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Transforming Indonesia's coal dependence into clean energy opportunities

Innovative approaches to repurpose stranded coal assets can accelerate the shift to renewable energy

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Contents

Figures and Tables

Key findings

Indonesia’s electricity system faces oversupply, aging infrastructure, and underutilized coal-fired power plants (CFPPs). Maintaining inefficient coal assets burdens the national utility, PT Perusahaan Listrik Negara (PLN), with high maintenance costs and long-term contracts with Independent Power Producers. As a result, government subsidies and compensation to PLN increased by 24% in 2024 to USD11 billion, accounting for 5% of the national budget.

Indonesia’s Presidential Regulation No. 112/2022 and Ministry of Energy and Mineral Resources (MEMR) Regulation No. 10/2025 lay the legal and strategic foundation for early retirement of CFPPs, yet implementation remains slow. Unclear retirement pathways, limited asset data, and complex Power Purchasing Agreements (PPAs) continue to delay the coal phase-out.

Various business models tailored to Indonesia’s unique asset landscape can address the financial and operational complexity associated with the acceleration of CFPP retirement. These include asset divestment, public-private partnerships (PPPs), and blended finance structures that align incentives for public and private stakeholders. Transition credits also offer promising instruments to address the financial gap in early coal retirement.

Danantara, Indonesia’s newly established sovereign wealth fund, can drive PLN portfolio optimization by leading CFPP retirement or repurposing through identifying eligible assets, standardizing retirement pathways, and ensuring that just transition principles, such as workforce reskilling and community support, are embedded in every phase-out plan.

Executive summary

Indonesia's coal phase-out is no longer a policy aspiration, but a strategic and economic necessity. The country's electricity system is burdened by oversupply, aging infrastructure, and underutilized coal-fired power plants (CFPPs), many of which operate far below optimal capacity. Despite previous ambitious expansion plans, actual demand growth has lagged, resulting in reserve margins exceeding 39%, which is significantly higher than the national electricity utility, PT Perusahaan Listrik Negara's (PLN) own standards.

The oversupply has created cascading inefficiencies in Indonesia's grid. Between 2015 and 2024, the average capacity factor of on-grid CFPPs remained below 70%, indicating persistent underperformance across the fleet. In 2024, the national average utilization factor for CFPPs, combining assets owned by PLN and Independent Power Producers (IPPs), was approximately 65%. Even IPP-owned assets operating under take-or-pay power purchase agreements (PPAs) with PLN, which require delivering at least 80% of installed capacity, have failed to meet this condition. Over the past three years, IPP-owned CFPPs have operated at a utilization rate below 70%, highlighting a persistent gap between contracted capacity and actual output.

These inefficiencies result in a growing financial burden for both PLN and the Government of Indonesia (GOI). While coal has long been viewed as cost-effective, its generation cost has risen sharply, from IDR637 per kilowatt-hour (kWh) in 2020 to IDR941/kWh in 2024, marking a 48% increase attributed to aging infrastructure and rising operational, maintenance, and compliance costs. This has occurred despite the government's policy caps on the price of coal at below-market cost.

Under existing PPAs, PLN remains obligated to pay IPPs as if the plants were operating at the full contracted capacity factor, regardless of actual output. This difference creates a financial gap between the electricity PLN pays for and what is actually delivered, costing the utility an estimated IDR33 trillion (USD2 billion) annually to maintain IPP contracts.

This fiscal strain is growing. In 2024, government allocations for subsidies and compensation surged by 24% from IDR142 trillion (USD9 billion) in 2023 to IDR177 trillion (USD11 billion), representing a staggering 33% of PLN's total revenue. In stark contrast, electricity sales increased by only 6%, from IDR333 trillion to IDR353 trillion, highlighting the widening gap between system costs and revenue generation.

However, apart from the financial and technical aspects, retiring coal plants also involve social and economic transformations. Retiring these assets without adequate planning risks triggering job losses, economic disruption, and social dislocation. Repurposing coal assets offers a practical and socially responsible pathway forward.

Frameworks such as the Energy Transition Mechanism (ETM) by the Asian Development Bank (ADB) and the Just Energy Transition Partnership (JETP) offer promising financial support, but implementation has been slow. Projects like the proposed retirement of Cirebon-1 CFPP illustrate the challenges of navigating regulatory, contractual, and financing hurdles. Unlocking private sector participation, particularly for state-owned assets, requires viable and replicable models that balance risk, return, and policy alignment.

A range of business models tailored to Indonesia's unique asset landscape can help address the financial and operational complexity associated with the early retirement of coal plants. These include asset divestment, public-private partnerships (PPPs), and blended finance structures that align incentives across public and private stakeholders. Transition credits also offer a promising mechanism to close the financing gap and compensate for foregone revenues associated with early retirement.

Daya Anagata Nusantara (Danantara), Indonesia's newly established sovereign wealth fund under Law No. 1 of 2025, is poised to play a catalytic role. With a mandate to manage state-owned assets and mobilize investment, Danantara is uniquely positioned to accelerate the coal phase-out and the implementation of the Ministry of Energy and Mineral Resources (MEMR) Regulation No. 10/2025 by identifying eligible assets, standardizing retirement and repurposing pathways, and ensuring that just transition principles, such as workforce reskilling and community support, are embedded in every phase-out plan. With suitable institutional support and financial tools, Danatara could transform coal assets from stranded liabilities into launchpads for Indonesia's clean energy future.

1. Introduction: The coal phase-out urgency

Coal phase-out has emerged as a defining pillar of Indonesia's energy transition strategy. This shift is driven by growing international pressure and commitments under charters such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, as well as subsequent Conference of the Parties (COP) meetings. These global platforms have pushed countries, including Indonesia, to take concrete steps toward reducing emissions. Coal phase-out has emerged as one of the most visible strategies. It is estimated that unabated coal-fired power plants (CFPPs) should be decommissioned at an average of 10 to 30 years earlier to limit global temperature rise to 1.5 degrees Celsius and avoid severe climate change impacts.[1]

In view of this urgency, Indonesia, together with other countries, signed the "Global Coal to Clean Power Transition Statement," pledging to phase out existing coal fleets.[2] This commitment translated into regulatory action with the issuance of Presidential Regulation (PR) No. 112 of 2022, which provides the legal foundation for early CFPP retirement. The key provisions include prohibiting the building of new CFPPs (except under strict conditions, such as grid reliability needs or strategic national interest) and mandates for early retirement pathways, which enable national electricity

[1] World Resources Institute. Understanding the Legal Implications of Early Decommissioning. 18 December 2024.
[2] UNFCCC. End of Coal in Sight at COP26. 04 November 2021.

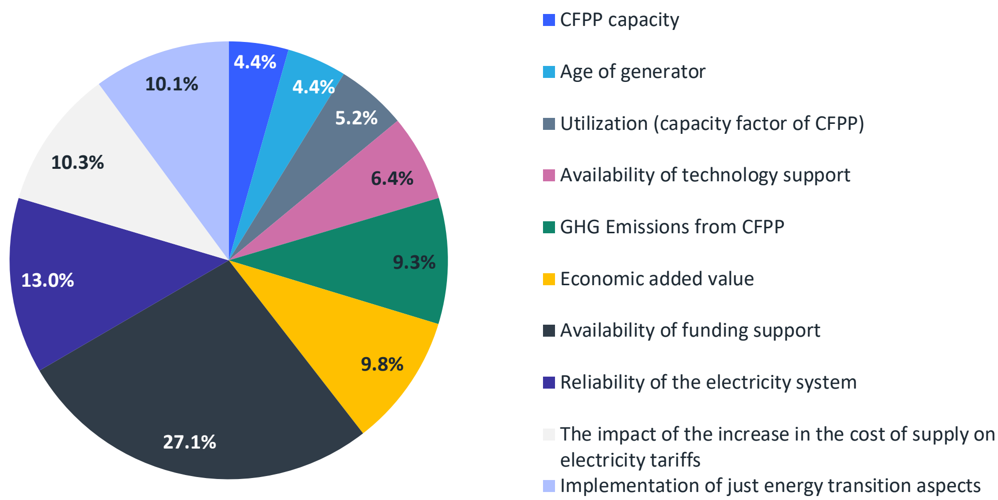
utility, PT Perusahaan Listrik Negara (PLN), and Independent Power Producers (IPPs) to decommission aging coal assets ahead of schedule.[3]

Coal phase-out gained further momentum when supporting financing mechanisms were proposed.[4] Understanding the challenges faced by developing countries in phasing out coal and to help Indonesia accelerate the energy transition, the Asian Development Bank (ADB) established the Energy Transition Mechanism (ETM), a blended finance platform designed to hasten the early retirement of CFPPs and replace them with clean energy alternatives.[5] The latest support offered is through the launch of the Just Energy Transition Partnership (JETP) for Indonesia on 16 November 2022, in collaboration with the International Partners Group (IPG).[6] These initiatives have elevated coal retirement from a peripheral policy discussion to a central focus of national and international climate cooperation, linking emissions reduction with financial innovation, regulatory reform, and long-term energy system transformation.

Building on this momentum, President Prabowo also reaffirmed Indonesia's commitment to phasing out all coal-fired and fossil fuel power within the next 15 years[7] and achieving 100% renewable energy[8], emphasizing the dual strategy of natural retirement and accelerated phase-out of fossil fuel assets. To support President Prabowo's ambitious policy statement and in alignment with PR No. 112 of 2022, the Ministry of Energy and Mineral Resources (MEMR) issued Regulation No. 10 of 2025 on the Roadmap for Energy Transition in the Electricity Sector (MEMR No. 10/2025).[9] This regulation outlines a strategy framework to reduce greenhouse gas (GHG) emissions by managing existing power plants and accelerating CFPPs retirement schedules. It also provides clear criteria and methodology for identifying which coal plants are eligible for early retirement.

[3] Government of Indonesia. Peraturan Presiden (PERPRES) Nomor 112 Tahun 2022. September 2022.
[4] World Resources Institute. Understanding the Legal Implications of Early Decommissioning. 18 December 2024.
[5] ADB. ADB and Indonesia Partners Sign Landmark MOU on Early Retirement Plan for First Coal Power Plant Under Energy Transition Mechanism. November 2022.
[6] JETP Indonesia. Comprehensive Investment and Policy Plan. November 2023.
[7] Cabinet Secretariat of the Republic of Indonesia. G20 Summit: President Prabowo Subianto Highlights Indonesia's Green Energy Vision, Global Climate Role. November 2024.
[8] The Straits Times. Prabowo says Indonesia can hit 100% renewable energy by 2035. 10 July 2025.
[9] Ministry of Energy and Mineral Resources. Regulation No. 10 of 2025 on the Roadmap for Energy Transition in the Electricity Sector. April 2025.

Figure 1: Analytical hierarchy criteria



Source: MEMR Regulation No. 10 of 2025.

MEMR No. 10/2025 has the potential to be a key pillar of Indonesia's coal transition strategy. However, the regulation has several unresolved issues that hinder its effectiveness. These include:

- **Overreliance on funding availability as the primary criterion for coal retirement decisions**: While financial feasibility is critical, especially given the high costs of decommissioning, this approach risks sidelining projects with greater strategic value but less access to capital.
- **Lack of a clear retirement pathway:** The regulation does not provide a transparent or standardized process for evaluating and approving CFPPs for early retirement.
- **Absence of an asset eligibility list:** There is no publicly disclosed list of CFPPs prioritized for retirement, making it difficult to assess the scope, timeline, and financial requirements of the transition.
- **Limited progress on execution:** To date, there has been minimal progress in the actual early retirement of coal assets following the issuance of this regulation. Key transactions, such as the proposed early retirement of Cirebon-1 and Pelabuhan Ratu CFPPs, remain stalled, with financing and contractual negotiations yet to be finalized.

The coal phase-out also presents complex financial, technical, and social challenges that should be addressed. For developing economies like Indonesia, securing adequate funding is a significant hurdle. Early coal plant retirement poses considerable financial challenges for governments and investors, as many plants are still relatively young and are tied to long-term contracts. Early retirement of profitable CFPPs requires compensating owners and operators for the loss of anticipated future earnings. These compensation costs are often substantial and difficult to finance, particularly in markets where fiscal space is limited and energy subsidies remain entrenched. Governments and investors face steep expenses, and the economics of early retirement are often difficult to justify without a robust support mechanism.[10]

Limited fiscal space and competing priorities constrain domestic investment in climate and energy transition efforts, making concessional finance and international support essential. JETP pledges USD20 billion to support a 1.7 gigawatt (GW) target for early retirement by 2040, with ETM as a key delivery mechanism. The ADB's ETM uses blended finance to accelerate the retirement of CFPPs and their replacement with clean energy. A pilot project with Cirebon Electric Power aims to retire a 660-megawatt (MW) plant in West Java, serving as a replicable model. However, implementation faces regulatory and contractual challenges, with negotiations ongoing for over three years. Progress remains slow, and the financial gap is significant. Unlocking private sector participation is difficult due to the lack of viable business models, especially for state-owned assets, where natural retirement is often underutilized as a result of institutional inertia and financial uncertainty.

Coal remains a cornerstone of Indonesia's energy system, valued for its reliability, dispatchability, and domestic availability. It supplies a substantial share of the country's baseload power. Despite low renewable energy supply and global examples of high renewable integration, officials view early plant retirements as a risk to grid stability and power security. Coal has long been perceived as the cheapest and most accessible source of electricity, largely due to Indonesia's abundant coal reserves, regardless of the falling costs of renewables. This perception is because coal plants receive subsidies, fixed contracts, and preferential dispatch rights. These market distortions prevent planners and policymakers from recognizing the true costs of the national energy economy, making it increasingly difficult for clean energy to compete with coal.

This deep reliance on coal creates a policy dilemma. While the long-term benefits of shifting from coal are clear, the short-term risks to energy security may pose a challenge, politically and technically. Even with financing tools such as blended finance and concessions through the ETM and JETP, concern over grid reliability continues to make early coal retirement a difficult proposition.

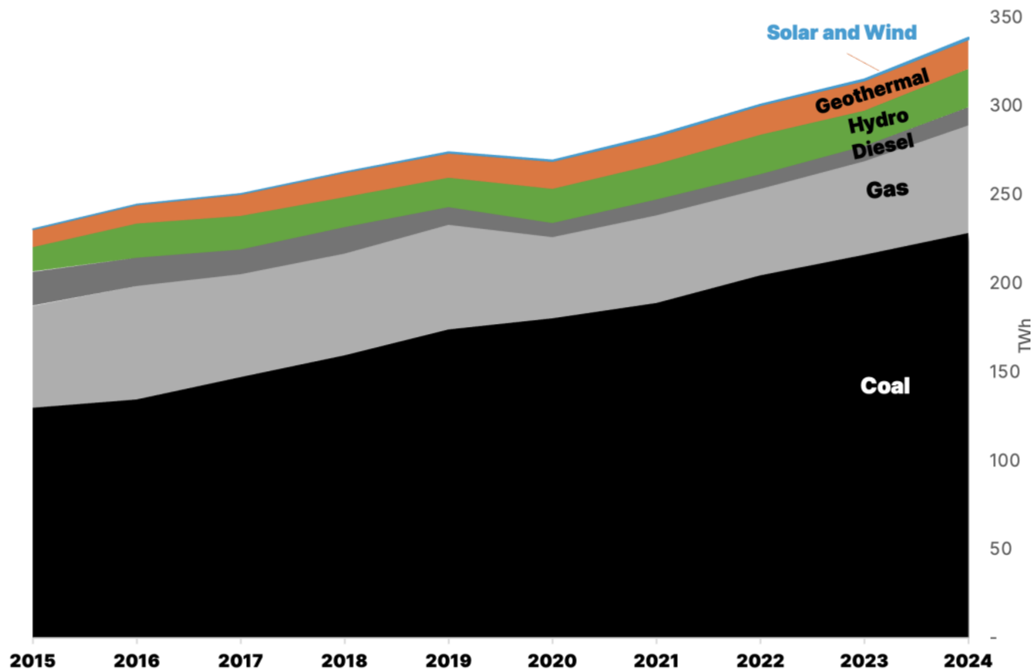
Finally, the just transition and social dimension of the coal phase-out should be taken into consideration. In coal-dependent regions, plant closures can result in job losses. However, a large-scale shift toward renewable energy and storage holds the potential to create numerous diverse and skilled jobs across the country. Strong just transition policies, including workforce reskilling and career transition (for those directly employed and indirectly impacted), community support, and economic diversification, can ensure the energy shift promotes equity and broad participation.[11]

[10] IEEFA. Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch. April 2025.
[11] IEEFA. Accelerating the Coal-to-Clean Transition. June 2024.

2. Indonesia's heavy reliance on coal

Indonesia is among the most coal-dependent countries globally, with coal accounting for approximately 68% (around 228 terawatt-hours [TWh]) of its electricity generation. This share has increased over time. In 2015, coal contributed 56% of the energy mix, while gas and diesel accounted for 25% and 8%, respectively. Instead of transitioning away from fossil fuels, Indonesia has restructured its fossil fuel composition by reducing its reliance on gas and diesel, which have dropped to 18% and 3%, respectively, while increasing its dependence on coal.

Figure 2: Indonesia's electricity production in TWh

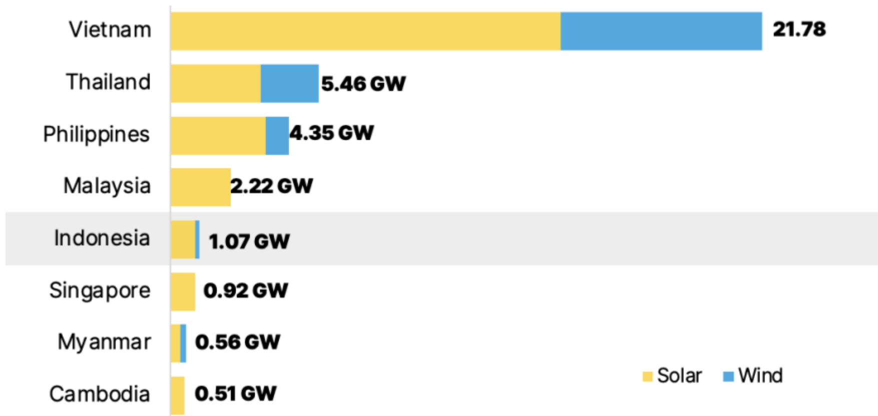


Source: Indonesia's Electricity Supply Business Plan 2025 – 2034; PLN's Annual Report.

Meanwhile, despite Indonesia's abundant solar and wind potential, these sources account for a negligible percentage, and their contribution to the grid remains minimal. As of 2024, the combined installed solar and wind capacity in the country was just 1.07GW, and the electricity production from these technologies was only 0.27% of total electricity generation.[12] This trajectory contrasts starkly with global trends, as other countries are actively shifting from fossil fuels to renewable energy sources. Indonesia lags behind even neighboring countries. Vietnam, for example, has developed 21.78GW of solar and wind capacity, followed by Thailand and the Philippines, which have developed 5.46GW and 4.35GW, respectively.

[12] MEMR. Laporan Kinerja Kementerian Energi dan Sumber Daya Mineral 2024. 19 February 2025.

Figure 3: Operating solar and wind in Southeast Asia



Source: Global Energy Monitor, Global Wind Power Tracker, February 2025; Ministry of Energy and Mineral Resources; Energy Market Authority; PLN's Annual Report.

Indonesia's over-reliance on coal is based on a few reasons. A key factor has been the government's mandate to achieve 100% electrification, aimed at ensuring nationwide access to electricity.[13] Coal has been a primary energy source. Planners and policymakers considered CFPPs to be the cheapest way to supply electricity to meet domestic energy demand.

Two structural advantages underpin coal's dominance in Indonesia's energy mix:

- **Abundant domestic coal reserves and established infrastructure.** Indonesia is one of the world's top coal producers with ample domestic coal reserves (ranked seventh globally)[14], established supply chains, and mature infrastructure. Coal has offered a seemingly practical pathway to rapidly expand electricity access and support economic development.

- **Perceived cost-efficiency.** For planners and policymakers, CFPPs remain the cheapest option for baseload electricity generation. However, Indonesia's coal advantage is not purely market-driven. It is shaped by policies that create artificial price stability and supply certainty for domestic consumers, particularly PLN. Historically, the government has issued several policies and regulations that favor coal. An artificial advantage is secured by the Domestic Market Obligation (DMO) and Domestic Price Obligation (DPO) policies to reserve a minimum 25% volume of domestically mined coal for national consumption at prices fixed at USD70 per tonne below global market rates. As of the second half of October 2025, the export market value of coal is USD109.74 per tonne.[15] While the DMO policy is necessary to ease procurement efforts and ensure a stable supply for domestic needs, the DPO distorts

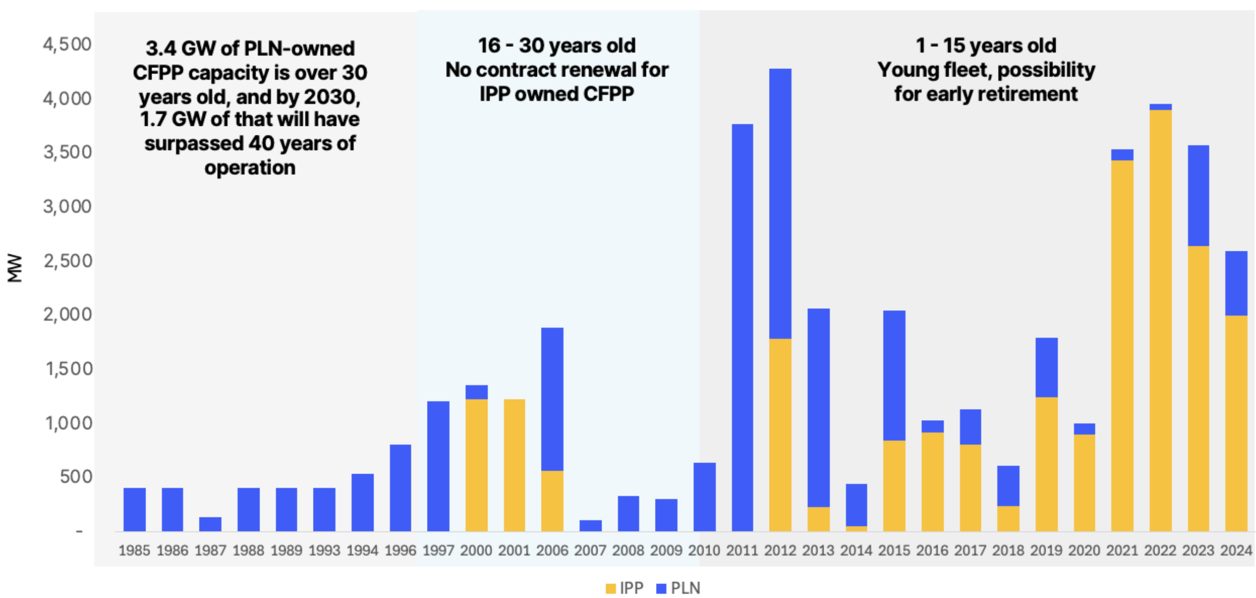
[13] IEEFA. Pathways to Financial Sustainability for PLN through Renewable Energy Development. May 2024.
[14] Coal Metal Asia. Energy security warning: Indonesia's coal proven reserves are less than 50 years. 15 November 2024.
[15] MEMR. Harga Acuan. October 2025.

the market price and creates artificially low prices for CFPPs during periods of high coal prices.[16]

As of 2024, the country operates approximately 54GW of on-grid CFPP capacity, making coal the largest source of electricity.[17] PLN manages around 41GW of this, with 21GW from its own fleet and 20GW operated by IPPs under contractual schemes.[18, 19] Most IPP plants are developed under build-own-operate (BOO) or build-own-operate-transfer (BOOT) arrangements, backed by long-term power purchase agreements (PPAs) that guarantee revenue regardless of dispatch levels.

While PLN's CFPPs include aging infrastructure (3.4GW are over 30 years old, and 2.1GW are over 35 years old), many IPP-operated plants are newer and more modern. By 2030, a large share of PLN's fleet will be over 40 years old, underscoring the critical need for strategic planning.

Figure 4: Indonesia's annual CFPPs capacity



Source: Global Energy Monitor; PLN; IEEFA.

From Indonesia's perspective, early CFPP retirement is becoming increasingly rational and economically beneficial for several reasons:

1. Indonesia's electricity system is facing chronic oversupply — a structural challenge rooted in a fossil-fueled expansion strategy. This includes the 2015 plan to add 35GW of capacity based

[16] JETP Indonesia. Supply chain incentives: Why does the CIPP recommend to keep the Domestic Market Obligation (DMO), but to remove Domestic Price Obligation (DPO)?.
[17] MEMR. Handbook of Energy & Economic Statistics of Indonesia 2024. May 2025.
[18] PLN. Statistics PLN 2024. June 2025.
[19] MEMR. Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025 – 2034. May 2025.

on overestimated economic growth projections. This mismatch has led to persistently high reserve margins, reaching 39.32% in 2024, well above the national standard of 30%.

2. Persistent overcapacity has resulted in widespread asset underutilization. Many plants are operating far below their optimal load factors, failing to deliver expected return and efficiency. Underutilized assets also crowd out space for renewables, locking in emissions and delaying the energy transition.

3. The pursuit of a 100% electrification ratio and significant expansion of CFPPs has come at a high cost. Overcapacity has resulted in widespread asset underutilization, which has become a growing financial burden for both the government and the broader economy, as PLN must maintain its own aging CFPPs, as well as IPP-owned plants. Many IPP-owned CFPPs were constructed under long-term contracts that assumed high capacity factors. However, they are producing less electricity than they are contracted to. Consequently, fixed costs remain high while revenue generation stagnates, straining public budgets and utility finances.

4. Extending the life of older CFPPs would further exacerbate the financial burden, as it entails expensive refurbishment. It will lock Indonesia in costly liabilities and delay the transition to a more efficient and low-carbon energy system.

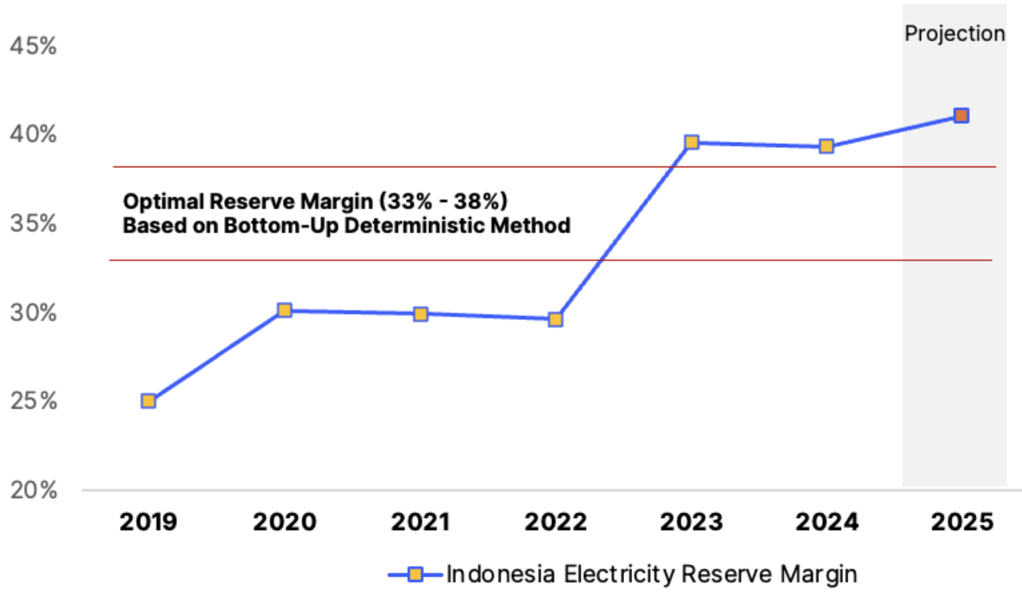
5. The rapid and extensive expansion of CFPPs over the past two decades has led to a sharp increase in GHG emissions. Indonesia now faces mounting pressure to meet its climate commitments, yet its energy system remains heavily reliant on coal. This dependence not only undermines decarbonization efforts but also acts as a deterrent to foreign investment, particularly from institutions and countries that have adopted strict environmental, social, and governance (ESG) criteria.

2.1 Structural oversupply driven by excessive coal capacity

Indonesia's electricity system is facing a persistent oversupply challenge rooted in decades of fossil-fueled expansion and misaligned demand projection. A key driver of this imbalance was the 2015 Government of Indonesia (GOI) initiative to add 35GW of new generation capacity.[20] However, the plan was based on an annual economic growth projection of 6%–7%. This was a miscalculation as the Indonesian economy could only maintain about 5% growth, except during the COVID-19 pandemic, when economic activity dropped dramatically. As a result, PLN had a reserve margin of 39.55% in 2023 and 39.32% in 2024, higher than the reserve margin standard of 30%[21], and the optimal reserve margin standard based on a bottom-up deterministic method.[22]

[20] IEEFA. Pathways to Financial Sustainability for PLN through Renewable Energy Development. May 2024.
[21] MEMR. Laporan Kinerja Kementerian Energi dan Sumber Daya Mineral 2024. February 2025.
[22] MEMR. Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025 – 2034. May 2025.

Figure 5: Indonesia's electricity reserve margin

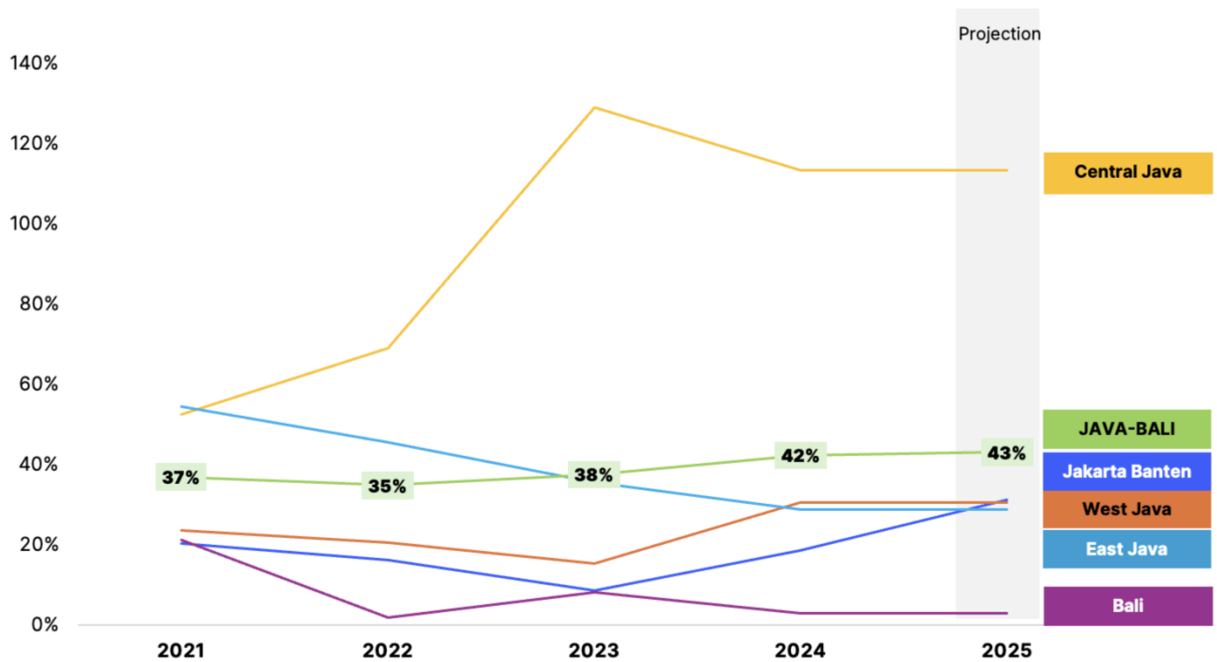


Source: MEMR. RUPTL 2025 – 2034.

The situation is even more pronounced in the Java-Bali grid. With the commissioning of Suralaya CFPP Units 9 and 10[23], an additional 2GW of capacity has increased the reserve margin well beyond planning targets. Under the new Electricity Supply Business Plan (RUPTL), the reserve margin target for the Java-Bali grid is set at 35%. However, in 2024, the reserve margin was around 42% and is expected to increase to 43% in 2025.

[23] CNN Indonesia. PLTU Jawa Unit 9 dan 10 Suralaya Resmi Beroperasi. 09 October 2025.

Figure 6: Reserve margin in the Java-Bali grid



Source: RUPTL 2025 – 2034, IEEFA analysis.

2.2 Inefficiencies in Indonesia's grid

Oversupply, where demand growth lags behind capacity expansion, has led to lower utilization rates, rendering many assets economically inefficient and environmentally unsustainable. An analysis of total electricity generation relative to installed capacity reveals that CFPPs in Indonesia have consistently operated well below optimal capacity factor (CF), both by domestic standards and international benchmarks. The CF measures the actual electricity a plant generates relative to if it ran at 100% full capacity continuously. Higher values indicate greater competitiveness and operational efficiency. Typically, different technologies will have varying CFs that indicate their performance. For example, in Indonesia, a CFPP is designed to operate for approximately 6,000 full-load hours of generation annually, or at a CF of 70%–80%.[24] However, the CF for operational CFPPs is below the standard and steadily declining.

Between 2015 and 2024, the average CF of these CFPPs never surpassed 70%, indicating persistent underperformance across the fleet. In 2024, the national average utilization factor for CFPPs, combining assets owned by PLN and IPPs, was approximately 65%. This modest improvement was largely driven by enhanced performance from IPP-owned CFPPs, whose average utilization or CF

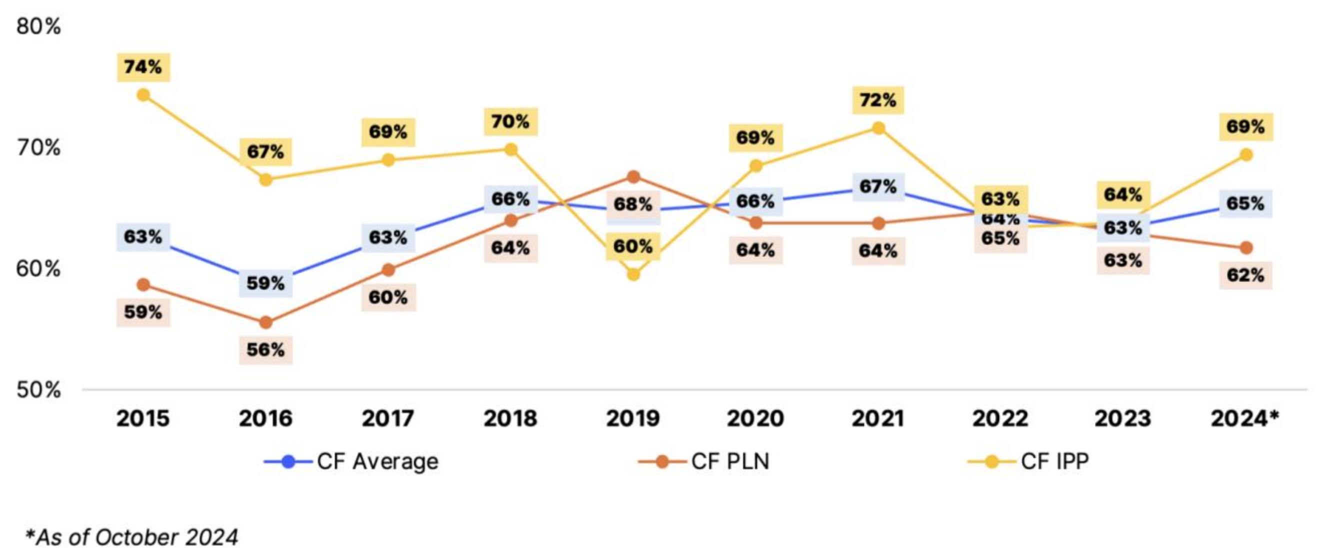
[24] MEMR. Technology Data for Indonesia Power Sector 2024. March 2024.

rose from 64% to 69%, partially offsetting PLN's continued inefficiencies. In 2022, the CF of PLN-owned CFPPs on average was 65%, which decreased to 62% in 2024.

Even IPP-owned assets operating under PPAs with PLN (which require delivering at least 80% of installed capacity) have failed to meet this requirement. Over the past three years, IPP-owned CFPPs have operated at a utilization rate less than 70%, highlighting a persistent gap between contracted capacity and actual utilization.

Contractually, PLN bears the risk and effectively pays these IPPs despite not accepting the minimum energy that was contracted for. Initially, the clauses were designed to make CFPPs more attractive to potential investors. However, host governments and off-takers have less flexibility to reduce the operational hours of these plants.

Figure 7: Indonesia's CFPP capacity factor (CF)

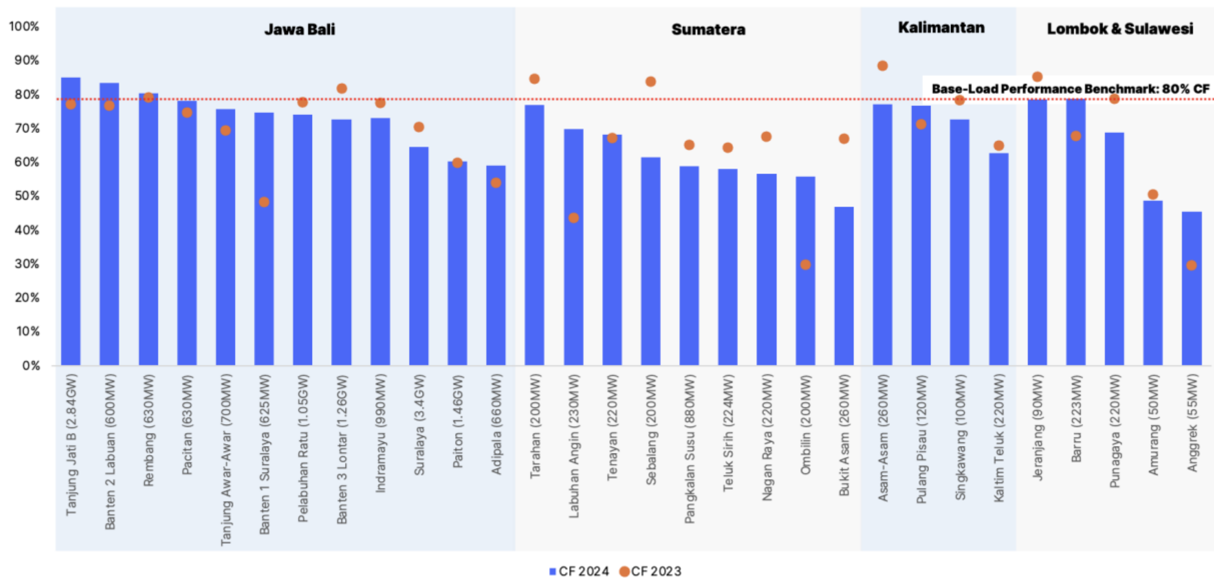


Source: Indonesia's Electricity Supply Business Plan 2025 – 2034; PLN's Annual Report.

A considerable number of PLN's coal assets have become increasingly unproductive or inefficient, with low capacity factors and limited operations. In 2024, only 1.8GW of CFPP capacity operated above the 80% threshold typical of baseload performance, while the remainder functioned below that.

This underperformance highlights inefficiencies in energy planning and infrastructure management, suggesting deeper structural issues should be addressed to enable a resilient and sustainable energy transition.

Figure 8: PLN-owned CFPPs capacity factor (CF) in 2023 and 2024

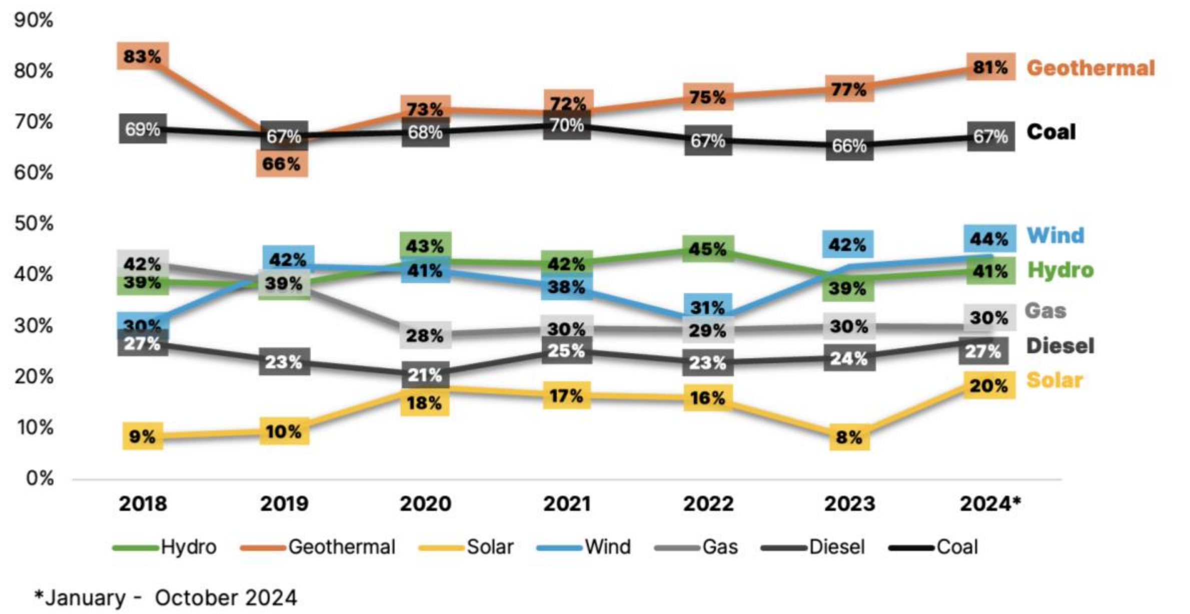


Source: PLN Indonesia Power's Statistic Report; PLN Nusantara Power's Statistic Report.

Aside from coal, assets that are technically capable of serving as baseload, such as hydro and gas, are significantly underutilized. In 2024, gas plants operated at only 30% of their full capacity, in part due to high marginal fuel costs. This overcapacity and underutilization have further constrained renewable energy use, particularly hydropower, which should serve as a baseload resource. Instead of achieving an average capacity factor worldwide of 48%[25], hydro was only utilized at 41% in 2024, limiting its contribution to the grid.[26] However, hydro use is constrained by its typically more remote siting, which may lack transmission interconnections to areas with higher demand.

[25] Statista. Average capacity factor of renewable energy worldwide in 2024, by technology. September 2024.
[26] IEEFA. The risks of fossil fuel dependence in Indonesia's Electricity Supply Business Plan (RUPTL) 2025 – 2034. 23 June 2025.

Figure 9: Indonesia’s capacity factors for different energy technologies (%)



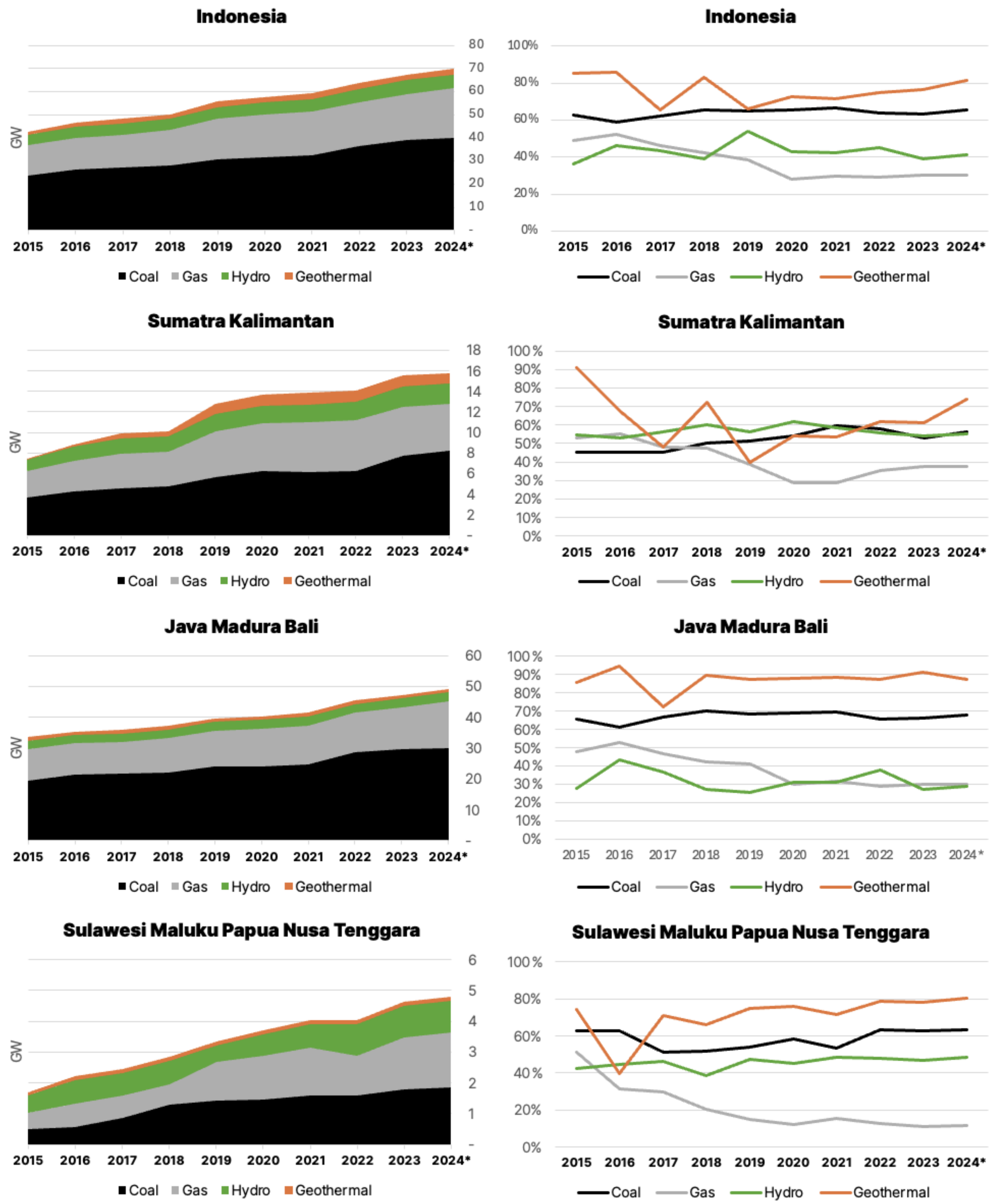
Source: RUPTL, IEEFA

Meanwhile, the capacity factors of solar and wind have remained stable, though at a low installed base, operating at 20% and 44%, respectively. Notably, these exceeded global expectations, where solar typically operates at 17.4%[27] and wind at 34%[28], illustrating their resource strength in Indonesia and reinforcing their viability as scalable solutions.

However, any meaningful analysis of Indonesia’s power system must take into account its geographic complexity. The country is not a single interconnected grid but a vast archipelago comprising multiple large islands, each with its own generation profile, demand patterns, and grid constraints. Utilization or capacity factors vary significantly across regions, and a one-size-fits-all assessment risks overlooking critical local dynamics. For instance, Java may exhibit different utilization trends compared to Sumatra, Kalimantan, or Sulawesi due to differences in industrial activity, transmission infrastructure, and renewables availability.

[27] Statista. Average capacity factor for utility-scale solar PV systems worldwide from 2010 to 2024. July 2025.
[28] Statista. Capacity factor of onshore wind power worldwide from 2010 to 2024. September 2024.

Figure 10: Indonesia's power generation capacity (left) and capacity factor (right)



Source: Indonesia's Electricity Supply Business Plan 2025 – 2034; PLN's Annual Report.

Between 2015 and 2024, Indonesia's total installed power generation capacity has steadily increased, driven primarily by coal and gas additions. Coal remains the dominant source, especially in Java and Sumatra, while gas has expanded moderately in eastern regions such as Sulawesi and Nusa Tenggara. Renewable energy sources, such as hydro and geothermal, have grown slowly, and diesel capacity has declined in line with PLN's de-dieselization efforts.

Despite this capacity growth, the CF across most regions has declined, signaling a mismatch between installed capacity and actual demand. Gas-fired power presents a paradox. Indonesia has made substantial investments in expanding its gas generation fleet from 13GW in 2015 to 22GW in 2024 (an increase of 69%)[29], yet the utilization rate decreased from 49% to 30%. Compounding the issue is the fact that natural gas is both expensive and price-volatile. This is because the price of gas is denominated in US dollars, regardless of whether it is for export or domestic use. That means this price is tied to global markets where supply disruptions and geopolitical tensions can drive sharp cost increases.

Furthermore, Indonesian gas production is typically located far from consumption centers and has to be transported either over long pipelines or in liquefied form. These factors have led to higher generation costs, or Biaya Pokok Penyediaan (BPP), which ultimately burden consumers and strain public finances. Regardless of how gas is delivered, it remains a high marginal cost fuel compared to renewables and coal.

2.3 Hidden costs and operational risks of an aging CFPP fleet

There are numerous risks associated with relying on coal for an extended period, including lower reliability, higher power prices, safety issues, and financing uncertainties.[30] The current global average retirement age for coal plants is 36 years.[31] Coal plants approaching or exceeding 40 years of age often face reliability and safety issues, with higher maintenance costs, which increases the urgency for retirement.

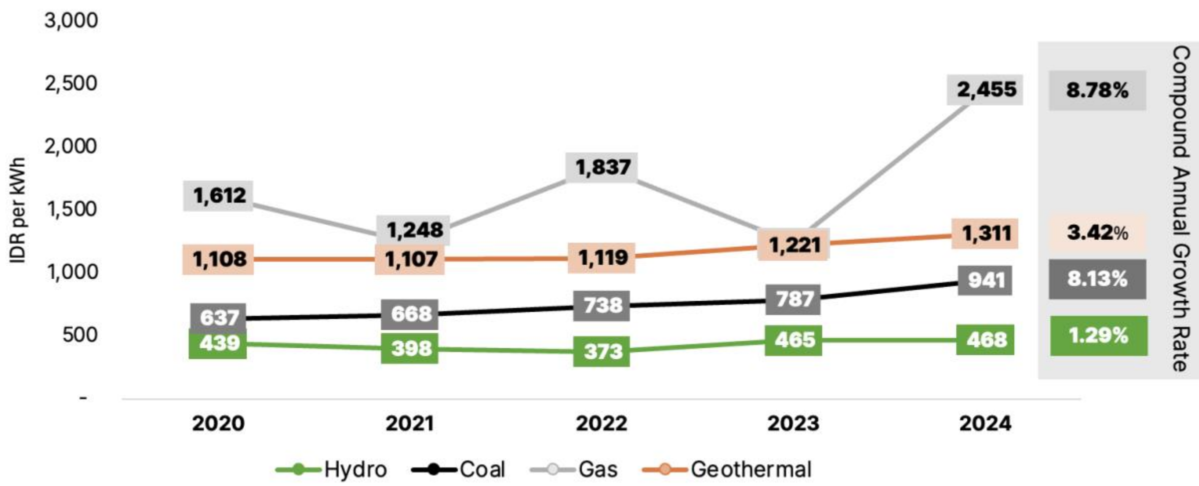
The reliability of CFPPs typically declines as they age, due to the progressive degradation of critical plant components. These plants are subject to considerable thermal and mechanical stress, which leads to parts wearing out over time. With proper maintenance, they can continue performing reliably for several decades, albeit at decreasing levels of efficiency. However, as they approach and exceed 40 years of age, achieving acceptable operating performance specifications becomes increasingly difficult and costly. Further, aging plants become prone to increased risk of accidents; components can fail, leading to explosions and fires that threaten the safety of workers and the surrounding community.[32]

[29] MEMR. Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2025 – 2034. May 2025.
[30] IEEFA. Delaying coal power exits: A risk we can't afford. April 2025.
[31] Global Energy Monitor. Southeast Asia's not so young coal plants. August 2024.
[32] IEEFA. Delaying coal power exits: A risk we can't afford. April 2025.

PLN owns 21GW of CFPPs, including 6.1GW operating for over 20 years and 3.4GW for more than 30 years, resulting in significant maintenance expenses and rising coal costs.

Figure 11 illustrates the PLN's average cost trends of four major power plant types in Indonesia between 2020 and 2024. Among these, gas power plants exhibit the most volatility, with costs fluctuating significantly and surging to IDR2,455 per kilowatt-hour (kWh) in 2024, reflecting rising global LNG prices and supply chain disruptions. Coal power plants, while traditionally viewed as cost-effective, exhibited a steady upward trend, from IDR637/kWh in 2020 to IDR941/kWh (approximately USD5.94 cents per kilowatt-hour [¢/kWh]) in 2024, marking a 48% increase attributed to aging infrastructure and rising operational, maintenance, and compliance costs.

Figure 11: PLN's average power plant cost

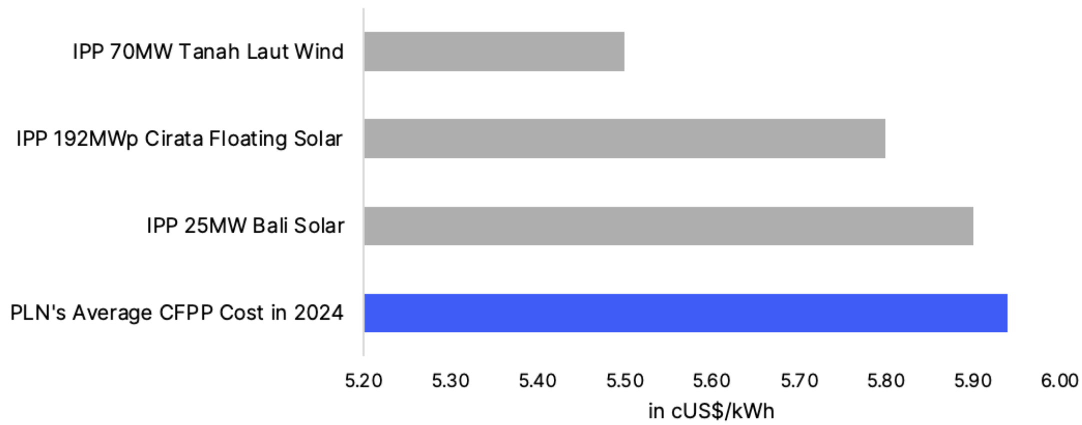


Source: PLN. Statistic Report 2024.

Note: Diesel power plants are excluded from the chart due to their high cost, averaging around IDR5,513.75 in 2024. Solar and wind power plants are also not included, as most of their capacity is owned by IPPs, while PLN's share remains relatively small.

A clear price gap emerges when comparing the cost per kilowatt-hour of maintaining PLN-owned CFPPs with the PPA prices for electricity from IPP-owned solar and wind projects. Even with DPO policy support, the expense of sustaining PLN's aging CFPP assets has already surpassed the cost of procuring cleaner energy from IPPs.

Figure 12: Cost comparison between PLN's CFPPs versus IPP renewable tariffs

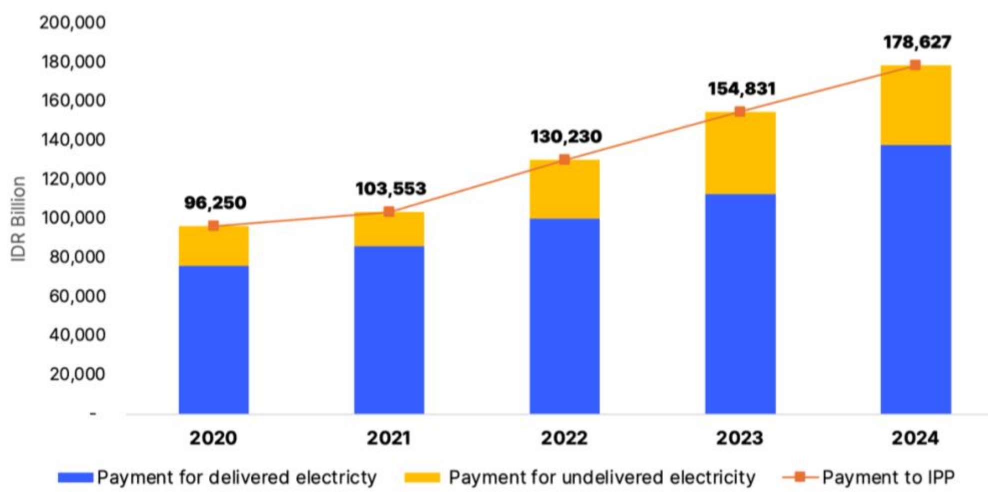


Source: PLN. IEEFA.

PLN continues to bear the cost of maintaining its aging and underutilized assets, while also paying for unused electricity from IPP-owned plants under long-term take-or-pay contracts. Reducing generation from IPP assets alone does not resolve the issue and risks further distorting the market.

Due to increased end-use efficiency in the electricity system, the utilization rate of many IPP-owned CFPPs has dropped significantly below the contracted CF of 80%. However, under take-or-pay agreements, PLN is still obligated to pay IPPs according to if the plants were operating at the full contracted CF, regardless of actual output. This difference creates a financial gap between the electricity PLN pays for and what is actually delivered. According to estimates by the Institute for Energy Economics and Financial Analysis (IEEFA), PLN paid approximately IDR41 trillion (USD2.5 billion) in 2024 for undelivered electricity from IPP-owned CFPPs. On average, the GOI loses IDR33 trillion (USD2 billion) annually to maintain IPP contracts.

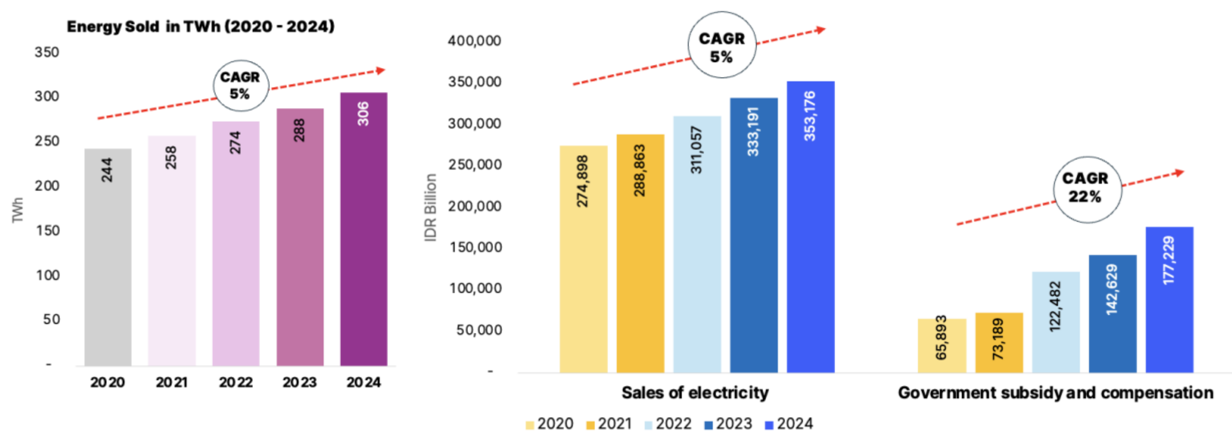
Figure 13: Electricity purchasing cost payment to IPPs



Source: PLN Audited Financial Report, IEEFA analysis.

This rising cost has direct fiscal implications. Despite PLN reporting substantial profits, these figures are supported by government subsidies and compensation. Without financial assistance, PLN would report losses. In 2024, total allocations for subsidies and compensation surged by 24% from IDR142 trillion (USD9 billion) in 2023 to IDR177 trillion (USD11 billion), accounting for 33% of PLN's total revenue. In contrast, electricity sales increased by only 6%, from IDR333 trillion (USD21 billion) to IDR353 trillion (USD22 billion). This widening gap highlights a structural imbalance where PLN's financial performance is becoming increasingly dependent on fiscal support. Such dependence underscores the unsustainability of the current model and raises concerns about the long-term viability of PLN's operations and Indonesia's broader energy budgetary framework. These subsidies and compensation represent nearly 5% of Indonesia's total government budget.[33] This amount is slightly higher than the recently increased IDR171 trillion budget for the government's Free Nutritional Meal program in 2025, seeking to improve nutrition availability to nearly 83 million people.[34]

Figure 14: PLN's energy sold, sales of electricity and government subsidies and compensation



Source: PLN.

2.4 Financial risks of extending the life of aging CFPPs

Extending the life of an aging coal fleet could improve reliability through component replacement and refurbishment. However, this requires substantial capital and ongoing operations and maintenance (O&M) investments. Upgrades include turbine and boiler retrofits, emissions control system replacements, and digital control enhancements to meet evolving performance, safety, and environmental standards.

[33] Reuters. Indonesia books lower-than-expected 2024 fiscal deficit. 06 January 2025. Indonesia's total public expenditure was IDR 3,550 trillion for 2024.
[34] Indonesia Business Post. Indonesia expands free nutritious meal program with Rp171 T budget boost. 14 Marcs 2025.

In Indonesia, the refurbishment cost for an aging fleet is not publicly known. However, based on Australia and Germany's experience, the refurbishment costs can range from USD322,829/MW to USD1,722,105/MW to extend the aging fleet's life by 10–15 years, depending on the unit's size, age, and technical scope.[35] Meanwhile, modernization costs can range from USD132,000/MW to USD405,000/MW.[36]

Table 1: Retrofit/refurbishment costs in Australia and Germany

Country	CFPPs Age	Retrofit/Refurbishment Package	Investment Cost
Australia	41–50 years old	10–15 years extension, Energy Performance Certificate (EPC) for refurbishment, boiler repair & maintenance	USD323,000/MW – USD1,722,000/MW
Germany	25–37 years old	Plant rejuvenation and modernization	USD132,000/MW – USD405,000/MW

Source: IEEFA, IESR.

These figures do not account for the rising cost of compliance with stricter emissions regulations, inflation on input component costs, or the opportunity cost of delaying investment in cleaner alternatives. Therefore, retaining older CFPPs will result in lower CFs and higher maintenance costs. These plants become less economically viable over time, especially when compared to newer, more efficient generation assets or renewable energy options.[37]

Indonesia faces a significant financial burden if it decides to extend the life of its older CFPPs. With refurbishment costs estimated at USD0.6–USD0.91 million per MW for units aged 35–40 years, maintaining operations for 4.79GW of capacity (projected to surpass 35 years of age by 2035) would require an investment of approximately USD2–USD4.3 billion. At current market prices, Indonesia could build 2GW to 5GW of wind or 3GW to 7GW of solar generation, with minimal recurring costs (assuming solar costs USD600,000/MW and wind costs USD1,000,000/MW).

Indonesia risks incurring billions of dollars in avoidable costs to maintain outdated infrastructure if PLN does not retire or replace its aging CFPPs with renewable energy alternatives.

There are significant challenges if the state utility continues to operate obsolete coal plants:

- **Escalating operation, maintenance, and fuel costs:** Aging plants require more frequent repairs and consume fuel less efficiently, driving up operational expenditures and straining PLN's budget.

[35] IEEFA. Delaying coal power exits: A risk we can't afford. April 2025.
[36] IESR. Flexible Thermal Power Plant: An Analysis of Operating Coal-Fired Power Plants Flexibly to Enable the High-Level Variable Renewables in Indonesia's Power System. May 2022.
[37] IEEFA. Delaying coal power exits: A risk we can't afford. April 2025.

- **Payments for unused electricity under PPAs:** PLN remains obligated to pay IPPs under long-term take-or-pay agreements, even when electricity from these plants is not dispatched due to oversupply or grid constraints.

- **Expensive refurbishment costs:** Extending the life of aging CFPPs often requires costly refurbishment, including boiler upgrades, emissions control retrofits, and structural repairs. These investments may not be economically justified, especially when compared to the expense of repurposing sites for renewable energy or retiring them altogether.

Continuing to operate aging CFPPs could cost PLN an estimated USD32–USD37 billion by 2035, encompassing operations, maintenance, and refurbishment, as well as payments for unused electricity to IPPs.

President Prabowo's commitment to phasing out all coal-fired power generation within the next 15 years signals growing recognition that aging CFPPs impose mounting fiscal and environmental challenges. It also creates uncertainty about whether investments in CFPP overhauls are warranted. This political momentum, coupled with the issuance of MEMR No. 10/2025, provides a foundation for action. A clear, actionable roadmap is necessary for notable progress to occur.

Strategically retiring or repurposing PLN's least efficient coal assets, while optimizing dispatch from newer, more efficient IPP-operated plants, offers a pathway to enhance system efficiency, reduce public expenditure, and accelerate the shift toward clean energy. However, this transition must be managed with care and foresight.

3. From coal to clean energy in Indonesia

3.1 Repurposing legacy infrastructure to accelerate clean energy deployment

Apart from the financial and technical aspects, retiring coal plants also involve social and economic transformations. CFPPs and associated coal mining operations are major employers and revenue sources in many regions. Abrupt closures without adequate planning could trigger job losses, disrupt local economies, and erode public services. A just and inclusive transition requires comprehensive strategies for workforce reskilling, community support, and regional economic diversification.

Former CFPP sites are among the most valuable assets that utilities own. They are already connected to the grid through permitted transmission lines, equipped with substations and switchyards, and located near water sources (which eases cooling and construction logistics). Therefore, repurposing coal assets can be a practical solution as it offers several advantages, including reducing decommissioning costs by partially avoiding complete environmental remediation, reusing existing assets such as generators and substations, and lowering costs for greenfield builds.

Repurposing coal plant sites for clean energy can be valuable, as they typically have large land areas and are already connected to the grid. Former coal sites can host solar photovoltaic (PV) installations on coal storage yards, and battery storage can be located on reclaimed or rehabilitated ash disposal areas. Generator houses can be reused to accommodate synchronous condensers and other equipment that helps maintain grid stability.

Furthermore, reutilizing these assets can generate employment in renewable energy, enable coal workers to be retrained and transition into new roles, and attract new industries and investment, ensuring that communities benefit from new projects.

Other countries provide examples of repurposing their old coal assets. For instance, Canada reutilized existing coal plant infrastructure to build a 44MW solar power station in Nanticoke. Built in 1972, the Nanticoke power plant was decommissioned in 2013. Once the largest coal power station in North America, its eight generating units could provide 3,964MW of power to the southern Ontario power grid. 192,431 solar panels were installed over 158 hectares of land, and the existing transmission switch yard was used to connect to the grid.[38]

Another example of a coal-to-clean transformation is the Ferrybridge power station in West Yorkshire, United Kingdom (UK). Once home to three coal-fired power stations, the site operated for nearly a century. The first station began operating in 1927 and was decommissioned in 1976, the second ran from 1957 until 1992, and the third, Ferrybridge C, was commissioned in 1966 and remained active until its closure in 2016. In 2004, Ferrybridge C came under the ownership of SSE, which operated the plant until its eventual demolition. Today, SSE is repurposing the site into a 150MW battery energy storage system (BESS), designed to support grid flexibility and renewable integration. Once operational, the facility will be capable of powering up to 250,000 homes. Construction began in August 2023, and by July 2024, all 136 battery units were successfully installed.[39]

Germany offers another compelling example of economic regeneration. In former coal mining regions, the country has created over 80,000 jobs through the development of solar parks, surpassing historical employment levels in coal-fired power generation. These solar projects provide clean electricity and also stimulate local economies, retrain workers, and revitalize communities that were once dependent on fossil fuels.[40] These examples illustrate a global trend and demonstrate that coal retirement does not have to mean economic decline.

With solar PV and BESS now cost-competitive, repurposing CFPP sites for clean energy offers one of the most practical and forward-looking solutions for Indonesia's energy transition. Unlike retrofitting with carbon capture and storage (CCS) or co-firing, which are expensive, technically

[38] World Economic Forum. Coal to Solar, Nanticoke Power Station. 01 March 2019.
[39] BBC. The UK coal-fired power station that became a giant battery. 30 September 2024.
[40] Renewable and Sustainable Energy Reviews. Repurposing coal plants – regional economic impacts from low carbon generation. July 2024.

complex, and yield limited emission reductions[41], repurposing it with clean energy can leverage existing infrastructure and reduce costs simultaneously.

Reusing these sites for solar and storage not only minimizes capital expenditure but also reduces development timelines and supports grid reliability. Transforming legacy fossil infrastructure into clean energy hubs while avoiding the escalating costs and risks associated with transitional technologies can be a successful strategy.

3.2 Indonesia's co-firing and CCS strategy risks locking in emissions and financial burdens

Instead of considering repurposing CFPP sites for clean energy, the newly released Indonesian National Electricity Master Plan (RUKN) 2025–2060 proposes retrofitting select CFPPs with CCS, ammonia co-firing, and biomass fuel switching. While these technologies may offer incremental emission reductions, they are expensive, complex, and often incompatible with aging infrastructure. Refurbishment costs could double, as expenses include installing CCS or co-firing technology and upgrading the existing coal plant to enable continued operation. Retrofitting old plants risks locking in high costs for limited climate benefit, diverting resources from more impactful clean energy investments.

3.2.1 Biomass co-firing: Limited gain, high risks

Under Indonesia's current RUKN, biomass co-firing will be gradually implemented in CFPPs at specific blending ratios. Since early 2019, PLN has piloted biomass co-firing across several CFPPs. Under the Low Emission Coal Optimization (LECO) framework, PLN has proposed expanding biomass co-firing to over 50 coal units, targeting blend rates of 10%–20%.[42] While this strategy is purported to offer short-term emission reductions, it risks locking Indonesia into suboptimal and potentially unsustainable trajectories. Co-firing does not eliminate coal dependence; it only reduces it marginally and may delay more transformative measures such as early retirement, flexible dispatch, or complete repurposing.

Challenges also arise due to insufficient biomass supply and technical limitations related to boiler capabilities. Biomass has a lower energy content than coal. Consequently, a plant retrofitted to burn blended biomass and coal will either face lower net output or will need to burn more fuel to match its original output. For 100% biomass-fueled power plants, other technologies are required. Such plants use a different combustor-boiler design and are typically limited in size to 50MW to 100MW due to the practicalities of handling, storing, and processing large amounts of biomass. Overall, the net reduction in emissions is not directly proportional to the biomass burned, as the carbon cost of

[41] IEEFA has undertaken an extensive study on the environmental under-performance of CCS facilities. For more information, please refer to https://ieefa.org/ccs.
[42] RMI. Indonesia's Just Energy Transition Partnership (JETP). June 2025.

growing, harvesting, transporting, chipping/processing, drying, and handling the fuel must be netted off the carbon benefit.

Moreover, scaling biomass demand without robust safeguards on fuel supply can lead to unintended consequences. These include competition with food production, unsustainable land use, and increased pressure on forests, particularly in regions already facing deforestation and agricultural encroachment. Biomass co-firing in Indonesia is projected to reduce national coal power emissions by only 1.5%–2.4%, while introducing new environmental risks and economic inefficiencies.[43]

Cost is another critical concern. Biomass co-firing in Indonesia is proving to be more complex and expensive than initially projected. In many cases, biomass, especially wood pellets and palm kernel shells, can be significantly more expensive than coal, particularly when factoring in logistics, calorific value adjustments, and supply constraints. PLN's own procurement data shows that biomass purchasing costs for co-firing are often higher than the price paid for solar power under PPAs.

3.2.2 CCS and ammonia co-firing: High cost, low scalability

The RUKN also promotes CCS and ammonia co-firing as future mitigation strategies for CFPP emissions. While technically feasible, these approaches face substantial financial, logistical, and operational hurdles.

Primarily, there are three approaches to capture carbon specifically tailored for CFPPs[44]:

- **Pre-combustion capture** involves converting coal into syngas through gasification, followed by the extraction of carbon dioxide (CO_2) during the hydrogen production process. During gasification, carbon monoxide and CO_2 are generated, which are subsequently captured after passing through the shift gas reactor. The purified gas is then used as fuel for power generation, while carbon emissions are trapped and sequestered. However, this method demands significant fuel consumption due to losses incurred during gasification. Additionally, retrofitting existing facilities is unadvisable as it requires installing a new power generator capable of converting the low-carbon fuel into electricity.

- **Post-combustion capture** extracts CO_2 from flue gas after combustion. This process is retrofit-friendly, allowing existing equipment to continue operating, but it needs additional electricity and heat. These resources can be obtained from a new power and heat generator through cogeneration, or by harnessing energy from the existing unit and heat from the steam cycle. The internal power consumption for operating carbon capture equipment can range from 20% to 35% of the power station's gross energy output, representing a significant energy tax on operations.

[43] Centre for Research on Energy and Clean Air. Biomass co-firing in Indonesia: Prolonging, not solving coal problem. May 2025.
[44] Reza, Alfian & Heksaprilla, Aga & Prakoso, Andal. Carbon Capture & Storage for Indonesia Coal-Power Plant: Opportunity or Gimmick?. September 2024

- **Oxy-fuel combustion** replaces air with pure oxygen during combustion, producing high-concentration CO_2 for easier capture. However, it requires an air separation unit and significant modifications to the combustion system, making retrofitting complex and costly. Implementing this concept for retrofitting purposes is challenging as it involves considerable changes to the existing combustion system of the power generator, or even necessitates the installation of an entirely new unit.

Further, any CO_2 captured must be disposed of. This requires compression, transportation, and injection underground for permanent storage. Not all CFPPs are located near suitable geological formations for storage, such as saline aquifers or coalbeds. Transporting captured CO_2 then adds further complexity and cost. According to IEEFA, CCS projects have consistently underperformed across sectors, with multiple projects failing or falling short of their targets. In the power sector, high-profile initiatives like Petra Nova and Boundary Dam faced major setbacks, while others like Kemper never launched.[45] Notably, NRG Energy Inc. sold its 50% stake in Petra Nova, once the world's largest carbon capture plant, for only about USD3.6 million — less than 0.5% of the project's roughly USD1 billion construction cost.[46] Even purported success stories in Norway, Sleipner and Snøhvit, revealed serious geological risks and expensive interventions.[47]

[45] IEEFA. Fact Sheet: Carbon Capture and Storage (CCS) has a poor track record. 08 February 2024.
[46] IEEFA. The ill-fated Petra Nova CCS project: NRG Energy throws in the towel. 05 October 2022.
[47] IEEFA. Norway's Sleipner and Snøhvit CCS: Industry models or cautionary tales?. 14 June 2023.

Figure 15: Carbon capture and storage (CCS) projects' report card

Project	Capacity (MtCO2 p.a.)	Performance
Natural Gas processing		
1986 Shute Creek	7	Lifetime under-performance of 36%
1996 Sleipner	0.9	Performing close to the capture capacity
2004 In Salah	1.1	Failed after 7 years of operation
2007 Snøhvit	0.7	Performing close to the capture capacity
2019 Gorgon	4	Lifetime under-performance of ~50%
Industrial sector		
2000 Great Plains	3	Lifetime under-performance of 20–30%
2013 Coffeyville	0.9	No public data was found on the lifetime performance.
2015 Quest	1.1	Performing close to the capture capacity
2016 Abu Dhabi	0.8	No public data was found on the lifetime performance.
2017 Illinois Industrial (IL-CCS)	1	Lifetime under-performance of 45–50%
Power sector		
2014 Kemper	3	Failed to be started
2014 Boundary Dam	1	Lifetime under-performance of ~50%
2017 Petra Nova	1.4	Suspended after 4 years of operation

Source: IEEFA.[48]

Retrofitting coal plants to run on 100% green ammonia (NH_3) is another alternative. However, ammonia co-firing has limited emissions reduction potential, fuel costs are significantly higher than coal, and technical feasibility for deployment at scale remains uncertain, especially for aging CFPP infrastructure.[49]

Shifting from conventional coal power to 20% ammonia co-firing would double fuel costs.[50] Analysis by Bloomberg New Energy Finance (NEF) found that co-firing with high ratios of blue or green ammonia is more expensive than renewables.[51] According to S&P Global, the cost of green ammonia ranges from USD800–USD1,200/tonne, depending on electrolyzer efficiency, renewable electricity price, and scale.[52]

[48] IEEFA. Fact Sheet: Carbon Capture and Storage (CCS) has a poor track record. 08 February 2024.
[49] E3G. Explained: Why ammonia co-firing in coal power generation is a flawed approach. 05 April 2023.
[50] E3G. Explained: Why ammonia co-firing in coal power generation is a flawed approach. 05 April 2023.
[51] BloombergNEF. Japan's Costly Ammonia Coal Co-Firing Strategy. 28 September 2022.
[52] S&P Global. Interactive: Ammonia price chart. 16 October 2025.

Both CCS and ammonia retrofits entail substantial investment costs. CCS requires significant capital expenditure, while 100% ammonia retrofitting leads to higher fuel costs. The unproven nature of these technologies adds to the risk that investments will fail to perform and, in any event, will result in significantly more expensive energy.

4. Business models to support shifting away from coal

Indonesia's energy planners should weigh the trade-offs between retrofitting legacy coal assets and investing in clean energy infrastructure. While CCS, ammonia, and biomass co-firing may offer some incremental emission reduction improvements, they risk prolonging coal dependence and diverting resources from more transformative pathways. A more strategic approach would prioritize:

- **Natural or early retirement of inefficient CFPPs.** Phasing out aging, high-cost coal plants can reduce fiscal burdens, improve system reliability, and unlock space for clean energy integration. Retirement decisions should be guided by asset-level performance, age, contractual flexibility, and regional energy needs.

- **Repurposing sites for renewables and storage.** Many CFPP sites offer valuable grid connections, land, and infrastructure that can be reused for solar PV, battery storage, or hybrid clean energy hubs. Repurposing avoids stranded assets and accelerates deployment timelines.

- **Mobilizing finance for clean energy deployment.** Redirecting capital toward renewables, storage, and grid upgrades, through blended finance, concessional loans, and public-private partnerships (PPPs), can deliver greater climate impact and economic returns than retrofitting coal. Mechanisms such as the ETM and the JETP should be leveraged to de-risk investment and scale deployment.

However, enabling large-scale repurposing is not just a technical challenge; it also requires viable business models that make clean energy redevelopment financially attractive. Plant owners must be able to recover sunk capital and generate new revenue streams. Innovative solutions are needed to enable plant owners to recoup their capital through alternative revenue models.[53]

PR No. 112/2022 and MEMR No. 10/2025 offer PLN a strategic opening to retire aging CFPPs. Yet despite growing political and international support, Indonesia faces persistent financial, structural, and institutional barriers, compounded by a fragmented CFPP portfolio across diverse ownership and operational models.

[53] International Energy Agency. Scaling Up Transition Finance. October 2025.

Figure 16: Barriers to coal plan retirement in Indonesia

National Utility (PLN)	Independent Power Producer (IPP)
These plants are operated directly by PLN, Indonesia's state-owned utility, or its wholly-owned subsidiaries. They typically represent older, publicly financed assets that are integrated into the national grid.	IPP-operated plants are governed by long-term PPAs with guaranteed returns. These assets are generally newer and privately financed, with guaranteed capacity payments and locked-in profit margins.
Challenges:	**Challenges:**
Asset write-off restrictions: Limit PLN's ability to decommission plants without incurring financial or regulatory penalties. **Fiscal accountability requirements:** PLN must avoid booking losses under state-owned enterprise regulations. **Reliability mandates:** Require an uninterrupted electricity supply.	**Contractual rigidity:** Terminating a PPA prematurely often requires compensatory payments, refinancing, or renegotiation. Other than that, the BOOT scheme also complicates matters, as PLN will need to relinquish the assets that should be transferred to them once the concession period is over. **Political sensitivity:** Renegotiation can be a legally complex and politically contentious process, especially when involving foreign investors or sovereign guarantees.

Source: IEEFA analysis.

Indonesia's coal transition requires a tailored approach. A one-size-fits-all strategy will not be suitable across PLN, IPPs, and captive operators, each facing distinct regulatory, financial, and operational constraints. Retirement pathways must be customized and supported by reforms, innovative financing, and stakeholder engagement.

4.1 Retirement strategy for PLN-owned CFPP assets

CFPPs operated by PLN are the most challenging retirement cases. Unlike IPP assets, which can be decommissioned once their PPA expires, PLN's legacy infrastructure is governed by rigid regulatory frameworks, fiscal accountability rules, and reliability mandates.

Under Indonesia's legal and administrative framework, assets held by state-owned enterprises (SOEs), such as PLN, cannot be retired or written off unilaterally. The process requires multiple layers of approval, including internal PLN review, ministerial oversight, and final approval from the Ministry of Finance (MOF) and other relevant government bodies, particularly if the asset retirement has implications for public expenditure, debt servicing, or national energy security.

Additionally, PLN faces significant financial disincentives when retiring CFPPs. PLN has to recognize a financial loss if the assets are removed from its books, which can negatively impact its financial statements and affect profitability and financial ratios. This challenge is compounded by PLN's use of fair value accounting, which replaces historical cost with market-based valuations. Historically, assets were recorded at their original purchase or construction cost. However, PLN currently uses fair value accounting, which reflects the existing market value of assets based on periodic appraisal. Consequently, even old assets may appear more valuable if appraisers determine that their market value has increased, either due to inflation, replacement cost, or other factors. This creates a financial and strategic dilemma, as PLN must carry obsolete assets at inflated values unless it is willing to absorb significant losses.

In practice, this means that even plants approaching the end of their technical life may continue operating longer than necessary, simply because the administrative hurdles for retirement are too high. This situation could persist despite a plant experiencing chronic operating inefficiencies, incurring expensive maintenance costs, or having excessive emissions. This underscores the need for regulatory reform and institutional coordination to streamline asset retirement procedures for SOEs, especially in the context of Indonesia's broader energy transition goals.

To overcome these barriers and unlock private capital, PLN and GOI can pursue two strategies:

- Divestment bundled with strategic incentives
- Public-private partnerships (PPPs) for asset repurposing

4.1.1 Divestment bundled with strategic incentives

PLN can pursue full divestment of CFPP assets to third-party investors, transferring complete ownership and operational responsibility for site redevelopment. This approach is particularly well-suited for younger assets with remaining technical life. A pilot transaction is currently underway through the proposed sale of the 3 × 350MW Pelabuhan Ratu CFPP to PT Bukit Asam Tbk. The transaction represents a potential blueprint for asset transition. However, progress has been slow, largely due to uncertainties surrounding the plant's valuation and the lack of clearly defined incentives for the acquiring party.

More broadly, the divestment strategy presents a significant challenge for aging CFPPs. Many of these assets suffer from poor efficiency, environmental non-compliance, or long-term liabilities, making them unattractive in a conventional market-based sale. As a result, these assets are unlikely to achieve their recorded book value, and investor interest remains limited without a compelling business case.

To overcome this barrier and to stimulate investor appetite, PLN and the government could consider bundling the sale of CFPPs with strategic benefits, such as:

- **Electricity replacement quotas and renewable energy development rights**

Under this mechanism, PLN would enable buyers of retired CFPPs to replace them with cleaner alternatives, such as solar or wind, while securing guaranteed grid access or offtake agreements for the new capacity. This approach bypasses the conventional tendering process, offering a direct pathway for clean energy deployment.

To ensure transparency and uniformity, private sector entities interested in acquiring these assets, along with associated incentives like electricity replacement quotas and renewable development rights, can submit competitive bids to PLN. Each proposal would be evaluated based on technical merit, financial strength, and relevant experience.

This model serves several strategic objectives, such as unlocking value from aging CFPP assets that may otherwise be unattractive due to weak standalone economics, and accelerating renewable deployment by linking divestment directly to clean energy development, rather than just asset transfer.

This mechanism should be governed by a clear eligibility framework, including technical criteria for replacement capacity, emissions reduction benchmarks, and community engagement requirements to safeguard transparency and public interest. Additionally, PLN and the government may consider setting performance milestones to ensure that buyers fulfill their renewable development commitments.

- **Enabling the joint transmission network utilization mechanisms**[54]

To attract more investors, the GOI could offer incentives such as implementing shared use of the transmission network, allowing CFPP buyers to use PLN's transmission network to sell electricity directly to end users, on the condition that they replace the coal plant with renewable energy generation within a specific period. This mechanism can be targeted at new industrial customers who are considering building new captive coal plants, allowing those investments to be redirected toward more sustainable alternatives.

This creates an opportunity for the private sector to drive renewable energy development and generate private sector capital without additional financial commitments from the public sector in asset investment. Meanwhile, it allows PLN to concentrate investment efforts on grid improvements and expansion.

4.1.2 Elevating PPPs as a strategic tool for coal asset repurposing

Beyond divestment, PLN can explore PPPs to repurpose aging assets. A PPP is a contractual arrangement between public (national, state, provincial, or local) and private entities through which the skills, assets, and/or financial resources of each of the public and private sectors are allocated in a complementary manner, thereby sharing the risks and rewards, providing optimal service delivery

[54] IEEFA. Accelerating Renewables Investment in Indonesia: Shared use of the transmission network. April 2025.

and value to citizens. In a PPP, the public sector retains the ultimate responsibility for service delivery, although the private sector provides the service for an extended time.[55]

These collaborations are designed to leverage the complementary strengths of both sectors: the public sector contributes regulatory authority, strategic oversight, and access to land or core assets, while the private sector brings in capital, technical expertise, and operational efficiency. In PPPs, design, construction, and operational risks are typically assigned to the private partner.[56] Through this shared structure, risks and rewards are distributed, promoting innovation, accountability, and value-for-money service delivery. Importantly, while the private partner may design, build, finance, and operate the infrastructure, the public sector retains final responsibility for ensuring service quality and public benefit.

In Indonesia, PLN has utilized PPP-like arrangements, particularly in its procurement of electricity from IPPs under BOO and BOOT schemes. These models allow the state utility to secure a reliable power supply without upfront capital expenditure, while enabling private investors to recover costs through long-term PPAs.

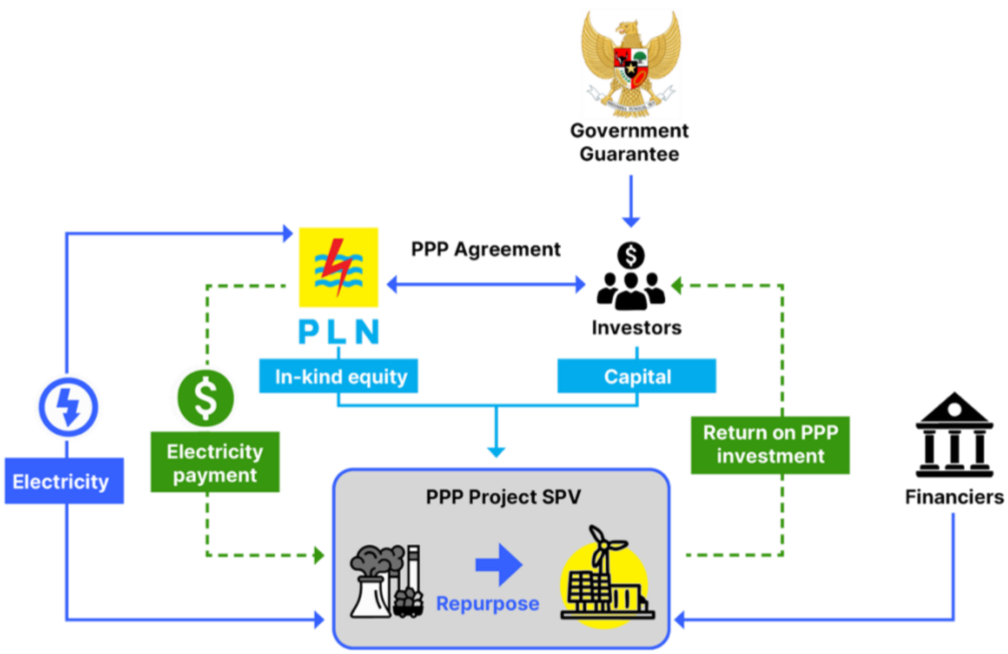
Recently, PLN has begun applying PPP models to its de-dieselization program, aiming to replace aging diesel power plants with solar PV and BESS. In these instances, IPPs co-develop clean energy infrastructure alongside PLN, demonstrating the potential of PPPs to support asset transition, not just expansion.

In the future, PPPs can be elevated beyond conventional generation contracts and applied to repurpose aging SOE assets, especially CFPP sites. Under this model, PLN retains ownership of the land and infrastructure, such as substations and grid connections. Meanwhile, the private sector invests in redevelopment and operations under a long-term concession or lease.

This approach offers several advantages. First, it allows PLN to contribute in-kind equity, such as land and existing grid infrastructure, without deploying new capital. Second, it significantly reduces project costs for the private partner, making the investment more attractive and bankable. Third, it aligns with Indonesia's broader energy transition goals by enabling the reuse of stranded assets in a way that supports decarbonization, local economic development, and just transition principles.

[55] ADB. Public-Private Partnership Monitor Indonesia. December 2020.
[56] ADB. Realizing the Potential of Public-Private Partnerships to Advance Asia's Infrastructure Development. January 2019.

Figure 17: CFPP asset repurposing through PPPs



Source: IEEFA analysis.

4.2 Retirement strategy for IPP-owned CFPP assets

To meet Indonesia's 2040 decarbonization goals, the retirement of PLN-owned CFPPs must be complemented with the early phase-out of IPP-operated CFPPs. While PLN's assets are governed by public sector mandates and internal financial constraints, IPP assets are embedded within complex contractual frameworks, most notably PPAs.

A PPA is a long-term contract between the project company and the off-taker (PLN in Indonesia's case), designed to ensure a predictable cash flow from electricity tariffs. This revenue stream enables the project company to pay debt obligations and deliver returns to equity investors. The PPA also underpins the bankability of the project, providing lenders with assurance of repayment and investors with a stable risk profile.

However, retiring IPP assets ahead of schedule requires terminating or renegotiating the PPA, which is legally and financially complex. Early termination typically occurs due to default by either party, prolonged force majeure, or government-induced policy shifts.

In Indonesia, while the government does not offer an explicit sovereign guarantee to IPPs, it bears financial liability for PLN's payment obligations under the Law on State-Owned Enterprises.[57] Therefore, in an early termination, the government is expected to provide compensation to IPPs, and PLN is entitled to claim subsidies and recover costs from the MOF.

Beyond PPAs, other project contracts, such as O&M agreements, may also be affected by early retirement. In such cases, termination is often treated as a government-induced force majeure event, where risks are shared between the contracting parties.

Finding a business model that can address these issues is essential, given the government's recent commitment to achieving a renewable energy-dominated power sector by 2040. To illustrate how early retirement can be achieved in practice, the following section explores blended finance models that have been implemented or are currently under development.

- **Private sector-led: ACEN South Luzon Thermal Energy Corporation (SLTEC)** – A voluntary retirement initiative driven by a private developer, leveraging internal capital and strategic repositioning.

- **Multilateral-led: Cirebon-1** – A coal retirement project supported by international partners under the ETM, combining concessional finance and policy reform.

4.2.1 Private sector-led: ACEN SLTEC

Indonesia can draw valuable lessons from its regional peers that have successfully implemented early coal retirement strategies. A notable example is the Philippines-based energy company ACEN, which pioneered the world's first market-based ETM transaction to accelerate the retirement of its last remaining CFPP, the SLTEC facility. SLTEC is a 246MW CFPP commissioned in 2015.[58] Prior to the private ETM transaction, the plant was expected to operate through 2055.

For the ETM's SLTEC case, the transaction involved a strategic restructuring of SLTEC's debt and the sale of ACEN's ownership stake to institutional investors, including Insular Life Insurance Company and the Government Service Insurance System.

ACEN's divestment from the SLTEC was a significant milestone in its shift toward renewable energy. The transaction involved restructuring SLTEC's debt and selling ACEN's equity stake to a special purpose vehicle (SPV), backed by Insular Life and the Government Service Insurance System. The transaction allowed ACEN to exit fossil fuel power entirely and provided the company with access to capital for reinvesting in its growing portfolio of clean energy projects.

[57] GOI. Undang-undang Nomor 19 tahun 2003. 19 June 2023.
[58] ACEN. ACEN completes the world's first ETM transaction for the 246 MW SLTEC coal plant. 07 September 2022.

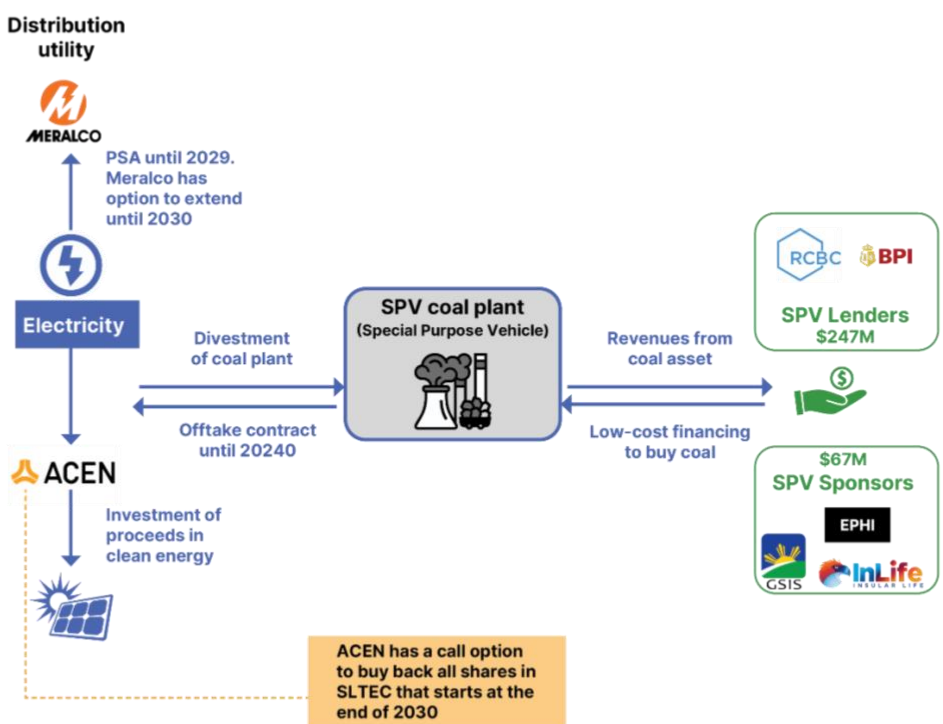
Notably, the deal included just transition provisions to protect the 200 workers at the Batangas coal plant, which is scheduled to close by 2040. These measures aim to support employees through retraining, redeployment, and other workforce programs as the company transitions away from coal.

Before the transaction, SLTEC had PHP10.1 billion in debt and PHP7.2 billion in equity. Through the ETM, ACEN raised PHP13.7 billion in long-term debt (15-year tenor) and PHP3.7 billion in equity. The proceeds were used to refinance existing debt, cover transaction costs, and return PHP7.2 billion to ACEN — half through capital return and half through a secondary share sale. The use of leverage optimized SLTEC's capital structure, reducing its effective cost of capital to below 8%.

The transaction requires the new owners to retire the plant in 2040, 15 years ahead of schedule, and fund a just transition for the plant's workers and local communities. The transaction also involves ACEN continuing to purchase the power produced by the plant, as well as operating and maintaining the plant, through an arm's length contract.

One of the most important elements of this transaction is ACEN's provision of a call option, which grants the company the right to repurchase all shares in SLTEC at a future date. By retaining the option to regain ownership, ACEN ensures that the coal plant will be retired according to the agreed schedule, with full decommissioning targeted for 2040.

Figure 18: ACEN SLTEC coal retirement structure



Source: RMI.

This structure reflects ACEN's long-term commitment to the energy transition. It prevents future owners from extending the plant's life and provides confidence to stakeholders that the shift away from coal will stay on track.

4.2.2 Multilateral-led: Cirebon-1

The early retirement of Cirebon-1, an IPP-owned CFPP, marks Indonesia's first proposed pilot project under the ETM. This project offers a revealing case study of the institutional and financial complexities involved in transitioning Indonesia's coal fleet.

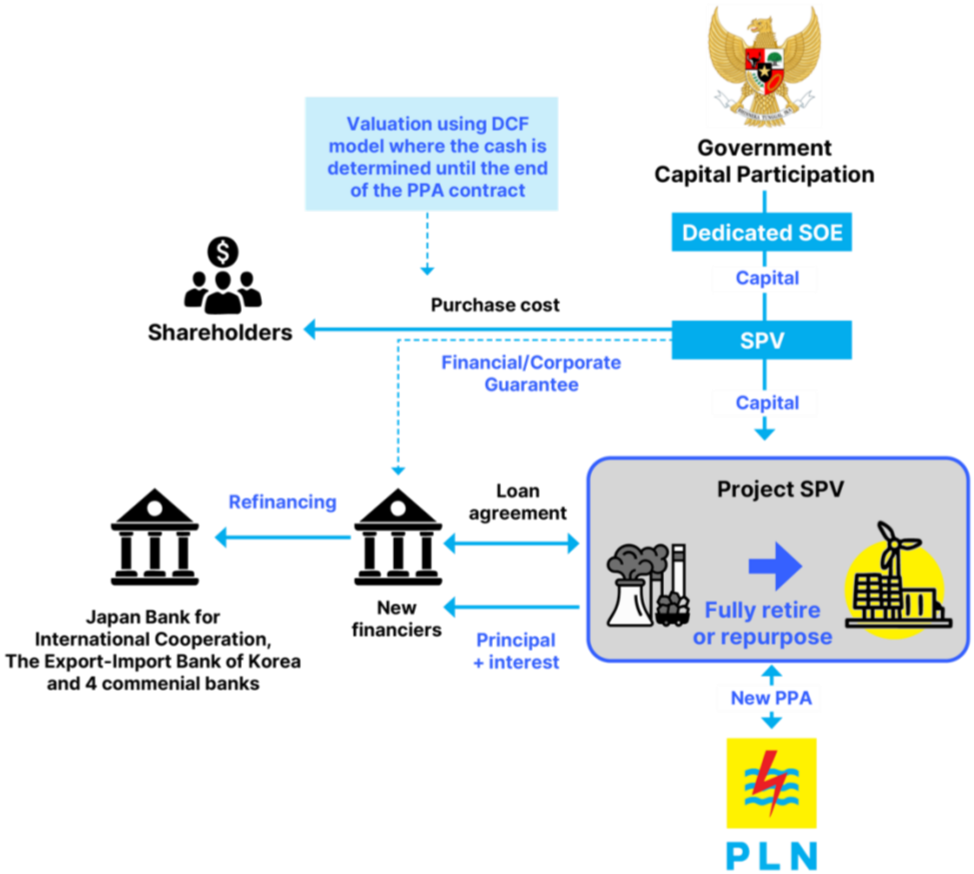
Cirebon-1 is a 660MW CFPP owned by PT Cirebon Electric Power (CEP), an IPP in West Java Province, supported by Marubeni Corporation, Korea Midland Power Company Limited, ST International Corporation, and PT Indika Energy Tbk.[59] The plant signed a PPA with PLN in 2007[60], reached financial close in 2010[61] , and secured approximately USD595 million in financing from Japan Bank for International Cooperation and the Export-Import Bank of Korea (Japanese and Korean public finance institutions), together with four commercials banks — Sumitomo Mitsui Banking Corporation, Bank of Tokyo-Mitsubishi UFJ Ltd., Mizuho Corporate Bank Ltd., and ING Bank N.V.[62] The total construction cost was USD877.5 million[63], and the plant's Commission Operational Date (COD) was 27 July 2012. It was expected to operate for 30 years until 2042.

Under the ETM framework, a blended finance CFPP retirement facility is being structured to shorten the PPA tenor by 7 years, enabling the plant to retire by 2035. This initiative is designed to ensure net present value neutrality for the owners, which means that early retirement does not result in any losses or gains in dividend cash flows.

Similar to the ACEN SLTEC transaction, ADB is expected to refinance Cirebon-1's outstanding loan through a USD250 million to USD300 million deal with the condition that the CFPP owners would be contractually obligated to permanently terminate unabated coal-fired operations at the end of the shortened PPA.[64]

[59] ADB. Indonesia: Cirebon Energy Transition Mechanism Pilot Project.
[60] MEMR. Lima Proyek Energi Indonesia-Jepang Diteken. 20 August 2007.
[61] Marubeni Corporation. Marubeni achieves the loan agreements execution for Cirebon IPP Project in Indonesia. 08 March 2010.
[62] Marubeni Corporation. Marubeni achieves the loan agreements execution for Cirebon IPP Project in Indonesia. 08 March 2010.
[63] Cirebon Power. Cirebon Power dalam angka.
[64] The Jakarta Post. Indonesia, ADB launch first coal power plant retirement deal. 14 November 2022.

Figure 19: Cirebon-1 coal retirement structure



Source: IEEFA analysis.

While the initiative aligns with national and international climate goals, its success hinges on the active participation and coordinated approval of key stakeholders, particularly PLN and the GOI.

As the sole off-taker in Indonesia's electricity market, PLN plays a pivotal role in determining the viability of the transaction. For the retirement to proceed, the state utility must agree to terminate the existing PPA and enter into a new agreement that supports the development of a cleaner replacement facility, potentially at a higher tariff. This creates a critical bottleneck: advancing the transaction depends on PLN's willingness to renegotiate terms, which is limited by internal financial constraints, regulatory oversight, and affordability mandates. Without the utility's formal commitment, the project cannot proceed.

Beyond PLN's role, the transaction requires the GOI to establish a SPV or a joint venture entity that would act as the sponsor and equity acquirer. This SPV would be responsible for purchasing the ownership stake from the current operator and compensating them for foregone future earnings, which could be substantial given the remaining plant life and its contractual entitlements. The SPV would also need to provide financial guarantees, absorb significant risk, and operate under tight fiscal margins, as the deal is not expected to yield high commercial returns.

While the transaction presents fiscal and regulatory challenges, it also provides an opportunity for transformative change. By adopting a Discounted Cash Flow (DCF) model and leveraging concessional finance under the ETM and JETP, Indonesia can demonstrate how early coal retirement can be achieved in a responsible and equitable manner.

4.3 Transition credits offer an innovative option for coal retirement

In the Indonesian context, both the ACEN SLTEC model, where a private entity acquired the coal plant assets, and the current Cirebon-1 approach, where the buyer would be an SOE under government control, present implementation challenges. Regardless of the buyer, PLN, as the sole off-taker, would need to revise the existing PPA and agree to a new tariff structure. The new tariff for the replacement project (likely renewable or transitional infrastructure) may be higher than the original tariff from the coal plant. Transition credits offer a potential solution to make such a model acceptable and financially viable.

Transition credits are promising instruments to address the financial gap in early coal retirement.[65] These are a form of carbon credit specifically designed to support the phase-out of CFPPs by monetizing the emissions avoided by retiring coal assets ahead of schedule and redirecting capital toward clean energy infrastructure. By assigning a market value to avoided emissions, transition credits create a new revenue stream that can help offset the financial losses incurred by asset owners, lenders, and governments.

Within Asia, the Monetary Authority of Singapore (MAS) has taken a leadership role in advancing this concept. In September 2023, MAS published a joint paper with McKinsey & Company outlining the framework for transition credits, followed by the launch of the Transition Credits Coalition (TRACTION) in December 2023.[66]

The coalition brings together banks, regulators, and energy developers to test and expand the use of transition credits across the region. These credits offer a new approach to support early coal plant retirements by creating economic incentives and attracting private investment. First, they provide an additional revenue stream. Selling transition credits can help offset the financial losses that coal plant owners face when closing plants early, making these retirements more viable. For example, shutting down a 1GW coal plant in Indonesia five years ahead of schedule could leave a USD70 million funding gap, which transition credits could help fill. Second, these credits can attract private capital by turning avoided emissions into marketable carbon assets. Third, transition credits provide a direct economic incentive that complements policy efforts by rewarding owners for retiring their plants

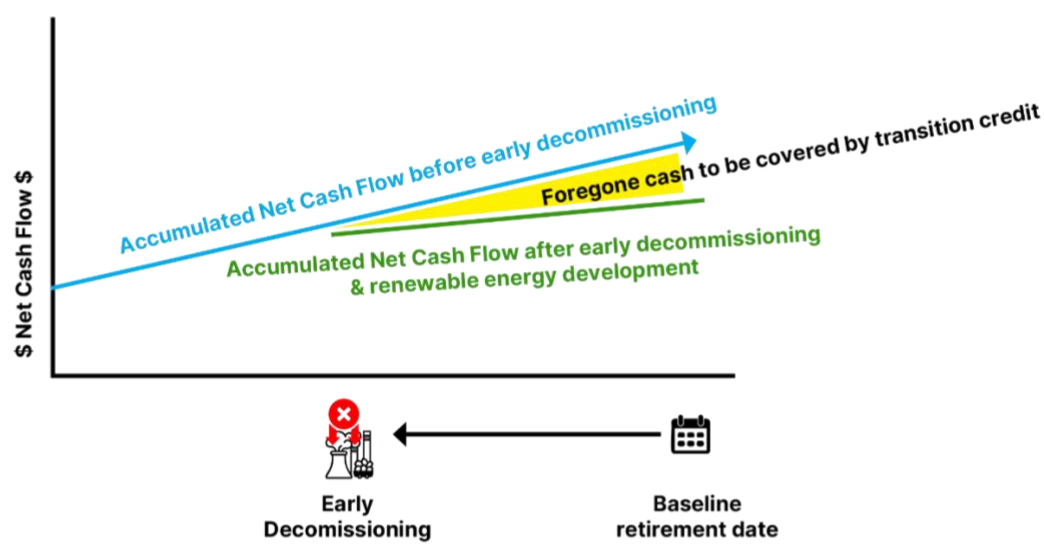
[65] IEEFA. Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch. April 2025.
[66] MAS. Transition Credits Coalition (TRACTION) - An Interim Report on the Application of Transition Credits for Accelerated Coal Retirement. November 2024.

early. Fourth, the mechanism is scalable and could be applied to many young coal plants across Asia. Finally, part of the revenue from these credits could be used to support just transition programs, helping workers and communities affected by coal plant closures.[67]

One of TRACTION's flagship initiatives is the ACEN SLTEC retirement project in the Philippines, which can serve as a blueprint for Indonesia. Following the divestment of SLTEC, ACEN joined forces with the Climate Change Commission and the MAS to develop the world's first transition credit that would leverage carbon finance to underwrite an accelerated transition and bring forward the plant's closure from 2040 to 2030.

Like the ETM, transition credits under TRACTION are designed to cover three critical components of coal phase-out. First, they compensate for foregone cash flows resulting from the early retirement of CFPPs, helping mitigate financial losses for asset owners. Second, supporting the replacement of retired capacity with clean energy generation, ensuring continued electricity supply and grid stability. Third, providing just transition support for affected workers and communities, covering retraining, relocation, and economic diversification to ensure that the shift away from coal is equitable and inclusive.

Figure 20: Transition credit structure



Source: IEEFA analysis.

Several studies demonstrate how transition credits can help cover the cost of retiring coal plants early. The funding deficit created by early closure could be filled by carbon credits, with initial estimates ranging from USD11–12 per million tonnes of carbon dioxide equivalent ($MtCO_2e$) to as

[67] MAS. Transition Credits Coalition (TRACTION) - An Interim Report on the Application of Transition Credits for Accelerated Coal Retirement. November 2024.

high as USD52/$MtCO_2e$. For example, a report by MAS estimates that closing a typical Indonesian plant five years ahead of schedule would require approximately USD70 million, which could be covered by selling transition credits at USD11–12/$MtCO_2e$. In the Philippines, ACEN's ETM found that early retirement would result in USD48–75 million in lost revenue, with avoided emissions valued at USD16–25 per $MtCO_2e$, in addition to another USD18–27 per $MtCO_2e$ for battery storage to replace the power.[68] In Indonesia, the Institute for Essential Services Reform (IESR) and CASE calculated that early retirement would cost about USD25.2/$MtCO_2e$, compared to continuing operations with carbon capture.[69]

Transition credits could play a pivotal role in bridging the financial gap. They could be used to compensate the current owners or lost revenue, finance the development of renewable alternatives, and support local communities through targeted just transition programs. This would reduce the fiscal burden on the government and improve the bankability of the transaction, making it more attractive to private investors and multilateral partners.

However, there are some limitations. The replicability of the transaction may be more complicated than a generic methodology can provide. The valuation of transition credits would vary across countries and depend on the unique characteristics of each CFPP, and the price may differ depending on the unique source of the credit. Consequently, accuracy, verifiability, and credibility would be crucial.[70]

5. Danantara's role in coal retirement and clean energy redevelopment

Daya Anagata Nusantara (Danantara), Indonesia's newly established sovereign wealth fund under Law No. 1 of 2025,[71] is uniquely positioned to lead the country's coal transition. With a mandate to manage state-owned assets and mobilize investment, this wealth fund can accelerate the implementation of the MEMR No. 10/2025. As the sole shareholder of PLN, the largest coal asset owner, Danatara has the leverage to drive structural change across the energy sector. Every decision made by PLN will affect not only government subsidies and fiscal exposure, but also Danantara's asset portfolio, dividend flows, and long-term investment strategies.

Danantara offers a transformative solution. By separating SOE assets from state property and granting financial autonomy, the wealth fund can enable more flexible asset restructuring, divestment, and PPPs. This is especially relevant for aging CFPPs constrained by rigid accounting rules and bureaucratic hurdles. Danatara's ability to mobilize capital, coordinate across ministries,

[68] IEEFA. Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch. April 2025.
[69] IEEFA. Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch. April 2025.
[70] IEEFA. Transition Credits: A Potential Financial Enabler for the Coal-to-Clean Switch. April 2025.
[71] Kementerian Keuangan RI. Danantara – Membangun Masa Depan Keuangan Indonesia Melalui Sovereign Wealth Fund. 08 April 2025.

and engage international partners, as well as an underlying mandate to be profitable, makes it an ideal national platform to unlock the coal repurposing strategy.

The following recommendations can help Danantara realize its full potential:

1. **Develop a national CFPP asset screening framework and a roadmap for coal retirement**

Danantara should establish a standardized methodology to assess CFPPs based on technical, financial, environmental, and social criteria. Developing clear pathways for retirement, repurposing, or reinvestment is essential to maximizing the value of existing infrastructure while minimizing social disruption. This includes evaluating which assets can be converted into renewable energy hubs, which should be phased out entirely, and where reinvestment can catalyze new economic opportunities. This framework will help identify high-priority sites for retirement, repurposing, or transformation into clean energy hubs, ensuring resources are directed for maximum impact.

2. **Create a dedicated transition platform within Danantara**

Danantara should set up a specialized unit to manage coal asset portfolios, structure investment deals, and oversee project execution. This platform should be equipped to conduct due diligence and valuation of aging CFPP assets and design bankable project pipelines for repurposing. The new platform can also serve as a central interface for stakeholders across government, finance, and industry.

3. **Align regulatory and financing mechanisms**

Danantara should coordinate closely with PLN, MEMR, MOF, and the SOEs Regulatory Agency (BP BUMN) to streamline regulatory approvals, clarify asset ownership structures, and unlock financing mechanisms. This includes accelerating permitting for clean energy redevelopment, structuring fiscal incentives for early retirement, harmonizing asset transfer and divestment protocols, and reforming PLN's accounting practices.

The state utility should revisit its continued use of the fair value model for CFPP assets. This accounting approach may overstate the book value of aging infrastructure, obscuring economic signals and limiting flexibility in structuring divestment or repurposing deals. A shift toward more transparent and adaptive valuation models would better reflect the true value of assets.

4. **Engage international partners for investment**

Danantara can serve as a credible platform for blended finance, risk-sharing, and performance-based investments. To deliver impact at scale, it is essential to proactively engage multilateral development banks, climate finance institutions, and global investors. Co-financing clean energy and just transition programs will be critical, as Danantara cannot achieve these goals alone.

6. Conclusion

Indonesia stands at a defining moment in its energy journey. For decades, coal has underpinned the country's economic growth, powering industrial expansion and electrification. However, this legacy now poses significant economic, environmental, and social risks that can no longer be ignored. Aging infrastructure, rising operational costs, and global climate commitments are converging to make coal exit a strategic necessity.

Based on IEEFA's analysis, there are three critical risks if PLN continues to operate obsolete CFPPs:

- Escalating operational, maintenance, and fuel costs: Aging plants require more frequent repairs and consume fuel less efficiently, driving up operational expenditures and straining PLN's budget.

- Payments for unused electricity under PPAs: PLN remains obligated to pay IPPs under long-term take-or-pay agreements, even when electricity from these plants is not dispatched due to oversupply or grid constraints.

- Expensive refurbishment costs with limited return: Extending the life of aging CFPPs often requires expensive refurbishment, including boiler upgrades, emissions control retrofits, and structural repairs. These investments may not be economically justified, especially when compared to the cost of repurposing sites for renewable energy or retiring them altogether.

Indonesia has a unique opportunity to turn these risks into a catalyst for transformation. By repurposing existing assets, unlocking innovative financing, and designing policies that prioritize equity and sustainability, Indonesia can accelerate its shift toward a cleaner energy future. Programs like the ETM and JETP offer unprecedented financial support, but their success depends on transparent, inclusive, and adaptive frameworks.

To operationalize this transition, Indonesia must deploy a suite of business models tailored to its institutional landscape. These include divestment bundled with strategic incentives, public-private partnerships for asset repurposing, blended finance, and transition credit mechanisms that compensate for foregone revenues and support clean energy replacement.

Table 2: Comparative overview of business models for CFPP retirement and repurposing

Retirement Mechanism	Asset Owner	Advantages	Challenges
Divestment bundled with strategic incentives	PLN	Clean exit from coal Unlocks private capital Enables strategic bundling	Low asset value Resistance from the buyer if there are no incentives Political sensitivity
Repurposing assets through PPPs	PLN	No change of ownership No significant upfront investment from PLN (PLN can contribute in-kind equity) Risk-sharing through a PPP model Utilizes existing grid assets Ideal for aging CFPPs	Complex regulatory coordination The auction/tender process for PPPs can be extended Stakeholder resistance risk if there are no incentives
Private sector-led - ACEN SLTEC model	IPP	Replicable SPV structure for IPP-owned asset, includes just transition	Needs strong investor appetite to accept the lower return PPA termination/renewal bottleneck
Multilateral-led model – Cirebon 1 model	IPP	High visibility, multilateral support JETP alignment	PPA termination bottlenecks High fiscal burden Low returns
Transition Credits	PLN/IPP	Monetizes avoided emissions Bridges financial gaps Market-driven	Requires robust monitoring, reporting and verification Context-dependent valuation Still in pilot phase

Source: IEEFA analysis.

To accelerate Indonesia's coal retirement strategy, a hybrid approach is essential, which combines PPP repurposing, asset divestment, blended finance, and transition credit mechanisms tailored to the specific characteristics of each CFPP. Unlocking stalled deals, such as Cirebon-1, requires prioritizing regulatory reform and deploying blended finance to overcome structural and fiscal bottlenecks. Proven models, such as ACEN's SLTEC SPV, should be scaled for willing private players, while TRACTION credits can be leveraged to enhance bankability and close financial gaps.

To realize this potential, Indonesia must take coordinated action across institutions and sectors. Key priorities include:

- Developing a national CFPP asset screening framework and a roadmap for coal retirement, grounded in technical, financial, environmental, and social criteria
- Empowering Danantara, PLN, and private stakeholders to co-design and implement divestment and repurposing strategies
- Reform outdated regulations that hinder asset write-offs, compensation mechanisms, and flexible ownership models
- Protecting workers and communities through robust just transition policies, including retraining, relocation support, and local economic diversification

This is not a one-size-fits-all transition. Each plant, region, and community will require tailored solutions that reflect local realities and stakeholder needs. With bold leadership, strategic planning, and inclusive dialogue, Indonesia can transform its coal legacy into a launchpad for a green revolution, securing energy access and promoting economic growth.

For PLN and the government, it provides a solution to shift legacy coal assets into platforms for future-ready energy solutions while avoiding capital outlays. It changes the narrative from “retirement as a cost” to “retirement as an opportunity”, especially if paired with a clear regulatory framework and government support.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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