Ambiguities versus Ambition:
A Review of Indonesia's Energy Transition Policy

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Key Findings

- Over 12 GW of fossil fuel power plants have been commissioned in the last five years, increasing Indonesia's operating coal fleet by 30%. Meanwhile, only 1.6 GW of renewable energy capacity was added, mostly hydro and geothermal.
- In 2021, 33% of the 58 GW of total installed fossil fuel capacity in Indonesia was in excess of what was needed to meet peak demand and maintain a 15% reserve margin. This oversupply exceeds the national electricity reserve margin standard of 30-35% and is maintained by IDR 16 trillion (USD 1.2 billion) annually in FOM cost. (Figure 2)
- An estimated 40.6 GW of capacity is planned for commercialization between 2021 and 2030; of which 34% (13.8 GW) will come from coal and 14% (5.8 GW) from gas and diesel. Such capacity additions are incompatible with an ambitious NZE and will likely worsen oversupply.
- At present, the determination of the NZE targets is not fully aligned across ministries and related entities. PLN and MEMR set 2060 as the official target, while MoEF set 2070 and Bappenas set 2045. (Figure 1)
- Amid slower economic growth rates, electricity grid oversupply, and CPP's funding uncertainty, nearly 6 GW of new CPPs are "shelved" in the 2021-2030 RUPTL in case they are needed for "adjusting system needs." The most significant portion is found in Sumatra (2.59 GW) and Java (2.66 GW), even though these grids both faced oversupply concerns of over 50%.
- From 2021-2030 RUPTL, PLN plans to convert 1.2 GW of proposed coal projects to fossil gas. The existing coal overcapacity in Indonesia and the low penetration of renewables in the energy mix means that gas infrastructure will only lock in fossil fuels infrastructure.
- PLN's strategy to reduce GHG emissions will not be met by increasing biomass co-firing at coal plants because the portion of biomass is only 1-5%, and the remaining 95% will still use coal. Co-firing runs the risk of derating the asset and also potentially provides a reason to extend the coal life and keep them operating. PLN plans to implement this technology in 144 CPP units with a total capacity target of 18.3 GW by 2025.

- The feasibility of ammonia co-firing remains untested outside of Japan. Factors such as the need to import the fuel and the retrofitting of existing plants will likely make this technology extremely costly in Indonesia and are of concern as it could extend the lifetime of CPPs and LNG power plants. PLN plans to implement this technology in 7 units of power plants with a total capacity target of 4 GW.
- CCUS technology remains largely unavailable commercially and remains extremely costly to implement for power projects, especially in the face of renewable energy alternatives. The implementation will reduce the plants' generating capacity because the technology is energy-intensive.
- Clean Coal Technology (CCT) does not guarantee the reduction of GHG emissions and air pollution from CPP. CPPs with CCT still emit CO2 and toxic pollutants such as sulfur dioxide, nitrogen dioxide, and particulate matter.

Introduction

In response to the climate crisis and the need for energy security amidst unpredictable social and economic upheavals, countries need to halt new fossil fuel investments and urgently transition their energy systems to net zero by 2050, as recommended by leading international bodies on climate and energy, such as the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC).

Indonesia's role in addressing climate change cannot be understated, nor can the challenge of addressing it domestically within its energy mix be underestimated. With the 11th largest coal reserves in the world, the country is the 3rd largest coal producer globally as well as one of the highest consumers of coal. The Southeast Asian nation will face many challenges in transitioning away from coal, but the abundance in natural resources and immense potential for low-carbon energy such as solar, hydro, wind and geothermal is a backdrop that could make it a key player for a green energy transition.

In the last few years, Indonesia has made significant strides towards a green transition. In November 2022, Indonesia launched two ambitious energy transition initiatives, the Energy Transition Mechanism (ETM) and Just Energy Transition Partnership (JETP), at the G20. The ETM is expected to allocate funds worth USD 500 million and mobilize more than USD 4 billion, while JETP will see an initial USD 20 billion mobilized over the next three to five years towards Indonesia's adoption of renewable energy.

This 2023 will be a crucial year, as the Indonesian Government is expected to release an Investment Plan for the JETP. Meeting targets set by the JETP, such as peak power sector emissions by 2030 and 34% renewable energy generation by 2030, will require an overhaul in power regulation and a divergence from past energy security planning. At present, Indonesia derives half of its electricity from coal-fired power plants (CPP). In the last five years alone, over 12 gigawatts (GW) of fossil fuel capacity have been commissioned, increasing the country's operating coal fleet by 30%. Meanwhile, non-fossil fuel development lags far behind; only 1.6 GW of renewable energy (RE) capacity was added between 2017 to 2021, mostly from hydro and geothermal. Solar and wind account for less than 1% of capacity additions.

The overwhelming additions of capital-intensive fossil fuels have contributed to the poor financial returns and heavy debt burdens on the state electricity company, Perusahaan Listrik Negara (PLN). Oversupply is a major issue that developed as a combination of overestimating future demand, over constructing large fossil fuel-fired generators, and market barriers that prevent full utilization of this existing capacity. This will have to change under the JETP; new coal power plants, both committed and awarded should be halted and cancelled. PLN's highly-anticipated update of the Electricity Supply Business Plan (RUPTL) will need to align with the targets under the partnership.

A closer look at key power sector policies and announcements reveal that exemptions and existing, planned projects may not be setting Indonesia in the most straightforward path to achieving an effective, efficient and timely energy transition.

This report looks at the state of capacity on Indonesia's grid and the proposed capacity additions that could either prolong the use of fossil fuels or potentially deviate essential resources towards "new" and unproven technologies rather than renewable energy under the JETP. Both should be considered and addressed in PLN's updated RUPTL.

Gaps in Climate Commitments & Energy Policies

More action is needed to align with Paris Climate Agreement. The Indonesian government became a signatory to the Global Coal to Clean Power Transition Statement at COP26, committing for the first time to phase out coal and not build or invest in new coal power plants. This was followed by the release of PLN's roadmap for carbon neutrality by 2060. Climate Action Tracker rated Indonesia's revised NDC as "highly insufficient" in reducing the country's carbon emission contributions to a level compatible with meeting the 1.5C target.

> **More recently,** the Indonesian Government and the IEA released the Net Zero Emission (NZE) Roadmap proposing three different transition scenarios: Optimistic, Moderate, and Pessimistic. This roadmap, along with the JETP commitment, brings Indonesia's net zero target forward from 2060 to 2050, and raises the share of renewable electricity to 34% by 2030. However, the IEA acknowledges that the plan is still ten years too late for a 1.5C Paris-aligned scenario.

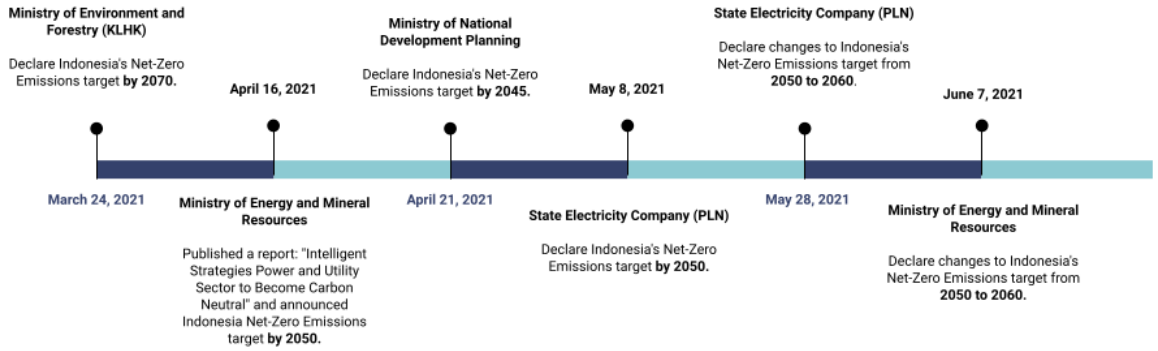
At present, the determination of the NZE targets is not fully aligned across ministries and related entities. Both PLN and Ministry of Energy and Mineral Resources (MEMR) initially[1] shared a target for NZE by 2050 but have backtracked and set 2060 as the official target, while Ministry of Environment and Forestry (MoEF) set a NZE target for 2070. On the other hand, an earlier Bappenas[2] recommendation under the National Vision 2045[3] urged an optimistic NZE scenario target for Indonesia.

[1] "Intelligent Strategies Power and Utility Sector to Become Carbon Neutral," MEMR

[2] Known also as Ministry of National Development Planning

[3] Indonesia's National Vision 2045 was prepared by the Ministry of National Development Planning/Bappenas to provide an overview of the state of Indonesia in 2045 and provide a roadmap that is capable and needs to be achieved by 2045. The vision consists of four pillars, namely human development and mastery of science and technology, sustainable economic development, equitable development, and national resilience and governance. One of the targets/missions is to reduce carbon emissions by 41% by 2045 (Bappenas, 2019).

Figure 1. Timeline and Change in National Net-Zero Emissions Targets



Source: Trend Asia, 2021

One key ambiguity is the country's verbal commitment to stop building new coal plants by 2025. In May 2021, the Government announced a moratorium on coal plant construction. The deadline for new plant construction was initially set for 2023, but was changed to 2025 not long after, with the Government stating that they seek to complete 35 GW of megaprojects in the remaining time.

In September 2022, Presidential Regulation No. 112/2022 (PR 112) clarified that the construction of any new CPP would be prohibited beyond those stipulated in the RUPTL 2021-2030. This gives an allowance of new fossil fuel capacity as part of the 35 GW megaproject, of which 48% will come from coal (14 GW), 22% from gas, and 30% from "new and renewable energy" (NRE). This is on top of 7 GW of Fast Track Program[4] (FTP) coal. This adds new coal to an already overcapacitated grid, at a time when net zero ambitions are not yet Paris-aligned.

PR 112 also makes a concerning exemption to the moratorium on coal construction: captive[5] coal plants, or plants that "integrated with any industry... or is listed in the National Strategic Project (PSN)..." can be built, so long as they are "committed to reducing greenhouse gas emissions (GHG) by at least 35% within ten years of operation, compared to the average CPP emissions in Indonesia in 2021 through technological advancement, carbon offsets, and/or renewable energy mix..." and "operational no later than 2050." These exemptions will allow the construction of CPPs to continue as long as they retire by 2050. Additionally, smaller coal plants may continue to operate even if they are not economically viable.

[4] FTPs targeted to build around 10,000 MW of CPPs by 2010

[5] A condition where a company is allowed to manage and provide its own source of electricity, outside of supply from PLN (DPR RI, 2020).

According to Global Energy Monitor data, there are over 22.6 GW of captive coal dedicated to various industries, particularly metal smelting and cement — 7.3 GW in operation, 8.5 GW under construction, and 6.8 GW in permitting or planning phase. While narrow, this exemption leaves the option open for more captive coal to come online.

These exemptions risk enabling coal operators and owners to prolong coal assets. In addition, they do not guarantee a reduction in energy sector emissions. Technologies like ammonia co-firing are unproven in their use; biomass co-firing runs the risk of derating the coal asset. Many of these technologies, like CCUS, remain expensive; and therefore, not competitive with alternative renewable technologies like solar and wind.

- **Vague policies and misaligned targets** are counterproductive and could undercut the most ambitious NZE target for Indonesia. In keeping with the Paris Agreement 1.5°C target to avert catastrophic climate change, the IPCC recommends a complete global coal phase out by 2040. Climate Action Tracker found Indonesia's current, updated policies to meet the 1.5°C target remain "insufficient", even when compared to their fair share contribution. Within the electricity sector, unabated coal power in Indonesia should fall 10% by 2030 and be phased out by 2040. This is possible, as a recent report by IESR presented a just and accelerated retirement pathway to net-zero for Indonesia set the coal phaseout date to 2045 at the latest.

Significant investments and planning will be needed to make net zero a reality in Indonesia. In the months leading up to Indonesia's JETP Investment Plan, it is crucial for responsible government ministries, energy stakeholders, and donor countries to ensure that proposals to prolong coal assets and bank false solutions are avoided completely. Another report by IESR assessed that the Indonesian grid would need a total renewable energy capacity of 112.1 GW of solar PV, 9.2 GW of hydro power, 5.2 GW of geothermal, 1.5 GW of wind turbine, and 1 GW of biomass to align with the Paris Agreement's goal.

Rather than continuing with fossil fuel projects, vital funds under the JETP should be allocated towards meeting these renewable needs, and regulatory policies and reform that supports renewable energy deployment. Our research shows that existing overcapacity on the grid should encourage Indonesia to avoid new coal construction while devoting much-needed capital for grid improvements and zero carbon technologies to preserve security of supply.

Grid Check: Oversupply on Indonesia's Electricity System

Today, the key objectives of energy planning are not just to keep the lights on in an economically efficient way, but also deliver rapid emissions reductions. To this end, capacity investment decisions must ensure sufficient dispatchable capacity to meet demand every day, in addition to maintaining reserve capacity in case of unexpected outages, spikes in demand or fortuitous events.

In the past, PLN has consistently overestimated the country's electricity demand growth. For instance, in 2019, actual electricity demand grew by 4.5% against the MEMR's estimate of 6.3%. Unfettered construction of coal capacity alongside this overestimation has created an oversupply issue that cannot be allowed to persist.

Overcapacity has capital, operating and opportunity costs. Take-or-pay (TOP) schemes between PLN and independent power producers (IPP) are built into power purchase agreements (PPA). While such payments are meant to assure a revenue stream for plant operators; in an oversupplied grid, capacity payments are paid to operators regardless of whether the power produced by the plant is dispatched to service demand. In addition to TOP arrangements, operating coal plants incur fixed operating and maintenance (FOM)[6] costs, which do not vary with output; underutilized coal plants will need to be kept in servicing condition.

Left unchecked, uneconomic PPAs for new and unnecessary coal and related technologies could lock in PLN with excess TOP for unneeded capacity and lead to stranded assets. This is likely an issue that will worsen with the planned coal construction.

Our research found that an estimated 33% of the 58 GW of total installed fossil fuel capacity in Indonesia was in excess of what was needed to meet peak demand and maintain a 15% reserve margin[7] in 2021. This oversupply exceeds the national electricity reserve margin standard of 30-35%, and amounts to an estimated IDR 16 trillion (USD 1.2 billion)[8] in FOM costs spent to keep this excess capacity in working condition. The growing emphasis on energy efficiency, demand response and the integration of zero carbon generation technologies will only exacerbate the issue of excess capacity

[6] FOM costs are those incurred at a power plant which do not vary with generation. FOM costs typically include routine labor, materials and contract services, and administrative and general expenses.

[7] A reserve margin is a percentage of additional available capability in an electric power system, available on top of peak demand/load.

[8] The average exchange rate of 1 USD is 14,308 IDR (International Monetary Fund, 2021)

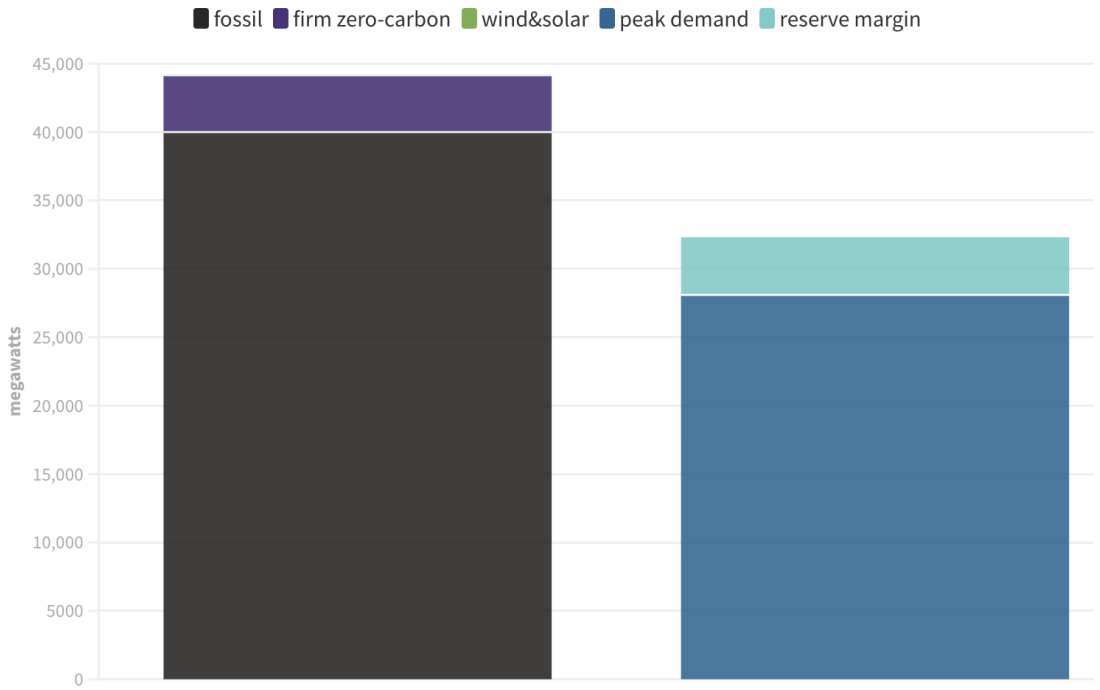
Breakdown of Overcapacity by Grid

Our analysis found that on the Java-Bali grid, an estimated 30% of installed fossil fuel capacity was in excess of what was needed to maintain security of supply in 2021. This is equivalent to 11.9 GW of CPP capacity, or nearly half of the CPPs installed on the Java-Bali grid — where 60% of the country's operating coal capacity is built. Oversupply on the Java grid has increased over the last three years, and the cost of maintaining this excess capacity was estimated at IDR 7.8 trillion (USD 546 million) in 2021.

Figure 2. Share of Fossil Fuel Overcapacity by Grid in Indonesia by Year 2019-2021

Source: ESDM, PLN, Global Energy Monitor

Figure 3. Peak Load vs. Installed Capacity on the Java Bali Grid, 2021



Source: MEMR, CREA.

Sulawesi contends with approximately 69% — 5.1 GW — of installed fossil fuel overcapacity in 2021 in excess of what was needed to meet peak demand. The Sulawesi grid has the highest share of overcapacity estimated, though the share has decreased in the last 3 years due to increasing demand in the region. Still, the FOM cost of maintaining the excess coal assets is estimated at IDR 3.4 trillion (USD 235 million) annually. The region is a major industrial area with over 8 GW of proposed and operating captive power capacity for nickel refining and steel production set to cater to an expected increase power demand.

> **In Sumatera, an estimated 49% of excess fossil fuel capacity** — or all 5 GW of installed CPP and 1.3 GW of gas plants — maintained by IDR 3.8 trillion (USD 268 million) annually in FOM costs in 2021.

Overcapacity on the smaller grids of Kalimantan (14%) and Maluku-Papua-Nusa Tenggara (36%) in 2021 were more manageable, given that peak demand in these areas are still expected increase. However, some grids have experienced a rapid increase in generation supply with new coal plants coming online despite stagnant demand. In Kalimantan, this has resulted in the largest electricity reserves, with a percentage of reserves increasing to 67% in December 2022.

The existing excess capacity already provides a buffer and opportunity for fossil fuel capacity to be leapfrogged in favor of low-cost, modular and zero-carbon alternatives such as solar and wind power, especially as the transmission infrastructure will be a challenge to build out.

The Danger in Fueling Oversupply

PLN's electricity growth projection declined from 6.4% in the 2019-2028 RUPTL to 4.9% in the 2021-2030 RUPTL due to the COVID-19 pandemic. However, an estimated 40.6 GW of capacity is planned for commercialization between 2021 and 2030; of which, 34% (13.8 GW) will come from coal and 14% (5.8 GW) from gas and diesel.

> **Overcapacity is a heavy financial burden for PLN** because of the TOP system, which requires electricity generated from IPPs to be paid for, even if not used. In 2017, Institute for Energy Economics and Financial Analysis (IEEFA) estimated that for every 1 GW of unused electricity, PLN pays at least USD 3.16 billion in TOP cost. In 2021, PLN was estimated to pay approximately IDR 103 trillion to IPPs through the TOP scheme. This is supported by the Government's annual subsidies[9] to reduce PLN's financial burden by IDR 4.7 trillion in Q1 2022. In 2021, PLN's revenue from electricity subsidies was estimated at IDR 49.8 trillion.

Efforts to address the financial burden of TOP on an oversupplied grid have been made. PLN renegotiated TOP costs on 17 IPPs for various types of power plants, reducing the TOP from an 80% capability factor to 70%. PPA renegotiations are underway to reduce the availability factor (AF) for another 32 power projects that are under construction. However, moving forward with more projects planned still increase the payments that will need to be made under PPAs, unless the scheme is removed entirely.

In addition to TOP, the cost of dependence on fossil fuel affects PLN's Biaya Pokok Penyediaan (BPP) — the cost of providing electricity by PLN, excluding the distribution cost. BPP remains vulnerable to commodity prices, particularly that of crude oil (ICP). For every USD 1 increase in ICP, there is an estimated IDR 500 billion increase in BPP. As a result, government compensation[10] becomes larger. From 2018-2021, the government provided subsidies to PLN of IDR 197 trillion and compensation funds of IDR 87.7 trillion. In 2022, PLN estimates that a compensation fund of IDR 65.9 trillion will be paid by the government to cover the BPP; this is higher than the cost of electricity sales tariffs for non-subsidized electricity customers. This highlights the

[9] Subsidy is the cost from the government to PLN to enable the poor or vulnerable to buy electricity at a lower price than the predetermined cost.

[10] Compensation is the cost from the government to PLN to cover the BPP, which is higher than the cost of electricity sales rate for non-subsidized groups.

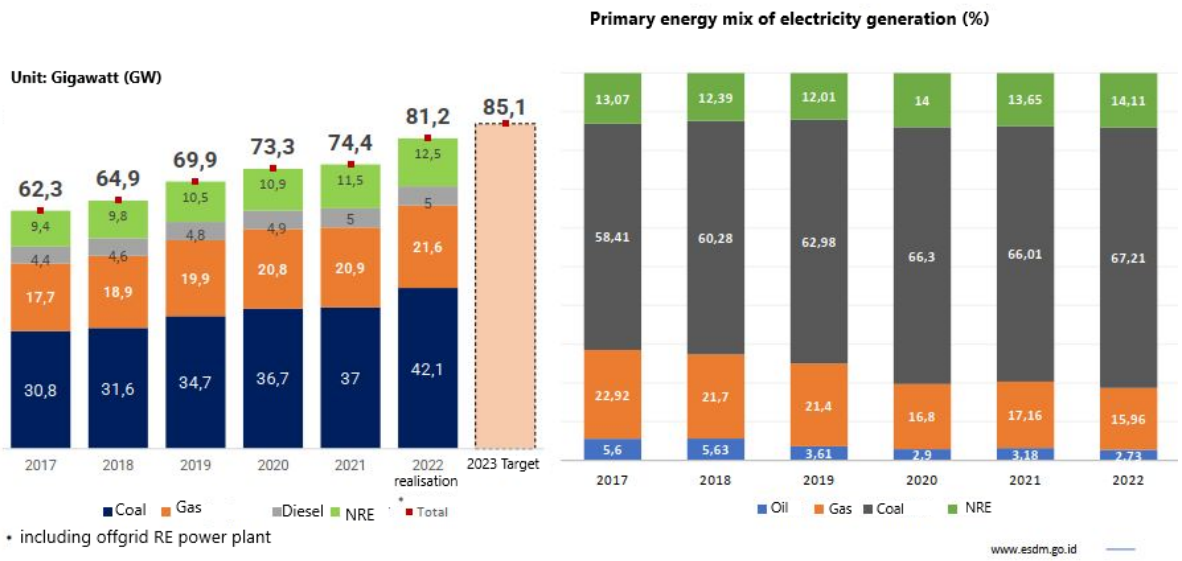
danger of fossil fuels; regardless of Indonesia's significant domestic supply of coal, oil and gas, fossil fuels are subject to the fluctuations in global market prices.

In addition to the financial burdens of excess fossil fuels, overcapacity affects electricity system reliability. As a result of the high overcapacity, rotating blackouts from both planned and unplanned plant outages have become a recurring issue in Indonesia. Outages significantly reduce firm capacity that can be counted upon to meet demand, and the issue lies largely with the system planners and generators rather than an issue of installed capacity and supply. The inefficiencies in systems planning must be addressed to deal with the reliability of the grid and ensure proper integration of renewables moving forward.

Transparency around the status of long-term PPAs and a timely retirement schedule for fossil fuel power plants will be crucial. The political will is needed to ensure that incumbent generators do not continue to keep unnecessary fossil fuel capacity subject to costly TOPs that eat up government subsidies.

Government, utilities, and operators will need to reevaluate the share of fossil fuel-based capacity in the energy mix. Across the 5 main grids, it is clear that low-carbon energy sources should be the priority for planning, policies, and investments. Realizing the potential economic and emissions benefits of the energy transition will also require improved transmission infrastructure and more dynamic grid management to better integrate variable RE technologies.

Figure 4. Installed Capacity of Indonesia's Electricity Generation

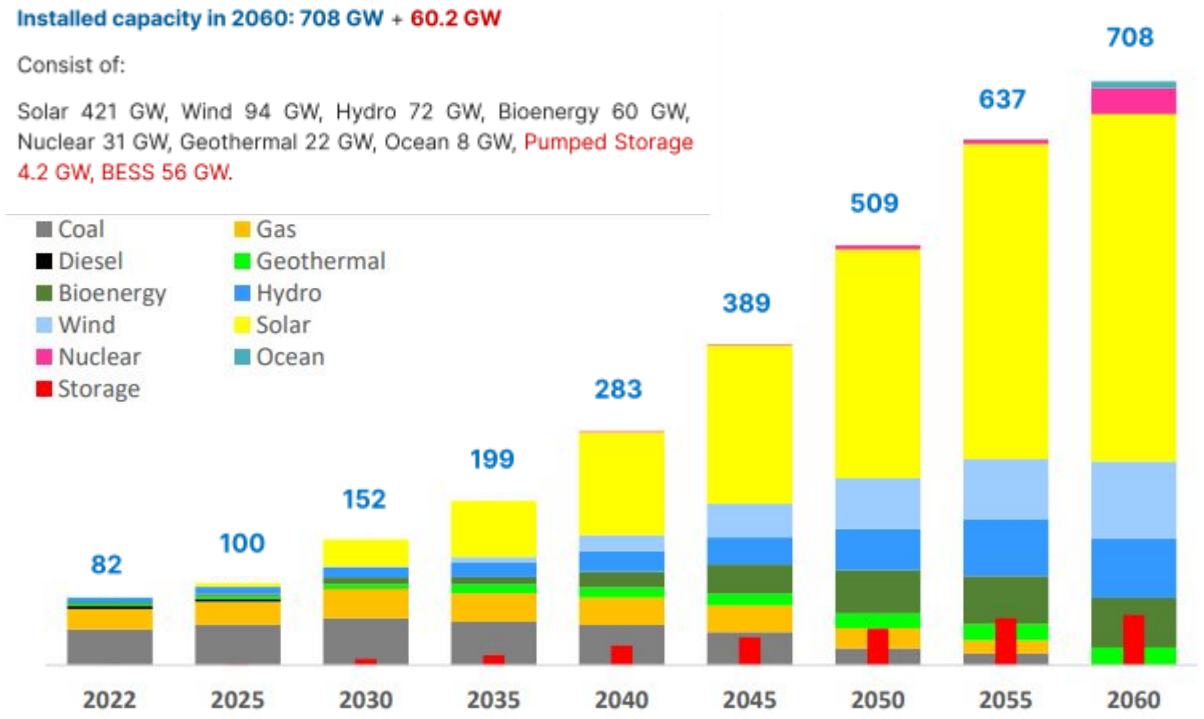


Source: MEMR, 2023

Meeting Future Demand alongside Climate Action

Indonesia must avoid building additional fossil fuel capacity. To meet, short-term and mid-term demand, additional capacity should come from renewable energy. The projected growth in Indonesia's energy demand and planned retirements of its dominant energy supply warrants a significant ramp up in renewable energy. However, while the country recognizes the share of renewables in its future energy mix, these technologies are not yet accounted for in its energy planning. In the existing NRE Development Plan, a massive jump in solar capacity can be seen in 2030, which highlights the shortcomings of Indonesia's current plans for solar deployment in 2030. The deployment of such renewables will need to occur early.

Figure 5. Indonesia's Electricity Supply Plan towards NZE 2060



Source: MEMR, 2023

Instead, fossil fuel-powered plants and false solutions dominate the proposed generation projects in Indonesia. If pursued in lieu of meaningful solar and wind energy deployment, these "new" technologies could undermine Indonesia's pledges and energy transition by diverting vital time, capital and political will away from the integration of renewable energy.

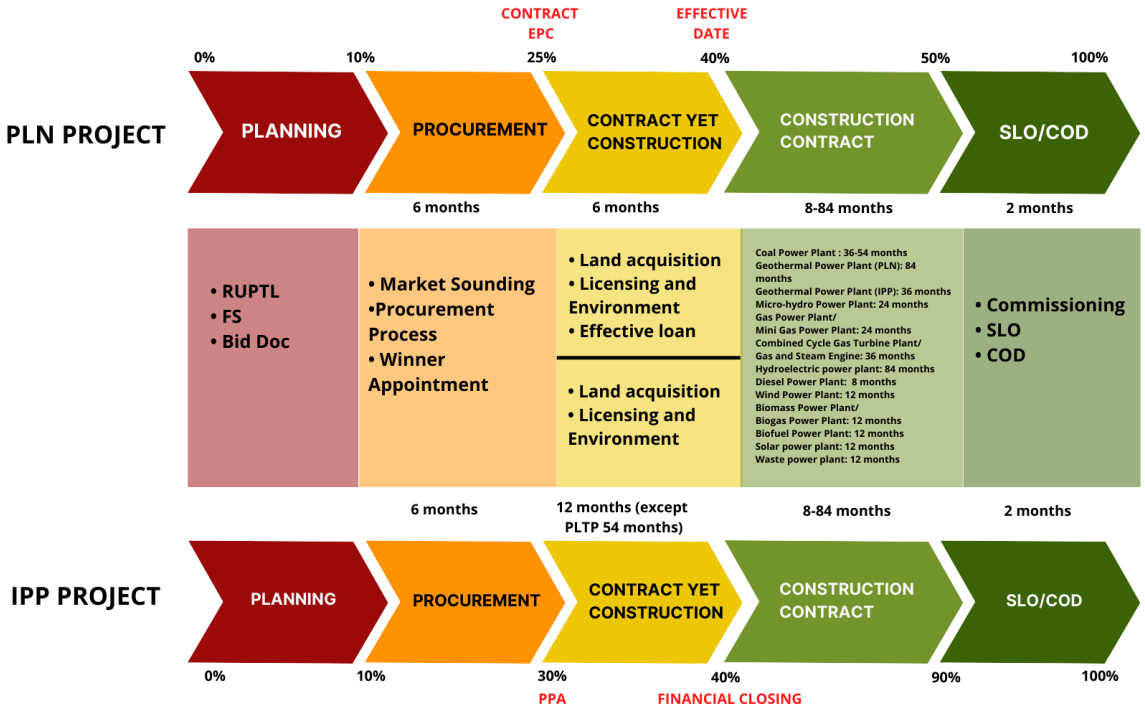
Critical Ambiguities in the RUPTL

Given the importance of PLN in the energy transition, the updated RUPTL will be a key guiding document for the initial disbursement of JETP financing.

When the last RUPTL was published in 2021, it was touted as a "Green RUPTL". However, of the proposed 40.6 GW identified to meet future power demand, 50% (19.6 GW) were fossil fuel powered. Such capacity additions are incompatible with an ambitious NZE, and will likely worsen oversupply. In the Java-Bali grid, where the majority of this capacity is proposed, PLN estimates that oversupply will increase 61% with the addition of 13 GW of fossil fuel-based generation.

While President Jokowi emphasized that he would "prohibit and cancel" new CPPs unless they had secured financial closure or were in construction stages, several power plants on PPA status and commercial operation dates (COD) in 2024 or beyond were not canceled in RUPTL 2021-2030.

Figure 6. Formal Stages of Electricity Generation Project in Indonesia



Source: Ministry of Energy and Mineral Resources, 2021

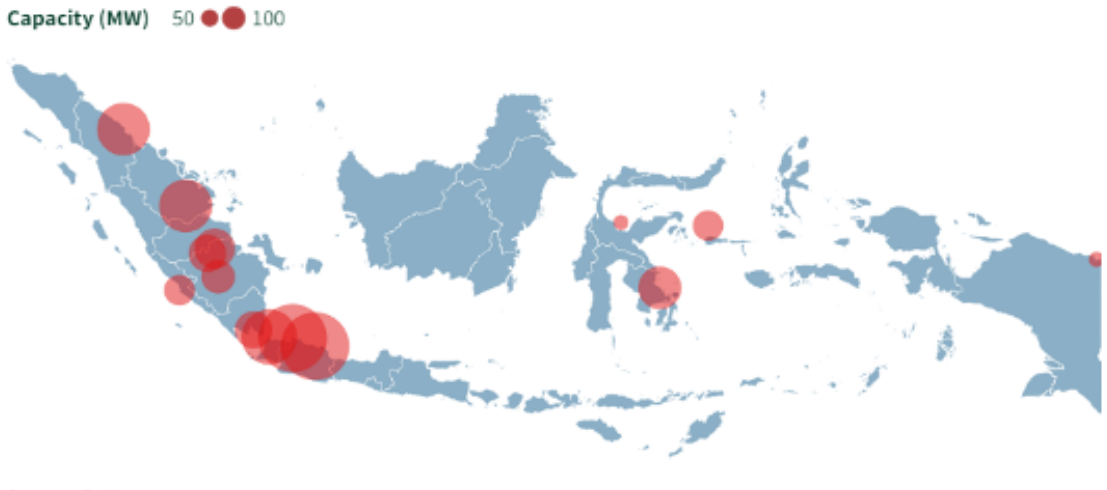
Instead, PLN is accelerating FTP 1, FTP 2 and 35 GW megaprojects. Of the 35 GW megaprojects, 13.8 GW (70%) are proposed coal plants. These proposals include coal power plants that have not secured financial closure. Some plants have been assigned COD between 2024 and 2029, despite the moratorium on coal construction after 2025.

A study from Trend Asia (2021) found that the 13.8 GW of proposed coal in the RUPTL would add an additional 86.9 million tons of carbon dioxide (CO_2) emissions each year — equivalent to the total annual carbon emission of Nigeria. The Government estimates that CPP is expected to have a commercial lifetime operation of 25-30 years, and has historically operated CPPs even beyond this period. For instance, in one of the largest coal plants in Indonesia, the Suralaya CPP, which 1-4 coal power generation units have reached 37 years of operation.

In addition to these 13.8 GW, it remains unclear whether shelved projects are included in the moratorium. Based on public information disclosures requested from the MEMR (2021) regarding technical guidelines for CPP construction, there was a 12-month deadline for plants to obtain financing, following the awarding of a PPA with PLN. However, the majority of plants in the RUPTL 2021-2030 list have significantly exceeded the timeframe for reaching a financial close. The updated RUPTL should see such projects officially cancelled, rather than shelved, to avoid any danger of being reactivated despite the MEMR's guidance.

Amid slower economic growth rates, electricity grid oversupply and CPP's funding uncertainty, nearly 6 GW of new CPPs are "shelved" in the 2021-2030 RUPTL in case they are needed for "adjusting system needs (*Table 1*)." The most significant portion is found in Sumatra (2.59 GW) and Java (2.66 GW), even though these grids both faced oversupply concerns of over 50% (*Figure 7*). PLN also included 3.8 GW of CPPs in planning and permitting stages.

Figure 7. Indonesia Coal Power Plants "Adjusting to System Needs"



Source: RUPTL 2021-2030

Similarly, smaller coal projects in remote areas are likely to continue construction through PLN's institutional budget, especially considering the exemptions made by PR 112. This includes 25 new small-scale CPPs, including ones on small islands with no coal resources, which they previously cancelled in June 2021 following the announcement of the NZE and the CPP moratorium. Despite a lack of funding and a

limited capacity to offer bounded financial returns, the Government seems to have continued the CPP project.

Table 1. Planned Coal fired power plants without financial closure but in the RUPTL 2021-2030 to "Adjust to Systems Needs"

Region	Name of Plant	Capacity (MW)`
Sumatera	PLTU Bengkulu	200
	PLTU Lampung Extension	300
	PLTU MT Riau-1	600
	PLTU MT Banyuasin	240
	PLTU MT Sumsel MT (Expansion)	350
	PLTU MT Sumsel-6	300
	PLTU Sumut-2	600
Java, Madura, Bali	PLTU Banten	660
	PLTU Jawa-5	1,000
	PLTU Indramayu	1,000
Sulawesi	PLTU Sulbagut 2	200
	PLTU Sulbagsel 2	400
	PLTU Tolitoli	50
Maluku, Papua, and Nusa Tenggara	PLTU Jayapura 3	50
Total		**5,950**

Source: RUPTL 2021-2030

The next RUPTL must set firm paraments for the 2025 deadline for building new coal plants, and ensure that the moratorium on coal completely halts new coal construction beyond those in the 35 GW megaproject category.

"New" Technologies could be false and none solutions

Indonesia is encouraging the exploration of "new and renewable technologies" in preparation for the pending phase out of coal. A look at proposed projects shows an overwhelming emphasis on "new" technologies in the short-term. Many experts are warning that the deployment of fossil gas, biomass co-firing and carbon capture, utilization and storage (CCUS) could be false solutions, given that these technologies remain much more carbon intensive and polluting than renewable alternatives. In some cases, the technologies being advertised are not only unfeasible, but unproven; they could become problems in themselves if pursued.

New "Fossil Gas" Infrastructure should be replaced by renewables

- ⊗ Indonesia's plans to add gas-fired power plants rely largely on building new infrastructure, which may open up Indonesia to fluctuations in the commodity market.
- ⊗ RUPTL 2021-2030 converted 1.2 GW of proposed coal projects to fossil gas. The existing coal overcapacity in Indonesia and the low penetration of renewables in the energy mix means that gas infrastructure will only lock in fossil fuels infrastructure. Cancelling such projects or converting them to renewable energy should be revisited.

Indonesia currently has 18 GW of gas-fired power plants in operation, of which 1.9 GW are captive gas. According to the Global Energy Monitor, another 4.8 GW of new gas plants are in construction and an additional 7 GW are proposed, including 1.2 GW of gas-fired power projects that replaced coal in the RUPTL (Table 2). However, because projects are in early stages, a conversion to renewables is still possible and can avoid any additional stranded asset risk from new fossil fuel infrastucture and aid PLN in aligning with NZE ambitions.

Captive gas capacity accounts for 1.6 GW of in-contruction projects and 3.6 GW of proposed projects.

Photo 1. Gas Power Plant Tambak Lorok, Central Java.

Source: Melvinas Priananda - Trend Asia

Table 2. Proposed CPP Projects Converted to Gas Power Plant

No	Project	Capacity (MW)	COD	Status	Developer
1	PLTG/GU Kalbar/Pontianak	300	2024	Relocation	PLN
2	PLTGU Sulbagsel	450	2023	Planning	PLN
3	PLTMG Bau-Bau 2	30	2023/2024	Planning	PLN
4	PLTMG Lombok 2	100	2024/2025	Planning	PLN
5	PLTMG Sumbawa 3	100	2024/2025	Planning	PLN
6	PLTGU Haltim	200	2024	Relocation	PLN
Total		**1,180**			

Source: RUPTL 2021-2030, Trend Asia, GEM

For Indonesia, the coal-to-gas switch could make the country's electricity prices more vulnerable to fuel cost fluctuations. Demand for natural gas for fertilizer and power in Indonesia plateaued before the COVID-19 pandemic. While demand for natural gas is expected to grow in the long term, supply from existing natural gas fields in Indonesia is expected to decline by about 25 billion cubic meters, or about 3%, by 2035. Unlike coal, an increase in fossil gas generation would require imports or building out upstream and midstream infrastructure, a costly option as new production is incurring much higher wellhead costs.

Biomass Co-firing.
Ambiguities:

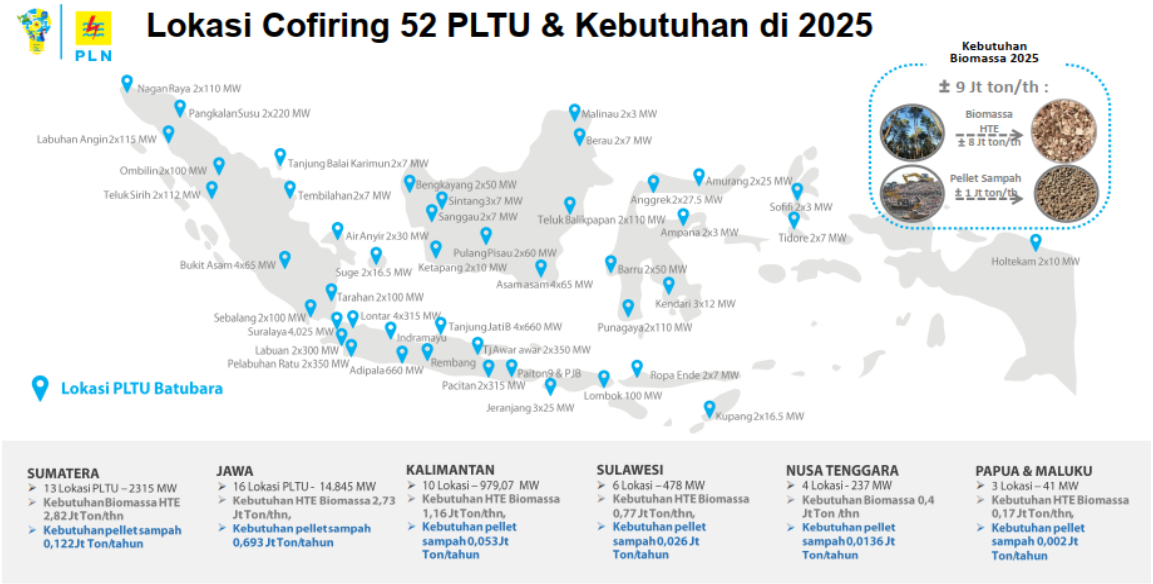
- ⊗ PLN's strategy to reduce GHG emissions will not be met by increasing biomass co-firing at coal plants because the portion of biomass slated for fuel mixing is only 1-5%, and the remaining 95% will still use coal. Co-firing also runs the risk of derating the asset.
- ⊗ The growing biomass demand potentially causes excessive felling of trees and additional emissions from deforestation or new land clearing.
- ⊗ Instead of retiring old CPPs, the biomass co-firing implementation potentially provides a reason to extend the coal life and keep them operating.

Biomass co-firing is a false strategy that PLN is pushing aggressively in RUPTL 2021-2030, in hopes that it will reduce GHG emissions from existing CPPs and contribute to the RE mix target of 23% in 2025 and 31% in 2050. While the co-firing method adds biomass such as woodchips, wood pellets, sawdust, palm kernel shells,

waste, rice husks, and corncob as fuel for power generation, the fuel mix is still largely dominated by coal.

Since 2020, PLN planned to gradually implement biomass co-firing technology in 144 CPP units spread across 52 locations with a total capacity target of 18.3 GW by 2025 (*Appendix-Table 1*). This plan seeks to co-fire biomass with coal at 10% of CPPs in Java-Bali and 20% of CPPs in the rest of Indonesia. However, not only would plants still burn highly-emitting coal at 95-97%, such a move would require 9 million tons of biomass per year, including 8 million tons of processed wood pellets annually, and 900,000 tons of waste per year. In May 2022, PLN tested a 3-5% portion of biomass blended in with coal in 37 CPPs, and of which 32 CPPs have been implemented commercially.

Figure 8. Location of Biomass Cofiring Plan in Indonesia



Source: PLN, 2021

PLN claims that co-firing does not cause emissions or is carbon neutral. Financially, they also claim that it does not need enormous costs, only incurring operational expenditures, rather than capital expenditures, in purchasing or building fixed assets. However, the reduction of GHG emissions in the energy sector by co-firing will not be significant because the portion of biomass is only a fraction of the fuel actually burned, with the remaining 95% still useing coal. Research shows that mixing 5% co-firing will only reduce GHG emissions at CPPs by 5.4%. Based on calculations by PLN, it takes 5 million tons of wood pellets per year or 738,000 tons of waste pellets per year to meet the needs of 1% co-firing per year at the 18 GW of existing coal power plants in their pilot program. With PLN's target to implement 10% co-firing, the volume of biomass needed will be greater. Meeting this need will potentially cause excessive new land clearing.

Trend Asia estimates that the co-firing of biomass as much as 10% in 107 CPP units adds to the emission of around 26.5 million tons of CO_2 every year. Emissions as a result of biomass co-firing are not only from burning biomass with coal, but also from emissions caused by deforestation as a result of felling trees for wood pellets. The net emissions difference is estimated at around 6.8 million to 11.3 million tons of CO_2 equivalent per year.

- **In the New and Renewable Energy (NRE) Bill, biomass is included in the list of renewable energy**. However, biomass cofiring is likely a way for PLN to extend the life of coal that should have entered retirement age. For example, the 400 MW Suralaya-1 Unit 1 CPP which has been operating for 38 years since 1984 is part of the biomass co-firing program. The CPP should have retired without co-firing so that RE generators could replace it.

In addition to the issue of feedstock, biomass bleding derates the facility. Because the calorific value of biomass is less than coal, even low levels of co-firing result in a drop of boiler efficiency. This means that more fuel will need to be burned to produce the same amount of output, suggesting that while the emissions per kilowatt-hour of electricity from the plant may decrease, the overall emissions from the plant may not change given that more fuel is needed to get the same amount of power generated at a plant.

Biomass co-firing can potentially be a false solution because coal is still the most widely used feed in the process, potentially reneging on the government's promise to retire CPP early.

Feasibility of Ammonia Co-firing in Indonesia should be questioned

- ⊗ The feasibility of ammonia co-firing remains untested outside of Japan. Factors such as the need to import the fuel and the retrofitting of exiting plants will likely make this technology extremely costly in Indonesia, and is of concern as it could extend the lifetime of CPPs and LNG power plants.

Ammonia co-firing in Indonesia is a recent issue, with 6 units ammonia co-firing proposals undergoing feasibility studies and 1 unit under testing.

Table 3. Planned Ammonia Co-Firing in Indonesia Power Plants

No	Name of CPP/GPP	Units & Capacity (MW)	Co-Firing Type	Co-Firing Portion	Status
1	Jawa 9-10 CPP	2×1,000	Ammonia	60%	Feasibility Study
2	Suralaya CPP Unit 5-7	3×600	Ammonia	N/A	Feasibility Study
3	Gresik CPP Unit 1	1×100	Ammonia	0,2%	Tested
4	Gresik CPP Unit 2	1×100	Ammonia	N/A	Feasibility Study
	Total	**4,000**			

Source: Trend Asia

The initiative is largely driven by cooperation with Japan. The Japanese engineering corporation, IHI Corporation, secured an agreement to research the technological and economic feasibility of ammonia co-firing and mono-firing technology with the PLN subsidiary, Pembangkitan Jawa Bali (PJB). The initiative sets an initial target to implement 20% ammonia co-firing on CPP assets managed by PJB. Feasibility study will begin with the 200 MW PLTU Gresik, a 42-year old gas plant in East Java that should be entering retirement. In addition, Mitsubishi Heavy Industries Ltd (MHI) has also started feasibility studies for ammonia co-firing on the Suralaya coal power plant and the nearby, Suralaya Gas Power Plant.

Co-firing ammonia has little benefit in reducing carbon emissions in comparison to RE technologies, especially in the near-term. Amidst JETP planning to set retirement schedules for coal plants and increase renewable energy's share, this initiative to co-fire ammonia could divert important funds towards a false solution that may only extend the lifetime of CPPs and LNG power plants in Indonesia. Efforts to reduce the country's carbon emissions by 29% by 2030, where the electricity sector needs to reduce up to 314 million tons of CO_2, are at risk of distraction. Ammonia fuel will also need to be imported from Japan under current proposals, making it an unexpensive undertaking for a largely unproven technology.

Carbon Capture, Utilization and Storage (CCUS) remains uneconomical and distracting for power sector use

Ambiguities:

- ⊗ CCUS is one of the MEMR and PLN strategies presented as a solution to reduce GHG emissions and achieve NZE by 2060. However, the technology remains largely unavailable commercially and remains extremely costly to implement for power projects, especially in face of renewable energy alternatives..
- ⊗ CCUS implementation will reduce the plants' generating capacity because the technology is energy-intensive.

Currently, there are 10 CCUS projects in the RUPTL 2021-2030, including six CO_2 capture projects in the natural gas processing sector and four others for plants related to low-carbon ammonia plants for fuel applications, coal-to-liquids, pulp and paper production, and refining. CCUS for coal power is still in development, carried out through a cooperation scheme between Japan and Indonesia.

CCUS for CPPs in Indonesia faces many obstacles. In 2015, World Bank and PLN conducted a study on the application of CCUS to a 2,000 MW CPP in West Java, which produces 12.1 million tons of emissions per year, and a 600 MW CPP in South Sumatra, which produces 4.1 million tons of emissions per year. The addition of the technology for a 90% CO_2 capture scenario is associated with massive costs; the levelized cost of electricity[11] (LCOE), or electricity costs per kilowatt hour (kWh), for a coal plant with CCUS in West Java and South Sumatra is twice that of one without CCUS. In addition, the CCUS technology would reduce the plants' generating capacity because CCUS could consume up to 20% to 30% of the power generated by the plant. With the 90% CO2 capture scheme, the capacity of the CPP in West Java is reduced from 2,000 MW to 1,449 MW, while the South Sumatra's CPP capacity would be reduced from 600 MW to 415 MW.

While the implementation of CCUS for power plants in Indonesia will not be a factor until 2040. According to the IEA, implementing CCUS in Indonesia until 2060 can reduce 190 billion tons of CO_2 annually. The CCUS implementation plan should be revised considering that a study by PLN and the World Bank showed that CCUS at the CPP is very expensive, which would burden PLN's finances in the future. Funds for emission reductions at CPP through the CCUS scheme should be used for the energy transition to renewable energy.

[11] The levelized cost of energy (LCOE) is a measurement used to assess and compare alternative methods of energy production. The LCOE of an energy-generating asset can be thought of as the average total cost of building and operating the asset per unit of total electricity generated over an assumed lifetime (CFI, 2022).

CCUS can potentially be a fake and false solution to reduce emissions because coals are still used in the process. The energy transition should start leaving coals, not maintaining the age of the power plant through the CCUS scheme. The use of CCUS itself also reneges on the government's promise to retire CPP.

While the Ministry recognizes that CCS/CCUS implementation is expensive investment, they have taken steps to subsidize it. One of the main points in a pending regulation for CCS/CCUS is to label CCS/CCUS as a petroleum engineering activity so the technology would be part of oil production operations and could be subject to cost recovery from the government.

Clean Coal Technology is a myth

⊗ Indonesia has pushed Clean Coal Technology (CCT), but the term itself remains ambiguous, and does not guarantee the reduction of GHG emissions and air pollution from CPP.

In 2020, the MEMR announced the use of clean coal technology (CCT) in Indonesia. The latest enhanced Nationally Determined Contribution (NDC) published by the Indonesian government prior to COP27, also features the incorporation of Clean Coal Technology. This inclusion presents a potential justification for expanding coal-fired power plants, under the premise of emission reduction, a claim is put forth. According to government, CCT will be installed on ultra-supercritical (USC) and supercritical to reduce their CO2 emissions by about 30-40%. However, the scope of technologies and emission control techniques that would characterize a coal plant as having CCT remains vague.

In some scenarios, an ultra-supercritical plan seems to quality a project as having CCT; however, the increased combustion efficiency technology does not guarantee a reduction in emissions of CPP. What is considered CCT on lower efficiency bioler technologies (supercritical) is even more unclear, some reports consider emission control technologies as CCT. In any case, CCT is not a solution that reduces the environmental risk of new plants, nor should it be used to allow plants to operate for longer than their scheduled retirement date under the JETP.

CPPs with CTT still emit CO2 and toxic pollutants such as sulfur dioxide, nitrogen dioxide and particular matter (PM). Retrofit emission control technologies and upgrading boilers to ensure that coal plants emit the lowest possible carbon and

pollution and meet the most stringent environemntal standards until their retirement should be required of plants that operate until the end of Indonesia's coal phaseout. Coal plants should not be allowed to emit dangerous levels of air pollution. The World Coal Association estimates it will cost USD 31 billion to upgrade a 400 GW CPP with the best technology. That's just a fraction of the health and economic impact that pollution from such a plant will generate throughout it's lifetime USD 2.4 trillion clean energy investment.

However, CCT in itself is not a solution or alternative to continue the use of coal. By canceling all planned coal plants, funds can be useful in accelerating the energy transition rather than continuing to support coal.

The alternative technologies above are proposed for emissions reduction of the existing coal fleet, but the most cost-effective and efficient way to reduce emissions from the electricity sector is to half new coal construction, retire CPPs that have entered retirement age rather than put them on life support with false solutions, and rapidly deploy zero carbon technologies that will support earlier retirements of CPPs. Indonesia can achieve the most ambitious NZE targets if much needed support and resources are allocated to optimize for such results.

Photo 2. Java 9-10 Coal Power Plant Construction in Suralaya Banten that will use CCT

Source: Melvinas Priananda – Trend Asia

Conclusion and Recommendations

Indonesia faces a massive challenge to meet future energy demand while transitioning its energy system away from its historical dependence on coal. Persisting plans for new publicly-funded coal, as well as other fossil fuel-based projects such as biomass and ammonia co-firing risk massive and unnecessary public budget spending, and threaten the waterdown the country's net zero ambitions and long-term energy security.

Electricity consumers are already bearing the burden of overcapacity from Indonesia's existing coal fleet. This report shows that plans that support continued fossil fuel use mostly protect incumbent generators with high carbon and air pollutant emissions, even when their contributions are not needed to meet current or future power demand with adequate safety margins. Given the enormous potential savings in maintenance costs and the benefits to human and planetary health, halting the development of new plants for fossil fuel generation is a crucial first step in the energy transition. This would give leeway for earlier retirements of excess fossil fuel capacity because early retirements efforts will only be hindered by additional coal on the grid, which unnecessarily take from public budget spending. In the future, taxpayers would have to compensate for the retirement of the new coal power plant.

The upcoming revision of the RUPTL must align Indonesia's future energy planning with its climate pledge.

Things to Watch in the RUPTL

- **Assorted net-zero scenarios in the RUPTL, including the progressive scenarios**

  MEMR and IEA recently published a report on a pathway to a net-zero target. Thus, the upcoming RUPTL should include the conceptualized framework national NZE target in various scenarios.

  This is important because there is a key potential aspect related to important prerequisites to support national net-zero target adjustment to be faster, as stated by President Joko Widodo about transition funding. Currently, energy transition initiatives and funding are emerging and will become a significant driven factor in accelerating the transition scenario.

- **Coal retirement roadmap**

  The upcoming RUPTL needs to include important aspects related to the CPP retirement roadmap initiative. In detail, it has to identify and list the coal retirement project, including the list of CPP and the end-of-life operation based on their PPA.

- **Increasing investments in the grid and cancelling coal to avoid further oversupply**

  Oversupply is a major issue in the national electricity grid and system, it would strongly affect the national electricity supply policy ahead. In the previous RUPTL, the discourse on oversupply issues was minimal. It only gave a general indication of the problem of oversupply in the network, Sumatra, and Java-Bali. And a glimpse explanation of efforts that need to be made.

  The discussion on oversupply must be carried out in a more comprehensive approach and must parse and list the oversupply percentage in each grid compared to the reserve margin rate set by PLN.

  Currently, the government is accelerating the energy transition through strategic efforts to retire CPP. This would be supported through a number of potential initiatives such as the Energy Transition Mechanism (ETM)[12] initiated by Asian Development Bank (ADB) or the Just Energy Transition Partnership (JETP)[13] initiative which was launched after the G7 meeting this year.

Recommendations

New and important policy and investment plans under the highly anticipated RUPTL and the JETP Investment Plan provide a signicant opportunity for Indonesia to jumpstart its energy transition, and phasedown its dependence on coal. A combination of different options can support the accomplishment of the optimistic net zero scenario by 2040. This includes but is not limited to:

- **Canceling all new fossil fuel power plants in the pipeline.** There is a growing consensus that no additional fossil fuel capacity should be built in order to meet temperature goals under the Paris Agreement. Additional fossil fuel plants are not guaranteed operation or even revenues for their conventionally assumed economic lifetime, especially in Indonesia where oversupply and under-utilization of fossil fuel capacity will likely lead to increased stranded asset risk.

  The RUPTL must reflect President Jokowi's 2025 moratorium on new coal, canceling permits for new plants as well as already "shelved" projects. Building new coal power plants until 2025 will lock-in CPP operation for another 25 to 35

[12] Country-specific ETM funds seek to buy back coal power assets with the goal of retiring them on an earlier schedule than if they remained with their current owners.

[13] The Just Energy Transition Partnership (JETP) is a climate financing mechanism, announced at COP26 last year by the United States, the United Kingdom, Germany, France and the European Union. It aims to support countries in their transition away from coal and reduce emissions in the power generation sector. The partnership first announced with South Africa. It has been followed by the partnership in Indonesia, India, Senegal, and Vietnam.

years, making it virtually impossible to achieve an early 2040 phaseout and undermining early CPP retirement schemes like the ADB's ETM.

- **Reevaluate fossil fuel projects that are subject to PPA renewals** to free utilities and distribution companies from huge capacity charges that would need to be paid to keep idle fossil fuel power plants in operating condition. Instead, finances can be utilized for efficiency improvements and the procurement of cheaper renewable energy sources.

- **Expedite timeline for phase out of coal power plants, while scaling up deployment for new solar and wind technologies.** Given the potential annual savings from retiring excess fossil capacity, Indonesia should redesign phaseout plans and target the 2040 coal retirement schedule, identified in its NZE roadmap. The amount of excess fossil fuel capacity across Indonesia's grids demonstrates that security of supply can be maintained without keeping ageing capacity on life support. Reductions in public health burdens and associated economic costs are unaccounted for in this study, but will increase potential savings and benefits that would stem from earlier retirements.

- **Disclose long-term power purchase agreements (PPAs) and plant-level retirement plans to the public.** The disclosure of power purchase agreements by the Indonesian Government is essential to fostering transparency and public participation.

  Transparency in the retirement guidelines and timelines for older and polluting fossil fuel power plants are also needed as part of PLN's efforts. The lack of firm guidelines or policy for the retirement of such plants has allowed their operations to continue beyond their useful life, resulting in risky operations leading to accidents, and a higher carbon and environmental pollution footprint. Together with open and accesible PPAs, such guidelines will encourage accountability in the CPP early retirement process and ensure the proper use of public funds and a fair valuation of CPP retirement compensation for operating plants.

- **Reevaluate fossil fuel based capacity, and its share in the energy mix.** Where capacity expansion is already committed, financiers, suppliers, and planners must find solutions to convert projects into clean energy.

- **Completely avoiding fossil gas and false solutions in power sector and energy transition initiatives.** Given Indonesia's fossil fuel-dependent and expansive coal fleet, there are significant risks of coal power plant conversion to new fossil gas infrastructure or ammonia and biomass co-firing that would prolong coal power plants' lifetime operations. Wind and solar deployment should be the priority, over the redeployments and pilot projects of these false

solution, particularly in the power sector and in part of the energy transition initiatives such as JETP and ETM.

- **Integrate sub-national electricity grids and improve grid management.** In many countries, realizing the potential economic and emissions benefits of retiring fossil fuel capacity requires modern and integrated grid management, as well as sufficient transmission capacity between grids.

For Indonesia, this requires overcoming special interests that benefit from inefficient and fragmented grids. Well-functioning grids will be of the essence in managing the energy transition and integrating high shares of variable renewable energy capacity during this decade.

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Appendix

Table 1-A. Biomass Co-firing Implementation

No	Name of CPP	Co-firing Portion	Units & Capacity (MW)	Type of Biomass
Commercial				
1	Paiton 1-2	5%	2×400	Sawdust - Wood Pellet
2	Pacitan	5%	2×315	Sawdust
3	Jeranjang	3%	150	SRF-Waste
4	Ketapang	5%	2×10	Palm Kernel Shell
5	Sanggau	5%	2×7	Palm Kernel Shell
6	Suralaya 1-4	5%	4×400	Rice Husk
7	Anggrek (Gorontalo)	5%	2×27.5	SRF-Waste
8	Rembang	5%	2×315	Wood Pellet
9	Labuan (Banten 2)	5%	2×300	SRF-Waste
10	Lontar (Banten 3)	1%	3×315	SRF RDF Pellet - Rice Husk
11	Paiton-9	5%	1×660	Sawdust
12	Pelabuhan Ratu	5%	1,050	Sawdust
13	Barru	3%	2×50	SRF-Waste
14	Adipala	5%	600	Sawdust
15	Tanjung Awar-awar	3%	2×350	Refused Derived Fuel
16	Indramayu	5%	2×330	Wood Pellet
17	Bolok (Kupang)	5%	2×16.5	Wood Pellet / Woodchips
18	Bukit Asam	5%	4×65	Sawdust
19	Ropa-Ende	10%	2×7	Wood Pellet
20	Asam Asam 1-4	5%	4×65	Sawdust
21	Sintang	5%	3×7	Palm Kernel Shell
22	Pulang Pisau	5%	90	Woodchips
23	Tarahan	3%	2×100	Woodchips
24	Nagan Raya 1-2	5%	2×110	Palm Kernel Shell
25	Suge (Belitung)	5%	2×16.5	Palm Kernel Shell

No	Name of CPP	Co-firing Portion	Units & Capacity (MW)	Type of Biomass
26	Air Anyir (Bangka Baru)	5%	2×30	Woodchips
27	Berau (Teluk Bayur)	5%	2×7	Palm Kernel Shell
28	Tembilahan	25%	2×7	Palm Kernel Shell
29	Sumbawa	3%	2×7	Corncob
30	Suralaya 5-7	N/A	3×600	N/A
31	Suralaya 8 (Banten 1)	N/A	625	N/A
32	Kendari	N/A	3×12	N/A
Already Tested				
33	Tenayan	5%	2×110	Palm Kernel Shell - Sawdust
34	Kaltim (Teluk Balikpapan)	5%	2×110	Palm Kernel Shell
35	Punagaya (Takalar)	5%	2×110	Corncob
36	Sebalang (Tarahan Baru)	N/A	2×100	Woodchips
37	Holtekam (Jayapura Baru)	N/A	2×10	N/A
Planned				
38	Amurang	5%	2×25	Woodchips
39	Tidore	5%	2×7	Coconut Shells
40	Ombilin	N/A	2×100	Sawdust
41	Teluk Sirih	N/A	2×112	Palm Kernel Shell
42	Ampana	5%	2×3	N/A
43	Pangkalan Susu	N/A	2×220	N/A
44	Labuhan Angin	N/A	2×115	N/A
45	Tanjung Balai Karimun	N/A	2×7	N/A
46	Tanjung Jati B	N/A	4×660	N/A
47	Lombok	N/A	100	N/A
48	Bengkayang (Kalbar 3)	N/A	2×50	N/A
49	Sofifi	N/A	2×3	N/A
50	Malinau	N/A	2×3	N/A
51	Lontar Extention Unit 4	N/A	315	N/A
52	Kalselteng	N/A	2×100	N/A
TOTAL			**18,333**	

Source: MEMR, 2021; PLN, 2020; PJB, 2022; RUPTL 2021-2030; Trend Asia Research Unit

Table 2-A. Identified Plants for Advanced Coal Technology in Indonesia

No	Project	Technology	Status	COD	Capacity (MW)
1	Cirebon Unit 1 CPP	Supercritical	Operating	2012	660
2	Paiton Unit 3 CPP	Supercritical		2012	815
3	Cilacap Unit 3 CPP	Supercritical		2019	660
4	Adipala Unit 1 CPP	Supercritical		2015	660
5	Banten/LBE 1	Supercritical		2017	660
6	Jawa 7	Supercritical		2020	1,000
7	Jawa 8	Ultra-supercritical		2019	1,000
8	Batang Unit 1, 2	Ultra-supercritical		2022	1,900
9	Indramayu Sumuradem Unit 4	Supercritical	Shelved	2026	1,000
10	Jawa 5 Unit 1	Supercritical		2023	1,000
11	Banten/LBE 1 Unit 2	Supercritical		2025	660
12	South Sumatra-8 MT Unit 1, 2	Supercritical	Construction	2022	1,200
13	Cirebon/Jawa-1	Ultra-supercritical		2022	924
14	Tanjung Jati A/Jawa 3 Unit 1, 2 CPP	Ultra-supercritical		2025, 2026	1,320
15	Tanjung Jati B/Jawa 4 Unit 5, 6	Ultra-supercritical		2022	2,000
16	Banten-3 Lontar Exp/Teluk Naga Unit 4	Ultra-supercritical		2022	315
17	Jawa-9	Ultra-supercritical			2,000
18	Jawa-10	Ultra-supercritical			1,000

Source: RUPTL 2021-2030, Trend Asia, Republika.co.id