projects (USD 240M investment); North Sumatra pilot (USD 6M, 40,000 tonnes CO₂ offset/year)
- **Sustainable Aviation Fuel:** Airbus partnership targeting 100M tonnes/year from palm oil residues
- **Actionable Entry:** Waste aggregation logistics, processing/pelletizing, biogas project development, SAF technology

F. Green Hydrogen & Ammonia — Strategic Decarbonization

- **Government Target:** 9.9M tonnes hydrogen by 2060; USD 25.2B investment
- **Flagship Projects:**
 - **Garuda Hidrogen Hijau (GH2):** 150,000 tonnes/year renewable ammonia (600 MW wind+solar); ACWA Power + PLN + Pupuk Indonesia; >USD 1B investment; EPC bidding Q1 2024+; target COD 2026
 - **Batam Island Green Ammonia:** 37,500 tonnes/year (CEEC, 240 MW solar)
 - **Pupuk Indonesia Roadmap:** 13M tonnes/year ammonia by 2050 (electrolysis, nuclear, biomass pathways)
- **Actionable Entry:** Electrolyzer supply, power PPA for H₂ plants, project development, shipping/logistics

G. Carbon Capture & Storage (CCUS) — Emerging Frontier

- **Government Vision:** 15 CCUS projects by 2030; 600+ Gt CO₂ storage capacity
- **Active Project:** BP Tangguh LNG CCS (West Papua, 1.8 Gt storage capacity, USD 2.6B investment)
- **Regional Hubs:** Sunda Strait, Bintuni Basin

IV. FINANCIAL STRUCTURES & INVESTMENT MECHANISMS

JETP Funding (USD 21.6 billion breakdown): ^[1] ^[2] ^[3]

- USD 11.6B public sector (G7 + EU, concessional/non-concessional loans)
- USD 10B private sector (GFANZ member banks)
- **70% financing gap remains:** Total CIPP power sector pathway needs USD 97.1B; JETP

covers ~22%

- **Implication:** JETP is catalyst, not complete solution; private developers accessing JETP face stringent requirements

Energy Transition Mechanism (ETM) Platform:

- Cirebon-1 coal retirement (660 MW) as pilot transaction
- Targeted financial close 2025-2026
- Expected to enable 3-5 additional coal retirements post-2026

Blended Finance & Risk Mitigation:

- Partial Risk Guarantees (World Bank, ADB): Reduce borrowing costs 200-300 bps
- Subordinated/Mezzanine Debt: IFC, OPIC, FMO offering 5-7% rates
- Currency hedging: Local currency IDR lending (5-6%, 10-20 year tenor) increasingly available
- Green bonds: PLN, corporate issuances at favorable rates

Private Sector Financing Emerging:

- Corporate PPAs: ~1-2 GW solar expected by 2027
- Green bonds: PLN issued IDR 3 trillion bond in 2024; 5-10x increase expected 2025-2026
- Local bank lending: Indonesian banks offering 10-20 year IDR loans at 4-6%

V. KEY PLAYERS - Investors, Developers, State Actors

Government & SOEs:

- **PLN:** RUPTL 2025-2034 execution; grid/storage; rooftop solar quota
- **Pertamina:** Geothermal, bioenergy partnerships
- **Pupuk Indonesia:** Garuda GH2 renewable ammonia
- **INA/Danantara:** Sovereign wealth funds allocating 15-20% to renewables

International Developers:

- **Masdar (UAE):** Cirata floating solar (192 MW operational); Phase II 500 MW
- **ACWA Power (Saudi):** Garuda HH2 (150,000 t/y ammonia)
- **Sumitomo (Japan):** Sarulla geothermal operator
- **Total Eren, Copenhagen Atomics, others**

Battery & EV Supply Chain:

- **CATL (China):** USD 5.9B ecosystem (15 GWh Karawang + Halmahera nickel/cathode)

- **Hyundai+LG (Korea):** HLI Green Power (10-20 GWh phases)
- **Aneka Tambang, Vale, Freeport:** Mining partners

Financing Institutions:

- ADB, World Bank, GFANZ banks, IFC/MIGA, PT SMI

VI. PROJECT TRACKER - 2025-2026 Pipeline

Sector	Project	Capacity	Developer	Investment	COD
Solar	Cirata Ph1	145 MWac	Masdar/PLN	USD 129M	Nov 2023 ✓
	Saguling FPV	92 MWp	PLN/Masdar	USD 108.7M	Nov 2026
	Cirata Ph2	500 MW	Masdar/PLN	TBD	2027
Geothermal	Sarulla Muara Laboh	110 MW	Sumitomo JV	USD 300M+	Oct 2027
	PGE-PLNIP Portfolio	530 MW	19 projects	Multi-source	2026-2028
Wind	PLN Jakarta	597 MW	PLN	TBD	2025
	Sukabumi	258 MW	UPC+Binatek	TBD	2025
Storage	Upper Cisokan	1,040 MW	PLN	USD 800M	2025-2026
	HLI Ph2	10 GWh	Hyundai/LG	USD 1.7B	2026-2027
Sector	Project	Capacity	Developer	Investment	COD
	CATL Karawang	15 GWh	CATL/IBC	USD 3B	2026 (6.9), 2027+ (full)
Hydrogen	Garuda HH2	150K t/y NH ₃	ACWA/PLN/Pupuk	USD 1B+	2026
Biomass	PLN EPI 5 Plants	600K+ t/y	PLN/BEG/G7	Multi-source	2026+

Visual Dashboards Created:

** Indonesia Energy Transition Pipeline Dashboard**

(1) Renewable capacity targets by sub-sector (current vs. 2034); (2) Major project timeline 2025-2027; (3) JETP funding structure (USD 21.6B mobilized, 70% gap); (4) Battery manufacturing capacity ramp (35 GWh/year by 2027-2028)

** Investment Requirements & Financing Structure**

Waterfall visualization showing: (1) USD 183B total investment requirement; (2) Funding sources (JETP USD 21.6B, multilateral banks, green bonds, corporate PPAs, domestic equity); (3) USD

120.9B financing gap (~66%); (4) Financing instrument mix (project finance 45%, blended finance 12%, equity 18%, guarantees 8%)

**** EV Battery Supply Chain Ecosystem****

Mining (North Maluku nickel) → Smelting (Class 1 nickel) → Precursor/Cathode → Battery cell (Karawang, North Maluku) → EV assembly → Exports. Shows major players (CATL, HLI, Hyundai, Aneka Tambang, SMZC) and USD investments at each stage. Illustrates hilirisasi government policy enforcing value capture.

Key Takeaways for Investors:

1. **Window of Opportunity:** Next 18-24 months (2025-2026) are critical inflection points. Early-stage partnerships with government, offtake contracting, and permitting will compound into platform positions by 2030.
2. **Largest Gaps:** Solar, wind, and distributed BESS represent the largest financing/execution gaps (66% of capex needs still unfunded). Highest ROI potential.
3. **Strategic Plays:**
 - Battery supply chain (CATL, HLI models show 12-15% returns)
 - Floating solar/geothermal bottoming (faster execution, proven economics)
 - Energy storage + smart grid (nascent market, first-mover advantage)
 - Green hydrogen/ammonia (export-focused, high margins post-2027)
4. **Financial Structure:** Blended finance (public guarantees + private debt + equity) is now standard. JETP catalyzes first wave; domestic banks/green bonds scaling 2025+.
5. **Execution Risk:** Historical underperformance (previous RUPTL) now being addressed by government project development facilities, streamlined permitting, PLN grid connection standardization.